

GUYANA GOLDFIELDS INC.

FINAL ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

AURORA GOLD MINE

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EXECUTIVE SUMMARY

Guyana Goldfields Inc. (GUY) was granted a Prospecting License (PL), under Section 30 of the Mining Act 1989, by the Guyana Geology and Mines Commission (GGMC), in 2004, to an area encompassing the former Aurora Gold Mines on the Cuyuni River. This Environmental and Social Impact Assessment (ESIA) was undertaken for a surface and underground gold mine to be developed and operated on that property. The Guyana Environmental Protection Agency (EPA) has determined that construction and operation of the mine may potentially impact the environment and has mandated that an ESIA be conducted. This ESIA conforms to guidelines and policies developed by Guyana Environmental Protection Agency (EPA). Further the ESIA describes the physical, biological, social and economic environment within the study area which are relevant to the Project.

The property is located in Region 7, Northwest Guyana approximately 170 km west of Georgetown and is accessible by air and overland. Mineralized zones were first discovered in the Aurora area during the Pigeon Island gold rush of 1911. Since that time the property has been explored and exploited by several companies including the Solar Development Company, Cuyuni Goldfield Limited and Mr. William Dann. Mining activities on the property included both open-pit and underground mining. The mining operation was complemented by several exploration phases including a total of 4362 m and 1160 m of surface and underground diamond drilling during the period 1946 – 1948.

The property was acquired by GUY in 1998. In 2000, GUY undertook an exploration program with 39 shallow diamond drill holes (1,067m). The exploration resulted in the discovery of a number of new mineralized gold zones and deposits, as well as the expansion of previously known mineralized zones. Since, then, work at Aurora has primarily consisted of exploration drilling activities.

GUY now proposes, based on the results of the exploration program to convert the current prospecting operations into a mining operation based on both open-pit and underground mining. Several facilities will complement the proposed mining operation to ensure its long-term viability. These include construction of an access road to the mine site and construction and operation of a wharf at Buck Hall on the Essequibo River.

A feasibility study is currently being undertaken for the design and construction of the hydropower plant to support the operations. Significant declines in the cost of fuel may result in the hydropower plant not being deemed feasible. The Environmental and Social Impact Assessment consequently does not examine the development of the hydropower plant. A separate ESIA will be prepared for that facility if it is considered feasible.

The mine pit design is comprised of five main pits over Rory's Knoll, East Rory's Knoll, Aleck Hill, South Aleck Hill, North Aleck Hill, Walcott Hill, East Walcott Hill, Mad Kiss, South Mad Kiss, and West Mad Kiss. These pits will be eventually coalesced into one large pit. The overall pit would be limited to remain a minimum distance of 50 m from a dyke constructed to protect the work areas from the Cuyuni River floodplain. Overall pit slopes will vary from 43° to 51° in rock and 26° to 34° in saprolite. Ramps will be designed to be 25 m wide for double lane access and will narrow down to 15 m single lane access in the bottom 25 m depth of each pit area. The pit design is based on a 0.65 g/t gold cut-off grade and has a waste to mineralization strip ratio of 9.5:1.

The major equipment requirements for the open pit operation will include sixteen 100 tonnes haul trucks, four 8.8m³ loaders, and four 6.5" drills. Conventional truck and shovel surface mining methods would be used for the open pit mining phase of the operation. Mining limits will be defined by location survey in the field. Mining depths of up to 150 meters are expected to be achieved with conventional open pit methods. Overburden and organic materials will be removed and stockpiled and reserved for environmental reclamation activities.

Sublevel open stopping would be utilized for the underground mining phase of the operation. Stopes will be mined in a “primary-secondary” sequence starting at the bottom of the mining front and progressing upwards and “centre-out”. Paste fill will be used as the preferred backfill method.

Gold would be recovered by gravity and cyanidation. The processing plant would treat a blend of saprolite/transition rock and hard mineralized material at a rate of 8,000 t/d. Saprolite mineralization will be crushed using a mineral sizer and the harder mineralized fresh rock will be crushed using either a jaw or gyratory crusher. Crushed material will feed into a semiautogenous grind (SAG) mill. A circulating part of the SAG mill discharge will be conveyed to a pebble crusher. A cone crusher rated at 70–100 tonnes per hour (t/h) will be selected for pebble crushing. The SAG mill discharge will be split equally and will feed two parallel ball mills in closed circuit with a cyclone pack.

To maximize recovery of gravity recoverable gold, a portion of the cyclone underflow would be diverted to a Knelson concentrator. It is anticipated that approximately 35 to 50% of the gold would be recovered by gravity. The thickener underflow would be fed to a preaeration tank before the leach tanks. The slurry from the leach tanks will be pumped to the carbon in pulp (CIP) circuit. Loaded carbon will be directed to the carbon stripping circuit. Cathode gold would be periodically removed under tight security, refined to doré in a furnace and cast into bars for shipment and sale. Tailings from the last CIP tanks will be discharged to a cyanide destruction plant. The residual cyanide content would be reduced below permissible levels through oxidation, using a SO₂ air process.

This Environmental and Social Impact Assessment (ESIA) and its associated public consultation are parts of the implementation process for design, construction and operation of the mine site. The Environmental and Social Impact Assessment objective is a systematic study, analysis and evaluation of the potential environmental and social impacts related to project execution. The assessment includes an evaluation of the environmental implications of The Project and its alternatives including the no action alternative.

This ESIA is guided by several international policies and local legislation and regulations developed to ensure sound management of the environment. National Policies, Regulations and Legislations which are relevant to the deliberations of this ESIA include the National Environmental Action Plan, The Environmental Protection Air Quality Regulations, The Environmental Protection Water Quality Regulations, The Environmental Protection Noise Management Regulations, The Environmental Protection Hazardous Wastes Management Regulations, The Environmental Protection Authorizations Regulations, The Environmental Impact Assessment Guidelines for Mining, The Mining Guidelines for Water Quality, The Mining (Amendment) Regulations 2005, The Guyana Geology and Mines Commission Act of 1979 and Mining Act of 1989, The Amerindian Act No. 6 of 2006, The Occupational Safety and Health in Mining, The Wild Birds Protection Act Chapter 71:01, The Town and Country Planning Act Chapter 20:01, The National Biodiversity Action Plan, The Public Health Act Cap 145, The Forest Act 2008 and Guyana Forestry Commission Act 2007 and the Code of Practice for Timber Harvesting 2002. The ESIA also identifies the EPA’s Role in EIAs.

International policies which are relevant to the preparation of this ESIA include Agenda 21, The Protocol Concerning Pollution from Land-Based Sources and Activities (LBS), The Protocol Concerning Specially Protected Areas and Wildlife (SPA), The Treaty on Cooperation for the Development of the Amazon Basin and The UN Framework Convention on Climate Change (UNFCCC).

The assessment of the environmental and social impacts of the proposed project was preceded by a baseline characterization of environmental and social variables in the project areas. The biological baseline characterization focused on examining the biodiversity of the proposed mine site. It was based on field surveys of the mine site area to capture temporal and spatial variations. The biodiversity survey was supplemented by a review of literature on the area biodiversity and the results of that review have also been incorporated into the biological baseline characterization.

The socio-economic and socio-cultural baseline was compiled based both on literature review and on field surveys conducted in communities considered to be within the project area of influence. The definition of the socio-economic and socio-cultural baseline and the identification of potential impacts associated with the project were aided by a public consultation process. Primary stakeholders for this project include groups and individuals directly affected by the project. Secondary stakeholders are the public and/or private sector organizations who may have a role and responsibility in the implementation and/or monitoring of the project. In addition to residents in close proximity to the site, other primary stakeholders include Guyana Geology and Mines Commission (GGMC) and the Region 7 Regional Development Council in which the mine site is located. Secondary stakeholders are regulatory bodies consisting of the Environmental Protection Agency (EPA), the Ministry of Labor, Occupational Safety and Health Department (OSHD), and commercial and industrial enterprises located within close proximity to the site.

Consultations were held with all primary stakeholders. Consultations with state/sectoral agencies and NGOs, based in Georgetown were held in the EPA boardroom on April 28, 2009. Consultations with residents of communities in proximity to the facility were facilitated by a meeting hosted by the Environmental Protection Agency (EPA) on April 28, 2009. Both meetings were initiated with a description of the project and its anticipated environmental and social impacts. Stakeholders were subsequently invited to identify issues and concerns for inclusion into the impact assessment and management measures for the facility.

The project area lies within the Precambrian Guiana Shield. Rocks in the concession area and its immediate vicinity can be classified into three units all of which appear to be of Precambrian age; the Aurora Granite, the Cuyuni Formation and the Devil's Hole Gneisses. The soils at the mine site, access road, and wharf have developed in place and consist of residual material derived from weathered acid crystalline rocks (granite, schist, dolerite, granodiorite, and phyllite), alluvial sediments derived from quartz, and stratified, unconsolidated deposits of sand, silts, and clays. In the upland areas the soils are deep, well drained, yellow and reddish-brown sandy clay loams and gravelly clays. In the riverine and alluvial fan areas, the soils are also deep and poorly drained, moderately well drained, or excessively drained. These soils are brown to white clay loams and sands.

Guyana is located in the Equatorial Trough Zone (ETZ) and its weather and climate are influenced primarily by the seasonal shifts of the ETZ and its associated rain-bands called the Inter Tropical Convergence Zone (ITCZ). There are no major industries in the area. Aerial emissions in the Project area are directly related to the emission of gases by rotting trees and other vegetative matter. Airborne discharges and particulate matter are not monitored in the area.

The mine site area is drained by several tributaries and by the Cuyuni River. The Cuyuni River originates in Venezuela and has an estimated total drainage area of approximately 53,380 km² of which approximately 14,500 km² lies in Guyana. The Cuyuni watershed in Guyana is relatively narrow and its flow in the vicinity of the Aurora Mine Site is west to east. During periods of high flows the Cuyuni River overflows its bank and areas within the mine footprint are flooded during these occurrences. Runoff from the Cuyuni watershed ranges from a minimum of 0.0017 cubic metre per sec per square metre (m³/sec/m²) to a maximum of 0.2692 m³/sec/m² with the mean daily runoff flow of 0.0536 m³/sec/m². The total drainage area of the Cuyuni up to the mining concession at Aurora is approximately 90 percent of its overall drainage area.

To capture baseline surface water quality in the area, surface water samples were recovered from exact locations on the Cuyuni River, Gold River and from an unnamed tributary of the Cuyuni River immediately downstream of Devil's Hole, at times coincident with the four seasons in Guyana. Sediment samples were recovered from points coincident with surface water samples concurrently with the surface water samples.

Practically no data is available on groundwater levels and other groundwater flow parameters in the mining concession. A single well was located to coincide with each corner of an area identified as the Golden Mile and one well was located to coincide with the approximate center of that area. Each monitoring well was installed to a depth of approximately 6 m. Groundwater samples were recovered, at four times coincident with seasonal trends in Guyana, from all wells.

The Aurora Concession is considered as mixed lowland forests with *Morabukea* forest found on laterite areas. It occurs on undulating terrain with slopes in the near interior, east of the Cuyuni River. The dominant species is *Mora gonggrijpii*.

The floral assessment identified 232 species of plants as occurring in the area. Species identified within this area are common to fairly common to this area and within the brown sand/swamp forest biogeographic province of Guyana.

A total of 140 avifaunal species from 42 families was documented within the Aurora Concession. A pair of Harpy Eagles, *Harpia harpyja*; an adult and juvenile; was identified and recorded within the area identified for the tailings pond. Two (2) migrant species were recorded within the area, namely Swallow-tailed kite *Elanoides forficatus* and Spotted-Sandpiper *Actitis macularius*. In addition, six (6) species were recorded as endemics to the Guianan shield, namely *Pionopsitta caica*, *Monasa atra*, *Pteroglossus viridis*, *Myrmeciza atrothorax*, *Perissocephalus tricolor* and *Cyanocorax cayanus*. A total of 45 species of herpetofauna were identified by the 2009 surveys, with 23 species of amphibians from eight (8) families and 22 species of reptiles within 13 families. All of the species encountered are common to the wider geographic area of Guyana and many are found across the entire Guianan-Amazonian lowlands region.

The 2009 ichthyofaunal assessment documented 45 species of ichthyofauna. Eighteen (18) species were collected at Julian Ross Itabu, rapids and inter-rapids, while six (6) species were identified at the location of the Mine Water Management site, three (3) at the potential Tailings Pond and seventeen (17) at the Cuyuni mainstream, creeks and streams. Twelve (12) species were documented at Gold Creek. All species documented were fairly common to the area and Guyana generally.

A total of 18 mammalian species were documented during the 2009 assessment. A single giant otter (*Pteronura brasiliensis*) was observed swimming in the Cuyuni River in front of the Aurora Concession in the May 2009 field surveys. An otter sighting was also reported in the 2006/2007 baseline surveys. Internationally-recognized giant otter specialist Dr. Nicole Duplaix was retained to provide a field assessment for the giant otter in the Project Area of Influence. The field assessment was performed 13-22 October 2009. No evidence for recent inhabitation by giant otters was found. Previous reports (2006/2007, 2009) are interpreted as transient males.

A total of 22 families/orders of macro-invertebrates were identified within the Aurora area. Most of the families and/or orders were present at all sampling sites, except for the Annelidae, Diptera and Scorpiones.

The socio-economic baseline study was undertaken to create a profile of the communities in and around the project area. There were no formal or established communities or settlements in the immediate vicinity of the Aurora mine-site, and very few communities in proximity to associated project components. Hence, due to its remote location, the Aurora Project does not involve the types of direct socio-economic effects characteristic of most mining projects. Given the lack of communities in the area of direct influence of the project, the social baseline was developed looking at a broader area where possible interactions and impacts of the Project on formal settlements/communities were likely to occur, even if relatively far from the three main Project components.

The Aurora Mining Concession is located within Administrative Region 7. The mine site is located within the Middle Mazaruni Sub-region with a District Administrative Centre located at Kamarang. The total

population of Region seven is approximately 17,597 people and accounts for 2.3 per cent of the total population of Guyana.

The socioeconomic baseline was conducted to establish: (i) dominant uses of land and other resources for subsistence and livelihood activities, such as farming, fishing, hunting and mining practices; (ii) presence of infrastructure such as schools, medical facilities, communications network/transport networks and markets; (iii) public health issues in terms of health risks and diseases; (iv) local institutional capabilities; (v) land ownership patterns; (vi) identification and characterization of community cohesion and management; and (vii) identification of existing and proposed development plans for the study area. Consultations and field work was done with the relevant stakeholders to compile the baseline. Socio-cultural and socio-economic data was compiled for Bartica and Itaballi which served as gateways to the mine site and for Kurutuku and Aranka which are the two communities in closest proximity to the project.

The potential impacts related to construction activities at the mine site and to mining operations include potential impacts to the atmosphere, aquatic and terrestrial resources and to human, socio-economic and cultural resources. An impact rating system was employed to ensure the application of analytical rigor to the assessment of impacts. Impacts were initially rated as direct, indirect or cumulative. The direct, indirect and cumulative impacts were further subdivided into positive and negative impacts, random and predictable impacts, local and widespread impacts, temporary and permanent impacts and short- and long-term impacts. Impacts were further categorized according to their seriousness by examining the likelihood and severity of each impact. The impact mitigation measures were then identified and the residual rating of impacts was then classified as to both severity and likelihood.

Potential impacts to soil could result from construction of the access road linking the mine site to the Barama Road and from clearance of vegetation over the mine footprint. The likelihood of soil erosion and sedimentation will be minimized or avoided by the implementation of the Best Management Practices (BMP). The movement of heavy equipment during construction and mining may impact soil resources by causing rutting and compaction of susceptible soils. The impacts to the soil resources are expected to be minor (low severity, low likelihood). Topsoil mixing could potentially occur during the project execution. BMP implemented during construction and operation will result in minor impacts.

Construction works will result in emissions of fugitive dust and products of combustion. Impacts to air quality could be moderate. These impacts will be mitigated by scheduling land clearing activities to less windy days, limiting vehicle speed during construction to a maximum 30 km/hr and employing dust suppression technique. Analyses indicated very minor changes in air quality resulting from equipment emissions.

During mining, soil and rock would be excavated from the mine pit area. The present geologic profile of the area consists of a stratum of unconsolidated silty sandy clay soils overlying rock in the area to be mined. Mining will not segregate soils based on the depths at which these soils are encountered when the overburden material is disposed in the spoil piles. Mining and spoil disposal will result in an alteration of the stratification of the unconsolidated soils at the site. These are major impacts (low severity, high likelihood), however these impacts would be localized to the mine site.

Excavation for the underground mine will create openings in the subsurface. These openings will alter the stress and strain distribution in the rock and can potentially lead to collapse and ground subsidence. Subsidence-induced tilt, curvature, thrust, stretch and/or compression of the ground surface may alter the direction and flow in watercourses such as the streams and creeks in the project area. These are moderate impacts (high severity, medium likelihood). These impacts would be mitigated by progressing backfilling the stopes as mining extends from the lower to upper level and by employing well-planned and controlled extraction techniques. Implementation of the mitigation measures will result in minor impacts (low severity, low likelihood).

An erosion and sediment control plan will mitigate potential impacts to water quality from erosion. The potential for accidental spills of fuels, oils and grease and the associated contamination of surface waters will be minimized by implementation of a Spill Prevention and Contingency Plan.

Construction of the access road and clearing for the mine footprint will fragment the area. The physical disturbance and noise produced by equipment may impose additional stresses upon wildlife and may lead to increased migration. These impacts will be mitigated by minimizing the area cleared for the facilities and by maintaining wildlife corridors within the cleared areas.

The development of the mine and potential employment opportunities may attract people to the site for work. The uncontrolled influx of people from outside could possibly create health risks for GUY employees and vice versa. The construction and operations phase of the project is likely to increase movement of vehicles such as trucks or other vehicles carrying equipment along the Barama road. The traffic volume due to Guyana Goldfield Inc. activities could greatly increase overall traffic movement in this corridor increasing dust, noise, vehicular emissions as well as increase risks of accidents and incidents.

An Environmental Management Plan was developed to mitigate the potential negative impacts and risks and to enhance the potential positive impacts of the proposed action. Environmental management measures address the environmental impacts and risks to both the physical and socio-cultural environments. The environmental management measures, which are designed to the feasibility level, include time frames and responsibility for implementation and the associated costs.

A monitoring program has been developed for the proposed operations. The monitoring program will provide data which would serve as the basis to determine the environmental performance of the operation. The facility will be monitored to confirm its adherence to sound environmental management practices and contractually established operational standards. Monitoring will be conducted during the construction and operation phases of the project. The monitoring program is designed to ensure that the trends for specific parameters are tracked. It will also provide information on compliance with legislation, guidelines and contractual requirements for the construction and operation of the facility.

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GLOSSARY OF TERMS

Alluvial Gold - Gold deposited by flowing water.

Amalgam - Gold or silver mixed with mercury.

Amalgamation - A process that separates gold (or silver) from ore. Ore is crushed in a mercury-water solution and subjected to violent agitation, which breaks up the mercury into minute particles that adhere to the gold. When the gold has partially separated from the mercury, the remaining mass is heated in a retort. The mercury vaporizes and is condensed to use again. The gold is now almost pure and is cast into bars.

Assay Office - A place that evaluated or chemically tested and analyzed the mineral content of ore to determine the nature and proportion of the ingredients.

Adit - A mine entrance that is horizontal or inclined.

Auriferous - Gold-bearing.

Barren pond Storage pond for solution from which gold has been extracted.

Base Gold - Gold alloy.

Bund A low embankment often constructed around potential spillage areas to reduce the risk of environmental contamination. It is important these structures can retain the volume of any potential spillage.

Bullion - Unprocessed gold or silver, before coinage or minting. Usually melted into bricks or bars for easy storage.

Carat - (1) One 24th part of pure gold. (2) It's also a unit of weight equal to about 0.2 grams used to weigh precious gems.

CIL Carbon-in-leach. A process used to recover gold into activated carbon during the agitation leach process.

CIP Carbon-in-pulp.

Decant: The removal of solution from a tailings storage facility after solids have been allowed to settle.

Dredging A gold mining method in which a barge or boat equipped with machinery scoops the gold-bearing gravel from the river beds. The gravel is then processed by washing or sluicing.

Drift A horizontal tunnel leading from the main bore or shaft of a mine.

Dust Minute particles of gold taken by placer mining and used as money.

Eh Reduction potential (in units of volts or millivolts)—a measure of how oxidizing or reducing a system is (more positive values tend to indicate oxidizing environments, more negative values reducing).

EMS Environmental Management System

Freeboard: The distance between the crest of a pond or impoundment and the level of contained solution.

Free Cyanide: The uncomplexed cyanide ion (CN-) and gaseous or aqueous hydrogen cyanide (HCN).

Gangue Unwanted rock found during gold mining.

Gold A heavy yellow metallic chemical element; a precious metal used in coins, jewelry

Gravels A loose mixture of small pebbles and rock fragments like coarse sand that contain gold particles; also called placer deposits.

HACCP Hazard Analysis at Critical Control Points—a formal procedure designed to identify the hazards associated with particular stages in a given process.

Hardrock (Quartz) Mining The underground method of mining accomplished by sinking a shaft deep into ground containing a vein or ore pocket, with drifts (tunnels) radiating out on various levels.

Heap leach To dissolve minerals or metals out of an ore heap using chemicals. During heap leaching gold a cyanide solution percolates through crushed ore heaped on an impervious pad or base pads.

Hydraulic Mining (Hydraulicking) A method of mining whereby water under pressure is directed at hillsides of soft gravels through a hose with a nozzle called a monitor or giant, causing mud to run down into long lines of sluice boxes.

Lixiviants Chemical leaching agents.

Lode - An underground vein bearing gold or other precious metal.

MercurySee Quicksilver

Metallurgy - The science of separating metals from their ores and preparing them for use by refining, etc., developed from alchemy of the Middle Ages.

Mixing Zone: A predefined area beyond an outfall or discharge point in which the applicable jurisdiction or regulatory agency permits water quality criteria to be exceeded. Beyond the mixing zone boundary, applicable water quality criteria for the protection of aquatic life must be observed.

Ore - Rock containing enough precious metal to make it worth mining.

Overburden - Material, like dirt and rock, covering the gold-bearing veins or gravel that was removed by hydraulicking.

Panning - A simple but slow method of mining. Gravels from the stream bed are washed in a pan, causing lighter materials to spill over the side and heavier gold-bearing particles to settle to the bottom.

Pay Dirt - Expression describing gold-rich ore, sand, or gravel taken from claims. The claim became "pay dirt" when the miner realized a profit after his expenses had been covered.

pH The measure of acidity (or alkalinity) defined as being the negative log (to base 10) of the free hydrogen ion concentration. The pH scale ranges from 0 to 14; a pH of 7 is neutral, less than 7 acidic and more than 7 alkaline.

Phreatic Surface: The surface between the zone of saturation and the zone of aeration; ground water table.

Process Solution: Liquid cyanide received from the supplier, solutions used to leach gold, barren leach solution from heap leaching, mill tailings, tailings return water and carbon stripping solution. However, solutions with concentrations of WAD cyanide below 0.5 mg/l are not considered to be process solutions.

Placer - A deposit of gravel or sand containing particles of gold that can be washed out. Usually eroded from the hills or deposited by a river.

Placer Mining - Mining on the surface. A process of extracting surface gold from ore-bearing gravels by panning, dredging, and sluicing.

Pocket - A small but rich concentration of gold in a quartz vein, or gold-bearing gravel in a hole or low spot in a stream bed.

Quartz - A common, hard mineral, often with brilliant crystals, generally found in large masses or veins.

Quicksilver - Mercury (Hg.): a heavy, silver-white metallic chemical element, liquid at ordinary temperatures. Used to help capture gold particles in sluicing when placed at the riffles or ribs in the box.

Retort - A high-temperature furnace used in refining gold. Amalgam is super-heated so the mercury is vaporized and saved, and the gold is formed into bars.

Riffles - The wooden ribs or slats placed on the bottom of rockers, long toms and sluice boxes to capture the heavy gold particles while the lighter material is washed away.

Slimes The finest particles suspended in a tailings slurry.

Sluice Box - A box with a sloping trough or inclined flume where heavy gold-bearing particles are caught by riffles or slats.

Sparging A procedure designed to minimize operator exposure to cyanide during transfer from transport container to storage facility at a mine site.

Stamp Mill - A mill built to break up and grind gold-bearing ore, saving the gold by amalgamation. A mill could have any number of "stamps".

Stamps - Metal arms at a stamp mill that raised and lowered like battering rams to crush the ore so the gold could be extracted.

Stakeholder: Stakeholders are individuals and groups that have interest in the cyanide-related activities of a mine, or who are or may reasonably be affected by those activities. The term is applied differently depending on the specific nature of the issue to be addressed, and can require considerable flexibility and judgment.

Surface Water(s): Any natural water body occurring on the surface, including but not limited to rivers, creeks, streams, lakes, marshes, and marine waters.

Tailings - Waste material left after gold-bearing ore is processed. Material rejected from a mill after the recoverable valuable minerals have been extracted.

Tailing Storage Facility (TSF): An impoundment used to place mill effluent containing the leached ore in a water slurry that may contain cyanide. The solids remain in the TSF for disposal and the water may be recycled back to the mill for reuse or may be treated and discharged.

Troy Ounce - Based on the ancient unit of measure, the grain, and used to measure gold. The troy ounce contains 480 grains, while the avoirdupois ounce contains 437.5 grains. Therefore, a troy ounce equals 1.097 avoirdupois ounces. Also, a troy ounce equals 20 pennyweight (DWT).

Vein - Route followed by gold from the lower depth of the earth towards the surface.

Worked Out - A claim, mine, or area that has been thoroughly mined of all gold that is profitable to mine.

TSF Tailings storage facility

Volatilization Release of gaseous phase of a chemical, in this case cyanide.

WAD cyanide Weak acid dissociable cyanide that is readily released from cyanide-containing complexes when the pH is lowered

1.0 INTRODUCTION

Guyana Goldfields Inc (GUY) was granted a Prospecting License (PL), under Section 30 of the Mining Act 1989, by the Guyana Geology and Mines Commission (GGMC) in 2004 to an area encompassing the former Aurora Gold Mines on the Cuyuni River in Region 7, northwest Guyana. The area covered by the Prospecting License, shown as Figure 1, is described as a tract of State Land situated in the Cuyuni Mining District No. 4 enclosing Gold River, located on Terra Survey Topographic Sheets 17NW, 17NE and 17SE as follows:

From a point X located with geographical coordinates of latitude 6o 47' 10" N, longitude 59o 42' 06" W and situate at the confluence of the Cuyuni and Gold River, thence going upriver for a distance of approximately 1 mile, 704 yards to point of commence, 'A', located with true geographical coordinates of latitude 6o 47' 32" N, longitude 59o 43' 17" W, thence at a true bearing of 135o for a distance of approximately 3 miles to point 'B' located with true geographical coordinates of latitude 6o 45' 38" N, longitude 59o 41' 24" W, thence at a true bearing of 180o for a distance of approximately 3 miles to point 'C' with geographical coordinates of latitude 6o 43' 03" N, longitude 59o 41' 24" W, thence at a true bearing of 270o for a distance of approximately 2 miles, crossing Gold River at point 'D' located with true geographical coordinates latitude 6o 43' 03" N, longitude 59o 43' 08" W, thence at a true bearing of 315o for a distance of approximately 6 miles to point 'E' located with true geographical coordinates latitude 6o 46' 40" N, longitude 59o 46' 54" W, then at a true bearing of 0o for a distance of approximately 1 mile, 1513 yards to point 'F' on the right bank of the Cuyuni River located with approximate geographical coordinates of latitude 6o 48' 15" N, longitude 59o 46' 54" W, thence going downriver along the bank of the Cuyuni River for a distance of approximately 4 miles 633 yards to the point 'A' thus enclosing 14131.2 acres, save and except all lands lawfully held and occupied.

This PL is referred to as the Aurora Property. The property lies on the south bank of the Cuyuni River. The area is generally low with small hills near to the river. The elevation rises to over 200 m towards the southwest. Several creeks drain into the Cuyuni River and there are some large swampy areas within the PL. The area is located approximately 170 km away by air from Georgetown and is accessible both by air and overland. The overland route entails travel to Parika by road and then over a distance of approximately 200 km by water to the site.

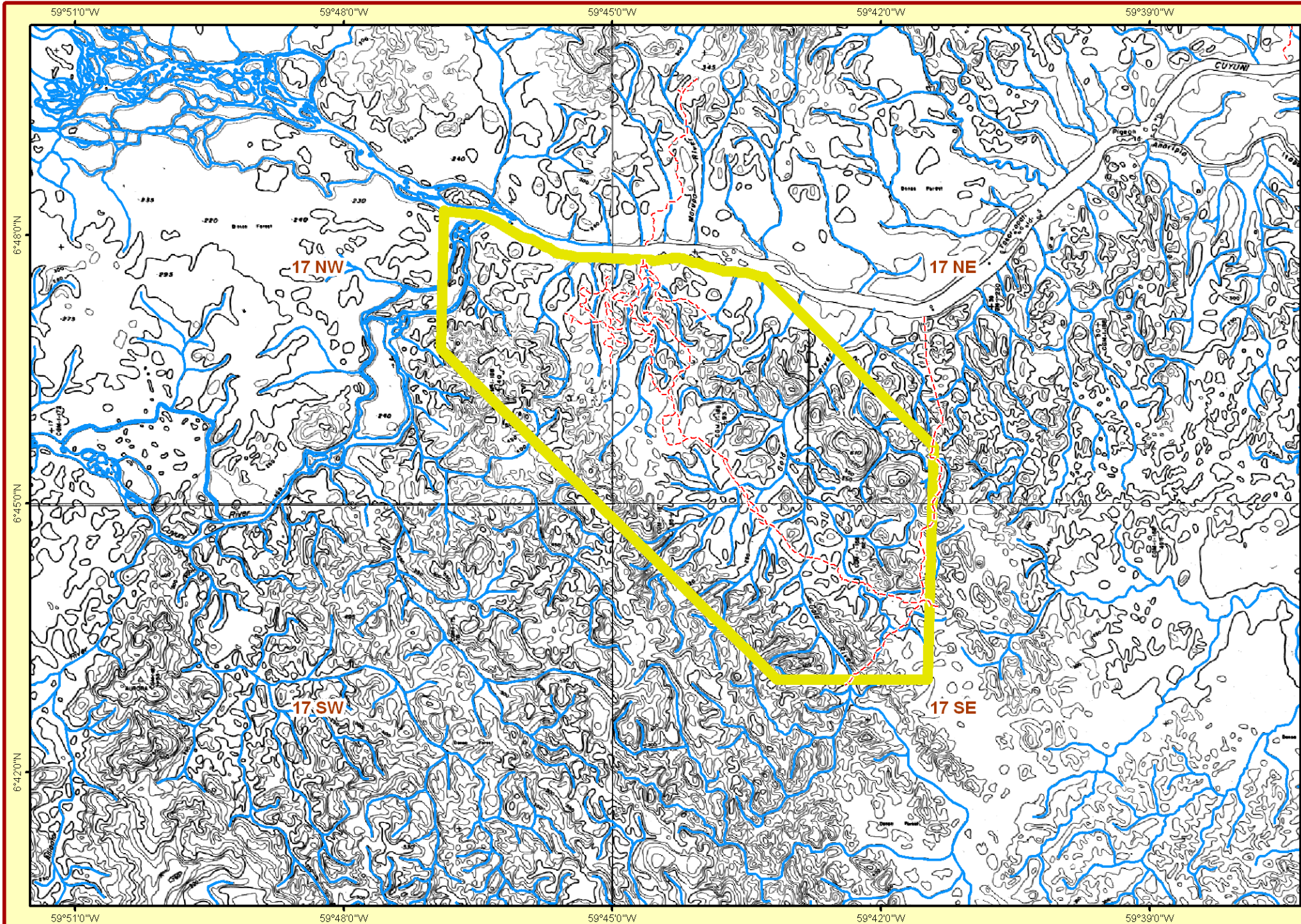
1.1 Purpose of and Need for Action

In 2000, GUY undertook a small exploration program with 39 shallow diamond drill holes (1,067m). The program resulted in the discovery of a number of mineralized gold zones and deposits, as well as the expansion of previously known mineralized zones. Since, work at Aurora has primarily consisted in exploration drilling activities. Three primary resource areas have been established by the exploration programs. These resource areas are Aleck Hill, Rory's Knoll and East Walcott. Several smaller resource areas, including Mad Kiss, have also been established by the exploration program.

A preliminary assessment of a possible mine development was undertaken for the property (Snowden, 2007). The assessment envisaged a mine site development schedule as follows (Snowden, 2007):

- Rory Knoll/East Walcott open pit followed by
- Aleck Hill open pit, while Rory' Knoll underground is developed; followed by
- Aleck Hill underground; followed by
- Rory Knoll/East Walcott underground

Conditions of the Prospecting License include allowing for the application of a Mining License at any time during its tenure. That mining License may be applicable to any part or parts of the area. To facilitate the issuance of a Mining License, however, GUY is required to submit a feasibility study for the



GUYANA GOLDFIELDS INC

AURORA LICENSE

Right bank Cuyuni River, Cuyuni Mining District

0 0.5 1 2 3 4 Kilometers

1:100,000

Note: Road network was compiled from several data sources (GGMC, GFC, GL & SC). This map in no way seeks to indicate road conditions.

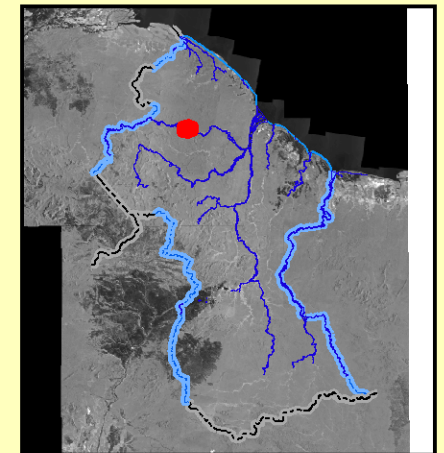
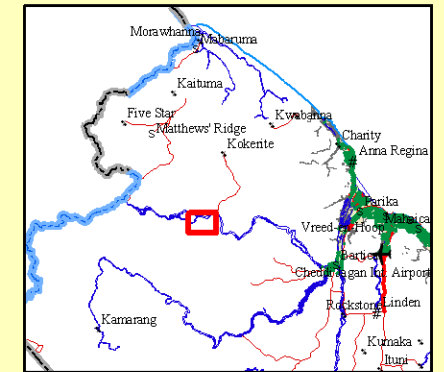


FIGURE 1: GUYANA GOLDFIELD CONCESSION AND SURROUNDING AREA

approval of GGMC. The feasibility study must include an Environmental and Social Impact Assessment (ESIA) for any mining operation proposed to be undertaken at the property.

The firm proposes to apply to GGMC for issuance of a Mining License in accordance with the terms of the PL. The area proposed for development into the mine encompasses the mineralized zones established by the exploration work at the property and includes Aleck Hill, Rory's Knoll and East Walcott. The mine will be operated in accordance with the GGMC Mining License and the Guyana Environmental Protection Agency (EPA) guidelines.

The purpose of the proposed action is therefore to convert the current prospecting operations in the area identified as the Aurora Property into a mining operation. To attain the objectives of the proposed action a surface and underground mine and mineral processing operation for the recovery of gold will be undertaken at the property. Several additional facilities will be provided to ensure the viability of the proposed mining operation. These include the following:

- Construction and operation of a hydropower plant on the Cuyuni River;
- Construction of an access road to the mine site;
- Construction and operation of a wharf at Buck Hall on the Essequibo River.

A feasibility study is currently being undertaken for the design and construction of the hydropower plant. There have been significant declines in the cost of fuel since the prefeasibility study was undertaken for the proposed plant. The reduction in fuel prices may result in the hydropower plant not being deemed feasible. The Environmental and Social Impact Assessment consequently does not examine the development of the hydropower plant. A separate ESIA will be prepared for that facility if it is considered feasible.

The action is needed to recover gold confirmed to be present at the location based on the results of an exploration program undertaken at the property. The results of that investigation have verified that gold is present in adequate quantities and is of reasonable grade to warrant the establishment of a mine and mineral processing operations at the site.

1.2 Background

Mineralized zones were discovered in the Aurora area during the Pigeon Island gold rush of 1911. Several claims were worked in the period between 1934 and 1937 by small claim holders. These claims were all amalgamated and transferred to the Solar Development Company (Solar) in 1938. Solar Development Company was then a subsidiary of Consolidated Mining and Smelting Corporation (Cominco) of Canada.

Investigations by Solar between 1938 and 1939 resulted in the discovery of two small high-grade gold-quartz vein outcrops at Aleck Hill and placer gravel at Powis Creek. In 1939 a small Sunveldt mill was installed to test the Aleck Hill deposits. Cuyuni Goldfield Limited (Cuyuni) was registered in 1940. Cuyuni located 19 claims in the area and in 1945 acquired the Mad Kiss claims of Solar and was granted an Exclusive Permission to prospect over seven and one-half square kilometers in the vicinity of the area.

The Aleck Hill deposit was discovered in 1939. Trenches along the crest of the hill, excavated at that time, revealed outcrops of enechelon quartz veins with a NNW strike. These outcrops were first worked by Mr. William Dann using a small Sunveldt Mill situated on the Mad Kiss claim. A tunnel was driven into the hill and a large opencut trending NNW and measuring about 90mx24mx9m was excavated. Smaller open-cuts were completed to the SSE and extensive trenching was undertaken.

The first underground level was opened from No. 1 Adit to 25 m below the top of the hill after the formation of Cuyuni in 1940. The adit trended WSW and after passing through barren compact red and

brown clay for 55m, it intersected a 15 m wide zone grading 1.1 ozs/tonne. Surface trenches indicated that the orebody extended about 300m to the NW. The first level has since been driven 195 NNW and 95m SSW of the No. 1 adit.

In 1943, a second level was opened by a WSW bearing adit, from a point near the foot of Aleck Hill, about 20 m below the first level. After passing through 80 m of barren clay, the adit intersected a wide ore body and was driven for a distance of 100m. In total, the second level was driven 105m NNW and 325 m SSW with a southwest ventilation at 365 m.

From 1946 to 1948, 26 surface and 26 underground diamond drill holes were completed. In total, 4362 and 1160 m respectively was drilled. The main gold bearing structure was intersected at a maximum vertical depth of 160 m. Gold values up to 26.14 g/tonne were recovered. In 1946 a two-compartment shaft was sunk 28 m above the second level adit to a depth of 75 m. A NW bearing cross-cut was made at a depth of 65m and intersected the ore body at a depth of 51 m.

The No. 4 level was driven 175 m to the NNW and 37 m to the SSW. A raise was made at 22 m from the No. 4 level to provide access to develop No. 3 level. The No. 3 level was later connected by a cross-cut to the two compartment shaft. The four levels at Aleck Hill, Nos 1 thru 4 had depths of 23, 39, 53.5 and 76 m respectively below the summit of Aleck Hill.

The Mad Kiss deposit was investigated in detail by Solar between March 1938 and February 1939. Approximately 600 m of trenching was completed and determined the occurrence of three main ore shoots of auriferous quartz feldspar porphyry dykes. The main porphyry dike is about 20 m thick and strikes N60oE with a northwesterly dip of 70o. Five shafts, 9 to 15 m deep were sunk and from there two underground drifts and cross-cuts totaling 124 m were made.

In 1946, Cuyuni began work on an elliptical shaped opencut in the Mad Kiss deposit. A total of 8700 tonnes of ore with an average grade of 7.87 gms/tonne were mined from a pit 9 m deep, 37 m long and 12.5 m wide. The Mad Kiss area was investigated by four diamond drill holes. Hole No 13 bearing at N31oW and Hole No 14 bearing North intersected the porphyry dike at a depth of 83 m and 40 m respectively. Hole No 13 returned values of 6.85 and 17.14 g/tonne over approximately 11 m. Hole No 16, bearing S66oE and inclined at 35o intersected porphyry at a depth of 35 m.

Walcott Hill (East Walcott) was discovered in 1938. Deposits then confirmed in the area consisted of mineralized quartz veins located 185 m north of Mad Kiss. A small opencut revealed three quartz veins 30 cm by 60 cm and 5 m long with gold grades ranging from 6.3 to 20.2 g/tonne. Trenching northwest of this zone exposed several northwesterly trending quartz veins varying up to 1.6 m in width. Further, exploration in this area in 1943 revealed additional quartz veins with promising gold values. These veins which strike at 40o West of true North are parallel to those of Aleck Hill located to the SW.

The project area was acquired by GUY in 1998. In 2000, GUY undertook a small exploration program with 39 shallow diamond drill holes (1,067m). The exploration resulted in the discovery of a number of new mineralized gold zones and deposits, as well as the expansion of previously known mineralized zones. Since, then, work at Aurora has primarily consisted in exploration drilling activities.

Samples of drill cores, recovered during the exploration program being undertaken by GUY were tested to establish resource grades. The resulting mineral resources from the block model, as reported using the 1.0g/t Au cut-off, are presented in Table 1 below.

Table 1: Resource Summary

Area	Indicated Resource				Inferred Resource			
	Million Tonnes	Grade (g/t Au)	Contained Metal		Million Tonnes	Grade (g/t Au)	Contained Metal	
			Tonnes of Gold	Million Ounces			Tonnes of Gold	Million Ounces
Aleck Hill	5.27	3.55	18.71	0.60	1.60	2.07	3.31	0.11
Rory's Knoll	11.73	3.35	36.24	1.26	20.24	3.46	69.99	2.25
East Walcott					1.45	3.77	5.45	0.18
Total	17.00	3.41	57.95	1.86	23.29	3.38	78.75	2.53

Source: Snowden, 2008

1.3 Scope of Environmental and Social Impact Assessment

This ESIA has been prepared to conform to guidelines established by the Guyana Environmental Protection Agency and as detailed in the EPA publication titled Environmental Impact Assessment Guidelines, Volume 3 Mining, Version 1, August 2000. In accordance with those guidelines this ESIA is comprised of three components, the Environmental Baseline Study, The Environmental and Social Assessment and the Environmental and Social Impact Management Plan. The baseline detailed herein is a record of the present quality of the physical, biological and socio-economic and socio-cultural variables within the project area of influence. The existing environment is described only for those aspects of the physical, biological, social and economic environment within the study area that are relevant to the project.

The Environmental and Social Assessment identifies and assesses the impacts of the proposed action and its alternatives taking into consideration the measures that are proposed to mitigate and/or enhance the probable impacts. The assessment identifies the project-environment interactions during design, construction and operation and after closure of the operation. The schedule and costs associated with mitigation of environmental effects are also examined as part of the ESIA.

The Environmental Management Plan (EMP) has been prepared to confirm to the "Guidelines for Preparing Environmental Management Plans" detailed in the referenced document. In accordance with those guidelines, the EMP identifies feasible and cost effective measures to reduce potentially adverse environmental impacts to acceptable levels. It also includes operational procedures to avoid environmental risks during operations as well as emergency and contingency plans in the event of accidents during operations.

The Study area considered by this ESIA includes the area defined by the limits of the proposed mine and its ancillary facilities. The study area encompasses the proposed access road to the site, the road constructed by the Barama Timber Company from Buck Hall to which the access road will be linked and the area for the associated wharf at Buck Hall. The study area also encompasses communities which are likely to be affected by the proposed project such as Bartica, Kartabo Point and Kurutuku. The extent of the study area is depicted as Figure 2.

1.4 ESIA Study Team

The Environmental and Social Impact Assessment would be undertaken by Environmental Resource Management (ERM) and the firm of Ground Structures Engineering Consultants Inc (GSEC). The study team assembled for this assignment consists of individuals who are recognised experts in conducting environmental impact assessments in Guyana and elsewhere. This collaboration has resulted in the creation of a unique group of professionals, all of whom have the necessary range and depth of

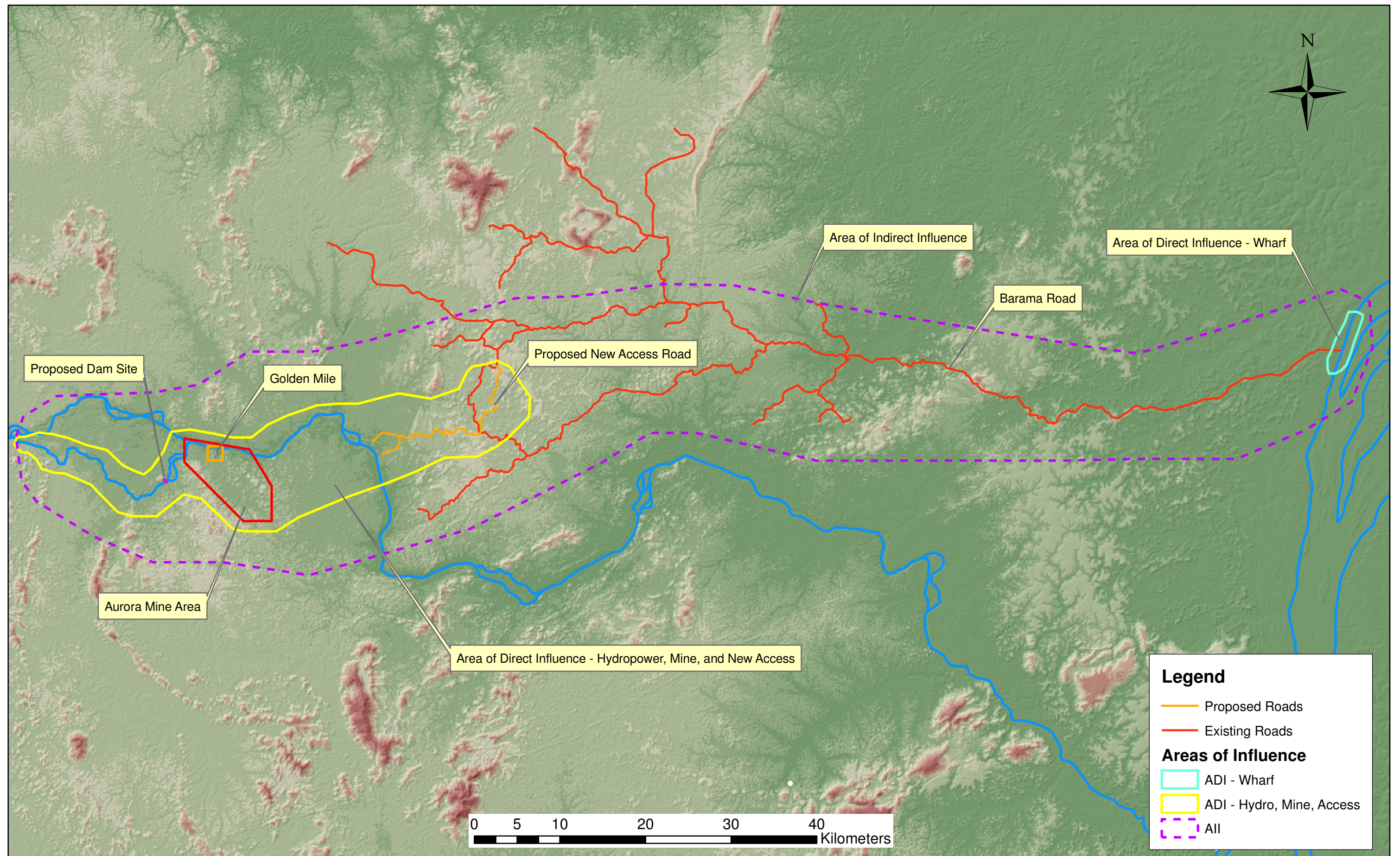


FIGURE 2: PROJECT AREA OF INFLUENCE

experience and a thorough understanding of local conditions to conduct the ESIA's to World Bank, IFC, IDB and Guyana EPA Standards.

Reed Huppman, ERM Project Director is a partner and manages ERM's Washington, DC office and has over 25 years of experience in applied sustainability consulting. Reed will provide overall strategic advice and guidance to the team as well as quality assurance and quality control. He has managed and contributed to numerous interdisciplinary studies including environmental and social impact assessments, environmental due diligence audits for financial transactions, public consultation and assessment programs, and capacity building and training in sustainable finance. His project experience encompasses mining, oil and gas development, major infrastructure projects, corridor projects including major pipelines and roads, industrial and agricultural operations, forest and watershed management, coastal zone management, clean production and energy efficiency, climate change, and ecosystem restoration, having received two awards for restoration design projects.

Mr. Huppman has worked in Guyana on several occasions in the past, most recently for the Inter-American Development Bank in the privatization of the electrical sector. He is currently working on mining projects in Irian Jaya, Guinea, Madagascar, Cameroon and the Democratic Republic of Congo, power projects in Guatemala, Peru and Jamaica, a review of the Panama Canal Expansion project for lenders, and an LNG export project in Peru. He has worked in over 35 countries in Latin America and the Caribbean, Africa, Eastern Europe and the former Soviet Union, and South and Southeast Asia.

Charles P. Ceres, GSEC Project Director, is the Managing Principal of Ground Structures Engineering Consultants Ltd. of Guyana. He will be the local Project Director and will provide strategic guidance to the team and will be responsible for project co-ordination and logistics. Charles will oversee the fieldwork and baseline studies in Guyana. Charles has also managed several EIAs and EAs in Guyana and has served as a consultant to the Guyana Environmental Protection Agency.

Sunrita Sarkar, Project Manager and Social specialist, ERM will be the project manager and coordinate team activities and deliverables. She will be the social lead for the project and will coordinate the deliverables of the 'social' aspects of the impact assessment. Sunrita is a Sociologist and is based in ERM's Washington DC office. Her responsibilities in ERM include project planning, management and execution related to social impact assessment, resettlement & rehabilitation, social audits/due diligence, social risks, community participation and natural resources. She has more than 9 years experience of working on social impact assessments and resettlement & rehabilitation issues of a number of development projects in mining, oil and gas, power, dams, roads and highways. She has extensive experience in stakeholder, community management and indigenous people's issues. She has undertaken several poverty and livelihood assessments, as a part of the impact assessments and formulation of Resettlement Action Plans (RAPs).

Dr. Robert Langstroth, Biodiversity Lead Specialist, ERM will be the lead for the biodiversity and ecological aspects of the assignment. Dr. Langstroth's professional experience with biological, environmental, and geographic studies spans over more than 20 years. He has become a specialist in South American biodiversity and ecosystems studies, with expertise in the development of baselines, impact assessments, management plans, as well as field implementation, monitoring, and auditing. Dr. Langstroth has examined the impacts of energy infrastructure (such as pipelines, terminals, and plants) development on ecosystems and local stakeholders, such as comparative social management studies, fire and grazing management of pipeline rights-of-ways, and conservation impacts.

Edward M. Buchak, P.H., Surface Water Modeling Specialist, ERM, has civil engineering degrees from MIT and the University of Pennsylvania. His experience since 1972 has been in developing and applying hydrodynamic and water quality models to rivers, lakes, reservoirs, estuaries, and coastal water bodies. He is the co-developer of the primary version of CE-QUAL-W2, the Corps' hydrodynamic and water quality model for reservoirs and of GEMSS, a public domain 3-D hydrodynamic and water quality

model. Ed contributes expertise in problem definition, project management, data examination, modeling, and presentations to clients, stakeholders, and the general public. He has worked extensively for the electric utility, manufacturing, mining, oil and gas industries as well as for public agencies. He manages ERM's Surfacewater Modeling Group.

Dana Frye, Social and natural resources specialist, ERM will support Sunrita in conducting baseline studies, impact assessment and report writing. Dana R. Frye is a consultant with ERM based in Washington, D.C. Since joining ERM, Dana's work has focused on the identification, mitigation and compensation of social impacts and risks which has included leading social audits, developing social management plans and ensuring compliance of existing plans with international best practice. Prior to joining ERM, Dana worked for 2 years at the World Bank on agricultural development and natural resource management projects in Latin America. Then she joined UNDP/GEF in Brazil as project design specialist on a project on the effective conservation and sustainable use of mangrove ecosystems.

Dana has also worked with indigenous and peasant communities doing project design and evaluation work on agricultural development, biodiversity conservation and natural resources management projects. She has worked as an election observer in Colombia and Ecuador and as a researcher on a variety of different environmental and international political issues. Dana possesses in-depth knowledge of the multi-laterals, the different phases in the project cycle and relevant performance standards.

Ndibi Schwieters, Regulatory/Legislative Expert, GSEC, is an Environmental Scientist and Forester, has several years of experience both in the forestry and environmental areas in Guyana. Her responsibilities have included developing protocols for baseline definition of forest resources and the development of management and mitigation plans to minimize impacts on these resources.

Michelle Kalamandeen, Biodiversity Specialist GSEC, is an extremely well qualified biodiversity specialist with extensive credentials and experience in Guyana. Michelle will work closely with Robert Langstroth to cover biodiversity aspects.

Ayaana Jean-Baptiste, Social/Community Specialist, GSEC will support Sunrita in the social/community aspect of the assessment. She will be the local specialist who will provide support in the surveys, community consultations and analysis.

1.5 ESIA Organization

This remainder of this ESIA will be developed in the following sequence:

- Chapter 2 identifies the various phases of the Proposed Action and details of the components of the Proposed Project.
- Chapter 3 identifies and discusses alternatives to the Proposed Action.
- Chapter 4 outlines the Legal and Institutional Framework for environmental compliance by large scale mining operations.
- Chapter 5 is a description of the physical and biological environment within the project study area.
- Chapter 6 is a description of the socio-economic and socio-cultural environment within the project study area.
- Chapter 7 is a discussion of the public and community consultation process incorporated into the assessment of potential impacts of the proposed action.
- Chapter 8 presents the impacts on the physical environmental and identifies the risks associated with the proposed action.
- Chapter 9 examines the socio-cultural and socio-economic impacts and risks of the proposed action.

- Chapter 10 outlines the Environmental Management Plan (EMP) proposed to mitigate the impacts associated with the project and the implementation schedule and costs for each element of the EMP.
- Chapter 11 outlines the Institutional framework for project execution and supervision.
- Chapter 12 presents the Monitoring Plan required to ensure compliance during the various phases of the proposed action.
- Chapter 13 examines the risks associated with the proposed action and details steps required to minimize those risks.
- Chapter 14 details a preliminary closure plan for the site and
- Chapter 15 details the results of discussions with agencies and NGOs.

2.0 DESCRIPTION OF THE PROPOSED ACTION

2.1 Proposed Action

For the purposes of conducting this environmental and social impact assessment, the proposed action is the operation of an open pit and underground mining and mineral processing operation for the recovery of gold in the GUY Concession at Aurora on the Cuyuni River. Mining will entail ore recovery from Rory's Knoll, East Rory's Knoll, Aleck Hill, South Aleck Hill, North Aleck Hill, Walcott Hill, East Walcott Hill, Mad Kiss, South Mad Kiss, and West Mad Kiss. A processing plant with three primary circuits; gravity, Carbon-in-Leach (CIL) and Electrowinning will be utilized for gold recovery from the mined ore.

Several facilities will be constructed on site for the operations in addition to the processing plant. These facilities will include personnel housing, equipment repair shops and fuel oil storage facilities. The proposed layout of the mine site is shown on Figure 3.

2.2 Preliminary Works

It is anticipated that the preliminary works or setup phase will be conducted prior to the access road being serviceable. However, it is assumed that a trail would be opened to the Barama Company Limited (Barama) road network providing tote road access. The tote road will allow a starter suite of construction equipment, fuel and materials to move onto the Aurora site. If trail access is unavailable then the current method of road, river and air access will be utilized.

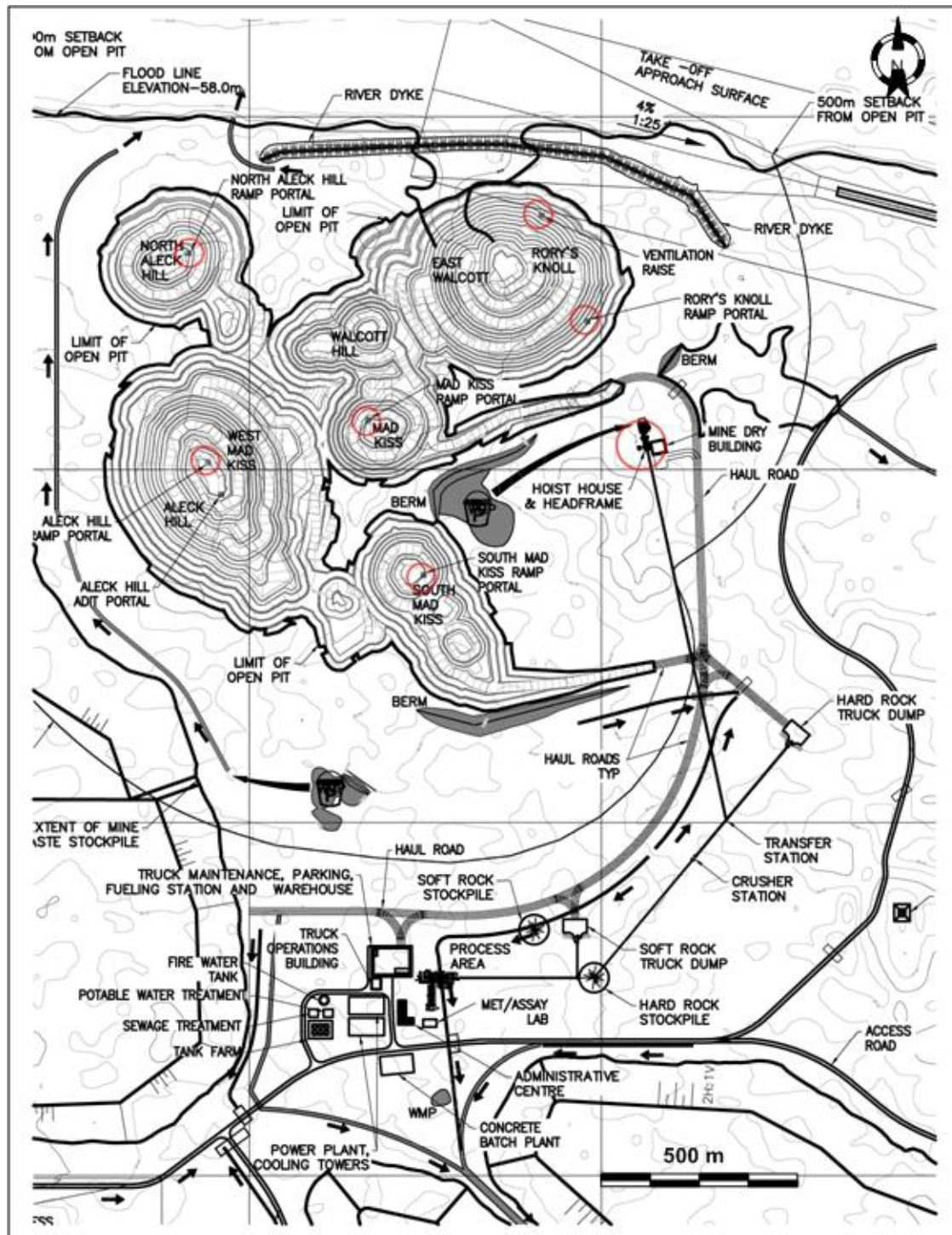
Off site setup activities will include setting up a consolidation facility and port and access road development. Access road construction will be required to connect Aurora to the port facility to be constructed at Buckhall. Materials handling equipment will be staged at the port and materials and equipment will start to ship.

Site activities during the setup phase will be focused on preparing a construction starter camp, kitchen and construction offices of wood construction. Communications will be installed and onsite administration and management readied. Rudimentary utilities for sewer and water would be provided for the starter camp on a design that contemplates connection to services to be later installed for the permanent workforce accommodations and kitchen.

Core setup activities would include:

1. Tote road access to the Aurora exploration camp and airstrip
2. Brushing and grubbing of the construction camp location
3. Fuel and lubricant containment and storage
4. Setup and operation of a portable sawmill with planer and jointing capabilities
5. Installation of sewer, water and power services
6. Accommodation, kitchen and office construction
7. Boardwalk construction connecting buildings
8. Outbuildings and shelter for minor repair and maintenance, power generators, water pumps, storage lockups etc.

The portable sawmill will continue operations producing beams and timbers, forming boards and dimensional lumber. Timbers will be used for embankment cribbing and decking for vehicles at stream crossings. Temporary post and beam covered structures to accommodate carpentry, fabrication, and maintenance will be erected. Skid mounted sheds, tool cribs, tanks, and portable offices will be assembled for deployment to work areas.



Source: AMEC, 2009.

Figure 3: Layout of Mine Site

Site access and drainage will be improved and brushing and grubbing activities will be expanded. Brushing and grubbing would be controlled by survey to ensure that the required designed footprint of the operations is managed. Dock and loading ramps will be prepared to provide workable river access. Laydown area will be developed. Access to a rock or aggregate source will be developed. Survey control and site layout activities will commence. It is anticipated that exploration drilling to improve confidence and provide condemnation of mine footprint real estate will be ongoing. Geotechnical investigations will continue and drainage management will be laid out and detailed in the field for construction.

Site capture will kick into high gear when road access and river crossing infrastructure is useable. Materials for permanent camp construction and fuel storage and tank fabrication will arrive and these activities will be undertaken. The construction equipment fleet will be expanded.

Quarrying equipment and starter aggregate crushing operations will start to produce limited quantities of concrete for camp construction. Permanent camp sewage, water treatment and solid waste equipment and power services will be installed.

A permanent airstrip will be constructed and a security and terminal building constructed.

When the facilities to support a construction workforce are complete and land has been cleared and surveyed, construction of site infrastructure will be undertaken. Significant works will include the process plant, crushing and conveying, maintenance shops, administration facilities, warehouse and laydown for stores, mine operations access road construction, power lines, tailings containment and water management structures.

At the completion of construction the mine will be producing ore and the process plant will be operational. Construction personnel and equipment will be demobilized and mining activities will commence.

It is anticipated that construction period will take 24-30 months and manpower levels will peak at 400-500 persons.

2.3 Mining and Mineral Processing

2.3.1 Open Pit Mining

The mine pit design is comprised of five main pits over Rory's Knoll, East Rory's Knoll, Aleck Hill, South Aleck Hill, North Aleck Hill, Walcott Hill, East Walcott Hill, Mad Kiss, South Mad Kiss, and West Mad Kiss. These pits will be eventually coalesced into one larger pit. The extent of the individual and coalesced pit is shown on Figure 4. The overall pit would be limited to remain a minimum distance of 50 m from a dyke constructed to protect the work areas from the Cuyuni River floodplain. Overall pit slopes will vary from 43° to 51° in rock and 26° to 34° in saprolite, based on variable face slopes and berm widths for geotechnical zones. Ramps will be designed to be 25 m wide for double lane access and will narrow down to 15 m single lane access in the bottom 25 m depth of each pit area. There will be no haul ramps on the north side of Rory's Knoll area by the river dyke to reduce the slope angle and extend the pit bottom further.

The pit design is based on a 0.65 g/t Au cut-off grade and has a waste to mineralization strip ratio of 9.5:1. The strip ratio varies in the individual pit areas from 8 (for Aleck Hill and North Aleck Hill) to 17 (for South Mad Kiss). The saprolite depth varies from 11 m in Rory's Knoll to 63 m in Aleck Hill.

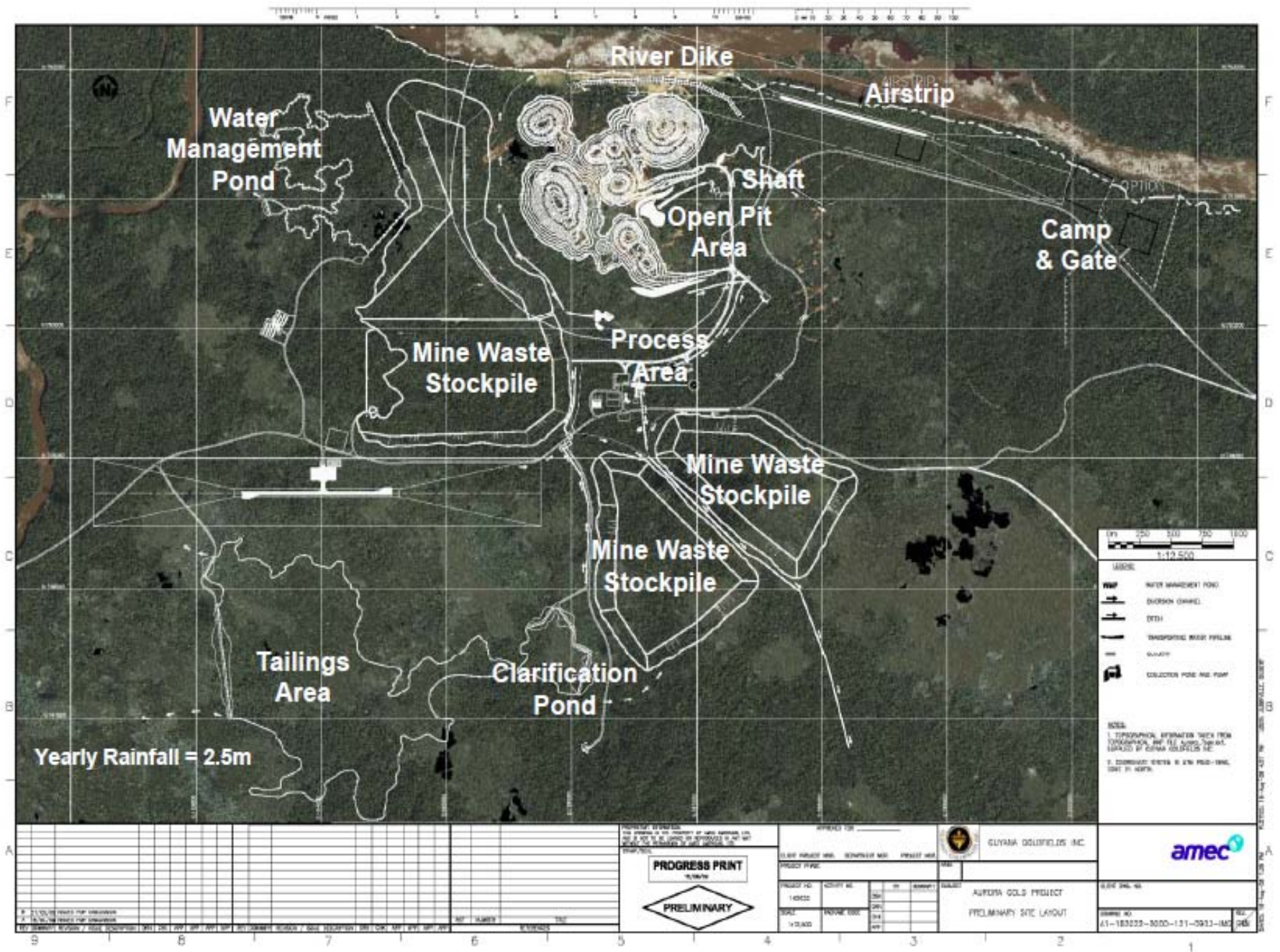


Figure 4: Extent of Individual and Coalesced Mine Pits

Pit production is scheduled to commence mining at Rory's Knoll first which will open up access for the underground portal development as soon as possible. When saprolite is mined out in Rory's Knoll, mining of saprolite will commence at the other pit areas, with mining of rock occurring in Rory's Knoll. The sequence will continue to Aleck Hill, then South Mad Kiss and North Aleck Hill. The central area, Walcott Hill, would be left until last in order to keep open haul access to the mill for North Aleck Hill open. Mining is scheduled to occur 350 day year and will start 390 days prior to mill start up to better utilize the equipment fleet over the mine life with the higher strip ratio in the early years. Mill feed is targeted at 8,000 t/d for the first three years and will then be reduced to 5,000 t/d for the remainder of the open pit mine life. The life-of-mine for the open pit is 9.6 years including the pre-production waste removal.

The major equipment requirements for the open pit operation will include sixteen 100 tonnes haul trucks, four 8.8m³ loaders, and four 6.5" drills. Conventional truck and shovel surface mining methods would be used for the open pit mining phase of the operation. Mining will be conducted within the boundaries of the deposit as identified by exploration work. The mine limits will be defined by location survey in the field. Mining depths of up to 150 meters are generally achievable with conventional open pit methods. Overburden and organic materials will be removed and stockpiled and reserved for environmental reclamation activities.

Materials to be mined will be sampled to determine whether they are waste or ore. The in situ material would be marked by flags and pickets prior to excavation. Waste materials will be sorted from mineral bearing materials and loaded into mining trucks. The trucks will transport mineralized ores to the process plant and waste materials to waste stockpile locations. Tracked 400hp dozers will maintain the stockpiles. Some ore will be fed directly into the process plant and some will be stockpiled to ensure adequate supplies of ore feed are maintained.

The weathered material close to surface will be excavated without blasting. As mining progresses fresh hard un-weathered material will be drilled and blasted. Blast patterns will be engineered to ensure a design allowing adequate fragmentation and maximum control.

A small bulk explosives plant will be constructed to blend blasting agents at the mine site for use in the mine. This process allows for the shipping of oxidizer and other components separately. These ingredients are not explosive until blended together in exact proportions at the mine site and sensitized. Bulk explosives will be delivered directly from the bulk plant to the blast holes in specially designed bulk explosive blending trucks.

The mine area will be engineered to ensure the design controls the mine footprint and limits the clearing of forest to the area required to conduct mining activities. The footprint design will contemplate the minimum removal of forested areas.

2.3.2 Underground Mining

The Rory's Knoll underground extends from approximately 240 m to 1,350 m below ground surface. Primary access to Rory's Knoll Underground mineralized material will be through a 5.8 m diameter shaft and a service ramp. Sublevel open stoping was selected as the preferred mining method based on a list of 15 criteria developed by AMEC and Guyana Goldfields.

The Rory's Knoll Underground deposit has been divided in three mining fronts, each producing 1,200 t/d (on average), in a total of 3,600 t/d. Stopes will be mined in a "primary-secondary" sequence starting at the bottom of the mining front and progressing upwards and "centre-out". Paste fill was selected as the preferred backfill method. The crown pillar immediately below Rory's Knoll open pit will be recovered near the end of mine life.

The Satellites Underground mining zones (i.e. Aleck Hill Underground, North Aleck Hill Underground, Mad Kiss Underground, and South Mad Kiss Underground) will serve as supplemental production sources for Rory's Knoll Underground. These deposits extend from below the open pit bottoms of 30 m to 140 m. For the Satellites Undergrounds, ramps will provide primary access, and the mining method is the same as the Rory's Knoll Underground. The overall production rate from the Satellite Underground is set at 800 t/d.

Life-of-mine for the underground operation is approximately 17 years. The major equipment requirements for the underground operation include 2-boom jumbo drills, in-the-hole (ITH) production drills, load-haul-dump units (LHD), development and production haulage trucks, and service equipment.

Underground mining will be done using sublevel open stope (SLOS) mining methods with delayed backfill. The mine deposit would be accessed by a shaft and/or a decline/ramp with several adits main levels and sublevels at different levels horizons. The main levels would be connected to the shaft while the sublevels would not. All main levels and sublevels will be driven parallel to the deposit and connected by the decline/ramp.

The underground mine development will involve activities such as drilling, blasting, mucking and hauling, ground support and installations of services. The underground production will include unit operations such as longhole drilling, explosive loading and blasting, ore mucking, and backfilling.

The underground mine services will include the following subsystems:

1. ventilation
2. material handling (load-haul-dumping and/or trucking and hoisting)
3. dewatering
4. backfill
5. compressed air
6. process water and portable water
7. power supply
8. communications
9. egress and refuge, etc.

2.3.2.1 Underground Mine System

Production rate from the underground mine will range from 3,000 to 4,000 tonnes per day (tpd). Geological and geotechnical drill cores indicate that the underground geomechanics are favorable to sublevel longhole open stope mining with delayed backfill. The major underground mine operations and subsystems would include:

- Underground mine major infrastructure
- Underground mine development
- Mining method and mining cycle
 - Drilling
 - Blasting
 - Mucking
 - Backfilling
- Ventilation
- Material handling
 - LHD – grizzly – rockpass – trucking/conveying
 - Hoisting
- Other services
 - Dewatering and process water

Compressed air
Underground communications

- Mine geology

The underground operation will include infrastructure required for level access, production, power supply and transportation of material and men and equipment maintenance. Figure 5 illustrates the conceptual underground mine at Aurora and basic required infrastructure. The figure also illustrates the conceptual spatial relationship between the open pit and underground mine.

The shaft will form the primary access to the underground levels, and would be the main artery for materials and personnel transport. Shaft stations would be established at pre-set levels from which drifts and internal ramps would be driven to access the mining horizons.

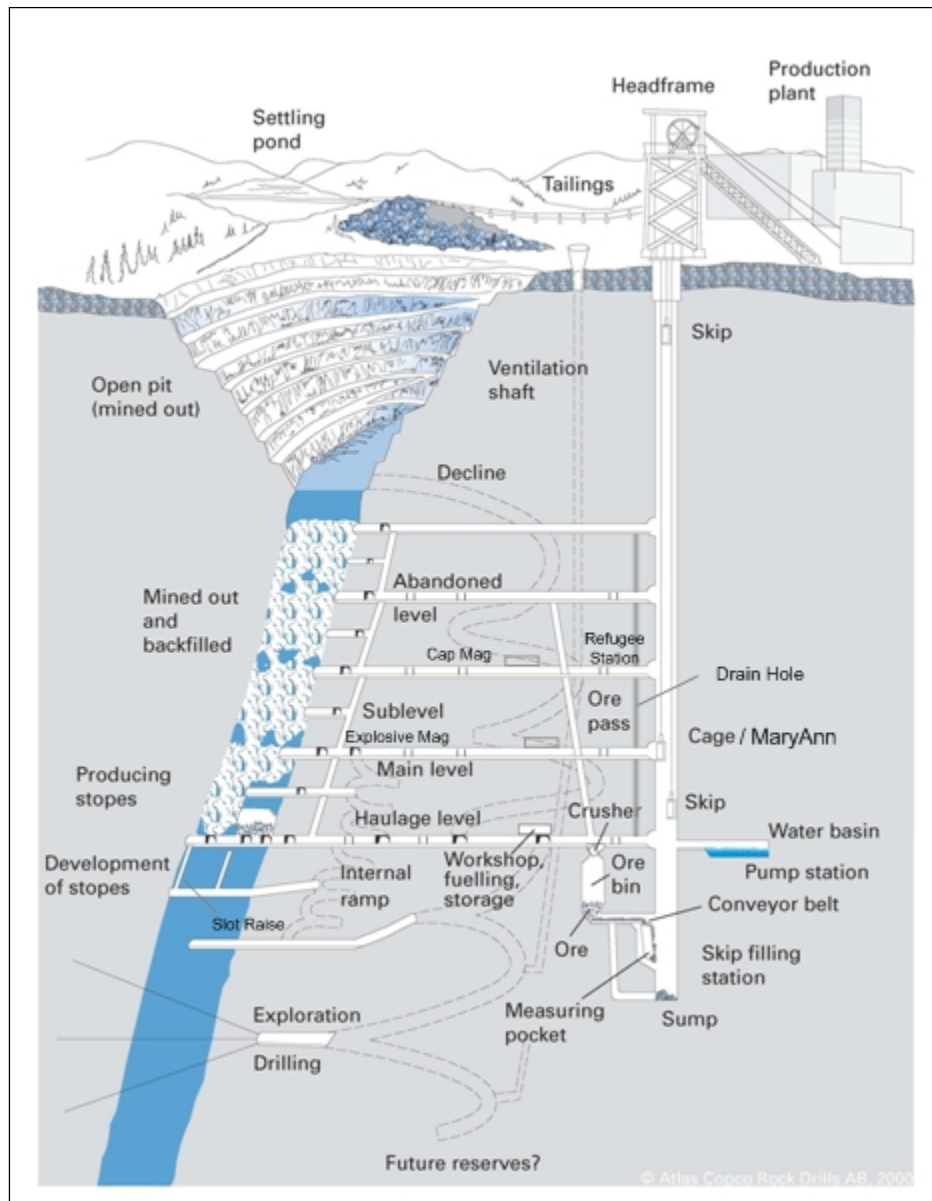


Figure 5 - Conceptual Layout of Underground Mine at Aurora

Approximately 1000 - 1500 m³ of saprolite (soil) will be excavated during underground mining. The soil will be placed on a saprolite stockpile for rehabilitation after closure. Total waste rock tonnage is expected to be approximately 1.8 million tonnes (Mt) over the 17 years life of the mine. Prior to production, rock from mine development will be hauled to a waste dump. During the production period, 40% of the waste rock will be used to backfill the mined out stopes. The mining sequence will be bottom-up, from lower level to upper level. Therefore, the development waste from upper levels will be dumped or backfilled to the lower mined stope voids as much as possible to save hauling/hoisting and paste fill costs.

During production, blasted material would be taken from the production stopes and would be passed through a grizzly equipped with a rockbreaker. The grizzly would be used to size the material dumped into and stored in the orepass before transfer by truck, rail or conveyor to the loading pocket at the skip station, where it would be hoisted to the surface. The oversize material, from the grizzly, will be further downsized using a rock breaker or will be moved to a secondary blasting chamber.

Electric power would be distributed throughout the mine and would be used to illuminate work places and to power drills, pumps and other equipment. A compressor plant will supply air to pneumatic rock drills and other tools, through a network of pipes. Water would be provided in the mine for drilling, blasting and mucking, for dust suppression and for hole flushing.

Groundwater would be coupled with flushing water and will flow to secondary or tertiary sumps, which would be situated near drain holes on the levels and sublevels. All water would flow by gravity to main sumps located on the bottom level. After settling and/or neutralizing, clear water will be pumped to the surface into surge ponds and will be used/recycled as mill and underground process water. If the collected water satisfies quality requirements, it may be partially discharged directly; otherwise, it will be conveyed to the water management pond.

Air quality in the underground mine will be maintained to acceptable health standards. The underground mine will be provided with a ventilation system, to remove smoke from blasting and exhaust gases from diesel-powered machines, and to provide fresh air for the workers. This will be provided via a downcast fresh-air shaft. High pressure fans on the ground surface will extract foul air through the upcast shaft. Ventilation doors will control the underground airflow, passing fresh air through active work areas. Polluted air would be collected in a system of exhaust airways for channeling back to the ventilation shaft.

2.3.2.2 Underground Mine Infrastructure

The underground mine infrastructure will include access drives to sublevels, drifts for longhole drilling, loading drawpoints, and orepasses. Together, they will form an intricate network of underground openings (drifts, ramps, shafts, raises, etc), each with its own function.

The shaft would be a long-lived installation which will serve the life of mine. The hoist will provide the means to access the main underground levels. It is on these levels that load-haul-dump (LHD) mobile equipment, trucks, and other trackless mining equipment will operate. Skips would be used as it is the most efficient way to hoist ore from underground to surface.

Material will be handled by mobile equipment throughout the mine. Maintenance workshops will be located underground at convenient points on the main levels between ramp positions. Workshops will have floor drains that channel all spillage to a sump, similar to the surface workshops. Each sump will be equipped with a water treatment system which will collect and remove oils via an oil-water separator. Used oils will be collected in containers and will be brought to the ground surface for disposal by an outside contractor. Used oil rags and filters will be collected in containers which will also be brought to the surface for disposal by an outside contractor.

The shaft will remain as the mine's main artery. However both downwards and upward ramps will be developed to access the mineralized horizon. It is also likely that a ramp may be driven from surface while the shaft is being developed to more quickly access the deposit at deeper levels.

2.3.2.3 Underground Mine Development

Underground development will involve the excavation of shafts, drifts, ramps, steep raises, explosive magazines, fuel bays, refugee stations, pump houses and workshops. Based on the current known resources, a 1,400 m deep shaft is expected to last the life of mine. The shaft will be circular in profile.

Drifts and ramps would be dimensioned to accommodate equipment and services. Ramp grades will vary between 15% and 20%. A typical ramp will run in loops with a curve radius of 20 – 25 m and a grade of 17%. Drifts and ramps will be mainly developed by using two-boom electro-hydraulic jumbos for fast and accurate drilling. Typical drift and ramp development cycle will consist of drilling-blasting-ventilating- Load-Haul-Dump mucking- scaling and ground support.

Raises will connect the levels and sublevels at different elevations and would be primarily used for ladderways, orepasses, slots or ventilation. The inclination of a raise is expected to vary from 70° to vertical, with cross-sections from 1.2 m² to 15 m². A raiseboring machine (RBM) will provide a safe and efficient mechanized excavation of circular raises. Conventional raise boring would be used and would consist of a pilot hole drilled to the target level where the bit would then be removed and be replaced by a reaming head. The RBM would then ream back the hole to the final diameter by rotating and pulling the reaming head upward. The cuttings will fall to the lower level, and will be removed by LHD.

2.3.2.4 Underground Mine Production

2.3.2.4.1 Mining Method

Sublevel open stoping (SLOS), a large-scale open stoping mining method, or one of its many variations will be used to exploit the underground deposit. The orebody will be divided into a series of primary and secondary stopes. The primary stopes will be mined first, with the unblasted mineralized material between the primaries being left as a temporary pillar to support the hanging wall. These temporary pillars would be recovered at a later time as secondary stopes. Horizontal section of ore may be also left, as crown pillars or sill pillars.

If sublevel open stoping is used, the largest dimensions would normally be in the vertical direction. Mining activities such as drilling and blasting would be conducted in the sublevels with the mineralized material being collected through drawpoints on these levels.

2.3.2.4.2 Drilling

Sublevel drifts would be strategically located within the orebody between main levels. These drifts would be driven to allow the longhole rigs to drill the blast patterns. Longhole drilling will be performed by either top hammer or in-the-hole (ITH) hammer longhole production rigs.

2.3.2.4.3 Blasting

Production blasting would generally be carried out in single lift and would be commonly initiated around a 1.2 m diameter raisebored slot raise located on the end of the stope. The slot raise initially may serve as a fill raise for the stope below, then as a slot for blasting. Blastholes would be charged with ammonium nitrate and fuel oil (ANFO) with the holes being "tied-in" immediately before the blast. Typical power factors for production blasts are expected to range between 0.6 – 0.9 kilogram per tonne (kg/t), and will depend on the stope size, drill pattern and hole diameter.

The frequency of blasting will depend on the stope size and production requirements. After each blast, the mine's ventilation system will clear the mine of the noxious gases. Before the mine is re-entered, trained personnel will use gas detection equipment to check air quality in all work areas to ensure the mine is clear of blasting gases.

Blasting operations will be undertaken by qualified persons using proper equipment and materials. Everyone involved in the blasting operations will be trained to ensure commitment to safe working practices and to ensure that every step of the operation is done in a manner which uses the correct methods and procedures. General blasting procedures will consist of the following steps:

- Survey the area
- Preparing the primer
- Loading the borehole
- Selecting detonators
- Connecting the shot
- Clearing the area
- Firing the blast
- Handling misfires

Explosives used for underground blasting shall conform to Fume Class I rating. The general blaster's rules shall be as follows:

- a. Check blasting equipment for condition, capacity, etc. prior to loading the shot.
- b. Arrive at the blast site early. Allow ample time to load and connect shots.
- c. Observe the information and drill pattern prior to loading.
- d. Look for mud seams, soft material, burden and spacing.
- e. Diagram the shot as drilled. Time shot. Review timings before caps are laid out.
- f. Calculate powder factors prior to loading.
- g. Keep the number of people to a minimum when loading and connecting up.
- h. Assign duties to specific people during loading and be sure they carry out those duties.
- i. Start loading shot in such a manner that it could be shot in the event of equipment failure.
- j. When loading bulk explosives, a 30 cm to 60 cm column of explosives would be loaded prior to the primer.
- k. When loading packaged explosives, load one stick prior to the primer.
- l. Be certain that stemming is adequate.
- m. Always clean the shot area prior to connecting up.
- n. Always have adequate cover at the blasting point.
- o. Make sure understanding of the signal to fire the shot.
- p. Complete shot report before leaving the site.
- q. Excavate blast area when threatened with electrical storms.
- r. Always use common sense.

The underground mine would only be evacuated for large scale blasts. Typically it would not be evacuated before every blast. If the mine is evacuated, the blast would be detonated from the surface using electric-nonelectric combined blasting techniques.

Refuge station would be located at a minimum distance of 60 m from the explosive magazine, cap magazine, and storage container (Ontario Reg. 854 s. 126). Refuge stations would be located in a crosscut or blind heading adjacent to the main travelling roadway with thick fire-proof stopping at each end and would be supplied with telephone, compressed air, food, and water.

Both permanent and portal refuge stations will be provided. Permanent refuge stations would be located on the main levels within 300 m of the shaft stations. Portal refuge stations would be mounted on skids and will be moved with the working face and would be sited within 300 – 500 m of the working face.

2.3.2.4.4 Mucking

Mucking would be carried out at stope drawpoints on the level at the base of the stope. To ensure the safety of the workers, the LHD's would be operated by remote control in the stope once the brow of the drawpoint has been exposed. The mucked material may be dumped into an adjacent orepass, or into trucks if the distance to the orepass is excessive.

2.3.2.4.5 Backfilling

To minimize ore loss, consolidated backfill techniques will be used to fill the open stopes. The mined-out stope will be backfilled with cemented paste fill and/or cemented rock fill (CFR). Cemented paste fill is a high density mixture of de-slimed tailings mixed with cement. The mixture would be prepared on surface and would be pumped underground via a network of drill holes and pipes. CRF is a mixture of cement slurry and crushed rock or underground development waste. This mixture would be prepared underground and would be dumped into the stopes via fill raises.

The primary stopes would be mined first, then backfilled so that the secondary stopes can be safely extracted. The secondary stopes, in turn, would be backfilled with a lower ratio of cement content for paste fill or non-cemented waste rock, as the backfill does not require the same strength as in the primary stopes. Backfilling stopes will allow for close to a 100% recovery rate of the ore.

2.3.3 Mineral Processing

The processing plant is planned to treat a blend of the saprolite/transition rock and hard mineralized material at a rate of 8,000 t/d. Saprolite mineralization, which is soft, will be crushed using a mineral sizer; the harder mineralized fresh rock will be crushed using either a jaw or gyratory crusher. Crushed material will feed into a semiautogenous grind (SAG) mill. A circulating load (20%) of the SAG mill discharge will be conveyed to a pebble crusher. A cone crusher rated at 70-100 tonnes per hour (t/h) will be selected for pebble crushing. The SAG mill discharge will be split equally and will feed two parallel ball mills in closed circuit with a cyclone pack.

To maximise recovery of gravity recoverable gold, a portion of the cyclone underflow would be diverted to a Knelson concentrator. Based on preliminary metallurgical results it is anticipated that approximately 35 to 50% of the gold would be recovered by gravity.

To improve the cyanidation kinetics the thickener underflow would be fed to a preaeration tank before the leach tanks. The slurry from the leach tanks will be pumped to the carbon in pulp (CIP) circuit, which conceptually would be a train of six agitated tanks. Loaded carbon will be directed to the carbon stripping circuit. Cathode gold would be periodically removed under tight security, refined to doré in a furnace and cast into bars for shipment and sale.

Tailings from the last CIP tanks will be discharged to a cyanide destruction plant. The residual cyanide content would be reduced below permissible levels through oxidation, using a SO₂ air process.

The major process units would be:

- Primary crushing, ore handling and storage
 - o Mineral Sizer
 - o Jaw Grinder

- Grinding
 - o Sag Mill
 - o Ball Mill
- Classification-Cyclones
- Gravity Circuit
 - o Knelson Concentrator
 - o Intensive Cyanidation Unit
- Thickener
- Cyanidation -Leach Tanks-Adsorption (CIP or CIL)
- Elution
- Refining and Smelting
- Tailings-Cyanide Destruction

2.3.3.1 Crushing/Material Handling

Two crushing circuits will be proposed in the design to account for crushing oxidic or sulphidic ore types. During the first two years of mining, the processing plant will treat the saprolite ore at a rate of 8000 tpd. SGS has established that Saprolite is a fairly soft rock whose work index is 7.0 kWh/t. The Saprolite will require minimal crushing so we are proposing the utilization of a Mineral Sizer as the primary crusher when handling saprolite. A typical Mineral Sizer is depicted in Figure 6. When the oxide layer is depleted, hard rock with a work index of 14.2 kWh/t will be encountered. A jaw crusher or gyratory crusher would be installed in year two. The Mineral Sizer will remain in the circuit to possibly handle other saprolitic material likely to be encountered.

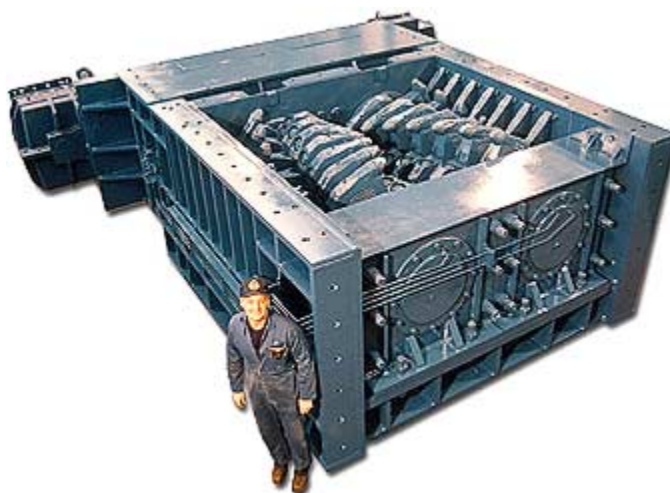


Figure 6 - Typical Mineral Sizer

2.3.3.2 Milling and Pebble Crushing

The Mineral Sizer or the Jaw/gyratory crusher will feed a SAG mill, which will be designed for a throughput of 4000 tonnes per day. The work index for the oxides is 7 kwh/t and that for the sulphides is 14 kWh/t. Theoretically the throughput would be 8000 tpd when milling a softer ore (and smaller feed size of the oxidized saprolite). The SAG mill could even be operated as an AG mill (Autogenous) and will be converted to a SAG when the harder ores are encountered. Foundations will be designed for a SAG Mill. A circulating load, 20%, of the SAG mill discharge, will be conveyed to a pebble crusher. A cone crusher rated at 35-45 tph will be selected for pebble crushing. The SAG mill discharge would be split equally and feed two parallel ball mills in closed circuit with a cyclone pack. Cyanidation tests have been conducted at three grinds, ranging from K80 of 95 µm to 160 µm and as expected higher recoveries

(>96%) have been achieved at finer grinds). The grind will be optimized at K80 of 75 µm. A conceptual schematic flowsheet and process flow diagram which covers all process units is illustrated in Figure 7.

2.3.3.3 Classification Thickening

Each ball mill will be operated in closed circuit with a cyclone cluster. The cyclone overflow from each mill will be fed to a high rate thickener, to achieve an underflow density of at least 45%. The thickener underflow would be fed to an aeration tank prior to cyanidation, and the thickener overflow would be pumped to a process water tank. Due to anticipated low settling rates for saprolitic ores, a flocculant would be added to the thickener feed to improve settling rates.

2.3.3.4 Gravity Recoverable Gold and Intensive Cyanidation

To maximise recovery of gravity recoverable gold for the 8000 t/d throughput, a portion of the cyclone underflow would be diverted to a Knelson concentrator. Based on preliminary metallurgical results it is anticipated that at least 30–35% of the gold would be recovered by gravity. The gravity product would be treated in an intensive cyanidation unit (ICU). In particular the tabling of gravity concentrates offers very low recoveries often between 30% and 60%.

Research also showed that the tabling of concentrates in a number of circuits resulted directly in instantaneously high cyclone overflow grades when the table tails are returned to the milling circuit and subsequent losses from the leach circuit to tails. High recoveries from the gravity concentrate-in excess of 97% are achievable. The intensive cyanidation technology is attractive in that it would result in:

- Significant improvements in recovery of gravity gold (no recycle streams from the shaking table), Improved security,
- Capital cost reductions for increased leach throughput.

The gravity concentrator and intensive leach reactor (ILR) would be supplied as a package.

2.3.3.5 Leach

To improve the cyanidation kinetics the thickener underflow would be fed to a preaeration tank before the leach tanks. Leach tanks will be designed and sized for a pulp density of 45% solids and 24–36 hour residence time. The leach circuit will consist of the nominal six agitated tanks. Sodium cyanide would be metered into the first and second leach tank to maintain a nominal 0.5–0.8 g/L concentration. Air will be supplied to all tanks and a provision made for by passing of any one tank.

2.3.3.6 Carbon Circuits

The slurry from the leach tanks will be pumped to the carbon in pulp (CIP) circuit, which conceptually would be a train of six agitated tanks. Each tank will be equipped with an inter-stage screen for carbon retention. Loaded carbon will be directed to the carbon stripping circuit. Stripped carbon from the carbon elution and activation kiln will be delivered to the last CIP tank. Slurry from the last CIP tank would be screened to ensure that no carbon is inadvertently lost. Loaded carbon from CIP would be transferred to a pressure vessel where gold would be eluted with weak caustic-cyanide solution at an elevated temperature. Stripped carbon will be screened and reactivated in a horizontal kiln.

2.3.3.7 Gold Refinery

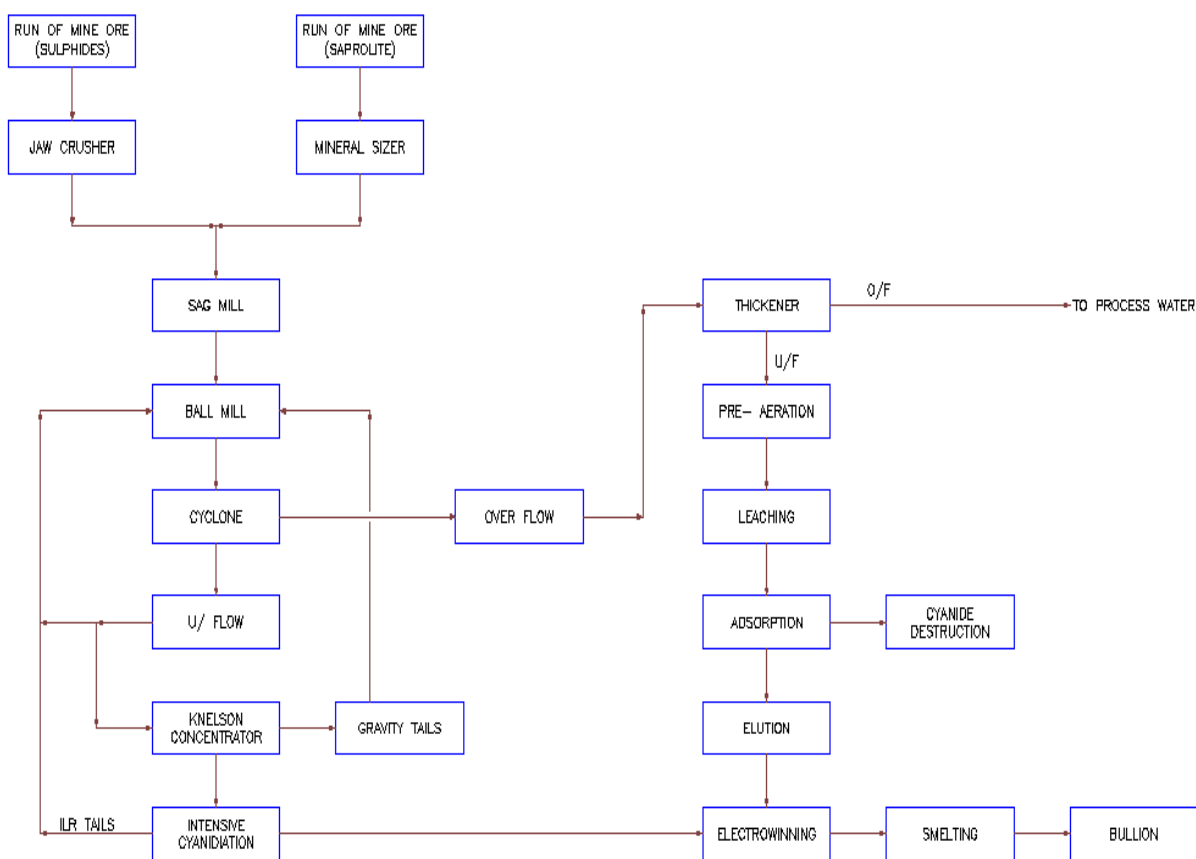
Pregnant strip solution from the elution process would be accumulated in the pregnant solution tanks and would be fed continuously to the electrowinning cells for gold recovery. The electrowinning (EW) will be divided in two sections, with one handling the pregnant solution coming from the ICU and the

other dealing with the eluate from the carbon stripping vessel. Cathode gold would be periodically removed under tight security, refined to doré in a furnace and cast into bars for shipment and sale.

2.3.3.8 Tailings

Tailings from the last CIP tank would be discharged to a cyanide destruction plant. The leach circuit tailings will report to a carbon safety screen, from which they will pass through a sampler for collection of metallurgical accounting sample before entering the agitated cyanide destruction tank. In this tank the residual cyanide content would be reduced below permissible levels through oxidation, using a SO₂-air process before discharge to the tailings pond.

Figure 7 - GUY Schematic Flow Sheet



2.3.3.9 Reagents Preparation Systems

2.3.3.9.1 Lime Preparation System

Lime would be delivered as fine quicklime (CaO) to the site in bulk via trucks. The trucks would discharge into a 150 tonnes capacity silo using their on-board compressor and a hose connecting the truck to a pipe riser, which delivers the quicklime to the top of the silo. The silo will be equipped with a bag house fitted with a mechanical shaker for dust control. The slaked lime slurry will overflow the slaker at a solids density of 12% solids into an agitated holding tank. From this tank, the lime slurry will be distributed throughout the plant and delivered at the various addition points in the leach and cyanide destruction circuits through a pressurized close-circuit distribution loop.

2.3.3.9.2 Sodium Cyanide

Cyanide is planned to be delivered to site in bulk carriers as a 30% solution. The tanker truck will discharge the cyanide into a storage tank from where it can be distributed by metering pumps into the cyanidation circuits. The cyanide preparation area will have a sump pump that will be used to direct any spillage back to the holding tank.

2.3.3.9.3 Caustic Soda Preparation System

Caustic soda would be delivered to the site in a 1,000 kg isotainer as a 50% solution. The caustic soda will be further diluted to 30% strength in a mixing tank and then stored in holding tank. For distribution, the caustic will be pumped in a pressurized loop from which individual control valves will bleed the amounts needed for the addition points in the carbon circuits and for the wet scrubber servicing of the gold refinery induction furnace off-take gases.

2.3.3.9.4 Hydrochloric Acid Preparation System

Hydrochloric acid is planned to be delivered in bulk to the site at a 31.45% solution concentration. The delivery truck will transfer the acid solution into a container provided by the acid supplier. From there, the acid will be drawn upon as required by a metering pump directly to the carbon acid wash solution tank.

2.3.3.9.5 Sulphur Dioxide Preparation System

Sulphur dioxide is expected to be delivered to site in pressurized tanker trucks and transferred into a pressurized tank. A control valve, operated in conjunction with a Coriolis flowmeter indicating the mass flow of reagent, will regulate the addition of the liquid sulphur dioxide, in proportion to the amount of residual cyanide required to be destroyed.

2.3.3.9.6 Copper Sulphate Preparation System

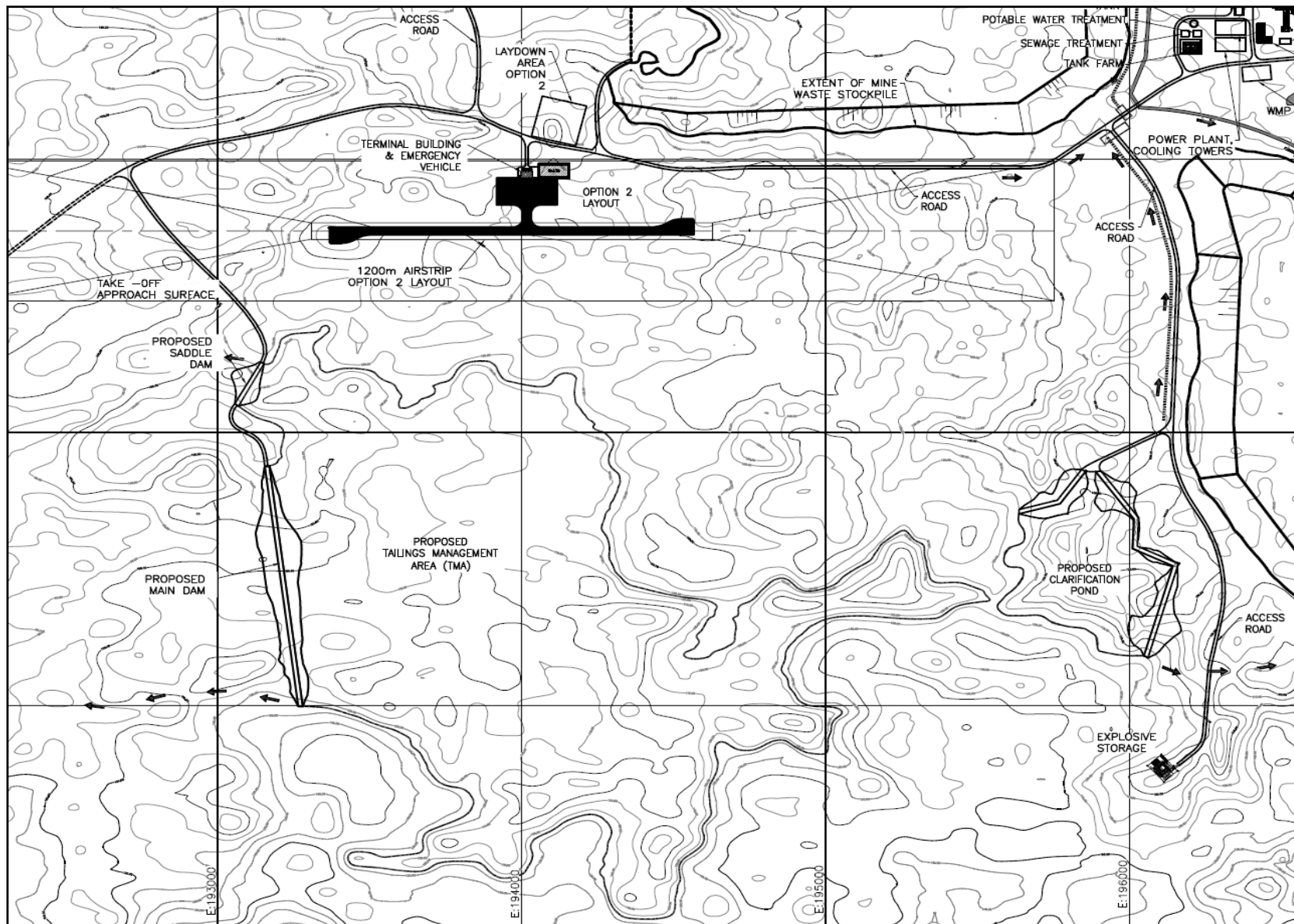
Copper sulphate will be received at the site in 1,000 kg bulk bags. A batch will be prepared by hoisting a bag on a bag breaker to release the solid copper sulphate pellets into the agitated mixing tank, which is previously filled with fresh water. The target solution strength will be typically 15% of copper sulphate. From the distribution tank, a series of metering pumps will provide the desired reagent flowrates to the cyanide destruction circuit.

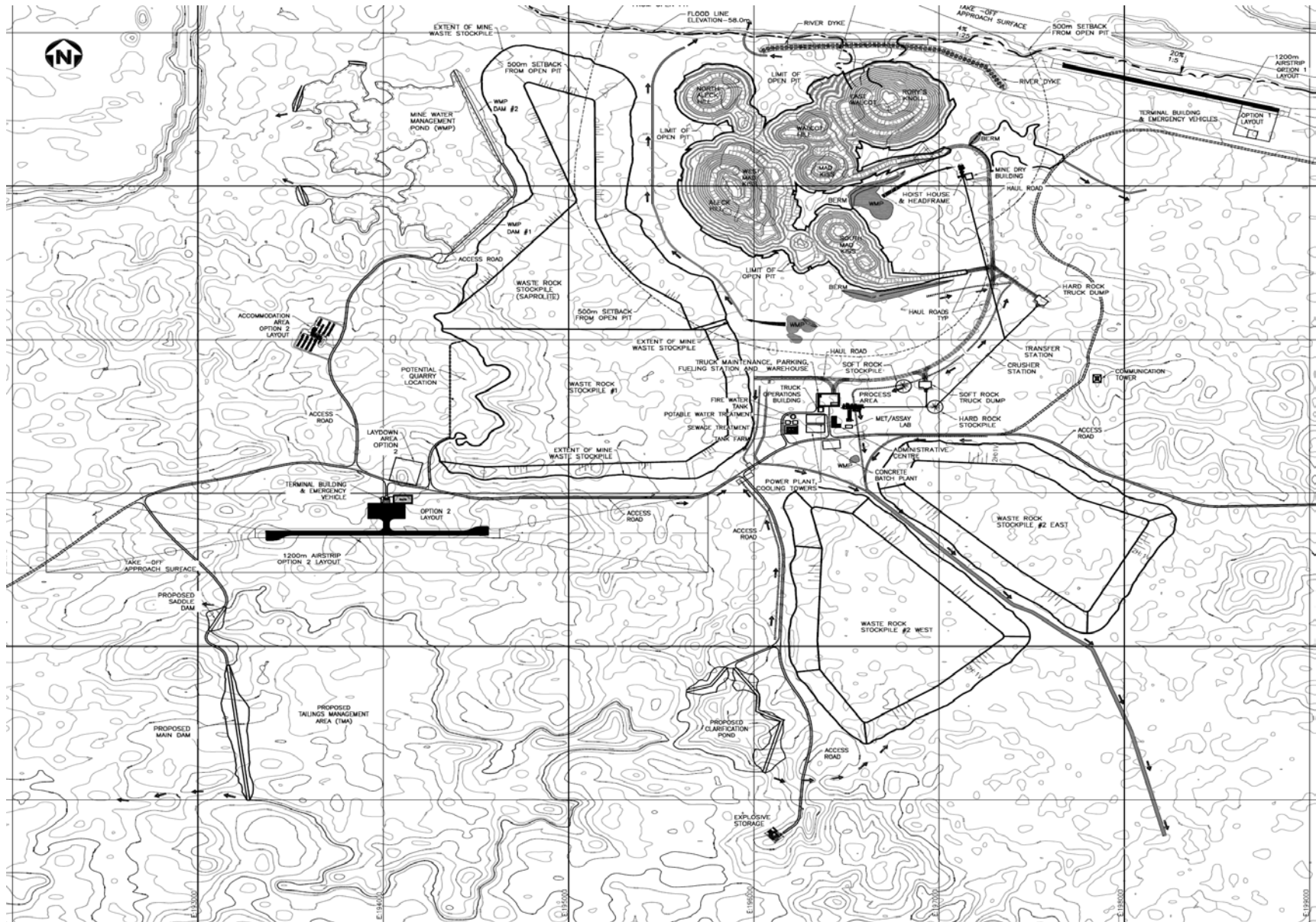
2.3.4 Explosives Plant and Magazine

The explosives plant and magazine is currently planned to be located approximately 3 km to the south of the process plant. The explosives plant area will be fenced and access will be controlled. All works will be stored and handled in accordance with Guyanese explosives regulations. The magazines will be surrounded on three sides with berms for safety and leakage control.

2.3.5 Tailings Management Plan

Tailings will be disposed of as slurry in the Tailings Management Area (TMA), proposed to be located to the southwest of the open pit (Figures 8 and 9). The TMA is designed to contain the Life of Mine (LOM) tailings production of 25 Mt of dry solids. The tailings production rate is projected at 8,000 t/d dry solids, pumped at 45% solids content by weight, corresponding to 13,733 m³/d slurry water.





Due to the uncertainty associated with the tailings geochemistry, it is conservatively designed, at this stage, that the tailings will be discharged to the TMA under a permanent water cover of 1.5 m depth. The typical tailings pond operating level is expected to be about 121.2 m. The cyanide associated with the processing will be destroyed in the process plant to a sufficiently low level. The large retention time and pond surface will enhance the natural degradation of the residual cyanide.

The TMA will be formed by the construction of 2 perimeter dams: TMA dam 1 (875 m in length and 30 m high), and TMA dam 2 (170 m in length and 14 m high). Three perimeter dams will be required to form the clarification pond, clarification pond dam 3 (330 m in length and 20 m high), clarification pond dam 4 (320 m in length and 24 m high), and clarification pond dam 5 (550 m in length and 34 m high). The TMA and clarification pond dams are to be built to 124.0 m crest elevation.

Excess water from the TMA will be discharged at the east edge of the facility through a connecting channel to the clarification pond, which will provide settling to enhance discharge water quality, and will also be the source for process water reclaim. Excess water from the clarification pond will be discharged through an overflow (stoplog) structure to a local receiving watercourse flowing easterly, eventually reporting to the Cuyuni River downstream of the site. The invert elevation of the overflow structure will be set to maintain a permanent water cover over the final tailings surface. The clarification pond is designed to provide a 5-day retention time for a 1-in-2-year 24-hour rainfall storm. Runoff from events up to a 1-in-100-year 24-hour storm will be discharged through the clarification pond overflow structure.

An emergency spillway will be located at the south abutment area of Dam 1 and set at invert elevation above the 1-in-100-year 24-hour storm level. Runoff from events exceeding the 1-in-100-year event will be discharged through both the clarification pond overflow structure and TMA emergency spillway.

The inflow design flood is the probable maximum flood (PMF), corresponding to the extreme consequence category (Canadian Dam Association). The emergency spillway will be sized to convey the inflow design flood, and the dam crest elevation will provide a minimum 0.3 m freeboard above the maximum water level for this event.

The dams will be constructed of locally available fill materials, including silty clay to clayey silt (primarily saprolite), clean waste rock and overburden materials from the open pit excavation. Sand and gravel will be produced from crushing, if not available from a local or nearby source.

2.3.6 Site Water Management Plan and Cuyuni River Flood Protection Dyke

No local runoff data is available. Developed site condition will reflect a higher runoff coefficient than the value of 40% estimated for the Cuyuni River watershed at the project site. For preliminary design purposes and as a conservative assumption, a curve number of 75 were used, which corresponds to a runoff coefficient of about 70% for a 1-in-10 year 24 hour rainfall. This conservative assumption was made for the following reasons:

- Cuyuni River flow data represents the hydrologic response of the upstream river basin, characterized by undisturbed ground with heavy vegetation. This type of ground cover results in significant rainfall losses to interception and evapotranspiration. In contrast, development activities at the project site will result in significant areas with reduced or cleared vegetation, removal of top soil and compacted ground surface. These changes are expected to significantly increase the runoff response.
- Short term high intensity storm events, which govern the sizing of runoff management facilities, generally occur during the rainy season. This will result in high antecedent moisture conditions, increasing runoff response.

2.3.7 Site Water Management Plan

A water management plan was developed for the site to provide flood protection, handle potentially contaminated water, and manage site runoff. The main features of site water management plan are:

An earthfill river dyke is to be constructed alongside the Cuyuni River to mitigate flood risk to the Project. The dyke is to be designed for the very severe flood and earthquake criteria, being the 1-in-10,000-year flood level and the maximum credible earthquake (MCE). The proposed dyke will be about 1540 m long, with a 15 m crest width, 3H:1V slope on the upstream side and a 2.5H:1V slope on the downstream side. A road surface with bedding layer adequate for light vehicular traffic will be provided on the dyke crest. Designs may be revised during more detailed studies.

A Water Management Pond (WMP) will be constructed and will serve as the central water management facility for the entire mine site. The Water Management Pond will be formed by the construction of five earthfill dams: WMP dam 1 (710 m in length and 12.5 m high); WMP dam 2 (500 m in length and 12 m high); WMP dam 3 (143 m in length and 10 m high); WMP dam 4 (231 m in length and 7 m high); and WMP dam 5 (135 m in length and 2 m high). The WMP is designed to provide sufficient storage capacity for 5-day retention of the runoff volume from a 1-in-5-year 24-hour rainfall storm. This assumes a very high pumping capacity of about 7,000 m³/h would be needed to pump the open pit dry over a 24-hour period. The pond will discharge continuously through an overflow structure. For flood events exceeding the 1-in-100-year 24-hour storm runoff, pond water will be allowed to spill through an emergency spillway. Contaminated water from the open pits, underground operations, and any other potentially-contaminated site water will be pumped to the WMP for clarification or treatment if required.

Pit dewatering requirements will be reduced by diverting site runoff away from the open pit. The design concept is to divert runoff away from the open pit in a progressive or staged manner to avoid accumulating large flows and volumes of surface water near the pit perimeter. This will be achieved by diverting site runoff that would normally reach the open pit into one of four diversion channels that will eventually be discharged into the Cuyuni River.

In general, runoff will be collected in ditches alongside the site access roads and haul roads, and routed to the diversion channels. Where topography and site layout make ditching impractical, runoff will be collected in topographic lows, which will be developed into two water management ponds. These will be equipped with a pump station able to route runoff over local high ground to a ditch or culvert.

In certain areas where diversion or collection and pumping is not practical due to topographical constraints, runoff in areas between the haul roads and the pit will be allowed to drain into the pit. This extra drainage has been considered in the sizing of pit dewatering requirements. The site water management plan will be revised during feasibility-level studies and will be based on more detailed survey data, with the aim of further reducing the percentage of site runoff that reaches the pit.

2.3.8 Support Services

Site infrastructure will include rock offload and crushing areas, mine buildings and warehouses, administration building, power generation facilities, accommodation complex, water and sewage management and treatment areas, waste disposal areas, on-site roads and drainage, airstrip, tailings and waste rock management areas, and a river dyke.

The site layout for the Project was determined based on the existing topography as well as the location of the deposits. Condemnation drilling has determined that there are additional areas of mineralization to the southeast of the proposed open pit, precluding most of the works from being located on the easterly and southeast boundaries of the open pit.

The planned process facilities, administration centre and operational facilities are located on the south side of the open pit so as to be as close as possible to the open pit and shaft headframe, while avoiding the east and southeast quadrants. The proposed tailings management area and the waste rock facilities are located on the sides of a ridge located on the west side of the open pit. The use of the ridge minimizes the amount of dams and/or berms required.

The accommodation complex is located close to the river on a westerly-trending ridge; however, if the selected site is within the riparian flood plain, a second site has been identified along the same ridge.

Support services such as equipment maintenance, provision of project housing and other services activities would be performed to reduce accidental spillage of solid matter, contaminants, debris, and other objectionable pollutants and wastes into waterways in the project area. Such pollutants and wastes include, but are not restricted to, refuse, garbage, cement, concrete, oil and grease, and other petroleum products. All water discharges from the area will be done in a manner to ensure minimal discharge of sediments to any waterway. Excavated soil will not be stockpiled or deposited near or on the banks of waterways where they can be washed away by storm runoff.

2.3.8.1 Site Utilities Supply

Two water supplies services will be provided to the camp. These will provide water for the following purposes:

- drinking/cooking
- washing, showers, toilets, etc. (Shower water)

Adequate supply will be provided for the needs of approximately six hundred people. Water for drinking/cooking will either be imported from Georgetown or obtained from onsite wells set at some distance and at higher elevations from the mining operations and sewerage treatment facilities.

2.3.8.1.1 Power Plant

Power will be supplied to the site by an in-house power plant with the capacity to be connected to a transmission line fed from a hydroelectric power plant located approximately 7 km from the proposed mining operation. Power generation will be provided by 13.8 kV (5.82 MW) generators running on heavy fuel oil (Bunker), one of which will be in standby mode as a backup. The generators will be sized so that the units can supply the site demand while running at 82-87% of their rated capacity. With the loss of one generator, the remaining generators shall be capable of handling the total load for a minimum of one (1) hour until the standby unit is brought on line.

In the initial five years of operation, only five (5) generators will be purchased (four units running and one unit functioning as a standby generator). After year five, two (2) additional generators of similar size will be added to satisfy the increased load from the underground mining operations. The heat passed out through the exhaust stacks will be recovered using an exhaust flue gas heat recovery system and will be used to heat the heavy fuel oil in the tank farm. The power plant will consist of a steel-framed, clad building with a footprint of approximately 80 m x 40 m.

Emergency diesel generators will be used to provide emergency power for the mining operations. The units will be sized to provide sufficient power for life safety, including the accommodation camp, and other critical loads. In the initial five years of operation, only one (1) generator will be purchased and installed near the power plant. After year five, an additional generator will be added to support underground mining operations.

2.3.9 Buck Hall Port Facility

Marine cargo will be destined for Buckhall Port on the Essequibo River. Delivery options available include barging from Georgetown or transferring cargo from ocean going vessels to barges at the Essequibo River mouth and barging to the port.

The port facility will occupy approximately 10 fenced hectares on the west bank of the Essequibo River in the area of Buck Hall and will be designed to handle general cargo. The facility will be used as a transfer point for materials in transit to and from the Aurora mine. Materials will be delivered to the port by barges and small and mid-sized ocean-going vessels and transported off-site by trucks. The facility will include the following:

- A dock facility which will consist of a wharf and a short pier that connects the wharf to the shoreline
- A covered storage area and workshop for maintaining equipment and vehicles
- Fuel storage and dispensing facility
- Offices and housing facilities for a wharfinger and support workers
- Utilities, including potable water, solid waste and sewerage disposal, fire protection, and electricity
- Security fencing and structures
- A small-boat landing
- An open lay-down/storage area

The dock and short pier will consist of a reinforced concrete deck supported by timber piles. A timber revetment will be constructed along a part of the shoreline adjoining the pier.

The on-shore covered storage area and workshop will consist of a steel frame structure with metal roof, reinforced concrete floor, and concrete block siding where needed.

Fuel (gasoline and diesel) storage tanks and dispensing facilities will be constructed on-shore and close to the dock. Steel storage tanks will be constructed on raised concrete or wooden supports enclosed in a berm designed to contain any spillage and with a volume of 110% of the total tank capacities.

Offices, conference room, housing, and utilities will be provided for about 25 personnel. The buildings will be single-story concrete or wood structures.

Potable water will be trucked to the facility and stored in separate tanks in the office buildings, housing facilities, and covered storage area. A septic tank and leach tiled system will be provided for sanitary sewer waste disposal. Solid waste will be collected in dumpsters and disposed off-site by a local trash collector. Fire protection will be provided for the entire facility. The fire protection water supply system will consist of a storage tank (for non-potable river water) on its own concrete foundation, a pump station with its intake system at the river, and a distribution system with appropriately design and located hydrants and pipelines. Electricity will be provided by an on-site diesel-powered generator.

Security will be provided by a 3 m high chain-link fence that will completely surround the site. A security building will be located at the front gate. An elevated security tower will be located strategically on the perimeter of the facility. Cameras will be strategically installed to continuously monitor the facility.

A landing for small boats will be provided adjacent to wharf. This will be designed to allow access to the dock by passengers and light cargo.

The lay-down/storage area will consist of an engineered subgrade and gravel surface designed to support the heavy equipment, trucks, and mobile truck cranes that will be used and stored in this area. The site will be provided with adequate drainage.

All structures and facilities will be designed to meet acceptable national and international requirements and standards.

2.3.10 Traffic

Traffic expected to be generated by the project will be from tankers hauling fuel from Buck Hall to the mine site, from trucks hauling chemicals reagents for the beneficiation process, from water tankers servicing the roadway and vehicles transporting company employees. Traffic will be generated by the following vehicles:

- o 4 Fuel Tankers;
- o 2 motor graders;
- o 2 water tankers;
- o 4 - 48 seater passenger busses and
- o 2- 15 seater minivans.

The maximum loaded weight of any vehicle using the road will not exceed 25 tonnes and heavily loaded vehicles would have tandem axles to reduce bearing pressures on the access and roads.

2.3.11 River Crossing

The Cuyuni River will be crossed at a remote location approximately 20 km downstream from Aurora. The crossing would provide service to accommodate initial tote road construction, upgrading the tote road to an all weather road and for transport of mine construction cargo, construction consumables, and resupply cargo and consumables for an operating mine.

The river crossing will service a construction period of approximately 400 days. Based on current projections, an initial crossing may be required in the next 200 days. Peak daily traffic during construction is expected to be approximately 500 metric tonnes (mt) consisting of 12 tractor trailer loads of cargo for 6-10 crossings/day, loaded and 6-10 return crossings/day, empty. Normal mine operations resupply will peak at 6 tractor trailer loads/day. The average situation will consist of 4 tractor trailer loads/day for the life of the mine. It is conceivable that average usage for the life of the project operational phase might be 3 trips per day. The crossing has consequently been conceptualized to embrace the life of mine requirements and to provide capacity for construction peaks.

Bridge construction is not a viable solution given the very low levels of traffic and immense capital requirements necessary to construct a bridge of this span. Bridge costs are several orders of magnitude greater than a barge system. In addition, land access to the construction site is on the critical path. Bridge construction would not be possible in the construction schedule. The navigable waters issue and future use of the river system for navigation further complicates bridge design and schedule.

The river is approximately 300 m wide at the point identified for the crossing; however, the cross-section geometry and flows at this point are unknown. The crossing has been conceptualized to provide a temporary barge crossing if loads are less than 100 mt. A permanent barge crossing will be provided if loads are expected to exceed 200 mt.

During development work on the initial tote road survey and construction works at the mine site a temporary barge crossing will be utilized. The temporary barge will consist of a sectional barge. Each barge section would have a surface area of about 15m² and a width of less than 2m. It is proposed to

utilize 12 prefabricated sections transported to the river and pinned together as they are floated for this temporary barge. This configuration would provide the capacity during construction inclusive of adequate freeboard to transport tractor trailer loads of GVW 100 mt as required. The surface area of this functional barge would be approximately 180m². Adequate buoyancy would be provided and deck space for 2 standard tractor trailer loads would be available. Data on river flow and section would also be compiled during the period that this barge is in use.

During mine site operations, a permanent barge and barge system would replace the temporary barge installed in support of access road and construction activities. The permanent barge design would be based on data compiled on river flow and section during temporary barge use. The permanent barge will be propelled by either a cable or hydraulic propulsion system.

Cable systems commonly consist of a cable laid in the bed of the river and attached at its ends to each barge landing. The cable passes through a tunnel in the center of the ferry and the barge travels along the cable. Hydrostatic drive systems are well adapted to river use and barge profile. The out drive mechanism adjusts to depth as the barge operates in loaded or unloaded configuration. The drive rotates 360 degrees allowing the barge to be propelled at any angle or either direction. The shoreward drive can be lifted to the vertical position when approaching ramp position. Barge configurations with drives mounted both fore and aft provide excellent maneuverability and redundancy.

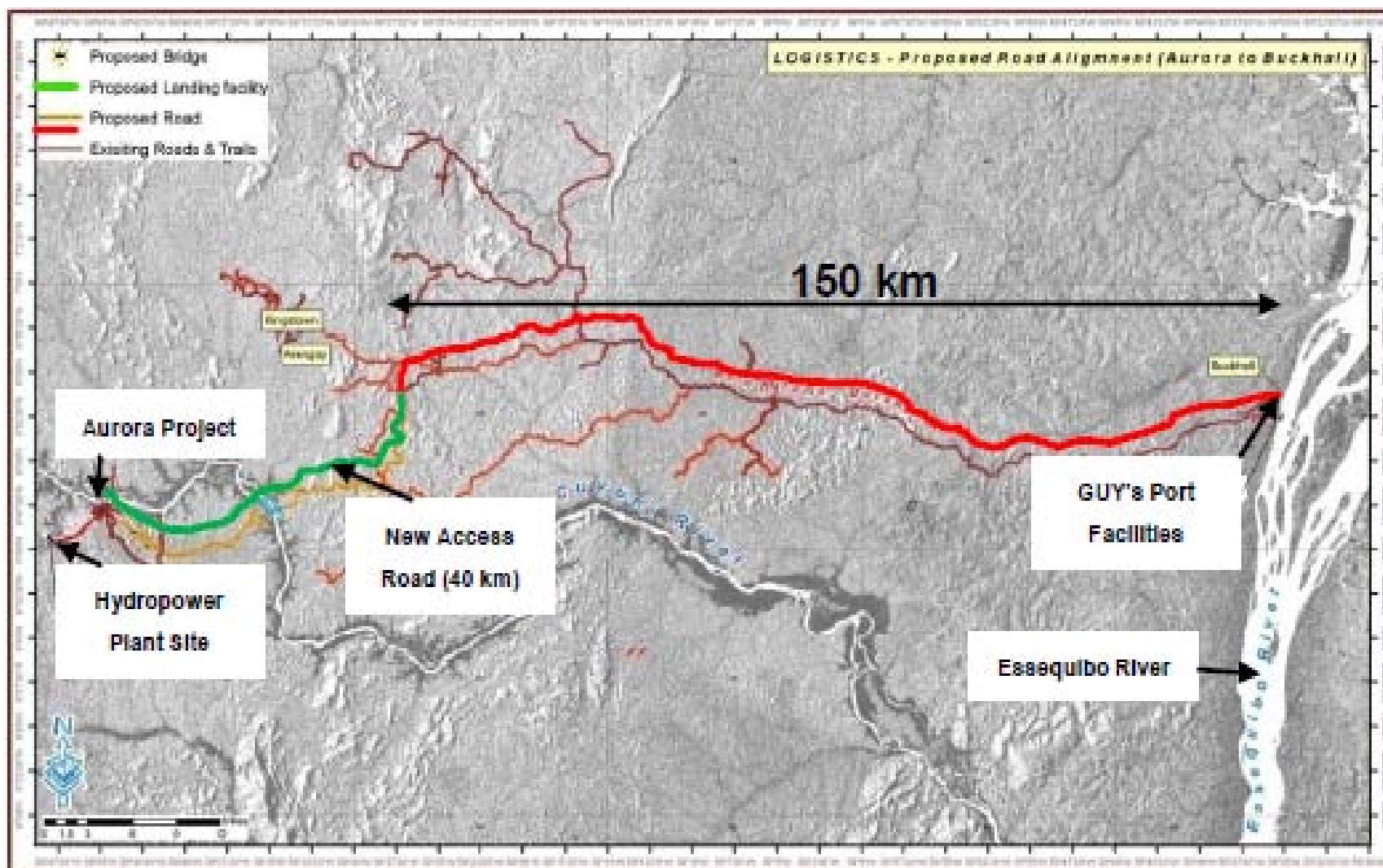
A trade off study would be conducted based on the data compiled to determine the preferred propulsion system.

2.3.12 Access Road

Barama Company Limited has constructed forest access road for its logging operations in close proximity to the Cuyuni River and within 40 km of the Project. Sections of the 150 km of Barama logging road from the Buckhall Port to the Cuyuni River will be upgraded and surfaced. The 40 km section of undeveloped road will require new road construction and will feature barge landings and standard river barge equipment to transit the Cuyuni River. A truck-and-trailer operation will take materials and equipment from Buckall to the barge crossing on the Cuyuni River. Transport equipment based at the mine site will drop empty trailers at the Cuyuni River barge staging area and transport the loaded trailers to the mine site.

The alignment of the access road is shown on Figure 10. The access road will be approximately 25 m wide. It would be constructed by clearing the vegetation on the alignment. The access road will be surfaced using lateritic material available on the roadway alignment. Horizontal and vertical alignment on the access road will confirm to the Guyana Forestry Commission (GFC) guidelines. The access road will be drained by excavating several pits adjacent to the roadway at discrete intervals on the alignment. Runoff from the roadway will be channeled to these pits.

In instances where the roadway crosses streams/creeks, timber bridges would be constructed where spans are in excess of 3 m. In those instances where the spans are less than 3, the stream crossing will be made using High Density Polyethylene (HDPE) culverts.



3.0 DESCRIPTION OF ALTERNATIVES

This section reviews the factors leading to the decisions regarding the selection of the primary alternatives for the development of mining operations at the Aurora Property, including the “No Project” alternative. The physical, biological, environmental, and socio-economic impacts associated with the selected alternatives will be detailed separately in respective sections of this ESIA.

3.1 No Project Alternative

The “No Project” alternative is not considered viable to GUY, as it would result in the foregoing of economic benefits to Guyana derived from the revenues of the gold production and creation of direct and indirect employment by the project. This alternative would also lead to the necessity of further exploration in other concessions and would not leverage the findings of the exploration and prospecting carried out in the Aurora Property to date, thus resulting in greater environmental impacts in areas presently not subject to such activities.

3.2 Mine and Infrastructure Location

The mineral resources at Aurora were first discovered in 1911 and have been explored and partially developed since the 1930s by various mining enterprises. The proposed mine location was selected based on the exploration studies performed by GUY within the Aurora Property since 1996. These studies have identified and delimited the resource, which is concentrated within the zone known as the Golden Mile. There is no alternative location for the mining activities due to absence of other significant findings within the Aurora Property. The siting of the tailings dam, the water management area, the mine waste disposal area, and other facilities have been guided by topography and the principles of minimizing the affected area and concentrating the impacts to a single zone within the concession, as well as the IFC/World Bank Group Environment, Health, and Safety Guidelines for Mining.

3.3 Mining and Beneficiation Processes

The resources to be mined consist of both unconsolidated soils and hard rock. The hard rock portion of the deposit can be recovered solely by drilling and blasting. The unconsolidated soils can be removed by wet-extraction and/or dredging operations where both the overburden and ore are hydraulically extracted and transferred to a processing facility. Operation of a wet extraction method would require the creation of artificial lakes within the mining area and will create tailings that are highly saturated and that contain primarily very fine material. Gold can be recovered from the alluvial deposits at the site by mercury amalgamation. Similarly gold can also be recovered from rock by mercury amalgamation after the rock is crushed to a fine pulp.

GUY will utilize international best practice for all mining and beneficiation processes and will incorporate the IFC/World Bank Group Environment, Health, and Safety Guidelines for Mining in the final design of all facilities and processes. The International Cyanide Management Code for the Manufacture, Transport and Use of Cyanide in the Production of Gold (the Cyanide Code) will be applied to the cyanide management and destruction processes. Wet extraction and mercury amalgamation techniques do not conform to Best Management Practices in the gold mining industry. The cyanidation alternative adopted for the project will result in almost 100% gold recovery.

3.4 Access/Transport Mode

Access to the project and transportation of materials and products is possible by three primary modes: overland, river, or air. Air transport will be used as the primary transportation mode for personnel to and from the mine, which will minimize the number of persons and vehicles/vessels travelling along the access road or on the river and keep the camp as an “offshore operation”. Due to the limitations of

navigability of the Cuyuni River due to the numerous rapids, especially during the low water season, the primary mode of transport of materials and supplies to the mine and product from the mine will be overland by truck from the mine to a port on the Essequibo River.

3.5 Haul/Access Road Route

In order to avoid impacts of constructing an entirely new road, the route for overland transport was selected based on the availability of existing roads that extend west of the Essequibo River toward the project area. There are very few existing roads in the region, limiting the selection to the road constructed for the Barama forestry concession. The “Barama road” runs roughly E-W from the lower Essequibo through forested uplands to the north of the Cuyuni River. There are no roads from the Bartica or the Mazuruni areas that reach the project area; therefore, the only alternative that would not require construction of a new road through currently inaccessible areas would be to use the existing road from the Essequibo River to the Barama forestry concession.

3.6 Port Location

The location of the port on the Essequibo River is limited primarily by the following considerations: location of existing access, location of existing port facilities, location of communities and private land holders, and geomorphological and bathymetric conditions. The Buck Hall location was selected due to its proximity to the “Barama road”, the port of Parika, the availability of suitable lands for the installation of the facilities, and favorable bathymetry for access by ocean-going vessels.

3.7 Energy Supply

Two primary alternatives were considered for the long-term provision of electrical energy to power the mining operations: onsite thermal generation and hydroelectric generation. Other renewable generation alternatives such as wind or solar were not considered in detail due to the required footprint of these technologies in the site. The option of connecting to the national grid was not considered viable due to remote location of the Aurora site. Onsite thermal generation would require the transport of large quantities of fuel to the site and the generation of greenhouse gases and other atmospheric contaminants. However, the initial energy demand will require a generating capacity of approximately 11 MW, with a future peak of approximately 20 MW, levels which are likely to be below the IFC Performance Standard 3 threshold level (i.e., approximately 25 MW generating capacity for oil-fired power plants) for potentially significant greenhouse gas emissions. Hydroelectric generation is being considered in detail as the long-term energy source due to the availability of a plentiful year-round water supply in the Cuyuni River and final feasibility studies for hydropower alternatives are underway. Initial construction and operations will utilize onsite thermal generation, which will be replaced by hydroelectric power in the future.

The findings of the feasibility studies for the hydropower generation alternative along with justification for the chosen long-term energy supply will be provided to the relevant regulatory agencies prior to project commencement. If hydropower generation is determined to be the most feasible option, design and location plans for power generation and dams as well as an Environmental and Social Impact Assessment of the impacted area would be undertaken.

4.0 POLICY, LEGISLATIVE AND REGULATORY CONSIDERATIONS

4.1 Introduction

The project components include the mine site development and operation, construction and operation of the access road and construction and operation of a wharf on the Essequibo River.

The legislative and regulatory framework, for the project, is a combination of guidelines for construction and operation of these diverse facilities. That framework is a combination of national, international and regional policies, regulations, legislations and guidelines to which Guyana is a signatory. Additionally, several IFC Performance Standards (PS) for Environmental and Social Impact Assessments, will apply to the project.

The environmental and social impact assessment process for development and operation of the project will be undertaken in accordance with the legislative and regulatory framework detailed below.

4.2 National Policies, Regulations and Legislations

4.2.1 Environmental Protection Act 1996

The implementation of the project will be guided by the Environmental Protection Act 1996. The Environmental Protection Act established the Environmental Protection Agency and provides for the management, conservation, protection and improvement of the environment. *This project will involve management, conservation, protection and improvement of the environment, this act is consequently applicable to the project.* The act has provisions for 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 mandates the performance of Environmental Impact Assessments for projects with significant impacts on the environment.

This Act was amended in 2001 and includes a section on record keeping and monitoring requirements. Under this section, the Environmental Protection Agency requires that any person who releases or engages in the handling of hazardous substances or contaminants to:

- Sample and analyze such contaminant or hazardous substance, or material contaminated by same for specific constituents or characteristics;
- Install, use and maintain such monitoring equipment, and implement such environmental audit procedures as may be specified in any environmental authorization issued pursuant to this Act;
- Establish and maintain records regarding such sampling, monitoring, and environmental auditing activities;
- Establish and maintain records regarding pollution control equipment on the premises (including records on control equipment parameters, production variables and other indirect data when direct monitoring is not required);
- Submit reports including compliance reports; and
- Provide such other information as the authority may require.

There are five (5) pieces of legislations governing environmental protection which were enacted in 2000 as a consequence of the Environmental Protection Act. These are:

1. The Environmental Protection Air Quality Regulations
2. The Environmental Protection Water Quality Regulations
3. The Environmental Protection Noise Management Regulations
4. The Environmental Protection Hazardous Wastes Management Regulations
5. The Environmental Protection Authorizations Regulations

4.2.2 Environmental Protection Regulations

Regulations on Hazardous Waste Management, Water Quality, Air Quality and Noise Management were established, in 2000, under the Environmental Protection Act. *The mining project will utilize cyanide, chemical reagents, fuel oils and greases in its operation. Improper discharges of these substances can impact water quality and wildlife. In addition equipment used for mining and processing will have emissions to air that can potentially impact air quality. Noise from equipment operation may also impair communication. Local and international environmental protection regulations related to these media are therefore applicable to the project. These include Guyana EPA, World Bank and WHO standards detailed below.*

4.2.2.1 Environmental Protection Air Quality Regulations 2000

The construction, operation and closure phases of the project may impact air quality. The air quality regulations established by the EPA would be strictly followed. In instances where no parameter limits are set, the most stringent of the guidelines detailed below will be adhered to.

Environmental Protection (air quality) regulations were developed in 2000 under the Environmental Protection Act 1996. 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 and shall submit an application to the EPA at least one hundred and eighty days before the date on which the emission is to commence. In accordance with the regulations the EPA shall establish parameter limits with respect to emission of smoke, solid particles, sulfuric acid mist or sulfuric trioxide, fluoride compounds, hydrogen chloride, chlorine, hydrogen sulfide, nitric acid or oxides of nitrogen and carbon monoxide. No parameters limits have been mandated to date. This project proposes to adhere to a combination of WHO Ambient Air Quality (2007) and World Bank Guidelines. These guidelines (2007) are detailed in Table 2.

Table 2: WHO Air Quality Guidelines

POLLUTANT	AVERAGING PERIODS	GUIDELINE VALUE (µg/m ³)
Nitrogen Dioxide (NO ₂)	1-hour average	200µg/m ³
Particulate Matter (PM ₁₀)	24-hour average	150µg/m ³
Sulphur Dioxide (SO ₂)	24-hour average	125µg/m ³

4.2.2.1.1 World Bank Guidelines

4.2.2.1.1.1 Ambient Air

Concentrations of contaminants, measured at the project property boundary, should not exceed the following limits:

Particulate matter (<10 mm)

Annual Arithmetic Mean	100 mg/m ³
Maximum 24-hour Average	500 mg/m ³

Nitrogen Oxides as NO₂

Annual Arithmetic Mean	100 mg/m ³
Maximum 24-hour Average	200 mg/m ³

Sulphur Dioxide

Annual Arithmetic Mean	100 mg/m ³
Maximum 24-hour Average	500 mg/m ³

4.2.2.1.1.2 Workplace Air Quality

Arsenic	0.05 mg/m ³
Carbon Monoxide	29 mg/m ³
Copper	1 mg/m ³
Free Silica	5 mg/m ³
Hydrogen Cyanide	11 mg/m ³
Hydrogen Sulphide	14 mg/m ³
Lead, Dust and Fumes, as Pb	0.15 mg/m ³
Nitrogen Dioxide	6 mg/m ³
Particulate (Inert of nuisance dusts)	10 mg/m ³
Sulphur Dioxide	5 mg/m ³

During project design, emission modeling will be conducted to determine whether the most stringent of these air quality standards will be exceeded. If these standards are exceeded mitigation measures will identified to minimize impacts associated therewith.

4.2.2.2 Hazardous Waste Management Regulations 2000

Gold will be beneficiated by cyanidation. This will entail the utilization of cyanide and other hazardous reagents in the processing operations. Petroleum products will be used for power generation and equipment operations. The chemical reagents and petroleum products will have to be managed in conformance with the EPA Hazardous Waste Management Regulations, 2000.

These regulations outline the rules and procedures for transport, storage, treatment and disposal of hazardous wastes. There are no regulations for the management of hazardous substances. It can be inferred that these regulations will apply to reagents to be used by the project.

These regulations 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. For the purposes of that regulation, hazardous material/waste is regarded as the following:

- Explosives
- Flammable liquids
- Flammable solids or waste solids other than explosives which may be readily combustible
- Oxidising substances
- Organic peroxides
- Poisonous substances
- Infectious substances
- Corrosives
- Toxic gases
- Toxic substances which if inhaled or ingested may cause delayed or chronic effects
- Ecotoxic substances which if released may present immediate or delayed adverse impacts to the environment by means of bioaccumulation and/or toxic effects upon systems
- Materials capable, after disposal, of yielding another material which possesses any of the characteristics specified above

4.2.2.3 Environmental Protection Water Quality Regulations 2000

The water quality regulations were promulgated to minimize impacts of discharges on water quality. The project will entail discharges to surface water. If the level of contaminants in effluent discharge from the project exceeds tolerable limits, water quality will be impacted. The most stringent of the water quality standards outlined below will be applied during project execution.

These regulations require registration and environmental authorization by any person whose construction, installation, operation, modification or extension of any facility cause the discharge of effluents. These regulations cover parameter limits of effluent discharges, new sources of effluent discharges, fees for registration and environmental authorization, sampling points, records and reports and general provisions for the registration of water effluent, biological integrity, spills or accidental discharges and standard methods of analysis. Guidelines on the discharge of effluents and disposal of sludge are detailed in these regulations.

In accordance with these regulations the EPA was mandated to establish parameter limits for concentration of constituent of effluent which can be discharged into any inland or coastal waters or lands of Guyana for Ammonical Nitrogen, Sulphate, Chloride, Cobalt, Colour, Detergents, Anionic, Fluoride (as F), Molybdenum, Phosphate 9 as P, Polychlorinated Biphenyls, Selenium, Silver, Beryllium, Vanadium, Radioactive Material, Nitrate Nitrogen, Temperature, Pesticides, Fungicides, Herbicides, Insecticides, Rodenticides, Fumigants or any other Biocides or any other Chlorinated Hydrocarbons. Standards were also to be established for any substance that either by itself or in combination with other waste or refuse may give rise to any gas, fume or odour or substance which causes or is likely to cause pollution. The Guyana National Bureau of Standards (GNBS), along with the EPA, have developed interim industrial effluent standards which however are not specific to mining.

4.2.2.3.1 Mining Guidelines for Water Quality

In addition to the mandates for effluent discharge to the environment, the EPA has established guidelines for water quality associated with mining. *Since this a mining project these standards would be considered applicable to all phases of the project.* These guidelines mandate that both surface and groundwater associated with mining operations be analysed for pH, TDS, TSS, turbidity, conductivity, organic compounds (phenol and oil and grease), major anions (Ca, Mg, Na, K), nutrients (TKN, total ammonia, phosphate, nitrate + nitrite), trace metals (Al, As, Cd, Co, Cr, Cu, Fe, Hg, Mn, Mo, Ni, Pb, Se, Sb, Zn). The EPA further dictates that concentration levels of these substances shall not exceed levels of environmental concern (normally set as levels to protect aquatic species). The EPA also reserves the right to request analyses to determine bacteriological levels (coliforms, fecal coliforms and standard plate counts), rare earth elements, radioactive elements and other trace metals.

4.2.2.3.2 World Bank Water Quality Standards

Tolerable limits have not been established by the EPA for water quality for construction or mining operations which would be applicable to this project. However, for this project, the 2007 IFC EHS guidelines for the mining and milling industries are considered applicable. These guidelines for liquid effluents, residual heavy metals and cyanide are detailed below.

Liquid Effluents

The following guidelines for effluent discharged to receiving waters from tailings impoundment, mine drainage, sedimentation basins, sewage systems and storm water drainage are considered applicable to this project.

pH	6 to 9
BOD ₅	50 mg/l
Oil and Grease	10 mg/l
Total Suspended Solids	50 mg/l
Temperature-at the edge of a designated mixing zone	Max 5°C above ambient temperature of receiving waters, Max 3°C if receiving waters >28°C

These standards do not apply to direct discharge of tailings to the environment.

Residual Heavy Metal

The following recommended target guidelines, which are expected to pose no risk for significant adverse impact to aquatic biota or human use are considered applicable to this project.

Arsenic	1.0 mg/l
Cadmium	0.1 mg/l
Chromium, Hexavalent	0.05 mg/l
Chromium, Total	1.0 mg/l
Copper	0.3 mg/l
Iron, Total	2 mg/l
Lead	0.6 mg/l
Mercury	0.002 mg/l
Nickel	0.5 mg/l
Zinc	1.0 mg/l

If natural concentrations exceed these levels, the discharge may contain concentrations up to natural background levels. Concentrations up to 110% of natural background are acceptable if no significant adverse impact can be demonstrated.

Cyanide

The following tolerable limits for discharge of cyanide to the environment are considered applicable to this project.

Free Cyanide	0.1 mg/l
Total Cyanide	1.0 mg/l
Weak Acid Dissociable	0.5 mg/l

In no case should the concentration in the receiving water outside of a designated mixing zone exceed 0.022 mg/l.

Effluent discharged from the site during all operational phases will be required to adhere to the most stringent of the water quality standards detailed above.

4.2.2.4 Environmental Protection Noise Management Regulations 2000

The noise management regulations were developed to ensure effective implementation of health and maintain safety measures during operations and to minimize impacts on receptors in the site vicinity. The project will generate noise. The regulations are consequently applicable to the project. Further the most stringent of the following noise regulations will be applied during project execution.

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 categories for which permissible noise levels are fixed by the EPA were identified as follows: Residential, Institutional, Educational, Industrial, Commercial, Construction, Transportation and Recreational.

The Guyana National Bureau of Standards (GNBS) and the EPA together with other relevant agencies developed Interim Guidelines for Noise Emission into the Environment. Under these guidelines, noise emissions from Industrial and Commercial sources for both day (06:00h – 18:00h) and night (18:00h – 06:00h) would be 75 and 70 decibels (Industrial) and 65 and 55 decibels (commercial) respectively at the property boundary or 15 meters from the source.

The ESIA will form the basis of an authorization for a permit to emit noise from the proposed operation.

4.2.2.5 Environmental Protection (Authorizations) Regulations 2000

Before an application for Environmental Authorization is made, an Environmental Impact Assessment or any other relevant document should be submitted to the EPA for approval. Under this regulation, Guyana Goldfields Inc. is mandated to keep records of all environmental monitoring (not less than 3 years), sampling procedures, maintenance and calibration procedures and all problems and malfunctions. These records should be made available to the Environmental Protection Agency. The records should be project specific and shall include:

- Steps Guyana Goldfields should follow to avoid, minimize, mitigate and compensate for impacts
- Records of monitoring information such as date, place and time of measurement etc.
- Proper maintenance of facilities and appropriate quality assurance procedures;
- Establishment of environmental monitoring programme.

4.2.3 National Environmental Action Plan

The National Environment Action Plan (NEAP) developed in 1994 outlined the Government of Guyana main environmental policy objectives for sound management of the environment and natural resources. *The project must be undertaken based on sound environmental management practices. The National Environmental Action Plan is consequently considered applicable to this project.*

Twelve policy objectives were outlined. One of the policy objectives calls for the Government of Guyana to require that environmental assessments are undertaken for proposed development activities that may significantly affect the environment. In keeping with this environmental policy objective, the Environmental Protection Act was made law in June 1996 and the legal framework for undertaking an environmental impact assessment was outlined. Further, the Act established the Environmental Protection Agency and outlined the legal process for undertaking sustainable and effective management of the environment and its natural resources.

This plan was updated in 2000 and sets out the environmental development strategy for Guyana for the next five years. It states Guyana's Policy position as 'sustainable development that integrates economic, environmental and social values during planning, and recognizes the need to distribute benefits equitably across socio-economic strata and gender upon implementation.' The main goals of protecting the environmental as defined in the plan are:

- The prevention or control of pollution in order to maintain the integrity of the land and the natural purity of the air and water resources;

- The general preservation and conservation of ecological integrity and the protection of natural habitats and fragile ecosystems in particular;
- Ensuring sustainability through best practice of the management and use of natural resources for economic development.

Existing environmental legislation is primarily focused on the exploitation of resources such as precious metals, timber and fisheries. Recent legislation has seen the passage of a Toxic Substances Control Act. This Act is intended to regulate the use and disposal of toxic substances.

Guyana has initiated the development of a national land use policy. Consultations with Ms. Andrea Mohammed of the Guyana Lands and Surveys Commission have however indicated that this process has stalled but is likely to recommence later this year. The absence of a National Land Use Policy has resulted in conflicting land uses. Land use is presently regulated by the Town and Country Planning Act. This Act regulates the development of Georgetown, Towns and other areas and provides for the public participation in the planning process. The Act however, does not mandate the performance of Environmental Impact Assessments.

4.2.4 EPA's Role in EIAs

The Environmental Protection Act mandated four functions for the EPA which relates to environmental assessment. *The EPA has determined that this project is likely to have significant environmental impacts. These four functions of the EPA are consequently applicable to this project. These four functions are:*

- 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 natural resources;
- To promote the participation of members of the public in the process of integrating environmental concerns in planning for development on a sustainable basis;
- To ensure that any development activity which may cause an adverse effect on the natural environment be assessed before such activity is commenced and that such adverse effect is taken into account in deciding whether or not such activity should be authorized.
- To give development consent which entitles the developer to proceed with the project.

The Agency is required to implement several principles of environmental management as part of this process. These principles are:

- The "polluter pays principle": the polluter should bear the cost of measures to reduce pollution
- The "precautionary principle": where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing measures to prevent environmental degradation.
- The "strict liability" legal principle: any person who contravenes this Act or regulations shall be liable to the penalties prescribed thereafter;
- The "avoidance" principle: it is preferable to avoid environmental damage, as it can be impossible or more expensive to repair rather than prevent damage;
- The "state of technology" principle: measures protecting the environment are restricted by what is technologically feasible and as technology improves, the improved technology should be used to prevent and repair environmental damage.

The management plan detailed in the ESIA will conform to principles of environmental management proposed by the EPA and which is detailed above.

4.2.5 The EIA Process

The ESIA being undertaken for mining of this project must conform to the EIA process established by the Guyana EPA. A summary of that EIA process is detailed below.

Commencement of the environmental impact assessment process is preceded by an application for an environmental authorization and a summary of the project including information on the site, design and size of the project, possible effects on the environment and a non-technical explanation of the project. The Environmental Protection Agency would then indicate whether an environmental and social impact assessment is a mandatory requirement for the issuance of an environmental authorization for the operation.

A draft Terms of Reference is prepared and submitted to the EPA. After that submission, the EPA publishes a notice of the project in at least one daily newspaper. A summary of the project is made available to members of the public for a period of 28 days. Within this period the EPA accepts written submissions to the Agency related to the project. These submissions detail questions and matters which members of the public consider relevant to the deliberations of the EIA.

A public consultation meeting is held after this 28 day period. Additional concerns of the public are noted at this forum and the EPA provides comments to the ESIA Consultants for finalization of the Terms of Reference (TOR) of the EIA. This meeting is chaired by the Environmental Assessment Board. The Environmental Assessment Board (EAB) is a body which provides an independent contribution to the development and finalisation of the EIA and makes recommendations which uphold the principles of the EP Act in the context of the interests of the developer, the public and the regulatory agencies. In order to carry out its functions, the EAB is involved in the development of the ESIA from the point of ESIA scoping to establishing conditions for the issuance of an Environmental Permit.

During the environmental impact process the Developers and Consultants are required to consult members of the public, interested bodies and organizations and also provide to members of the public on request, and at no more than reasonable cost, copies of information obtained for the purpose of the EIA. The Developer and Consultant must submit to the EPA, the ESIA report along with an Environmental Impact Statement (EIS) for evaluation and recommendations. Every environmental impact assessment is required to contain a description of the project, an outline of the main alternatives studied and reasons for choices, a description of significant effects of the development on the environment, an indication of any difficulties encountered by the developer in compiling information for the ESIA, a description of the best available technology, a description of any hazards or dangers which may arise and a risk assessment of same, a description of mitigation measures for any adverse effects, a monitoring plan and an emergency response/contingency plan and a program for rehabilitation and restoration. The decision by the Agency to grant an environmental authorization for a project shall be subject to conditions, which are reasonably necessary to protect human health and the environment.

The ESIA must be completed to conform to the TOR and copies submitted to the EPA for review and public comment. The EPA subsequently publishes a notice in at least one daily newspaper notifying the public of the submission of the ESIA. The public has 60 days from the publication date of the notice to make submissions to the EPA and/or the EAB related to the EIA. The EPA, along with relevant sector agencies review the EIA during this sixty day period to ensure that the EIA is in line with any plans, guidelines, regulations or codes of practice developed by the EPA and sector agencies. Copies of the EIA and the findings of the review by EPA and sector agencies are passed to the EAB for review and recommendation.

A public meeting, chaired by the EAB may be held, if considered necessary, at the end of the 60 days period. Additional comments are provided by members of the public at this meeting. The key objectives of public involvement in the EIA process are to:

1. give the public a voice in project planning;
2. obtain local knowledge, information and ideas;
3. provide information to the people on planned activities to stimulate local interest and involvement in the project;
4. ensure early detection of environmental and social impacts arising from the project;
5. initiate and establish mechanisms and procedures to enable local people to participate in all phases of the project.

A final EIA is then prepared to address the comments of the EPA, the sector agencies, the public and the EAB to address issues in the TOR initially agreed to but excluded from the EIA. The EAB will then recommend to the EPA whether the EIA is acceptable and the conditions to be attached to the Environmental Permit, should it be granted.

The EPA takes into account the recommendations of the EAB and sectoral agencies, comments of the public and its own review, and decides whether or not the project should be approved. For approved projects, the EPA issues an Environmental Permit with the terms and conditions necessary to effectively manage the environment. If an Environmental Permit is not granted, the developer can file an appeal within 28 days with the Environmental Appeals Tribunal (EAT). The EAT is a superior court of record and has in addition to the jurisdiction and powers conferred by the EP Act, all the powers inherent in such a court. The Tribunal has the power to enforce its own orders and judgements and the same power to punish contempt as the High Court of Justice. The EAT has the jurisdiction to hear and determine appeals against:

1. The refusal of an Environmental Permit;
2. The requirement of an Environmental Permit;
3. Cancellation or suspension of an Environmental Permit.

This ESIA is being undertaken in accordance with the framework for the EIA process established by the EPA. The Draft Terms of Reference was submitted to the EPA in July 2009 and was followed by public consultations with sectoral agencies and communities in proximity to the proposed operations. The additional components of the ESIA will conform to the procedure outlined above.

4.2.6 Environmental Impact Assessment Guidelines

The Environmental Protection Agency (EPA) in collaboration with the Environmental Assessment Board (EAB) has produced guidelines for conducting Environmental Impact Assessments (EIA) for Mining Projects in Guyana. The guidelines are intended to compliment those in Section IV of the Environmental Protection Act, 1996 (EP Act).

This ESIA is being conducted in accordance with guidelines established by the EPA for the mining sector. In accordance with the guidelines, EIA for the mining sector shall consist of three components; Environmental Baseline Study, Environmental Assessment and Environmental Impact Statement. The Environmental Baseline Study records the quality of the environment within the area of influence before the project is implemented. The data is analysed in the environmental assessment and is used to predict and quantify impacts. The Environmental Assessment (EA) is the identification and assessment of impacts of the proposed project and of its alternatives. The EA considers mitigation measures to offset negative impacts and assesses the impact of implementing these measures on the environment. The Environmental Impact Statement is a summary of the findings of the Environmental Baseline Study and the Environmental Assessment and includes an Environmental Management Plan.

4.2.7 Mining Regulations

The regulations contain provisions for the sanitary management of human waste and for burial of animals and any person who expires at the mine. Detailed provisions are outlined for the Regulation of Mines. These regulations include prohibition against the hiring of females, and underage boys in addition to restriction on persons permitted to work underground. These regulations also mandate requirements for ventilation of shafts and for the use of explosives in mining operations and in general details provisions for underground mines.

Procedures for the use of poisonous substances including cyanide and mercury are also outlined in these regulations with restrictions being placed on the discharge of poisonous effluent to the environment and on the exposure of individuals to mercury fumes.

The royalty payable on gold, silver and precious stones are detailed in the regulations in addition to the rights and expectations of lessees and tributors. The regulations places restrictions on individuals eligible to be employed as laborers in mining districts and mandate that each person, who is not an Amerindian, who works as an employee in a mining district shall be registered. The employer at a mine site is mandated by regulations to keep medicines and medical supplies for the use of mine employees and in instances where the number of employees exceed 50 the employer is compelled to employ a sicknurse or dispenser and prohibits employers from punishing employees.

The regulations further mandate provisions for the keeping of record of gold, valuable minerals and precious stones, payment of royalty on gold, valuable minerals and precious stones, sale and purchase, of gold valuable minerals and precious stones and on the export of precious Stones.

Part XXII of the regulations applies to the rights, privileges and restriction on Amerindians and the miscellaneous provisions provide for disposal of forfeited gold, valuable minerals and precious stones.

4.2.7.1.1 Environmental Provisions

The environmental provisions of Cap 65:01 as inferred from those regulations relate to the management of mine operation effluents. The provisions for construction of dams can be interpreted as being related to the construction of tailings, detention and sediment control structures.

In accordance with Part VIII 60 (a) a dam can be constructed on state land as part of a mining operation. There is also a mandate that no one shall deposit any earth, stone, gravel, debris or tailings on a claim held by another person without their consent. This regulation also mandate that any area of water containing poisonous or injurious chemical solutions used in the treatment of gold or other minerals must be fenced to prevent inadvertent access thereto, and notice boards shall be erected in suitable places warning persons from making use of such water. In addition, in no case shall water containing any poisonous or injurious chemical solutions be permitted by a claim holder or his agents to knowingly escape or enter any river, creek, race, lake, reservoir, or any stagnant water without having been previously rendered innocuous. The stipulations of these regulations are applicable to the siting of tailings ponds and the management of effluent discharge from ponds.

Additional provisions of the regulations which are inferred to relate to the utilization and impacts on water resources stipulate that a person may hold at the same time on any water-course which is not navigable, claims extending from the point where such water-course ceases to be navigable to its source and no claim other than a dredging concession or river location shall include the bed of a navigable river or water-course. In addition, no person holding a claim on either bank of a navigable water-course shall prevent free navigation and passage thereon and every holder of a claim shall be entitled to the free use of water naturally flowing through or past his claim, and not already lawfully appropriated in such

manner as may, in the opinion of the commissioner or of the mines officer, subject to the approval of the Commissioner, be necessary for the proper working thereof.

Additional regulations related to water resources is a mandate that no person shall back the water of any river, creek or water-course upon any claim or cause any claim to be flooded, either willfully or by neglect through the construction of any dam or stop-off, or in any other way and permits the Minister to grant to any person a licence, with such terms and conditions as he may think proper to take direct and use any water from any river, creek, tributary, stream, lake or pool, situated upon or flowing through any State lands for the purpose of supplying with water any machine or any engine or machinery employed and for mining purposes provided that such works shall not interfere with existing rights. Every water-race shall have a point to be specified by the commissioner or mines officer at which water shall be taken from the river, creek, or other source, but in no case shall such river, creek, or other source be included in or form part of any water-race or pipe for or the conveyance of water.

The final water resources provision states that in case any holder of a licence under this regulation fails to make a reasonable use of the advantages allowed to him by his licence or if he takes water in excess of a reasonable quantity or if he wastes water or if he fails to comply with the condition under which his licence was granted the Minister may cancel his licence and every person who willfully or negligently causes the water of any well or reservoir on or near any claim, or of any creek used for drinking purposes and set apart by the mines officer for that purpose, to become contaminated shall be guilty of a breach of the regulations.

Limits on effluent disposal are covered by the requirement that in no case shall water containing any poisonous or injurious chemical solution be permitted to escape or enter any river, creek, race, lake, reservoir, or any stagnant water without having been previously rendered innocuous.

4.2.7.1.2 Safety Provisions

Health and safety regulations are not explicitly detailed in Cap 65:01. However, the provisions of Part XIII Regulation of Mines can be interpreted as relating to the regulating conditions in mines to ensure health and safety. The regulations of Mines details requirements for the employer of a mine manager and places restrictions on persons appointed manager of a mine. In addition, duration of work restrictions are detailed for underground work in addition to the age of employees delegated to perform certain functions such as the lander or bracedman over any shaft and persons in charge of steam or other machinery used in connection with any mine, or for the treatment of any products of any mine. A mines officer is also empowered by these regulations to authorize in writing the entry of any surveyor, assessor, inspector or other person into and upon any mine or site for the purpose of measuring the depth of any shaft, dip, or inclination or the length of any tunnel or drive, or for any other purpose. .

The regulations include requirements for the provision of an adequate amount of ventilation to be constantly produced in a mine to such an extent that the shafts, winches, sumps, levels and working places of the mine, and the traveling road to and from such working places, shall be in a fit state for working and passing therein.

The regulations permit the use of gunpowder or other explosive or inflammable substance provided that specific conditions are adhered to. These include the storage in a chamber or magazine of the mine, at a distance of not less than two hundred feet from where any blasting operations are being carried on and restrict these materials from being taken for use into the workings of the mine except if in a securely covered case or canister containing not more than eight pounds of gunpowder, or more than five pounds of nitro-glycerine compounds. In addition detonators for blasting are required to be kept on the surface of the ground in a covered box placed in a magazine and at least fifty feet from the nitroglycerine compounds. Notification is required when blasting operations are being carried on and procedures are detailed for dealing with missed charges.

The safety regulations dictate that the top and all entrances between the top and bottom of every working or pumping shaft shall be properly and securely fenced or securely covered and that all abandoned or disused shaft shall be fenced or securely covered and its position indicated on the surface. The safety provisions details requirements for use of shafts, methods of signaling, covering of underground braces and the use of chains for lowering or raising persons in shaft or plane.

4.2.8 The Mining (Amendment) Regulations 2005

The GGMC amended its mining regulations in 2005. These amended regulations together with the Mining Act 1989 are applicable to this project. Guyana Goldfields Inc was granted a Prospecting Licence by the Guyana Geology & Mines Commission (GGMC). When this ESIA satisfies both the EPA and GGMC, a mining licence would be issued for the recovery of Gold in the Aurora area. GGMC would be responsible for enforcing the provisions in this regulation.

Environmental provisions applicable to current mining operations are detailed in the Mining (Amendment) Regulations 2005. The Mining (Amendment) regulations 2005 contain mandates for the following:

- Use of Poisonous Substances
- Requirements for Environmental Management for Large and Medium Scale Mining
- Requirements for Environmental Management for Small Scale Mining
- General Requirements
- Protected Areas
- Pollution Control
- Offences and Penalties

4.2.8.1 Use of Poisonous Substances

The poisonous substances regulations are applicable primarily to the use of mercury and cyanide in the gold mining arena and stipulate that no person shall use elemental mercury or any form of mercury. Contravention of the regulations results in a Cease Work Order being placed on the operations on the claim or area until clean-up is done to the satisfaction of the Commissioner.

These regulations present mandates for the use of cyanide and require that no operation in which cyanide or any preparation containing cyanide is used in the treatment of gold or other minerals may be commenced until the necessary buildings, structures, rooms, appliances and other arrangements to carry on these operations have been inspected and approved by a mines officer. In addition, at every mine or other place where cyanide is used an approved cyanide antidote shall be kept in a conspicuous and convenient place in a box labeled cyanide antidote. Explicit directions for the use of such antidote shall be affixed inside the lid of the box and the mines manager shall ensure that all persons working in any place where the cyanide is used, familiarize themselves with the location of the box and the directions for use of the antidote,

The Commission is required to keep registers which shall contain information related to cyanide permits issued with information in the register to include:

- the name of the person to whom the cyanide permit is granted;
- the date that the permit was granted, expiration and renewal dates;
- the date and reason for revocation and suspension of the licence or permit and in respect of suspension the period thereof;
- the number of the licence or permit;
- the amount of cyanide purchased and any relevant remarks.

The register shall be open for inspection by the public at the office of the Commission during office hours, free of charge, and the Commission shall, on payment of the prescribed fee, cause to be made copies of any entry in any such register.

The regulations stipulate that any area of water containing poisonous or injurious chemical solutions used in the treatment of gold or other minerals must be fenced in any effective form to prevent inadvertent access thereto, and notice boards shall be erected in suitable places warning persons from making use of such water and in no case shall water containing any poisonous or injurious chemical solutions be permitted by a claim holder or his agents to knowingly escape or enter any river, creek, race, lake, reservoir, or any stagnant water without having been previously rendered innocuous.

The owner or manager of any claim or mine, in which cyanide or any preparation containing cyanide or any other poisonous substance is used for any purpose is mandated to enter or cause to be entered in a register to be kept for that purpose, the quantities of cyanide and other poisonous substances received and issued. The record of each poisonous substance shall be kept separately and shall show the date of receipt, the date of issue, quantities received or issued and the balance of stock on hand, and the signature of the receiver or issuer, as the case may be. The owner or manager of any claim or mine shall have the said register available at all times for inspection by a mines officer. All vessels or plants used for the treatment of zinc or lime with acid or for the cyanide process shall be fitted with mechanical agitators and hoods or other appliances of such a nature that the fumes generated in such vessels shall be carried directly to the external air at a distance approved by the Commissioner from time to time. All facilities shall be located downwind or in any other wind of all residences so that such residences are not unduly disturbed.

The regulations provide for an adequate supply of wholesome drinking water to be provided in each premises or place where cyanide or any preparation containing cyanide is used, and this supply shall be distinctly labeled Drinking Water.

Cyanide or other poisonous substances used in any mining or milling process are required to be kept in a separate compartment specially set aside for the storage of such poisonous substances with the compartment being locked and in the care of a person duly authorized by the manager and no person is authorized to remove from a claim or mine any cyanide or other poisonous substances without having obtained the written permission of the manager. Further all holders of licences and permits as granted under the Mining Act, shall adhere to the provisions of the Code of Practice on Use and Handling of Poisonous Chemicals as published jointly by the Commission and Environmental Protection Agency, and updated from time to time.

4.2.8.2 Requirements for Environmental Management for Large Scale Mining

There are specific requirements for environmental management of large scale mining operations. Every person who proposes to use cyanide at the final stages of processing, and which entails disposal of effluent is required before commencing any action related thereto, to apply either personally or in writing to the Commission for a cyanide permit and shall submit with such application, the prescribed fee and a description in summary of the activities in respect of which cyanide is to be used including information on:

- the site, design or process and amount of Cyanide to be used; site characteristics and layout; distance to water bodies; ground water regime and mode of tailings disposal;
- possible effects on the environment;
- a simplified description of the activity; and
- activities for minimizing the use of cyanide in the long-term.

Where the Commission is satisfied with regard to an application for a cyanide permit for the use of cyanide that the proposed use does not significantly affect the environment and that the requirements of these Regulations have been complied with, together with the requirements of the Environmental Protection Act 1996 and the recommendations of the EPA it shall grant the permit applied for on such terms and conditions and in such form as the Commission may from time to time determine.

The Commission may refuse to grant a cyanide permit under this regulation where it has reason to believe that the application is based on false or misleading information; or after consultation with the Agency, it is satisfied that the preservation and character of the environment, including flora and fauna will be adversely affected. If the Commission, after consultation with the EPA is satisfied that there has been material changes in the circumstances that existed at the time the cyanide permit was granted, the Commission shall convey this in writing to the permit holder and advise that a new permit must be applied for and the current permit will remain valid only up to a stipulated date.

A person to whom a cyanide permit has been granted in accordance with this regulation can apply to the Commission to vary or modify the cyanide permit stating clearly the reasons and the Commission may issue a written warning to the cyanide permit holder and manager of the operation for any breach of provisions of these Regulations or any term and condition subject to which the permit is granted. The Commission may however, suspend a cyanide permit for a breach of any provision of these Regulations or for any term or condition subject to which the permit is granted.

The Commission is required, on suspending a cyanide permit to notify the holder in writing stating the breach that gave rise to the suspension, requiring the holder of the cyanide permit to remedy the breach, stating the time within which the breach is to be remedied and stating whether the cyanide permit is to be returned within a specific time to the Commission.

Where the Commission cancels a cyanide permit, the Commission is required as soon as practicable thereafter to notify in writing the person to whom the permit or certificate was granted of the cancellation and the notice shall state the reason for the cancellation, and such cancellation shall take effect on receipt of the notice by the addressee and any person who is aggrieved by a decision of the Commission shall within twenty-eight days of the decision, appeal in writing against such decision to the Minister. The Minister after examining all relevant information on the matter appealed shall issue an appropriate order. A cyanide permit is mandated not to be transferable except with the permission of the Commissioner and where the Commissioner authorizes the transfer of such a permit, he may vary the conditions already imposed on the cyanide permit or he may impose such other conditions as he may consider appropriate. The Commission, EPA, the mining associations and educational training institutions shall in accordance with the curricula approved by the Commission jointly or singularly provide training and certification courses for miners on the proper use of mercury and cyanide and environmental hazards associated with such use in mining activities. The Commission is also mandated by the regulations to prepare a Code of Practice that will provide further guidance on practices involving mercury use, cyanide use and disposal of effluent which shall form part of these Regulations.

Every holder of Mining licence, Prospecting Permit or Mining Permit is also mandated to lodge an Environmental Bond in favor of the Commission, for an amount to be determined by the commissioner. The Environmental Bond or part thereof, shall be used by the Commission to restore the environment where restoration of the said area was not done to the satisfaction of the Commissioner provided that the Commission shall retain no third party to carry out such restoration before the miner has been given three months from the date restoration becomes due to restore the area.

The regulations also mandate preparation of a closure plan before any new prospecting or mining licence is issued by the Commission and the closure plan must be approved by the Commission and before a new prospecting or mining licence, is issued by the Commission to an operator, the mining guidelines should be seen to have been adhered to in the previous mining operation the applicant may have had.

The reclamation and closure plan is required to include measures for the backfilling of placer mine pits, where applicable, the sealing or capping of shafts at closed mines in accordance with the Code of Practice or the directions of an appropriate authority at the Commission, as appropriate, the stripping and stockpiling of topsoil for use in reclamation, the replacement of topsoil and vegetation of disturbed lands and the restoration of water courses, where appropriate. Holders of Prospecting and Mining Licences are required to prepare a contingency and response plan in accordance with the Code of Practice. The contingency and emergency response plan must set out provisions for hazards in mining operations including practical mechanisms for responding to cyanide and fuel spills and spills of other poisonous or hazardous substances and breaches of tailings ponds. Any person who contravenes this regulation commits an offence and holders of prospecting and mining licences and medium scale permits are required to ensure that all relevant information of the contingency and emergency response plan are communicated to employees and independent contractors, and shall include information on first person response, notification procedures, location of clean-up equipment, an analysis of potential accidents and responses and materials safety data sheets for all materials which could be spilled.

4.2.8.3 General Requirements

The general requirements of the regulations stipulate that the Commissioner shall determine the number of dredges or mining operations which shall be permitted to dredge or mine in any area which may already be or likely to be affected by tailings discharge and to also direct the method of mining permissible in the areas affected or likely to be affected by tailings discharge if necessary. The basis for the commissioner determination is the percentage of clay content found in the overburden or deposit or the total load of clay which may be released in the tailings and shall be made from results of sampling and tests done by officers of the Commission. The regulations also permit the The Nephelometric Turbidity Units (NTU) value at the affected area to be stipulated by the Commissioner from time to time and operators of land operations are mandated to discharge tailings into a tailings pond or into a river, creek or stream where the critical turbidity has not exceeded 30 NTU. In addition, operators of river operations are required to discharge tailings into a tailings pond on land or to a river, creek or stream where the critical turbidity has not exceeded 30 NTU or in any other manner as approved by the Commissioner.

Operators are also required to ensure that discharges from tailings ponds or a dredges into any river or creek shall not exceed either 100 mg/l of total suspended solids (TSS) or 50 Nephelometric Turbidity Units (NTU). The Commissioner is authorized to stipulate the limits for chemical contamination from time to time. Discharges from tailings ponds and river dredge are required to be released underwater through a conduit at a minimum depth specified by the Commissioner. Where any operation exceeds either of the stipulated limits, the operator shall be cited for such breach and be given twenty-four hours within which to rectify same and operators are required to keep a daily record of the readings of the total suspended solids or Nephelometric Turbidity Units (NTU) readings in the grab sample of the discharge and such readings of the daily record shall be approximately twenty four hours after the previous reading.

Where settling ponds are used as parts of the mine drainage system, channels discharging into the river are required to be culverted, and where necessary the slopes must be protected from erosion. Approved devices, chemical procedures or ponds are required to be used to remove settleable solids from tailings discharges from on-land mines and every settling pond is required to have a minimum water residence time equivalent to the aggregate volume of slurry processed or water used in each sluice box or mine processing device in any continuous two hour period with discharge being in accordance with the effluent limits. Operators are also restricted from disposing of petroleum products or any matter containing tars, oil, grease or any poisonous substances directly on the surface of the land or in a river or creek.

The regulations require that all hazardous waste earmarked for disposal whether recovered from prior workings or from the current operations shall be sealed in barrels which are made of or lined with plastic, marked and sealed and conveyed to an area set aside or facility set up for the disposal of hazardous waste. The accumulated waste shall be brought to the Commissioner's attention for treatment as appropriate and where facilities for disposal are not available, a miner shall burn all waste products including batteries using fuel such as kerosene or similar substances of high flash point in an area set aside for such purposes or, where appropriate shall use the said waste products.

Prior to the commencement of mining in any area a miner is required, if the miner considers that the area has been environmentally damaged, to request in writing an inspection of such areas by the Commissioner or an officer appointed in writing by the Commissioner.

The regulations require that information in relation to the disposal of effluent shall be provided by the applicant to the Commission on the following, the site of the disposal, the amount of the disposal and the possible effects on the environment provided that in the case of small scale miners there shall be the option of applying for a cyanide permit as a syndicate or individually. In, such cases the requirements shall be provided by the small scale miner by completion of a questionnaire provided by the Commission.

Among the requirements of the general requirements is that tailings dam or water retaining dams higher than 16 feet or six metres shall be inspected annually by a qualified civil, mining or geotechnical engineer registered with the Commission and approved by a recognized engineering body. The reports of such inspection are required to be kept on file and be available for review by inspectors of the Commission and every tailings pond shall be equipped with emergency spillways that pass the flows from the probable maximum flood so as to prevent overtopping of dams under extreme rainfall or runoff rainfall.

The regulations stipulate that no compensation shall be paid to a holder of a permit where the decision to cancel the permit was necessary for the purposes of protecting and conserving the environment, any animal or plant or by reason of an unforeseeable change in circumstances on the basis of which the permit was granted.

4.2.8.3.1 Protected Areas

The regulations mandate that no person shall conduct mining and quarrying activities in the areas within 20 metres of the low water mark of a river bank except for access of dredges from the river or in specified nature reserves and parks where resource extraction is prohibited or in buffer areas without the express approval of the Commission and the notification of parties likely to be affected by the activity. In addition, no dry mining or excavation shall be conducted in any watershed without prior permission from the Commissioner.

4.2.8.3.2 Pollution Control

Environmental effects monitoring shall be conducted for every mine including new mines. Each environmental effects monitoring program shall be required to be submitted to the Commission for approval as part of the Environmental Management Plan.

4.2.9 Guyana Geology and Mines Commission Act of 1979 and Mining Act of 1989

The Guyana Geology and Mines Commission established by the GGMC Act 1979 is responsible for the implementation of the Mining Act 1989, which establishes the legal framework for the utilization of mineral resources in Guyana. The Act makes provision for a system of mineral agreements and licences for regulating prospecting. It gives the Commission the responsibility for establishing regulations for mining and quarrying operations. A mining licence is required in order to mine any mineral and is

issued at the discretion of the Commissioner of Guyana Geology and Mines Commission with the Minister responsible for mining. In addition, the act makes provisions for the disposal of sanitary waste and the storage of poisonous substances in mining areas.

Sections 76 and 77 of the Mining Act of 1989 details provisions for regulations related to safety in mines or quarries or in prospecting, mining or quarrying operations and the welfare of workers. The Guyana Geology and Mines Commission is currently developing a document on Occupational Health and Safety in Mines. The provisions of this act are superseded by the Mining Act 1989 if inconsistencies prevail.

4.2.10 Occupational Safety and Health in Mining

The Occupational Health and Safety Act 1997 contain provisions applicable to the regulation of health and safety in mines. In 2002, a draft Mining Occupational Safety and Health Regulation was proposed by the Ministry of Labour, Human Services and Social Security with the assistance of the International Labor Organization (ILO). The mine will be required to operate in accordance with the Occupational Health and Safety Act 1997.

The Occupational Health and Safety Act 1997 contain provisions applicable to the regulation of health and safety in mines. In 2002, a draft Mining Occupational Safety and Health Regulation was proposed by the Ministry of Labour, Human Services and Social Security with the assistance of the International Labor Organization (ILO).

The draft OSH Regulation covers duties of employers and self-employed persons, owners of mines, manufacturers and workers. Reporting of dangerous situations and occurrences, administrative requirements such as the preparation, checking and maintenance of mine development plans in advance of mine development, as well as those for mine operations, inspections by mine operators, minimum age of workers and the maximum duration of work shifts, testing of shaft ropes and notice of death or injury are also covered. Other general areas included in the regulation are competency requirements for the supervision of workers at a mine, training for the performance of mining operations, the supervision of work done by competent workers, safe access to and egress from workplaces such as mine openings, ladders, stairways, platforms and open pit workings and general safety for working alone, protective equipment and clothing, protection from falling objects, the prohibition of substance abuse in mines, and the use of pressurized systems.

Safety requirements are also prescribed for surface operations and underground operations. Emergency procedures and fire prevention and control strategies are outlined. The draft Regulation also addresses working environment conditions such as ventilation, records and control of specific contaminants, noise and dust limits, vibration and heat stress, ergonomics, sanitary facilities and precautions against exposure to radon and radiation. The safe handling, storage, operation, and transport of explosives are also dealt with. Basic safety procedures for electrical safety in mines, safety requirements for machinery and plant equipment, and the operation of hoisting equipment are detailed as well as miscellaneous provisions regarding the resolution of health and safety issues and the refusal of a worker to work in particular instances.

This extensive draft Regulation has not yet been given legal effect by the Ministry of Labour, Human Services and Social Security. This mine will have to operate under these regulations after their promulgation.

4.2.11 Wild Birds Protection Act Chapter 71:01

The Act stipulates for the protection of certain wild birds. Wild birds are defined in the schedule of the Act. Certain wild birds are protected absolutely. It is an offence to wound, kill, expose for sale, and offer for sale or export wild birds that are absolutely prohibited. However, there are some wild birds that are not so protected; they receive protection only during a prescribed closed season. However, it is not an

offence to wound or kill any wild bird for the purpose of procuring food and if done ten miles or more from a plantation. *There are no provisions for the protection of wild birds relative to mining operations however conservation of biological resources is applicable to the project. The company will therefore conform to the provisions of this act.*

4.2.12 Town and Country Planning Act Chapter 20:01

Provisions are made in this Act for the orderly and progressive development of land (which is specifically defined), Cities, Towns and other areas be they urban or rural, for their preservation and improvement and for other related matters. The prescribed authority, responsible for effecting the provisions of the Act is the Central Housing and Planning Authority established under the Housing Act Chapter 36:20. This act would regulate any new settlement associated with operations. *The Central Housing and Planning Authority will consequently be required to provide consent for the development and regulation of any new settlement associated with operations.*

4.2.13 Pesticides and Toxic Chemicals Control Act No. 13 of 2000

This project will entail the importation of cyanide and other chemicals reagents for use in beneficiation, some of which can be classified as toxic chemicals. The Pesticides and Toxic Chemicals Control Act No. 13 of 2000 regulates the manufacture, importation, transportation, storage, sale, use and disposal of pesticides and toxic chemicals. The act also resulted in the establishment of the Pesticides and Toxic Chemicals Control Board. This act would be applicable to the reagents to be used during project execution.

In accordance with the act regulations should be developed to include as follows:

- Regulations for the health and safety of workers against the risk of poisoning by controlled products when working in connection with the use of controlled products or when working on land or in any premises on or in which controlled products have been or are being used, stored or manufactured
- Regulations imposing duties on the employers of workers, on the workers themselves and on others using controlled products and controlling and prohibiting sale, use, disposal and transportation of any toxic chemical or pesticide.

A 'controlled product' is defined in the Act as 'any pesticide or toxic chemical'. 'Toxic chemical' is defined as 'any disinfectant or any other substance known to be poisonous corrosive, irritating, capable of causing a sensitive reaction or sensitive to man or animal that is used in agriculture, the art, commerce or industry or for any domestic or other purpose ...'

In accordance with the act, the following is mandated:

- Registration of toxic chemicals and pesticides;
- Licensing of persons wishing to import, manufacture and sell pesticides or toxic chemicals.

Analysts, Inspectors and Medical examiners may be appointed to support and enforce provisions of the Act.

The functions of the of Pesticides and Toxic Chemicals Control Board include

- The registration of Pesticides and Toxic Chemicals
- The issuance of licence to persons to import or manufacture registered pesticides and toxic chemicals.

- Consideration and determination of applications relevant to the Act and dealing with all aspects of the importation, manufacturer, storage, transportation, sale, preparation for sale, use and disposal of pesticides and toxic chemicals.

4.2.14 National Biodiversity Action Plan

The National Biodiversity Action Plan (NBAP) was prepared in 1999 to integrate the implementation of the Convention on Biological Diversity into national development. The overall goal of the NBAP was “to promote and achieve the conservation of Guyana’s biodiversity, to use its components in a sustainable way, and to encourage the fair and equitable sharing of benefits arising out of the use of Guyana’s biodiversity’. The stated objectives of the plan were to:

- Evaluate the state of capacity nationally to achieve the above goal;
- Identify gaps and needs relating to achieving the above goal;
- Propose actions to achieve this goal and close the gaps;
- Develop activities in a number of priority areas relating to the overall goal;
- Identify the roles and responsibilities of the various stakeholder groups in the implementation of the plan;
- Increase public awareness of biodiversity.

The plan included a number of programme areas partitioned under two phases with various actions for execution. Phase 1 identified foundation programmes that are essential for sustainable biodiversity planning and management. This included Human Resources and Institutional Capacity Building. Phase 2 on the other hand, consolidated phase 1 and initiated additional interventions for the second cycle of the plan. The programme area for the additional interventions included Planning a Biodiversity Action Plan.

This plan entered its second cycle in 2007 to focus mainly on conservation and sustainable use of biodiversity and sharing of benefits. It retained as its cornerstone the goal and seven objectives from the previous plan. Four thematic natural resource areas are listed as requiring attention. These are:

- Forests
- Agriculture
- Coastal resources
- Marine resources

The mining operation and access roads will be located in forested areas and impinges on biological diversity. Therefore, according to NBAP 1 consideration should be given to the adoption of the four approaches stated below when planning for management of biodiversity.

The Participatory Approach

This approach recognises that conservation and responsible use of biodiversity requires commitment and collaboration from agencies, individuals etc that impact/use biodiversity through their activities.

The Cyclical/adaptive Planning Approach

This approach is cyclic in nature and adaptive to change in circumstances and national policy.

The Ecosystem Approach

The ecosystem approach to biodiversity planning and management is based on the linking of the social, economic and environmental aspects of biodiversity management.

The Precautionary Principle

The precautionary principle according to the Convention on Biological Diversity is “where there is a threat of significant reduction or loss of biological diversity, lack of full scientific certainty should not be used as a reason for postponing measures to avoid or minimise such a threat.” This principle has been incorporated into the Environmental Protection Act.

4.2.15 Public Health Act Cap 145

The provisions of the Public Health Act will be factored into the employee health and safety plan for the mine site operations.

Section 2 of the Public Health Act Cap 145 states that mining districts under the Public Health Act are understood to include mining districts established under section 4 of the Mining Act. Under Section 147, the Minister responsible for Health is enabled to make regulations generally for the sanitary control of mining districts or parts thereof, and the health and welfare of the inhabitants. Revisions to the Public Health Act including draft regulations for mining have been made but not yet promulgated.

4.2.16 Forest Act 2008

The Aurora Gold Mine Project is located in a State Forest and is subject to conditions prescribed by the Guyana Forestry Commission. The Forest Act 2008, consolidates and amends the law on forests. It governs all activities that are carried out in the forest including mining and associated activities. Under this Act, no person shall engage in the following unless a mineral prospecting or mining licence has been granted under the Mining Act 1989:

- Enter and occupy state forest;
- Cut, damage or take any forest produce or carry on any kind of forest operation;
- Carry out any kind of exploratory operation in a state forest

The Guyana Forestry Commission with the approval of the Minister is vested with the power for carrying out the purposes of the Act.

4.2.17 Guyana Forestry Commission Act 2007

The Guyana Forestry Commission Act 1979 repealed and replaced the Guyana Forestry Commission Act 2007. The functions of the Commission as defined in the act include:

- To provide advice on various forest related issues and on formulation of forest policy;
- To prepare plans, codes of practice, and guidelines for the conservation and management of forests;
- To research, collate, analyse, prepare and disseminate data, statistics and other information about forests and all aspects of forestry including forest ecology and the use of forest produce;
- To inspect, certify and accredit services for quality control of forest produce.

The project will entail management and reclamation of forest resources and this act must therefore be adhered to.

4.2.18 Code of Practice for Timber Harvesting 2002

The Code of Practice for Timber Harvesting was developed by the Guyana Forestry Commission (GFC). It provides guidelines and standards on what constitutes satisfactory road building and other related forestry activities. *One important component of this project is the construction of an access road to the mine site. This road will at a minimum have to conform to GFC Road Planning guide as outlined in the Code of practice for Timber Harvesting.*

4.2.19 Low Carbon Development Strategy

The Low Carbon Development Strategy (LCDS) is outlined in the document “Transforming Guyana’s Economy While Combating Climate Change” dated June 2009 from the Office of the President, Republic of Guyana. The LCDS aims to build “on previous reforms to further stimulate investment, economic growth and job creation as well as to improve security and social services, protect vulnerable sections of society, and deal with increased climate change induced flooding”. It recognizes that the majority of Guyana’s 15 million hectares is suitable for timber extraction and places an annual value of US \$580.0 million on that resource.

The LCDS recognizes the need for “continuing the modernization of the traditional economic sectors which have generated Guyana’s historical growth and employment”. The document further “prioritizes the modernization of four traditional sectors: sugar, rice, forestry and mining”.

The LCDS is focused primarily on the consequences of deforestation and avoided deforestation. The intent is to ensure a carbon neutral position results from forestry operations. It has very little discussion on the mining sector and proposes “to align all land-use policies with the LCDS - most importantly forestry and mining policies”. It was recently proposed by the GGMC, as a consequence of the LCDS, that the use of mercury in mining be curtailed entirely. A two year period has been identified for enactment of the mercury ban.

4.3 INTERNATIONAL AND REGIONAL POLICY

4.3.1 Rio Declaration

The Rio Declaration on Environment and Development was one of five (5) documents that resulted from the Earth Summit in Rio de Janeiro in 1992. The other documents that are applicable to this project are:

- Agenda 21
- United Nations Framework Convention on Climate Change
- United Nations Convention on Biological Diversity

The Rio Declaration consisted of 27 principles intended to guide future sustainable development around the world. It confirms the responsibilities of all countries including Guyana to among other principles:

- Use the precautionary approach to prevent environmental degradation (Principle 15)
- Prepare environmental impact assessments with full public participation (Principle 10)
- Include Indigenous People and their communities in development projects (Principle 22)

Guyana ratified the Rio Declaration and developed and implemented guidelines for conducting Environmental Impact Assessments, which will be used to guide this project.

4.3.2 Agenda 21

Agenda 21 arises from the United Nations Conference on Environment and Development (UNCED) held in Rio De Janeiro in 1992 and outlines a number of environmental policy and management issues for a more sustainable pattern of development in the 21st century. Four major areas of political action were identified in Agenda 21, the social and economic development, natural resources, fragile ecosystems, major organizations and groups of people and means of implementation (Selman, 1996). Further, twenty-seven (27) environmental principles for the protection of environmental resources were outlined as the Agenda 21 action programmes. *One of its principles which states that environmental impact assessment should be a national instrument, and 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 is applicable to this project (Principle 17).* This global principle guided the development of a national policy on environmental impact assessment.

The UNCED Conference also initiated global statements on key environmental issues. These included the Framework Convention on Climate Change and the Convention on Biological Diversity which Guyana has ratified. In light of this, Guyana must consider these global agreements during environmental impact assessment for developmental projects.

4.3.3 Convention on Biological Diversity

This project could potentially impact the biodiversity of the area to be exploited. The project will consequently be executed to satisfy the objectives of the Convention to conserve biological diversity.

Guyana ratified the Convention on August 12, 1992, and it was entered into force on November 12, 1997. The National Focal Point is the Office of the President and the Implementing Agency is the Environmental Protection Agency. The objectives of the Convention include: the conservation of biological diversity (defined as the variability among living organisms from all sources including inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexities of which they are part including diversity within species, between species and of ecosystems), the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources.

The provisions of the Convention apply to areas within the limits of national jurisdiction of contracting parties and as regards the effects of processes and activities, both within and beyond the limits of national jurisdiction. Contracting parties are required under Article 7 of the Convention, to identify processes and activities which have or are likely to have significant adverse impacts on the conservation and sustainable use of biological diversity and to monitor their effects through sampling and other techniques. Parties are, also as far as is possible and as appropriate, required to establish protected areas or areas where special measures need to be taken to conserve biological diversity. In areas adjacent to these protected areas environmentally sound and sustainable development should also be promoted. Article 8 requires that degraded ecosystems be rehabilitated and restored and the recovery of threatened species be done through the development and implementation of plans or management strategies. Contracting parties are also required to regulate or manage relevant processes or activities where a significant adverse effect on biological diversity has been determined.

Article 10 of the Convention supports the integration of conservation and sustainable use of biological resources in national decision-making, and the support of local populations to develop and implement remedial action in degraded areas where biological diversity has been reduced. The avoidance or minimising of adverse transboundary effects is also considered important and should be addressed by the introduction of environmental impact assessments of proposed projects that are likely to have significant adverse impacts on biological diversity, the exchange of information and consultation on activities likely to significantly adversely affect the biological diversity of other States and notification to

such States of imminent or grave danger to biological diversity within areas under the jurisdiction of States.

In observance of the Convention, Guyana established the Environmental Protection Agency in 1996, to coordinate and implement a programme for the conservation of biological diversity. A National Biodiversity Action Plan was also developed with stakeholders.

4.3.4 Protocol Concerning Pollution from Land-Based Sources and Activities (LBS)

The Protocol requires contracting parties to develop and implement programmes, plans and measures as effective means of preventing reducing or controlling pollution of the Convention area from land-based sources and activities. Parties are required to address the source categories, activities and pollutants of concern listed in Annex 1 to the Convention. Extractive industries and mining are identified as priority source categories and activities, while heavy metals and compounds, cyanides and fluorides are listed as primary pollutants of concern. Annex II identifies factors to be used to determine effluent and emission limitations and/ or management practices.

Possible landbased sources of pollution at the site will include fuel storage tanks, chemical reagent holding facilities and leaks from mining equipment. In accordance with this protocol, the project proponent shall develop and implement programs, plans and measures to prevent, reduce and/or control pollution of the project area from land-based sources and activities.

4.3.5 Basel Convention on the Transboundary Movement of Hazardous Waste and their Disposal

The Basel Convention aims to protect human health and the environment against the adverse effects resulting from the generation, management, transboundary movements and disposal of hazardous and other wastes. Guyana is a party to this convention which came into force in 1992. It was designed specifically to prevent transfer of hazardous waste from developed to less developed countries (LDCs). The Convention is also intended to minimize the amount and toxicity of wastes generated. This ensures that toxic waste is managed as closely as possible to the source of generation. Examples of hazardous waste as defined by the convention are:

- Wastes from the manufacture, formulation and use of wood preserving chemicals
- Waste pharmaceuticals, drugs and medicines
- Wastes from the production, formulation and use of organic solvents
- Waste mineral oils unfit for their originally intended use
- Waste oils/water, hydrocarbons/water mixtures, emulsions
- Wastes from production, formulation and use of inks, dyes, pigments, paints, lacquers, varnish

Consequent to this convention Guyana developed regulations on environmental protection. One of these regulations focuses on the management of hazardous wastes.

4.3.6 Protocol Concerning Specially Protected Areas and Wildlife (SPA)

The SPAW Protocol which is used as a means of regionalising global conventions such as the CBD, utilises an ecosystem approach to conservation by protecting rare and fragile ecosystems and the endangered species it houses. Through its Caribbean Regional Coordinating Unit, assistance is given in the establishment of protected areas, as one of the objectives of the SPAW Programme is to significantly increase the number and improve the management of national protected areas and species in the region and assist the Governments of the region, on request, in developing guidelines for the establishment and management of such areas.

The Protocol extends to the Convention Areas as well as water courses extending up to the fresh water limit or watersheds designated by the parties. It urges when necessary, the establishment of protected areas in instances where it is necessary to protect:

- representative types of coastal and marine ecosystems of adequate size to ensure their long-term viability and to maintain biological and genetic diversity;
- habitats and their associated ecosystems critical to the survival and recovery of endangered, threatened or endemic species of flora or fauna;
- the productivity of ecosystems and natural resources that provide economic or social benefits and upon which the welfare of local inhabitants is dependent; and
- areas of special biological, ecological, educational, scientific, historic, cultural, recreational, archaeological, aesthetic, or economic value, including in particular, areas whose ecological and biological processes are essential to the functioning of the Wider Caribbean ecosystems.

In the application of protection measures, each party is urged to progressively take such measures in accordance with its national laws and international law as are appropriate for:

- the regulation or prohibition of the dumping or discharge of wastes and other substances that may endanger protected areas;
- the regulation or prohibition of coastal disposal or discharges causing pollution, emanating from coastal establishments and developments, outfall structures or any other sources within their territories;
- the regulation or prohibition of fishing, hunting, taking or harvesting of endangered or threatened species of fauna and flora and their parts or products;
- the prohibition of activities that result in the destruction of endangered or threatened species of fauna or flora and their parts and products, and the regulation of any other activity likely to harm or disturb such species, their habitats or associated ecosystems;
- the regulation or prohibition of any activity involving a modification of the profile of the soil that could affect watersheds, denudation and other forms of degradation of watersheds, or the exploration or exploitation of the subsoil of the land part of a marine protected area;
- the regulation or prohibition of industrial activities and of other activities which are not compatible with the uses that have been envisaged for the area by national measures and/or environmental impact assessments pursuant to Article 13;
- any other measure aimed at conserving, protecting or restoring natural processes, ecosystems or populations for which the protected areas were established.

If any rare or fragile ecosystems are encountered within the area being exploited the ecosystem approach to conservation would be utilized to manage that rare or fragile ecosystem.

4.3.7 Treaty on Cooperation for the Development of the Amazon Basin

The area proposed for the development of this project is considered part of the Amazon Basin and this treaty would be applicable to the development. The Treaty on cooperation for the Development of the Amazon Basin was established in 1978 to promote the harmonious development of the Amazon Region and to undertake joint action and efforts to promote the harmonious development of the Amazonian territories in such a way that joint actions produce equitable and mutually beneficial results and also achieves the preservation of the environment, conservation and rational utilization of the natural resources.

Six sub-committees were set up to initiate, implement and address issues as relates to the implementation of the Amazonian Treaty. These include the following: Health, Transportation, Education, Infrastructure, Tourism, Environment, Science and Technology and Indigenous Affairs.

The area proposed for the development of this project is considered part of the Amazon Basin. The aforementioned environmental conditions and agreements place emphasis on the Government of Guyana as a signatory to these treaties to put specific measures in place for compliance. The enactment of the Environmental Protection Act and its regulations have established the institutional and regulatory measures for the implementation of the treaty some of which forms part of the environmental impact assessment requirements.

4.3.8 Convention on International Trade of Endangered Species

This convention was established in 1972 to control international trade of live and dead animals and plants through the issuing of permits/certificates for such trade. Requirements for the establishment of Scientific and Management authorities; regulation of trade in specific species via permits and certificates; records of trade are detailed in the convention. The legal obligation under this convention was established in the Species Protection Regulations of 1999 under the Environmental Protection Act.

The project will not entail capture and trade in endangered specie and the company will enforce a policy of no hunting or trapping to ensure its employees are not involved in contravening this convention.

4.3.9 UN Framework Convention on Climate Change (UNFCCC)

The CO₂ emitted by mining equipment is a greenhouse gas. In addition, clearing of forested areas for mining will reduce the sequestration ability of the forests impacted by that clearing. These quantities of greenhouse gases emitted and the reduction in sequestration will be quantified in the ESIA.

UNFCCC 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. Further, acceptable levels of greenhouse gas (GHG) should be achieved within a time frame that is sufficient to allow ecosystems to adapt naturally to climate change.

In keeping with the provisions of the Convention, a national climate change committee was established and a national inventory of Greenhouses Gases was prepared for base-year 1994. Aspects related to technology transfer, capacity building requirements, vulnerability assessment and adaptation measures were compiled.

4.4 IFC Performance Standards and Applicable EHS Guidelines

The International Finance Corporation (IFC) developed eight (8) performance standards for Environmental and Social Impact Assessment (Performance Standards on Social and Environmental Sustainability 2006). These standards manage social and environmental risks and impacts of projects. GUY is expected to consistently meet these standards throughout the life of an investment by IFC.

The performance standards that are applicable to the project are:

Performance Standard 1: Social and Environmental Assessment and Management Systems

Performance Standard 2: Labor and Working Conditions

Performance Standard 3: Pollution Prevention and Abatement

Performance Standard 4: Community Health, Safety and Security

Performance Standard 6: Biodiversity Conservation and Sustainable Natural Resource Management

Performance Standard 7: Indigenous Peoples

4.4.1 PS 1: Social and Environmental Assessment and Management Systems

This performance standard underscores the importance of managing social and environmental performance throughout the life of a project. It entails the thorough assessment of potential social and environmental impacts and risks from the early stages of project development, and provides order and consistency for mitigating and managing these on an ongoing basis.

The objectives of the Social and Environmental Assessment and Management Systems as detailed in this PS are:

- To identify and assess social and environment impacts, both adverse and beneficial, in the project's area of influence;
- To avoid, or where avoidance is not possible, minimize, mitigate, or compensate for adverse impacts on workers, affected communities, and the environment;
- To ensure that affected communities are appropriately engaged on issues that could potentially affect them;
- To promote improved social and environment performance of companies through the effective use of management systems

4.4.1.1 Requirements of the Social and Environmental Assessment and Management Systems

The IFC mandates that a Social and Environmental Management System appropriate to the nature and scale of the project be established and maintained. The management system shall incorporate the following elements:

- Social and Environmental Assessment
- Management Program
- Organizational Capacity
- Training
- Community Engagement
- Monitoring
- Reporting

4.4.1.1.1 Social and Environmental Assessment

The social and environmental assessment should consider the potential social and environmental (including labor, health and safety) risks and impacts of the project. It should also include a description of the project and an appropriate social and environmental baseline data. National and International laws and regulations appropriate to social and environmental matters shall be taken into account.

Risks and impacts shall be analyzed in the context of the project's area of influence. Among the issues considered by the assessment shall be:

- Emission of greenhouse gases;
- Pollution of air;
- The role of third parties such as Governments;
- Groups that may be affected by the project because of their disadvantaged or vulnerable status.

4.4.1.1.2 Management Program

The management program shall take into consideration the findings of the Social and Environmental Assessment and consultation with affected communities. The program shall include mitigation and

performance improvement measures and actions that address identified social and environmental risks and impacts. In instances where risks and impacts cannot be avoided, mitigation measures shall be identified so that the project operates in compliance with applicable laws, regulations and the Performance Standards.

Where specific mitigation measures and actions have been identified (from consultation) to make the project compliant with applicable laws, regulations and the requirements of the Performance Standards, an Action Plan must be prepared. The Action Plan shall:

- Describe the actions necessary to implement the various sets of mitigation measures or corrective actions to be undertaken;
- Prioritize these actions;
- Include the time-line for their implementation;
- Be disclosed to the affected communities;
- Describe the schedule and mechanism for external reporting on the implementation of the plan.

4.4.1.1.3 Organizational Capacity and Training

An organizational structure that defines roles, responsibilities and authority to implement the management program shall be developed. Employees and Contractors with responsibility for social and environmental performance shall be trained in the requirements of the Performance Standards, Guyana's regulatory requirements and actions required under the management program.

4.4.1.1.4 Community Engagement

The purpose of community engagement is to build and maintain constructive relationship with local communities that may be affected by risks from this project. This shall be ongoing process which involves:

- The disclosure of information on the risks, impacts and opportunities of the project;
- A process of consultation so that affected communities can express their views on project risks, impacts and mitigation measures and have their concerns addressed.
- Establishing a grievance mechanism if ongoing risks or adverse impacts are anticipated. The grievance mechanism receives and facilitates resolution of the concerns of the affected communities. The affected communities should be informed of the grievance mechanism during the engagement process.

4.4.1.1.5 Monitoring and Reporting

The plan shall include procedures to monitor and measure the effectiveness of the management program. Mechanisms such as inspections and audits shall be used to verify compliance toward the desired outcome. Monitoring results shall be documented and identified and shall reflect the necessary corrective and preventive action in the amended management program. The effectiveness of the management program shall be reported to senior management in accordance with Company Policy. Progress with implementation of the Action Plan on issues that involve ongoing risk to or impacts on affected communities shall be reported to affected communities no less than annually.

4.4.2 PS 2: Labor and Working Conditions

This Performance Standard recognizes that the pursuit of economic growth through employment creation and income generation should be balanced with protection for basic rights of workers. Failure to establish and foster a sound worker-management relationship may undermine worker commitment and retention, and can jeopardize a project.

The objectives of the Labor and Working Conditions Performance Standard are:

- To establish, maintain and improve the worker-management relationship
- To promote the fair treatment, non-discrimination and equal opportunity of workers, and compliance with national labor and employment laws
- To protect the workforce by addressing child labor and forced labour
- To promote safe and healthy working conditions, and to protect and promote the health of workers.

4.4.2.1 Requirements of Labor and Working Conditions Performance Standards

Implementing the actions necessary to meet the requirements of this Performance Standard is managed through the Social and Environmental Management System as outlined in Performance Standard ¹. This Performance Standard includes the following elements:

- Working Conditions and Management of Worker Relationship
- Protecting the Workforce
- Occupational Health and Safety

4.4.2.1.1 Working Conditions and Management of Worker Relationship

The company is mandated to adopt a human resources policy that sets out the company's approach to managing employees consistent with this Performance Standard. This PS mandates that upon employment, employees shall be provided with information regarding their working conditions and terms of employment and their rights to wages and benefits.

Where national law recognizes workers' rights to form and join workers' organization of their choosing, GUY shall comply with such law and workers who participate in such organizations and bargain collectively should not be discriminated against. Employment relationship shall be based on the principle of equal opportunity and fair treatment. Workers will not be discriminated against with respect to recruitment and hiring, promotion, training, discipline etc. If national laws are silent on non discrimination, this Performance Standard will be met. A plan to mitigate the adverse impacts of retrenchment on employees should be developed if a significant number of jobs will be eliminated. The plan shall be based on the principle of non-discrimination and shall adequately reflect consultation with employees, their organizations and Government. A grievance mechanism shall be established for workers to raise reasonable workplace concerns. Concerns should be addressed promptly without retribution.

4.4.2.1.2 Protecting the Workforce

No child below the age of 18 years will be employed in a manner that is economically exploitative, interfere with his/her education, health, physical, mental, moral or social development. Forced labor, which is any work or service not voluntarily performed, will not be employed.

4.4.2.1.3 Occupational Health and Safety

A safe and healthy work environment shall be provided for workers. This considers physical, chemical, biological and radiological hazards in the various work areas. Consistent with good international industry practice¹ the following areas will be addressed:

¹ Defined as the exercise of professional skill, diligence, prudence and foresight that would reasonably be expected from skilled and experienced professionals engaged in the same type of undertaking under the same or similar circumstances globally.

- The identification of potential hazards to workers particularly those that may be life-threatening;
- Provision of preventive and protective measures including modification, substitution, or elimination of hazardous conditions or substances;
- Training of workers;
- Documentation and reporting of occupational accidents, diseases and incidents;
- Emergency prevention, preparedness and response arrangements

4.4.3 PS 3: Pollution Prevention and Abatement

This performance standard recognizes that increased industrial activity generate increased levels of pollution to air, water and land that may threaten people and the environment. The objectives of the pollution prevention and abatement performance standard are:

- To avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities
- To promote the reduction of emissions that contribute to climate change.

4.4.3.1 Requirements of the Pollution Prevention and Abatement Performance Standard

Implementing the actions necessary to meet the requirements of this Performance Standard is managed through the Social and Environmental Management System as outlined in Performance Standard 1. This Performance Standard includes the following elements:

- General Requirements on Pollution Prevention and Abatement
- Ambient Considerations
- Greenhouse Gas Emissions

4.4.3.1.1 General Requirements on Pollution Prevention and Abatement

During the life-cycle of the project, pollution prevention and control technologies to avoid or minimize adverse impacts to human health and the environment shall be considered within the realm of technical and financial feasibility². IFC's Environmental Health and Safety (EHS) Guidelines shall be used to evaluate and select pollution prevention and control techniques for the project. These guidelines contain the performance levels and measures that are applicable to projects.

- Hazardous and non-hazardous wastes that cannot be recovered shall be disposed of in an environmentally sound manner.
- A plan that addresses training, responsibilities, communication, and procedures should be prepared to respond to accident and emergency situations.

4.4.3.1.2 Ambient Considerations

To address adverse project impacts on existing ambient conditions (air, soil, surface and groundwater), the following shall be considered:

- Existing and future land use

² Technical feasibility is based on whether the proposed measures and actions can be implemented with commercially available skills, equipment and materials, taking into consideration local factors such as climate, geography, demography, infrastructure, security, capacity and operational reliability.

Financial feasibility is based on commercial considerations including the magnitude of the incremental cost of adopting such measures and actions compared to the project's investment, operating and maintenance cost and whether this incremental cost could make the project non viable.

- Existing ambient conditions
- Project proximity to ecologically sensitive areas etc.

Additionally, strategies that avoid, minimize or reduce the release of pollutants should be promoted.

4.4.3.1.3 Greenhouse Gas Emissions

The reduction of project-related Green House Gas (GHG) emission shall be promoted. Cost-effective options to reduce or offset project-related GHG emissions include carbon financing, use of renewable energy source, emissions offsets etc. Quantification and monitoring of GHG emissions shall be conducted annually in accordance with internationally recognized methodologies.

4.4.4 PS 4: Community Health, Safety and Security

This Performance Standard addresses Guyana Goldfield's responsibility to avoid or minimize the risks and impacts from project activities to community health, safety and security. The objectives of PS 4 are:

- To avoid or minimize risks to and impacts on the health and safety of the local community during the project life cycle from both routine and non routine circumstances
- To ensure that the safeguarding of personnel and property is carried out in a legitimate manner that avoids or minimizes risks to the community's safety and security.

4.4.4.1 Requirements of Community Health, Safety and Security Performance Standard

Implementing the actions necessary to meet the requirements of this Performance Standard is managed through the Social and Environmental Management System as outlined in Performance Standard 1. This Performance Standard includes the following elements:

- Community Health and Safety Requirements
- Security Personnel Requirements

4.4.4.1.1 Community Health and Safety Requirements

During the life of the project, the risks and impacts to health and safety of affected community shall be evaluated and measures shall be developed to favour prevention or avoidance of risks and to minimize impacts. The failure of structural equipment and components of the project may threaten the health and safety of communities. These facilities shall consequently be designed and constructed by qualified and experienced professional.

Workers, their families and the community shall be protected from hazardous materials that may be released by the project. Where there is a potential for exposure to life-threatening hazards, the substance or condition causing the hazard shall be modified, substituted or eliminated.

Adverse impacts from project activities on soil, water and other natural resources used by affected communities shall be minimized. Water-borne and other communicable diseases that could result from project activities shall be minimized.

Hazards that stem from the risks and impacts from project activities shall be communicated to affected communities. GUY shall collaborate with local government agencies in its preparation to respond effectively to emergency situations. Additionally, it shall document its emergency preparedness and response activities, resources and responsibilities. Appropriate information in the Action Plan or other document shall be made available to affected communities or Government Agencies.

4.4.4.1.2 Security Personnel Requirements

Risks of security arrangements within and outside the project site will be assessed. Reasonable enquires shall be done to ensure that those providing security are not implicated in past abuses. These individuals shall be trained in the use of force and act within applicable law. Unlawful or abusive acts of security personnel shall be investigated and reported to public authorities when appropriate.

4.4.5 PS 6: Biodiversity Conservation and Sustainable Natural Resource Management

This Performance Standard addresses how GUY can avoid or mitigate threats to biodiversity³ and manage renewable natural resources. The objectives of PS 6 are:

- To protect and conserve biodiversity
- To promote the sustainable management and use of natural resources through the adoption of practices that integrate conservation needs and development priorities

4.4.5.1 Requirements of Biodiversity Conservation and Sustainable Natural Resource Management

Implementing the actions necessary to meet the requirements of this Performance Standard is managed through the Social and Environmental Management System as outlined in Performance Standard 1. The requirements of this PS are applied to all habitats whether or not they are legally protected or have been previously disturbed. This Performance Standard includes the following elements:

- Protection and Conservation of Biodiversity
- Management and Use of Renewable Natural Resources

4.4.5.1.1 Protection and Conservation of Biodiversity

To avoid or minimize adverse impacts to biodiversity in the project area of influence, the following shall be done:

- Assess the significance of impacts on all levels of biodiversity. This should include the different values attached to biodiversity by stakeholders and the impacts on ecosystem services.
- Assess the major threats to biodiversity including habitat destruction and invasive alien species.

Natural habitat shall not be significantly converted or degraded unless conversion is appropriately mitigated. Mitigation measures shall include:

- Post Operation restoration of habitats
- Offset of losses through the creation of ecologically comparable area (s) that is managed for biodiversity. The ongoing usage of such biodiversity by indigenous peoples or traditional communities will be respected.
- Compensation to direct users of biodiversity

The project shall not be implemented in a critical habitat unless the following requirements are met:

- Impacts are mitigated in accordance with the mitigation measures above
- There is no reduction in the population of any recognized critically endangered or endangered species as defined by IUCN or national legislation

³ The variety of life in all its forms, including genetic, species and ecosystem diversity. The components of biodiversity include ecosystems and habitats, species and communities, and genes and genomes all of which have social, economic, cultural and scientific importance.

- There are no measurable adverse impacts on the ability of the critical habitat to support the established population of species or functions of the critical habitat.

No new alien species with a high risk of invasive behaviour will be intentionally introduced in the project area.

4.4.5.1.2 Management and Use of Renewable Natural Resources

Renewable natural resources will be managed in a sustainable manner.

4.4.6 PS 7: Indigenous Peoples

This Performance Standard recognizes that Indigenous Peoples may play a role in sustainable development by promoting and managing activities as partners in development. The objectives of PS 7 are:

- To ensure that the development process fosters full respect for the dignity, human rights, aspirations, cultures and natural resource-based livelihoods of Indigenous peoples
- To avoid adverse impacts of the project on communities of Indigenous Peoples, or when avoidance is not feasible to minimize, mitigate or compensate for such impacts, and to provide opportunities for development benefits in a culturally appropriate way
- To establish and maintain an ongoing relationship with the affected Indigenous Peoples throughout the life of the project
- To respect and preserve the culture, knowledge and practices of Indigenous Peoples

4.4.6.1 Requirements of Indigenous Peoples Performance Standard

Implementing the actions necessary to meet the requirements of this Performance Standard is managed through the Social and Environmental Management System as outlined in Performance Standard 1. This Performance Standard includes the following elements:

- Avoidance of Adverse Impacts and Information Disclosure, Consultation and Informed Participation
- Development Benefits

4.4.6.1.1 Avoidance of Adverse Impacts and Information Disclosure, Consultation and Informed Participation

All Indigenous communities within the project's area of influence that may be affected by the project shall be identified. The nature and degree of expected social, cultural and environmental impacts shall also be identified. Where avoidance is not feasible, GUY shall minimize, mitigate or compensate for these impacts. Their actions will be developed with full participation of affected Indigenous Peoples and contained in a time-bound plan.

An ongoing relationship shall be established with affected Indigenous Communities in project planning and throughout the life of the project. If their communities are affected by project activities, the consultation process shall facilitate their informed participation on matters that affect them. The process shall include the following steps:

- Involve Indigenous Peoples representative bodies
- Be inclusive of both men and women of various age groups
- Provide sufficient time for Indigenous Peoples' collective decision-making process
- Ensure that grievance mechanism established for the project is accessible

4.4.6.1.2 Development Benefits

Opportunities for culturally appropriate development benefits for affected communities shall be identified through consultation. This shall be documented and provided in a timely manner.

5.0 EXISTING ENVIRONMENT

Baseline data on the physical environment in the mine site area was compiled over a one year period to track temporal trends, if any. The periods during which physical data was compiled for the site are as follows:

- January 17 to February 04 2006
- July 1 to July 7 2006
- October 06 to October 13 2006
- February 22 to March 05 2007

Data collection for the physical environment, conducted during each period, focused on surface water hydrology, topography, soils, benthic sediment, climate and meteorology, ambient air quality, and water quality. Data on site geology was compiled from published references. Field surveys conducted during each period included recovery and analysis of surface and groundwater samples. Groundwater sampling and analyses was focused totally on an area within the concession referred to as the Golden Mile where the development work for the mine will be concentrated to minimize the extent of clearing to access sample locations.

Surface water flow volumes and quality were obtained for the Cuyuni River for each survey period. In addition, surface water quality was also recorded for locations expected to be upstream and downstream of the Golden Mile.

5.1 Geology, Soils and Topography

The mining concession lies within the Precambrian Guiana Shield which extends across northern South America from east of the Andes to northeastern Brazil. The rocks in the concession area and its immediate vicinity can be classified into the three following units all of which appear to be of Precambrian age (Carter, 1963).

- Aurora Granite - Younger Granites
- Cuyuni Formation - Barama-Mazaruni Assemblage
- Devil's Hole Gneisses

The rocks of the Devil's Hole gneisses can be classified into two sets based on whether the rock are amphibole rich or not. The sets are the (i) amphibolites and small basic bodies and (ii) the foliated biotite gneisses and minor quartzites. The foliated biotite gneisses and minor quartzites are comprised of a variety of rocks differing only slightly in composition and texture which makes it difficult to map each type separately. Rocks of this unit are typically leucocratic with a foliation defined by aligned biotite. Hornblende may sometimes be present. Small basic bodies occurring in them do not normally show an alignment of minerals though a later schistosity is often displayed. Locally amphibole rich bands are developed within the feldspar rich rocks and here the banding is conformable with the dominant foliation direction. In the lower Labaria Creek, well foliated biotite gneisses are associated with very dense, fine-grained, amphibole rich rocks which appear to represent former basic bodies in the gneisses. Here minor quartzites are also interbanded with the gneisses. Small bodies of gneissose biotite granites are also exposed, with biotite foliation again conformable with the regional foliation direction.

There are a minimum of three types of amphibolites and small basic bodies occurring in the area. The main development of these bodies exists in the Julian Ross Itabu above Haimaralli Falls. The hornblende rich rocks in the Falls Creek area represent an extension of this main mass of amphibolites. The amphibolites in the northwestern portion appear to be older than the mass exposed just above Falls Creek. The smaller lens-like bodies are considered to be of similar ages. The main mass of amphibolites in Julian Ross Itabu is medium to coarse-grained dark rocks composed essentially of hornblende and

feldspars. This schistosity is usually restricted to narrow bands and therefore represents the effects of shearing. In both Falls and Labaria Creeks the amphibolites display similar features and thus might be part of the same basic intrusive body. The contact between the biotite gneiss and this body of amphibolites is exposed in Julian Ross Itabu. Here the amphibolite becomes very fine grained and the contact between the two rock types runs generally north south. The amphibolite in this vicinity is slightly sheared. In low water the contact between the amphibolites and the gneisses is well exposed and can be traced to the mouth of Labaria Creek. The chief characteristic of this body of amphibolite is its lack of good orientation of amphibole crystals.

The Cuyuni Formation is a unit of rocks of great extent in the Cuyuni River area. The formation consists of laterally impersistent tongues predominantly of conglomerates, pebbly sandstones and sandstones and porphyritic fine-grained igneous rocks. Some of the Volcanic rocks in the Aurora Creek area carry abundant vesicles suggesting that they represent the tops of flows. Usually these fine grained volcanic rocks are devoid of any observable schistosity. In thin section all the rocks of the Cuyuni Formation display the characteristics of rocks subjected to a low grade of regional metamorphism approximately within the Greenschist facies. In most cases the porphyritic volcanic flow rocks still preserve some original texture. These sometimes carry very large crystals of what was originally pyroxene set in very much finer-grained groundmass. Although the eight sided outlines of the pyroxenes remain unchanged, entire crystals have been replaced by an amphibole within the tremolite range of composition. Some original pyroxenes of the augite-aegirine group are still observable.

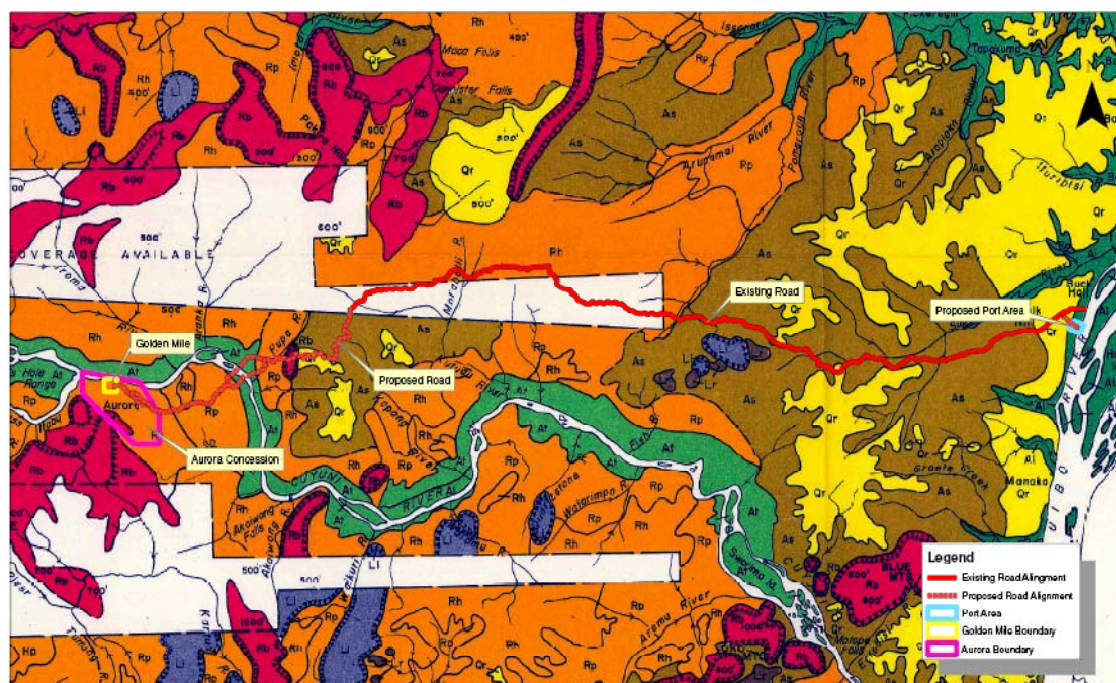
The Aurora Granite is an outcropping of granitic rocks immediately to the south of the former Aurora Gold Mine which forms a small copola intruding both the Cuyuni Formation and the Devil's Hole Gneisses. The rock is typically very leucocratic and in most instances it can be termed an aplite. Ferromagnesians are absent away from the margins or away from xenoliths. The granite often appears pinkish due to the color of feldspar and the quartz is usually smoky. In a few outcrops, particularly near to the former Aurora mine, the granite has a marked green appearance owing to chloritization of some of the feldspars. Typically ferromagnesians are absent but a few patches of iron oxides are sometimes present. Quartz, orthoclase and microcline make up most of the rock but carbonates are sometimes prominent. The granite is often well strained as testified by the anomalous extinction of many minerals.

Close to the contacts between the granite and the Cuyuni Formation shearing in both granite and sediments is usually well developed but there is seldom much reaction between the two rock types. The most characteristic feature of these contact areas is the presence of auriferous quartz veins in the sheared country rock. There is usually some reaction between the granite and the amphibole rich rocks found to the south of Falls Creek. These effects are, however, restricted to the regions close to the contacts. In places the aplitic granite becomes rather rich in amphiboles and changes within a very short distance from an aplite into an amphibole rich rock. At the contact between the granite and amphibolites, silicification is often well developed and granitic material is introduced as spots and seams in the amphibolite. Contact rocks have been observed in which granitic material pervades a rock which was dominantly amphibole rich. Some of the smaller creeks often flow between the contact of amphibolite and granite with the result that one bank of a 12 feet wide creek carries dominantly granitic material whilst on the other bank amphibolite is the main rock type. In a few places in Julian Ross Itabu the contact between amphibolite and granite is sharp with little observable change within a few feet of the contact but in other places intense silicification is sometimes seen.

Most of the rocks occurring close to the granite margins have been intensely saussuritized and silicified. Here discrete patches rich in introduced quartz-feldspathic material are in evidence. In places highly altered plagioclases are replaced by large patches of quartz. Where saussuritization is well developed distinct crystals of epidote and zoisite are abundant. In the altered basic rocks near the granite margins tremolite, actinolite and hornblende are often abundant, usually associated with original pyroxene. As would be expected there is a diminishing of the effects away from the contacts with the granite. The plagioclase feldspars become less altered and the amount of introduced silica diminishes.

The soils on the proposed mine site, access road, and wharf have developed in place and consist of residual material derived from weathered acid crystalline rocks (granite, schist, dolerite, granodiorite, and phyllite), alluvial sediments derived from quartz, and stratified, unconsolidated deposits of sand, silts, and clays. In the upland areas the soils are deep, well drained, yellow and reddish-brown sandy clay loams and gravelly clays. In the riverine and alluvial fan areas, the soils are also deep and poorly drained, moderately well drained, or excessively drained. These soils are brown to white clay loams and sands (Braun and Derting, 1964).

The soil types on the proposed Project site include seven soil map units (see Figure 11). Table 3 summarizes the major characteristics of the soil types.



Source: ERM, 2009; after Braun and Dertin, 1964 (see Figure x-1 for a description of the different soil types)

Figure 11 - Soils Map of the Proposed Project Site

Table 3: Major Characteristics of Soil at Project Site

Soil Map Unit	Soil Association Characteristics	Geomorphology/Landform	Parent Material	Land Capability Classification
Mine (Aurora Concession)				
Rh	Deep, dominantly well drained, yellow and brown, sandy clay loam, clay, and gravelly clay-soils (red-yellow soils). Shallow, excessively drained, sandy loam and silt loam soils with occasional gravel.	Hilly to steep residual uplands.	Deeply, weathered, residual, acidic crystalline rocks, such as granite, schist, phyllite, and granodiorite.	III
Rb	Deep, well drained, brown, and red gravelly clay and clay soils (reddish-brown lateritic soils).	Steep to hilly, hills and mountains.	Deeply weathered, residual, basic rocks (dolerite and amphibolite).	III
Access Road				
Rh	Deep, dominantly well drained, yellow and brown, sandy clay loam, clay, and gravelly clay-	Hilly to steep residual uplands.	Deeply, weathered, residual, acidic crystalline rocks, such as granite, schist, phyllite, and granodiorite.	III

Table 3: Major Characteristics of Soil at Project Site

Soil Map Unit	Soil Association Characteristics	Geomorphology/Landform	Parent Material	Land Capability Classification
	soils (red-yellow soils). Shallow, excessively drained, sandy loam and silt loam soils with occasional gravel.			
Rp	Deep, dominantly well drained, yellow and brown, sandy clay loam, clay and gravelly clay soils (red-yellow soils). Poorly drained, silty and clayey soils (low-humic gley soils).	Rolling pedimentry and residual uplands.	Unconsolidated pedimentary and alluvial deposits and residual materials derived from deeply weathered acid crystalline rocks (granite, schist, and phyllite).	I - II
At	Association of deep, dominantly poorly and moderately well drained, grey and brown silty and sandy soils. Excessively drained white sand and well drained sandy clay loam.	Level to gently sloping river alluvium and terrace.	Stratified, unconsolidated, recent and subrecent deposits of sand, silt, and clay.	I - II
As	Association of deep, dominantly well drained, yellow and brown sandy clay loam and clay soils (red-yellow soils). Excessively drained brown and white sands, and shallow sandy loam soils.	Sloping to hilly dissected white sand plateau with crystalline exposures.	Stratified, unconsolidated, sandy deposits and residual acidic materials.	I - II
Qr	Deep, excessively or poorly drained white sand soils.	Gently sloping to sloping white sand plateau.	Stratified, unconsolidated, white quartz sand deposits.	IV
Wharf / Dock				
Qr	Deep, excessively or poorly drained white sand soils.	Gently sloping to sloping white sand plateau.	Stratified, unconsolidated, white quartz sand deposits.	IV
Al	Association of deep, grey and brown, poorly drained, clayey, silty and sandy soils (low-humic gley soils).	Nearly level to level river alluvium.	Stratified, unconsolidated, recent alluvial deposits of silt, clay, and sand.	I - II

Source: Environmental Resource Management, Inc. 2009 after Braun and Derting, 1964.

Key:

Land Capability Classification: I - II = Good to moderate agricultural land (no to moderate limitations for general agricultural use); III = Poor agricultural land (severe limitations for general agricultural use); and IV = Nonagricultural land (very severe limitations for agricultural use).

5.2 Natural Hazards

5.2.1 Seismic Activity

Seismicity in the northern part of the South America continent is largely controlled by plate boundary events occurring along the southern rim of the Caribbean Basin. Major earthquakes frequently occur along the plate boundary between the South American and Caribbean Plates. Figure 12 and 13 show the distribution of historical deep seated and shallow earthquakes occurring around the Caribbean Basin respectively. These figures demonstrate that earthquake activity is concentrated in a circular pattern around the perimeter of the Caribbean tectonic plate.

Figure 12 - Deep and Intermediate Depth Seismicity, 1901-1993 (from OAS CDMP, 2001)

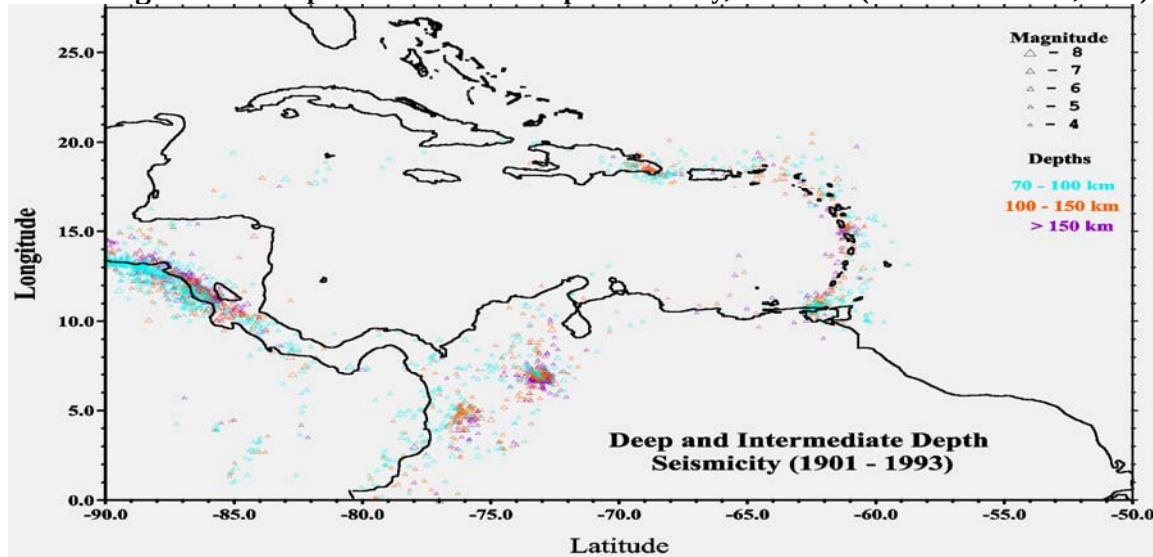
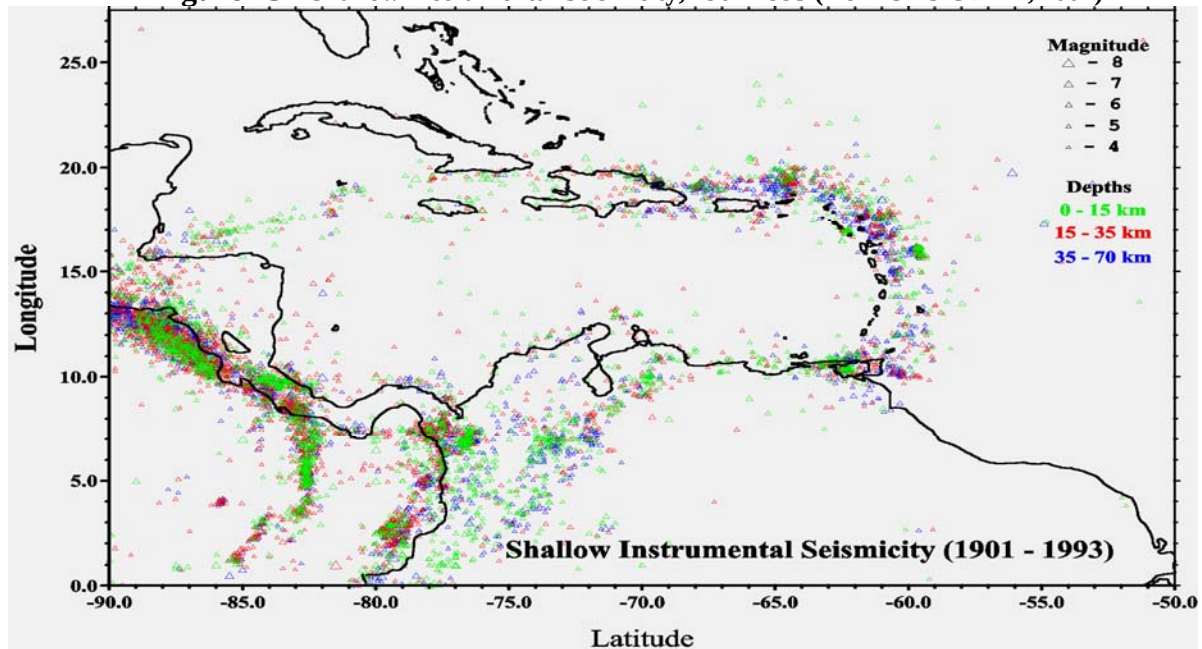


Figure 13 - Shallow Instrumental Seismicity, 1901-1993 (from OAS CDMP, 2001)



Guyana is located within the South American tectonic plate. The project site is located more than 200 km from the Caribbean and South American plate boundary and is located in an area of low seismic activity.

A search was conducted of the National Oceanic and Atmospheric Administration Earthquake database, which includes data on a half-million earthquakes dating back to 2100 B.C. The results of that search are shown as Figure 14.

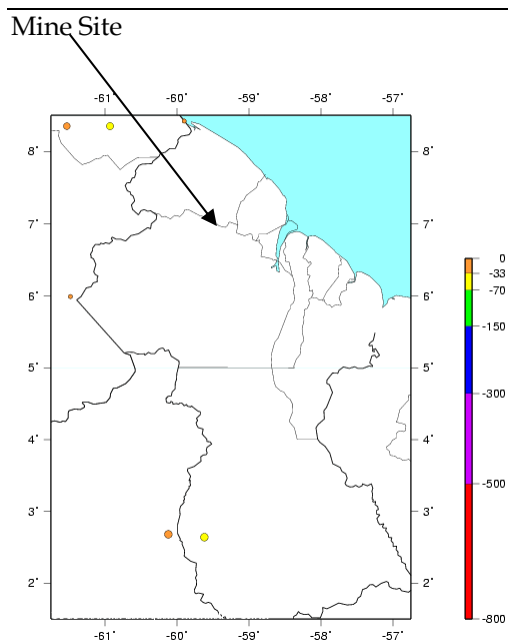


Figure 14 - Earthquake Location within and around Guyana

That search revealed that five events have occurred within recorded history within 300 km of the project area. One of these events occurred in Guyana, in 1964, at a point defined by 2.64° North and 59.62° West at a depth of 50 km and with a magnitude of 4.50. The second event occurred almost immediately west of that point in Brazil at a point defined by 2.68° North and 60.12° West. The depth of that event was not recorded. The magnitude of that event was reported as being 4.90. The earthquake occurrence closest to the site occurred in Venezuela at a point defined by 5.99° North and 61.48° West. The depth and magnitude of that event were not reported.

5.3 Climate and Air Quality

Guyana is located in the Equatorial Trough Zone (ETZ) and its weather and climate are influenced primarily by the seasonal shifts of the ETZ and its associated rain-bands called the Inter Tropical Convergence Zone (ITCZ). Secondary influences on the climate are of Pacific origin. Formation of El Niño and La Niña can disturb the regular location of the ITCZ and thus result in higher or lower than normal rainfall at specific locations. The El Niño/La Niña is primarily responsible for inter-annual variation in rainfall. The entire area identified for development into the mine, like the rest of Guyana has a tropical climate and is not subject to extreme variations in temperature and humidity.

Hydro meteorological Service (HMS) maintained a Meteorological Station at Kamaria Falls on the Cuyuni River which is downstream of the mining concession at Aurora. Daily rainfall and stream flow data from this station for the period 1971- 1980 was reviewed to develop estimates of weather parameters prior to the commencement of detailed field monitoring. Similar data for evaporation and temperature for this station is not available. The maximum monthly rainfall recorded over the period of record at Kamaria Falls was approximately 492 millimeters (mm). The minimum monthly rainfall recorded over the same period was 10 mm. The maximum and minimum yearly rainfall over the period was 2710 and 1956 mm respectively. The two dry and wet periods inferred from that data are identified in Table 4.

Table 4: Wet and Dry Periods in Project Area

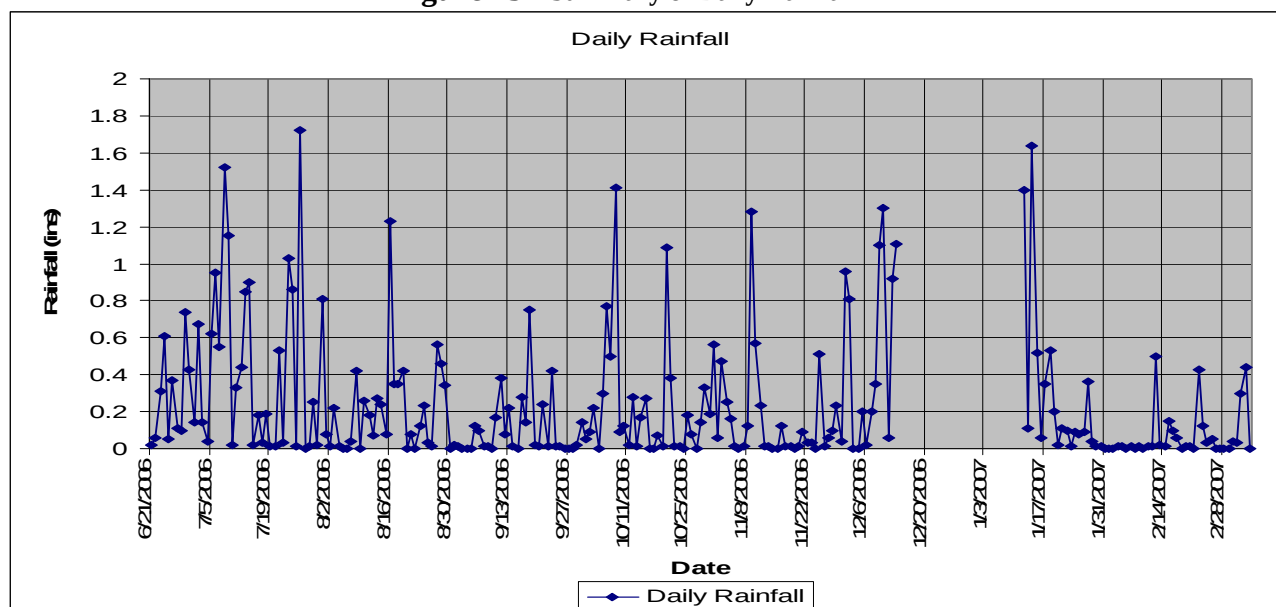
Wet Period	Dry Period
Mid-April to Mid-August	Mid-January to Mid-March
November to Mid-January	Mid-August to November

An automated weather station was installed at the mining concession in June 2006 to develop baseline data. The weather station has provided an automated record of minimum and maximum temperatures, total rainfall, rainfall rate, maximum and average wind speeds and direction, barometric pressure, humidity, solar radiation and several other parameters at one-half hour intervals since that time. Figures 15 through 17 are graphical representations of total daily rainfall, total daily evapotranspiration and daily solar radiation for the period June 2006 to March 2007.

The rainfall record indicates maximum rainfall at the site equates to approximately 1.7 inches in 24 hours, with the greatest rainfall occurring in the periods of Mid-June to Mid-August and Mid-November to Mid-January over the period of record. This correlates with occurrences of the wet seasons. The driest period was observed to occur to coincide with the period End-January to End-February. Daily evapotranspiration rates were relatively common over the period of record at approximately 0.17 in/day. There were, however, some periods of elevated evapotranspiration during the very dry periods of End-January to End-February and August-September.

The wind rose of Figure 18 indicates that wind speeds are primarily out of the east northeast and in general averaged around 5 m/s. Elevated wind speeds in excess of 8 m/s were recorded in some instances. Solar radiation values equated to values typically associated with countries at close to the equator.

Figure 15 - Summary of Daily Rainfall



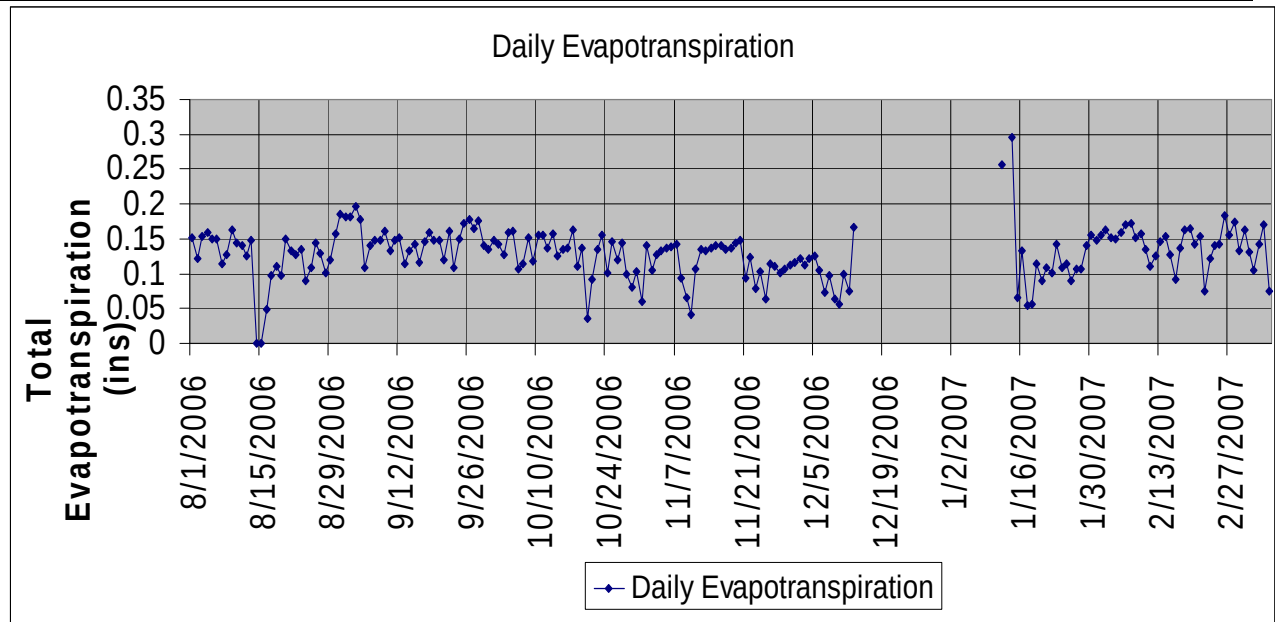


Figure 16 - Summary of Daily Evapotranspiration

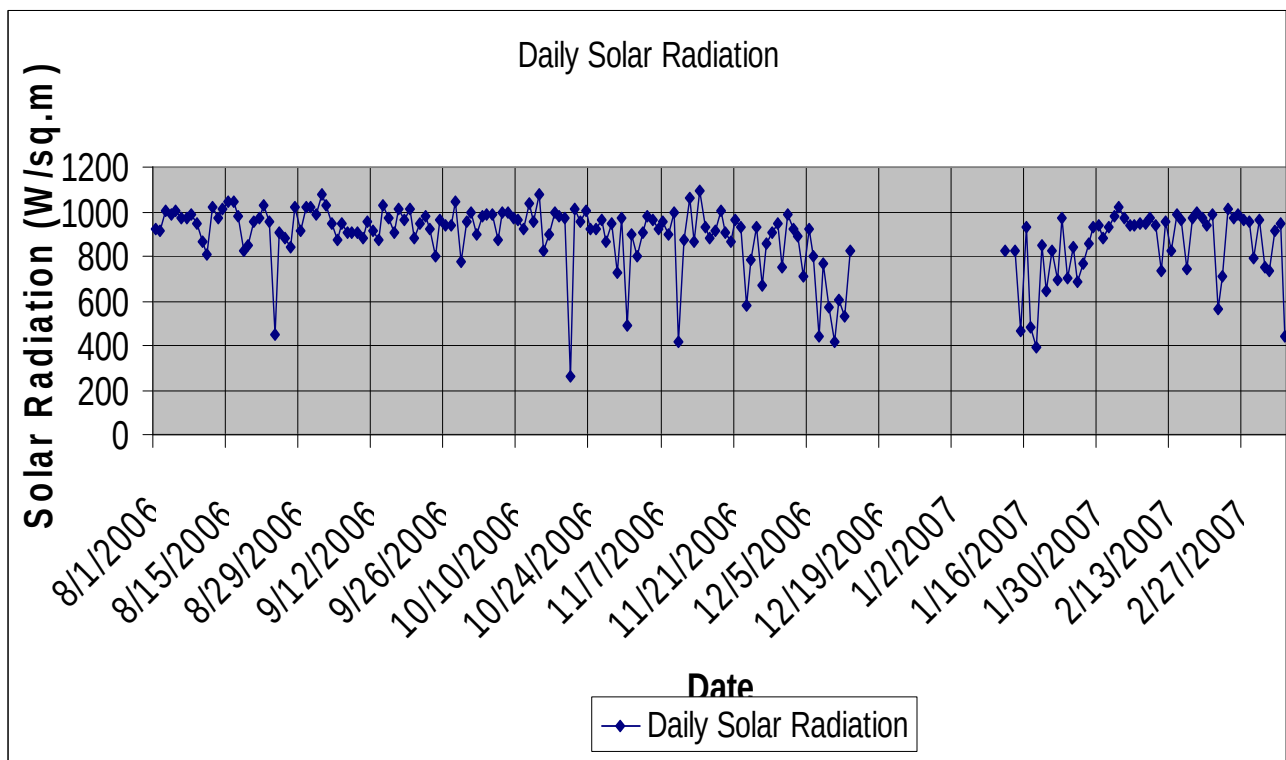


Figure 17 - Summary Of Daily Solar Radiation

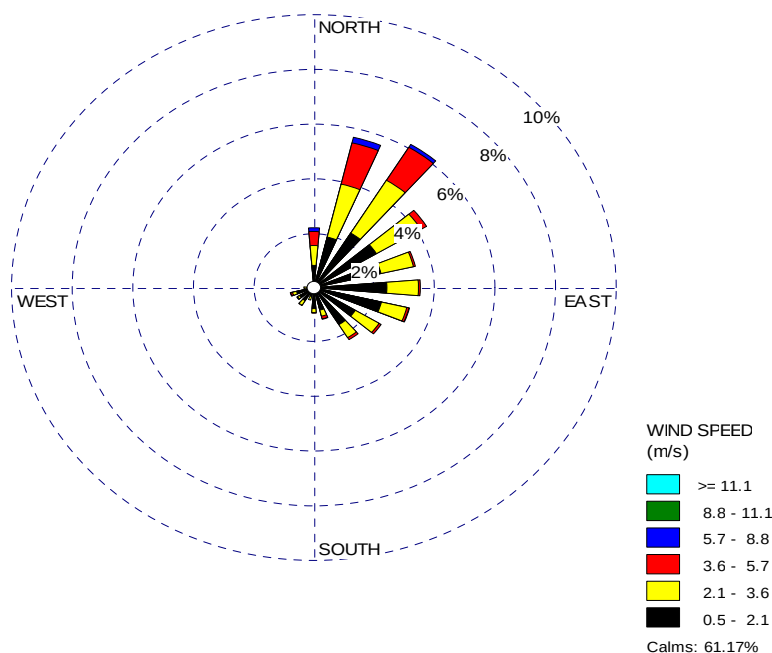


Figure 18 - Wind Rose

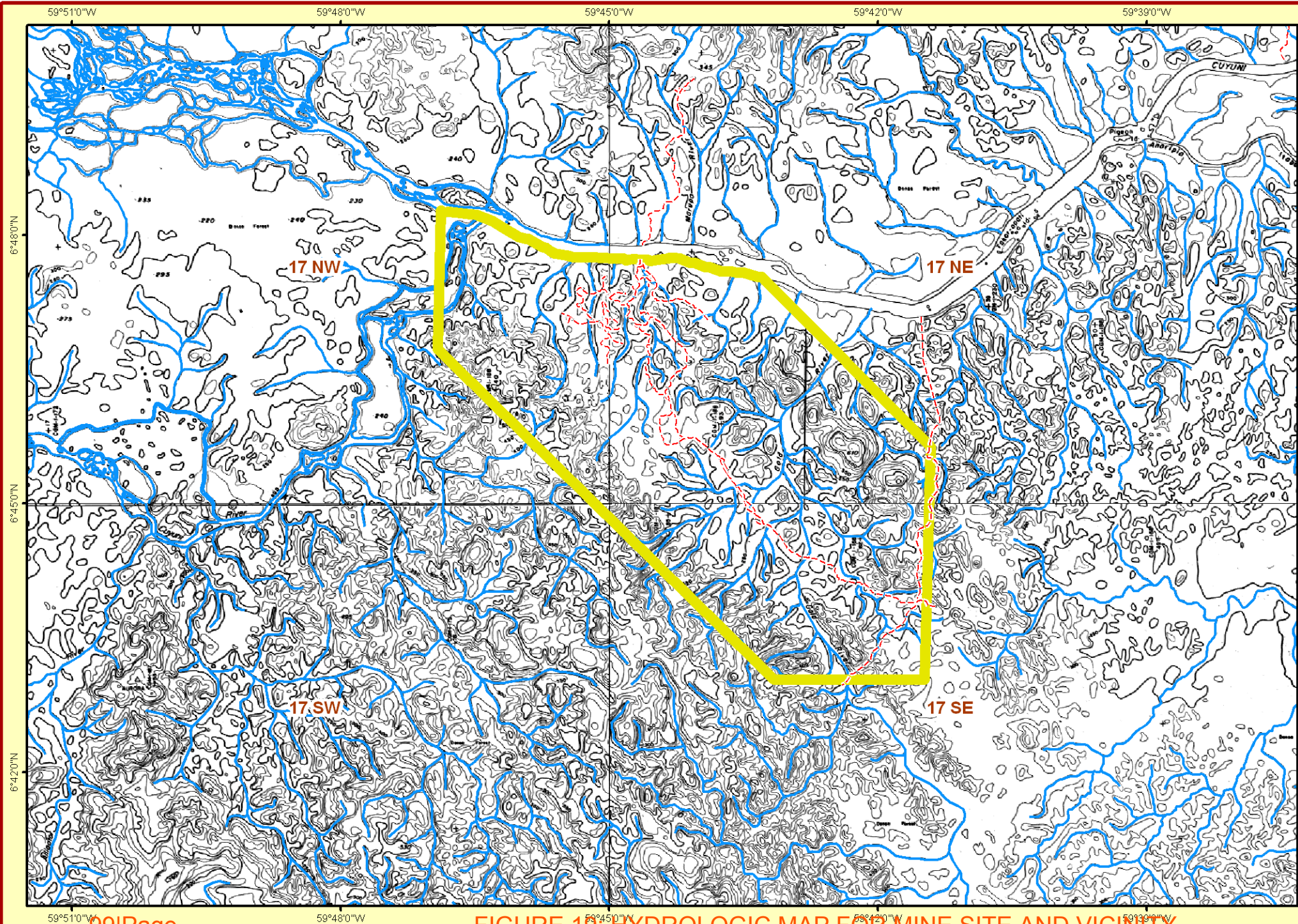
There are no major industries in the area. Aerial emissions in the project area are directly related to the emission of gases by rotting trees and other vegetative matter. Some aerial emissions are also related to the operation of dredges in the vicinity of the mining concession and from exploration equipment. Airborne discharges and particulate matter are not monitored in the area. However, World Bank guidelines for sulfur emissions specify two levels of allowable emissions. If the region is unpolluted the maximum allowable emissions should not exceed 500 tonnes per day (tpd). If the region is polluted the maximum allowable emissions should not exceed 100 tpd. Neither criterion is expected to be exceeded by current aerial emissions.

5.4 Surface Water

The mine site area is drained by several tributaries and by the Cuyuni River. The location of the tributaries and the Cuyuni River and their relationship to the area to be developed is shown on Figure 19. The Cuyuni River, which runs immediately north of the site, serves as the primary conduit for all precipitation from the site. At present the forest canopy intercepts most precipitation in the project area. The soil present at ground surface is a mix of granular and cohesive material. It is highly likely that a large part of precipitation incident on the ground surface infiltrates the ground. Flows in the streams and creeks traversing the site are therefore most probably reflective of groundwater discharge to surface water bodies.

5.4.1 Catchment Area & Flow Volumes

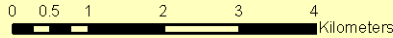
The Cuyuni River originates in Venezuela and has an estimated total drainage area of approximately 53,380 km² of which approximately 14,500 km² lies in Guyana. The Cuyuni watershed in Guyana is relatively narrow and its flow in the vicinity of the Aurora Mine Site is west to east. The Cuyuni River valley itself is broad with a gently undulating terrain. The Cuyuni watershed, in Guyana, is bounded on the north and south by the Northwest Coastal Region and the Mazaruni River Basin respectively. It is



LOGISTICS

HYDROLOGICAL MAP

Ground Structures Engineering Consultants



1:100,000

Note: Road network was compiled from several data sources (GGMC, GFC, GL & SC). This map in no way seeks to indicate road conditions.

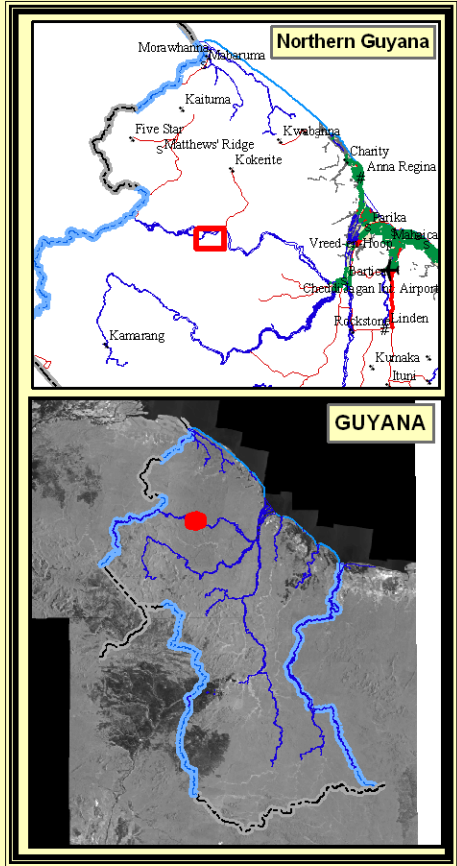


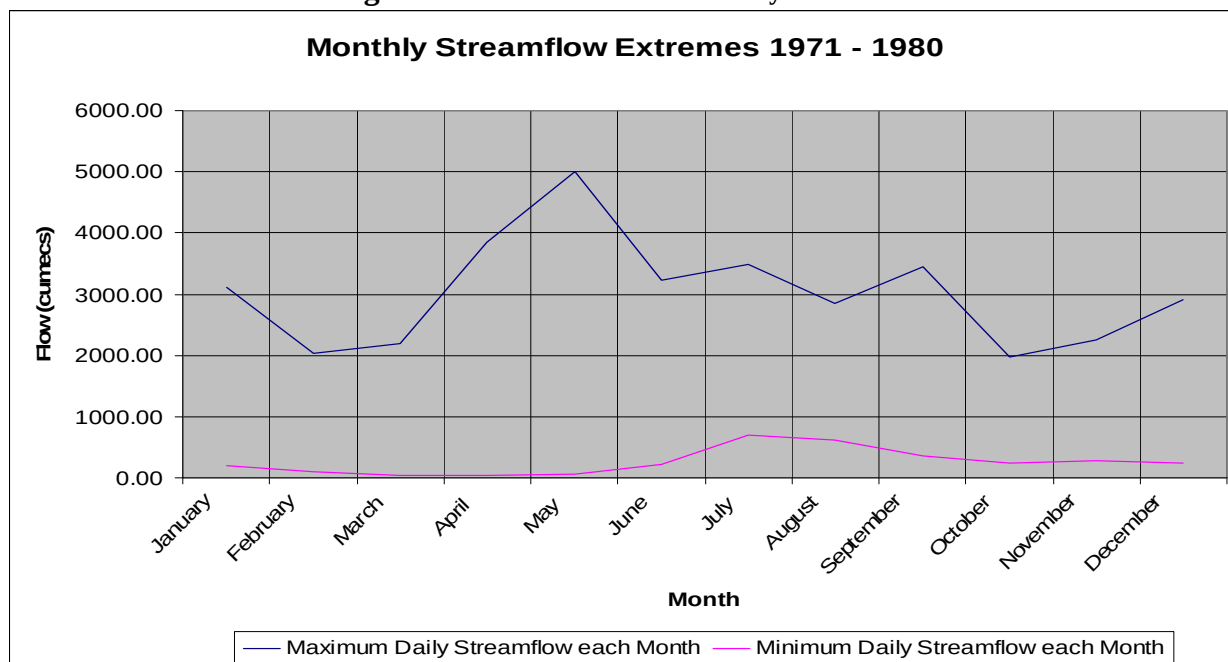
FIGURE 19: HYDROLOGIC MAP FOR MINE SITE AND VICINITY

--- Road Network — River Network Aurora Property Location

bounded on the west by the Venezuelan border. Extremes values for daily streamflow for each month for the period of record are shown on Figure 20.

Anecdotal evidence from individuals in the area indicate that during periods of high flows the Cuyuni River overflows its bank and areas within the mine footprint are flooded during these occurrences. Further, that evidence indicates that during low flow period the possibility of traversing the river decreases significantly. Neither of these scenarios obtained during the baseline characterization work of 2006 or 2009. It was consequently inferred that flows during the studies fell within the bounds of the flows recorded during the period of flow observations.

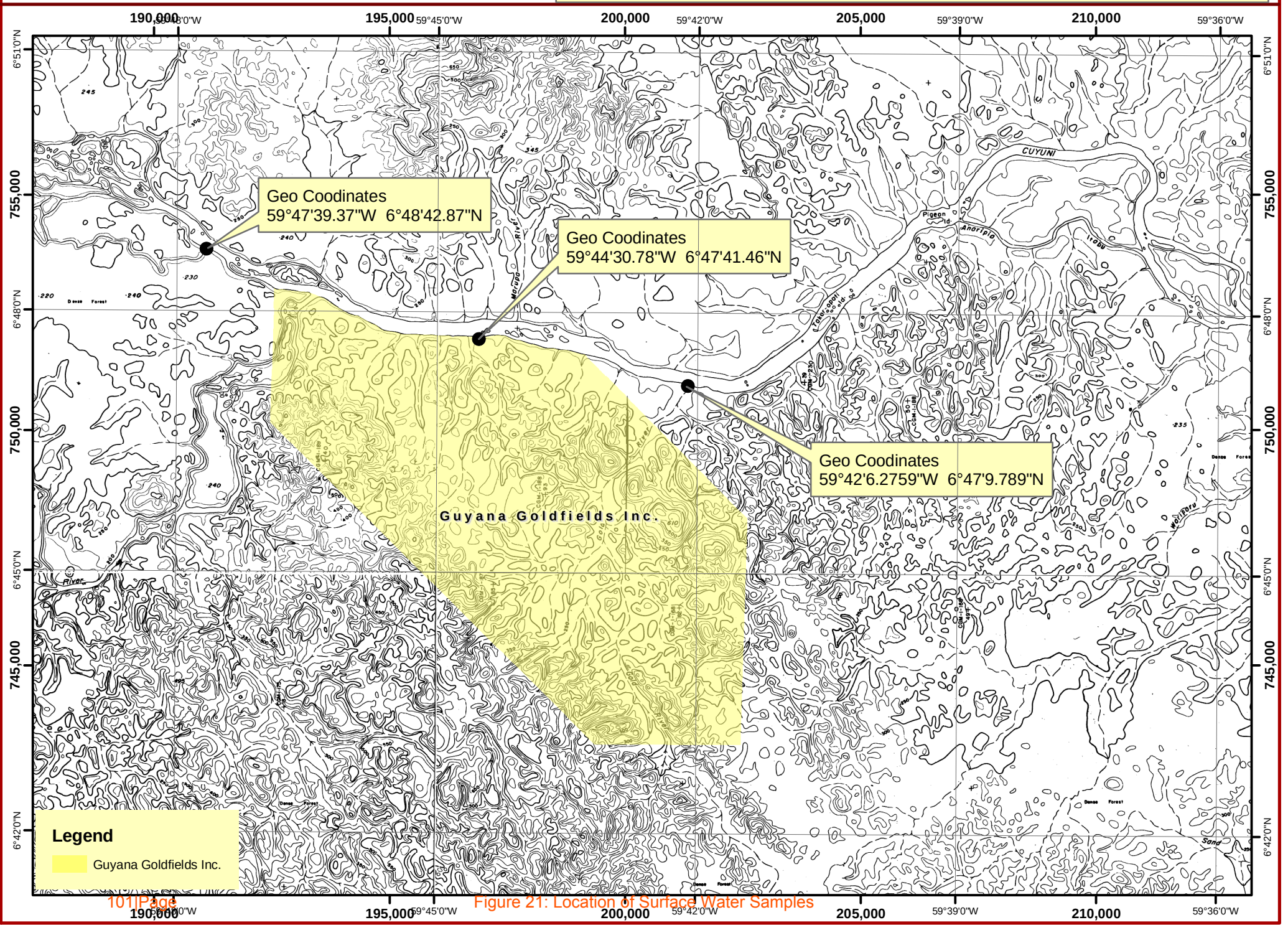
Figure 20 - Extremes values for daily streamflow



A gauging station was maintained on the Cuyuni River at Kamaria Falls over the period 1946 to 1970. Review of historical hydrological and hydrometeorological data for the Cuyuni River based on information from that station indicates that the basin is located in a relatively hot area with mean annual precipitation of approximately 2800 mm. The runoff generated by the watershed ranges from a minimum of 0.0017 cubic metre per sec per square metre ($\text{m}^3/\text{sec}/\text{m}^2$) to a maximum of 0.2692 $\text{m}^3/\text{sec}/\text{m}^2$ with the mean daily runoff flow of 0.0536 $\text{m}^3/\text{sec}/\text{m}^2$. The total drainage area of the Cuyuni up to the mining concession at Aurora is approximately 90 percent of its overall drainage area. Approximate maximum and minimum flows of the Cuyuni at Aurora for the period of record were consequently obtained by taking 90 percent of the maximum and minimum flows recorded for the period of record at Kamaria Falls.

5.4.2 Surface Water Quality

Surface water samples were recovered from exact locations on the Cuyuni River, Gold River and from an unnamed tributary of the Cuyuni River immediately downstream of Devil's Hole, at times coincident with the four seasons in Guyana. The unnamed tributary of the Cuyuni River is upstream of the area identified for development into the mine and Gold River is downstream of the area identified for development. Samples recovered from the Cuyuni River are immediately north of the area identified as the Golden Mile. Water quality at the unnamed tributary is consequently indicative of background water quality for the proposed mine. The location of points at which surface water samples were recovered is shown on Figure 21.



Water quality for both Gold River and Cuyuni River would be impacted by the mine operations and is indicative of water quality prior to the commencement of mining operations. Tables 5 thru 8 present the results of analyses on the surface water samples recovered during each sample period detailed above. The tables indicate the date each sample was recovered. World Bank Standards for effluents from mining operations are also presented in the table for comparison purposes.

The water quality data is for conditions prior to the commencement of construction and/or mining operations at the site. The results of analyses on surface water samples indicate that baseline water quality conforms to World Bank Standards for effluent discharged from mining operation. It is understood that several unregulated mining operations are ongoing at points upstream of the proposed operations. These operations have apparently had no impacts on surface water quality in the mine site area. The water quality was also examined for conformance to the GGMC regulations for discharges from mine tailings ponds to receiving water. The GGMC regulations mandate that the limits of total suspended solids (TSS) should not exceed 100 mg/l and is exceeded in no instance.

Table 5: Results of Analyses of Surface Water Samples

Sample Date: February 10, 2006						
Parameter	Units	Detection limit	Unnamed Creek	Cuyuni River	Gold River	World Bank Standard
Biochemical Oxygen Demand	mg/l	1	< 1	< 1	< 1	50.0
Cyanide (free)	mg/l	0.005	< 0.005	< 0.005	< 0.005	0.1
Cyanide (total)	mg/l	0.005	< 0.005	< 0.005	< 0.005	1.0
Ph			7.23	7.3	7.63	6 to 9
Total Suspended Solids	mg/l	2	21	27	13	50.0
Arsenic	mg/l	0.001	< 0.001	< 0.001	< 0.001	1.0
Cadmium	mg/l	0.0001	< 0.0001	< 0.0001	< 0.0001	0.1
Chromium	mg/l	0.001	< 0.001	0.002	0.001	1.0
Copper	mg/l	0.001	< 0.001	< 0.001	< 0.001	0.3
Hexavalent Chromium	mg/l	0.05	< 0.05	< 0.05	< 0.05	0.05
Iron, Total	mg/l	0.03	1.65	9.11	3.08	2
Lead	mg/l	0.001	< 0.001	< 0.001	< 0.001	0.6
Mercury	mg/l	0.0001	< 0.0001	< 0.0001	< 0.0001	0.002
Nickel	mg/l	0.005	< 0.005	< 0.005	< 0.005	0.5
Zinc	mg/l	0.01	0.01	0.01	< 0.01	1
Oil and Grease - Mineral	mg/l	1	< 1.0	< 1.0	< 1.0	
Oil and Grease - Non-Mineral	mg/l	4	< 4.0	< 4.0	< 4.0	
Oil and Grease Total	mg/l	5	< 5.0	< 5.0	< 5.0	20

Table 6: Results of Analyses of Surface Water Samples

Sample Date: July 06, 2006						
Parameter	Units	Detection limit	Unnamed Creek	Cuyuni River	Gold River	World Bank Standard
Biochemical Oxygen Demand	mg/l	1	< 1	< 1	< 1	50.0
Cyanide (free)	mg/l	0.005	< 0.005	< 0.005	< 0.005	0.1
Cyanide (total)	mg/l	0.005	< 0.005	< 0.005	< 0.005	1.0
pH			7.38	7.48	7.82	6 to 9
Total Suspended Solids	mg/l	2	32	45	18	50.0
Arsenic	mg/l	0.001	< 0.001	< 0.001	< 0.001	1.0
Cadmium	mg/l	0.0001	< 0.0001	< 0.0001	< 0.0001	0.1
Chromium	mg/l	0.001	< 0.001	0.002	0.001	1.0

Copper	mg/l	0.001	< 0.001	< 0.001	< 0.001	0.3
Hexavalent Chromium	mg/l	0.05	< 0.05	< 0.05	< 0.05	0.05
Iron, Total	mg/l	0.03	2.01	8.67	2.91	2
Lead	mg/l	0.001	< 0.001	< 0.001	< 0.001	0.6
Mercury	mg/l	0.0001	< 0.0001	< 0.0001	< 0.0001	0.002
Nickel	mg/l	0.005	< 0.005	< 0.005	< 0.005	0.5
Zinc	mg/l	0.01	<0.01	<0.01	< 0.01	1
Oil and Grease - Mineral	mg/l	1	< 1.0	< 1.0	< 1.0	
Oil and Grease - Non-Mineral	mg/l	4	< 4.0	< 4.0	< 4.0	
Oil and Grease Total	mg/l	5	< 5.0	< 5.0	< 5.0	20

Table 7: Results of Analyses of Surface Water Samples

Sample Date: October 12, 2006						
Parameter	Units	Detection limit	Unnamed Creek	Cuyuni River	Gold River	World Bank Standard
Biochemical Oxygen Demand	mg/L	1	<1	<1	<1	50.0
Cyanide (free)	mg/L	0.005	0.011	0.008	0.009	0.1
Cyanide (total)	mg/L	0.005	NA	NA	NA	1.0
Ph			6.63	6.49	6.42	6 to 9
Total Suspended Solids	mg/L	2	44	17	37	50.0
Arsenic	mg/L	0.001	<0.001	<0.001	<0.001	1.0
Cadmium	mg/L	0.0001	<0.0001	<0.0001	<0.0001	0.1
Chromium	mg/L	0.001	0.002	0.003	0.003	1.0
Copper	mg/L	0.001	0.002	0.002	0.002	0.3
Cr(VI)	mg/L	0.05	<0.05	<0.05	<0.05	0.05
Iron	mg/L	0.03	0.50	0.55	0.68	2
Lead	mg/L	0.001	<0.001	<0.001	<0.001	0.6
Mercury	mg/L	0.0001	<0.0001	<0.0001	<0.0001	0.002
Nickel	mg/L	0.005	<0.005	<0.005	<0.005	0.5
Zinc	mg/L	0.01	<0.01	<0.01	<0.01	1
Oil & Grease - Mineral	mg/L	1	<1	<1	<1	
Oil & Grease - Non-mineral	mg/L	4	<4	<4	<4	
Oil & Grease - Total	mg/L	5	<5	<5	<5	20

Table 8: Results of Analyses of Surface Water Samples

Sample Date: March 4, 2007						
Parameter	Units	Detection limit	Unnamed Creek	Cuyuni River	Gold River	World Bank Standard
Biochemical Oxygen Demand	mg/L	1	<1	<1	<1	50.0
Cyanide (free)	mg/L	0.005	<0.25	<0.25	<0.25	0.1
Cyanide (total)	mg/L	0.005	<0.25	<0.25	<0.25	1.0
Ph			7.27	7.41	7.25	6 to 9
Total Suspended Solids	mg/L	2	37	24	18	50.0
Arsenic	mg/L	0.001	<0.001	<0.001	<0.001	1.0
Cadmium	mg/L	0.0001	<0.0001	<0.0001	<0.0001	0.1
Chromium	mg/L	0.001	0.001	0.003	0.001	1.0
Copper	mg/L	0.001	0.003	0.003	0.001	0.3
Cr(VI)	mg/L	0.05	<0.05	<0.05	<0.05	0.05
Iron	mg/L	0.03	1.00	2.14	2.57	2
Lead	mg/L	0.001	<0.001	<0.001	<0.001	0.6
Mercury	mg/L	0.0001	<0.0001	<0.0001	<0.0001	0.002
Nickel	mg/L	0.005	<0.005	<0.005	<0.005	0.5
Zinc	mg/L	0.01	<0.01	<0.01	<0.01	1
Oil & Grease - Mineral	mg/L	1	<1	<1	<1	
Oil & Grease - Non-mineral	mg/L	4	<4	<4	<4	
Oil & Grease - Total	mg/L	5	<5	<5	<5	20

5.5 Groundwater Resources

Practically no data is available on groundwater levels and other groundwater flow parameters in the mining concession. A single well was located to coincide with each corner of the area identified as the Golden Mile and one well was located to coincide with the approximate center of that area. Each monitoring well was installed to a depth of approximately 6 m. The depth of each well was limited by the availability of drill rods to progress to greater depths. The locations of the wells are shown on Figure 22 and are as follows:

MW - 1	59°44.5'W, 6° 47.7'N
MW - 2	59° 45.43'W, 6° 46.8'N.
MW - 3	59°44.5'W, 6°46.8'N
MW - 4	59° 45.43'W, 6° 47.7'N
MW - 5	59°44.95'W, 6° 47.25'N

Groundwater samples were recovered, at four times coincident with seasonal trends in Guyana, from all wells in accordance with the USEPA RCRA Groundwater Monitoring Technical Enforcement Guidance Document. During the initial sampling period, no groundwater sample was recovered from MW-3 and MW-4 since those wells were dry to the drilled depth of 6 m. Results of analyses on the groundwater samples are presented in Table 9 through 12.

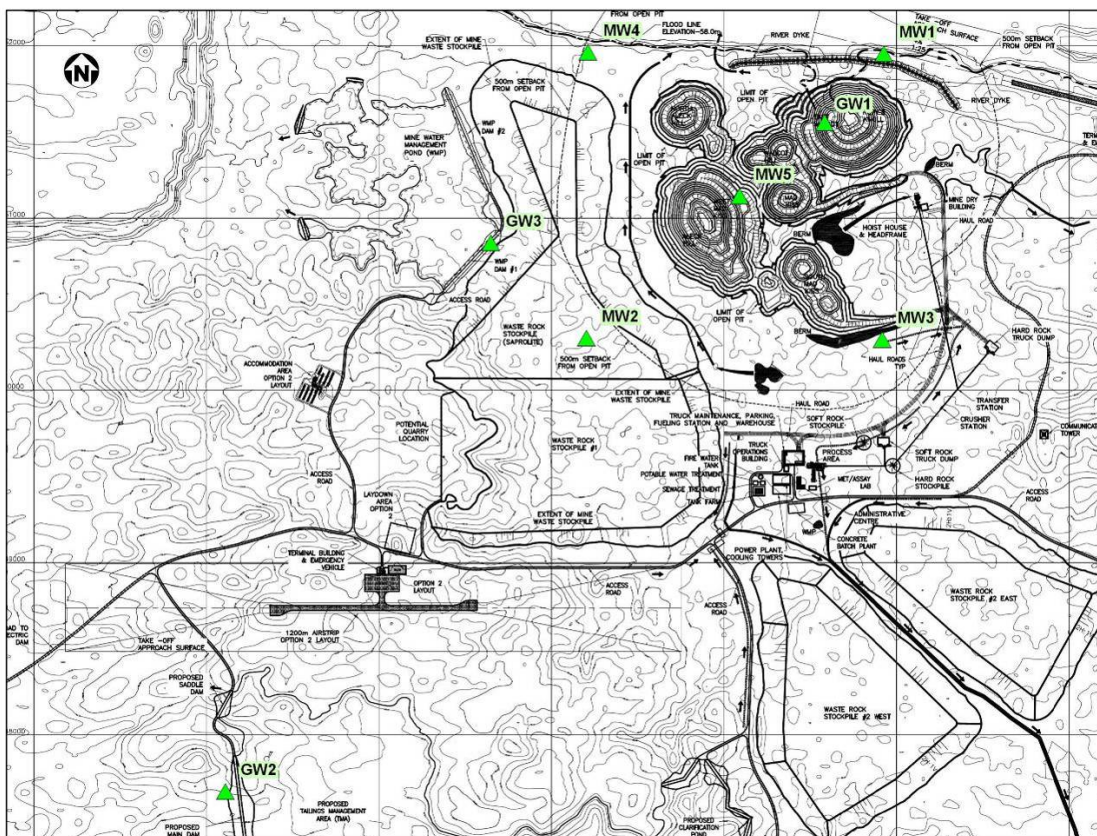


Figure 22 - Location of Ground Water Samples

Table 9: Results of Analyses on Ground Water Samples

Sample Date: February 10, 2006						
Parameter	Units	Detection limit	MW-1	MW-2	MW-5	World Bank Standard
Biochemical Oxygen Demand	mg/l	1	< 1	10	N/A	50.0
Cyanide (free)	mg/l	0.005	< 0.025	< 0.025	< 0.25	0.1
Cyanide (total)	mg/l	0.005	< 0.025	< 0.025	< 0.025	1.0
pH			6.22	5.48	7.01	6 to 9
Total Suspended Solids	mg/l	2	41600	73700	19200	50.0
Arsenic	mg/l	0.001	< 0.01	< 0.01	< 0.01	1.0
Cadmium	mg/l	0.0001	0.005	0.008	< 0.001	0.1
Chromium	mg/l	0.001	0.025	0.048	0.012	1.0
Copper	mg/l	0.001	0.27	0.21	0.07	0.3
Hexavalent Chromium	mg/l	0.05	< 0.05	< 0.05	< 0.05	0.05
Iron, Total	mg/l	0.03	19.9	245	6.7	2
Lead	mg/l	0.001	0.07	0.06	0.02	0.6
Mercury	mg/l	0.0001	< 0.0001	< 0.0001	< 0.0001	0.002
Nickel	mg/l	0.005	0.14	0.26	< 0.05	0.5
Zinc	mg/l	0.01	2.98	3.93	0.3	1
Oil and Grease - Mineral	mg/l	1	< 1.0	< 1.0	6	
Oil and Grease - Non-Mineral	mg/l	4	< 4.0	< 4.0	4	
Oil and Grease Total	mg/l	5	< 5.0	< 5.0	10	20

Table 10: Results of Analyses on Ground Water Samples

Sample Date: July 06, 2006								
Parameter	Units	Detection limit	MW-1	MW-2	MW-3	MW-4	MW-5	World Bank Standard
Biochemical Oxygen Demand	mg/l	1	< 1	10	<1	1	46	50.0
Cyanide (free)	mg/l	0.005	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025	0.1
Cyanide (total)	mg/l	0.005	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025	1.0
Ph	mg/l		6.75	5.76	4.64	5.48	6.41	6 to 9
Total Suspended Solids	mg/l	2	6432	7870	6930	15100	6110	50.0
Arsenic	mg/l	0.001	< 0.001	< 0.001	<0.001	<0.001	<0.001	1.0
Cadmium	mg/l	0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	0.1
Chromium	mg/l	0.001	0.012	0.004	0.005	0.006	0.002	1.0
Copper	mg/l	0.001	0.29	0.27	0.007	0.004	<0.001	0.3
Hexavalent Chromium	mg/l	0.05	< 0.05	< 0.05	<0.05	<0.05	<0.05	0.05
Iron, Total	mg/l	0.03	21.8	262	0.73	0.86	1.45	2
Lead	mg/l	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.6
Mercury	mg/l	0.0001	< 0.0001	< 0.0001	<0.0001	<0.0001	<0.0001	0.002
Nickel	mg/l	0.005	0.18	0.32	0.005	<0.005	<0.005	0.5
Zinc	mg/l	0.01	3.03	3.28	0.02	0.01	<0.01	1
Oil and Grease - Mineral	mg/l	1	< 1.0	< 1.0	<1	<1	3	
Oil and Grease - Non-Mineral	mg/l	4	< 4.0	< 4.0	<4	<4	<4	
Oil and Grease Total	mg/l	5	< 5.0	< 5.0	<5	<5	<5	20

Table 11: Results of Analyses on Ground Water Samples

Sample Date: October 12, 2006								
Parameter	Units	Detection limit	MW-1	MW-2	MW-3	MW-4	MW-5	World Bank Standard
Biochemical Oxygen Demand	mg/l	1	<1	<1	<1	<1	5	50.0
Cyanide (free)	mg/l	0.005	0.015	0.007	0.19	0.385	0.014	0.1
Cyanide (total)	mg/l	0.005	NA	NA	NA	NA	NA	1.0
Ph	mg/l		5.85	6.23	5.56	5.35	6.43	6 to 9
Total Suspended Solids	mg/l	2	633	10	8320	27500	2700	50.0
Arsenic	mg/l	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	1.0
Cadmium	mg/l	0.0001	<0.0001	<0.0001	0.0002	<0.0001	<0.0001	0.1
Chromium	mg/l	0.001	0.002	0.002	0.008	0.008	0.001	1.0
Copper	mg/l	0.001	0.001	0.002	0.008	0.007	0.002	0.3
Cr(VI)	mg/l	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05
Iron	mg/l	0.03	0.27	0.54	1.36	0.79	1.49	2
Lead	mg/l	0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.6
Mercury	mg/l	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.002
Nickel	mg/l	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.5
Zinc	mg/l	0.01	0.01	<0.01	0.03	0.02	<0.01	1

Oil & Grease - Mineral	mg/l	1	3	Sample Bottle Broke	<1	<1	<1	
Oil & Grease - Non-mineral	mg/l	4	4		<4	<4	4	
Oil & Grease - Total	mg/l	5	7		<5	<5	<5	20

Table 12: Results of Analyses on Ground Water Samples

Sample Date: March 4, 2007								
Parameter	Units	Detection limit	MW-1	MW-2	MW-3	MW-4	MW-5	World Bank Standard
Biochemical Oxygen Demand	mg/l	1	2	<1	<1	<1	7	50.0
Cyanide (free)	mg/l	0.005	<0.25	<0.25	<0.5	<0.5	<0.25	0.1
Cyanide (total)	mg/l	0.005	<0.25	<0.25	<0.5	<0.5	<0.25	1.0
Ph	mg/l		7.31	7.06	6.15	6.58	6.87	6 to 9
Total Suspended Solids	mg/l	2	19	1690	8330	8670	16300	50.0
Arsenic	mg/l	0.001	<0.001	<0.001	0.001	<0.001	<0.001	1.0
Cadmium	mg/l	0.0001	0.0004	0.0002	<0.0001	<0.0001	<0.0001	0.1
Chromium	mg/l	0.001	0.003	0.004	0.007	0.003	0.002	1.0
Copper	mg/l	0.001	0.005	0.006	0.011	0.005	0.003	0.3
Cr(VI)	mg/l	0.05	<0.05	<0.05	<0.05	<0.05	0.06	0.05
Iron	mg/l	0.03	0.34	3.40	0.88	1.52	0.26	2
Lead	mg/l	0.001	<0.001	0.001	<0.001	<0.001	<0.001	0.6
Mercury	mg/l	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.002
Nickel	mg/l	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.5
Zinc	mg/l	0.01	0.02	0.02	<0.01	<0.01	<0.01	1
Oil & Grease - Mineral	mg/l	1	<1	<1	<1	Sample Bottle Broke	<1	
Oil & Grease - Non-mineral	mg/l	4	<4	<4	<4		4	
Oil & Grease - Total	mg/l	5	<5	<5	<5		<5	20

Groundwater depths were recorded at each well during each sampling event. The depths to groundwater at each well are detailed in Table 13 below. The depth to groundwater generally confirms the trend of the wet and dry seasons for the mine site area in that groundwater depths are greater in the dry seasons.

Table 13: Depth to Groundwater (m)

Well No.	Sample Period			
	Jan - Feb 2006	July 2006.	October 2006.	Feb - Mar 2007
MW-1	2.44	2.18	2.90	3.25
MW-2	2.15	1.09	3.10	3.52
MW-3	Dry	1.96	2.95	3.38
MW-4	Dry	2.03	3.15	3.76
MW-5	2.44	1.07	2.62	3.08

Rising head insitu hydraulic conductivity tests were also conducted in each well after completion of the sampling exercise. Values of hydraulic conductivity computed from groundwater response data at the location of each well are detailed in Table 14.

Table 14: Summary of Hydraulic Conductivities (cm/sec)

Location	Sample Period			
	Jan - Feb 2006	July 2006.	October 2006.	Feb - Mar 2007
MW-1	7.9x10 ⁻⁶	1.34x10 ⁻⁶	5.3x10 ⁻⁶	3.8x10 ⁻⁶
MW-2	8.36x10 ⁻⁵	4.70x10 ⁻⁷	1.44x10 ⁻⁵	8.76x10 ⁻⁶
MW-3	1.35x10 ⁻⁵ (Falling Head)	9.28x10 ⁻⁷	6.8x10 ⁻⁶	3.8x10 ⁻⁶
MW-4	2.18x10 ⁻⁵ (Falling Head)	3.49x10 ⁻⁷	6.3x10 ⁻⁶	4.8x10 ⁻⁶
MW-5	9.7x10 ⁻⁶	2.71x10 ⁻⁶	1.5x10 ⁻⁵	9.7x10 ⁻⁶

The variations in hydraulic conductivity values are reflective of the variation in the depth to groundwater at each location tested. In general hydraulic conductivity values are within an order of magnitude estimate of each other.

5.6 Biological Resources

The concession occupies a total area of approximately 14,000 acres on the south bank of the Cuyuni River. The area was worked in the 1940s and again in the 1980s as documented by Hollowell et al (2003). In Guyana, the biodiversity of plants can be grouped as:

Bryophyta	186 species
Lycopodiophyta	28 species
Filicophyta	100 species
Gymnospermae	6 species
Dicotyledonae	4238 species
Monocotyledonae	1109 species

resulting in a total of 5,667 species or 89.9% of all groups of plants recorded to date in Guyana or 2.3 % of the world's current total.

Biogeographically, Guyana may be divided into three major provinces (Guyana/UNEP, 1992). These are the coastal biogeographical province, the savannah biogeographical province and the forest biogeographical province. The forest biogeographical province is comprised of tropical rainforest of the Amazon type. Biotic communities are divided into the following:

- Tropical moist forest** - major forest type in Guyana. It covers half of the country and occurs at elevations below 300m. This forest has two associations; one that occurs in the low-land areas and one that is found in the Pakaraima region. Some of the main tree species in the Tropical Moist Forest include greenheart, purpleheart, morabukea and kakaralli. Below the canopy level are various palms, manicole and awarra. Herbs and ferns dominate the forest floor.
- White sand forests** - considered as climax vegetation. The main plant species include wallaba, ituru, dakama and muri. In some areas, evergreen seasonal forests are found.
- Brown sand forest** - occurs on the borders of the white sand forests. The main forest species is greenheart but other species found are morabukea, lianas and epiphytes.
- Montane forest** - two types exist; those that flourish on the lower mountain slopes of the Pakaraima, Kanuku and Akarai mountains at elevations below 365m and those that occur between 610 and 1535m. Few commercial trees are found in this ecosystem. On the higher slopes are mosses, epiphytes, ferns and dwarf palm trees. Above 1525m are Elfin Forests which are recognized by gnarled and stunted trees.

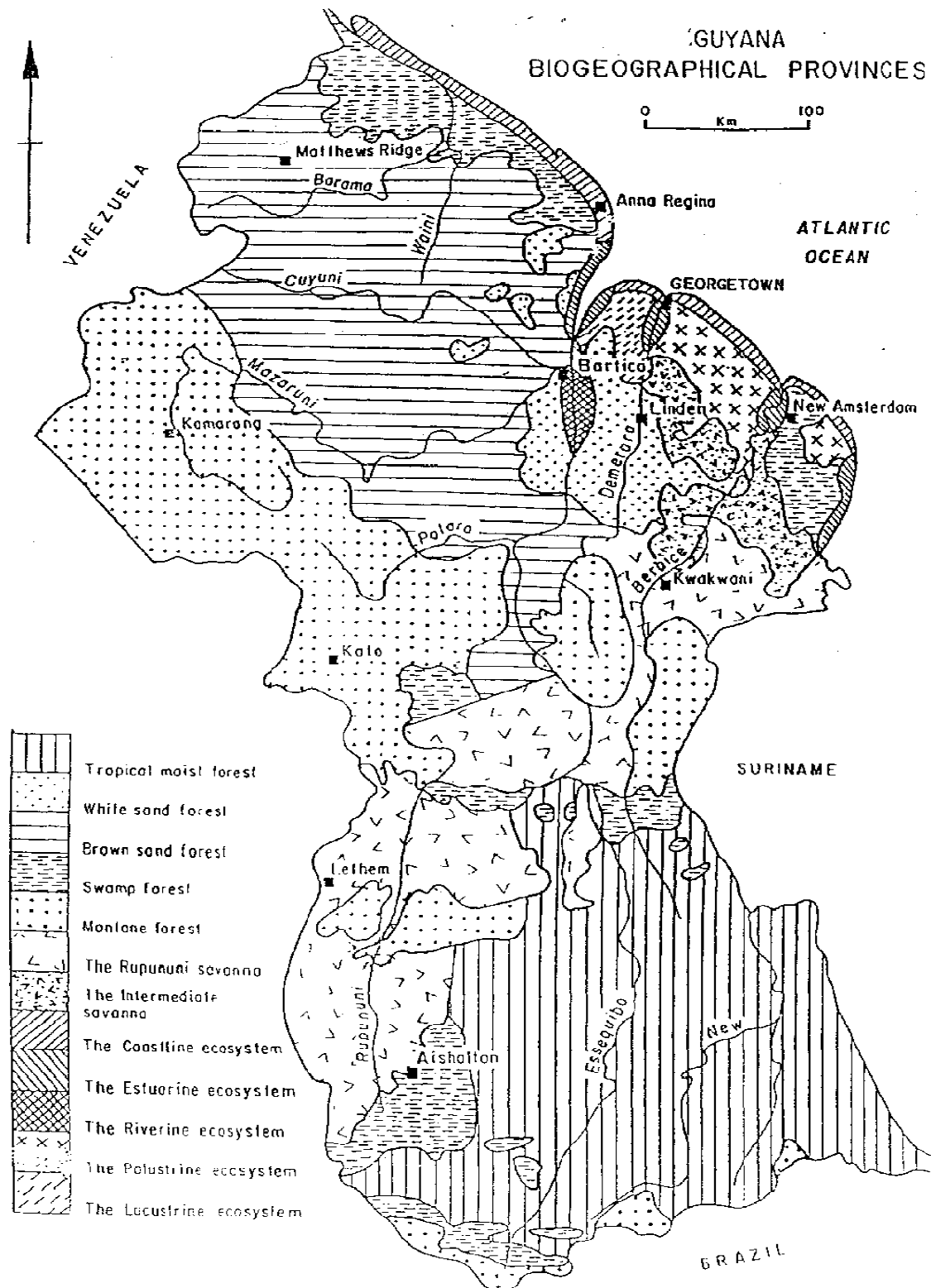


Figure 23 - Biogeographic Provinces of Guyana

- e. **Swamp forests** - are found in the poorly drained coastal areas in the northwest of the country. Mora and corkwood are the dominant species found in association with various palms. Marshes are mixed with crabwood, white cedar and kakaralli.

The Aurora/Cuyuni Area is comprised of the brown sand forest and swamp forests with Mora excelsa being the dominant species. The mora forests are located on alluvial silt, clay or loam along rivers and on riverine flats throughout the lowland region.

Generally, the area is considered as mixed lowland forests with Morabukea forest found on laterite areas, less frequently it is encountered on sandy loam or on brown sand. It occurs on undulating terrain with slopes in the near interior, east of the Cuyuni River. The dominant species is Mora gonggrijpii.

The information, now detailed, was acquired by field surveys conducted from 28 April to 5 May 2009. This information supplements data acquired over a one year period (Jan 2006 to March 2007), which is presented as Appendix A. The data acquired by this phase of the field work does not differ significantly from that previously acquired.

The areas sampled during the current program together with their corresponding coordinates are as detailed below:

SITES	GPS Coordinates
Terrestrial	
Golden Mile	59o 44.5' W 6o 47.7' N, 59o 45.43' W 6o 47.7' N, 59o 44.5' W 6o 46.8' N, 59o 45.43' W, 6o 46.8' N.
Potential Hydropower site	N6o 45'26.8" W59o 47'58.3"; N6o 45'26.5" W59o 47'59.2"; N6o 45'21.7" W59o 47'57.7"; N6o 45'20.8" W59o 47'59.1"; N6o 45'22.1" W59o 47'58.9"; N6o 45'31.5" W59o 48'05.7"; N6o 45'31.6" W59o 48'05.8"; N6o 45'34.1" W59o 48'13.7"; N6o 45'33.0" W59o 48'13.0"
Potential Mine Water Management Area	N6o 47'22.0" W59o 45'28.2"; N6o 47'21.9" W59o 45'25.8"; N6o 47'24.4" W59o 45'26.4"; N6o 47'26.2" W59o 45'26.3"
Potential Tailing Ponds	N6o 45'57.3 W59o 43'05.0; N6o 45'59.3 W59o 43'05.5"
Euterpe Palm Forest	Unknown
Gold Creek	N6o 46'53.9" W59o 41'49.3"; N o 46'47.5" W59o 41'53.7"
Aquatic	
Cuyuni River Mainstream	N06 48'04.5" W059 46'54.9"; N06 48'04.2" W059 46'58.3"; N06 48'03.5" W059 46'47.8"; N06 4804.1 W059 4641.6; N06 4808.0 W059 4626.8; N06 4754.2 W059 4616.3-creek; N06 4748.5 W059 4545.1-creek; N06 4746.2 W059 4559.8-creek; N06 4746.8 W059 4542.1-creek; N06 4743.6 W059 4421.4-creek; N06 4733.7 W059 4322.0
Julian Ross Itabu including the potential Hydropower site, Rapids and Inter-rapids	N06 4514.1 W059 4813.2-creek; N06 4514.2 W059 4805.7-creek; N06 4528.6 W059 4803.7-rapid-hydrosite; N06 4531.6 W059 4759.7-rapid; N06 4558.0 w059 4723.0-rapid; N06 4602.4 W059 4724.4-interrapid; N06 4604.8 W059 4724.3-interrapid; N06 4610.0 W059 4725.3-creek; N06 4617.8 W059 4727.6-rapid; N06 4538.2 W059 4727.5-rapid; N06 4610.3 W0594721.5-creek; N06 4545.1 W0594720.1-creek; N06 4543.8 W059 4720.5-rapid; N06 4634.1 W059 4737.4; N06 4637.8 W059 4737.9; N064639.7 W059 4737.9; N06 4641.4 W0594737.7; N06 4643.9 W0594733.1-big rapid; N06 4722.4

	W059 4526.8; N06 4723.2 W059 4524.3; N06 4725.6 W059 4524.8; N06 4727.4 W059 4524.7; N06 4729.9 W059 4522.3; N06 4732.4 W059 4524.0
Gold Creek	N06 4651.8 W059 4148.6
Smaller creeks within Mine Water Management Area, Tailing Ponds and Euterpe Palm Forest	N06 4754.1 W059 4616.3-creek; N06 4804.1 W059 4641.6-creek

5.6.1 Terrestrial Resources

5.6.1.1 Vegetation

The Guyana Forestry Commission (GFC), classifies the area as mixed forests ranging from undulating to hilly, flat to undulating and deeply dissected. Florally, the area consists of mature and disturbed, non-flooded rainforest and seasonally flooded riparian forest (including Brownea). Along the banks of the Cuyuni River and its maze of islands and channels and tributaries, the forest is still consistently riparian with *Mora*, *Inga* and *Triplaris* species.

Previous studies conducted by Gillespie (1989) and Hollowell et al, 2003, (Appendix B) documented 258 species of plants occurring at Aurora and adjacent areas along the Cuyuni River. The methodologies used for floral survey included 250m transects, with 50m x 50m subplots at every 100m, creating a herring bone formation. Within the 50m x 50m main plots, sub plot measuring 10m x 10m square were also established. In the main plots (50m x 50m), all trees measuring 20 cm DBH and above were recorded. In the sub plots all trees and saplings measuring 19.9 cm DBH and less were recorded. Additionally, the area was stratified into two elevation intervals, where necessary. These are respectively 0 – 300 GD and 300 – 600 GD (Georgetown Datum).

Species identified within this area are common to fairly common to this area and within the brown sand/swamp forest biogeographic province of Guyana. Eighty one species of plants were identified during the 2009 survey (Table 15). Overall a total of 232 species have been documented by a combination of this survey of the potential Hydropower site, Mine Water Management site and Tailings pond and the previous surveys referenced above for Aurora. (Appendix C).

Table 15: 2009 Floral Assessment of Aurora, Guyana

English Name	Scientific Name	Site Location
Aeriods	<i>Monstera adansonii</i>	Goldcreek, Hydro site, Mine Water Mngt site
Aeroids	<i>Philodendron fragrantissimum</i>	Goldcreek
Antwood	<i>Cordia nodosa</i>	Goldcreek
Aromata	<i>Clathrotropis macrocarpa</i>	Golden Mile, Hydro site, Mine Water Mngt site
Aromata	<i>Clathrotropis brachypetala</i>	Hydro site
Asepoko	<i>Pouteria guianensis</i>	Hydro site
Baramalli	<i>Casostoma commune</i>	Hydrosite, Tailings pond
Batrics palms	<i>Bactris oligoclada</i>	Goldcreek, Hydro site, Tailings pond
Black kakaralli	<i>Eschweilera subglandulosa</i>	Hydrosite, Tailings pond
Black yari ari	<i>Guatteria foliosa</i>	Hydro site, Mine Water Mngt Site
Buroda	<i>Parinari campestris</i>	Tailings pond
Bromeliads		Goldcreek
Bromeliads	<i>Aechmea nudicaulis</i>	Mine Water Mngt site ,Tailings pond
Clusia	<i>Clusia amazonica</i>	Gold Creek, Mine Water Mngt site
Conga Pong/Cecropia	<i>Cecropia peltata</i>	Golden Mile, Hydro site
Conga Pong/Cecropia	<i>Cecropia scrdophylla</i>	Golden Mile, Mine Water Mngt Site

Conga Pong/Cecropia	<i>Cecropia surinamensis</i>	Golden Mile
Corkwood	<i>Pterocarpus officinalis</i>	Hydro site
Corkwood	<i>Pterocarpus santalinoides</i>	Hydro site
Crabwood	<i>Carapa guianensis</i>	Hydro site
Cupa		Hydro site
Cupa(liana)		Aurora Water management site,
Dali		Gold creek
Duka	<i>Tapiraira marchandii</i>	Hydro site
Duka	<i>Tapiraira obtuse</i>	Gold creek
Duru	<i>Annona symphyocarpa</i>	Hydro site
Ferns		Gold creek, Aurora, Hydrosite, water management site, Tailings pond
Fine leaf counta		Hydrosite
Fine leaf kakaralli	<i>Eschweilera wachenheimii</i>	Goldcreek, hydrosite, water management site, tailings ponds
Futi	<i>Jacaranda copaia</i>	Golden Mile
Grasses		Hydro site
Habudiballi	<i>Anacardium giganteum</i>	Golden Mile
Haiawa	<i>Protium guianense</i>	Hydro site
Heliconia		Hydro site
Hold me Back	<i>Desmoncus polyacanthos</i>	Hydro site, Golden Mile
Kamwari	<i>Desmoncus orthoacanthos</i>	Mine Water Mngt site
Kauta	<i>Licania laxiflora</i>	Hydro site, Mine Water Mngt Area, Tailings pond
Kauta	<i>Licania persaudii</i>	Hydro site, Mine Water Mngt Area, Tailings pond
Kautaballi	<i>Licania laxiflora</i>	Goldcreek, hydrosite, water management site, tailings ponds
Kautaballi	<i>Licania alba</i>	hydrosite, Water management site, tailings ponds
Kiruballi	<i>Licania heteromorpha</i>	Aurora, hydrosite, waer management site
Kurokai	<i>Protium decandrum</i>	Hydro site
Lianas		Hydro site, Mine Water Mngt Area, Tailing Ponds
Maho	<i>Sterculia guianensis</i>	Aurora, hydrosite, Tailings ponds
Manicole Palm	<i>Euterpe oleracea</i>	Euterpe Palm Forest
Melastome		Hydro site, Mine Water Mngt Site, Tailing pond
Monkey ladder	<i>Bauhinia guianensis</i>	Hydro site
Monkey pot		Golden Mile
Mora	<i>Mora excels</i>	Gold creek, Golden Mile, Hydro site, Mine Water Mngt site
Mukru	<i>Ischnosiphon arouma</i>	Hydro site
Myrantaceae		Hydro site
Nibi	<i>Heteropsis jenmanii</i>	Hydro site, Mine Water Mngt sire, Tailings pond
Orchids		Gold creek, Golden Mile, Mine Water Mngt Site, Hydro site, Tailings pond
Parakusan	<i>Swartzia schomburgkii</i>	Hydro site, Mine Water Mngt site
Purple Heart	<i>Peltogyne densiflora</i>	Hydro site
Rose of the mountain	<i>Brownea latifolia</i>	Golden Mile, Hydro site
Rubiaceae(red flowers)		Gold creek, Hydro site, Tailings pond
Sedges		Hydro site
Simaroupa	<i>Jacaranda copaia</i>	Hydro site
Simarupa	<i>Quassia simarouba</i>	Hydro site
Smooth leaf kakaralli	<i>Eschweilera coriacea</i>	Hydro site
Spiny palm		Gold creek
Squashi bitters		Gold creek
Trysel	<i>Pentaclethra macroloba</i>	Gold creek, Golden Mile, Hydro site, Mine Water Mngt Area
Turu palm	<i>Jessenia bataua</i>	Hydro site, Mine Water Mngt site
Wallaba	<i>Eperua falcatae</i>	Hydro site, Tailings ponds
Wamara	<i>Swartzia leiocalycina</i>	Hydro site
Warakosa	<i>Inga capitata</i>	Golden Mile, Tailings pond
Warakosa	<i>Inga melinonis</i>	Golden Mile, Hydro site
Warakosa	<i>Inga pezizifera</i>	Golden Mile, Hydro site
Whitey	<i>Inga sp.</i>	Hydro site
Wild mango		Tailings pond
Wild ginger	<i>Ginger sp.</i>	Goldcreek
Yari-yari	<i>Duguetia neglecta</i>	Goldcreek, Aurora, hydrosite, water management site
Yari-yari	<i>Duguetia calycina</i>	Hydro site
Yari-yari	<i>Duguetia guianensis</i>	Hydro site
	<i>Piper hispidum</i>	Hydro site
	<i>Psychotria cupularis</i>	Hydro site
	<i>Psychotria lupulina</i>	Hydro site

	<i>Sipanea sp.</i>	Hydro site

Species identified within this area are common to fairly common to this area and within the brown sand/swamp forest biogeographic province of Guyana.

Species of Commercial interest are detailed in Table 16. These species are relatively common in the project area. There are no local communities within the project vicinity. The species within the concessions are consequently not harvested and it is highly unlikely that these species will be harvested in the future by the far-flung communities.

Table 16: Species of Commercial Interest

Common Name	Scientific Name	Commercial Usage
Asepoko	<i>Pouteria guianensis</i>	Timber
Aromata	<i>Clathrotropis macrocarpa</i>	Timber & Medicine
Aromata	<i>Clathrotropis brachypetala</i>	Timber & Medicine
Baramalli	<i>Casostoma commune</i>	Timber
Black kakaralli	<i>Eschweilera subglandulosa</i>	Timber
Wallaba	<i>Eperua falcate</i>	Timber
Smooth leaf kakaralli	<i>Eschweilera coriacea</i>	Timber
Fine leaf kakaralli	<i>Eschweilera wachenheimii</i>	Timber
Buroda	<i>Parinari campestris</i>	Timber, food, firewood & medicine
Mora	<i>Mora excels</i>	Timber & Medicine
Corkwood	<i>Pterocarpus officinalis</i>	Timber & Medicine
Crabwood	<i>Carapa guianensis</i>	Timber, Medicine & NTFP
Haiawa	<i>Protium guianense</i>	Timber & NTFP
Duru	<i>Annona symphyocarpa</i>	Timber & Firewood
Futi	<i>Jacaranda copaia</i>	Timber
Antwood	<i>Cordia nodosa</i>	Timber
Yari-yari	<i>Duguetia neglecta</i>	NTFP
Yari-yari	<i>Duguetia calycina</i>	NTFP
Yari-yari	<i>Duguetia guianensis</i>	NTFP
Trysel	<i>Pentaclethra macroloba</i>	Timber & Medicine
Monkey pot		Timber
Wamara	<i>Swartzia leiocalycina</i>	Timber
Whitey	<i>Inga sp.</i>	Timber
Nibi	<i>Heteropsis jenmanii</i>	NTFP
Turu palm	<i>Jessenia bataua</i>	Roofing material, NTFP
Manicole Palm	<i>Euterpe oleracea</i>	Food
Monkey ladder	<i>Bauhinia guianensis</i>	Medicine
Batrics palms	<i>Bactris oligoclada</i>	Some species are used as food in forest communities
Conga Pong/Cecropia	<i>Cecropia peltata</i>	Medicine
Conga Pong/Cecropia	<i>Cecropia scrdophylla</i>	Medicine
Conga Pong/Cecropia	<i>Cecropia surinamensis</i>	Medicine
Maho	<i>Sterculia guianensis</i>	Medicine
Mukru	<i>Ischnosiphon arouma</i>	NTFP
Dali		Timber
Kurokai	<i>Protium decandrum</i>	Timber
Simarupa	<i>Quassia simarouba</i>	Timber
Habudiballi	<i>Anacardium giganteum</i>	Timber

5.6.1.2 Wildlife

5.6.1.2.1 Avifauna

The biodiversity assessment recorded a total of 140 avifaunal species from 42 families (Table 17). Species were identified by visual encounter surveys (VES), vocalization (mainly dawn song and sunset flight sessions when species are most active), night spotting and opportunistic sightings. Point counts and opportunistic mist netting were also conducted.

The majority of the birds, 405 individuals, were identified within the wider Golden Mile area. Approximately 189 individuals were recorded in the tailing pond area and 156 in the area of the hydropower plant. These areas entertain rich feeding sites for avifaunal species from observation of fruiting trees with disturbance mainly focused around the Golden Mile area. The possible reason for the Golden Mile recording a greater number of individuals may be due to the large dispersion of grasses currently growing from previous disturbances, which provides a prime feeding site for birds.

A pair of Harpy Eagles, *Harpia harpyja*; an adult and juvenile; was also identified and recorded within the area identified for the tailings pond. These birds are considered globally near-threatened by the IUCN and are CITES Appendix I species. The Guyana Amazon Tropical Bird Society (GABTS) highlighted that this area, because of the presence of Harpy Eagles, could qualify as an Important Bird Area (IBA) under the A1 Criteria for globally threatened species. The IUCN Red List has noted that the population of this species is declining worldwide. The field surveys were unable to confirm the location of nesting site and population size. Further study is recommended as nesting sites was observed by local miners in the area.

Harpies do not fly long distances and usually stay close to their nesting site. Forests supporting these eagles are usually less than 90 m in height and undisturbed forests are ideally suited to their needs; but they can occur in secondary growth forests and minimally disturbed areas.

Two (2) migrant species were recorded within the area, namely Swallow-tailed kite *Elanoides forficatus* and Spotted-Sandpiper *Actitis macularius*. In addition, six (6) species were recorded as endemics to the Guianan shield, namely *Pionopsitta caica*, *Monasa atra*, *Pteroglossus viridis*, *Myrmeciza atrothorax*, *Perissocephalus tricolor* and *Cyanocorax cyanus*.

Several species of the pet/wildlife trade were identified and have been identified under CITES Appendix II and II (see Table 22 for additional information). Species for this trade are from the Psittacidae family, inclusive of *Pyrrhura picta*, *Ara nobilis*, *Ara chloropterus*, *Ara macao*, *Ara ararauna*, *Forpus passerines*, *Brotogeris chrysopterus*, *Pionites melanocephala*, *Pionopsitta caica*, *Pionus menstruus*, *Pionus fuscus*, *Amazona dufresniana*, *Amazona ochrocephala*, *Amazona amazonica*, *Amazona farinosa* and *Derophtys accipitrinus*.

It was observed that the Ruddy-breasted Seedeater, *Sorophila minuta*, and Chestnut-bellied Seedeater, *Sorophila castaneiventris*, were used by the local miners as song birds/pets. It is unclear whether these birds were brought in from other areas or captured at Aurora.

The 2006-2007 field data (Appendix A) indicated the presence of the Sun Parakeet (*Aratinga solstitialis*), an endangered species under the 2009 IUCN Red List. However, this species is not known to inhabit the Cuyuni River Basin and is associated with dry forest hills surrounding the Rupununi Savannas and areas of adjacent Brazil. No Sun Parakeets were observed during the 2009 surveys.

All species identified during this survey are common to fairly common throughout the area and Guyana, except for the Harpy Eagle.

Table 17: 2009 Avifauna Assessment at Aurora

English Name	Scientific Name	Golden Mile	Hydropower Site	Euterpe Forest	Mine Water Mngt Area	Gold Creek & Cuyuni R.	Tailings Pond
Agami Heron	<i>Agamia agami</i>	1					1
Anhinga	<i>Anhinga anhinga</i>	1					1
Bananaquit	<i>Coereba flaveola</i>		2				
Barred Antshrike	<i>Thamnophilus dollatus</i>	2					
Bat Falcon	<i>Falco rufigularis</i>	1	1			1	
Bay-headed Tanager	<i>Tanagra gyrola</i>		1				1
Black-necked Aracari	<i>Pteroglossus aracari</i>	3	4				
Black Caracara	<i>Daptrius ater</i>	6	3	1			
Black Curassow	<i>Crax alector</i>	1	1				
Black Nunbird	<i>Monasa atra</i>	3					

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Black Vulture	<i>Coragyps atratus</i>	4	12	4	4	4	8
Black-banded Woodcreeper	<i>Dendrocolaptes picumnus</i>	1				1	
Black-chested Antshrike	<i>Sakesphorus Canadensis</i>	2					
Black-headed Parrot	<i>Pionites melanocephala</i>	12					6
Blackish Nightjar	<i>Caprimulgus nigrescens</i>	2			1		1
Black-tailed Tityra	<i>Tityra cayana</i>	1			2		1
Black-throated Antbird	<i>Myrmeciza atrothorax</i>	1				2	
Blue - crowned Motmot	<i>Momotus momota</i>	1					
Blue Dacnis	<i>Dacnis cayana</i>		2				1
Blue-and-Yellow Macaw	<i>Ara ararauna</i>	14					
Blue-cheeked Parrot	<i>Amazona dufresniana</i>	2					8
Blue-gray Tanager	<i>Thraupis episcopus</i>		4				3
Blue-headed Parrot	<i>Pionus menstruus</i>	14					4
Boat-billed Flycatcher	<i>Megarynchus pitangua</i>	3					
Brown-chested Martin	<i>Progne tapera</i>	4	6				
Buff-breasted Wren	<i>Thryothorus leucotis</i>	2					1
Caica Parrot	<i>Pionopsitta caica</i>	19					8
Capuchinbird	<i>Perissocephalus tricolor</i>	1					1
Cayenne Jay	<i>Cyanocorax cayanus</i>	2					1
Channel - billed Toucan	<i>Ramphastos vitellinus</i>	2	2				
Chestnut Woodpecker	<i>Celeus elegans</i>	1	2				
Chestnut-bellied Seedeater	<i>Sorophila castaneiventris</i>		2				
Cinnamon Attila	<i>Atilla cinnamomeus</i>	2					
Cocoi Heron	<i>Ardea cocoi</i>	1					1
Common Potoo	<i>Nyctibius griseus</i>	1					1
Common Black-Hawk	<i>Buteogallus anthracinus</i>	1					
Common Pauraque	<i>Nyctidromus albicollis</i>	2			1		1
Common Tody-Flycatcher	<i>Todirostrum cinereum</i>	1					3
Coraya Wren	<i>Thryothorus coraya</i>	2					2
Cream-colored Woodpecker	<i>Celeus flavus</i>	1	1				
Crested Oropendola	<i>Psarocolius decumanus</i>		1				1
Crimson-crested Woodpecker	<i>Campephilus melanoleucos</i>	1	1				
Dusky Parrot	<i>Pionus fuscus</i>	2					4
Dusky-capped Flycatcher	<i>Myiarchus tuberculifer</i>	1					1
Ferruginous-backed Antbird	<i>Myrmeciza ferruginea</i>	10				2	
Fork-tailed Flycatcher	<i>Tyrannus dominicensis</i>	1			2		
Fork-Tailed Palm-Swift	<i>Tachornis squamate</i>	10				17	
Fulvous Shrike-Tanager	<i>Lanio fulvous</i>		1				1
Giant Cowbird	<i>Scaphidura oryzivora</i>		6				5
Golden-headed Manakin	<i>Pipra erythrocephala</i>	2					2
Golden-winged Parakeet	<i>Brotogeris chrysopterus</i>	18					
Grassland Sparrow	<i>Ammodramus humeralis</i>		2				
Gray Hawk	<i>Asturina nitida</i>	1					1
Gray Kinbird	<i>Tyrannus dominicensis</i>	1		1			
Gray-breasted Martin	<i>Progne chalybea</i>	4	5				
Gray-breasted Sabrewing	<i>Campylopterus laripennis</i>	1				1	
Gray-necked Wood-Rail	<i>Aramides cajanea</i>	2		2			1
Gray-winged Tropicbird	<i>Psophia crepitans</i>	1	1				1
Great Egret	<i>Ardea alba</i>	1			1	1	1
Great Kiskadee	<i>Pitangus sulphuratus</i>	1					3
Great Tinamou	<i>Tinamus major</i>	1	3	1	1	2	3
Green Kingfisher	<i>Chloroceryle Americana</i>	4			2		
Green Aracari	<i>Pteroglossus viridis</i>	4	1				
Green Honeycreeper	<i>Chlorophanes spiza</i>		4				3
Green Ibis	<i>Mesembrinibis cayennensis</i>	2	5	1	1	1	2
Green Oropendola	<i>Psarocolius viridis</i>		1				2
Green-rumped Parrotlet	<i>Forpus passerines</i>	10					8
Harpy Eagle	<i>Harpia harpyja</i>	2					
King Vulture	<i>Sarcoramphus papa</i>	1		1			1
Lesser Kiskadee	<i>Philophydor lector</i>	4					
Lesser Yellow-headed Vulture	<i>Cathartes burrovianus</i>	1		1			

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Lineated Woodpecker	<i>Dryocopus lineatus</i>	1	2		2	1	1
Little chachalaca	<i>Ortalis motmot</i>	2	1		2		
Long-tailed Hermit	<i>Phaethornis bourcieri</i>	2		1		1	
Long-tailed Tyrant	<i>Colonia colonus</i>	1					1
Mealy Parrot	<i>Amazona farinosa</i>	20					6
Musician Wren	<i>Cyphorhinus arada</i>	1					1
Neotropic Cormorant	<i>Phalacrocorax brasilianus</i>	1					1
Orange-winged Parrot	<i>Amazona amazonica</i>	20					20
Painted Parakeet	<i>Pyrrhura picta</i>	18					12
Pale-eyed Thrush	<i>Platycichla leucops</i>		2				
Palm Tanager	<i>Thraupis palmarum</i>		3				1
Paradise Jacamars	<i>Galbula dea</i>	1					
Pinnated Bittern	<i>Botaurus pinnatus</i>	1					1
Piratic Flycatcher	<i>Legatus leucophaius</i>	2	5				4
Plain-brown Woodcreeper	<i>Dendrocincla fuliginosa</i>	2				2	
Purple Honeycreeper	<i>Cyanerpes caeruleus</i>		2				2
Re-capped Cardinal	<i>Paroaria gularis</i>		2				
Red-billed Toucan	<i>Ramphastos tucanus</i>	2	1				
Red-and-Green Macaw	<i>Ara chloropterus</i>	12					
Red-fan Parrot	<i>Derophtus accipitrinus</i>	2					
Red-and-black Grosbeak	<i>Periporpyrus erythromelas</i>				6	6	
Reddish Hermit	<i>Phaethon ruber</i>	1		1		1	
Red-legged Honeycreeper	<i>Cyanerpes cyaneus</i>		2				2
Red-necked Woodpecker	<i>Campephilus rubricollis</i>	1	1			1	2
Red-rumped Cacique	<i>Cacicus haemorrhous</i>		2				2
Red-shouldered Macaw	<i>Ara nobilis</i>	20					4
Red-throated Caracara	<i>Ibycter americanus</i>	5	1				
Ringed Kingfisher	<i>Ceryle torquata</i>	1					
Ruddy-breasted Seedeater	<i>Sorophila minuta</i>		20				
Russet-crowned Crane	<i>Anurolimnas viridis</i>	1					
Rusty-margined Flycatcher	<i>Myiozetetes cayanensis</i>	1					
Scarlet Macaw	<i>Ara macao</i>	2					
Screaming Piha	<i>Lipaugus vociferans</i>	4			3		5
Short-eared Owl	<i>Asio Flammeus</i>	1					
Short-tailed Swift	<i>Chaetura brachyuran</i>	10				27	
Silver-beaked Tanager	<i>Ramphocelus carbo</i>		4				4
Smoothed-billed Ani	<i>Crotophaga ani</i>	6					1
Southern Rough-winged Swallow	<i>Stelgidopteryx ruficollis</i>	1	4				
Southern House-Wren	<i>Troglodytes musculus</i>	1					2
Spectacled Owl	<i>Pulsatrix perspicillata</i>	1					1
Spotted Antpitta	<i>Hylopezus macularius</i>	1			1		1
Spotted-sandpiper	<i>Actitis macularius</i>	2					
Striated Heron	<i>Butorideis striatus</i>	1					1
Striped Cuckoo	<i>Tapera naevia</i>	1	1		1		
Striped Owl	<i>Pseudoscops clamator</i>	1					
Sunbittern	<i>Eurypyga helias</i>	1	1				1
Swallow-tailed Kite	<i>Elanoides forficatus</i>	6	6	2		2	4
Swallow-wing	<i>Chelidoptera tenebrosa</i>	5					
Thrush-like Antpitta	<i>Myrmothera campanisona</i>	1			1		
Tropical Kingbird	<i>Tyrannus melancholicus</i>	4	4				
Turkey Vulture	<i>Cathartes aura</i>	2	2	2			
Variegated Tinamou	<i>Crypturellus variegates</i>	1					1
Violaceous Euphonia	<i>Euphonia violacea</i>		2				
Violaceous Trogon	<i>Trogon violaceus</i>	1	1				
Wedge-billed Woodcreeper	<i>Glyphorhynchus spirurus</i>	3				2	
White-collared Swift	<i>Streptoprogne zonarris</i>	6				4	
White-tailed Trogon	<i>Trogon viridis</i>	2	1				
White-breasted Wood-Wren	<i>Henicorhina leucosticte</i>	1					1
White-crowned Manakin	<i>Pipra pipra</i>	4					4
White-flanked Antwren	<i>Myromotherula axillaris</i>	1				1	
White-fringed Antwren	<i>Formicivora grisea</i>	1				2	
White-lined Tanager	<i>Tachyphonus rufus</i>		1				1

White-throated Kingbird	<i>Tyrannus albogularis</i>	4					
White-winged Swallow	<i>Tachycineta albiventer</i>	3	5				
Yellow -crowned Parrot	<i>Amazona ochrocephala</i>	3	4				6
Yellow-breasted Crane	<i>Porzana flaviventer</i>	2					
Yellow-green Grosbeak	<i>Caryothraustes Canadensis</i>				4	3	
Yellow-rumped Cacique	<i>Cacicus cela</i>		1				2
Yellow-tufted Woodpecker	<i>Melanerpes cruentatus</i>	1	1				

5.6.1.2.2 Herpetofauna

A total of 45 species of herpetofauna were identified by the 2009 surveys, with 23 species of amphibians from eight (8) families and 22 species of reptiles within 13 families (Table 18). All of the species encountered are common to the wider geographic area of Guyana and many are found across the entire Guianan-Amazonian lowlands region.

A total of 22 species were identified at both the Golden Mile and potential Hydropower Site. The Water Management Area sourced 15 species while the potential Tailing Pond documented 14 species of herpetofauna. *Pipa pipa*, an aquatic toad, was observed in the Euterpe palm area only.

Table 18: 2009 Herpetofaunal Assessment at Aurora, Guyana

Abundance Codes:

U – small numbers recorded, but not encountered daily (uncommon)

F – less than 5 individuals recorded daily (fairly common)

C – observed between one to ten individuals daily (common)

A – observed more than ten individuals daily (abundant)

R – observed less than once a day (rare)

O – observed once (status unknown)

I – identified by third person e.g. local miners, geologist, etc.

English Name	Scientific Name	Golden Mile	Hydropower Site	Euterpe Forest	Mine Water Mngt Area	Gold Creek & Along Cuyuni R.	Tailings Pond
AMPHIBIA							
Brilliant-thighed poison frog	<i>Allobates femoralis</i>	F	A				F
Spotted Toad	<i>Rhaebo guttatus</i>				C	O	
Werner's Toad	<i>Rhaebo nasicus</i>	F	C		C		C
Giant Toad	<i>Rhinella marina</i>	F	C		C		C
Venezuela Cochran Frog	<i>Cochranella helenae</i>		U				
Taylor's glassfrog	<i>Hyalinobatrachium taylori</i>		U				
Three-striped poison arrow frog	<i>Ameerega trivittata</i>		C				
-	<i>Dendrosophus punctatus</i>	C	A				
Giant gladiator treefrog	<i>Hypsiboas boans</i>	C	A	C	C		C
Troschel's treefrog	<i>Hypsiboas calcarate</i>			C	C		
Map treefrog	<i>Hypsiboas geographica</i>	C	C		C		C
-	<i>Hypsiboas multifasciata</i>	U			C		
Cayenne slender-legged treefrog	<i>Osteocephalus leprieurii</i>		U	U	C		
Manaus slender-legged treefrog	<i>Osteocephalus taurinus</i>		U		C		
-	<i>Scinax nebulosus</i>						C
Red snouted treefrog	<i>Scinax ruber</i>	F					
Knudsen's thin-toed frog	<i>Leptodactylus knudensi</i>		C		C		
Gold-striped frog	<i>Leptodactylus lineatus</i>	C	U				
Lutz's thin-toed frog	<i>Leptodactylus lutzi</i>			C			
-	<i>Leptodactylus sp.</i>			C			
Amazonian white-lipped frog	<i>Leptodactylus mystaceus</i>	C	C	C			
Surinamese Toad	<i>Pipa pipa</i>			O			
-	<i>Lithobates palmipes</i>		U		O	U	
REPTILIA							
False coral snake or red pipe snake	<i>Anilius scytale</i>	I					
Emerald Tree Boa	<i>Corallus caninus</i>	I					

Boa constrictor	<i>Boa constrictor</i>	O				
Anaconda	<i>Eunectes murinus</i>	O				
- False coral snake -	<i>Erythrolamprus aesculapii</i>					
-	<i>Leposoma percarinatum</i>	C	U			
Common Iguana	<i>Iguana iguana</i>		C		U	
Anole	<i>Anolis fuscoauratus</i>	C				U
Anole	<i>Anolis nitens</i>		U			
Common South American Skink	<i>Mabuya nigropunctata</i>					U
Gecko	<i>Gonatodes humeralis</i>	U			O	U
Green-garden Lizard	<i>Ameiva ameiva</i>	C				C
-	<i>Kentropyx calcarate</i>	F	C		C	C
Northern Tegu Lizard/Salipenter	<i>Tupinambis teguixin</i>	U				U
Plica Lizard	<i>Plica plica</i>		O			C
Plica Lizard	<i>Plica umbra</i>		U			
Hump-head Iguana	<i>Uranoscodon superciliosus</i>				U	
Fer-de-lance	<i>Bothrops atrox</i>	U				
Red-footed tortoise	<i>Geochelone carbonaria</i>				U	
-	<i>Phrynos sp.</i>				U	
Spectacle Caiman	<i>Caiman crocodiles</i>	O	U			
Cuvier's Smooth-fronted Caiman	<i>Paleosuchus palpebrosus</i>	F				F

Species were identified by visual encounter surveys (VES), vocalization for frogs and opportunistic sightings.

5.6.1.2.3 Mammals

A total of 18 mammalian species were documented during the 2009 assessment (Table 19). The methodologies used for the identification of mammals were visual encounter surveys (VES), track and scat identification, mist netting for bats and opportunistic sightings.

Table 19: 2009 Mammalian Assessment at Aurora, Guyana

Abundance Codes:

U – small numbers recorded, but not encountered daily (uncommon)

F – less than 5 individuals recorded daily (fairly common)

C – observed between one to ten individuals daily (common)

A – observed more than ten individuals daily (abundant)

R – observed less than once a day (rare)

O – observed once (status unknown)

I – identified by third person e.g. local miners, geologist, etc.

English Name	Scientific Name	Golden Mile	Hydropower Site	Mine Water Mngt Area	Gold Creek & Along Cuyuni R.	Tailings Pond
Howler Monkey	<i>Alouatta seniculus</i>	C	C			
Red Brocket Deer	<i>Mazama Americana</i>	C	C	C		
Grey Brocket Deer	<i>Mazama gouazoubira</i>		C	C	C	
Nine-banded Armadillo	<i>Dasypus novemcinctus</i>		U			
Paca	<i>Agouti paca</i>	C	C			
Red-rumped Agouti	<i>Dasypus leporinus</i>	C	C			
Common Vampire Bat	<i>Desmodus rotundus</i>	U				
Ocelot	<i>Leopardus pardalis</i>	I				
Jaguar	<i>Panthera onca</i>	C				U
Capybara	<i>Hydrochoeris hydrochaeris</i>	C			C	
Neotropical Otter	<i>Lutra longicauda</i>				U	
Giant Otter	<i>Pteronura brasiliensis</i>				O	
Tamandua	<i>Tamandua tetradactyla</i>		U			
Silky Short-tailed bat	<i>Carollia cf. brevicauda</i>	C				
Common Mastif bat	<i>Molossus rufus</i>	C	F			
River Bat	<i>Rhynchonycteris naso</i>	C			C	
Tapir	<i>Tapirus terrestris</i>	C	C	C	C	C
Common Porcupine	<i>Coendou prehensilis</i>					O

Twelve (12) species were identified at the Golden Mile, recording the highest number of sightings. This may be due to the increase number of interaction with the habitat of these species. The potential Hydropower site garnered nine (9) species followed by the Gold Creek/along the Cuyuni River which documented six (6) species. The potential Tailing Pond and Mine Water Management area documented three (3) species each.

Other species of primates reported by the 2006-2007 field surveys were not observed by the 2009 surveys, particularly at the potential Tailing Pond area, which remains relatively intact. The presence of the Harpy Eagles which depend on primates as prime food sources, may explain the absence of sightings of other primates.

Several species of bats were identified at the sites using mist nets when possible. It was noted that the species found within the old mine tunnels were *Carollia* cf. *brevicauda*, while those flying around the Golden Mile were *Molossus rufus* and *Desmodus rotundus*. *Molossus rufus* were in abundance at the potential hydropower site.

A single giant otter (*Pteronura brasiliensis*) was observed swimming in the Cuyuni River in front of the Aurora Concession in the May 2009 field surveys. An otter sighting was also reported in the 2006/2007 baseline surveys. No additional individuals or any otter dens were identified within the survey area. It is possible that the individual observed was a lone male that was passing through the area. None of the persons interviewed at the Aurora camp or the adjacent garimpeiro camp had observed giant otters in the project area. This otter is classified as an endangered species on the IUCN Red List. It was recommended that further studies be done to determine whether there were any resident populations within the project area, identify the location of any dens, estimate the population size, and assess potential impacts of the mining on this species, if present.

As a result, internationally-recognized giant otter specialist Dr. Nicole Duplaix was retained to provide a field assessment for the giant otter in the Project Area of Influence (Annex 3). The field assessment was performed 13-22 October 2009. No evidence for recent inhabitation by giant otters was found. Previous reports (2006/2007, 2009) are interpreted as transient males.

It is believed that the presence of small-scale mining and logging in the Project Area of Influence has led to a reduction in the abundance of large mammals due to hunting and disturbance (see Annex 3 for detailed discussion). The presence of exploration activities in the Aurora Concession has also likely led to the retreat of more sensitive species due to noise and activity (such as frequent use of ATVs on trails).

5.6.1.2.4 Macro-Invertebrates

A total of 22 families/orders of macro-invertebrates were identified within the Aurora area (Table 20). Most of the families and/or orders were present at all sampling sites, except for the Annelidae, Diptera and Scorpiones. Macro-invertebrates were sampled using visual encounter surveys, leaf litter sampling and dip netting.

Table 20: 2009 Assessment of Macro-Invertebrates at Aurora, Guyana

Abundance Codes:

U – small numbers recorded, but not encountered daily (uncommon)

F – less than 5 individuals recorded daily (fairly common)

C – observed between one to ten individuals daily (common)

A – observed more than ten individuals daily (abundant)

R – observed less than once a day (rare)

O – observed once (status unknown)

Families/Orders	English Identification	Julian Ross Itabu	Mine Water Mngt site	Tailing ponds site	Golden Mile	Gold Creek
Annelidae	Segmented worms	U	U	U	U	U
Amblypygi	Whip scorpions				U	
Araneae	Spiders	A	A	A	A	A
Blattidae	Cockroaches	A	U	U	U	U
Coleoptera	Beetles	C	C	C	C	C
Diplopoda	Millipedes	A	A	A	A	A
Diptera	True flies-cowfly	U	U	U	U	U
Hemiptera	True bugs	C	C	C	C	C
Hydrometridae	Water threaders	A	A	A	A	A
Hymenoptera	Leaf cutter ants	A	A	A	A	A
	Redants, army ants					
	Bees	C	C	C	C	C
	Wasps	C	C	C	C	C
Lepidoptera	Butterflies	A	A	A	A	A
Riodiniae						
Lycaeniidae						
Morphidae						
Satyridae						
Heliconidae						
Papilionidae	<i>Helicopsis cupido</i>	F			F	
	<i>Mesosemia sp.</i>					
	<i>Stalachits sp.</i>					
	<i>Themone sp.</i>					
	<i>Arawacus sp.</i>					
	<i>Pelion sp.</i>					
	<i>Malvina sp.</i>					
	<i>Morpho rhetenor</i>					
	<i>Deidamia sp.</i>					
	<i>Pierella sp.</i>					
	<i>Euptychia-Tricolor</i>					
	<i>Lea sp.</i>					
	<i>Taygetis sp.</i>					
	<i>Heliconius numata-cramer</i>					
	<i>Deris sp.</i>					
	<i>Philaethria sp.</i>					
	<i>Doris sp.</i>					
	<i>Arcas-antheas</i>					
Lepidoptera	Moths	A	A	A	A	A
Odonata	Dragonflies	A	A	A	A	A
	Damselflies	A	A	A	A	A
Opiliones	Harvestmen	C	C	C	C	C
Orthoptera	Grasshopper	C	C	C	C	C
	Crickets	C	C	C	C	C
Plasmiidae	Stick insects	C	C	C	C	C
Scorpiones	Scorpion	U	U	U	U	U
Culicidae	Mosquitos	C	C	C	C	C
Lampyridae	Fireflies	A	A	A	A	A
Decapoda-Brachyura	Crab	C	C	C	C	C
Decapoda-Caridea	Shrimp	C	C	C	C	C
Gastropoda	Snails	A	A	A	A	A
Tettigoniidae	Katydid	C	C	C	C	C

The most abundant family/orders observed were the Araneae, Diplopoda, Hydrometridae, Hymenoptera, Lepidoptera and Gastropoda. At the potential Hydropower site, Lepidoptera was abundant, consisting of 15 types of skippers and 17 other species belonging to six (6) genres.

All species present at the Hydro site were also present at Golden Mile except for Doris sp. Light gaps created in the forest canopy can account for the increase presence at Golden Mile and along certain areas at the Hydro site. Additionally, our sampling during the dry season and the presence of significant fruiting and flowering plants within the various areas, can account for the significant presence and observation of Lepidoptera and other families.

All species of macro-invertebrates observed were common to fairly common throughout Guyana.

5.6.1.3 Aquatic Resources

5.6.1.3.1 Fishes

The ichthyofauna of Aurora was sampled at five different sites in 2009: the Julian Ross Itabu including the potential Hydropower Site, rapids and inter-rapids, the potential Mine Water Management Site, potential Tailing Pond site, the Cuyuni River mainstream with the surrounding channels and creeks; and Gold Creek. Samplings were done using tangle seines, and hook and line methods.

No previous systematic sampling had been done at the Cuyuni River in Guyana prior to the 2006-2007 surveys. However, in Venezuela, 135 species of fishes were documented occurring along the Rio Cuyuni and its tributaries in Venezuela (Allison et al, 2000). This River joins with the Cuyuni River in Guyana. As such, it can be postulated that similar species of fishes occur within the Cuyuni River as in Venezuela as they are biogeographically similar.

A total of 45 species of ichthyofauna was documented by the 2009 surveys (Table 21). Eighteen (18) species were collected at Julian Ross Itabu including the potential Hydropower site, rapids and inter-rapids, while six (6) species were identified at the Mine Water Management site, three (3) at the potential Tailings Pond and seventeen (17) at Cuyuni mainstream, creeks and streams. Twelve (12) species were documented at Gold Creek.

Although 45 species of fishes were collected in 2009, only a few individuals were collected per species. All species documented were fairly common to the area and Guyana generally.

Table 21: 2009 Ichthyofaunal Assessment at Aurora, Guyana

x: indicates presence of species

English Name	Scientific Name	Juliana Ross Itabu	Mine Water Mngt site	Tailings Pond	Cuyuni Mainstream & creeks	Gold Creek
Armoured catfish	<i>Platydoras costatus</i>	X				
Banana fish	<i>Phractocephalus hemiliopterus</i>	X				
Biara	<i>Hydrolycus scomberoides</i>	X			X	X
Boots	<i>Trachycorystes obscures</i>				X	X
Cullet paddle	<i>Sorubim elongates</i>					
Curimata	<i>Prochilodus rubrotaeniatus</i>					
Daray	<i>Leporinus sp.</i>	X				
Dawala	<i>Ageneiosus sp. 1</i>				X	
Dogfish	<i>Acestrorhynchus microlepis</i>					X
Electric eel	<i>Electrophorus electricus</i>					
Haimara	<i>Hoplias macrophthalmus</i>				X	
Huri	<i>Hoplias marabalicus</i>	X	X	X		X
Kassie	<i>Rhamdia holomelas</i>	X				
Knifefish	<i>Sternopygus macrurus</i>				X	

Pink tail	<i>Chalceus macrolepidotus</i>					
Puff-fish	<i>Colomesus psittacus</i>				X	
Tigerfish	<i>Pseudoplatystomus sp.</i>				X	
Waxfish	<i>Paraenipterus geleatus</i>	X			X	
Whiptail catfish	<i>Rhineloricaria sp.</i>				X	
Yarrow	<i>Hoploerythrinus unitaeniatus</i>	X	X	X		X
	<i>Tetragonopterus chalceus</i>	X				
	<i>Pimelodus sp.</i>	X				
	<i>Charax gibbosus</i>	X			X	
	<i>Serrasalmus eigenmanni</i>	X			X	X
	<i>Crenicichla alta</i>	X				
	<i>Hypostomus sp.</i>	X				
	<i>Serrasalmus sp.</i>	X				
	<i>Chilodus punctatus</i>					
	<i>Pimelodus ornatus</i>				X	
	<i>Serrasalmus rhombeus</i>				X	
	<i>Ageneiosus sp. 2</i>				X	
	<i>Aequidens tetramerus</i>		X			
	<i>Astyanax fasciatus</i>		X			
	<i>Crenicichla lugubris</i>		X			
	<i>Moenkhausia oligolepis</i>		X			
	<i>Poptella orbicularis</i>					X
	<i>Hemiodus sp.</i>					
	<i>Boulangerella lucius</i>					X
	<i>Platydoras hancocki</i>					X
	<i>Triporthus rotundatus</i>					X
	<i>Hassar sp.</i>					X
	<i>Crenicichla sp.</i>					X
	<i>Rhamdia quelen</i>			X		
	<i>Pimodella sp.</i>				X	
	<i>Auchenipterus sp.</i>				X	
	<i>Hypancistrus sp.</i>				X	

At the Julian Ross Itabu, many of the rapids were not far apart. From the eighteen species collected here only three species, *Serrasalmus eigenmanni*, *Serrasalmus sp.* and *Tetragonopterus chalceus* were collected at the inter-rapids due to the significant moment of the water currents. All other species were documented from the creeks and the Hydropower site as the water current was not as fast flowing. At the hydropower site, the sampled creeks were heavily contaminated from tailings runoff and oil from operations further upstream, which resulted in significant sedimentation and possibly depleted water quality. At one particular creek, the sedimentation was so severe that no species were collected during sampling.

At the Cuyuni mainstream and its creeks, including Gold Creek, a large number of species was collected as the water currents were relatively normal and sedimentation was not as significant as in the Julian Ross Itabu. This also allowed for a larger number of individual fishes to be collected.

The waterways at the potential Mine Water Management site were narrow and shallow, eventually creating a swamp. As a result, only smaller species such as the *Crenicichla sp.*, *Aequidens tetramerus*, *Astyanax sp.*, and *Hoplias malabaricus* were present due to their preference and ability to forage through the leaf litter in shallow waterways.

The *Hoplias macrophthalmus*, *Electrophorus electricus* and *Prochilodus rubrotaeniatus* were not collected on this trip, but local miners had previously reported this species occurring in the streams and rivers.

5.6.2 Access Road Biodiversity Survey

The mine site access road will progress approximately 28 km on the right bank of the Cuyuni River and 3 km on the left bank of the Cuyuni River and will cross the Cuyuni River at Tapir point. The access road

will connect to Barama Feeder Road, F-3-13. Several small creeks will be crossed by the access road. Culverts will be used at stream crossings and would be designed to ensure maintenance of design flows.

A rapid biodiversity assessment was undertaken of the access road alignment over a five day period commencing on February 08, 2010. The survey was undertaken to compile information on floral and faunal resources on the access road alignment.

Prior to the commencement of field work, a Literature review was conducted on the flora and fauna of the Cuyuni- Mazaruni area of Guyana. Field surveys were conducted at 5 km intervals on the access road alignment and progressed to distance of 0.5 km on either side of the access road. The surveyed area is comprised of Brown Sand Forest and Swamp forests on steep to hilly terrain at some points on the alignment. During the survey particular emphasis was placed on species of conservation interest or sites of conservation value. Direct observations were used to determine the species composition in areas along the proposed road.

Surveys were conducted at the following points determined by GPS:

1. E 0196369 N 0751118
2. E 0199202 N 0748023
3. E 0203204 N 0745806
4. E 0205983 N0745128
5. N06° 53 14.5 W058° 34 51.8
6. N06° 53 14.5 W058° 34 51.8
7. N06° 44 44.8 W059° 32 59.2
8. N06° 45 09.4 W059° 34 01.0

5.6.2.1 Floral Survey Methodology

Biogeographically, the Aurora/Cuyuni Area lies within the Brown Sand Forest and Swamp Forests with *Mora excelsa* being the dominant species. The Mora forests are located on alluvial silt, clay or loam along rivers and on riverine flats throughout the lowland region. Generally, the area is considered as Mixed Lowland Forests with *Morabukea* forest found on laterite areas, less frequently it is encountered on sandy loam or on brown sand. It occurs on undulating terrain with slopes in the near interior, east of the Cuyuni River. The dominant species is *Mora gonggrijpii*.

The methodologies used for floral survey included 1 km transects, with 50m x 50m subplots at every 100m, creating a herring bone formation. Within the 50m x 50m main plots, sub plot measuring 10m x 10m square were also established. In the main plots (50m x 50m), all trees measuring 20 cm DBH and above were recorded. In the sub plots all trees and saplings measuring 19.9 cm DBH and less were recorded. Species identified within this area are common to fairly common to this area and within the brown sand/swamp forest biogeographic province of Guyana. Additionally, it was observed that trees along the road were being cleared and used for possibly camp purposes.

The floral survey was designed to identify the various plant communities and species on the access road alignment. Plants that were unidentifiable in the fields were collected as voucher specimens and barks, stem, fruits and floral parts were also collected for trees, vines or shrubs that were unidentifiable. The collected specimens were subsequently identified, after the survey team returned to Georgetown, by comparison to herbarium material at the Guyana Forestry Commission and the Centre for the Study of Biological Diversity, University of Guyana and available literature. Plant species identified during the survey were recorded in a notebook. Observations were also made of the ecosystems present within the area of influence.

5.6.2.2 Faunal Survey Methodology

The methodologies used for the identification of mammals were visual encounter surveys (VES), track and scat identification, and opportunistic sightings. Mammal traps were also set up in some of the sample plots. There were baited with meat and checked periodically for the presence of mammals.

The faunal survey focused on the major vertebrate group namely, mammals, birds, fishes, amphibians and reptiles and macro-invertebrates. All faunal components within the area surveyed were characterized including vertebrate and invertebrate fauna, habitats for wildlife. Particular interests were placed on threatened or endangered species in the area. The Faunal survey also entailed activities such as litter searches, habitat assessment, bird surveys and routine checks of traps for wildlife presence. Birds were identified using their vocalization, visual encounter and opportunistic sightings.

Transects were established at 5km intervals along the 31 km stretch allocated for the construction of the access road. Each transect was 0.5 km long and was laid out on opposite sides of the proposed road. A total of eight transects were set up along the access road. Sampling were done in quadrats or sample plots along transects. Each sample plot measured 200mx100m. Sample plots were clearly demarcated using flagging tapes. During the survey the team walked the length of the quadrats and collected information on fauna with the plots.

Fishes were collected using tangle seines, dip nets and hook and line methods. Amphibians and reptiles were identified using visual encounter and by their vocalization. Macro-invertebrates were collected using dip nets where possible.

5.6.2.3 Results of Access road Biodiversity

5.6.2.3.1 Flora

A total of sixty five species of plants representing thirty (30) families were documented along the access road area. The most dominant family in terms of species diversity was Caesalpiniaceae. This family was represented by six species. Plants along the proposed road alignment are common throughout the area and little variation was seen in the ecosystems except those that occurred in swampy areas. Palms and sedges were abundant around swampy areas. Baromali, countaballi, morabukea, wallaba and trysil were common at plots along the access road. These were also abundant in the survey area. No endemic species was recorded. In most of the areas surveyed the forest is intact except those areas cleared for the construction of the road.

Shrubs, small trees, vines and grasses were particularly abundant at the sample plot closest to the right bank of the Cuyuni River. Two *Cecropia species*, were plentiful in this area and a large number of manicole and turu palm were also observed. The subsequent transects were characterised by predominately undisturbed forests, except for the small area that was cleared for the access road. Plants in the overstory had an estimated height of 30 m. A few species of fungi were observed growing on fallen trees. Epiphytes were observed to be associated with a number of trees in the sample plots

Some tree species were either fruiting or flowering. The seeds of *Licania alba* were especially plentiful on the forest floor. A few monkey pot and crabwood seeds and tonka bean pods were observed. The survey period was characterised by dry sunny days. The soil was very dry indicating the lack of rainfall over an extensive period of time. A list of plant species, families and their distribution are provided in Table 22.

Table 22: Plant species recorded along access road

Common Name	Scientific Name	Family
Epiphytes	<i>Unidentified</i>	-
Wild tamarind	-	Leguminaceae

Duka	<i>Tapirira obtuse</i>	Anacardiaceae
Yarri Yarri (black)	<i>Unonoposi glaucope</i>	Annonaceae
Yarri-yarri	<i>Duguettia pycnasteria</i>	Annonaceae
Dukali	<i>Parabancomia fasciculate</i>	Apocynaceae
Gum tree	<i>Sapium paucinervium</i>	Apocynaceae
Nibi	<i>Heteropsis flexuosa</i>	Araceae
Fuiti	<i>Jacaranda copaia</i>	Bignoniaceae
Baromalli	<i>Catostemma commune</i>	Bombacaceae
Kurokai	<i>Protium decandrum</i>	Burseraceae
Mora	<i>Mora excelsa</i>	Caesalpiniaceae
Morabukea	<i>Mora gonggripai</i>	Caesalpiniaceae
Purple Heart	<i>Peltogyne venosa</i>	Caesalpiniaceae
Wallaba (Ituri)	<i>Eperua grandiflora</i>	Caesalpiniaceae
Wallaba (soft)	<i>Eperua facata</i>	Caesalpiniaceae
Monkey ladder	<i>Bauhinia suranamensis</i>	Caesalpinioideae
Kabukalli	<i>Goupia glabra</i>	Celastraceae
Burada	<i>Parinari rodolphii</i>	Chrysobalanaceae
Counta (fine leaf)	<i>Licana alba</i>	Chrysobalanaceae
Countaballi	<i>Licana alba</i>	Chrysobalanaceae
Kautaballi	<i>Licana alba</i>	Chrysobalanaceae
Fukadi	<i>Buchenavia fanshawei</i>	Combretaceae
Sedge		Cyperaceae
Fern	<i>Touroulia guianensis</i>	Dryopteridaceae
Fern	<i>Polybtrya caudate</i>	Dryopteridaceae
Bara bara	<i>Diospyros ierensis</i>	Ebenaceae
Bread and cheese	<i>P.unguis</i>	Fabaceae
Blood wood	<i>Vismia guianensis</i>	Guttiferae
Clusia	<i>Clusia amazonica</i>	Guttiferae
Kufa	<i>Clusia grandiflora</i>	Guttiferae
Wild mango	<i>Tovomita obovata</i>	Guttiferae
Heliconia	<i>Heliconia pendula</i>	Heliconiaceae
Yuruwe	<i>B. humilis</i>	Lauraceae
Kakaralli (common black)	<i>Eschweilera sagotiana</i>	Lecythidaceae
Kakaralli (Fine leaf)	<i>Eschweilera wachenheimii</i>	Lecythidaceae
Karakalli (black)	<i>Eschweilera pedicellata</i>	Lecythidaceae
karakalli (smooth leaf)	<i>Eschweilera</i>	Lecythidaceae
Monkey pot	<i>Lecythis zabuajo</i>	Lecythidaceae
Mukru	<i>Ischnoiphon arouma</i>	Marantaceae
Mukuru	<i>Miconia guianensis</i>	Melastomataceae
Waraia	<i>Meriania urceolata</i>	Melastome
Crabwood	<i>Carapa guianensis</i>	Meliaceae
Trysil	<i>Pentaclethra macroloba</i>	Mimosaceae
Maporkon	<i>Inga alba</i>	Mimosoideae
Conga pump (common)	<i>Cecropia obtuse</i>	Moraceae
Conga pump(long leaf)	<i>Cecropia sciadophylla</i>	Moraceae
Dalli	<i>Virola elongate</i>	Myristicaceae
Duru	<i>Annona symphyocarpa</i>	Myristicaceae
Wild guava	<i>Myrcia rufipila</i>	Myrtaceae
Batric palm	-	Palmaceae
Manicole	<i>Euterpe edulis</i>	Palmaceae
Turu palm	<i>Jessenia bataua</i>	Palmaceae

Aromata	<i>Clathrotropis macrocapa</i>	Papilionaceae
Parakusan	<i>Swartzia jenmanii</i>	Papilionaceae
Tonka bean	<i>Dipteryx odorata</i>	Papilionaceae
Wamara	<i>Swartzia leiocalycina</i>	Papilionaceae
Cork Wood	<i>Pterocarpus sp.</i>	Papilionoideae
	<i>Unknown</i>	Rubiaceae
Ascepoko	<i>Pouteria guianensis</i>	Sapotaceae
Bullet wood/balata	<i>Manikara bidentata</i>	Sapotaceae
Buru buru	<i>Solanum stramonifolium</i>	Solanaceae
Maho	<i>Sterculia guianensis</i>	Sterculiaceae
Fowl cup	<i>Unknown</i>	Unknown
Bird Vine	<i>Phoradendron racemosum</i>	Viscaceae
Wild ginger	<i>Ginger sp.</i>	Xenobraceae

5.6.2.3.2 Fauna

5.6.2.3.2.1 Mammals

A total of fourteen (14) species of mammals were documented along the access road. Capybaras were encountered in large numbers early in the morning in the section of access road close to the Aurora mine site. These mammals were observed feeding close to the Cuyuni River. Additionally, howler monkeys were very vocal during the night and early in the morning. These were not seen but were heard regularly along the access road. None of the mammals documented are endangered, threatened or given special protection status. Table 23 identifies for mammals recorded as being present along the access road.

Table 23: Mammals encountered along the access road

Common Name	Scientific Name	Comments
Agouti	<i>Dasyprocta agouti</i>	Seen, prints common
Anteater	<i>Mymecophaga tridactylus</i>	Seen
Armadillo	<i>Dasypus novemcinctus</i>	Reports from workers
Bats	<i>Unidentified</i>	Seen
Capabyra	<i>Hydrochoeris hydrochaeris</i>	Seen
Collard Peccary	<i>Pecari tajacu</i>	Tracks and bathing pools
Common Porcupine	<i>Coendou prehensilis</i>	Smell
Forest rat	<i>Rodentia Sp</i>	Seen
Giant armadillo	<i>Priodontes maximus</i>	Prints
Grey deer	<i>Mazama gouazoubira</i>	Prints common
Howler monkey	<i>Alouatta seniculus</i>	Heard
Labba	<i>Agouti paca</i>	Prints common
Nine-banded Armadillo	<i>Dasypus novemcinctus</i>	
Red Brocket deer	<i>Mazama Americana</i>	Prints common

5.6.2.3.2.2 Avifauna

The Cuyuni area is known to support rich avifauna populations. Bird species were observed either hovering above the ground, in the middle canopy or in the understory regions of the forest. A few were observed on the ground. The canopy provides birds with food, shelter and nesting sites. Thirty seven (37) bird families representing 114 species were recorded along the access road. Seven families were represented by at least five species.

Eleven (11) species were recorded in the family Psittacidae, while the Tyracnidae and Tharupidae families were represented by nine and eight species respectively. The yellow oriole, pairs of red, yellow and blue Macaws were frequently seen along the access road within the vicinity of the Aurora Mine site.

Two migrants, notably *Elanoides forficatus* and *Ictinia plumbea*, were identified along the access road, with nine species of Guianan endemics, namely *Cyanicterus cyanicterus*, *Tyrannetes virescens*, *Corapipo gutturalis*, *Myrmeciza ferruginea*, *Ramphastos tucanus*, *Monasa atra*, *Gypopsitta caica*, *Ara ararauna*, and *Myrmotherula guttata*. Birds listed in table 24 were encountered on the access road alignment.

Table 24: Bird Encountered on the Access Road Alignment

Family	Scientific Name	Common Name
Tinamidae	<i>Great tinamou</i>	Tinamus major
	<i>Little tinamou</i>	Crypturcellus soui
Cathartidae	<i>Coragyps atratus</i>	Black Vulture
	<i>Cathartes aura</i>	Turkey Vulture
	<i>Buteogallus sp.</i>	Hawk
Accipitridae	<i>Elanoides forficatus</i>	Swallow-tailed Kite
	<i>Ictinia plumbea</i>	Plumbeous Kite
Falconidae	<i>Micrastur semitorquatus</i>	Collared Forest-Falcon
	<i>Ibycter americanus</i>	Red-throated Caracara
	<i>Caracara plancus</i>	Crested caracara
	<i>Milvago chimachima</i>	Yellow-headed caracara
	<i>Falco ruficularis</i>	Bat Falcon
Cracidae	<i>Ortalis motmot</i>	Little Chachalaca
	<i>Crax alector</i>	Black Curassow
Psophidae	<i>Psophia crepitans</i>	Gray-winged Trepeter
Columbidae	<i>Patagonenas specious</i>	Scaled Pigeon
	<i>Patagonenas cayennensis</i>	Pale-vented pigeon
	<i>Columbina passerina</i>	Common ground dove
	<i>Leptotila verreauxi</i>	White-tipped dove
	<i>Patagonenas subvinacea</i>	Ruddy pigeon
Psittacidae	<i>Forpus passerinus</i>	Green-rumped Parrotlet
	<i>Brotogeris chrysoptera</i>	Golden-winged Parakeet
	<i>Ara ararauna</i>	Blue and yellow Macaw
	<i>Pionites melanocephalus</i>	Black-headed Parrot
	<i>Gypopsitta caica</i>	Caica Parrot
	<i>Ara chloropterus</i>	Red- and- Green Macaw
	<i>Pionus fuscus</i>	Dusky Parrot
	<i>Amazona ochrocephala</i>	Yellow-crowned Parrot
	<i>Amazona amazonica</i>	Orange winged Parrot
	<i>Amazona farinosa</i>	Mealy Parrot
	<i>Deroptyus accipitrinus</i>	Red- fan Parrot
Cuculidae	<i>Piaya cayana</i>	Squirrel Cuckoo
	<i>Tapera naevia</i>	Striped Cuckoo
Tytonidae	<i>Megascops choliba</i>	Tropical Screech-owl
Caprimulgidae	<i>Chordeiles acutipennis</i>	Lesser Nighthawk
	<i>Nyctidromus albicollis</i>	Common Pauraque
	<i>Caprimulgus cayennensis</i>	White-tailed Nightjar
	<i>Caprimulgus parvulus</i>	Little Nightjar
Nyctibccdae	<i>Nyctibius granndis</i>	Great Potoo
Apodidae	<i>Chaetura brachyura</i>	Short-tailed Swift

	<i>Sterptoprocne zonaris</i>	White-collared Swift
Trochilidae	<i>Phaethornis superciliosus</i>	Long-tailed Hermit
	<i>Phaethornis ruber</i>	Reddish Hermit
	<i>Campylopterus laripennis</i>	Gray-breasted Sabrewing
	<i>Amazilia brevirostris</i>	White - chested Emerald
	<i>Amazilia sp.</i>	Hummingbird
Trogonidae	<i>Trogon viridis</i>	White - tailed Trogon
	<i>Trogon violaceus</i>	Violaceous Trogon
	<i>Trogon melanurus</i>	Black - tailed Trogon
Momotidae	<i>Momotus momota</i>	Blue - crowned Motmot
Bucconidae	<i>Monasa atra</i>	Black Nunbird
	<i>Chelidoptera tenebrosa</i>	Swallow-wing Puff Bird
Galbulidae	<i>Galbula dea</i>	Paradise Jacamar
Ramphastidae	<i>Pteroglossus aracari</i>	Black - necked Aracari
	<i>Ramphastos vitellinus</i>	Channel - billed Toucan
	<i>Ramphastos tucanus</i>	Red-billed Toucan
Picidae	<i>Melanerpes cruentatus</i>	Yellow-tufted Woodpecker
	<i>Celeus flavus</i>	Cream-colored Woodpecker
	<i>Celeus torquatus</i>	Ringed Woodpecker
	<i>Campephilus rubicollis</i>	Red-necked Woodpecker
Dendrocolaptidae	<i>Dendrocincla fuliginosa</i>	Plain-brown Woodcreeper
	<i>Glyphorhynchus spirurus</i>	Wedge-billed Woodcreeper
	<i>Xiphorhynchus picus</i>	Straight-billed Woodcreeper
Thamnophilidae	<i>Taraba major</i>	Great Antshrike
	<i>Sakesphorus Canadensis</i>	Black-chested Antshrike
	<i>Thamnophilus doliatus</i>	Barred Antshrike
	<i>Myrmotherula guttata</i>	Rufous-bellied Antwren
	<i>Hypocnemis cantator</i>	Warbling Antbird
	<i>Pithys albifrons</i>	White-plumed Antbird
Formicariidae	<i>Hylopezus macularius</i>	Spotted Antpitta
Tyrannidae	<i>Atalotriccus pilaris</i>	Pale-eyed Pygmy-Tyrant
	<i>Myiozetetes luteiventris</i>	Dusky-chested Flycatcher
	<i>Myiozetetes cayanensis</i>	Rusty-margined Flycatcher
	<i>Myiodynastes maculatus</i>	Streaked Flycatcher
	<i>Legatus leucophaeus</i>	Piratic Flycatcher
	<i>Myiarchus tuberculifer</i>	Dusky-capped Flycatcher
	<i>Myiarchus tyrannulus</i>	Brown-crested Flycatcher
	<i>Pitangus sulphuratus</i>	Great Kiskadee
	<i>Tyrannus melancholicus</i>	Tropical Kingbird
Incertae Sedis	<i>Pachyramphus rufus</i>	Cinereous Becard
	<i>Tityra cayana</i>	Black-tailed Tityra
	<i>Attila cinnamomeus</i>	Cinnamon Attila
Cotingidae	<i>Querula purpurata</i>	Purple-throated Fruitcrow
	<i>Lipaugus vociferans</i>	Screaming Piha
Pipridae	<i>Corapipo gutturalis</i>	White-throated Manakin
	<i>Chiroxiphia pareola</i>	Blue-backed Manakin
	<i>Pipra pipra</i>	White-crowned Manakin
	<i>Pipra erythrocephala</i>	Golden-headed Manakin
	<i>Tyrannneutes virescens</i>	Tiny Tyrant-Manakin
	<i>Neopelma chryscephalum</i>	Saffron-crested Tyrant-Manakin
Vireonidae	<i>Vireo olivaceus</i>	Red-eyed Vireo

Icteridae	<i>Icterus nigro gularis</i>	Yellow oriole
Hirundinidae	<i>Progne tapera</i>	Brown-chested Martin
	<i>Tachycineta albiventer</i>	White-winged Swallow
	<i>Atticora fasciata</i>	White-banded Swallow
Troglodytidae	<i>Thryothorus coraya</i>	Coraya Wren
	<i>Thryothorus leucotis</i>	Buff-breasted Wren
	<i>Troglodytes musculus</i>	Southern House-Wren
	<i>Cyphorhinus arada</i>	Musician Wren
Turdidae	<i>Turdus nudigensis</i>	Bare-eyed Thrush
	<i>Turdus albicollis</i>	White-necked Thrush
Tharupidae	<i>Tachyphonus luctuosus</i>	White-shouldered Tanager
	<i>Ramphocelus carbo</i>	Silver-beaked Tanager
	<i>Thraupis episcopus</i>	Blue-gray Tanager
	<i>Tanagra mexicana</i>	Turquoise Tanager
	<i>Thraupis palmarum</i>	Palm Tanager
	<i>Cyanicterus cyanicterus</i>	Blue-backed Tanager
	<i>Chlorophanes spiza</i>	Green Honeycreeper
	<i>Cyanerpes caeruleus caeruleus</i>	Purple Honeycreeper
	<i>Cyanerpes cyaneus</i>	Red-legged Honeycreeper
	<i>Coereba flaveola</i>	Bananaquit
Fringillidae	<i>Euphonia violacea</i>	Violaceous Euphonia
Cardinalidae	<i>Caryothraustes canadensis</i>	Yellow-green Grosbeak
	<i>Cyanocompsa cyanoides</i>	Blue-black Grosbeak
New world Blackbirds	<i>Psarocolius decumanus</i>	Crested Oropendola

5.6.2.3.2.3 Herpetofauna

The Cuyuni area is known to support rich herpetofaunal populations. Previous studies have documented a number of species within the area. A total of seventeen (17) species of herpetofauna were documented during this assessment, thirteen reptiles and four amphibians. Species were identified by visual encounter surveys (VES), vocalization for frogs and opportunistic sightings.

The area in which the general survey was conducted was dry and therefore amphibian species were not present in abundance. Forest clearance produced light gaps which were frequently use by reptilian species such as *Ameiva* and *Kentropyx*. Yellow foot tortoises, *Geochelone denticulata* were encountered in two sample plots close to the Aurora project site. Salipenters, *Tupinambus tebuixin*, were also plentiful in some sample plots. None of the species identified were listed as threatened or endangered. A list of herptofauna observed along the access road is provided in Table 25.

Table 25: Herptofauna on Access Road Alignment

Common Name	Scientific Name
Anaconda	<i>Eunectes murinus</i>
Bushmaster*	<i>Lachisis muta</i>
Emerald tree boa*	<i>Corallus caninus</i>
Frog	<i>Hyla sp.</i>
Giant gladiator treefrog	<i>Hypsiboas boans</i>
Green- garden Lizard	<i>Ameiva ameiva</i>
Green Iguana	<i>Iguana iguana</i>
Green Labaria	<i>Bothropsis sp.</i>
Land Boa	<i>Boa Constrictor</i>
Rainbow boa*	<i>Epicratus cenchria</i>

Salipenter	<i>Tupinambus tebuixin</i>
Skink	<i>Gymnolphthalmus underwoodi</i>
Snake	Unknown
Toad	<i>Bufo sp.</i>
Werner's Toad	<i>Rhaebo nasicus</i>
Yellow foot tortoise	<i>Geochelone denticulate</i> , <i>Testudines</i>
Unknown	<i>Anolis fuscoauratus</i>

5.6.2.3.2.4 Ichthyofauna

The Cuyuni River and several creeks outside the concession footprint were sampled and 21 species were documented. Two species of fishes were collected at both locations sampled, namely *Pimelodella sp.* and *Rhamdia holomelas*.

Table 26: Fishes along Access Road Alignment

Species	Common Name
<i>Agnoisus brevifilis</i>	Dawala
<i>Brachyplatystoma filamentosum</i>	Kumakuma
<i>Cichlasoma bimaculatum</i>	Common Patwa
<i>Crenicichla alta</i>	Sunfish
<i>Crenicichla reticulata</i>	Sunfish
<i>Hassar sp.</i>	Zipfish
<i>Hemiodopsis thayeria</i>	Unknown
<i>Hoplias macropthalmus</i>	Haimara
<i>Hoplias marabalicus</i>	Huri
<i>Hydrolicus scomberoides</i>	Biara
<i>Hypostomus sp.</i>	
<i>Moenkhausia oligolepis</i>	Silverfish
<i>Myleus pacu</i>	Pacu
<i>Pimelodella sp.</i>	
<i>Plagioscion squamissimus</i>	Basha
<i>Pygocentrus nattereri</i>	Peraí
<i>Rhamdia holomelas</i>	Kassie
<i>Serrasalmus rhombeus</i>	Peraí

5.6.2.3.2.5 Macro-invertebrates

More than ninety five percent of the macro invertebrate recorded along the access road existed above the forest floor. Litter searches recorded less than 5% of the total invertebrate life observed. A total of twenty two (22) families/orders of macro-invertebrates were identified. Orders or families were identified using visual encounter surveys, and litter searches. Dip nets were also used to capture macro-invertebrates. Dragonflies were especially plentiful near ponds. Further, only species from the orders/families Araneae, Hymenoptera and Lepidoptera, were abundant due to the prevailing dry weather. Little fruiting and flowering occurred in some areas and this may explain the lack of abundance of these species. Survey at night indicated a large population of spiders in the surrounding vegetation. Table 27 lists macro-invertebrates on the access road alignment.

Table 27: Macro-invertebrates observed along Access Road

Common Name	Family/Order of macro-invertebrate
<i>Ants-leaf cutters, Redants, army ants,bullet ant Bees and wasps</i>	Hymenoptera
Beetles	Coleoptera
Black crabs	Decapoda-Brachyura
Butterfly and moths	Lepidoptera <i>Riodiniae –Helicopsis cupido</i> <i>Lycaeniidae-hairstreak Saterines, Pierella hyalinus</i> <i>Heliconius</i> <i>Dismorphia</i> <i>Moths</i>
Millipedes	Diplopoda
Cockroach and mantids	Dictyoptera
Damsel flies Dragon flies (Anax sp)	Odonata
Earwig	Thysanoptera
Fire flies	Lampyridae
Grasshoppers and crickets	Orthoptera
True Bugs	Hemiptera
Hydrometridae	Water threaders
Katydid	Tettigoniidae
Mosquito (<i>Anopheles sp.</i>)	Diptera
Scorpion	Scorpionida
Segmented worms	Annelida (Oligocheta)
Snails (Pomacea sp.)	Mollusca-Gastropoda
Spiders	Aranea
Termites	Isoptera
Tick	Arachnida
True Flies (cow fly)	Diptera
Walking Stick	Plasmida

5.6.2.4 Wharf Biodiversity Survey

The finding of the biodiversity survey that was conducted at the wharf is provided below. The methodologies used mirrored that used for the access road survey.

5.6.2.4.1 Flora

A total of twenty nine (29) species of plants were recorded in areas along the wharf. These belong to eighteen families. Caesalpiniaceae and Lecythidaceae were the most dominant families recorded. In some plots secondary forest comprising mainly of dukali, small wallaba, malbotine, kookrite, turu and manicole palm were observed. Wild mangrove was noted along the rivers. No tree species was endemic to the area around the wharf. A list of plant species encountered in the wharf area is provided in Table 28.

Table 28: Plant species recorded at the Wharf Area

Common Name	Scientific Name	Family
Yarri Yarri (black)	<i>Unonoposi glaucope</i>	Annonaceae
Yarri-yarri	<i>Duguettia pycnasteria</i>	Annonaceae
Dukali	<i>Parabancomia fasciculata</i>	Apocynaceae
Nibi	<i>Heteropsis flexuosa</i>	Araceae

Baromalli	<i>Catostemma commune</i>	Bombacaceae
Kurokai	<i>Protium decandrum</i>	Burseraceae
Morabukea	<i>Mora gonggripii</i>	Caesalpiniaceae
Wallaba (soft)	<i>Eperua facata</i>	Caesalpiniaceae
Monkey ladder	<i>Bauhinia suranamensis</i>	Caesalpinioideae
Kabukalli	<i>Goupia glabra</i>	Celastraceae
Burada	<i>Parinari rodolphii</i>	Chrysobalanaceae
Countaballi	<i>Licania alba</i>	Chrysobalanaceae
Clusia	<i>Clusia amazonica</i>	Guttiferae
Baradan	<i>Ocotea Tormentalla</i>	Lauraceae
Kakaralli (common black)	<i>Eschweilera sagotiana</i>	Lecythythaceae
Karakalli (black)	<i>Eschweilera pedicellata</i>	Lecythythaceae
karakalli (smooth leaf)	<i>Eschweilera sp.</i>	Lecythythaceae
Monkey pot	<i>Lecythis zabucajo</i>	Lecythythaceae
Mukuru	<i>Miconia guianensis</i>	Melastomataceae
Trysil	<i>Pentaclethra macroloba</i>	Mimosaceae
Maporkon	<i>Inga alba</i>	Mimosoideae
Dalli	<i>Virola elongate</i>	Myristicaceae
Kookrite	<i>Maxmiliania maxima</i>	Palmaceae
Manicole	<i>Euterpe edulis</i>	Palmaceae
Turu palm	<i>Jessenia bataua</i>	Palmaceae
Parakusan	<i>Swartzia jenmanii</i>	Papilionaceae
Cork Wood	<i>Pterocarpus sp.</i>	Papilionoideae
Ascepoko	<i>Pouteria guianensis</i>	Sapotaceae
Maho	<i>Sterculia guianensis</i>	Sterculiaceae

5.6.2.4.2 Fauna

5.6.2.4.2.1 Mammals

A small number of mammalian species were encountered at the Wharf Area. Five mammalian species were encountered within this area. These species were also encountered along the access road. No threatened or endangered mammalian species were recorded within this area. Mammals encountered at the wharf area are documented in Table 29.

Table 29: Mammals encountered at the Wharf Area

Common Name	Scientific Name	Comments
Agouti	<i>Dasyprocta agouti</i>	Seen, prints common
Howler monkey	<i>Alouatta seniculus</i>	Heard
Labba	<i>Agouti paca</i>	Prints common
Nine-banded Armadillo	<i>Dasypus novemcinctus</i>	
Squirrel monkeys	<i>Saimiri sciureus</i>	Seen

5.6.2.4.2.2 Ichthyofauna

Six species of fish were documented in the wharf area. Table 30 provides a list of species documented in the Wharf Area.

Table 30: Fishes within the Wharf Area

Scientific Name	Common Name
<i>Aequidens tetramerus</i>	Unknown
<i>Agnoisus brevifilis</i>	Dawala
<i>Crenicichla alta</i>	Sunfish
<i>Hoplias marabalicus</i>	Huri
<i>Pimelodella sp</i>	unknown
<i>Rhamdia holomelas</i>	Kassie

5.6.2.4.2.3 Avifauna

The site is mainly dominated by mixed forest containing wallaba, crabwood, purpleheart and mora trees. Bird species were identified by visual encounter surveys (VES), vocalization (mainly dawn song and sunset flight sessions when species are most active), night spotting and opportunistic sightings. Surveys were done along plots while doing point counts along the way.

A total 46 avifaunal species from 20 families were recorded within the Wharf area. One migrant, *Elanoides forficatus* and one Guianan endemic *Tyrannetes virescens* were observed at the wharf area. Three waterbirds were identified within this area, *Megarynchus pitangua*, *Tachycineta albiventer* and *Atticora fasciata*.

Table 31 lists avifauna species encountered at the Wharf.

Table 31: List of bird species at the Wharf

Family	Scientific Name	Common Name
Cathartidae	<i>Coragyps atratus</i>	Black Vulture
	<i>Cathartes aura</i>	Turkey Vulture
Accipitridae	<i>Elanoides forficatus</i>	Swallow-tailed Kite
Falconidae	<i>Micrastur semitorquatus</i>	Collared Forest-Falcon
	<i>Caracara plancus</i>	Crested caracara
	<i>Milvago chimachima</i>	Yellow-headed caracara
	<i>Herpetotheres cachinnans</i>	Laughing Falcon
	<i>Falco ruficularis</i>	Bat Falcon
Cracidae	<i>Ortalis motmot</i>	Little Chachalaca
Columbidae	<i>Patagonenas cayennensis</i>	Pale-vented pigeon
	<i>Columbina passerine</i>	Common ground dove
Cuculidae	<i>Crotophaga ani</i>	Smoothed-billed Ani
Caprimulgidae	<i>Chordeiles acutipennis</i>	Lesser Nighthawk
	<i>Sterptoprocne zonaris</i>	White-collared Swift
Trochilidae	<i>Amazilia brevirostris</i>	White - chested Emerald
Bucconidae	<i>Chelidoptera tenebrosa</i>	Swallow-wing Puff Bird
Thamnophilidae	<i>Taraba major</i>	Great Antshrike
	<i>Thamnophilus doliatus</i>	Barred Antshrike
Tyrannidae	<i>Elaenia flavogaster</i>	Yellow-bellied Elaenia
	<i>Capseimpis flaveola</i>	Yellow Tyrannulet
	<i>Todirostrum cinereum</i>	Common Tody-Flycatcher
	<i>Megarynchus pitangua</i>	Boat-billed Flycatcher
	<i>Myiozetetes cayanensis</i>	Rusty-margined Flycatcher
	<i>Myiodynastes maculatus</i>	Streaked Flycatcher
	<i>Pitangus sulphuratus</i>	Great Kiskadee

	<i>Tyrannus melancholicus</i>	Tropical Kingbird
Cotingidae	<i>Lipaugus vociferans</i>	Screaming Piha
Pipridae	<i>Neopelma chryscephalum</i>	Saffron-crested Tyrant-Manakin
	<i>Tyrannus virescens</i>	Tiny Tyrant-Manakin
Hirundinidae	<i>Progne tapera</i>	Brown-chested Martin
	<i>Tachycineta albiventer</i>	White-winged Swallow
Troglodytidae	<i>Thryothorus coraya</i>	Coraya Wren
Tharupidae	<i>Tachyphonus luctuosus</i>	White-shouldered Tanager
	<i>Tachyphonus rufus</i>	White-lined Tanager
	<i>Ramphocelus carbo</i>	Silver-beaked Tanager
	<i>Thraupis episcopus</i>	Blue-gray Tanager
	<i>Tanagra Mexicana</i>	Turquoise Tanager
	<i>Thraupis palmarum</i>	Palm Tanager
	<i>Coereba flaveola</i>	Bananaquit
Emberizidae	<i>Volatina jacarina</i>	Blue-black Grassquit
	<i>Sporophila minuta</i>	Ruddy-breasted Seedeater
	<i>Sporophila castaneiventris</i>	Chestnut-bellied Seedeater
Cardinalidae	<i>Salator maximus</i>	Buff-throated Saltator
	<i>Caryothraustes canadensis</i>	Yellow-green Grosbeak
New world Blackbirds	<i>Psarocolius decumanus</i>	Crested Oropendola
	<i>Psarocolius viridis</i>	Green Oropendola

5.6.2.4.2.4 Herptofauna

At the wharf area, two amphibians and four reptilian species were recorded. Table 32 provides a list of herptofauna found at the Wharf.

Table 32: Herptofauna in Wharf Area

Common Name	Scientific Name
Anaconda	<i>Eunectes murinus</i>
Giant gladiator treefrog	<i>Hypsiboas boans</i>
Green Labaria	<i>Bothropsis sp.</i>
Snake	<i>Unknown</i>
Spectacled Caiman	<i>Caiman crocodiles</i>
Werner's Toad	<i>Rhaebo nasicus</i>

5.6.2.4.2.5 Macro-Invertebrates

Species of three invertebrate orders were abundant at the wharf area surveyed. Hymenopterans were especially plentiful at this site. Small numbers of individuals were recorded for eleven orders. The lack of large numbers of invertebrate species is associated with the non flowering phase of trees and persistent dry weather conditions. See Table 33 for list of invertebrate encountered.

Table 33: Macro -invertebrate recorded Wharf Area

Common Name	Family/Order of macro-invertebrate
Ants-leaf cutters, Red ants, army ants, bullet ant	Hymenoptera
Bees and wasps	
Beetles	Coleoptera
Black crabs	Decapoda-Brachyura
Butterfly and moths	Lepidoptera
	Riodiniae - <i>Helicopsis cupido</i>
	<i>Lycaenidae-hairstreak</i> <i>Saterines,</i> <i>Pierella</i>

	<i>hyalinus</i> <i>Heliconius</i> <i>Dismorphia</i> Moths
Millipedes	Diplopoda
Cockroach and mantids	Dictyoptera
Damsel flies Dragon flies (<i>Anax sp</i>)	Odonata
Earwig	Thysanoptera
Fire flies	Lampyridae
Grasshoppers and crickets	Orthoptera
True Bugs	Hemiptera
Hydrometridae	Water threaders
Katydid	Tettigoniidae
Mosquito (<i>Anopheles sp.</i>)	Diptera
Scorpion	Scorpionida
Segmented worms	Annelida (Oligocheta)
Snails (<i>Pomacea sp.</i>)	Mollusca-Gastropoda
Spiders	Aranea
Termites	Isoptera
Tick	Arachnida
True Flies (cow fly)	Diptera
Walking Stick	Plasmida

5.6.2.5 International Listing of Species

Two species were identified within this survey as being globally threatened or endangered by the World Conservation Union (IUCN)'s Red List. These species are the Harpy Eagle, *Harpia harpyja*, and the Giant Otter, *Pteronura brasiliensis*. Further detailed studies are recommended to establish population size and breeding sites for these species within the area.

This survey documented only species identified under CITES Appendix I and II, i.e. some restriction occurs with their trading. The majority of the species identified under CITES were avifauna. Please see Table 22 for a list of species under various international legislations. No local endangered/threatened species list currently exists for Guyana. The Environmental Protection Agency has drafted its Wildlife Regulations, which is under review, and will contain a list of same.

Table 34: Species listed under International Legislations

English Name	Scientific Name	Listing
Harpy Eagle	<i>Harpia harpyja</i>	CITES Appendix I, IUCN Red List: Near Threatened.
Black - necked Aracari	<i>Pteroglossus aracari</i>	CITES Appendix II
Black-headed Parrot	<i>Pionites melanocephala</i>	CITES Appendix II
Blue-and-Yellow Macaw	<i>Ara ararauna</i>	CITES Appendix II
Blue-cheeked Parrot	<i>Amazona dufresniana</i>	CITES Appendix II
Blue-headed Parrot	<i>Pionus menstruus</i>	CITES Appendix II
Channel - billed Toucan	<i>Ramphastos vitellinus</i>	CITES Appendix II
Dusky Parrot	<i>Pionus fuscus</i>	CITES Appendix II

Giant Otter	<i>Pteronura brasiliensis</i>	CITES Appendix I, IUCN Red List: Endangered
Golden-winged Parakeet	<i>Brotogeris chrysopterus</i>	CITES Appendix II
Green Aracari	<i>Pteroglossus viridis</i>	CITES Appendix II
Mealy Parrot	<i>Amazona farinose</i>	CITES Appendix II
Orange-winged Parrot	<i>Amazona amazonica</i>	CITES Appendix II
Painted Parakeet	<i>Pyrrhura picta</i>	CITES Appendix II
Red - billed Toucan	<i>Ramphastos tucanus</i>	CITES Appendix II
Red- and- Green Macaw	<i>Ara chloropterus</i>	CITES Appendix II
Red- fan Parrot	<i>Derophtus accipitrinus</i>	CITES Appendix II
Red-shouldered Macaw	<i>Ara nobilis</i>	CITES Appendix II
Scarlet Macaw	<i>Ara macao</i>	CITES Appendix I
Yellow-crowned Parrot	<i>Amazona ochrocephala</i>	CITES Appendix II

* CITES Appendix I - includes species threatened with extinction. Trade in specimens of these species is permitted only in exceptional circumstances; CITES Appendix II - includes species not necessarily threatened with extinction, but in which trade must be controlled in order to avoid utilization incompatible with their survival.

6.0 DESCRIPTION OF THE SOCIAL ENVIRONMENT

A zone of influence or study area was determined that took into consideration all possible interactions and impacts due to the project even if they are to relatively far away communities. Zone of influence has been thus defined as the physical radius to which the project footprints or impacts may potentially extend.

There were no formal or established communities or settlements in the immediate vicinity of the Aurora mine-site, and very few communities in proximity to associated project components. Hence, due to its remote location, the Aurora Project does not involve the types of direct socio-economic effects characteristic of most mining projects.

Given the lack of communities in the area of direct influence of the project, the social baseline was developed looking at a broader area where possible interactions and impacts of the Project on formal settlements/communities were likely to occur, even if relatively far from the three main Project components. The zone of indirect influence for the socio-economic baseline study was determined using this logic. For example, there are certain towns which are likely to serve as entry points to the Aurora site for project logistics and the transport goods, services and workers. Hence, Itaballi and Bartica were considered to be in the area of indirect influence. Similarly, potentially vulnerable communities, such as the Amerindian community of Kurutuku and the mining community of Aranka, were included, as it was considered appropriate that the Project should consider such communities since employees may be drawn from and benefits may potentially accrue to these communities. The socio-economic baseline study was consequently undertaken to create a profile of these communities.

There are several communities on the Cuyuni River more than 100 km downstream of the proposed mine site including Batavia and several homesteads. The mine site will, however be accessed overland from Buckhall on the Essequibo River. There would consequently be no potential impacts to these communities. These communities have therefore been excluded from the social and cultural baseline considered appropriate for the deliberations of this study.

The socioeconomic baseline was conducted to establish: (i) dominant uses of land and other resources for subsistence and livelihood activities, such as farming, fishing, hunting and mining practices; (ii) presence of infrastructure such as schools, medical facilities, communications network/transport networks and markets; (iii) public health issues in terms of health risks and diseases; (iv) local institutional capabilities; (v) land ownership patterns; (vi) identification and characterization of community cohesion and management; and (vii) identification of existing and proposed development plans for the study area. Consultations and field work was done with the relevant stakeholders to compile the baseline.

To achieve these objectives the following four data collection methods were employed:

- focused consultations with the Ministry of Amerindian Affairs and with non-governmental organizations (Guyana Organization of Indigenous Peoples, Amerindian Peoples Association and The Amerindian Action Movement of Guyana) which represent the interests of indigenous peoples in Guyana;
- review and update of secondary data (reports, legislation, etc.);
- telephone interviews with representatives of the Ministry of Health; and
- visit and consultations with the communities/villages of Aranka, Kurutuku and Itaballi and with residents of Buck Hall.

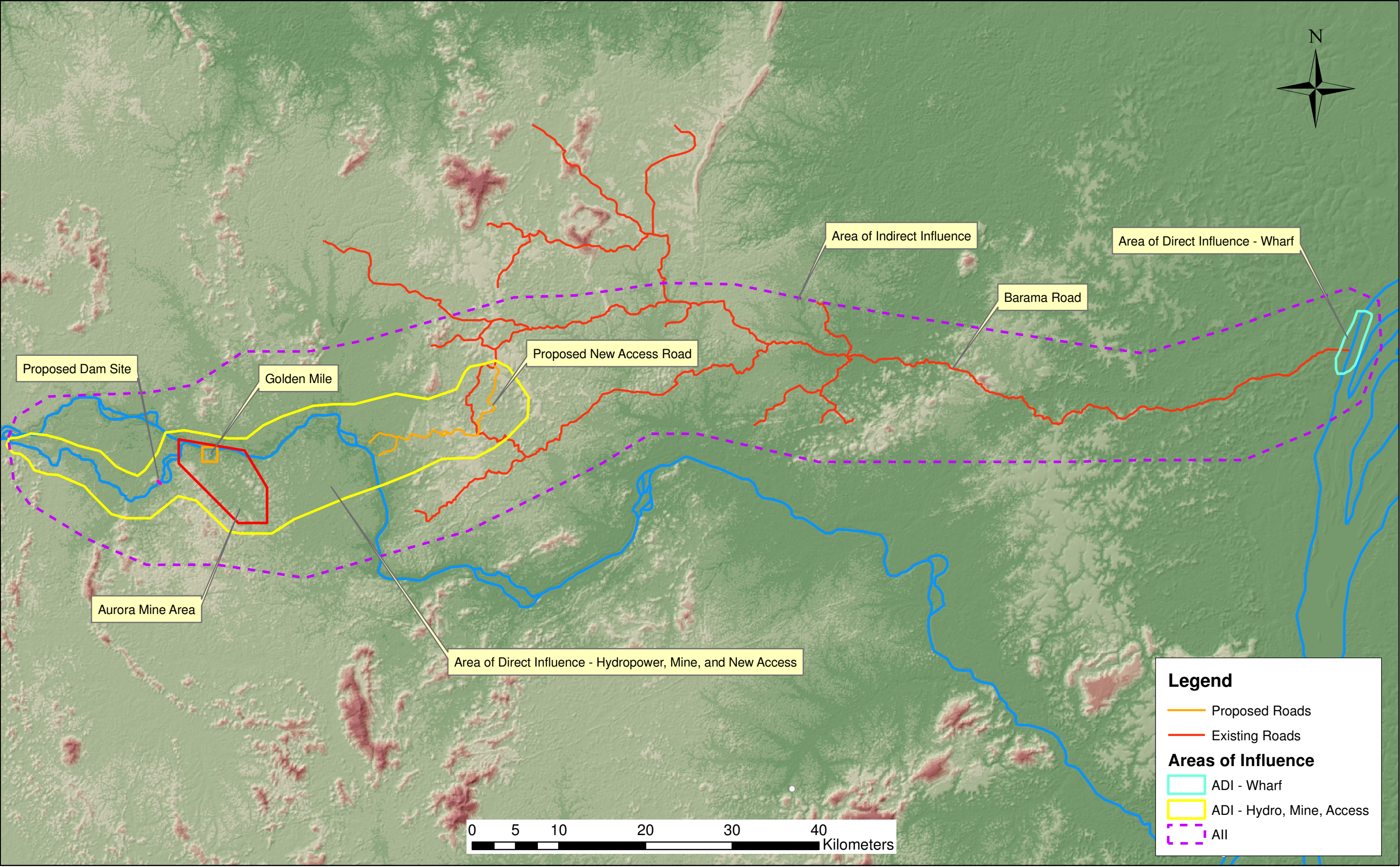
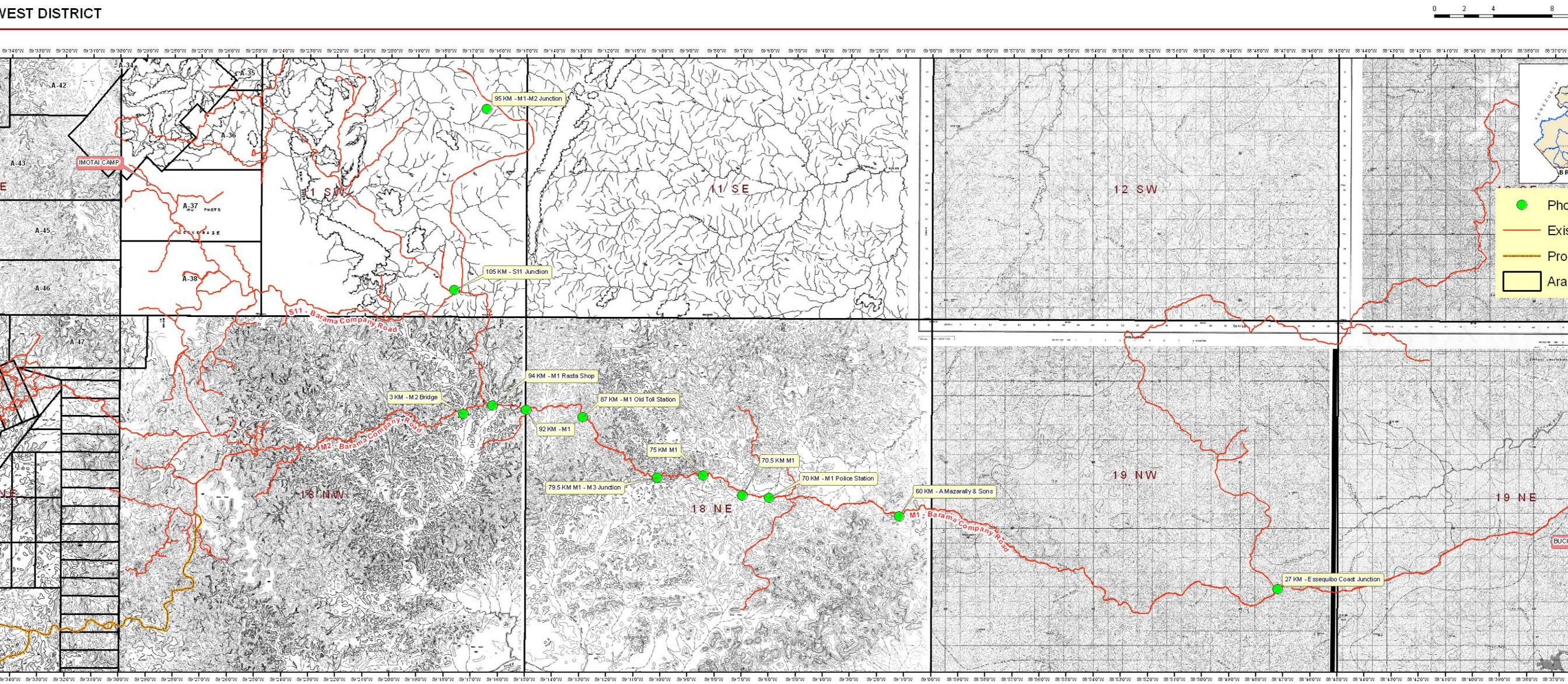


FIGURE 24: AREA OF INFLUENCE

FIGURE 25: ROADS AND POINTS OF INTEREST ON ROADS

STICS - BARAMA COMPANY LOGGING ROADS, APRIL 09

WEST DISTRICT



The Aurora Mining Concession is located within the Cuyuni-Mazaruni, Administrative Region 7. The area of influence considered appropriate for the deliberations of this ESIA is depicted on Figure 24.

6.1 Aurora Project Site

The Project Site is located immediately south of the Cuyuni River at Aurora. There are no established and/or traditional villages within the project area. Employees of GUY are present at the site. Transient miners infrequently pass through the area.

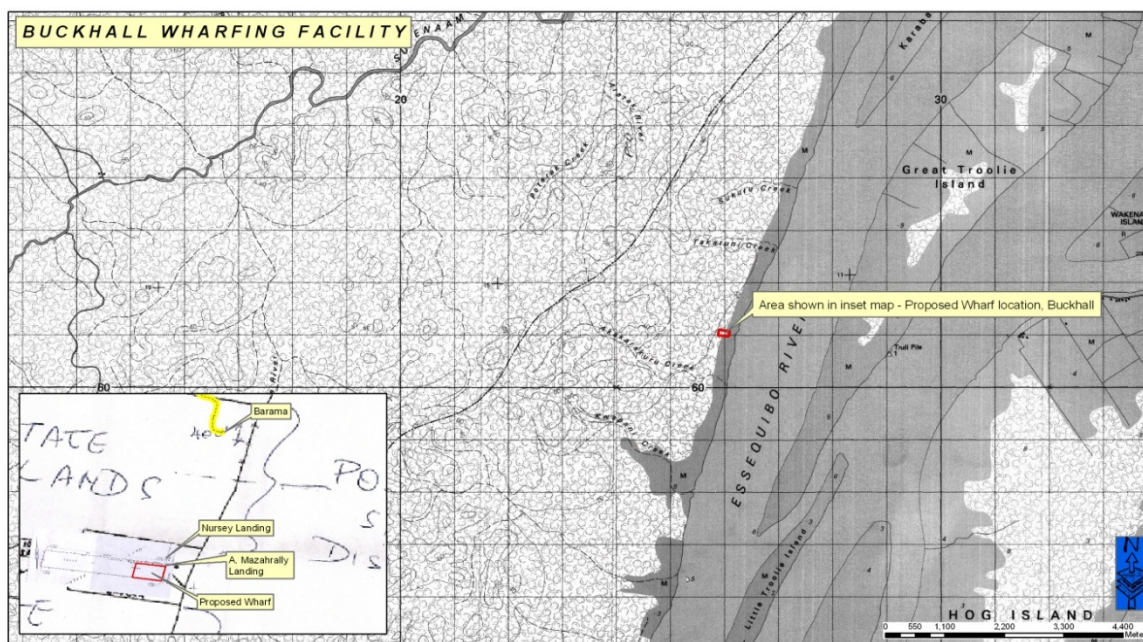
6.2 Access Road and Project Roads

The roads within the project area were constructed during previous mining operations and for exploration activities. The road from Buck Hall, built and operated by Barama Company Limited will connect with a new access road to be built to the mine site. There are no established or traditional villages along either Barama Company Limited road or the access road proposed to link that road to the mine site. There are several transient mining camps on the Barama Company Limited road and a shop which sells basic items. The map below (Figure 25) highlights points of interest along this route, known as M1, the 'Buck Hall Road'.

6.3 Proposed Wharf

Buckhall is located along the Essequibo River. The wharf to be constructed at Buck Hall will serve as a loading/unloading point for cargo to/from the mine site. In the Buck Hall area there are 3, port type structures ('landings'), where boats unload (See Figure 26). The larger landing is known as 'Barama Landing'. The smaller ones are known as 'Nurse Landing' and 'A Mazahrally Landing' respectively. 'Nurse Landing' and 'A. Mazahrally Landing' are utilized by GUY and are near to the proposed wharf.

Figure 26 - Buck Hall Wharf Areas



Source: GUY, Cyprian Moffett, April 2009

The socio-economic baseline section is divided into two parts. The first part provides an overview of Amerindians in Guyana and on Region 7 (Cuyuni-Mazaruni) which is the administrative Region in which the project is located. The second part provides the socio-economic profile of the communities and villages within the project area of influence.

6.4 Amerindians in Guyana

Anthropologists and administrators often classify Amerindians as coastal and interior⁴ tribes. Coastal Amerindians, who inhabit areas in close proximity to the Atlantic Coast and more particularly, the Pomeroon and Corentyne Rivers, are identified as the Carib, Arawak and Warau. Their names originated from three large families of Guyana's Amerindians (World Bank 2001). The seven interior tribes are the Akawaio, Arekuna, Barama River Carib, Makushi, Patamona, Waiwai and Wapisiana. The Barama River Caribs, Akawaio, Arekuna, and Patamona reside in river valleys located in the western part of Guyana.

Amerindians are the fourth largest ethnic group in Guyana and account for 9.2 per cent of the 751,223 persons in Guyana (Guyana Census Report, 2002). Between 1980 and 2002, the Amerindian population grew from 40,343 to 68,819. This represents a significant increase of 70.6 per cent. Approximately 70 percent of the Amerindian population is found in Regions 1, 2, 8 and 9 (Figure 21). Specifically, Amerindians account for more than three-quarters of the populations of Regions 8 and 9 (75.9 and 89.2 percent respectively) and more than two-thirds of the population of Region 1 (62.2 percent). The highest rate of growth occurred in Region 8 (104 %), followed by Region 9 (31%) and Region 1 (27%) (Guyana Census Report, 2002).

Like other indigenous peoples of the Amazon, Amerindians' subsistence lifestyles are based predominantly on agriculture. Amerindian poverty is characterized by high levels of unemployment, low income, lack of local capacity building, poor social infrastructure, lack of or inadequate access to markets, credit facilities, high transportation costs, low educational level and poor nutrition.

The 1999 Guyana Survey of Living Conditions (GSLC) Survey records 78.4 per cent absolute poverty in the rural interior. The extraordinarily high level of poverty found among Amerindian communities is the result of a combination of historical, political, socio-economic and spatial factors (Bynoe, 2005). For example, their geographic isolation; the dispersed settlement pattern and difficult terrain they occupy; the high administrative costs of projects in these areas; lack of technical, human and financial resources; exorbitantly high transportation costs and related effects on accessibility, mobility and markets.

The staple diet of the Amerindians consists of cassava, which supplies carbohydrates. Protein generally comes from fish or meat, which are either hunted or bought from the more successful fishermen or hunters. Sometimes these protein sources have to be bought from interior shops owned by people from the coast (Coastlanders).

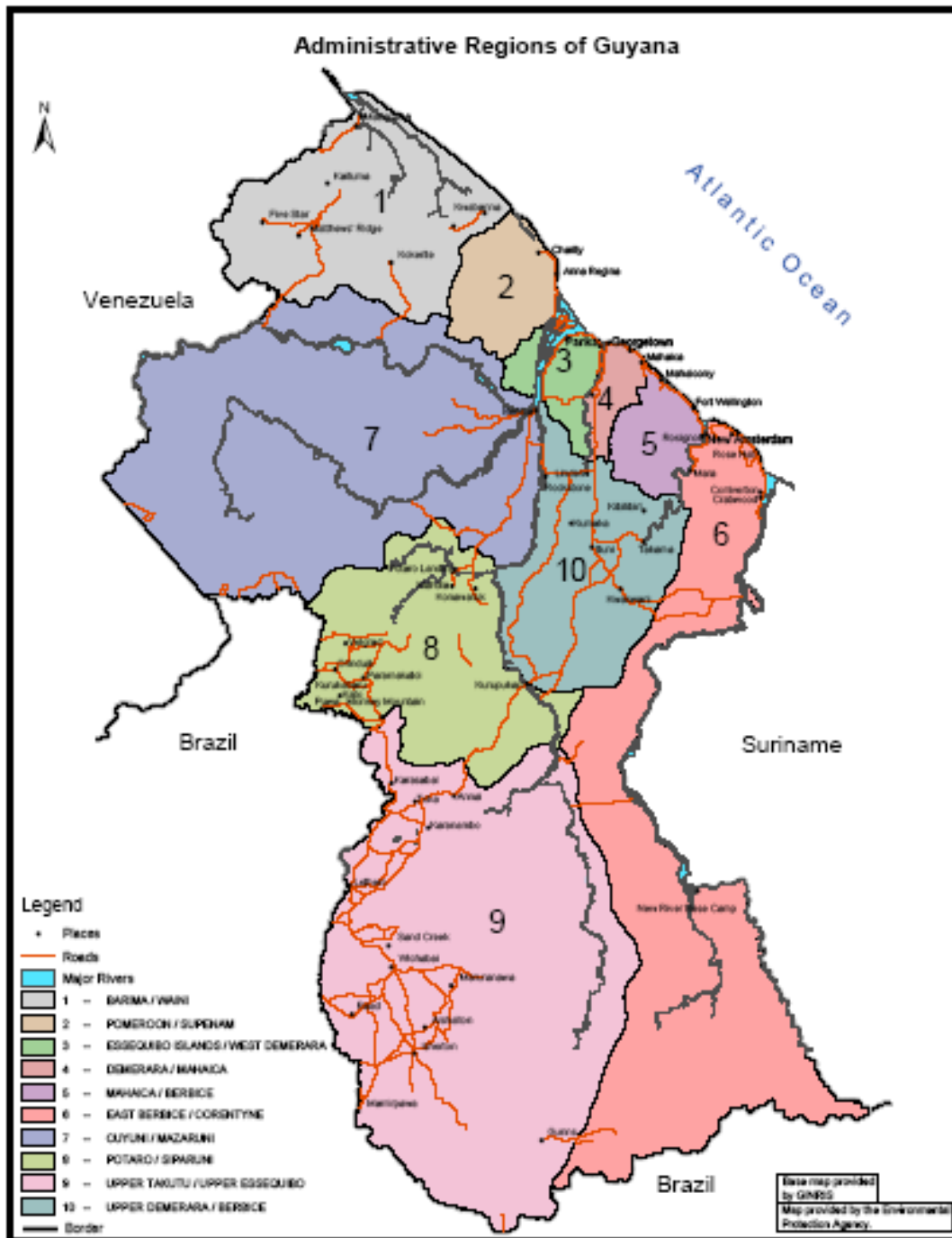
Access to potable water is very limited in the majority of Amerindian communities. Traditional sources of pure water, namely creeks and rivers, have increasingly come under threat of pollution due to the rapid growth of resource extractive industries in the interior beginning from the early 1980s.

6.5 Profile of Region 7 Cuyuni-Mazaruni

Guyana has ten administrative regions (Figure 27). Each of Guyana's ten administrative regions has a Regional Democratic Council (RDC) and a regional chairman. This system of local governments is designed to decentralize government functions and to provide each region with administrative responsibilities to serve the interest of that region. In Region 7, the RDC is located in Bartica, which is not easily accessible by most indigenous communities. As a result, the RDC has three sub-regions; Upper,

⁴ The term tribes are a linguistic and cultural classification.

Figure 27 - Administrative Regions of Guyana



Middle and Lower Mazaruni Sub-regions. The project area of influence straddles the Middle and Lower Mazaruni Sub-regions.

The mine site is located within the Middle Mazaruni Sub-region with a District Administrative Centre located at Kamarang. One of the objectives of the body is to address the problems faced by Amerindians in an organized manner (Colchester, La Rose, and James, 2002). At the local level, Village Councils, as required by law, administer each community.

Amerindian communities are governed by Village Councils made up of Toshias and Councillors. Elections are held every two years, and are supervised by Officers in the Regional Democratic Council. The Amerindian Act (2005) gives elected village officials similar powers to that of their counterparts in the local government structure in non-Amerindian areas. The functions of the Village Council are set out in the Amerindian Act (2005) as:

- a) represent the Community;
- b) act in the best interest of the Community;
- c) provide advice and strategic direction to the Community; hold for the benefit and use of the Community all rights, titles and interests in or over Community lands;
- d) manage and regulate the use and occupation of Community lands;
- e) promote the sustainable use, protection and conservation of Community lands and the resources on those lands;
- f) encourage the preservation and growth of Amerindian culture;
- g) ensure that places and artefacts located which hold sacred or cultural values to the Community are protected and cared for;
- h) protect and preserve the Community's intellectual property and traditional knowledge;
- i) nominate Councillors or other members of the Community to accompany the Toshao to meetings of the Regional Democratic Council, or to attend meetings on behalf of the Community; and
- j) ensure that proper accounts and financial records are kept.

Unfortunately, many Amerindian Councils are plagued with problems of poor record keeping of village finances, royalty payments, as well as law enforcement. The Captain is the only member of the village council, who receives a small stipend from the Government. Most Amerindian leaders have identified the need for leadership and other training as a priority for their development (National Development Strategy 2001-2010). In the words of one representative, *"we need some kind of workshop that would teach us about our rights so that we villagers and the Council can defend ourselves appropriately and make wise decisions in the best interest of our community"*⁵.

General constraints faced by Amerindians include access to land, lack of physical and social infrastructure, income poverty, limited sustainable livelihood alternatives, low literacy level, and lack of capacity to monitor activities taking place adjacent to their communities.

In terms of the social environment, the poverty level is high. This is due to among other factors, high levels of unemployment. Girls drop out of schools at age 13 or 14 and become involved in prostitution. The high level of employment is exacerbated by the influx of Brazilians, who take up jobs in mines within proximity of indigenous communities. There is also a breakdown in the education system since teachers are required to teach more than one class, resulting in some children being left unattended (Renshaw, 2006)⁶.

⁵ Colchester, M. La Rose, J. and James, K. (2002) "Mining and Amerindians," *Final Report of the APA/NSI Project on Exploring Indigenous Perspective on Consultation and Engagement within the Mining Sector in Latin America and the Caribbean*.

⁶ Renshaw, J. (2006) Access to Social services in Guyana. Draft Final Report (Version 2). Commissioned by the IADB under Technical Cooperation GY-T1010.

The most prevalent health risks are related to diarrhoeal-related diseases, malnutrition, HIV/AIDS, dental problems, malaria, gastroenteritis and bronchi-pneumonia. There is one hospital in Bartica⁷ which has modest facilities. Many patients must, consequently travel to Georgetown which is accessible by speedboat or ferry from Parika or by air, from Ogle.

Region 7 is well known for its gold mining activities. The third largest open-pit mine in South America, the Omai Gold Mines, a Canadian Mining entity, was operational until 2005/06 in this region. Gold mining has always been an economic pillar for Guyana, even though Region 7 has seen little of this gold wealth re-distributed in local communities. As such, subsistence farming, fishing, hunting, and employment in logging and mining businesses are the main sources of livelihoods in the Region. Generally, cost of living in this Region is extraordinarily high, and is estimated to be almost one and a half times that on the coast (Guyana Living Standards Survey, 1999). One of the root causes of the high cost of living is the high freight costs associated with the relative geographic isolation of the area, compounded by the difficulty in traversing the terrain. This high cost of living has negatively impacted the availability of government officers (teachers, health workers, nurses, etc.). Most government employees are not adequately compensated to remain for long periods in the area.

“This situation has also affected the Amerindian population. Many men are employed in the mining business, often at times that they should take care for their farms. The burden on the women is extra heavy, and not often the Amerindian families have to supplement their diets with coastal staple-foods (flour, rice, etc.) which are extra-expensive” (UNDP Report, 1999).

Generally, Amerindian subsistence economies are gradually integrated into cash economies through mining and logging activities.

6.6 Demographic and Population Information

The total population of Region seven is approximately 17,597 people (Guyana Census Report, 2002), and accounts for 2.3 per cent of the total population of Guyana. Amerindians⁸ are the fourth largest ethnic group in Guyana and make up about 9.2% of the total Guyanese population. Amerindians account for 41.7 per cent of the Region 7 population.

Between 1980 and 2002, the Amerindian population grew from 40,343 to 68,819. This represents a increase of 70.6 per cent. The population of Region 7 rose modestly by 1.53 per cent between 1980 and 2002. The population density is estimated at 0.4 persons per square kilometer, compared to the national average of approximately 3 to 3.5 persons per square kilometer, which suggests that the land area in Region 7 is sparsely populated (Guyana Census Report, 2002).

Based on information obtained from the Ministry of Amerindian Affairs, there are twenty-three (23) Amerindian communities (mainly Akawaio and Arecuna) in Region 7. These communities are scattered throughout the three sub-regions of Upper, Middle and Lower Mazaruni. The communities are identified in Table 35 below, which provides additional information on the estimated population of each community.

⁷ Bartica is the centre of small-scale and gold and diamond mining.

⁸ The word Amerindian is a contracted form of ‘American Indians’ referring to natives of the entire American continent. (Balkaran, 2002)

Table 35: Amerindian Communities in Region 7

Village	Sub-Region	Population
Arau	Upper Mazaruni	140
Chinoweng	Upper Mazaruni	540
Jawalla	Upper Mazaruni	1200
Kaikan	Upper Mazaruni	296
Kako	Upper Mazaruni	511
Kambaru	Upper Mazaruni	219
Kurutuku	Upper Mazaruni	127
Paruima	Upper Mazaruni	730
Phillipai	Upper Mazaruni	1098
Quebanang	Upper Mazaruni	
Waramadong	Upper Mazaruni	875
Warawatta/Kamarang	Upper Mazaruni	594
Isseneru	Middle Mazaruni	260
Tassarene	Middle Mazaruni	230
Kaburi/72 Miles	Middle Mazaruni	295
Kangaruma/Falls Top	Middle Mazaruni	
Batavia	Lower Mazaruni	132
Dogg Point	Lower Mazaruni	
Falmouth	Lower Mazaruni	
Goshen/Rivers View	Lower Mazaruni	330
Karrau	Lower Mazaruni	276
Kartabo	Lower Mazaruni	
Rockstone	Lower Mazaruni	375

Source: Ministry of Amerindian Affairs 2008

6.7 Health Issues in Region 7

Malaria is the most prevalent disease in Region 7. In 2004, 8,253 cases were reported. Other ailments that are significant in the region are symptoms, signs and abnormal clinical findings (4476 cases); respiratory tract infection (1666 cases); skin disorders (993 cases) acute diarrhoeal diseases (914 cases), hypertension (688), and worm infestation (668). Additionally, 812 accident and injuries cases were recorded.

6.8 Communities in the Area of Influence

The communities in the project area of influence are:

- Wharf Area-Buck Hall which is the entrance point utilized by GUY for transportation of cargo and employees to the site and is the point at which the wharf would be established
- Mine Area- Bartica, Itabali, Aranka and Kurutuku. Bartica has been a major hub for providing services for the interior since the 1880's. It is also the home of the Regional Democratic Council office, responsible for carrying out legislative and community services to Region 7. Itabali located approximately six miles from Bartica on the West Bank of the Mazaruni River, houses a GUY camp. This camp is utilized to house employees of GUY on their way to interior locations. Aranka is located approximately 30 km downstream from the Aurora mine site and contains a large community of transient miners. Kurutuku is the closest Amerindian community to the proposed mine site. It is located approximately 50km upstream from the Aurora camp site.

6.8.1 Buck Hall

Buck Hall is located on the west bank of the Essequibo River. Buck Hall was originally a farming community but the advent of Barama has seen a decrease in the number of individuals engaged in agriculture. According to their website⁹: “Barama Company Limited is a wholly-owned subsidiary of Samling Global Limited established in Guyana since 1991. The company was granted a lowland, mixed tropical forest concession for approximately 1.6 million hectares in the Northwest region of Guyana.”

Barama Company Limited (Barama) operations in Buck Hall commenced in 2002 and consists of a sawmill, an operations department, a log pond, and living quarters for their employees. Barama has developed a network of roads that service the forest concession. The primary road within the network, referred to as M1 is utilized by GUY and others to gain road access to mining and forestry areas further west.

6.8.1.1 Demographic Information

Long term residents in this community have estimated the past population of Buck Hall to have been approximately 150-200 persons. The current population has significantly decreased to about 65-70 persons. The population can be classified as being of mixed-race. There are between 8-10 households in the area close to the landing with approximately 5 persons per household.

6.8.1.2 Economic Activities

Since the reduction in farming activities, residents either work for Barama or are engaged in artisanal mining.

6.8.1.3 Health and Social Issues

Barama provides a health service to the residents of the area but this is only for minor injuries and conditions. For serious medical complications residents have to travel to Parika by boat then by road transportation to the Best Public hospital in Vreed-en-Hoop which is about 75 km away.

There is no governmental school in this area. There is however a primary school (i.e. Troolie Primary) located on Great Troolie Island, that some of the children attend on an infrequent basis. The primary reason for high absenteeism is the distance to the school and the need for a boat to access Grand Troolie Island.

6.8.2 Bartica

Bartica sits on the site of the old “Vryheid” Dutch Plantation that was established in 1678 by the Dutch West India Company. The first permanent structure to be established there in 1829 by the Church Missionary Society to carry out missionary work among the Amerindians housed the Bartica Mission Station. However, due to the soil’s unsuitability for agriculture, the mission moved eastwards for about a mile to a place called Bartica Grove (the current site of Bartica), at the confluence of the Essequibo, Mazaruni and Cuyuni Rivers.

In 1887, the land was repossessed with permission from the Court of Policy to lay the foundation for a future town in the hinterland and several lots were laid out and sold at a public auction. However, it was the rise of the gold industry in the 1880's which really give impetus to the development and growth of Bartica as it was an ideal location in terms of accessibility to the Georgetown, as well as the gold fields and the timber grants. Bartica also served as a major recruitment point for laborers and a number of

⁹ www.baramaguyana.com

service oriented businesses sprang up in the town to cater for the needs of the miners and woodcutters. Finally government departments were established to monitor and control the gold industry.

6.8.2.1 Population

According to the 1991 Population Census, Bartica had 1421 households, with a population of 6908. The average household size was 5. As Figure 28 indicates, Bartica has a very young population, with approximately 50 percent below twenty years old, and about 33 per cent between the ages of twenty and thirty-nine years. In 2002, the population rose by approximately 8 percent to total of 7458 people.

Bartica's population comprises four major ethnic groups, namely, Mixed (59.2%), African/Black (20.4%) East Indian (15.9%) and Amerindian (4.1%) as illustrated in Figure 30. In addition a sizeable portion of Brazilians reside at Bartica and are allowed to operate a number of establishments (shops and restaurants).

In 2002, there were 1664 households of varying sizes, and Bartica thus has an average household size of 5. According to the 2002 census the population remains predominantly young with maximum people being below 20 years of age. In comparison to 1991 there is also seen an increase in the population between ages 40 to 59 which shows almost a 30% increase.

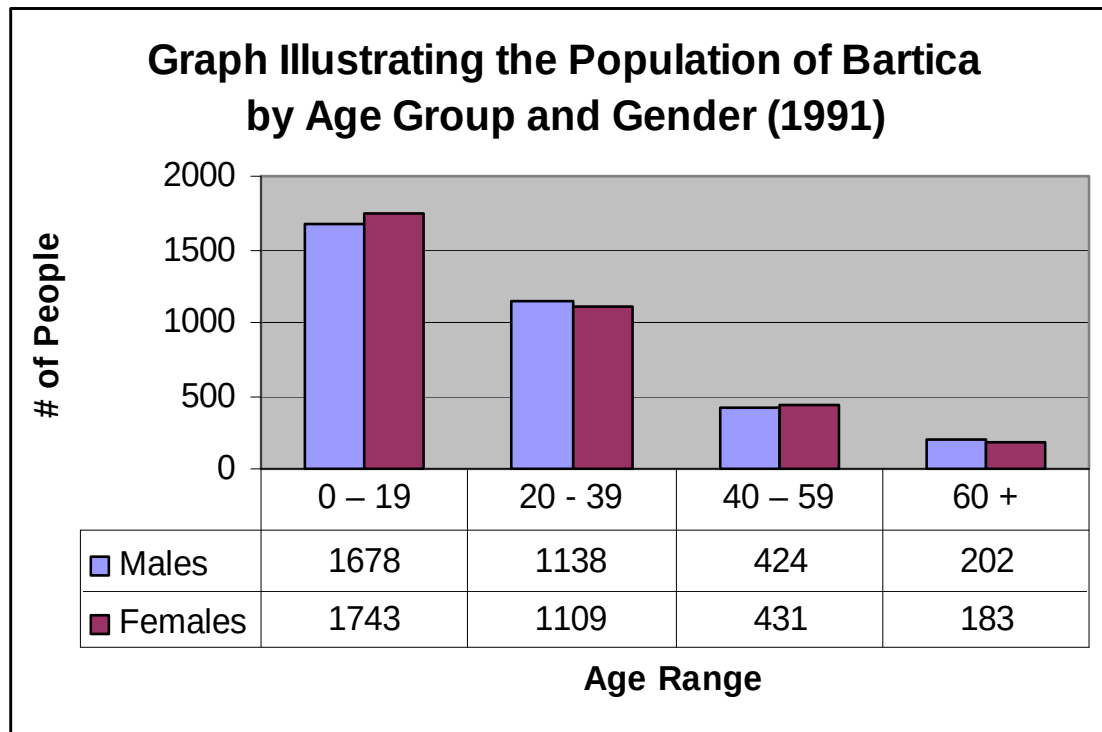


Figure 28 - Population of Bartica

Figure 29 - Bartica Population by Age Group

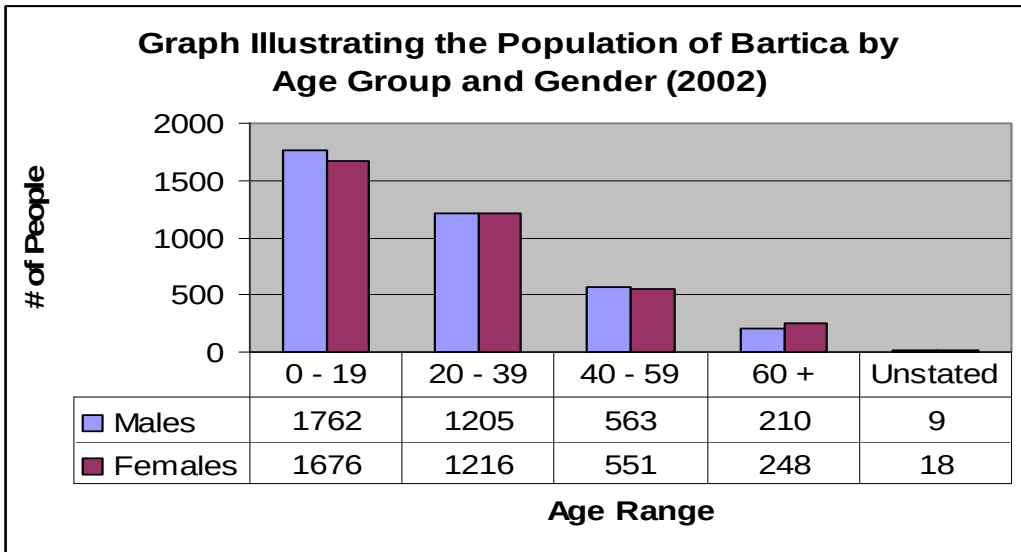
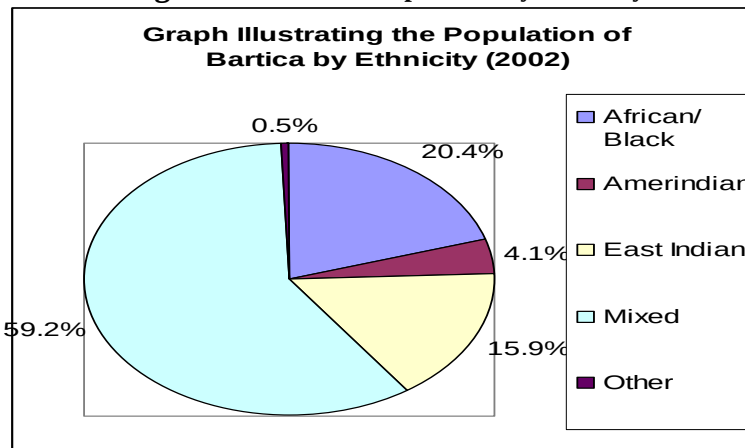


Figure 30 - Bartica Population by Ethnicity



The unemployment rate in Bartica is approximately 7.6 % for males and 15.6 % for females. Figure 31 provides more details.

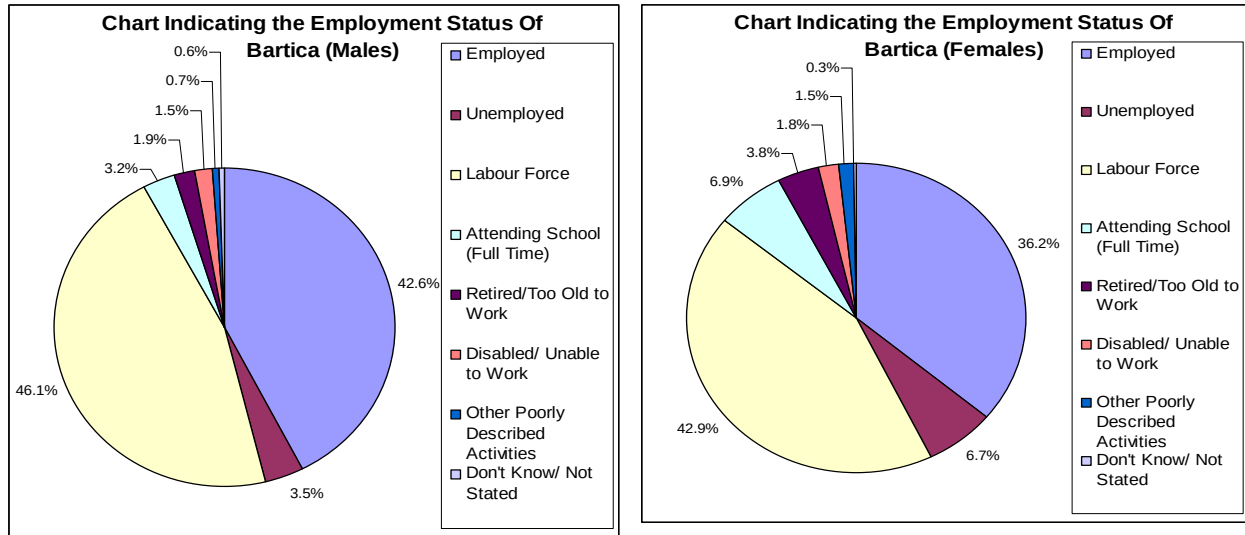
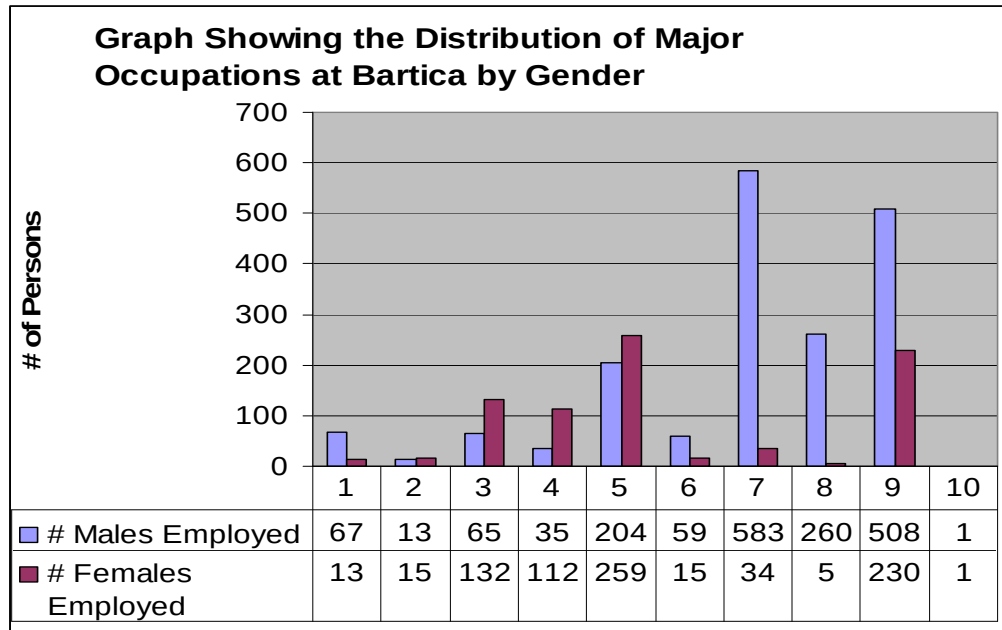


Figure 31 - Employment Levels in Bartica by Gender

6.8.2.2 Economic Activities

The dominant economic activities for males in Bartica are related to craft and related trades, elementary occupation, plant and machine operators and assemblers, and service and market sales workers and shops, respectively. On the other hand, most females are engaged in economic activities in areas such as service and market sales, workers and shops, elementary occupation, technicians and associate professionals, and clerks (Figure 32).

Figure 32 - Distribution of Occupations in Bartica



Occupation Key

Number	Occupation
1	Legislators, Senior Officials & Managers
2	Professionals
3	Technicians & Associate Professionals

4	Clerks
5	Service & Market Sales Workers & Shops
6	Skilled Agricultural & Fishery Workers/Farmers
7	Craft and Related Trades Workers
8	Plant & Machine Operators & Assemblers
9	Elementary Occupation
10	Not Stated

6.8.2.3 Health Issues in Bartica

Figure 33 provides information on ailments and their occurrences in Bartica. It may be inferred that the principal ailments are related to typhoid and paratyphoid fevers, asthma, and sexually transmitted diseases. It is noted that while there was a marked decrease in typhoid and paratyphoid fevers between mid 2003 and 2005, occurrences of asthma and sexually transmitted diseases have increased by at least 400 percent between 2003 and 2005.

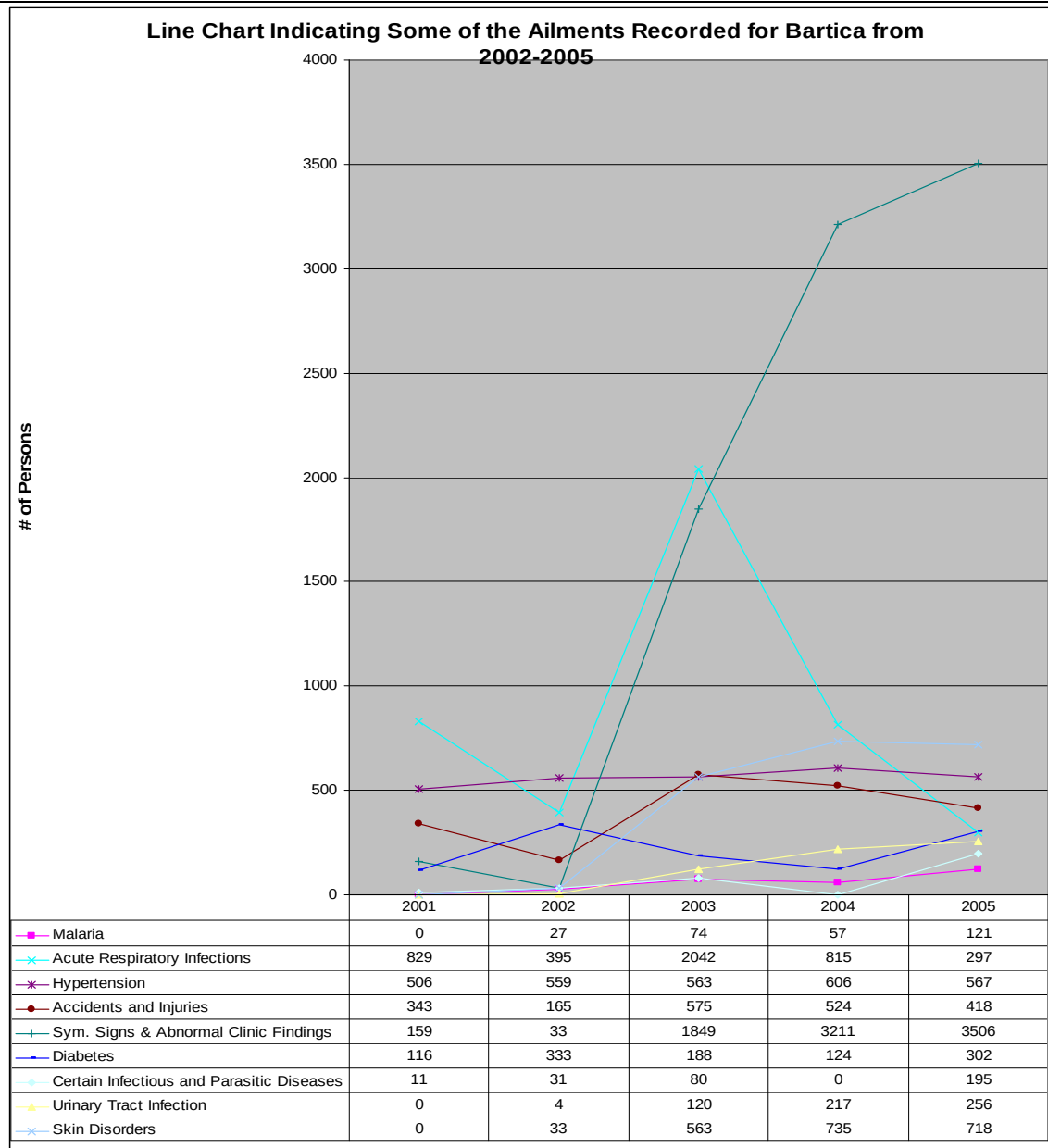


Figure 33 - Health Statistics for Bartica

6.8.2.4 Social Issues¹⁰

Currently, Bartica has the following social amenities:

- one secondary school;
- six primary schools;
- several nursery schools;
- a community centre;
- a police station;
- a library; and

¹⁰ Information provided by Ms. Audrey Jones, Education Officer, Regional Democratic Council)

- a hospital

Others social amenities include:

- a regional transportation workshop;
- the office of the Regional Democratic Council of Region 7;
- two commercial banks; and,
- several places of worship

The Hope Foundation, an HIV/AIDS NGO operates in Bartica and provides education and public awareness on HIV/AIDS and related issues. Bartica has historically been considered as low crime community, with crimes in the area being predominantly petty crimes (for examples, stealing) with few isolated cases of rape and murder. The relative calm was however shattered on the evening of February 16th 2008 when Bartica was invaded by a heavily-armed gang. The invasion resulted in the death of twelve persons, including three policemen. To commemorate this horrific attack, rightly labeled as “the worst tragedy ever in the Bartica community’s history”, by the regional chairman Mr. Knights, the community is seeking assistance to erect a monument to represent the lost lives of the innocent civilians that were victims of this massacre.

Brazilians who reside at Bartica are allowed to operate a number of establishments (shops and restaurants) which promote the use and abuse of alcohol. The Brazilian culture has been adopted by many of the youths of Bartica and this has led to both positive and negative changes in the local culture.

6.8.3 Itaballi

Itaballi is located on the West Bank of the Mazaruni River, approximately six miles from Bartica. It is referred to as the gateway to the mining areas of Guyana. The population is estimated to be 300, accounting for approximately 84 households. (2005/2006). Information documented by Dr. Mark Bynoe¹¹ indicates that in 2004 over 68.9 % of the population of Itaballi were within the age range of 20-39. This has positive implications on the demand for labor in the mining and logging industries operating within proximity of the area. It was estimated that 41% of Dr. Mark Bynoe survey respondents¹² were of mixed descent, approximately 4% were of other, approximately 14% were of Indo-Guyanese descent, and about 31% were of Afro-Guyanese descent. There seems to have been a gradual increase in the population in more recent years and this is likely attributable to the growth of the mining/logging industry in the past few years and the associated development of the area.

Itaballi has the following social infrastructure:

- a community centre;
- a library;
- a primary school;
- a recently constructed health centre/post;
- two churches; and
- a play field and pavilion.

¹¹ Information was obtained from the social assessment aspect of an Environmental and Social Impact Assessment for the Garner Forest Industries Inc. Sustainable Logging Operation in the Cuyuni -Mazaruni District, Guyana conducted in December 2004 by Dr. Mark Bynoe.

¹² Approximately 73 percent (29) of these 40 households in Itaballi were surveyed.

Itaballi has no secondary school, however, children from the community can and have, over the years, accessed secondary education in Bartica. A recently constructed health facility provides the community with basic health services, such as medical supplies, medical checks and testing for hypertension. Malaria smears are sent to be analysed at the Bartica Regional Hospital.

There are a number of shops which cater to the needs of miners. There are also a number of fuel depots which supply fuel to vehicles heading to the interior. In 2003, a security check-point was established at Itaballi with the aim of reducing the high incidence of crime at interior locations. Two officers of the Guyana Police Force and two GGMC mining officers are stationed at the check-point. These officers monitor persons and vehicles entering and leaving the mining district.

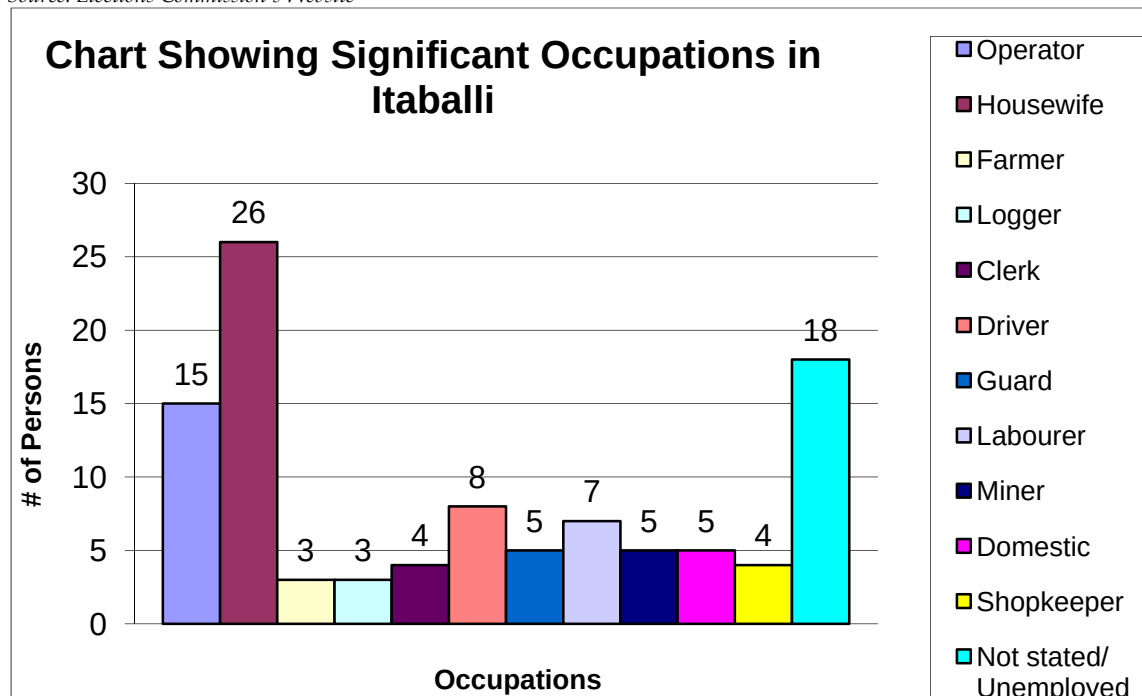
6.8.3.1 Economic Activity

Itaballi is primarily a farming community, with bananas, pears, and ground provisions being the main produce. Subsistence farming appears to be the main non-income household activity, while the major economic activities are gold/diamond mining, shop keeping, logging and farming. Figure 34 indicates that there has been an increase in the number of occupations¹³ not related directly to mining/logging which may perhaps be an indicator of development of the village. Other forms of income generation are:

- Cash crop farming;
- Small scale gold processing;
- Selling timber; and
- Wildlife trappers and sellers

Figure 34 - Occupations in Itaballi

Source: Elections Commission's Website



¹³ This information was obtained from the Elections Commission Web and only applies to persons 18 years and over.

6.8.3.2 Main Social and Environmental Concerns

At a recent forum of multi-stakeholders held in Bartica, residents of Itaballi identified the main social and environmental concerns as:

- high unemployment, especially among young people;
- absence of technical training facilities for youths and limited opportunities for self actualization and improved self esteem;
- poor health care system;
- poor water supply;
- land erosion and destruction of forests and vegetation;
- discrimination among different races/lack of social cohesion;
- drug and alcohol abuse;
- strangers entering the community and being involved in crime;
- a high prevalence of malaria among residents;
- a high incidence of diarrhea, typhoid and vomiting due to unsanitary conditions and the domestic use of contaminated water from nearby rivers, and
- the influence of alcohol in the community where all the shops in the area appeared to market the substance- alcohol has been seen as a major cause of spousal abuse and the lack of social cohesion within homes.

Itaballi has a larger percentage of males to females, due to the nature of employment being mining/logging oriented.

Other concerns which were identified during a visit to Itaballi in April of 2009 were as follows:

- more focus desired on the primary school by the Ministry of Education, due to lack of teachers, overcrowding, and inadequate teaching quarters;
- the expense and difficulty to travel to Bartica for medical emergencies and for children to attend the secondary school;
- need for a public convenience utility as a means to provide outsiders/visitors with a place to relieve themselves rather than in the nearby rivers that the community uses to bathe, cook and drink.

6.8.4 Aranka

Aranka has been a mining community for over 100¹⁴ years. Aranka can be accessed from several points along the Cuyuni River. It is however quite remote and access is mainly by river and tractor/ATV. A boat trip from the Project Site to Aranka takes about 2-3 hours when the water level is high, compared to about 6-7 hours when the water level is low. Since it is not an incorporated village, no official demographic surveys have been conducted for Aranka, however it is estimated that there are approximately 500-1000 persons residing there. Observations and community responses indicate the age of the population is generally lower than 40. The area predominantly consists of Black African-Guyanese (90%), Brazilians 9%, and other ethnicities (1%).

6.8.4.1 Social Infrastructure

The only official sign of infrastructure is the presence of a small Guyana and Geology Mines Commission (GGMC) office. The Guyana Geology and Mines Commission (GGMC) is the lead institution in charge of providing reconnaissance, exploration, prospecting guidelines and mining licenses. Although this office

¹⁴ Cited by a GUY IFC Incentive plan documentation.

is present, the representative for the office is not always on site and a great majority of the artisanal miners in this community do not possess licenses to undertake mining activities.

The remainder of the infrastructure is very basic and consists of a few bars, shops, and an overnight facility. The living conditions are also quite basic and are very similar to that of transient mining camps.

6.8.4.2 Economic Activity

Aranka is a community of transient/artisanal miners which is a male dominated trade. The population is approximately 75% male and 25% female. Very little farming occurs in the community with a few individuals cultivating cash crops and rearing livestock for personal use. Diets are also supplemented by fishing. The majority of people in the community purchase goods and supplies at expensive rates since the goods and supplies are brought in from Georgetown by service workers who bring in supplies to maintain their shops for approximately three months.

The women in Aranka are mostly service workers. They provide goods in shops, food services, laundry services and many participate in the sex trade. Petty trade also exists among the residents of the community.

6.8.4.3 Women in the community

There are very few, if any, traditional households. The women at Aranka indicated that they came from throughout Guyana and remain in Aranka for approximately three month periods. Every woman spoken to, had a child or children, none of whom were in Aranka, primarily due to the lack of security in this community. The women all claimed to be single and fully independent of male companions and expressed some fear over the presence of many firearms and the greater number of men in the community. Services are paid for in gold with monthly incomes ranging between 2-8 oz¹⁵ of gold.

6.8.4.4 Men in the community

The men insisted that there was great thrill in their work, especially in guarding themselves from theft with their firearms and being able to live off the land. The men, like the women, refused to bring their partners or families to the community for fear of the dangerous environment. On average the men claimed that one's monthly income can amount to over \$400,000. However, due to the lack of shops, many of the men complained of the high prices for food and goods in the community.

6.8.4.5 Main Social and Environmental Concerns

Mercury amalgamation is the only beneficiation option exercised by miners. This coupled with discharges to streams in the area may have resulted in some impacts on water quality. The river is however used to bathe and in dire times when rain water collection is reduced, is at times still used as a source of drinking water. This poses a serious health risk to the temporary residents of this community. There also only exists about 10-15 personal latrines within the community.

There is no health post or medics to support this community. If ever a medical emergency occurs, individuals in this community attempt to secure boat transportation to the Aurora mining campsite for assistance. The site medic attempts to tend to their medical needs and when necessary requests an aircraft to transport the individual to Georgetown.

The general concerns expressed by the individuals interviewed are:

¹⁵ 1 oz of gold is estimated at approximately \$124,000 GUY (\$620USD)

- lack of security,
- High risk of HIV/AIDS due to sex trade practices
- lack of potable water
- lack of transport facilities
- high malaria and dengue fever risk
- absence of health post/medic
- high cost of living

6.8.5 Kurutuku Community

Kurutuku is a titled Amerindian community which is located in the Upper Cuyuni River and is approximately 90 miles from Eterinbang, in the Administrative Region # 7. According to the Old Amerindian Act, Kurutuku is a tract of State Land situated on the right bank of the Cuyuni River, commencing at the mouth of Otomung River, right bank of Cuyuni River, thence up to the Otomung River for four miles, thence northwest for five miles, thence north east to the mouth of Otomung River, the point of commencement.” Its closest neighbour is San Martin, Venezuela. Currently, the community is accessed directly (only) by water transportation. The mining concession at Aurora is located approximately 53 km away from and downstream of the community.

Kurutuku was established in 1966 after the Guyana Defence Force had constructed an airstrip in Kurutuku. After some time, a Priest of the Bartica Anglican Church visited Bamboo Landing, or what is referred to as “Old Kurutuku”, and established a church in that area. In the past, many residents of Old Kurutuku depended mainly on subsistence farming as their livelihoods. However, the rocky soil in the area was not conducive for farming; thus, many households migrated due to difficult socio-economic circumstances. Consequently, a community was formed five (5) miles from Old Kurutuku, and in close proximity to the airstrip. This community is known today as Kurutuku.

Kurukutu was once a community with potential to expand and improve the quality of life of residents. In fact, the land was more fertile and conducive to farming activities, and the presence of the airstrip provided a good opportunity for trading activities. The area was also once renowned for its mineral wealth and the associated establishment of several small businesses. However, the Regional Democratic Council closed the trading operation due to alleged drug trafficking activities taking place between Guyana and Venezuela. That decision significantly affected the Kurutuku community: mining operations ceased and small businesses closed and residents gradually migrated to Venezuela in search of employment opportunities¹⁶. Consequently, many skilled persons, including the health workers, teachers and others took up residence in Venezuela, leaving only a few to remain in Kurutuku.

6.8.5.1 Demographic Features

Data derived from the 2002 Guyana Census indicates that there are about 120 persons and 25 households in Kurutuku. Of this total, 110 are Amerindians¹⁷, 7 are mixed, while 3 did not state their ethnicity. There are 66 males and 54 females. Households sizes vary, with the majority (10) having 4 to 6 persons and (6) 2-4 persons. Table 36 provides more details.

¹⁶ Information obtained from SIMAP.

¹⁷ Akawaio are the dominant tribe, while the Arekunas are the minority in Kurutuku.

Table 36: Household Size Group – Kurutuku

Source: Bureau of Statistics

Size	Frequency (Number of households)
1 person	3
2-3 persons	6
4-6 persons	10
7-9 persons	4
10-14 persons	2
Total	25

The most recent figures made public by the Ministry of Amerindian Affairs (2005) indicates that Kurutuku has a population of 127 persons.

6.8.5.2 Dominant uses of land and Livelihood Activities

Currently, members of the Kurutuku community are involved in subsistence activities (farming, fishing and hunting), in addition to forestry, artisanal gold mining and land dredging for gold mining operations. Farms are located between one and two miles from residences and are accessed by water and canoe. Produce from the farms range from ground provisions to an assortment of fruits and vegetables, and account for the staple diet of residents. Main crops grown on the farms are yam, sweet cassava, sugarcane, watermelon, pumpkin, sweet potato, eddo, banana and papaw. Basic and elementary agricultural implements such as cutlasses, shovels and forks are used to prepare the land. In cases where the land is unable to support a growing crop, shifting cultivation is practiced.

Fishing activities occur mainly at Powis Falls and Stop-off Falls and on rivers and creeks within proximity of the village and sometimes as far away as Devils Hole in the Cuyuni River. Fishes caught include bum bum, blinker, pacu, basha, kuma kuma, skeet, piranhas, hiamara, dawala, maripac and lou lou.

Hunting is done once a week using traditional arrow and bow or a shotgun. Hunting grounds are in the areas surrounding the village, in hilly areas on the south bank of the Cuyuni River, along creeks such as the Arenasi, and Takutu, as well as on the trail to Barama. Animals hunted include the forest deer, agouti, acouri, hog, white-lipped peccary, collared peccary, labba, wild cow, capybara, powis, marudi, mam and yacy. Birds are also trapped in areas around the village by the residents for food.

Some residents of the community are involved in gold mining operations. Gold mining is done mainly in the North West District, about 65 miles from the village. This two-day journey is completed on foot at least once a year. A metal detector is used to prospect for gold. Those who are unable to acquire this device, seek employment with other miners.

6.8.5.3 Utilization of Aurora Concession area

The Cuyuni River is used to access areas both upstream and downstream of the village. The downstream areas are accessible only during the high water periods. During these periods villagers, may from time to time stop at the Aurora Project Site to seek assistance or to spend the night.

6.8.5.4 Infrastructure

Children of Kurutuku are unable to access any formal education, even though a school building has been in place for almost 13 years. This is due to an absence of teachers within the community and the unwillingness of teachers outside of Kurutuku to go into the area due to the absence of appropriate accommodation. This has resulted in the lack of basic literacy and numeracy skills among residents. The situation may be rectified soon with the recently completed construction of a teachers' living quarters. Discussions with the Regional Education Officer of Region 7 had indicated that instructions at Kurutuku

Primary School will commence sometime during the first quarter of 2007 since teachers must be identified to serve the community and this is proving to be a very difficult task since residents of the village do not possess the required qualifications to function in that capacity and other individuals are reluctant to move to the area. More recent information from the same source (Regional Democratic Office of Region 7) revealed that the Kurutuku Primary School is still not functioning due to the lack of staff, as identifying teachers to serve the local community has proved to be a very difficult task.

There is currently a health post in the village, but no health worker is attached to the village. Health workers from Kaikan or Arau visit the village periodically. The community owns a radio set; however, it is sometimes difficult to get signals in and out of Georgetown. Residents use pit latrines and have no access to potable water or electricity.

6.8.5.5 Public Health

The major health issues in Kurutuku replicate those of Region 7 and include malaria, water borne diseases such as diarrhoea, gastroenteritis, and typhoid. Others include tuberculosis, worm infestation, and anaemia. The primary current health threat is increased occurrences of HIV/AIDS related to widespread female prostitution in Bartica and on the Venezuela border.

6.8.5.6 Institutional Structure

Kurutuku, as in the case of other Amerindian communities, is managed by a Village Council (Kurutuku Village Council) made up of a Toshao and a number of Councillors. Elections are held every two years, and are supervised by Officers of the Regional Democratic Council. Kurutuku is a titled community; hence communal ownership of the resources. All decisions concerning the utilization of resources must be made by the Village Council which has legal jurisdiction to govern all the 'affairs' of the community.

6.8.5.7 Land ownership patterns

In the early 1960's Amerindians should be granted, legal ownership "or rights of occupancy over areas and reservations or parts thereof where any tribe or community of Amerindians is now ordinarily resident or settled and other legal rights, such as rights of passage, in respect of any other lands where they now by tradition or custom de facto enjoy freedoms and permissions corresponding to rights of that nature. In this context it is intended that legal ownership shall comprise all rights normally attaching to such ownership."¹⁸

Today, Amerindians hold land collectively, although individual/family parcels are identified and generally accepted at the community level. In some communities, the Village Council has identified parcels for activities such as housing, farming, etc. As mentioned earlier in this Report, Kurutuku is a titled community; hence the communal ownership of the resources. All decisions concerning the utilization of resources must be made by the Village Council that has legal jurisdiction to govern all the 'affairs' of the community. Specifically, as a private landowner, the Village Council, subject to the approval of the Community, has the right to lease areas of its lands for the benefit of the Community. The Government of Guyana has adopted an approach to move to the second stage of issuing titles to Amerindian communities, that is, to have the lands surveyed and to demarcate the boundaries.

6.8.5.8 Principal Social Issues

The principal social issues facing residents of Kurutuku community and articulated by the Ministry of Amerindian Affairs and the Amerindian NGOs are:

¹⁸ British Guiana Independence Conference Report 1965

- Malaria Smears take a long time to confirm disease.
- Lack of employment which results in residents opting to migrate away from area as a survival strategy.
- Migration affects households' and families' structure, as well as community social cohesion.
- Lack of education due to the absence of school teachers. Illiteracy is claimed as being partly responsible for alleged 'exploitation' of Amerindian employees by mining operators and owners of logging concessions.
- Transportation costs associated with exorbitant travel costs make accessibility almost prohibitive.
- Amerindian employees do not maintain steady employment. Information provided by the Ministry of Amerindian Affairs reveal that workers are changed every two (2) months since persons migrate to Venezuela (and may return after a few years), due to the socio-economic realities of Kurutuku.
- Lack of specialized skills among the adult and younger population. The National Development Strategy (2001-2010) notes that only 0.1 percent of the interior population has received post-secondary education; hence the urgent need for upgrading basic skills among the adult population has been identified by indigenous people representatives. Skills training will prepare Amerindians to manage the resource base in their villages, as well as to take fuller advantage of job openings within the developing economy in the Guyana interior.

6.8.5.9 Proposed Plans for Development of Area

Community plans for future development of Kurutuku as indicated in a needs assessment conducted by SIMAP are as follows:

Priority 1: Construction of a teacher's quarter

Priority 2: training of residents to become health workers

Priority 3: Acquisition of a radio set

Priority 4: Acquisition of sewing machines for the women.

6.8.6 Communication

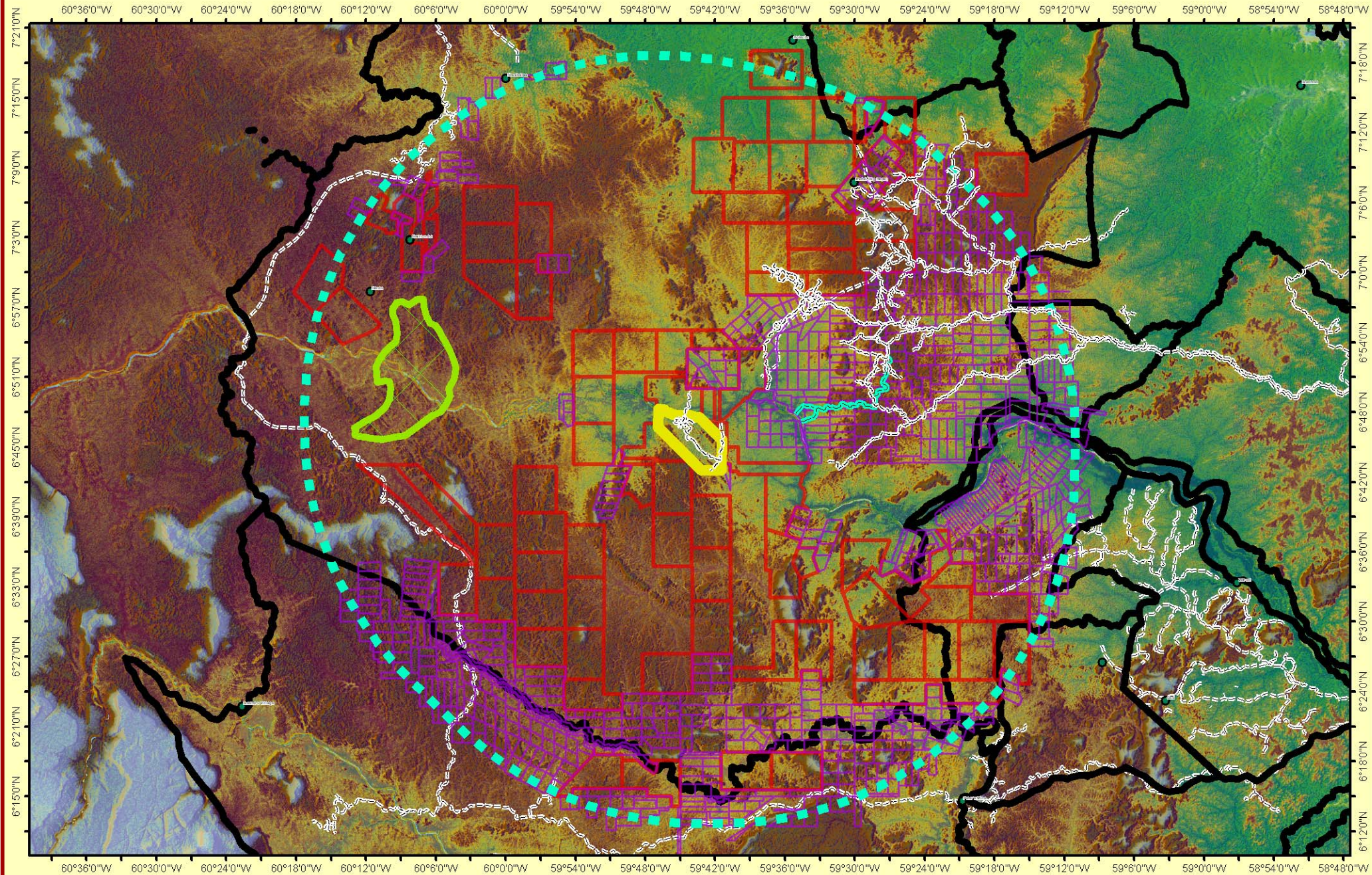
Access to Bartica is via water, air or land. The mine site at Aurora is accessed by water from Bartica or Parika by air from Georgetown/Timehri. During the rainy season the travel time, by water, to the site is approximately 36 hours. In the dry season the travel time by water could be as much as four days.

6.8.7 Utilities

There is no public utility service in the mine site area. The Guyana Power and Light Company (GPL) provide electricity to the residents of Bartica which is the administrative capital of the region. Telephone and other wireless communication services are provided by Guyana Telephone and Telegraph Company to residents of Bartica.

6.8.8 Land Use

Guyana does not have a country wide land use plan. A land use map for an area encompassing the proposed mine site and extending for approximately 50 km around the site is depicted as Figure 35. The map indicates that the entire area within 50 km of the mine site in all directions, with the exception of the Titled Amerindian community of Kurutuku, has been allocated to mining and/or timber operations. The area is therefore classifiable as mining and forestry lands.

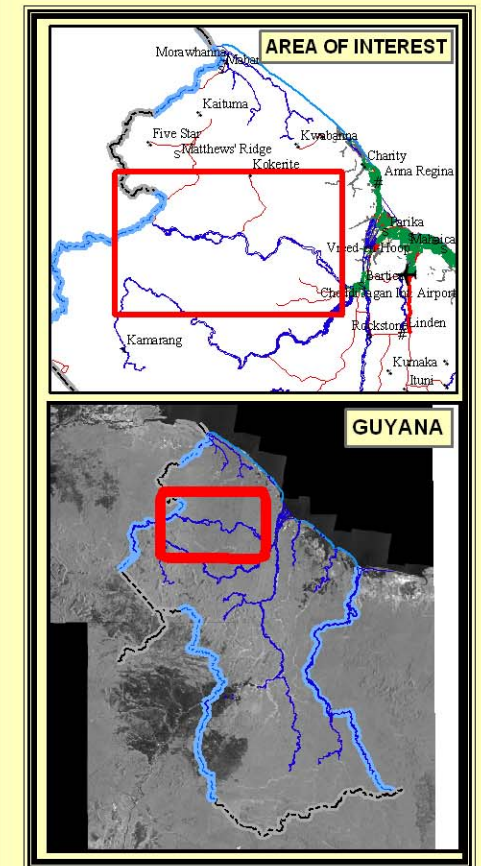
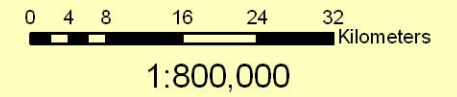


- Populated place/village/town
- Road Network
- 35 mile buffer
- Aurora Property Location
- Medium Scale Mining Properties
- Large Scale Mining Properties
- Forestry Allocations
- Kurutuku Amerindian Reservation

LANDUSE MAP

Ground Structures Engineering Consultants

Note: Road network was compiled from several data sources (GGMC, GFC, GL & SC). This map in no way seeks to indicate road conditions.



7.0 COMMUNITY CONSULTATIONS

The assessment of the environmental impacts and development of the Environmental and Social Management Plan (ESMP) was guided by the deliberations of a series of consultations with sectoral agencies, Non-Governmental Organizations (NGOs) and members of communities in proximity to the project. Meetings were facilitated by the EPA. The meeting with sectoral agencies and (NGOs) was held at the EPA boardroom. The Public meetings were held at the New Modern Hotel in Bartica. Minutes of both meetings are presented in Appendix D.

The consultation process was initiated with the meeting at the EPA boardroom on April 28, 2009. Present at that meeting were representatives of GUY, ERM, GSEC and AMEC. The sectoral agencies and NGOs represented at that meeting were GGMC, Conservation International (CI), Iwokrama Rainforest Programme (Iwokrama), The National Trust of Guyana, Ministry of Local Government and the Ministry of Health. Representatives of the EPA and the Environmental Assessment Board (EAB) were also present.

The public consultation meeting was held at Bartica on April 29, 2009. Representatives of GUY, ERM, GSEC and AMEC were in attendance together with representatives of the EPA and EAB. This meeting was open to members of the public.

The objective of the meetings was to provide details related to the project to sectoral agencies, Non-Governmental Organizations (NGOs) and members of communities in proximity to the project. Each meeting commenced with a GUY representative detailing the project scope. The GUY representative indicated that GUY has been conducting exploratory works in Guyana since 1996; however, the initial significant find did occur until 2004. The development and operation of the project will consist of construction and operation of an open pit and underground mine at Aurora on the Cuyuni River, construction of an access road to the mine site linked to an existing road built by Barama Timber Limited, construction and operation of a hydropower plant on the Cuyuni River upstream of the mine site and construction and operation of a wharf at Buck Hall on the Essequibo River to service the mine operations. Mining operations are expected to extend over a period of 12 - 15 years.

A representative of GSEC subsequently presented an overview of the ESIA study indicating that the ESIA would be conducted in accordance with the EPA guidelines for the mining sector. In accordance with those guidelines, the ESIA will include a baseline study, an assessment of environmental impacts and an environmental and social impact management plan. The representative went on to identify several of the potential environmental and social impacts associated with the project which were detailed in a draft Terms of Reference document submitted to the EPA.

These presentations were followed by suggestions and comments from representatives of the Sectoral Agencies, NGOs and members of the public. Ms. Karen Livan of the GGMC indicated that they were pleased with the initiative and were looking forward to the learning experience with regard to underground mining. The Commission however, had a number of concerns and/or interests including the contents of the baseline study, highlighting that when these studies are usually conducted, very little information is presented on water quality. She also requested that reports and results be presented on the ore constitution and underground mining which would highlight the technical parameters e.g. tailings treatment and cyanide. She also advised that it would be prudent to include an ongoing monitoring program for the dam to be constructed for the hydropower plant. The GGMC would also like to have plans for closure and progressive reclamation presented in the ESIA, in addition to information on underground mining methods.

Ms. Nadia Madho of the National Trust of Guyana indicated that the Trust was interested in preserving Guyana's natural heritage and should GUY discover any archaeological deposits/historic objects, they should be notified immediately.

Mr. Amarnauth Maraj of the Ministry of Health indicated that appropriate accommodation/housing should be provided for workers with appropriate plans to deal with sewage treatment and disposal. Food handlers should be trained and GUY should identify their sources of water and treatment methods. Mr. Eustace Alexander of CI indicated that CI would like to see the functionality of the area restored or enhanced after mine life. Among the issues CI would like to see addressed in the ESIA are programs for watershed and fire management. He also requested that the baseline studies cover biodiversity of the area and identify any globally important species. He also suggested that the developer should go beyond the EPA and engage NGOs in consultations with regard to environmental management.

Ms. Ann-Marie Ford of Iwokrama indicated that the closure plan was a critical element from their perspective and recommended that a road engineer be contracted to construct the access road. The EAB representative, Ms. Denise Simmons expressed the desire for a detailed baseline study and requested that GUY identify and address alternatives to the project.

The comments and suggestions of respondents at the public meeting in Bartica were similarly sought after presentations by GUY and the Consultants' representative.

Mr. Richard Williams, Deputy Chairman of the Regional Democratic Council of Region 7, explained that the community was negatively impacted by the tailings pond failure and consequent spill at Omai Gold Mines. His expectation was that this project would be undertaken to minimize the likelihood of another spill and its consequent impacts on Bartica and surrounding communities. In addition, historically, developments in Region 7 have benefited Linden. He would like to see measures implemented which will result in benefits going to Bartica.

Mr. Prembishal Persaud, a resident of Bartica, identified several issues and concerns related to the development of the project. Among these issues were the likelihood of the development of conflicts with small scale miners, chemical spills during operation, the utilization of timber cleared for the operations and impacts on water quality, fishes and indigenous and other communities in the project area. He requested that the ESIA examine the management of water-borne diseases and address the issue of displacement of indigenous communities and small scale miners and compensation to these groups. While there was appreciation for the proposed access road, he expressed concerns about tolls being charged for use of the road and the number of Guyanese nationals who would be employed and at what positions.

Mr. Colin Hopkinson of Hopkinson Mining indicated that he has been a miner in the Cuyuni River for many years. He opined that this would be a major development for the area. However, good water quality is essential for the residents on the River. He informed the meeting that he would usually dig wells and treat groundwater for his workers and that GUY should consider doing the same. Mr. Hopkinson also indicated that water from the river is not used for drinking since the river water quality is currently significantly deteriorated. Further, Amerindian communities view this Project as a tremendous opportunity for jobs and skills enhancement. He stated that the main issue is development, however effective measures should be in place to minimize impacts of any development.

Mr. Hopkinson later welcomed the venture and indicated that he has been working in the Cuyuni River for many years and knows that water from the River is not usable for human consumption. Further, there were no Amerindian villages in the area. The airstrip at Aurora, constructed by GUY., has proven very helpful to many small miners and Amerindians residing upstream in cases of medical emergencies. He stressed that OMAI and Aurora are two different situations and that the EPA is on board this time to ensure that everything is done in an environmentally friendly manner. Mr. Hopkinson made the suggestion that a meeting should be held in Aranka, which has already received much help from the Company. The Company facilitated the entire community through its medex and medical centre at Aurora since the Government has not yet set up any medical outposts in Aranka.

Mr. Eustace Prince a resident of the area informed the meeting that the only established Amerindian Community in the area is at Kurutuku which is about 120 miles upstream of Aurora. Mr. Prince recommended that wells be dug for drinking purposes as the river water is already contaminated and reiterated that no Amerindian Communities will be affected.

There are practically no communities located within proximity to any of these project components. There are several communities which however may be affected by the project. These include Kurutuku, Aranka and Buck Hall. Visits were made to these communities during compilation of the social and cultural baseline data. Discussions with residents of these communities did not result in expansion of the issues and concerns beyond those detailed above.

8.0 PHYSICAL ENVIRONMENTAL IMPACTS AND RISKS OF PROPOSED ACTION

This section analyses the potential positive and negative consequences of the construction and operation of the proposed Project and describes the recommended mitigation measures to avoid, minimize, or mitigate potential negative impacts and enhance potential positive effects. The resource-specific impact discussions include the design, construction, operation and closure phases of the Project as well as potential impacts during transitional stages, non-routine events, and impacts due to Project uncertainties.

8.1 IMPACT ASSESSMENT METHODOLOGY

Information on potential impacts from the construction and operation of the Project was obtained from various sources, including consultation with the EPA, the public consultations process, ESIA's for similar projects in Guyana and worldwide; literature, research, and independent modeling and analysis.

To identify potential and assess impacts associated with or resulting from Project activities, the Project team used professional judgment, fieldwork, and desk-top analysis to identify potential impacts and their interactions. The significance of potential impacts that may result from the proposed Project was determined to assist the EPA in preparing recommendations for evaluation of the proposed Project.

The methodology that will be used to identify and assess the potential physical and social impacts of the proposed Project is described in the following sections.

8.1.1 Steps of Impact Assessment

Impact Assessment takes place as follows:

1. Characterize the baseline – the existing conditions before the Project is undertaken and any effects are generated (see Sections 5.0 and 6.0);
2. Identify sources of impacts and the impacts themselves that are generated by any aspect of the Project;
3. Rate impacts before any mitigation (for negative impacts) or enhancement (for positive impacts) is implemented;
4. Recommended mitigation and enhancement measures to address the impact; and
5. Rate impacts after mitigation to produce a “residual” impact rating.

8.1.2 Why a System of Rating Impacts?

It is standard practice in ESIA processes to “rate” potential impacts to:

- Provide a basis for prioritization of impacts to be dealt with;
- Provide a method of assessing the effectiveness of proposed mitigation measures; and
- Provide a scale which shows the level of impact both before and after a proposed mitigation measure has been applied.

For the ESIA, a consistent system for rating impacts will be used in order to apply analytical rigor to the assessment and rating process. It must be remembered, however, that any outcome with regard to reducing major negative impacts or enhancing positive impacts is dependent on the selection, applicability, implementation and effectiveness of mitigation measures for the proposed Project.

Table 37: Severity Criteria: Negative Social/Health and Environmental Impacts

Severity	Negative Social/Health Impacts					Negative Environmental Impacts
	Duration	Geographic Extent	Ability to Adapt	Socio-Cultural Effects	Health Effects	
Low	Short-term < 1 year Low Frequency	Individual/Household	Those affected will be able to adapt to the changes with relative ease, and maintain pre-impact livelihoods, culture, quality of life and health.	Inconvenience but with no consequence on long-term livelihood, culture, quality of life, resources, infrastructure and services.	Event resulting in annoyance, minor injury or illness that does not require hospitalization.	Affects environmental conditions, species and habitats over a short period of time, is localized and reversible.
Medium	Medium-term 1-6 years Medium to Intermittent Frequency	Small Number of Households	Those affected will be able to adapt to the change with some difficulty and, and maintain pre- impact livelihoods, culture, quality of life and health but only with a degree of support.	Primary and secondary impacts on livelihoods, culture, quality of life, resources, infrastructure and services.	Event resulting in moderate injuries or illness, which may require hospitalization.	Affects environmental conditions, species and habitats in short and medium-term. Ecosystem integrity will not be adversely affected in the long-term, but the effect is likely to be significant in the short or medium term to some species or receptors. The area/region may be able to recover through natural regeneration and restoration.
High	Long-term/Irreversible > 6 years Constant Frequency	Large part of/Full settlement	Those affected will not be able to adapt to the changes and maintain pre-impact livelihood.	Widespread and diverse primary and secondary impacts likely to be impossible to reverse or compensate for.	Catastrophic event resulting in loss of life, severe injuries or chronic illness requiring hospitalization.	Affects Environment conditions, species and habitats for the long-term (over the life of the project) may substantially alter the local and regional ecosystem and natural resources, and may affect sustainability. Regeneration to its former state would not occur without intervention. Affects environmental conditions or media over the long-term, has local and regional affects and/or is irreversible.

Table 38: Enhancement Criteria: Positive Social/ Health and Environmental Impacts/Effects

Enhancement	Positive Social/Health Impacts				Positive Environmental Impacts			
	Duration	Extent	Degree of Change	Focus/Sensitivity	Duration	Extent	Degree of Change	Focus/Sensitivity
High Level of enhancement	Benefits will be lasting and sustained over the long-term i.e: > 7 years	Benefits throughout the local community and beyond to State/National Level.	Direct benefits to individuals and communities will provide significant opportunities for leveraging secondary benefits and significantly improving livelihoods for themselves and others.	Benefits will pertain to vulnerable groups and those that would have otherwise been 'losers' as a result of the project.	Benefits will be sustained over the long-term.	Benefits will extend beyond local environment (i.e., linkage of fragmented habitat, e.g., regional corridor)	Direct benefits to species or resources will provide significant opportunities for sustainability.	Benefits will pertain to species, habitats and natural resources that are degraded or are sensitive, rare or in need of protection.
Medium Level of enhancement	Benefits will be felt for a medium period of time (1 to 7 years) or be intermittent over the longer term.	Benefits to many individuals and households in the local community and beyond.	Moderate benefits to individuals and communities which will provide some opportunities for furthering themselves and improving livelihoods.	Benefits will possibly pertain to vulnerable groups and those that would have otherwise been 'losers' as a result of the project.	Benefits will be measurable in the short-term and possibly longer.	Benefits to many species, habitats and natural resources in the local environment and beyond.	Direct benefits to species, habitats and natural resources that may provide some opportunities for sustainability.	Benefits will pertain to species, habitats and natural resources that have some level of degradation, sensitivity or rarity.
Low Level of enhancement	Benefits will be short-term (up to one year).	Benefits to a few individuals and households either in the local area and/or further afield	Some benefits to individuals and communities potentially improving opportunities for furthering themselves and improving livelihoods.	Benefits will not pertain to vulnerable groups and will only benefit those that would have otherwise benefited from the project.	Benefits will be short-term.	Benefits to a few species associated with the habitat and resources in the local environment.	Benefits to a few species, habitats and natural resources that may provide minor opportunities for sustainability.	Benefits will pertain to species, habitats and natural resources that are not sensitive or rare.

8.1.3 Criteria for Rating the Impacts

An impact rating is the product of two elements: (1) the severity of the potential impact and (2) the likelihood of the “event” occurring.

8.1.3.1 Severity and Enhancement Criteria

The severity or enhancement of each impact will be rated using the criteria identified in Tables 37 and 38. Note that colors are used to assist the reader in reviewing the impacts and their relative magnitude.

8.1.3.2 Likelihood Criteria

Likelihood of the event occurring is comprised of the following categories:

- Low likelihood – Extremely rare;
- Medium likelihood – Uncommon; and
- High likelihood – Common.

8.1.4 Determining the Rating

The overall rating of the impacts will be determined by using the following matrix (Table 39). It should be noted that these matrices act as a guide and there may be situations where their rigid application is inappropriate and where stakeholder perceptions and feedback have a significant role to play. For specific impacts where this is the case, the rating is clearly explained in the evaluation of the impact.

Table 39: Rating Matrix

<i>Severity/Enhancement</i>	<i>Likelihood</i>		
	<i>Low</i>	<i>Medium</i>	<i>High</i>
<i>High Level of enhancement</i>	<i>Moderate</i>	<i>Major</i>	<i>Major</i>
<i>Medium Level of enhancement</i>	<i>Minor</i>	<i>Moderate</i>	<i>Major</i>
<i>Low level of enhancement</i>	<i>Insignificant</i>	<i>Minor</i>	<i>Moderate</i>
<i>Low Severity</i>	<i>Insignificant</i>	<i>Minor</i>	<i>Moderate</i>
<i>Medium Severity</i>	<i>Minor</i>	<i>Moderate</i>	<i>Major</i>
<i>High Severity</i>	<i>Moderate</i>	<i>Major</i>	<i>Major</i>

8.2 Physical Resources

8.2.1 Design Impacts

Design activities will include drilling boreholes for the geotechnical and geohydrogeological investigations and conducting topographic surveys of the area to be developed into the mine site. Drilling personnel will access drilling locations by All Terrain Vehicles (ATVs). Minor clearing would be required at the location of drill pads and to establish lines of sight for surveying equipment. Design impacts will consequently be limited to potential impacts on groundwater quality and on terrestrial resources.

The primary potential source of groundwater quality impacts would be direct discharge to groundwater of fuels and oils used by the drill rigs. The rigs are equipped with drip pans to catch any spills of fuels and oils during operations and all boreholes will be cased to isolate the holes from the surrounding geological formation. The design phase will have no impacts on groundwater quality. No mitigation measures would be required

The lines to be cleared for the topographic surveys will be less than 2 m wide. The area cleared will be infinitesimal when compared to the area to be developed into the mine site. The lines will be manually cleared. The lines cleared do not differ ecologically from the surrounding area. Fauna resident in the area

would experience no impacts related to line clearing. The design phase will have no impacts on terrestrial resources. No mitigation measures would be required.

8.2.2 Soils

8.2.2.1 Construction Phase

Potential impacts to soil could result from mine site, wharf, and access road construction (vegetation clearance, landscape grading, and re-contouring to ensure proper drainage), and other construction activities.

Soil erosion and sedimentation could be impacts of vegetation clearance and other construction activities. Significant impacts to soils are expected to occur in steep slope areas and where the soils erosion potential is severe or very severe. Short-term and minor impacts are expected to occur in areas where the soils have a severe or very severe erosion potential and where slopes are not too steep. There are no steep slopes within the proposed Project site. Therefore, the impact of the proposed Project construction on soils would be moderate (low severity; medium likelihood).

The likelihood of soil erosion and sedimentation will be minimized or avoided by the implementation of the following mitigation measures:

- Implementation of best management practices in Storm Water Management Plan for soil erosion, storm water runoff, and sedimentation control (e.g., silt fences);
- Develop channel control structures;
- Develop an Interim Reclamation Plan following clearance activities; and
- Implementation of a long-term Reclamation Plan for disturbed areas.

Potential impacts resulting from the movement of heavy equipment required to support the planned mining and construction activities may impact the soil resources by causing the rutting and compaction of susceptible soils. Given the soils of the Project site, compaction and rutting is not considered a widespread concern, and the impacts to the soil resources are expected to be minor.

Rutting and compaction will be minimized by scheduling the majority of the construction activities, to the extent practicable, to occur in the dry season, by limiting off-road access, and by implementing an awareness education and training program.

The potential for topsoil mixing is present during the construction of roads, access ways, and mine preparation; during landscape grading and re-contouring to ensure proper drainage; and during vegetation clearance and landscape grading. The mixing of the topsoil or surface soil with the subsoil from these activities could result in a loss of soil fertility and the loss of viable seeds present (topsoil seedbank) in the topsoil.

To prevent mixing of soil horizons, the following mitigation measures are will be implemented:

- Segregate topsoil or surface soil from subsurface layers during construction activities;
- Replace topsoil following construction, as applicable;
- Site topsoil storage areas;
- Identify and maintain or salvage topsoil pockets; and
- Replace segregated topsoil as indicated in the Reclamation Plan.

Following these mitigation measures, the impact of the proposed Project on soils would be minor (low severity; medium likelihood).

8.2.2.2 Operation Phase

The primary operational impact of the proposed Project on soils would be increase soil erosion and sedimentation potential. However, following the implementation of best management practices in Storm Water Management Plan for soil erosion, storm water runoff, and sedimentation control (e.g., silt fences, re-vegetation of pad slopes) as described above, the potential impacts to soils would be insignificant (low severity; low likelihood).

8.2.2.3 Closure

Closure will have no impact on soils. No mitigation is required.

8.2.3 Air Quality

8.2.3.1 Mine Site, Access Road and Wharf

8.2.3.1.1 Construction Phase

Construction works will result in emissions of fugitive dust and products of combustion. Fugitive dust emissions would result from land clearing, loading and unloading of trucks, excavation and grading. Dust generated would be a function of construction activities, soil type, moisture content, wind speed, frequency of precipitation, vehicle traffic and vehicle type. Fugitive emissions would be greater during dry periods.

Combustion emissions would result from chainsaw operations and the use of diesel and/or gasoline fired heavy duty equipment. Products of combustion will include: Benzene, PM10, PM2.5, carbon monoxide, NOx, SO2, VOCs – a precursor of ozone and Hydrocarbons. These emissions would be short-term and would be in the area of the vicinity of construction operations only. The impacts to air quality would be moderate (low severity; high likelihood). These impacts will be mitigated by employing the following measures:

- Covering trucks to minimize particulate emission
- Minimizing drop heights from vehicles
- Scheduling land clearing activities to less windy days
- Limiting vehicle speed during construction to a maximum 30 km/hr
- Employing dust suppression technique such as applying water or non-toxic chemicals
- Avoiding open burning of wastes at the construction site
- Maintaining construction equipment according to manufacturer's specifications.

Implementation of the mitigation measures will result in minor impacts (low severity, low likelihood).

8.2.3.2 Open Pit Mining

Operations would generate dust and combustion emissions from:

- Vehicles traversing site roads
- Wind erosion of stockpiles and spoil piles
- The operation of heavy duty equipment

Dust emissions from haul roads would occur over the duration of the operation. The Aurora area is noted for elevated levels of rainfall throughout the year. This would reduce dust emissions during wet periods. The impacts to air quality would therefore be minor (low severity, medium likelihood). These impacts will be mitigated by employing the following measures:

- Covering trucks to minimize particulate emission
- Minimizing drop heights from vehicles
- Limiting vehicle speed to a maximum 30 km/hr
- Employing dust suppression technique such as applying water or non-toxic chemicals
- Maintaining construction equipment according to manufacturer's specifications
- Providing facemasks with dust removal filters
- Conducting periodic medical checks of employees for effects of dust exposure
- Providing goggles and eye wash lotion for dust-induced eye irritation.

Implementation of the mitigation measures will result in minor impacts (low severity, low likelihood).

8.2.3.3 Underground Mining

Drilling, blasting, excavation of underground openings, and loading and unloading of ore carriers and other material handling equipment will generate dust. Dust generated would be a function of soil type and moisture content. Combustion emissions would result from the use of diesel and/or gasoline fired heavy duty equipment. Products of combustion will include: Benzene, PM10, PM2.5, carbon monoxide, NO_x, SO₂, VOCs – a precursor of ozone and Hydrocarbons. These emissions would be in confined spaces, consequently impacts to air quality would be major (high severity; high likelihood).

Impacts on air quality will be mitigated by installation of a ventilation system in the underground mine. The ventilation system will remove smoke from blasting and exhaust gases from diesel-powered machines, and will provide fresh air for the workers. Fresh air will be provided via a downcast fresh-air shaft. High pressure fans at ground surface will extract foul air through the upcast shaft. Ventilation doors will control the underground airflow and will be used to pass fresh air through active work areas. Polluted air, containing emissions from the operation will be collected in a system of exhaust airways and would be channelled back to the ventilation shaft.

Implementation of the mitigation measures will result in minor impacts (low severity, low likelihood).

8.2.3.3.1 Mine Closure

No impacts will be generated after site closure.

8.2.3.4 Access Road and Wharf

8.2.3.4.1 Operation Phase

Operations associated with the Aurora Project will require a substantial supply of electrical energy. It is understood that the onsite power plant will require four 5.8-MW diesel generators for the first five years of operation (five generators will be installed, with one as a back-up). An additional two generators will be added after five years to satisfy power needs for the facility at full operational capacity. The generators will be fueled by heavy fuel oil, and the heat from the exhaust of the generators will be used to preheat the fuel oil to increase combustion efficiencies. Based on these parameters, an air quality screening model was utilized to examine the impacts of the proposed power generating facility. The specifications including physical stack dimensions and exhaust characteristics were estimated based on similar sized diesel generators. It assumed that the exhaust would be combined into a single, 30-meter stack and that the effect of pre-heating the fuel would reduce the exhaust temperature from 767 Kelvin (K) to 460 K. Stack characteristics for the single stack, for both 4 and 6 units, are shown in Table 40.

Table 40: Estimated Stack Parameters for Generators

Description	Height (m)	Inner Diameter (m)	Exhaust Velocity (m/s)	Exhaust Flow (m³/s)	Exhaust Flow (acfm)	Exhaust Temperature (K)	Exhaust Flow (Nm³/s)	Heat Input (MMBTU/hr)
4 Units	30.00	1.568	37.87	73.09	154,869	460.0	40.36	188.40
6 Units	30.00	1.568	56.80	109.64	232,304	460.0	60.54	282.60

The assessment was conducted assuming that the power generation units would comply with the air quality sections of the IFC Environmental, Health, and Safety General Guidelines. In accordance with the general guidelines, it was assumed that the stack would be constructed in accordance with Good International Industry Practice (GIIP) guidelines and would therefore not be subject to aerodynamic downwash from nearby buildings and structures. Emission rates were calculated based on the general guideline recommendations of the IFC Environmental, Health, and Safety General Guidelines. Modeling was conducted for both ends of the ranges of those guidelines. Emissions calculated for SO₂, NO_x, and PM, for both 4 and 6 units and the low and high range of the IFC guidelines, are shown in Table 41.

Table 41: Modeled Emission Rates for Generators

Description	Exhaust Flow (Nm³/s)	Units	PM Low	PM High	NOx Low	NOx High	Units	SO2 Low	SO2 High
4 Units	40.36	Mg/Nm3	50	100	1460	1850	%S	1.50	3.00
		g/s	2.018	4.036	58.93	74.672	g/s	35.96	71.93
6 Units	60.54	Mg/Nm3	50	100	1460	1850	%S	1.50	3.00
		g/s	3.027	6.054	88.395	112.008	g/s	53.95	107.89

Modeling was conducted using the U.S. EPA screening model SCREEN3, which has been used widely in the U.S. as a conservative estimate of the maximum impacts of air pollution sources. Receptors were placed out to 50 km from the mine site, and maximum concentrations were identified for comparison to IFC standards. The IFC general guidelines defer to "...national legislated standards, or in their absence, the current WHO Air Quality Guidelines or other internationally recognized sources". For the purpose of this assessment, modeled impacts were compared to the WHO Air Quality Guidelines; additionally, all PM emissions were assumed to be PM_{2.5}. Due to the remote nature of this facility, no background concentrations were added to the modeled impacts. Additional emissions will come from non-stationary sources such as vehicles, machinery, and portable pumps and generators.

Table 42 presents the results of the modeling and demonstrates that the maximum impacts of the power generating units (4 and 6 units, both low and high emission rates) meet all of the WHO guideline values except for SO₂, 24-hour averages. However, modeled impacts do comply with the SO₂ 24-hour average interim guideline. Compliance with the interim guideline is generally considered acceptable.

Table 42: Model Results-- Emission Rates for Generators

SO₂

Avg. Period	Number of Unit	Description	Model Prediction	WHO Guidelines	WHO Interim Target
1-hr	4	Low	92.4	350	-
		High	184.7		
	6	Low	113.2		
		High	226.4		
24-hr	4	Low	36.9	20	125
		High	73.9		
		Low	45.3		
		High	90.5		

NO₂

Avg. Period	Number of Unit	Description	Model Prediction	WHO Guidelines
1-hr	4	Low	113.5	200
		High	143.8	
	6	Low	139.1	
		High	176.2	
Annual	4	Low	9.1	40
		High	11.5	
		Low	11.1	
		High	14.1	

PM

Avg. Period	Number of Unit	Description	Model Prediction	WHO Guidelines	WHO Interim Target
24-hr	4	Low	2.1	50	25
		High	4.1		
	6	Low	2.5		
		High	5.1		
Annual	4	Low	0.4	20	10
		High	0.8		
		Low	0.5		
		High	1.0		

Dust would be emitted from the access road surface and from unsurfaced areas within the port facility during operation. Equipment traversing the road will emit products of combustion emission. Equipment passage over the access road will be intermittent. The impacts to air quality would therefore be minor (low severity, medium likelihood). These impacts will be mitigated by employing the following measures:

- Limiting vehicle speed
- Employing dust suppression techniques
- Maintaining equipment in accordance with manufacturer's specifications
- Providing facemasks with dust removal filters.

Implementation of the mitigation measures will result in minor impacts (low severity, low likelihood).

8.2.3.4.2 Closure

No impacts will be generated after site closure.

8.2.4 Geology

8.2.4.1 Mine site

8.2.4.1.1 Construction Phase

Construction works will entail the construction of site facilities such as the access road, haul roads and airstrip, clearing and grubbing the construction camp location, construction of the fuel and lubricant containment and storage areas, setup and operation of a portable sawmill with planer and jointing capabilities, installation of sewer, water and power services, construction of site accommodation, kitchen and office construction and buildings and shelter for minor repair and maintenance, power generators, water pumps, storage lockups.

Surficial soils will be removed over that area of the site which has been identified for the above facilities. Removal of the surficial soils will result in insignificant impacts (low severity, high likelihood). No mitigation would be needed. Construction activities will not require excavation to the excessive depths which would alter the geology of the area. Construction work will consequently have no impacts on the geology of the area.

8.2.4.1.2 Operation Phase

During the operation phase, mines will be excavated to depths of approximately 150 m and a large area would be excavated for the water management pond. A tailings pond for process residuals, together with ore stockpiles and overburden spoil piles will be provided. The mine shaft and several adits will be excavated during the operation phase.

During mining, soil and rock would be excavated from the mine pit area. The present geologic profile of the area consists of a stratum of unconsolidated silty sandy clay soils overlying rock in the area to be mined. Mining will not segregate soils based on the depths at which these soils are encountered when the overburden material is disposed in the spoil piles. Mining and spoil disposal will result in an alteration of the stratification of the unconsolidated soils at the site. These are major impacts (low severity, high likelihood), however these impacts would be localized to the mine site.

Several pits will be created by the excavation operation. Spoil disposal and ore stockpiles may result in filling of depressed areas and creation of elevated areas. The pits, spoil and ore stockpiles will alter the topography, slope relief intensity, degree of shaping and exposure of the area. These are major impacts (low severity, high likelihood), however, these impacts would be localized to the mine site.

8.2.4.2 Underground Mining

Excavation for various elements of the underground mine will create openings in the subsurface. These openings will alter the stress and strain distribution in the rock and can potentially lead to collapse and ground subsidence. If structures are located in the area subject to ground subsidence, these structures may suffer structural damage. In addition, subsidence-induced tilt, curvature, thrust, stretch and/or compression of the ground surface may alter the direction and flow in watercourses such as the streams and creeks in the project area. These are moderate impacts (high severity, medium likelihood). These impacts would be mitigated by progressing backfilling the stopes as mining extends from the lower to upper level and by employing well-planned and controlled extraction techniques. Implementation of the mitigation measures will result in minor impacts (low severity, low likelihood).

Excavation and removal of subsurface soil and rock and the replacement of the in situ material by controlled backfill will alter the stratigraphic profile of the area subject to underground mining. This area which will be impacted by changes in the stratigraphic profile is very small in comparison to the overall

project area. This is therefore an insignificant impact (low severity, high likelihood). This impact would not be mitigated.

8.2.4.2.1 Closure

Closure will have no impacts on geology. No mitigation is required.

8.2.4.3 Access Road and Wharf

8.2.4.3.1 Construction Phase

Surficial soils will be removed over the surface of the access road and for construction of facilities to be sited on land for the port. Removal of the surficial soils will result in insignificant impacts (low severity, high likelihood). No mitigation would be needed. Construction activities will not require excavation to the excessive depths which would alter the geology of the area. Construction work will consequently have no impacts on the geology of the area.

8.2.4.3.2 Operation Phase

The passage of traffic over the access and operations at the port will have no impacts on geology. No mitigation is required.

8.2.4.3.3 Closure

There are no impacts on geology associated with closure of the access road and wharf.

8.2.5 Water Resources

8.2.5.1 Surface Water

8.2.5.1.1 Mine Site

8.2.5.1.1.1 Construction Phase

Sediment discharge from cleared areas has the potential to reduce water quality in streams and creeks adjacent to cleared areas. These are moderate impacts (medium severity, medium likelihood). The construction duration is likely to be relatively short. An erosion and sediment control plan (detailed in Section 10) will mitigate potential impacts to water quality from erosion. The mitigation measures will result in minor impacts (low severity, low likelihood).

The clearing of vegetation will reduce interception and may result in increased discharge to streams and creeks around the construction area and increased water levels in these streams and creeks. These are moderate impacts (low severity, high likelihood). The area is isolated from receptors and the construction period would be relatively short. Increased water levels in the streams and creeks are unlikely to exceed typical wet season levels. These impacts will be mitigated by undertaking most of the construction activities, which may result in increases in stormwater runoff, in the dry season. The mitigation measures will result in minor impacts (low severity, low likelihood).

Surface water quality may be negatively impacted during construction by accidental discharges of fuels, oils and grease from construction equipment. The potential for accidentals spills of fuels, oils and grease and the associated contamination of surface waters will be minimized by implementation of a Spill Prevention and Contingency Plan. That Plan details measures which will be implemented to prevent, and if necessary, contain spills of fuels, oils, or other contaminants. Implementation of these mitigation

measures would result in insignificant (low severity; low likelihood) impacts on surface water quality during construction.

8.2.5.1.1.2 Operation Phase

Wastewater during operations will consist of water from mine dewatering and wastewater from the mineral processing circuit. Water from the mine dewatering will only discharge to surface water after passing through the water management pond to ensure the attainment of water quality standards. This water will also be subject to conditions detailed in the Erosion and Sediment Control Plan to minimize sediment discharge to surface water during operations. All water from the processing circuit will be fed to the tailings pond. Excess water from the tailings pond will be fed back to the gravity circuit. Water from mine dewatering and the mineral processing operations will have no impacts on surface water quality.

Water quality may be potentially impacted by wastewater discharges from the onsite sewerage system, domestic wastewater or by stormwater run-off from developed areas such as workshops and other equipment storage and service areas. Discharge of wastewater from these areas to surface water may impair surface water quality by causing changes to its physical, chemical and biological properties.

Potential impacts of discharges from onsite sewerage systems and domestic wastewater will be mitigated by channeling that wastewater to several septic tanks and then through a granular filter bed and by monitoring the “end-of-pipe” water quality before final discharge to surface water. Stormwater runoff from workshops and other equipment storage and service areas will be channeled through several oil-water separators prior to discharge to surface water. The mitigation measures will result in insignificant impacts (low severity, low likelihood).

Surface water quality may be negatively impacted by accidental discharges of fuels, oils and grease from equipment and/or the failure of fuel containment facilities. The potential for accidental spills of fuels, oils and grease and the associated contamination of surface waters will be minimized by implementation of a Spill Prevention and Contingency Plan. That Plan details measures which will be implemented to prevent, and if necessary, contain spills of fuels, oils, or other contaminants. Fuel tanks will be founded on impervious bases and will be located within a bermed enclosure designed to hold 110 percent of the contents of tanks. Stormwater discharge from fuel storage areas will be channeled to an oil-water separator prior to being discharged to surface water. Implementation of these mitigation measures would result in insignificant impacts (low severity; low likelihood) on surface water quality during operation.

Several chemicals including cyanide and lime will be used during mineral processing. Potential negative impacts to surface water will occur in the event of spills of process chemicals. Discharges of cyanide and other chemicals used in the mineral processing operations will result in major impacts (High severity, medium likelihood). These impacts will be mitigated by implementation of Best Management Practices (BMP) during transportation, handling and storage and use of these chemicals during the operations. The details of the BMP proposed for implementation are detailed in Section 10. The utilization of BMP will result in minor impacts (low severity, medium likelihood).

Precipitation may induce leaching of chemicals from spoil piles. In the event of excessive rainfall, waste dumps may become saturated and slope failures may be induced. Storm water discharge from spoil piles containing water-soluble substances or heavy metals and sediment discharge to surface water from slope failures can potentially result in degradation of surface water quality. These are moderate impacts (high severity, low likelihood). All spoil piles will be surrounded by toe drains and perimeter berms to manage discharges of water and sediment. Water from the perimeter drain will be discharged to the water management pond before discharge to surface water. Sediment will be periodically removed from within the perimeter berm and will be placed back into the spoil piles. These mitigation measures will result in insignificant impacts (low severity, low likelihood).

Several streams/creeks currently lie within the footprint of the mines, tailing and water management ponds. Flow in the stream/creek beds downstream of the tailings and water management ponds and mine footprint will be curtailed after these facilities become operational. This will result in significantly reduced flows in stream/creek beds at points downstream from the mine footprint and the tailings and water management ponds. These are major impacts (High severity, high likelihood). These impacts will be mitigated by directing discharge from the water management pond to these stream/creek beds at points downstream of the tailings and water management ponds and mine footprint. Mitigation measures will result in minor impacts (medium severity, low likelihood).

Breaches and overtopping of the tailing pond and/or water management pond will result in major impacts (high severity, medium likelihood) to surface water quality. These impacts will be mitigated by utilization of BMP during design, construction and operation of these facilities. Implementation of BMP will result in moderate impacts (high severity, low likelihood).

Surface water will be initially withdrawn from the Cuyuni River and streams/creeks for mineral processing. This water will however be compensated for by the increased discharges due to site clearing. The withdrawal will result in minor impacts (low severity, low likelihood). As time progresses there would be less need for water withdrawals due to process recycling. No mitigation measures are proposed.

8.2.5.1.1.3 Closure

Acid mine drainage (AMD) from spoil piles, the open pit, underground workings and other areas during the mining operations will negatively impact surface water quality. These are potentially major impacts (high severity, medium likelihood).

A Preliminary Geochemistry Assessment has indicated that the style of mineralization associated with most of the Project generally produces low risk of acid rock drainage and metal leaching (ARD/ML), as the associated pyrite mineralization and carbonate (calcite) alteration is generally confined to the vein structures. This will generally results in non-acidic tailings and waste rock. However, a previous petrographic study has suggested that the primary carbonate present may be siderite. If this is the case there is the potential for ARD/ML to occur from any sulphide-bearing mineralization and waste.

Mineralization at Rory's Knoll is different from the other systems in the Project area, consisting of disseminated pyrite and gold within a carbonate-bearing alteration zone. Typically this type of mineralization/alteration has a greater probability of producing acid-generating waste rock than mesothermal vein-type mineralization. The possibility that the carbonate will not neutralize acid raises this concern.

Assessment of the ARD/ML potential of the proposed waste rock and tailings has been initiated and preliminary results are pending. Impacts of AMD will be mitigated by covering areas with non-AMD potential impervious soils having a minimum thickness of 60 cm. The implementation of the proposed mitigation will result in minor impacts (low severity, low likelihood).

8.2.5.1.2 Access Road

8.2.5.1.2.1 Construction Phase

Access road construction will include placing culverts at several stream crossings. Culverts constructed through the service road will modify the natural flow of surface water and concentrate flows at certain points and may increase the speed of surface water flow. These changes may potentially result in flooding, soil erosion, and increased sediment discharge to other streams in the vicinity of the access road. These are major impacts (high severity, moderate likelihood). These impacts will be mitigated by designing culvert sizes to pass the natural surface water flows. Culverts shall also be lined with grass

and/or, riprap, where necessary. Flow volumes will be determined as part of the hydrological monitoring program to be undertaken during design of the access road. This will result in minor residual impacts (low severity, low likelihood).

Surface water quality may potentially be impacted by discharges to surface water of spilled and leaked chemicals and oils during construction activities. These are moderate impacts (medium severity, medium likelihood). These impact will be mitigated by identifying specific points on the alignment for equipment storage and maintenance. These areas shall have segregated and contained locations with sumps and oil traps. Construction equipment shall be mandated to be provided with leak minimization and drip pans. Chemicals and oils collected from sumps, segregated areas and leak minimization devices will be stored in drums and would be disposed of at off-site locations. The mitigation measures will effectively remove any potential impacts to surface water quality. The residual impacts will consequently be minor (low severity, low likelihood).

Removal of vegetative cover over the access road alignment may potentially increase surface runoff volumes and alter drainage patterns locally in the vicinity of the alignment. These are minor impacts (low severity, high likelihood). These impacts will not be mitigated.

8.2.5.1.2.2 Operation Phase

Surface water quality may potentially be impacted by spills of fuel and other chemicals while being transported to/from the mine site. These are potentially major impacts (high severity, low likelihood). These impacts would be mitigated by implementation of the Spill Contingency Plan (SPC) detailed in Section 10. Implementation of measures in the SPC will result in minor impacts (low severity, low likelihood).

8.2.5.1.2.3 Closure

Closure of the access road will have no impacts on surface water.

8.2.5.1.3 Wharf

8.2.5.1.3.1 Construction Phase

Surface water quality may potentially be impacted by discharges to surface water of sediment from cleared areas and by oils and fuel spilled during construction. These are moderate impacts (medium severity, medium likelihood). These impact will be mitigated by implementation of an Erosion and Sediment Control Plan and by channeling site discharge through an oil-water separator. The mitigation measures will effectively remove any potential impacts to surface water quality. The residual impacts will consequently be minor (low severity, low likelihood).

8.2.5.1.3.2 Operation Phase

Surface water quality may potentially be impacted by spills of fuel and other chemicals being loaded/unloaded at the port. These are potentially major impacts (high severity, low likelihood). These impacts would be mitigated by implementation of the Spill Contingency Plan (SPC) detailed in Section 10. Implementation of measures in the SPC will result in minor impacts (low severity, low likelihood).

Surface water quality may be negatively impacted by accidental discharges of fuels, oils and grease from equipment and/or the failure of fuel containment facilities. The potential for accidentals spills of fuels, oils and grease and the associated contamination of surface waters will be minimized by implementation of a Spill Prevention and Contingency. Implementation of these mitigation measures would result in insignificant impacts (low severity; low likelihood) on surface water quality during operation.

8.2.5.1.3.3 Closure

Fueling facilities will be maintained at the site after closure. Surface water quality may be negatively impacted by accidental discharges of fuels and oils and the failure of fuel containment facilities. The potential for accidental spills of fuels and oils and the associated contamination of surface waters will be minimized by channeling site discharge through an oil-water separator. Implementation of these mitigation measures would result in insignificant impacts (low severity; low likelihood) on surface water quality after closure.

8.2.5.1.4 Modeling results

Two hypothetical accidental spills into the Cuyuni River were modeled to assess the potential impacts of utilizing and storing these materials at the mine site. The two materials evaluated were fuel oil (diesel) and cyanide. The CORMIX model was used to quantify the near-field dilution of the spills, while GEMSS was used for far-field impact assessment. The ambient river condition was set as the mean flow rate of 1000 m³/s for all model simulations.

8.2.5.1.4.1 Fuel Oil Spill

The fuel oil spill was postulated as 200,000 gallons of diesel fuel stored in a tank at the mine site adjacent to the river. The accidental spill scenario assumed that the diesel fuel breached the containment facility and all 200,000 gallons spilled over the bank into the river in one hour. When diesel was modeled as a conservative substance (no decay or evaporation), the CORMIX model of the spill showed that it diluted to approximately 20% of its initial concentration at 100 m from the spill location. At 1 km downstream, the spill diluted to 10%, and at 10 km the spill diluted to less than 1% of its initial concentration. As illustrated in Figure 36, the CORMIX model showed the diesel plume staying on one side of the river, but the CORMIX model employs an idealized, straight river section. In reality, as the plume reaches river bends and cataracts downstream of the spill site, the plume will mix laterally across the entire width of the river.

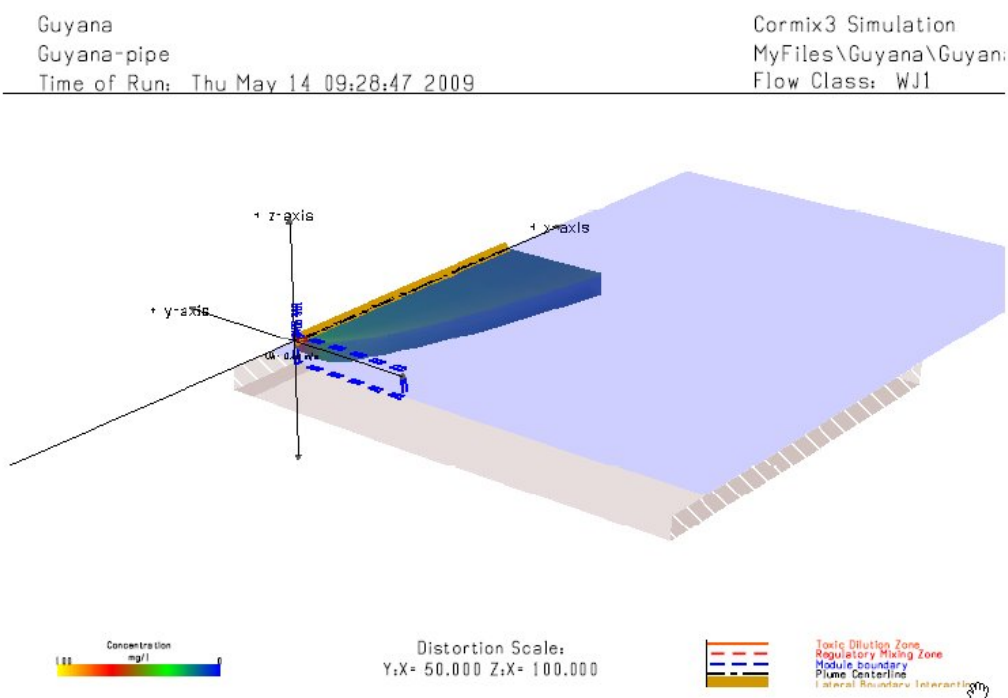


Figure 36 - CORMIX output – dilution factors from hypothetical spill

The GEMSS model of the diesel spill included evaporation and decay of the diesel fuel. Diesel typically evaporates approximately 50% of its mass in one day. As illustrated in Figure 37, the GEMSS model showed that a diesel spill of 200,000 gallons over one hour diluted to a concentration of 0.006 mg/l at a distance 10 km downstream from the spill site, and even lower concentrations further downstream.

A diesel oil spill into the river may have an effect on shorelines (where staining may coat plants or be ingested by wildlife), on the benthos (where sediments may become contaminated and organisms become physically fouled), on the water surface (where birds and sea creatures may become contaminated by contacting the oil), and in the water column (where aquatic organisms may ingest dissolved hydrocarbons causing narcosis in high concentrations and durations of exposure). If the assumed accidental fuel spill occurred, the Cuyuni River would experience concentrations as high as 36 mg/l at the initial spill location and 0.006 mg/l at a location 10 km downstream. At these concentration levels, humans, fish, invertebrates, mammals, and birds in the river may be at risk. These are considered to be Minor Impacts (Medium Severity, Low Likelihood). These impacts will be mitigated by strict adherence to the Environmental Monitoring Plan, specifically to include frequent monitoring of hydrocarbons in the tailings and water management ponds and inspection of fuel storage tanks. The Spill Prevention and Cleanup Control and Emergency Response Plans should include aggressive alerts, education, and clean up activities. In addition, discharges/drainage from these areas would be directed to the tailing and/or water management ponds, if practical or to a separate emergency containment pond. The emergency containment pond will act as a fail safe mechanism and will complement the Best Management Practice (BMP), Environmental Monitoring Plan (EMP) and the Spill Prevention and Clean-up Control and Emergency Response Plans proposed for implementation to mitigate impacts from spills. Application of these mitigation measures to contain and localize potential impacts will result in a rating of Insignificant Impact (Low Severity, Low Likelihood).

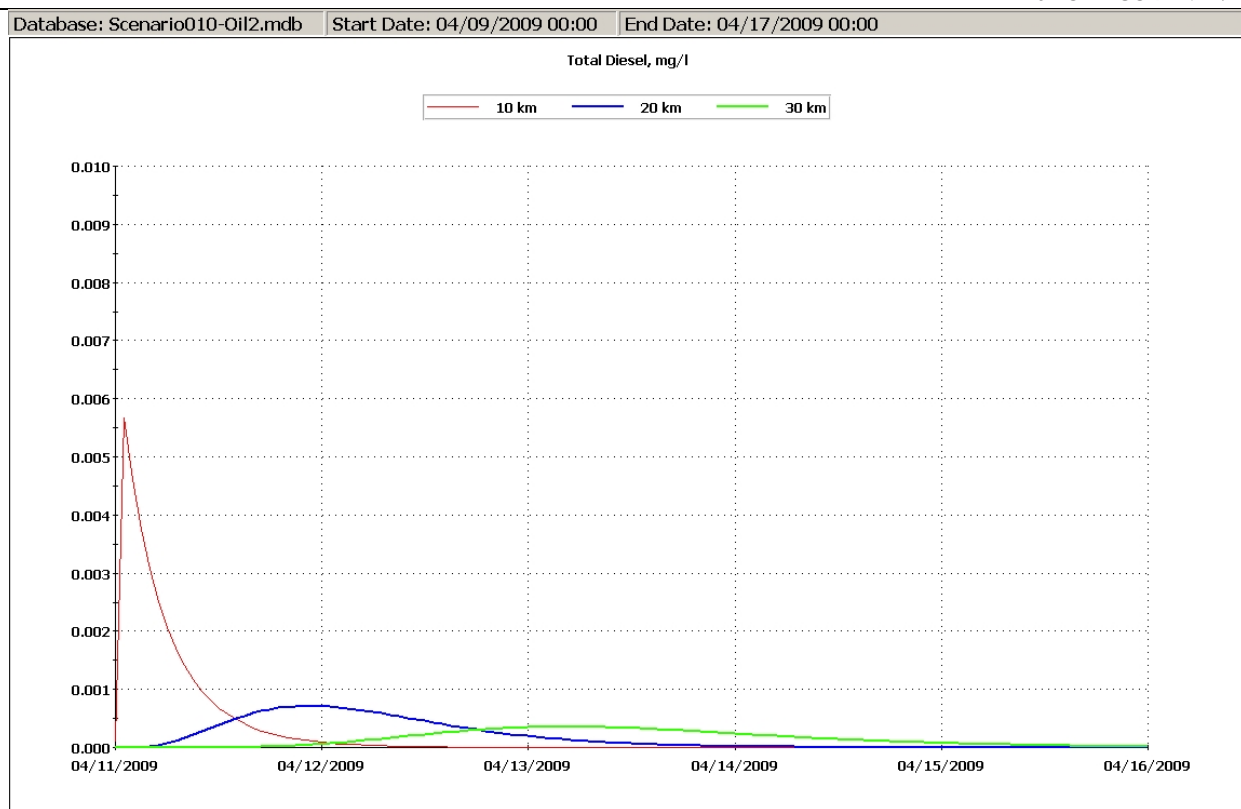


Figure 37 - GEMSS output - concentration of diesel in Cuyuni River downstream of mine site after hypothetical spill of 200,000 gallons

8.2.5.1.4.2 Cyanide Spill

Cyanide has the potential to be present on the mine site at several locations such as in the process tanks, storage tanks, mine tailings pond, and wastewater pond. The worst-case cyanide spill source was postulated as deriving from six 400 m³ vat tanks. Cyanide in the tanks is assumed to have a concentration of 800 mg/l (800,000 ug/l). The accidental spill assumed that the cyanide breached the containment facility and all 2400 m³ of solution spilled into the river in 4 hours. The GEMSS model of cyanide included speciation into free cyanide and a rapid decay rate. The GEMSS model showed that a cyanide spill of 2400 m³ over 4 hours produced a maximum concentration of 0.015 mg/l (15 ug/l) at a location 10 km downstream from the spill site. GEMSS model results of concentrations of free cyanide and hexacyanoferrate for the hypothetical spill over time at a location 10 km downstream of the spill are shown in Figure 38.

Cyanide is acutely toxic to humans. Liquid and gaseous cyanide can enter the body via inhalation, ingestion, or absorption through the skin, especially cut, abraded, or moist skin. Lethal dose standards (50% lethality) provided by the International Cyanide Management Institute are shown in Table 27. Contact with free cyanide at a concentration of 1 mg/l (or 1 part per million or 1000 ug/l) would be lethal to a 100 kg man. Cyanide has low persistence in the environment and does not accumulate or

biomagnify, so chronic exposure to sub-lethal concentrations does not result in acute toxicity. Chronic

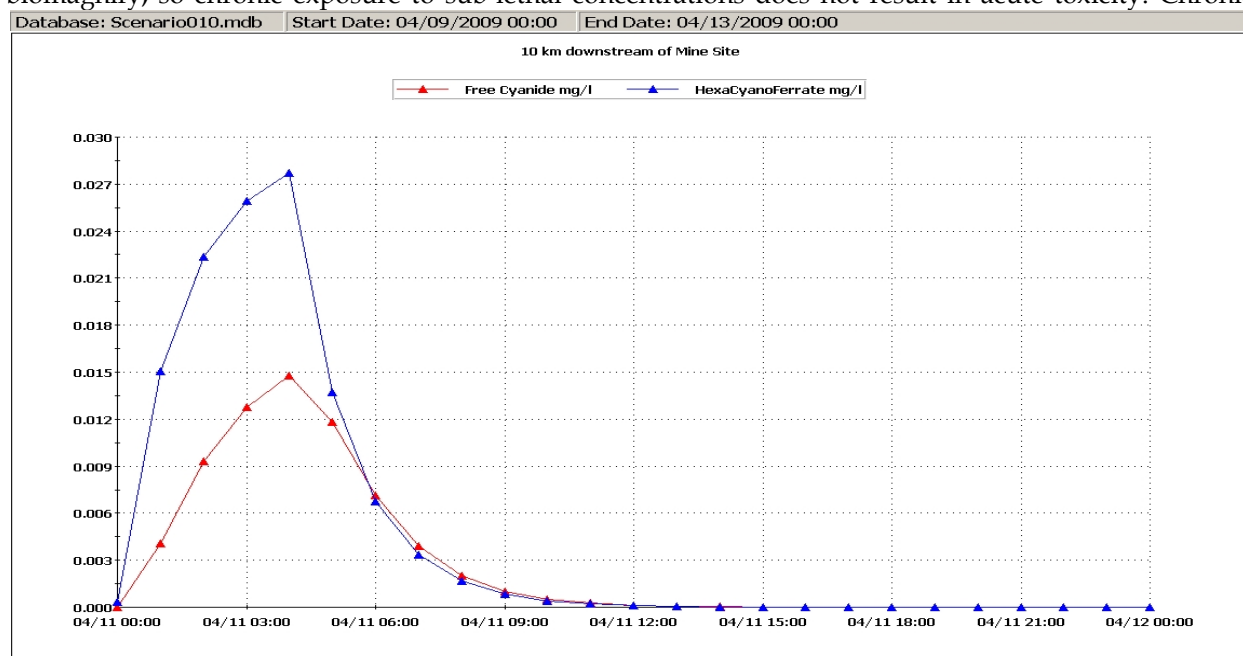


Figure 38 - GEMSS output - concentration of cyanide in Cuyuni River 10 km downstream of mine site after hypothetical spill of 2400 m³ of 800 mg/l cyanide

cyanide poisoning has been observed and is a potential risk to those with continuous exposure, but this analysis is based on a single, acute, accidental cyanide spill event.

Fish and aquatic invertebrates are also very sensitive to cyanide exposure. Adverse effects are observed at concentrations of 5 ug/l, with death of many species at 20 to 76 ug/l of free cyanide. At levels exceeding 200 ug/l, free cyanide is rapidly toxic to most species of fish. Birds and mammals are also susceptible to cyanide toxicity at concentrations from 0.8 to 11.1 mg /kg of body weight. These values, shown in Table 43, are provided by the International Cyanide Management Institute (www.cyanidecode.org).

If the assumed cyanide spill occurred, the Cuyuni River would experience free cyanide concentrations as high as 800,000 ug/l at the initial spill location and 15 ug/l at a location 10 km downstream. At these concentration levels, humans, fish, invertebrates, mammals, and birds in the river would be in danger for several kilometers downstream of the mine site. These impacts merit the rating of Moderate (High Severity, Low Likelihood). These impacts will be mitigated by strict adherence to the Environmental Monitoring Plan, specifically to include frequent monitoring of cyanide in the tailings and water management ponds, cyanide storage tank integrity, and containment of cyanide in ore processing and mining operations. The Spill Prevention and Cleanup Control and Emergency Response Plans should include aggressive alerts, education, and clean up activities. The application of proposed mitigation measures will contain and localize potential impacts, and result in a Minor Impact rating (Medium Severity, Low Likelihood).

Table 43: Surface Water Cyanide Standards – International Cyanide Management Institute

Parameter	Value
LD50 for human ingestion	50 - 200 mg or 1 - 3 mg / kg of body weight
LD50 for human contact	100 mg / kg of body weight
LD50 for fish	200 ug/l
LD50 for invertebrates	20 to 76 ug/l
LD50 for birds via ingestion	0.8 to 11.1 mg / kg of body weight
LD50 for mammals via ingestion	2 to 10 mg / kg of body weight

8.2.5.2 Groundwater

8.2.5.2.1 Mine Site

8.2.5.2.1.1 Construction Phase

Impermeable liners will be placed over the base of both the tailings and water management ponds during construction. The impermeable liners will reduce recharge to groundwater. Very little information is available on the hydrogeology of the project area. It can be inferred from the clayey nature of the soils, encountered at the site, that groundwater recharge rates within the area are relatively low with the greater percentage of precipitation reporting as interception and surface runoff. The project area is quite small in comparison to the area available for groundwater recharge. The impacts of reduced groundwater recharge, occasioned by the impermeable liner, would therefore be insignificant (low severity, low likelihood).

Wells will be drilled on site to provide water for drinking/cooking. These wells will be located some distance from and at higher elevations than the mining operations and sewerage management facilities. Withdrawals from wells are unlikely to have any impacts on the availability of groundwater since there are no other withdrawals in the area.

Spills of fuel and oils from equipment and from equipment and fuel storage and service areas can flow to the underlying aquifer and potentially impact groundwater quality. This will result in minor impact (medium severity, low likelihood). Potential contamination of the underlying aquifer will be minimized by installing drip pans on all equipment, enforcing a program to check for equipment leaks and implementation of a Spill Prevention and Contingency Plan (SPCP). The SPCP will detail plans for utilization of sorbents, biological agents, chemical dispersants, gelling agents etc. All fuel will be stored within containment walls designed to contain 110 percent of the tank contents. Implementation of these mitigation measures will result in insignificant impacts (low severity; low likelihood) to groundwater quality.

8.2.5.2.1.2 Operation Phase

Precipitation can induce leaching of water-soluble substances and/or heavy metals from spoil piles and introduction of these chemicals into the groundwater flow regime through the base of the spoil piles. These are minor impacts (medium severity, low likelihood). These impacts will be mitigated by compacting the base of the spoil piles before commencement of spoil disposal. The weight of the spoil will induce additional compaction of its base further reducing the infiltration potential of the soils. This will result in insignificant impacts (low severity, low likelihood).

Infiltration of wastewater from the tailings and water management ponds, waste management areas and leaching of minerals into solution in the mine can have potential negative impacts on groundwater quality. These are moderate impacts (high severity, low likelihood). These impacts will be mitigated by providing impervious liners below the tailings and water management ponds and waste management areas and directing water from the mine to the water management pond. The mitigation measures will result in insignificant impacts (low severity, low likelihood).

Mining will entail excavation below existing groundwater levels. This will disrupt the existing groundwater flow regime and result in groundwater flow into the mine in the area surrounding the mine footprint. These are moderate impacts (low severity, high likelihood). These impacts will not be mitigated.

Spills of fuel and oils from equipment and fuel storage and service areas can flow to the underlying aquifer and potentially impact groundwater quality. This will result in minor impact (medium severity,

low likelihood). Potential contamination of the underlying aquifer will be minimized by installing drip pans on all equipment, enforcing a program to check for equipment leaks and implementation of a Spill Prevention and Contingency Plan (SPCP). The SPCP will detail plans for utilization of sorbents, biological agents, chemical dispersants, gelling agents etc. All fuel will be stored within containment walls designed to contain 110 percent of the tank contents. Implementation of these mitigation measures will result in insignificant impacts (low severity; low likelihood) to groundwater quality.

8.2.5.2.2 Underground Mining

Openings in the subsurface will modify the existing groundwater flow regime and will open new pathways for flow of groundwater. Drainage into these openings, if significant, can result in a recession in groundwater levels. If the recession in groundwater levels progress to the ground surface, it can have detrimental impacts on vegetation in the area. However, the stratigraphy at the site consists of residual soils overlying bedrock and the underground mine will be located totally in bedrock. Given that the groundwater impacting vegetative resources at the site is located within the residual soils, there should be no impact from the underground mining on the groundwater availability to existing vegetation. In addition, there are no groundwater receptors within 50 km of the proposed operation. The impacts of any recession in groundwater would therefore be insignificant (low severity, medium likelihood). These impacts would not be mitigated.

It is highly unlikely that groundwater recession will extend to aquatic habitats and their biophysical components. The aquatic habitat and biophysical resources in the vicinity of underground operations will be monitored to validate this assessment. If impacts related to groundwater recession are detected, the impacts will be mitigated by increasing water discharges to impacted area to compensate for groundwater recession. The impacts of groundwater recession on aquatic and biophysical resources would therefore be insignificant (low severity, medium likelihood).

Groundwater quality can be impacted by discharge of mine waters containing various alkaline and other solutions to groundwater as well as discharge of losses of refrigerants used in the sinking of the shaft. Groundwater quality can also be impacted by the discharge of oils and grease from the underground workshop(s) to groundwater. These are potentially major impacts (high severity, medium likelihood). These impacts will be mitigated by sealing off the shaft and other worked-out parts of the ore deposit and by treating all water prior to discharge to groundwater. Discharge from workshops will also be directed to oil-water separators prior to discharge. Implementation of these mitigation measures will result in minor impacts (low severity, low likelihood).

8.2.5.2.3 Mine waters

Mining activities can alter the characteristics of mine waters. Acidic or alkaline water generated by mining activities has the potential to negatively impact the skin and clothing of persons exposed to that water and to corrode materials used underground. This is a minor impact (medium severity, low likelihood). This impact would be mitigated by providing underground personnel with appropriate safety clothing to protect against aggressive mine waters and by utilizing materials which are resistant to corrosion. Implementation of these mitigation measures will result in minor impacts (low severity, low likelihood).

8.2.5.2.3.1 Closure

After mine closure several depressions will remain within the footprint of the open pits. These depressions will become groundwater filled ponds. Surface water levels in these ponds will correspond to groundwater levels. Wet period precipitation on the surface of these ponds will result in minor disequilibrium of the groundwater flow regime. This is a minor impact (low severity, medium likelihood).

8.2.5.2.4 Access Road

8.2.5.2.4.1 Construction Phase

The access road alignment is located in a groundwater recharge area for the coastal aquifers. The road will be covered by a lateritic clayey gravel surface. The hydraulic conductivity of that surface may be less than the hydraulic conductivity of the white sands occurring at ground surface over a greater part of the alignment. Construction of the access road can potentially result in reduced infiltration to groundwater. The area covered by the road will be a very small fraction of the area potentially available for recharge. These are consequently minor impacts (low severity, medium likelihood). These potential impacts shall be mitigated by constructing infiltration ditches at selected points along the alignment to facilitate recharge to groundwater.

8.2.5.2.4.2 Operation Phase

Groundwater quality can potentially be impacted by spills of fuels, oil and other chemicals on the ground surface and the migration of spilled material to groundwater underlying the area. These are moderate impacts (medium severity, low likelihood). These impacts will be mitigated based on the adoption of procedures outlined in the Spill Prevention and Contingency Plan detailed in this document. Residual impacts will consequently be minor (low severity, low likelihood).

8.2.5.2.5 Wharf

8.2.5.2.5.1 Construction, Operation and Closure Phases

Groundwater quality can potentially be impacted by spills of fuels, oil and other chemicals on the ground surface and the migration of spilled material to groundwater underlying the area. These are moderate impacts (medium severity, low likelihood). These impacts will be mitigated based on the adoption of procedures outlined in the Spill Prevention and Contingency Plan detailed in this document. Residual impacts will consequently be minor (low severity, low likelihood).

8.2.6 Noise and Odor

8.2.6.1 Mine Site

8.2.6.1.1 Construction Phase

Construction activities will produce noise levels above the alert threshold of 86 decibels (dBA) and hazard threshold of 95 (dBA) from heavy-duty and earthmoving machines operation. Maintenance operations in workshops will generate noise levels in the vicinity of 72-110 decibels. Noise levels from power generation plant will range from 90-105 dBA. Exposure to noise levels above the internationally accepted level of 90 dBA can cause noise induced hearing loss. Noise levels above the tolerable threshold of 72 decibels may result in fatigue, tiredness, low morale and decreased production levels. Tired workers are prone to accidents which may contribute to an increase in work accidents. These are moderate impacts (medium severity, medium likelihood). There are no receptors within 25 km of the site and the only noise receptors will be individuals involved in construction activities at the site. These impacts will be mitigated by implementation of the following:

- Installation of sound suppression devices (such as mufflers) on earthmoving equipment, generators etc.
- Avoiding unnecessary idling of vehicles and machinery that are used intermittently
- Employing best available work practices on-site to minimize occupational noise levels
- Provide noise protection equipment to employees

Implementation of these measures would reduce the likelihood and impacts of noise occurrences. Noise impacts to receptors would as a result be minor (low severity; medium likelihood).

Construction activities would be localized to the project area and are unlikely to generate any significant odors. The short construction duration coupled with the absence of odor generating activities will require no mitigation measures.

8.2.6.1.2 Operation Phase

During the mining and mineral processing operations noise levels above the alert threshold of 86 decibels (dBA) and hazard threshold of 95 (dBA) will be emitted from heavy-duty and earthmoving machines operation and from process equipment such as crushers and grinders. Maintenance operations in workshops and the process plant area will generate noise levels in the vicinity of 72-110 decibels. If fossil fuel plant are used, noise levels from power generation plants will range from 90-105 dBA. Exposure to noise levels above the internationally accepted level of 90 dBA can cause noise induced hearing loss. Noise levels above the tolerable threshold of 72 decibels may result in fatigue, tiredness, low morale and decreased production levels. Tired workers are prone to accidents which may contribute to an increase in work accidents. These are moderate impacts (medium severity, medium likelihood). There are no receptors within 25 km of the site and the only noise receptors will be individuals working during the project operational phase. These impacts will be mitigated by implementation of the following:

- Installation of sound suppression devices (such as mufflers) on earthmoving equipment and generators, as necessary
- Employing best available work practices on-site to minimize occupational noise levels
- Isolation of noise source from employees' living and dining area
- Using acoustic insulating materials such as silencers on exhaust systems
- Issuing ear plugs or ear muffs to employees exposed to high noise levels
- Periodically monitoring noise levels to ensure compliance with recommended threshold levels.
- Posting visible warning signs in areas of high noise levels instructing employees to wear ear protection
- Conducting periodic medical hearing checks on workers exposed to high noise levels.

Implementation of these measures would reduce the likelihood and impacts of noise occurrences. Noise impacts to receptors would as a result be minor (low severity; medium likelihood).

Operational activities would be localized to the project area and are unlikely to generate any significant odors. Some odors may be generated from the sewerage management system. There are no receptors within 25 km of the site and the only receptors will be individuals working during the project operational phase. These are minor impacts (low severity, low likelihood). No mitigation will be required.

8.2.6.2 Underground Mining

Noise would be generated by drilling and blasting, by internal-combustion engines and pneumatic and hydraulic motors, and by conveyor belts, trains, vehicles and fans. Noise levels may exceed the alert threshold of 86 decibels (dBA) and hazard threshold of 95 (dBA). Maintenance operations in workshops will generate noise levels in the vicinity of 72-110 decibels. Exposure to noise levels above the internationally accepted level of 90 dBA can cause noise induced hearing loss. Noise levels above the tolerable threshold of 72 decibels may result in fatigue, tiredness, low morale and decreased production levels. Tired workers are prone to accidents which may contribute to an increase in work accidents. These are moderate impacts (medium severity, medium likelihood).

These impacts will be mitigated by implementation of the following:

- Installation of sound suppression devices (such as mufflers) on equipment, generators etc.
- Avoiding unnecessary idling of vehicles and machinery that are used intermittently
- Employing best available work practices to minimize occupational noise levels
- Provide noise protection equipment to employees

Implementation of these measures would result in minor impacts (low severity; medium likelihood).

Underground operations would be localized and are unlikely to generate any significant odors. The absence of odor generating activities will require no mitigation measures.

8.2.6.2.1 Closure

No noise and/or odor will be generated after site closure. No mitigation is required.

8.2.6.3 Access Road

8.2.6.3.1 Construction Phase

Access road construction will require the use of heavy machinery. Most activities will be intermittent and localized, however, those activities will contribute to sustained noise levels during equipment operation. Noise generated by construction activities may prevent animals from approaching or crossing the access road corridor because of fear. Noise may potentially reduce the success of these species and contribute to ecological alteration. These are potentially moderate impacts (low severity, medium likelihood). Noise impacts will be mitigated by mandating that equipment be maintained to manufacturer's standards. The mitigation measures will result in minor residual impacts (low severity, low likelihood).

No odors will be generated by construction activities.

8.2.6.3.2 Operation Phase

Minimal noise will be generated on the access road during operations. The noise will be intermittent and would be primarily due to the passage of vehicles. No mitigation would be required.

8.2.6.3.3 Closure

No noise and/or odor will be generated after site closure. No mitigation is required.

8.2.6.4 Wharf

8.2.6.4.1 Construction and Operation Phases

Construction of the wharf and related facilities will include pile driving operations and the use of other heavy machinery. Operational activities will include loading/unloading of equipment and supplies for the mine site. Most activities will be intermittent and localized, however, activities will contribute to sustained noise levels during equipment operation. Exposure to noise levels above the internationally accepted level of 90 dBA can cause noise induced hearing loss. Noise levels above the tolerable threshold of 72 decibels may result in fatigue, tiredness, low morale and decreased production levels. Tired workers are prone to accidents which may contribute to an increase in work accidents. These are moderate impacts (medium severity, medium likelihood). There are few receptors within 2 km of the site and the only noise receptors will be individuals working at the site. These impacts will be mitigated by implementation of the following:

- Installation of sound suppression devices (such as mufflers) on construction equipment
- Employing best available work practices on-site to minimize occupational noise levels
- Using acoustic insulating materials such as silencers on exhaust systems
- Issuing ear plugs or ear muffs to employees exposed to high noise levels
- Periodically monitoring noise levels to ensure compliance with recommended threshold levels
- Posting visible warning signs in areas of high noise levels instructing employees to wear ear protection

Implementation of these measures would reduce the likelihood and impacts of noise occurrences. Noise impacts to receptors would as a result be minor (low severity; medium likelihood).

No odors will be generated by construction activities.

8.2.6.4.2 Closure

No noise and/or odor will be generated after site closure. No mitigation is required.

8.2.7 Blasting and Vibrations

Explosive blasting can result in air-blast and fly-rock. Air-blast refers to vibrations in the air that are generated by blasting. The principal factors influencing the effects of air-blast include the type and quantity of explosive used; the method of initiation; the degree of confinement; the atmospheric conditions, the local geological conditions and topography. Air-blast can potentially result in moderate impacts (medium severity, medium likelihood). The effects of air-blast will be mitigated by the correct design of blasting rounds, avoiding the detonation of large unconfined charges and considering atmospheric conditions prior to blasting. The mitigation measures will result in minor impacts (low severity, medium likelihood).

Fly-rock can result from uncontrolled venting of gases initiated by charge detonation and may cause rock fragments to be thrown some distance from the blast area. Factors responsible for fly rock can include damaged or unstable holes, insufficient burden, blastholes that are too closely spaced, inadequate stemming, incorrect firing sequence or delay period, misfire, accidental initiation or poor site clearance. Fly rock can result in injury to persons and damage to property. These are major impacts (high severity, medium likelihood). These impacts will be mitigated by establishing danger zones around blast sites minimum stand-off distance during blasting.

Blasting operations will generate vibrations. The type of vibration will depend on the size of the explosive charge, the delay time sequence, the spatial pattern of the blast holes, the volume of the ground set into vibration, the attenuation characteristics of the ground and the distance from the blast. The effects of vibration due to blasting operations will be mitigated by using appropriate delay intervals for charge ignition, by utilization of an appropriate pattern and orientation of the blast holes, and by confinement of the charge.

8.2.8 Traffic

8.2.8.1 Mine Site

8.2.8.1.1 Construction Phase

A relatively small number of roads will be constructed on site to access construction locations. Speed limits will be imposed for vehicles during construction activities. Construction equipment will be equipped with manufacturer specified equipment to minimize the likelihood of accidents on site roads. Traffic impacts during construction will therefore be minor (low severity, low likelihood).

8.2.8.1.2 Operation Phase

Several haul roads will become operational for moving ore to the process plant. The increased speed on the haul roads can result in some instances of vehicular accidents. These are moderate impacts (medium severity, medium likelihood). These impacts will be mitigated by building the haul roads to standard widths associated with mining operations and by posting signs along these roadways to indicate that haul trucks should be given priority of passage. These mitigation measures will result in minor impacts (low severity, low likelihood).

8.2.8.1.3 Closure

The traffic after closure will be restricted to vehicles periodically accessing the site for the post closure monitoring of the effectiveness of the closure measures. Traffic impacts related to the periodic passage of vehicles will be insignificant (low severity, low likelihood).

8.2.8.2 Access Road

8.2.8.2.1 Construction Phase

A tote road will be used to provide site access during construction. The tote road will be adequate to allow vehicles and other equipment to travel at speeds of less than 25 km/hr. That speed will minimize the potential for accidents on the tote road. Traffic impacts during construction will therefore be minor (low severity, low likelihood).

8.2.8.2.2 Operation Phase

The 40 km long site access road will be upgraded to permit travel at speeds of more than 80 km/hour. The increased speed on the access road can result in some instances of vehicular accidents. These are moderate impacts (medium severity, medium likelihood). These impacts will be mitigated by building the access road to standard widths associated with mining operations and by posting signs along the roadway to indicate vehicles associated with the mining operation should be given priority of passage. These mitigation measures will result in minor impacts (low severity, low likelihood).

8.2.8.2.3 Closure

The traffic after closure will be restricted to vehicles periodically accessing the site for the post closure monitoring of the effectiveness of the closure measures. Traffic impacts related to the periodic passage of vehicles will be insignificant (low severity, low likelihood).

8.2.9 Biological Resources

8.2.9.1 Vegetation

8.2.9.1.1 Mine Site

8.2.9.1.1.1 Construction Phase

Construction works will include clearing large areas for the open pit, tailings and water management ponds and for other site facilities. The areas occupied by the process facilities, personnel facilities and operational mines will be subtracted from the total area available to flora. Cutting of large tracts will make plant regeneration difficult. This difficulty arises since nutrients, contained in the biomass can be washed away by rainwater after clearing. In addition, enhanced leaching, occasioned by clearing, can deplete the soil of nutrients. The absence of nutrients may result in any new vegetation consisting mainly

of grass species. Aggressive grass species and shrubs will effectively prevent seed-bearing plants from finding satisfactory living conditions. These grasses, similar to the growth currently occurring at various sites within the Golden Mile, can however serve as a food source for a significant population of birds. The surrounding area is exactly the same ecologically as the cleared area and the area cleared is a very small percentage of the total area. Clearing will consequently result in only minor impacts (low severity, medium likelihood) on the overall area.

8.2.9.1.1.2 Operation Phase

Traffic on mine haul roads during the operation phase would impact the early succession/edge and secondary forest habitats located along these roads by increasing dust, which will settle on vegetation. 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. Road dust deposits on vegetation up to one km away from the generation site and may contain pollutants or chemicals that can alter the permeability of the leaves or the pH of the leaves' surfaces (Farmer, 1993). Given the limited geographic scope of this impact, the impact of dust accumulation on plants would be minor (low severity; medium likelihood). Wetting roads during the dry seasons would reduce this impact to insignificant (low severity; low likelihood).

8.2.9.1.1.3 Closure

During regeneration the area may encounter encroachment by particularly aggressive and unwanted plant species (pests). These pests may result in the loss of some vegetation species. These pest species may have significant effects on native ecosystems by changing fire regimes, changing soil nutrient regimes, increasing soil erosion, eliminating or altering the natural vegetative strata, and displacing native species. Regrowth in the area after closure may consequently alter the diverse nature of the trees present in the area. This is a moderate impact (low severity, high likelihood). A weed management program would be implemented to control the spread of pest species and would reduce this to an insignificant impact (low severity; low likelihood).

8.2.9.1.2 Access Road

8.2.9.1.2.1 Construction Phase

Construction of the new portion of the access road will consume land and will result in the loss of natural habitat. This loss will be restricted to the access road only. The area bordering the access road is exactly the same ecologically and the area lost to the access road is very small in relation to the overall area. This would therefore result in minor impacts (low severity, high likelihood).

Construction of the new portion of the access road will cut an existing ecosystem into two parts. The two parts created by the road may potentially have less value than the initial whole ecosystem, since ecosystems are characterized by complex, interdependent relationships between component species and their physical environment. The access road may potentially fragment the area into weaker ecological sub-units and may make the entire area vulnerable to invasion and degradation. This is a direct impact which may be regional and long-term. This impact will be mitigated by minimizing the length and width of the new roadway required. The mitigation measures will result in minor residual impacts (low severity, low likelihood).

8.2.9.1.2.2 Operation Phase

Traffic on the access road during the operation phase would impact the early succession/edge and secondary forest habitats located along this road by increasing dust, which will settle on vegetation. 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. Road dust deposits on vegetation up to one km away from the generation site and may contain pollutants or chemicals that can alter the permeability of the leaves or the pH of the leaves' surfaces (Farmer, 1993). Given the limited geographic scope of this impact, the impact of dust accumulation on plants would be minor (low severity; medium likelihood). Wetting roads during the dry seasons would reduce this impact to insignificant (low severity; low likelihood).

8.2.9.1.2.3 Closure

It is expected that the road will remain in place after site closure. Traffic after closure will be totally for recovery of samples for the continued monitoring program. There would be no impacts on vegetation associated with that infrequent use of the access road after closure.

8.2.9.1.3 Wharf

8.2.9.1.3.1 Construction Phase

Construction of the wharf facilities will consume land and will result in the loss of natural habitat. This loss will be restricted to this area only. The area bordering the cleared area is exactly the same ecologically and the area lost to the wharf is very small in relation to the overall area. This would therefore result in minor impacts (low severity, high likelihood).

8.2.9.1.3.2 Operation Phase

Operations at the wharf will be restricted to offloading/loading of cargo and fueling of transport vehicles. These operations will have no impacts on vegetation. No mitigation is required.

8.2.9.1.3.3 Closure

There would be no impacts on vegetation associated with that infrequent use of the wharf after closure.

8.2.9.2 Wildlife

8.2.9.2.1 Mine Site

8.2.9.2.1.1 Construction Phase

Clearing for the mine, ponds, process and personnel facilities will fragment the area and can potentially impact wildlife since some animal species depend on the existence of other plant and animal species within the habitat for nutrients/food, cover, etc. The area cleared is relatively small in comparison to the available area. Clearing and encroachment will alter several of the physical conditions including light, humidity and temperature. The installation of facilities and other construction works will form temporary barriers to the movement of animals, including access to water bodies. These are minor impacts (low severity, low likelihood). These impacts will be mitigated by minimizing the area cleared for the facilities and by maintaining wildlife corridors within the cleared areas. The implementation of the proposed mitigation measures will result in insignificant residual impacts (low severity, low likelihood).

People working on the project may harvest commercially valuable animal and plant species. Species population may therefore decrease due to hunting and trapping. These are potentially moderate impacts (medium severity, medium likelihood). A term of employment of employees and contractors of the company would be the prohibition of hunting and fishing. In addition, employees and contractors will be forbidden from trading in endangered species. The mitigation measures will result in minor impacts (low severity, low likelihood).

The physical disturbance and noise produced by equipment may impose additional stresses upon wildlife and may lead to increased migration. 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. These are potentially major impacts (high severity, medium likelihood). These impacts will be mitigated by minimizing the extent of the cleared areas and by ensuring that noise levels are maintained at the lowest possible. The mitigation measures will result in moderate impacts (medium severity, medium likelihood).

8.2.9.2.1.2 Operation Phase

During operation of the mine, wildlife may move away from the area. This displacement will increase competition with wildlife on the periphery of the area. This is a moderate impact (medium severity, medium likelihood). This impact cannot be mitigated.

The physical disturbance and noise produced by equipment may impose additional stresses upon wildlife and may lead to increased migration. 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. These are potentially major impacts (high severity, medium likelihood). These impacts will be mitigated by minimizing the extent of the cleared areas and by ensuring that noise levels are maintained at the lowest possible. The mitigation measures will result in moderate impacts (medium severity, medium likelihood).

8.2.9.2.1.3 Closure

Persistent acid mine drainage and discharges to surface water, after closure, may contaminate surface water available to wildlife in the area. This is a major impact (high severity, medium likelihood). This impact will be mitigated by analyzing all material exposed at ground surface to determine their acid generating potential and by placing all acid generating material above the water table to isolate the material from contact with water, and by capping acid generating materials with clay or other materials to reduce permeability. This will result in minor impacts (low severity, low likelihood).

8.2.9.2.2 Access Road

8.2.9.2.2.1 Construction Phase

Clearing for the new portion of the access road will fragment the area and can potentially impact wildlife. The area to be cleared is relatively small in comparison to the available area. These are consequently insignificant impacts (low severity, low likelihood). These impacts will not be mitigated.

People working on the access road construction may harvest commercially valuable animal and plant species. These are potentially moderate impacts (medium severity, medium likelihood). A term of employment of employees and contractors of the company would be the prohibition of hunting and fishing. The mitigation measures will result in minor impacts (low severity, low likelihood).

The physical disturbance and noise produced by equipment may impose additional stresses upon wildlife and may lead to increased migration. The construction duration would be very short consequently these impacts will be minor (low severity, medium likelihood). These impacts will not be mitigated.

8.2.9.2.2.2 Operation Phase

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. If the new access road intersects or blocks wildlife corridors, animals may cease use of the corridor since animals are reluctant to cross open spaces and may be hit by vehicles using the access roads. The access roads may result in potential increase in animal mortality because of collisions with vehicles, or a delay in migration in search of food and for breeding and birthing. These are moderate impacts (medium severity, medium likelihood). These impacts will be mitigated by conducting an assessment after the access road is cleared to identify corridors and signs will be posted notifying drivers of the existence of these corridors and placing speed restrictions on the access road in the vicinity of the corridors. The mitigation measures will result in minor impacts (low severity, medium likelihood).

Some animals would be attracted to the open spaces created by the access roads for protection from predators, good food supplies and better travel conditions. This may potentially lead to accidental death and poaching. These are moderate impacts (medium severity, medium likelihood). These impacts will be mitigated by constraining the access road to the narrowest width possible and by lowering the vertical alignment. The access roads will also be designed to minimize cuts and fills and will have relatively flat side slopes with minimal clearing of existing vegetation. The narrower rights-of-way and lower vertical alignment will make crossing easier for animals and will provide longer sight lines for drivers resulting in less frequent collisions with animals. The mitigation measures will result in minor impacts (low severity, low likelihood).

8.2.9.2.2.3 Closure

The access road will be infrequently used after closure for the recovery of monitoring samples. The infrequent use will result in insignificant impacts (low severity, low likelihood).

8.2.9.2.3 Wharf

Construction, operation and closure of the wharf will have no significant impacts on wildlife since the wharf area is an existing disturbed area.

8.2.9.3 Aquatic Resources

8.2.9.3.1 Mine Site

8.2.9.3.1.1 Construction Phase

Construction activities will include creation of the tailings and water management pond impoundments and diversion of some streams for haul roads and other facilities at the site. Erosion and sedimentation from construction activities could transport contaminants from the construction areas into the aquatic systems. The introduction of sediment by surface runoff may introduce additional nutrient loads to the streams. The altered nutrient levels can potentially result in eutrophication. Pollution by contaminated surface runoff can also impact water quality in the streams and may lead to denitrification and increased oxygen consumption resulting in an environment less conducive to the survival of fishes. Contaminants 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, which can lower spawning success for many fish species and reduce overall habitat suitability for many aquatic organisms. During construction there could be hydrocarbon contamination of the aquatic systems from accidental spills of lubricants and fuel. Hydrocarbons introduced into aquatic environments may change aquatic plant and animal growth, mortality and communities. These are major impacts (high severity, medium likelihood).

These impacts will be mitigated by implementation of an Erosion and Sediment Control Plan and by channeling contaminated runoff to oil-water separators prior to discharge to streams/creeks. The mitigation measures will result in insignificant impacts (low severity, low likelihood).

8.2.9.3.1.2 Operation Phase

Creation of the Tailings and Water Management Ponds will encompass several streams containing fishes. The footprint of the open pit is also highly likely to encompass several streams. Process discharge to both the tailings and water management ponds are unlikely to meet surface water quality standards. Fishes trapped within the impoundments created for the tailings and water management ponds will be impacted by the impaired water quality. The impaired water quality in the ponds will result in a direct, permanent loss of aquatic habitat within these ponds and loss of aquatic fauna and degradation of aquatic habitats and water quality.

Process discharge to both ponds will contain sediments which will result in decreased transparency and a reduction of light available to aquatic plants, a primary food source for aquatic organisms. Further, the suspended sediment will ultimately settle onto instream habitat features (e.g., downed wood, gravel, etc.) or the bottom substrate causing embeddedness, which will decrease the value of instream habitat for macroinvertebrates and fish. Specifically, increases in embeddedness levels decrease the space between substrate particles and limit the available area and cover for small fish, macroinvertebrates, and periphyton.

The adverse effects of increased levels of fine sediments on fish include: increased mortality caused by gill damage; increased predation due to sedimentation of shelter; increased susceptibility to disease; impaired developmental rates; reduction of suitable spawning habitat; reduced spawning success; modification of migration patterns, impairment of visual feeders, and reduction of light penetration, which impedes primary production, reduces food availability, and alters food webs. These are major impacts (high severity, moderate likelihood).

These impacts would be mitigated during the construction stage of the project by constructing the impoundment at a rate slow enough to allow aquatic organisms to relocate outside of the footprint of the ponds. Construction will progress in the flow direction of streams to further enhance this possibility. The mitigation measures will result in moderate impacts (medium severity, medium likelihood).

During operation there could be hydrocarbon contamination of the aquatic systems from accidental spills of lubricants and fuel. Hydrocarbons introduced into aquatic environments may change aquatic plant and animal growth, mortality and communities. These are major impacts (high severity, medium likelihood). These potential impacts will be mitigated by implementation of the Spill Contingency Plan. The mitigation measures will result in minor impacts (low severity, low likelihood).

8.2.9.3.1.3 Closure

Discharges to surface water after closure will only occur after attainment of discharge water quality. The Erosion and Sediment Control Plan will be implemented until the area is adequately re-vegetated. Closure will therefore have no impacts on aquatic organisms. No mitigation is required.

8.2.9.3.2 Access Road

8.2.9.3.2.1 Construction Phase

Construction of the site access road will create the same impacts on the aquatic environment identified for the mine site. Additional impacts are discussed below.

Several culverts and/or bridges will be built along the access road. Constriction of surface water flows at culverts and other road crossings may potentially create currents too fast for some fish species to survive. The access road may potentially serve as barriers to movement of some aquatic species, especially where culverts are used. This may potentially restrict the migration of fish. These are moderate impacts (high severity, low likelihood). The impacts on aquatic ecosystems will be mitigated by bridging areas of standing water and by designing culverts to enable the passage of migratory aquatic species by incorporating baffles to slow the flow enough to allow fish and others to swim against the current, and by setting culvert bottoms below the level of the stream bed. Culvert gradients will also be designed to ensure that streambed gradients existing prior to construction of the access road are maintained to the maximum extent practicable. This will result in minor residual impacts (low severity, low likelihood).

8.2.9.3.2.2 Operation Phase

The aquatic environment could be impacted during operation by accidental spills of hydrocarbons and other chemicals to aquatic systems. Hydrocarbons and other chemicals introduced into aquatic environments may change aquatic plant and animal growth, mortality and communities. These are major impacts (high severity, medium likelihood). These potential impacts will be mitigated by implementation of the Spill Contingency Plan. The mitigation measures will result in minor impacts (low severity, low likelihood).

8.2.9.3.2.3 Closure

Closure of the access road will have no impact on aquatic organisms. No mitigation is required.

8.2.9.3.3 Wharf

During construction and operation and after closure, fuels storage facilities will be maintained at the wharf facility. Accidental spills of fuel and discharge to surface water can impact aquatic organisms. These are potentially moderate impacts (medium severity, low likelihood). These impacts will be mitigated by passing all surface water discharges through an oil-water separator. This will result in insignificant impacts (low severity, low likelihood).

8.2.9.3.4 Cuyuni River Crossing

The primary impact of the Cuyuni River crossing will be an increased risk of collisions with other vessels using the river. However, traffic volume on the river is very low. The increased risk of river boat collision is consequently minor (medium severity, low likelihood). These impacts will be mitigated by estimating the frequency of river crossing each day and by equipping the barges with lighting to increase visibility. GUY employees and other users of the river will also liaise on crossing times to minimize the possibility of accidents and incidents. The mitigation measures will result in insignificant impacts (low severity, low likelihood).

Table 44: Summary of Physical Environmental Impacts

Phase	Impact	Source of Impact and Existing Vulnerability	Impact Rating Prior to Mitigation or Prior Implementation of EMP	Recommended Mitigation Measures -Proposed Environmental Management Plan	Impact Rating After Mitigation or After Implementation of EMP
Soils					
Construction	Erosion	<i>Source</i> - Construction of roads - Vegetation clearance <i>Vulnerability</i> - Steep areas - High erosion potential soils - Potential surface water contamination by introduction of sediments	Moderate (Severity - Low; Likelihood - Medium)	- Best management practices for Storm Water Management; - Channel control structures; - Interim Reclamation Plan following clearance activities; - Long-term Reclamation Plan	Minor (Severity - medium; Likelihood - low)
Construction	Rutting and Compaction	<i>Source</i> - Operation of construction equipment <i>Vulnerability</i> - Highly compressibility soils - Wet and poorly drained soils	Minor (Severity - Low; Likelihood - medium)	- Scheduling Construction activities in dry season - Limiting off-road access - Implementation of awareness education and training program	Insignificant (Severity - low; Likelihood -Low)
Construction	Topsoil Mixing	<i>Source</i> - During the construction of roads, access ways, and mine preparation - During landscape grading and re-contouring for proper drainage - During vegetation clearance and landscape grading. <i>Vulnerability</i> - loss of soil fertility - loss of viable seeds present (topsoil seedbank) in the topsoil.	Moderate Severity - medium; Likelihood - medium)	- Segregate topsoil from subsurface layers during construction activities - Replace topsoil following construction, as applicable; - Create topsoil storage areas; - Identify, maintain or salvage topsoil pockets - Replace segregated topsoil as in the Reclamation Plan	Minor (Severity- low; likelihood - medium).
Operation	Erosion and Sedimentation	<i>Source</i> - Clearing of areas within mine footprint - Extension of roads to access mine, tailings and water management ponds and stockpiles <i>Vulnerability</i> - High erosion potential soils - Potential surface water contamination by introduction of sediments	Moderate (Severity - medium; Likelihood - medium).	- Implementation of best management practices for soil erosion and storm water runoff - sedimentation control (e.g., silt fences, re-vegetation	Insignificant (Severity - low; Likelihood - low).
Air Quality					

Construction	Increased emissions of fugitive dust and products of combustion	<i>Source</i> - Land clearing - loading and unloading of trucks - excavation and grading - Construction of roads, tailings and water management ponds and stockpiles - Emissions from chainsaws - Use of diesel and/or gasoline fired heavy duty equipment <i>Vulnerability</i> - Vegetation in proximity to work - Workmen at the site	moderate (Severity - low; Likelihood - high)	- Cover trucks to minimize particulate emission - Minimize drop heights from vehicles - Scheduling land clearing activities to less windy days - Limiting vehicle speed to a maximum 30 km/hr - Employing dust suppression technique - Avoiding open burning of wastes - Maintaining construction equipment according to manufacturer's specifications.	Minor (Severity - low; likelihood - low)
Operation	Increases in dust and combustion emissions	<i>Source</i> - Vehicles traversing site roads - Wind erosion of stockpiles and spoil piles - The operation of heavy duty equipment <i>Vulnerability</i> - Vegetation in proximity to work - Workmen at the site	Minor (Severity - low, likelihood - medium)	Cover trucks to minimize particulate emission Minimize drop heights from vehicles Limiting vehicle speed to a maximum 30 km/hr Employing dust suppression technique Maintaining construction equipment according to manufacturer's specifications Providing facemasks with dust removal filters Conducting periodic medical checks of employees Providing goggles and eye wash lotion	Minor (Severity - low Likelihood - low).
Underground Mining	Increases in dust and combustion emissions	<i>Source</i> - Drilling, blasting, excavation of underground openings - loading and unloading of ore carriers and other material handling equipment - Use of diesel and/or gasoline fired heavy duty equipment. <i>Vulnerability</i> - Workers in underground mine	Major (Severity - high; likelihood - high).	- Installation of a ventilation system - Provision of downcast fresh-air shaft and high pressure fans at ground surface	Minor (Severity - low Likelihood - low).
Geology					
Construction	Removal and alteration of surficial soils	<i>Source</i> - Construction of camp, fuel and lubricant containment and storage areas, installation of sewer, water and power services, construction of site accommodation etc, <i>Vulnerability</i> - Soil at depths of less than 2 m at site	Insignificant (Severity - low; Likelihood - high)	None Required	Insignificant (Severity - low; Likelihood - high)

Operation	Alteration in stratigraphic profile	<i>Source</i> - Excavation and removal of overburden and ore to 150+ m <i>Vulnerability</i> - Mine footprint	Major (Severity – low; Likelihood - high)	None provided	Major (Severity – low; Likelihood - high)
Underground Mining	Alteration in stress-strain distribution in rock	<i>Source</i> - Underground openings for adits, shafts etc. <i>Vulnerability</i> - Rocks underlying mine site	Moderate (high Severity – high; Likelihood – medium)	1. Progressive backfilling the stopes 2. Utilizing well-planned and controlled extraction techniques	Minor (Severity – low; likelihood - low)
Water Resources - Surface Water					
Construction	Reduced water quality	<i>Source</i> - Sediment discharge from cleared areas <i>Vulnerability</i> - Streams and creeks adjacent to cleared areas - Cuyuni River - Aquatic life	Moderate (Severity – medium; Likelihood - medium)	1. Implementation of erosion and sediment control plan	Minor (Severity – low; Likelihood - low)
Construction	Increased runoff to streams/ creeks - higher surface water levels	<i>Source</i> - Clearing of vegetation and reduced interception <i>Vulnerability</i> - Creeks and streams in area - Cuyuni River - Aquatic Life	Moderate (Severity – low; Likelihood - High)	1. Schedule major clearing operation for dry periods	minor impacts (low severity, low likelihood)
Construction	Potential Contamination	<i>Source</i> - accidental discharges of fuels, oils and grease from equipment <i>Vulnerability</i> - Creeks and streams in area - Cuyuni River - Aquatic Life	Moderate (Severity – medium; Likelihood – medium)	1. Implementation of a Spill Prevention and Contingency Plan.	Insignificant (Severity – low; Likelihood - low)
Operation	Potential Contamination	<i>Source</i> - discharges from sewerage system - domestic wastewater discharge - stormwater run-off from developed areas <i>Vulnerability</i> - Creeks and streams in area - Cuyuni River - Aquatic Life	Moderate (Severity – Medium; Likelihood – medium)	1. Utilization of septic tanks and granular filter beds 2. Monitoring the “end-of-pipe” water quality 3. Use of oil-water separators	Insignificant Severity – low Likelihood - Low)

Operation	Potential Contamination	<i>Source</i> - accidental discharges of fuels, oils and grease from equipment - spills of cyanide and other process chemicals - failure of fuel containment facilities - discharge of process wastewater <i>Vulnerability</i> - Creeks and streams in area - Cuyuni River - Aquatic Life	Major (Severity – high; Likelihood – medium)	- Implementation of a Spill Prevention and Contingency Plan. - Founding fuel tanks on impervious bases and within bermed enclosures - Use of oil-water separator prior to discharge - Implementation of Best Management Practices (BMP) during transportation, handling and storage and use of these chemicals	Insignificant (Severity – low Likelihood – low)
Closure	Potential Contamination	<i>Source</i> - Acid Mine drainage <i>Vulnerability</i> - Creeks and streams in area - Cuyuni River - Aquatic Life - Soil containing heavy metals	Major (Severity – high; Likelihood – medium).	- Assessment of the ARD/ML potential - Covering AMD areas with 60 cm impervious soils	Minor (Severity – low; Likelihood – low)
Water Resources – Groundwater					
Design	Groundwater Contamination	<i>Source:</i> - Fuels and oils from drill rigs. <i>Vulnerability:</i> - Potential groundwater quality degradation.	Moderate (Severity – Medium; Likelihood – Medium)	- Equipping rigs with drip pans to catch spills of fuels and oils. - Casing boreholes to isolate the holes from surrounding geological formation.	Insignificant (Severity –Low; Likelihood – Low)
Construction	Reduced recharge	<i>Source</i> - Impermeable liners on base of tailings and water management ponds. <i>Vulnerability</i> - Reduced quantity of available groundwater	Insignificant (Severity – low; likelihood – low).	None provided	Insignificant (Severity – low; likelihood – low).

Construction	Contamination	<i>Source</i> - Fuel and oils spills and discharge <i>Vulnerability</i> - Underlying aquifer	Minor (severity – medium; Likelihood - low).	1. Installation of drip pans on all equipment 2. Program to checks for equipment leaks 3. Implementation of a Spill Prevention and Contingency Plan	Insignificant (Severity - low; likelihood - low)
Operation	Contamination	<i>Source</i> - Water soluble compounds in excavated materials - Infiltration from tailings and water management ponds <i>Vulnerability</i> - Groundwater quality in underlying aquifer	Moderate (Severity – high; Likelihood - low)	1. Compacting spoil pile base 2. Impervious liner for tailings and Water Management Ponds	Insignificant (Severity – low; Likelihood -low)
Operation	Contamination	<i>Source</i> - Fuel and oils spills from equipment - Spills from fuel storage and service areas <i>Vulnerability</i> - Groundwater quality in underlying aquifer	Minor (severity – medium; likelihood - low)	1. Installation of drip pans on equipment 2. program to checks for equipment leaks 3. Implementation of a Spill Prevention and Contingency Plan (SPCP)	Insignificant (Severity - low; Likelihood - low)
Underground Mining	Recession in groundwater levels	<i>Source</i> - Openings in underlying rock - Drainage into openings <i>Vulnerability</i> - Discharge to surface water - Water quantity in aquifer - Vegetation in area above recession - Aquatic Resources in creeks/streams	Insignificant (Severity – low; likelihood - medium).	1. None provided	Insignificant (Severity – low; likelihood - medium).
Underground Mining	Contamination	<i>Source</i> - Discharge of mine waters with alkaline and other solutions - Discharge of refrigerants used to sink shaft. - Discharge of oils and grease from the underground workshop(s) <i>Vulnerability</i> - Water quality in underlying aquifer - Workers in underground operation - Equipment in underground operation	Major (Severity – High; Likelihood - medium)	1. Sealing off the shaft and worked-out parts of the ore deposit 2. Treating water prior to discharge to groundwater. 3. Discharge through to oil-water separators 4. Providing appropriate safety clothing underground personnel 5. Utilizing corrosion resistant materials	Minor (Severity – low; Likelihood - medium)

Noise					
Construction	Increased Noise Levels	<i>Source</i> - Heavy-duty and earthmoving machines operation. - Maintenance operations in workshops - Power generation plant <i>Vulnerability</i> - Wildlife receptors around area - Workers	Moderate (Severity - medium; Likelihood - medium).	- Installation of sound suppression devices - Avoiding unnecessary idling of vehicles - Best Available Work Practices - Provide employees with noise reduction equipment	Minor (Severity - low; Likelihood - medium)
Operation	Increased Noise levels	<i>Source</i> - Heavy-duty and earthmoving equipment operation - Process equipment such as crushers and grinders - Maintenance operations in workshops and process plant - Fossil fuel plant <i>Vulnerability</i> - Wildlife receptors around area - Workers	Moderate (Severity - medium; Likelihood - medium).	- Installation of sound suppression devices - Best Available Work Practices to minimize noise levels - Isolation of noise sources from employees' living and dining area - Installation of acoustic insulating materials - Provide noise suppression equipment to employees - Periodically monitoring noise levels - Warning signs in areas of high noise levels - Periodic medical hearing checks of workers	Minor (Severity - low; Likelihood - medium)
Underground Mining	Increased Noise levels	<i>Source</i> - Drilling and blasting - Internal-combustion engines - Pneumatic and hydraulic motors - Conveyor belts - Trains & vehicles - Fans. <i>Vulnerability</i> - Workers in underground mine	Moderate (Severity - medium; Likelihood - medium).	- Installation of sound suppression devices - Avoiding unnecessary idling of vehicles - Best Available Work Practices - Provide employees with noise reduction equipment	Minor (Severity - low; Likelihood - medium)
Rock Blasting					
Operation	Airblast Flyrock and Vibrations	<i>Source</i> - Explosive detonation <i>Vulnerability</i> - Workers - Equipment - Wildlife	Major (Severity - high; Likelihood - medium)	- Correct design of blasting rounds, - Avoiding detonation of large unconfined charges - Consideration of atmospheric conditions - Establishment of danger zones around blast sites - Minimum stand-off distance during blasting - Appropriate delay intervals for charge ignition - Utilization of appropriate blast patterns - Confinement of the charge	Minor (Severity - low; Likelihood - medium)

Traffic					
Operation	Increase accidents in	<i>Source</i> - Access roads, vehicle and equipment use <i>Vulnerability</i> - Workers - Wildlife	Moderate (Severity – Medium; Likelihood - medium)	- Build haul roads to standard widths for mining operations - Post signs along roadways - Restrict speed to 50 km/hour on access roads	Minor (Severity – low; Likelihood – medium)
Biological Resources – Terrestrial					
Construction	Land consumption and loss of terrestrial habitat	<i>Source</i> - Clearing for the open pit, tailings and water management ponds and other site facilities - Clearing for access road - Clearing for wharf <i>Vulnerability</i> - Displacement of wildlife - Nutrients in Biomass and Soil - Mortality and injuries of wildlife due to interaction with vehicles - Mortality and injuries of wildlife due to increased interaction with vehicles	Minor (Severity – low; Likelihood – medium)	None Provided. The surrounding area is exactly the same ecologically as the cleared area and the area cleared is a very small percentage of the total area.	Minor (Severity – low; Likelihood – medium)
Construction	Habitat Degradation	<i>Source</i> - Traffic resulting in dust covered vegetation. - Fragmentation caused by roads <i>Vulnerability</i> - Vegetation in access road vicinity - Displacement of wildlife. - Mortality and injuries of wildlife due to interaction with vehicles.	Moderate (Severity – medium; Likelihood – medium)	- Wet roads during the dry seasons. - Minimize road width - Limit speeds on roads - Implementation of a weed management program to control the spread of invasive and exotic species	Insignificant (Severity - low; Likelihood - low)
Construction	Increased Erosion and Disturbance of Soils	<i>Source</i> - Site preparation and construction of Roads, Tailings and Water Management Ponds. - Vegetation clearing for Site access and for construction. <i>Vulnerability:</i> - Disruption of nutrient cycles and destruction of soils. - Formation of gullies and increased sediment loads to aquatic systems. - Pollution of surface waters due to erosion.	Moderate (Severity – Medium; Likelihood – Medium)	Implementation of Best Management Practices	Minor (Severity – Low; Likelihood – Medium)

Construction	Mortality and Disturbance of Wildlife	<i>Source:</i> - Site preparation and construction of Roads, Tailings and Water Management Ponds. - More workers on site and noise from equipment. - Hunting by workers <i>Vulnerability:</i> - Displacement of wildlife. - Higher mortality and injuries of wildlife due to increased interaction with vehicles and hunting.	Moderate (Severity - medium, Likelihood - medium).	- Minimizing cleared areas - Slow and phased clearing to enable migration of wildlife - Maintenance of wildlife corridors in cleared areas - Ban on hunting and fishing by company employees - Controlled access of non-indigenous persons to mining concession - Minimization of noise emissions	Minor (Severity - low; Likelihood - medium)
Operation	Habitat degradation	<i>Source</i> - Dust accumulation on plants - Physical disturbance and noise from equipment operation - Blockage/intersection of wildlife corridors - Traffic on roads <i>Vulnerability</i> - Early succession/edge and secondary forest habitats located along roads - Displacement of wildlife and increased competition with wildlife on the perimeter of project area - Increased migration of wildlife - Animals on their way to and from feeding, breeding and birthing grounds, and between seasonal ranges - Animals attracted to access roads open spaces for protection from predators, food supplies and better travel conditions - Higher mortality and injuries of wildlife due to increased interaction with vehicles and hunting	Moderate (Severity - medium; Likelihood - medium)	- Wetting roads during the dry seasons - Minimize extent of the cleared areas - Utilise Best Working Practices for noise - Identification and flagging of migration corridors - Posting signs notifying drivers of the existence of these corridors - Speed restrictions on the access road in the vicinity of the corridors - Constrain width of access road - Lowered the vertical alignment to maximize line of sight. - Design access roads to minimize cuts and fills and with flat side slopes. - Hunting and fishing ban for employees	Minor (Severity - low; Likelihood - medium)
Closure	Habitat Degradation	<i>Source</i> - Encroachment by aggressive and unwanted plant species (pests) - Acid Mine Drainage <i>Vulnerability</i> - Native vegetation species and natural ecosystem - Historical fire regimes, - Soil nutrient regimes, - Increased soil erosion - Elimination/alteration of natural vegetative strata.	Moderate (Severity - low, Likelihood - high)	- Implementation of weed management program - Determination of acid generating potential - Placing acid generating material above the water table to isolate the material from contact with water - Capping acid generating materials with clay or other materials to reduce permeability	Insignificant (Severity - low; likelihood - low).
Biological Resources – Aquatic					

Construction	Loss of aquatic habitat and fauna	<i>Source</i> • Diversion/drainage of streams for haul roads • Impoundment of Tailings and Water management ponds • Constriction of surface water flows at culverts and other road crossings may create currents too fast for some fish species to survive. • Culverts on access road may act as barriers to movement of some aquatic species • Restricted migration of fish • Sediment discharge to waterways • Accidental spills of lubricants and fuel <i>Vulnerability</i> • Fish breeding areas. • Dissolved oxygen levels. • Nutrient loads to waterways. • Reproductive impairment, stunted growth, and other physiological effects. • Spawning success for fish species • Reduction of habitat suitability for many aquatic organisms	Major (Severity – high; Likelihood - medium)	1. Implementation of Erosion and Sediment Control Plan 2. Channelling contaminated runoff to oil-water separators prior to discharge to streams/creeks 3. Bridging areas of standing water 4. Designing culverts to enable the passage of migratory aquatic species by incorporating baffles to slow flows 5. Setting culvert bottoms below the level of the stream bed. 6. Designing culvert gradients to ensure that streambed gradients existing prior to construction are maintained to the maximum extent practicable	Minor (Severity – low; Likelihood - medium).

Operation	Degradation of aquatic habitat and water quality	<i>Source</i> - Absorption of creeks/streams within tailings and water management ponds - Process discharge to tailings and water management ponds - Sediment discharged in process wastewater - Hydrocarbon contamination of aquatic environment from accidental spills of lubricants and fuel <i>Vulnerability</i> - Fishes and other aquatic organisms trapped within tailings and water management ponds. - Decreased transparency and reduction of light available to aquatic plants. - Suspended sediment settlement onto instream habitat features (e.g., downed wood, gravel, etc.) or bottom substrate. - Reduction in available area and cover for small fish, macroinvertebrates, and periphyton. - Increased mortality caused by gill damage. Increased predation due to sedimentation of shelter. - Increased susceptibility to disease. - Impaired developmental rates. - Reduction of suitable spawning habitat and reduced spawning success. - Modification of migration patterns. Impairment of visual feeders. - Reduction of light penetration.	Major (Severity - high, Likelihood- medium)	- Construction of impoundment at a rate slow enough and in direction of stream flow to allow aquatic organisms to relocate outside of the footprint of the ponds. - Implementation of the Spill Contingency Plan - Implementation of Erosion and Sediment Control Plan	Moderate (medium Severity - medium; Likelihood - medium)

9.0 SOCIO-CULTURAL IMPACTS AND RISKS

9.1 Introduction

A summary of key socio-economic findings and issues/ concerns related to the project is presented here. The project to date has three components; mine, access road and wharf. As highlighted in the socio-economic baseline there are very few communities that are located in proximity to any of these project components and thus the direct impacts on human populace in neighborhoods/villages/towns is limited. However there could be potential indirect impacts that create social risks due to the development of the project such as possible influx in the remote areas due to building of access roads. In this section the potential impacts and risks are segregated by project component and phase (wherever appropriate) along with a rating of the impacts.

9.2 Mine

9.2.1 Construction Impacts

9.2.1.1 Potential influx into the Aurora concession due to mine area development and related risks

The Aurora mine site is located in a remote interior area. The development of the mines and potential employment opportunities may attract people to the site for work. Currently all hiring is done out of Guyana Goldfield Inc office in Georgetown and no recruitment is done on the site. With further development of the mines if the recruitment process does not continue to be streamlined and widely informed amongst the communities in Guyana, there is potential for people coming to the interior looking for jobs at the site.

At present there is a worker camp at the Aurora site (engaged in exploration activities) which has approximately 100-150 workers. The construction phase of the project will require more workforce. The exact estimates are not known and may vary depending on whether the hydropower units are built or not. Nevertheless the requirement for workforce will potentially double during construction phase of the project.

As has been the experience in several mining projects, once a worker camp is established in a remote area, it often attracts local people who come to sell goods and services to the workers. There is a possibility that the development of the mine may attract local vendors, service providers and even prostitutes into the area.

The influx situation may have a variety of impacts like:

- Pressure on existing resources - the site is already in a remote area which lacks resources and infrastructure. With the coming in of any local population and increase of workers it may pressurize the already limited shared resources like land, water, forest use, availability of goods and services;
 - Security issues - any influx can create security issues and increase crime leading to impacts on the Aurora workforce;
 - Impacts on worker health - the influx of people from outside could possibly create health risks to the Aurora workers and vice versa. Very often the introduction of new people into the area is often seen to be accompanied by transmission of contagious and other diseases. Influx of sex workers often leads to rise in HIV and other STD.
 - Social interaction with other groups is likely to bring about an increase in alcohol and drug abuse, prostitution and crime. The circulation of money from wages and salaries would sustain all of the workers leisure activities. This may increase the demand for alcohol, drugs and sexual services especially for those migrant and expatriate workers. In the mid-term this may bring about an increase in sexually transmitted diseases.
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This is adjudged to be a major impact (high severity, medium likelihood). With appropriate mitigation like planned development or discouraging influx the impact rating will be minor.

9.2.1.2 Increase in River Traffic

The river is the primary mode of transportation in the area. Communities upstream and downstream use the river for transport. The construction phase of the project may increase GUY movement of men and materials by the river. Current information available indicates that all goods will be carried from the wharf using the Barama road after which it will connect to the new road built by the company. At the point where the new access road ends a barge may be used to transport construction materials and equipment across the river to the site. The increase in river traffic potentially increases the risk of accidents and incidents with the local communities travelling the river.

This is a major impact (medium severity, high likelihood). Appropriate mitigation measures like a well enforced traffic management plan to control site related river traffic will reduce the impact rating to minor.

9.2.1.3 Expectation of Employment and Economic Opportunities

Owing to the lack of economic opportunities and intrinsic poverty and lack of infrastructure, the villages/local communities expect benefits from any project that develops here. They expect the project to promote local benefits such as employment and community development work.

They want benefits and not to be stuck with impacts of mining such as deforestation or pollution which has historically been their experience. Consultations in Kurutuku particularly revealed that unemployment and lack of economic opportunities was their primary issue and the indigenous community expects the Aurora project to provide them some benefits.

Information available indicates that currently it's not expected that the project will prioritise hiring locally (e.g from Kurutuku) as the recruitment centre is in Georgetown where it's difficult for most of these communities to go to. Hence direct local employment and sustained employment from the project is difficult.

The project not meeting the need for employment or providing enough economic opportunities could create discontent amongst the local communities and hinder fostering good relations.

This is a moderate impact (medium severity, medium likelihood). With appropriate mitigation like dialogue with local communities to understand their expectations and providing some employment or other opportunities would reduce the impact to minor.

9.2.1.4 Potential issues with artisanal mining

Artisanal mining is a common phenomenon in the area and considerable numbers of artisanal miners are present around GUY. concession. The building of the 40 km access road that will join the Barama transport corridor to the Aurora site could potentially create access for artisanal miners. This would lead to security risks and possible conflicts if they mine in GUY. concession.

This is a moderate impact (medium severity, medium likelihood). With measures like consultation and active patrolling of the concession boundaries the risk can be reduced to minor.

9.2.2 Operations impact

9.2.2.1 Reduction in employment and other induced economic benefits

It is often seen that mining projects create a situation of 'boom and bust'. In the construction phase there is high demand for workforce as well as opportunities for local service providers (vendors/contractors). Such demand typically reduces in the operations phase impacting local economy and employment rates. The operations phase of the project is likely to require fewer workforces especially for semi skilled labor. Thus the employment created during the construction phase is likely to go down drastically. This will create unemployment potentially locally around Aurora site or even nationally.

At the same time the reduction in workforce and less activities during operations phase could impact demand for local goods and services (if it was sourced locally) having an effect on the local or national economy.

This is rated as major impact (high severity, medium likelihood). The company has to follow sustainable strategies and diversify the skills of its workers as well as the service providers to enable them to find economic opportunities elsewhere in the country. A focused closure plan that addresses the issue of economic loss along with appropriate mitigation measures will reduce the impact to minor.

9.3 Barama Road

9.3.1 Increased Traffic and Safety Risks

Guyana Gold is proposing to upgrade the Barama road and use it as the main transport corridor between the wharf at Buckhall to the Aurora site. It is reported that there are no communities or settlements located along the 150 km transport corridor. However a screening exercise conducted by the company in April 2009 revealed that there are some artisanal mining camps that are located on various points on the road. There are a few shops along the road that sell groceries, alcohol and other amenities.

Although the exact traffic estimates are not known the construction and operations phase of the project is likely to increase movement of vehicles such as trucks or other vehicles carrying equipment along the Barama road. As the road is a public road it is likely that Barama or other companies or even artisanal miners use it to transport goods. The traffic volume due to Guyana Goldfield Inc. activities could greatly increase overall traffic movement in this corridor increasing dust, noise, vehicular emissions as well as increase risks of accidents and incidents.

This is rated to be a moderate impact (medium severity, medium likelihood). The enforcement of a traffic management plan in partnership with the Government and other users will reduce the impact to minor.

9.4 Wharf

9.4.1 Construction

9.4.1.1 Potential influx into Buckhall due to wharf development and related risks

Although the exact estimates are not available the information to date suggests that the construction of the wharf will require a significant amount of workers to build the wharf and associated facilities at Buckhall. Current plans also indicate that there will be facilities created to house workers at the Buckhall wharf area. Buckhall is mostly uninhabited but has 11 families living there. It is possible that the development of the wharf could attract workers (especially dock workers) into Buckhall in search of employment.

As has been the experience, once a wharf and worker camps are established it often attracts local people who come to sell goods and services to the workers. There is a possibility that the construction of the wharf may attract local vendors, service providers and even prostitutes into the area. The influx situation may have a variety of impacts like:

- Pressure on existing resources - With the coming in of any local population and increase of workers it may pressurize the already limited shared resources like land, water, forest use, goods and services;
- Security issues - any influx can create security issues and increase crime leading to impacts on the Aurora workforce;
- Impacts on worker health - the influx of people from outside could possibly create health risks for the Aurora workers, the inhabitants of Buckhall and vice versa. Very often the introduction of new people into the area is often seen to be accompanied by transmission of contagious and other diseases. Influx of sex workers often leads to rise in HIV and other STDs;
- Social interaction with other groups is likely to bring about an increase in alcohol and drug abuse, prostitution and crime. The circulation of money from wages and salaries would sustain all of the workers leisure activities. This may increase the demand for alcohol, drugs and sexual services especially for those migrant and expatriate workers. In the mid-term this may bring about an increase in sexually transmitted diseases.

This is adjudged to be a major impact (high severity, medium likelihood). With appropriate mitigations like planned development or discouraging influx the impact rating will be minor.

9.4.2 Operations

9.4.2.1 Reduction in Employment and other Induced Economic Benefits

In the construction phase of the wharf there could be higher demand for workforce which could reduce in the operations phase impacting local economy and employment rates.

The operations phase of the project is likely to require fewer workforces for loading and unloading at the dock. Thus the employment created during the construction phase is likely to go down drastically. This will create unemployment potentially locally in Buckhall or even nationally.

At the same time the reduction in workforce and less activities during operations phase could impact demand for local goods and services (if it is sourced locally) having an effect on the local or national economy.

This is rated as major impact (high severity, medium likelihood). The company has to follow sustainable strategies and diversify the skills of its workers as well as the service providers to enable them to find economic opportunities elsewhere in the country. If these measures are enforced correctly then the impact will be reduced to minor.

Table 45: Summary of Socio-Cultural Impacts

Phase	Impact	Source of Impact and Existing Vulnerability	Impact Rating Prior to Mitigation or Prior to Implementation of ESMP	Recommended Mitigation Measures - Proposed Social Management Plan	Impact Rating after Mitigation or After Implementation of ESMP
Social Resources					
Construction	Potential influx into the Area	<i>Source</i> - Development of mine - Potential employment opportunities - Inadequate information dissemination about GUY hiring practices - Non streamlined recruitment process - Local vendors - Service providers/Prostitutes <i>Vulnerability</i> - Pressure on existing resources like land, water, forest use, availability of goods and services - Security influx can create security issues and increased crime - Influx of people from outside could create health risks to the workers and vice versa. Influx of sex workers often leads to rise in HIV and other STD. - Social interaction with other groups is likely to bring about an increase in alcohol and drug abuse, prostitution and crime. - Circulation of money from wages and salaries may increase demand for alcohol, drugs and sexual services for migrant and expatriate workers.	Major (Severity - high, Likelihood - medium)	- Discourage influx into area for employment by having a clearly established hiring policy - Conduct information dissemination campaign on hiring practices - Undertake disease prevention training. Integrate communicable diseases and STD into fact sheets in H&S training for employees and contractors. - Make HIV and STD testing and counseling available to workforce, contractors on a voluntary basis. - Conduct awareness campaigns on HIV/AIDS for the workforce	Minor (Severity - low; Likelihood - medium)
Construction	Increase in River Traffic	<i>Source</i> Barge crossings of Cuyuni River <i>Vulnerability</i> Local communities and artisanal miners using Cuyuni River Equipment and materials being transported in barges on river Project employees	Major (Severity - medium, Likelihood - high)	Enforcement of Traffic Management Plan	Minor (Severity - low; Likelihood - medium)

Construction	Expectations/ concerns and management of local issues	<i>Source</i> Unaddressed socioeconomic issues in Kurutuku and communities serving as access points to project. The key issues are: Expectations of more jobs/opportunities from GUY which the communities feel are not coming to Them. Expectations that project will promote local employment and community development. Benefits associated with mining and dis-benefits of mining such as deforestation or pollution which has historically been their experience. Unemployment and lack of economic opportunities for residents of Kurutuku and other gateway communities; Bartica, Itaballi etc. <i>Vulnerability</i> Contentment of residents of Kurutuku and gateway communities such as Bartica, Itaballi etc. Good relations with Kurutuku and gateway communities such as Bartica, Itaballi etc.	Moderate (Severity - medium; Likelihood - , medium)	- Dialogue with Kurutuku and other gateway communities to understand their expectations - Providing employment and other opportunities to residents of Kurutuku and other gateway communities.	Minor (Severity - low; Likelihood - medium)
Construction	Potential conflicts with artisanal miners	<i>Source</i> History of artisanal, small and medium scale mining in area. Presence of unauthorized artisanal miners within concession <i>Vulnerability</i> Security of GUY workers Good relations with artisanal miners	Moderate (Severity - medium; Likelihood- medium)	- Consultation with artisanal miners - Active patrols of concession boundaries	Minor (Severity - low; Likelihood - medium)
Operation	Reduction in employment and other induced economic benefits	<i>Source</i> 'Boom and bust' effect. In the construction phase there is high demand for workforce as well as opportunities for local service providers. That demand will reduce in the operations phase. <i>Vulnerability</i> - Local economy and employment rates - Unskilled and semi skilled labor - Demand for local goods and services	Major (Severity - high; Likelihood - medium).	- The company will develop sustainable strategies and diversify the skills of its workers and service providers to enable them to find economic opportunities elsewhere in the country. - A focused closure plan will be developed to address the issue of economic loss with appropriate mitigation measures.	Minor (Severity - low; Likelihood - medium)

Operation	Increased Traffic and Safety Risks	<i>Source</i> - Upgraded Barama Road - Access Road to Mine Site <i>Vulnerability</i> - Trucks/other vehicles carrying equipment along the Barama and Access roads - Artisanal miners and shopkeepers - Company employees	Moderate (Severity - medium; Likelihood - medium)	1. Partnership with the Government and other road users to enforce Traffic Management Plan.	Minor (Severity - low; Likelihood - medium)

10.0 ENVIRONMENTAL MANAGEMENT PLAN

An applicable, relevant and appropriate Environmental Management Plan (EMP) has been developed to mitigate and minimize the environmental consequences identified in Sections 8 and 9. The EMP incorporates protection, mitigation, and enhancement measures. A separate monitoring plan has been developed to assess the effectiveness of the management plan. The environmental mitigation measures in this EMP include:

- Production technology, disposal methods, and engineering designs
- Pollution controls, recycling and conservation of resources, monitoring, special social services or community awareness and education and
- Compensatory measures for restoration of altered resources.

Monitoring would be undertaken to evaluate the success or failure of the environmental management plan measures and to reorient the EMP if required.

The EMP is intended to ensure that impacts which cannot be mitigated are minimized to the maximum extent possible and that positive impacts are enhanced. The EMP will ensure that impacts which cannot be mitigated do not exceed tolerable limits. Wildlife and vegetation impacts are not exactly mitigated by the provisions of the management plan, however, there is a relative abundance of similar vegetation and wildlife in the surrounding area. The open bodies of water left after completion of the mining operations will present a more diverse ecological system in the area and may result in habitation by aquatic species.

It is expected that wildlife will return to the area after completion of the mining operations and site closure. Regrowth may result in the growth of some plant types not initially present in the area.

The EMP addresses the management of raw cyanide and mining waste containing various concentrations of cyanide to preclude impacts on the environment.

10.1 Terrestrial Resources

New vegetation will be planted around production facilities and along access roads to mitigate the impact on terrestrial resources. Deep trenches, which were dug during the exploration phase, would be refilled to eliminate barriers to the passage of animals. Vegetated corridors will be maintained and gradually removed during construction to enable wildlife present in the area to relocate to adjacent areas. Construction rates will be monitored in relation to the time it will take for animals to move away from construction areas and construction works will be programmed, based on the results of that monitoring, to occur in a manner slow enough to ensure that animals can move to other locations. Construction of the tailings and water management ponds will progress in the direction of stream flow to enable aquatic organisms to vacate the area. Process plant and other buildings and facilities will be sited within areas which were previously cleared for earlier mining operations. The footprint of areas identified for tailings and water management ponds and the open pit together with the access road will be minimized.

Particular attention will be paid to vulnerable or conservation-worthy plant and animal species that will be affected and conservation measures will be enforced in consultation with the EPA Biodiversity Unit. Wildlife will be restricted access to cyanide-solution ponds, by erecting fences at strategic locations, if monitoring indicates significant occurrences of deaths associated with ingestion of water from the tailing pond and related water management facilities. In addition, all discharges from these facilities will be monitored to ascertain that discharges are safe for fish, as well as people. The company will restrict hunting for wildlife in the project area of influence by non-indigenous peoples. Access to the concession by non-indigenous persons, not employed by the project, will be restricted and the workforce will be educated about the consequences of hunting. GUY will also establish a reporting mechanism for hunting incidents within the concession.

The area will be revegetated with indigenous species after completion of mining as part of the Closure Plan. Primary and secondary site roads will be identified and site roads no longer needed would be closed to employees. The revegetation program will be tested on these closed roads to develop an appropriate revegetation program. The company will enact a policy to ensure no plants or wildlife is removed from the mine site. In addition employees will not be permitted to bring plants and wildlife from other areas to the mine site.

10.1.1 Implementation Schedule, Responsibility and Costs

The location of site facilities in previously worked areas and design of the ponds and pits to minimize their footprints will be undertaken by AMEC. Clearing operations will be undertaken by GUY during both construction and operational phases. These activities will take place during the design, construction and operation phases and GUY will be responsible for implementation. The costs for implementation of these measures are included in the project costs.

10.2 Openpit Management

Improper design of the mine pit coupled with improper mine operation may result in slope failure and pose threats to workers health and safety and equipment.

Mine walls will be designed based on the results of detailed geotechnical and geohydrological investigation with slopes to preclude slopes failures and slides. Excavated soil will not be stored at the crest of slopes. Ramps into the mine pit and roads within the pit will be wide enough to allow for the passage of two vehicles with slopes generally acceptable for the operation of those vehicles.

Discharge of contaminated water through the floor of the mine can result in groundwater contamination.

Equipment will not generally be serviced in the mine pit. Vehicle and equipment servicing will be restricted to emergency repairs only. In the event of emergency repairs, work will be undertaken to ensure there are no oil and/or fuel spills in the pit.

Groundwater inflow and precipitation can result in mine flooding.

Sumps will be excavated in mined out areas on the floor of the mine and all groundwater flow and precipitation will be channeled into the sumps. Pumps will be provided for mine dewatering based on the results of the hydrological analyses undertaken for the project. Berms will be maintained at the edge of open mine pits to prevent surface runoff from entering the open pit and from adding to the volume of groundwater inflow and direct precipitation.

10.2.1 Implementation Schedule, Responsibility and Costs

The geotechnical and geohydrological investigation and design of the mines pits will be undertaken by AMEC during the project design phase. GUY will be responsible for implementation of the measures to preclude groundwater contamination and flooding of the mine pit. These measures will be enacted immediately upon commencement of stripping operations for the mines and for the duration of the mining operation. The costs for implementation of these measures are included in the project costs.

10.3 Ground Support

Inadequate ground support can result in ground subsidence and may pose a threat to the health and safety of individuals working underground.

Excavation will progress from the lower level to the upper level and narrow veins will be excavated in the rock to ensure that the rock can adequately support open veins. As mining progresses to the next level up, material excavated from that level will be used to backfill the previous level mined. This system of excavating and backfilling will continue over the duration of the mine life.

10.3.1 Implementation Schedule, Responsibility and Costs

The ground support system will be designed based on the results of extensive geological and geotechnical investigations currently in progress at the site. GUY will be responsible for implementation of underground ground support system. Implementation of these measures is part of the operation, the costs for their implementation is a part of the overall project cost and no additional specific costs would be incurred to undertake this aspect of the EMP.

10.4 Overburden Management

Improper management of overburden spoils could increase sediment discharge to surface water and result in acid mine drainage after closure.

To minimize excessive land consumption and the associated clearing of forested areas, spoil piles will be located in mined out areas in the open pit. Initially spoils will be disposed above areas determined to be free of economic grade ore. However, as mining progresses, spoils will be disposed in mined out areas as part of the progressive reclamation. Spoil piles will be periodically watered to minimize dust emission. In addition, all spoil piles will be surrounded by a soil containment berm to preclude the easy flow of surface runoff and sediment. The containment berms will be constructed of soil pervious enough to enable the passage of surface runoff water while trapping sediment contained in that runoff. The height and slopes of each spoil pile will be such that foundation and slope failures do not occur. Spoil piles will be seeded and revegetated after closure.

10.4.1 Implementation Schedule, Responsibility and Costs

Spoil piles utilization will coincide with the commencement of mining operations. GUY will be responsible for the operation and management of spoil piles. The costs associated therewith are part of the project costs.

10.5 Water Management

Improper management of surface water can result in discharge of contaminated water and sediments to surface water and overtopping of the tailings and water management ponds.

All contaminated water will be directed to the water management pond. Liquid-based process wastewater will be channeled to the tailings pond. All water retention facilities will be provided with adequate capacity to contain the design rainfall event and to eliminate the likelihood and frequency of spills that may impact on downstream waters and on groundwater quality.

Site clearing operations will progress in a gradual and phased manner to ensure there are no large increases in sediment discharge. Sediment control structures will be used to prevent the inflow of sediment to surface water. These control practices will include sediment traps and screens to control runoff and sedimentation. Surface runoff from the workshop and other vehicle service areas will be channeled to oil/water separators. All water from the oil/water separators will be skimmed prior to discharge. The operations will monitor discharges to surface water upgradient and down gradient of the site.

The Tailings pond will be designed for the critical rainfall event. The top of the tailings pond will sit above surrounding ground level and will preclude runoff from the surrounding area from entering the pond. The pond would be provided with a minimum operating freeboard of 3 m which will allow for adequate containment of precipitation associated with the design rainfall event.

Water can exit the tailings pond dam as seepage through the embankment. Seepage controls will be provided in the design to maintain embankment stability, to decrease water losses and maintain water-quality at the site. Drains will be provided for seepage collection and all seepage collected in these drains will be pumped back into the process stream.

Precipitation data, topographic maps and stream flow measurements will be used during the design of the ponds to prepare hydrographs and frequency curves for use in estimating volumes of precipitation. Precipitation data from wet and dry years will be used to provide minimum, average, and maximum precipitation volumes to determine storage capacity for the ponds. The design of the ponds will include capacity to store precipitation incident on the ponds during rainfall. Surface runoff from other areas of the site will be channeled away from the tailings pond.

All storm water runoff will be channeled to the water management pond. Discharge from the water management pond will be via a spillway and will be channeled through a sediment control structure to remove sediment prior to discharge to surface water bodies in the site area. In some instances water from the water management pond will be discharged to augment water in the process circuit.

Infiltration through the base of the tailings and/or water management pond can negatively impact groundwater quality.

The tailings and water management ponds will both be provided with impervious liners. No direct discharge to surface water would be permitted from any of the ponds that constitute a part of the process circuit.

Openpit and water management and tailings ponds locations will eliminate flow in some streams/creeks.

The mine will be developed to ensure minimum disturbance to streams and creeks in the area. In instances where this cannot be avoided, these streams/creek will be diverted to ensure flow to downstream sections.

Improper management of water from the underground operation can result in discharge of contaminated water to groundwater and to surface water.

All water from the underground operations will be collected in impervious lined channels and will be directed to the sumps constructed on each mine level. Water from workshops and from drilling operations will be directed to oil-water separators. All water from the oil/water separators will be skimmed prior to discharge to surface water. Only water which attains EPA approved water quality standards will be discharged directly to the environment from the underground operations. All other water from the underground operation shall be directed to the Water Management Pond for treatment and clarification prior to discharge.

10.5.1 Implementation Schedule, Responsibility and Costs

AMEC will undertake all aspects of the design related to the water management facilities. That work will be done before construction activities commence at the site. GUY will be responsible for construction and maintenance of the water management facilities. All facilities will be constructed before mining commences at the site. Maintenance work on these facilities will continue throughout the operation

phase. The costs for the design, construction and maintenance of these facilities are an element of the project cost.

10.6 Tailings Pond Management

Improper design, construction and management of the tailing and water management ponds can lead to embankment failure and the discharge of contaminated water to the environment.

The tailings ponds will be designed to ensure stability of its embankment. Stability analysis will be performed of the embankment cross-section to optimize the structure with respect to cost and other objectives while maintaining reliability. Flow nets or an appropriate numerical method will be used to estimate seepage direction and volume and pore pressures at points within the embankment. A flow net is a graphical solution of Darcy's law to show steady flow through porous media and is used to show ground water flow. Finite-element and other analysis are also appropriate for predicting seepage direction and volume.

The analyses of the tailings pond embankment stability will consider the following failure modes:

- rotational slide
- overtopping
- foundation failure
- erosion
- piping
- liquefaction

Data for the analyses was generated by conducting a detailed geotechnical investigation in the area proposed for the tailings pond and on materials identified for use as fill for tailings pond construction. The objective of the investigation was to determine the geotechnical and hydrogeological conditions and characteristics of the subsurface soil and rock units as they affect the design of the structure.

Investigations comprised the installation of vertical boreholes through overburden units and bedrock, soil sampling, rock coring, field testing of soil and rock samples, and laboratory testing of the recovered soil samples. All open pit holes and any other holes where rock was encountered were packer tested to determine hydrogeological conditions, and vibrating wire piezometers for groundwater monitoring were installed in selected holes.

Field tests included standard penetration tests (SPT) and field vane tests in the overburden and packer tests in the rock. Laboratory testing was carried out on selected representative samples and comprised index and advanced laboratory testing. The subsurface soil, rock and groundwater conditions were inferred from the results of these investigations. .

The initial design of the tailings dam and other earth structures will be submitted to the EPA for review. The final design of the tailings pond and cyanide destruction ponds will be submitted to both GGMC and the EPA for approval of these structures prior to project start up and the use of these facilities.

Monitoring and preventive maintenance would be undertaken to assure optimal performance of the tailings and water management ponds. Monitoring will consist of visual observation of the tailings embankment, and the monitoring of piezometers and other instrumentation installed to assess the performance of these facilities. Preventive maintenance will be undertaken at all potential trouble spots observed during visual inspection. The preventative maintenance will be geared primarily to ensure the stability of the structure and to control seepage through the embankment cross-section. A beach will also be maintained immediately adjacent to the upstream slope of the embankments to increase the length of the seepage path and the stability of the embankment slope.

Measurements and monitoring will be made after the occurrence of unusual conditions such as heavy surface runoff or peak floods. If the characteristics of the tailings and the construction method change substantially over the time the pond is in use, these changes may alter the conditions governing the stability of the embankment. Changes could occur in crest levels, water levels, embankment slopes, cross-section geometry, seepage conditions, and material characteristics. A continuous program of inspection and maintenance would therefore be undertaken from the beginning of deposition throughout the life of the dam. Through careful monitoring, areas of concern will be noted and quickly repaired, thereby preventing failure.

Visual monitoring will be done to identify typical distress signals associated with tailings dam operation, such as cracking, wet spots on the downstream face, and critical settlement. The visual observations will be supplemented by instrumentation to enable an accurate interpretation of the extent of any problem likely to occur. The instrumentation inclusive of piezometers, settlement plates and inclinometers will be used to show developing trends in the behavior of the tailings and water management ponds.

The instrumentation would be installed in the embankment and its foundation to monitor changes which are critical to the embankment stability, and to predict unstable conditions. Instruments will be installed to measure pore water pressures, seepage flows, embankment movements, and total pressures. Pore water pressure in soils will be measured with piezometers. Seepage flow emerging downstream from the embankment, will be collected and directed to a weir for flow measurements. Seepage flows will be used to indicate when significant changes occur and to permit an evaluation of potential problems from piping.

Markers will be installed on the embankment surface and would be aligned in a straight line-of-sight to permit rapid detection of horizontal movement during surveys. In instances where cracks are visible on the embankment surface, successive measurements between two stakes spaced either side of the crack will indicate any widening and acceleration in separation rate.

Slope indicators will also be used to measure horizontal movement of the embankment. The slope indicators works by telescoping cylindrical casing into the embankment during construction. A sensing element is lowered down grooves inside the casing and measures the slope of the casing in two directions at right angles. From the measured slopes, the horizontal movements occurring over the length of the casing can be calculated. Settlement will be measured by leveling of temporary benchmarks.

The frequency of monitoring will depend on previous observations and on the critical nature of the parameters. The frequency of monitoring will be more pronounced during and immediately after construction. When records indicate that conditions are relatively stable, the frequency of monitoring will be extended.

10.6.1 Implementation Schedule, Responsibility and Costs

AMEC will undertake the geotechnical investigation and design the tailing and water management ponds prior to the commencement of construction activities at the site. GUY will undertake the construction work for the tailings and water management ponds, however AMEC will provide quality control/quality assurance (QA/QC) services to GUY during the construction phase and supervise the installation of embankment and foundation monitoring instrumentation. GUY will retain a reputable engineering firm to monitor the performance of the ponds during the project operation phase. Costs for design, construction, QA/QC and monitoring services are included in the project costs.

10.7 Ore Recovery

Improper recovery of ore may result in losses of pay dirt during mining and the associated loss in income from the mine.

Pay dirt shall be recovered using a system of primary and secondary stopes. The primary stopes shall be mined first. During mining of the primary stopes, the secondary stopes shall be utilized for ground support. The secondary stopes shall be mined after the primary stopes have been backfilled.

10.7.1 Implementation Schedule, Responsibility and Costs

The layout of primary and secondary stopes will be designed based on the results of extensive geological and geotechnical investigations currently in progress at the site. GUY will be responsible for implementing this system during the underground mining operation. Implementation of these measures is part of the operation, the costs for their implementation is a part of the overall project cost and no additional specific costs would be incurred to undertake this aspect of the EMP.

10.8 Hazardous Material Management

Improper handling of hazardous materials could result in discharge to the environment.

Hazardous materials at the mine site are expected to include cyanide, tailings with various percentages of cyanide, waste oils and grease from work shop operations and from vehicle. Hazardous materials will be located in secure storage facilities on-site to prevent accidental release and protect against rainfall that may result in contaminated run-off and leaching. All storage areas for hazardous material will be concreted to provide an impervious surface and to prevent uncontrolled discharges to groundwater. Material Safety Data Sheets (MSDS) will be kept on site and all measures to contain spills of hazardous materials shall be in accordance with the procedures therein. No rainfall would be allowed to percolate through areas where hazardous materials are stored and no uncontrolled run-off will be permitted from these areas. Stormwater from areas around storage facilities will be channeled to the water management pond.

Incompatible substances that can react upon mixing to generate heat, fire, gas, explosion, or violent polymerization will not be located within proximity of each other. Hazardous material will be disposed of in accordance with guidelines established by the EPA. Cyanide and cyanide waste will be managed in accordance with the cyanide management plan detailed below.

10.8.1 Implementation Schedule, Responsibility and Costs

These facilities will be constructed before the commencement of shipment of these materials to the mine. GUY will be responsible for constructing the impervious bases and containment facilities for hazardous materials and for managing the facilities. The costs for design and construction are included in the project costs.

10.9 Explosives Management

Explosives will be stored in a magazine manufactured to conform to U.S. Government specifications. The Explosive Storage magazine would be designed to be bullet, fire, weather and theft resistant. It would be manufactured from high quality heavy gauge steel with plywood or hardwood lined interiors and would be properly ventilated.

Placards will be posted on or near each magazine door, specifying explosive and personnel limits and general safety precautions that would be observed during work in the magazine. Vegetation around the magazine would be controlled to minimize potential damage. At least two fire extinguishers would be provided and maintained for immediate use by personnel working around the magazine. The purpose of these extinguishers would be to fight small external fires or magazine fires that do not involve explosives.

Explosives would be stored on shelves in the magazine. Explosives and explosives containers in storage would be positioned safely and securely. If explosives containers are stacked, they will be placed in stable arrays. Load limits will be established for shelves in the magazine. Materials will not be left suspended by booms, cranes, or hoists in the magazine.

Stored explosives will be segregated by lot designation. Stacks of explosives would be arranged so that air freely circulates to all parts of the stack. To prevent moisture accumulation, pallets would be used to ensure that containers are not stacked directly on the magazine floor. Aisles shall be wide enough to accommodate inspection, inventory, sampling, and materials handling operations in the magazine. Unobstructed aisles will be maintained to permit rapid exit of personnel.

The magazine will be locked at all times except when permissible operations are in progress or when opened for ventilation. Personnel will be present whenever the magazine is open for ventilation. All exit doors will be unlocked and open when personnel are working in the magazine.

The explosive magazine will be inventoried annually to determine the total weight of explosives present and to remove and destroy materials that are not properly identified or labeled.

Empty containers, tools, conveyors, lift trucks, skids, etc. would not be stored in the magazine. Combustible materials such as packing materials and boxes will not be stored in the magazine. Flammable liquids will not be stored or used in the magazine unless the liquid is an explosive or is needed as an explosives-wetting agent, or is an integral part of an explosives device.

Operations in and around the magazine will be prohibited when an electrical storm is in progress and minimized when it is evident that such a storm is approaching. Explosives handling operations will not be performed when magazine entranceways do not provide adequate footing. No operation involving hazardous materials will be permitted in the magazine. Only one container of explosives will be opened at one time in a magazine.

10.9.1 Implementation Schedule, Responsibility and Costs

The magazine will be constructed before the commencement of shipment of explosives to the mine. GUY will be responsible for constructing magazine for its management. The costs for design and construction are included in the project costs.

10.10 Cyanide Management

The transportation, storage, use and disposal of cyanide at the mine can be hazardous both to human health and the environment.

Best Management Practice (BMP) techniques will be adopted to minimize the risk of environmental damage from accidental cyanide release. The main goals of the BMP shall be to:

- Minimize the amounts of cyanide required for gold recovery
- monitor all operations, discharges and the environment to detect any escape of cyanide and subsequent impacts of that release
- ensure a full understanding of the actual and potential hazards and environmental impacts of cyanide use
- maximize the recovery of cyanide or to ensure its destruction
- construct physical containment facilities to control spills or leaks of cyanide
- to dispose of cyanide in a way that minimizes environmental impacts
- to keep adequate records of cyanide use.

Clear responsibility will be established for all phases of cyanide use, including transportation, storage, use and disposal. Cyanide levels in the tailings will be reduced by passage through an agitated cyanide destruction tank. In this tank the residual cyanide content would be reduced below permissible levels through oxidation, using SO₂-air process.

10.10.1 Transport

The transport of cyanide will be performed to ensure protection of all communities and the environment during transport. Clear lines of responsibility will be established for all aspects of transport including the safety, security, release prevention, personnel training and emergency response procedures in event of unplanned releases. The mines manager will identify personnel responsible for each aspect of cyanide transport. The transport aspects will include as follows:

- packaging & labeling
- storage and security at port of entry,
- transport to the operation,
- unloading at the operation,
- safety training
- security during transport,
- emergency response during transport.

The Emergency Response Plan addresses spill response scenario during transport to the site. All personnel involved in cyanide transport would be trained prior to the commencement of operations and would also be given periodic refresher training in the use of the equipment and in the implementation of the Emergency Response Plan.

Warning signs will be posted on all transport equipment alerting workers of the presence of cyanide and that smoking, open flames, eating and drinking are prohibited. In addition, workers will be required to wear cyanide-specific personal protective equipment. Security measures, such as lockouts on valves and fenced and locked storage of solids, would be provided at all transshipment points and at interim storage sites.

Storage of both solid and liquid cyanide would be separate from incompatible materials such as acids, strong oxidizers and explosives. All contact with low- and neutral-pH water would be prevented during shipping. Storage facilities will have spill containment capacity at least equal to 120% of the capacity of the storage area and personal protective equipment and clean-up materials appropriate for the type and amount of cyanide stored would be provided at all storage locations.

High-risk sections of the route to the site, such as river and stream crossing and areas of highly pervious soil, would be identified and evaluated to determine the need for special precautions in these areas. Communities in the area will be consulted and all applicable governmental/EPA transportation related and emergency response procedures would be considered to prevent and respond to any releases during cyanide transport.

The company road safety program for all cyanide transport vehicles will include, but not be limited to, vehicle and tire inspections, preventive maintenance, limitations on drivers hours, tie-down procedures for solids, and procedures by which transportation can be suspended if severe weather conditions are encountered. Vehicle operators will retain records to document that these activities have been conducted. The company will also implement inventory and/or chain of custody documentation procedures to identify the loss of any cyanide material during transport.

All transport vehicles will be provided with emergency communications capability to ensure timely communication. Any spills/releases will be immediately reported to the Mines Manager who will

immediately inform all potentially impacted communities, relevant government agencies and the company's designated emergency response team.

10.10.2 Handling and Storage

The company will design and construct unloading, storage and mixing facilities consistent with sound and accepted engineering practice and will employ quality control/quality assurance procedures and spill prevention and containment measures to protect workers and the environment during cyanide handling and storage.

To the extent practicable, all unloading and storage areas for liquid and solid cyanide would be located away from people and surface waters. Where this is not practicable, the potential for release to surface water and/or human exposure associated with the storage location would be evaluated and the operation would implement protective measures to prevent or minimize these potentials. The protective measures will include automatic sensors and alarms for hydrogen cyanide gas, additional containment structures, and specific emergency procedures for evacuation and response.

Unloading of all cyanide would be done on a concrete surface that can prevent leaks from coming in contact with the environment. An automatic level indicator, high-level alarm, or integrated tank and tanker valve-shutdown device will be provided on all cyanide storage tanks to prevent overfilling. Direct observation of tank levels or use of a manual gauging rod would not be done to prevent overfilling of cyanide storage tanks.

Storage areas for cyanide would be well ventilated to prevent the build-up of hydrogen cyanide gas. Measures would be put in place to minimize the potential for contact of cyanide with water. These measures will include storage in covered enclosures and off the ground or in secure containers.

The public and workers not directly involved in cyanide operations will be prohibited from accessing cyanide storage areas by a fenced boundary or by storing cyanide within a separate fenced and locked area of the plant. Cyanide would be stored separately from incompatible materials such as acids, strong oxidizers and explosives with berms, bunds, walls or other barriers that will prevent mixing.

Cyanide storage and mixing tanks would be located on a concrete surface to prevent seepage to the subsurface. Secondary containment would be employed to contain releases from these tanks as well as any precipitation that may come in contact with cyanide. The secondary containment will allow for recovery and return to the cyanidation process or proper disposal. Secondary containments used for this purpose would be constructed of concrete, plastic or other materials demonstrated to provide a competent barrier to leakage. All containments will be sized to hold 120 % of the volume of the largest tank within the containment and any piping that drains back into the containment.

Cyanide storage and mixing tanks and related pipeline would be constructed or coated with materials that are compatible with cyanide and high pH conditions. Tanks and pipelines would be clearly identified as containing cyanide. The direction of flow would also be indicated on pipelines. Cyanide-specific first aid and emergency response equipment would be readily available for use at unloading, storage and mixing locations, including high-pH water for decontamination of exposed workers, oxygen and a resuscitator and appropriate personal protective equipment. An antidote for cyanide poisoning will also be available. Workers involved with unloading, storage and mixing of cyanide would be trained in the use of emergency rescue equipment and in the first aid procedures for responding to cyanide exposures.

Spill neutralization and clean-up equipment would be available for use at unloading, storage and mixing locations. This will include water for cleaning spills of liquid cyanide, shovels for cleaning up spills of solid cyanide, and chemicals to treat or neutralize cyanide and cyanide-contaminated soils, as well as

cyanide-specific personal protective equipment. Personnel engaged in unloading, storage and mixing activities would be trained in the operation's procedures to respond to cyanide spills, including notifications, clean up and detoxification.

Storage areas, pipelines, pumps, valves and tanks would be inspected at least once monthly for evidence of leakage, presence of solution in secondary containments and integrity of the containment. Deficiencies would be noted and records would be retained documenting the inspection and the implementation of necessary corrective measures.

Empty cyanide containers would not be reused on or off the mine site for any purpose other than holding cyanide. Prior to their disposal or reuse, cyanide drums would be rinsed with high-pH water three times, and the rinse water would be added to the cyanidation process. The rinsed drum would then be crushed and placed in the onsite landfill. Plastic bags and liners would also be triple-rinsed prior to disposal. Wooden container would be burned or disposed of in the spoil pile area.

10.10.3 Operations

All cyanide related facilities would be inspected on an established frequency sufficient to assure and document that they are functioning within design parameters. Tanks holding process solutions would be inspected for structural integrity and signs of corrosion and leakage. Secondary containments would be inspected for their integrity, the presence of fluids and their available capacity, and to assure that drains are closed and, if necessary, locked, to prevent accidental releases to the environment. Leak detection and collection systems at leach pads and ponds would be inspected as required. Pipelines, pumps and valves would be inspected for deterioration and leakage. Ponds would be periodically inspected to ensure available freeboard and the integrity of embankment.

Facility inspections would be documented on inspection forms and in log books and would include the date of the inspection, the name of the inspector, and any observed deficiencies. The nature and date of corrective actions also would be documented.

Preventive maintenance programs would be implemented to assure the continuous functioning of equipment and devices that are necessary for cyanide management. Pumps, pipelines, and cyanide treatment, destruction and regeneration equipment would be regularly maintained so that failures do not result in worker exposure or releases to the environment. Preventive maintenance activities would be documented.

The operations would have a source of emergency power for pumps and other equipment when their primary power supply is interrupted to prevent unintentional cyanide releases and worker exposures. Back-up power generating equipment would be maintained and tested to ensure its availability if needed.

The operations will use bottle roll or another test procedure to determine the optimal rate of cyanide addition for the process. The rate of addition would be reevaluated and adjusted as necessary when changes in ore type or processing plant practices occur that effect cyanide requirements.

Unintentional releases will be prevented by maintaining adequate freeboard in tailings storage facilities. All facilities will be inspected and monitored to determine the accuracy of the water balance and to assure the facilities operates as designed. This will prevent an over-accumulation of water that can result in overtopping, unplanned discharge into the environment, and potential structural failure of the facility.

Tanks holding process solutions such as leaching vessels, CIP/CIL tanks and cyanide tanks associated with cyanide regeneration activities would be located on concrete to restrict seepage of spilled solution or leakage to the subsurface. Secondary containment would be provided for a potential failure of cyanide

process solution tanks, with provisions for recovery of released solution such that adverse impacts on surface or ground water are prevented.

Spill prevention or containment measures would be provided for pipelines transporting process solution. These measures will include secondary containment ditches, differential pressure sensing with alarms and/or automatic shutoff systems, or preventive maintenance programs with pipe thickness measurements. Cyanide process tanks and pipelines would be constructed or coated with materials that are compatible with cyanide and high pH conditions. Tanks and pipelines would be clearly identified as containing cyanide. The direction of flow would be indicated on pipelines.

Facilities for the management of cyanide would be constructed according to accepted engineering standards and specifications. Quality control and quality assurance programs would be implemented during construction of new facilities and modifications to existing facilities to assure their structural integrity and their ability to safely contain process solutions and solids.

The quality control and quality assurance program would address the suitability of the materials of construction and the adequacy of soil compaction for earthworks such as tank foundations and earthen liners. Quality control and quality assurance procedures would also be implemented for installation of synthetic membrane liners used in ponds, for pipes, pipe fittings, for welds and bolts on cyanide storage and process tanks, and for any other equipment containing cyanide. Records would be retained to document that the specified quality control and quality assurance procedures have been followed.

Holding facilities and compounds will be designed and maintained to ensure the storage areas are adequately ventilated to disperse any build up of hydrogen cyanide gas to minimize the possibility of contact with water. In addition all storage areas will be bunded and will be located well away from natural drainage channels. Cyanide will be stored separately from corrosive, acidic and explosive materials. The storage area will be fence and locked to prevent accidental entry or access by unauthorized individuals. The storage area will also be designed to be fire resistant and will be provided with adequate fire fighting capability. In addition, all vegetation will be cleared from the storage area to decrease the likelihood of fires.

An inventory will be maintained of all quantities stored and any loss will be immediately reported to the mines manager and to GGMC.

The company will deploy a system to enable rapid determination of cyanide concentration in any waste water discharged from the site. One of the following systems will be deployed.

- Cyanide Ion Specific Electrode
- Cnfield Cyanide Testing System
- Basic Color-Disc Field-Test Kits

10.10.4 Emergency Procedures

Operators undertaking operations involving cyanide use will wear appropriate protective clothing. For respirable forms of cyanide, a full face respirator would be worn. Since cyanide can be absorbed through skin, for liquid cyanides, worker would wear disposable coveralls, PVC gloves and waterproof boots. Workers will wash their hands before eating, drinking or smoking. Contaminated protective gear and clothing would be securely discarded, or washed before being stored and re-used. Operators will be protected through a monitoring and sampling program for airborne contaminants in confined spaces. Sampling for hydrogen cyanide gas will either be undertaken continuously, using electronic detection equipment, or batch sampling will be done using air pumps and sampling tubes.

Operators will work in pairs with one acting as a 'sentry' during all operations. The role of a sentry will be clearly defined and will be primarily to act as a passive observer of any cyanide handling process. The sentry will participate in the handling process only in the event of an emergency. Cyanide handling operations will include the following:

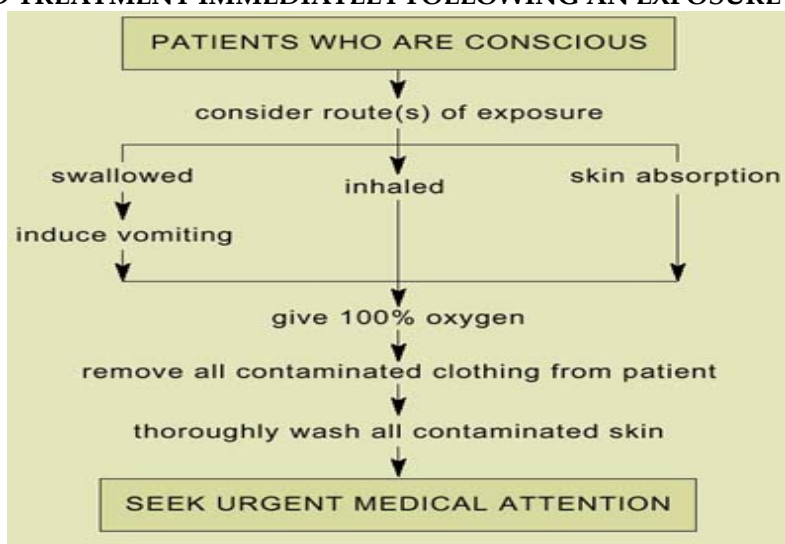
- opening storage containers;
- dissolving sodium cyanide pellets; and
- cleaning-up cyanide spillages.

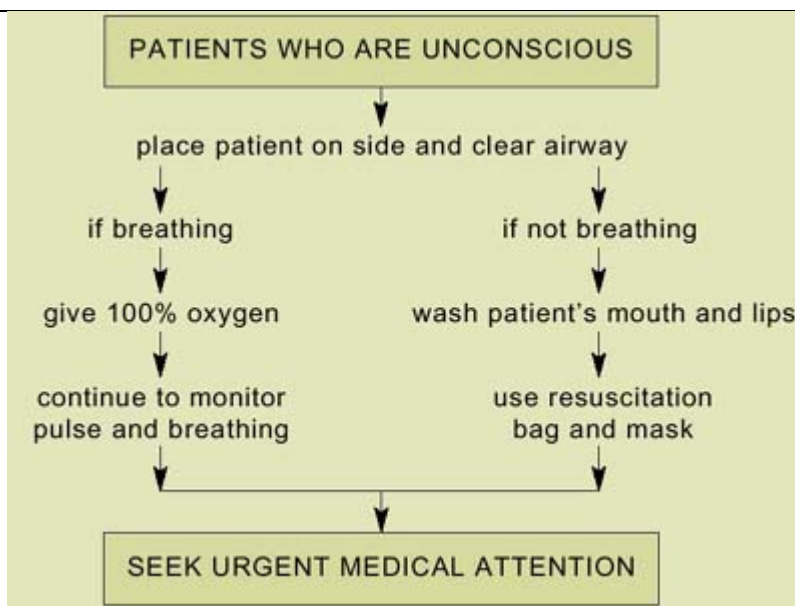
Should an operator be exposed to cyanide, effective and timely medical care will be provided. All personnel would be required to be familiar with the treatment procedures for personnel affected by cyanide exposure presented in the box below. The treatment of cyanide poisoning will fall into two categories.

1. Patients who are conscious
2. Patients who are unconscious

Treatment for both categories will be undertaken swiftly and efficiently by well trained and properly equipped personnel.

FIRST AID TREATMENT IMMEDIATELY FOLLOWING AN EXPOSURE INCIDENT





10.10.5 Implementation Schedule, Responsibility and Costs

AMEC will undertake the design of the cyanide containment facilities before/during construction works at the mine. GUY will undertake the management of cyanide transport, storage, use and disposal. GUY will also be responsible for employee training to respond to releases and training for transport, storage, use and disposal of cyanide and cyanide related waste. All signs required as part of the operation will be provided and be maintained by GUY. The costs associated with these measures are part of the project costs.

10.11 Waste Management

Improper disposal of waste could result in releases to the environment and the presence of vectors and vermin at the site.

The following waste will be generated by the project:

- overburden during mining
- tailings from the processing operation
- solid waste, including food waste from the camp operations
- septic waste from the camp operations

Overburden will be placed in spoil piles in the mined out area. All tailings and other process waste will be placed in the tailings pond. Solid waste from the operation of the camp will be included with overburden and would be placed in the spoil piles or disposed of in secure areas designed in accordance with guidelines provided by the EPA. All food waste and organic matter will be composted and the composted material will be used as fertilizer for revegetation of the spoil piles after closure. Septic waste will be managed by a series of septic tanks on site. Discharge from the septic tanks will be channeled through a granular filter bed prior to discharge. Septic tanks contents will be emptied as dictated by capacity constraints, by a licensed operator and will be trucked to Georgetown for disposal in accordance with EPA guidelines. The coarse fraction of the tailing waste, recovered from the gravity circuit, will be used as hard capping for access roads.

10.11.1 Implementation Schedule, Responsibility and Costs

Waste management procedure will be implemented after the commencement of mining operations. GUY will be responsible for implementation. The costs for waste management are included in the project costs.

10.12 Land Reclamation

Land reclamation will reduce negative perceptions and impacts associated with open pit mining.

All open-pit and spoil pile areas will be regraded to fit into the surrounding topography. Erosion controls would be applied around regraded areas to minimize soil loss prior to vegetation taking hold. Minimum compactive effort will be exercised during regrading to ensure that the soil compaction does not prevent stormwater infiltration. This will ensure the soil would be able to fulfill its diverse functions as a water reservoir, a biotope for plants and animals, and a basis of agricultural production. Regraded areas will be covered by humus to enhance conditions for revegetation. All streams that were temporarily diverted during the mining operations will be restored to their channels and cross-sections and berms will be provided adjacent to the reclaimed channels to preclude the easy flow of sediment into the restored waterways.

10.12.1 Implementation Schedule, Responsibility and Costs

Land would be progressively reclaimed during mining operations. GUY will undertake all land reclamation activities at the site. The costs of reclamation are included in the project costs.

10.13 Air Quality, Dust and Noise

Improper management of air in the mine can negatively impact the health of individuals working underground.

A ventilation system will be installed to provide fresh air to underground personnel and to remove foul air from the underground mine. The system will be designed to provide approximately 400 – 500 m³/sec of air to the mine. Ventilation requirements will be based on an estimation of the number of underground diesel equipment (trucks, LHD etc.) required for the 3,000 – 4,000 tonnes/day production rate. Manufacturer catalogues will be referenced to determine the approximate installed power on each piece of equipment. The Province of Ontario Mining Regulations 1 has been used to establish an adequate volume of air for ventilating the mine. The size and number of mine ventilation openings will be based on the following economical air velocities:

- Maximum air velocity in a bored raise - 15.2 m/s (3,000 fpm).
- Maximum air velocity in lateral excavations - 7.6 m/s (1,500 fpm).
- Maximum air velocity in circular concrete lining production shaft with fixed guides - 12.7 m/s (2,500 fpm).

Dust and other emissions to air can negatively impact air quality.

Water will be periodically sprinkled on roads, other conveying routes, stock piles and spoil piles to control dust emissions. Other emissions to air will include NO_x, CO, VOCs - a precursor of ozone, SO₂, respirable PM₁₀ and PM_{2.5}, and hazardous air pollutants (HAPs) from the operation of gasoline and diesel fired equipment. These emissions will be reduced to minimum levels by following the protocols of the manufacturer for equipment use and maintenance.

Excessive noise can damage the hearing of employees at the site and disrupt communications between animals in the area.

The noise emissions would be limited by appropriate soundproofing of individual pieces of equipment. Equipment will be fitted with special exhaust systems (mufflers). Additionally, the employees will be required to wear personal noise-protection gear, e.g., ear protectors.

10.13.1 Implementation Schedule, Responsibility and Costs

The implementation of these measures will commence during the construction phase of the site works and GUY will be responsible for implementation. The costs associated with these measures are part of the project costs.

10.14 Employee Health and Safety

Water in tailing and water management ponds may favor the multiplication of waterborne disease vectors such as flies, mosquitoes and other parasites and the introduction of new ones.

Pesticides that are non-toxic to humans, fish and livestock will also be used for habitat and vector control. A body will be established to provide health advisory and support health services and to monitor disease vector and disease incidences.

During the operation of the facility, emphasis will be placed on providing a safe and healthy environment for the workers. A health and safety plan will be implemented to ensure compliance with the regulations of the OHS Act 1997. Occupational Safety & Health plans will be implemented in the following areas:

- Industrial Accident prevention and management
- Occupational Hygiene.
- Illness & Infectious disease prevention and management.
- Sewage and Waste Disposal.

10.14.1 Industrial Accident Prevention and Management

Industrial accident prevention and management will be effected via the company safety program. This will commence during the construction phase of the new facility and last through the operating phase until the cessation of operations. The program will include the following:

- Hazard identification and control.
- Monitoring and reporting of industrial accidents.
- Training or education of employees in industrial first aid.
- Industrial Accident Protocol.
- Fire Safety & Preparation.
- Hazard Identification and Control

Table 46 lists the potential hazards in different phases of the operations of the facility and the preventative and remedial activities necessary for their elimination and control. In addressing these hazards, the first priority will be their elimination via modification in the design of equipment or process. If this is not possible or feasible and the hazard cannot be eliminated, then the employees will be provided with the necessary safety protective gear to prevent any injuries during the work process.

Table 46: Potential Hazards

Phase	Potential hazard	Protective & preventative Safety measures
1. Clearing of Site & Construction of Living Quarters: felling trees removal of topsoil & overlying vegetation assembly of building assembly of generating plant	Insect Bites Snake Bites Minor Trauma to Extremities Lacerations from use of sharp tools	Use of insect repellants Provision of snake bite kits Use of safety shoes & gloves
2. Excavation of Ore	Fugitive dust blown into eyes Inhalation of fugitive dusts High noise levels from working of heavy duty vehicles - trucks, tractors etc.	Use of clear goggles Use of dust/mist respirators Use of air plugs
3. Smelting of ore in furnaces	High temperatures Minor burns to extremities	Use of heat resistant aprons/overalls Use of heat resistant gloves
4. Operation of Power generating plant	High noise levels High noise levels	Use of air muffs, Wearing of air plugs
5. Maintenance shop operations	Contact dermatitis skin irritation from exposure to grease High noise levels	Use of barrier creams & detergents on hands Use of air plugs
6. Cyanide Exposure	Inhalation of Cyanide Gas Ingestion	Use of respirators, clear goggles, protective gloves, coveralls, cyanide gas monitoring, washing before eating, drinking or smoking.
7. Onsite and Offsite Spill	Discharge to Groundwater Discharge to Surface water	Containment around storage areas Monitoring discharges Communication with impacted areas

Hazard identification and reporting will constitute an ongoing activity in which the employees' participation will be considered an integral part of his work functions. The OHS Act 1997 clearly stipulates the responsibilities of employees and supervisor/management in this regard. In accordance with those regulations the supervisor/manager will do the following:

- Inspect all machines and equipment for the existence of potential hazards and ensure that they are in working order.
- Inform the worker of any hazards present.
- Instruct the employee in the correct safe work procedure to prevent injuries and ensure that those instructions are followed
- Provide the necessary safety protective gear when required.

In accordance with OSH Act 1997 employees will be authorized to do the following:

- Cease work once a hazard is perceived.
- Report the hazard to the supervisor who will in company with the safety representative inspect the condition or circumstance and determine its validity.
- Obey the instruction to perform alternative work or cease work completely as directed by the supervisor.
- Return to the workstation or proceed once the hazard has been adequately dealt with or eliminated.

10.14.2 Hazard Monitoring and Reporting

The Safety Representative, elected from among the workers, will monitor hazards and work conditions. He will do the following:

- Perform Safety Inspections on and off the operations site on a regular and programmed basis (at least once per month) for the detection of unsafe conditions or any potential hazards and report these hazards to management.
- Record all minor and loss time accidents in a ledger as required by the Ministry of Labor (Table 47 shows the format to be used for recording industrial accidents).
- Remit reports of industrial accidents or fatalities to the Ministry of Labor when required.

Table 47: Accident Report Format

ACCIDENT REPORT FORMAT

Personal injury	Equipment damage
Name of person involved	Dept/ Area
Name of injury	
Place of injury	
Description of accident	
Type of accident:	Loss Time
Foreman Signature.....	Minor
Diagnosis.....	
Remarks.....	

In addition to the abovementioned, all employees will be educated about their responsibility to participate in the creation of a healthy and safe environment by:

- reporting unsafe and hazardous conditions when detected
- performing work in a safe manner by following the correct work procedure.

10.14.3 Training & Education of Employees

The company will run periodic training program in:

- Basic first aid programs (all employees).
- Advanced first aid programs
- Accident investigation & reporting seminars (supervisory personnel & safety reps.)

The basic first aid program will be extended to all employees and would be geared to ensure that in the event of an accident or injury, someone with first aid knowledge will always be present to render initial assistance until further medical attention can be made available. Qualified personnel will run seminars to

impart the necessary theoretical as well as practical skills required. These courses will be scheduled depending on employee strength and attrition.

The advanced first aid program will constitute an upgrading course from the basic first aid program in which selected employees including supervisors and the Safety representative will be exposed to advanced first aid knowledge and techniques which will enable them to participate in the recognition and the initial management of serious injuries and illnesses e.g. Fractures, Spinal Injuries, Malaria, Typhoid fever etc.

10.14.4 Industrial Accident Protocol

Serious injuries will be referred to a medical practitioner and medical institution. The medical institution and practitioner will preferably be chosen from the nearest Town/Village to the operations and contact will be maintained by radio/ radiophone at all times. In the event of an industrial accident the following protocol will be followed:

- A basic first aider will be summoned if not already present at scene of accident.
- The basic first aider will render first aid care.
- The basic first aider will summon an advanced first aider who will administer further care if necessary and evaluate the necessity for removal to the first aid centre.
- The advanced first aider will summon the vehicle specifically identified for this purpose and supervise the removal of the injured to the first aid station.
- The employee's immediate supervisor will be informed. He will:
 - Make contact with the identified medical Practitioner and Institution and inform them of the time of arrival of the injured employee.
 - Complete the accident form and forward same along with the injured to the medical institution for completion by medical practitioner
 - Inform the Safety representative who will record the accident in the Industrial accident register.

A vehicle will be available at all times to respond to accidents. That vehicle will be equipped with a four wheel drive and will have the following equipment:

1. oxygen cylinder and gas masks resuscitation equipment,
2. a bed and accommodation for a first aid attendant to sit alongside the injured,
3. a flashing light attached to warn other road users,
4. communication equipment.

10.14.5 Occupational Hygiene

The main environmental occupational hazards to which employees will be exposed during the operations phase of the mining entity are:

Dust.
Noise.
Heat
Fumes

10.14.5.1 Dust Exposure

The following measures will be implemented in order to decrease or eliminate respirable dust inhalation and prevent any adverse effects on workers:

- Provision of dust respirator with filters to employees exposed during the excavation and transportation of ore
- Siting of living quarters a convenient distance from the operations site and on the leeward side of same.
- Minimal denudation of vegetation around campsite.
- Chest X-Rays of all employees once yearly in order to detect any incipient pulmonary disease such as persistent coughing and/or shortness of breath.

These measures will assist in elimination or reduce further the very low risk of the development of lung impregnated disease by employees exposed to dust.

Workers in the excavation and transportation phases of the operations would be exposed to wind blown/fugitive dust being blown into the eyes and causing eye irritation and conjunctivitis. These employees will be provided with clear goggles and eye wash lotion will at all times be available for washing the affected eyes.

10.14.5.2 Noise

The following measures will be implemented to address worker health and safety related to noise associated with the operation:

1. Control of noise levels at source via installation of silencers on exhaust system of power generating plant.
2. Provision of hearing protection to employees exposed to high noise levels: ear muffs for employees in the maintenance shops and generating plant areas.
3. Earplugs for employees who operate heavy-duty machines.
4. Siting of power generating plant and mining operations in location away from the living quarters of employees.
5. Warning signs in areas of high noise levels instructing employees to wear earmuffs or earplugs as required.
6. Hearing conservation program for employees exposed to noise. This will consist of:
 - Audiological examination before employment to establish baseline hearing capacity on initiation of employment.
 - Yearly audiological testing of employees exposed to high noise levels.
 - Acquisition of a portable sound level meter
 - Measurement of sound levels in instances where it is suspected that deviations from the previous levels are occurring.

10.14.5.3 Heat

Measures to decrease the effect of increased exposure to heat will include:

1. Measurement of ambient temperature levels in vicinity of generating plant
2. Provision of heat shields - coating of surface of generating plant by high reflective material such as polished aluminum.

10.14.5.4 Cyanide Exposure

Job functions and tasks would be evaluated to determine possible exposure scenarios and pathways. Process changes or engineering controls would be developed and implemented to eliminate these exposures where practicable and to reduce or control them when they cannot be eliminated. The operations would develop and document procedures for performing cyanide related tasks such as

unloading, mixing, plant operations, entry into confined spaces, and equipment decontamination prior to maintenance in a manner that minimizes worker exposures.

These procedures would address the use of cyanide-specific personal protective equipment such as respirators, eye protection and protective gloves, coveralls or suits, pre-work inspections, emergency response, cyanide monitoring and communications and documentation. Personnel involved in cyanide management would be trained in handling cyanide in a manner that protects their safety and the safety of their co-workers. Training would also include the proper use of personal protective equipment, emergency rescue equipment, and cyanide first aid equipment.

The plant would implement procedures to review process and operational changes and modifications for their potential impacts on worker health and safety, and to incorporate the necessary worker protection measures. Worker input through safety meetings, suggestion boxes, or other methods would be factored into the development and evaluation of health and safety procedures.

Process changes and engineering or administrative controls would be used to limit worker exposure to hydrogen cyanide gas and sodium and potassium cyanide to the American Conference of Governmental Industrial Hygienists (ACGIH) Ceiling Limit Value of 4.7 parts per million (5 mg/m³) as cyanide. Where the potential exists for significant worker exposure to hydrogen cyanide gas or sodium or potassium cyanide dust, the operation would monitor hydrogen cyanide concentrations with ambient and/or personal monitoring devices and evaluate the results to confirm that controls are adequate.

Cyanide monitoring equipment would be maintained, tested and calibrated as directed by the manufacturer, and records would be retained for at least one year. Warning signs would be placed where cyanide is used and would alert workers that cyanide is present, that smoking, open flames, eating and drinking are not allowed and that the necessary cyanide-specific personal protective equipment must be worn. Showers, low-pressure eye wash stations and dry powder or non-acidic sodium bicarbonate fire extinguishers would be located at strategic locations throughout the operation where cyanide is present. This equipment would be maintained and be inspected or tested on a regular basis, and records would be retained, to assure that it is in good working order if and when needed. Tanks and piping containing cyanide would be identified by color code, signs, labels, tags, decals or other means to alert workers of their contents. The direction of cyanide flow in pipes would also be labeled, marked or otherwise designated.

Cyanide first aid equipment including medical oxygen and a resuscitator will be provided and will be inspected regularly to assure that it is available when needed. Antidotes for cyanide poisoning would be available. Antidotes will be stored and/or tested as directed by their manufacturer and replaced on a schedule that assures their effectiveness. In general, the procedures for responding to inhalation of cyanide gas or skin contact with liquid or gaseous cyanide would include the following elements:

- Activate alarm or call for help to notify the appropriate site personnel (through alarms, radio, telephone) so that medical assistance is available as soon as possible.
- Call for assistance before responding to the emergency ("buddy-system"). Never try to rescue a cyanide victim on your own.
- The responder must put on the personal protective equipment necessary to safely enter the area and come in contact with the exposed individual.
- If possible, the responder must move the exposed individual to a safe area away from continued exposure. If removing the exposed individual from the area is not possible, the responder must attempt to prevent further exposure to the victim or seek assistance in moving the victim from the area of exposure.
- All contaminated clothing must be removed from the exposed individual, and the exposed individual should be decontaminated by washing with water. Safety shower and eye wash station using low pressure water are recommended.

- Oxygen must be administered, and medical help must be sought. Where authorized by the applicable jurisdiction, treatment with amyl nitrite is recommended along with oxygen. A resuscitator should be used if the exposed individual is not breathing.

If cyanide is ingested the response to such exposure should include the following elements:

- Notify the appropriate site personnel and put on personal protective equipment, as above.
- An exposed individual who is conscious should spit or be made to vomit, and the mouth should be rinsed with water.
- Continue with decontamination and administration of oxygen and amyl nitrite if permitted, or if the exposed individual is not breathing, a resuscitator should be used.
- An exposed individual that is not conscious, or has impaired consciousness should be treated with oxygen and amyl nitrite if permitted.

Workers who may be called upon to respond to cyanide exposures will be trained in the operation's response procedures and will take part in routine drills to test and improve their response skills. The operations will develop its own on-site capability to provide first aid or medical assistance to workers exposed to cyanide.

Formalized arrangements would be made with local hospitals so health workers are aware of the potential need to treat patients for cyanide exposure. In making these arrangements, the operation will ensure that the medical facility has adequate, qualified staff, equipment and expertise to be able to respond effectively. The operation will assist local medical providers with training and equipment to enhance its capabilities.

Mock emergency drills based on likely release/exposure scenarios would be conducted periodically to test response procedures. Lessons learned from the drills would be incorporated into response planning.

10.14.5.5 Food and Water Safety

Food and water will be provided by the mine site operator to employees. No sales of food, beverages will be permitted by vendors etc. within the mine site. A condition of employment will forbid purchasing of food, beverages etc from vendors. All food including both raw and refrigerated foods will be stored in accordance with guidelines provided by the Environmental Health Unit of the Ministry of Health. Redundancy will be provided for storage of refrigerated goods to ensure capacity exists in the event of damage or loss of any unit. All waste generated by the operation will be disposed in accordance with the Waste Management Plan detailed in Section 10.11.

A vector control program will implemented over the duration of the project. Should an outbreak of flies occur, an insect exterminator would be used to control the flies at the source. Uncovered and available food wastes will not be permitted to minimize the development of any rodent populations. Should an outbreak of rodents or other vermin occur within the area, the vermin will be exterminated by a licenced exterminator in a manner that is appropriate for the vermin in question.

All water for drinking purposes will be imported to the site from acceptable and certified drinking water sources. If groundwater is utilized for drinking water, it would be treated by chlorination and filtration to acceptable quality for potable water use. Samples of drinking water will be tested at the Government Analyst Department to ensure it conforms to drinking water standards.

10.14.6 Implementation Schedule, Responsibility and Costs

Implementation of the management program for health and safety of employees will coincide with the commencement of construction activities and will last through work on site closure. GUY will be responsible for its implementation and the costs for implementation are part of the project costs.

10.15 Fuel Oil Management

Spills of fuel oil could result in soil, surface and groundwater contamination.

Fuel oil storage areas will be located well away from areas of fire hazard such as where welding operations will be performed. All fuel will be trucked to site by secure fuel trucks and transferred into fuel storage tanks that are founded on impervious concrete surfaces. The fuel tanks will be housed within bermed enclosures. The enclosures will be sized to retain the contents of 120% of the tank in the event of tank failure. Discharge from fuel storage areas will be channeled to oil-water separators prior to being discharged to surface water.

Indiscriminate dumping of waste oil will not be permitted under any circumstances. Waste oil will be stored in suitable containers at designated points located around the Project site. All locations will be selected based on factors such as proximity to water, migration routes, fire risks and access. All waste oil storage area will be provided with secondary containment to deal effectively with any leakage or spillage. All liquids, spent oils, fuels and lubricants will be collected and returned in drums to oil companies and/or to Bosai for fueling of their calcination operations.

10.15.1 Implementation Schedule, Responsibility and Costs

Implementation of these measures will be coincident with the commencement of construction activities and will extend through to the project closure phase. GUY will be responsible for its implementation and the costs for implementation are part of the project costs.

10.16 Spill Contingency Plan

The spill contingency plan prepared for the project consists of two distinct plans; the Emergency Response Plan (ERP) and the Spill Prevention and Cleanup Control (SPCC) Plan. The elements of each plan are detailed below.

10.16.1 Emergency Response Plans

The objective of the Emergency Response Plan (ERP) is the protection of the communities and the environment in the project area of influence through the development of emergency response strategies and capabilities. This Emergency Response Plan details measures to respond to potential releases of tailings, process chemicals, process wastewater, fuel oils and/or other hazardous material. In addition it details emergency response procedures for potential release of hazardous material which is being transported to the site.

Examination of the proposed project has identified several possible scenarios which may require the activation of emergency response procedure. Emergency response actions will be needed for the following:

- Spills of fuel oil, cyanide or other hazardous material during road transport to the site
- Releases of fuel oil, cyanide or other hazardous material during unloading and mixing,
- Releases of fuel oil, cyanide or other hazardous material during fires and explosions,
- Release of fuel oil, cyanide or other hazardous material due to pipe, valve and tank ruptures,

- Overtopping of tailings and water management ponds,
- Failure of embankment of the tailings and/or water management pond,
- Power outages and pump failures,
- Uncontrolled seepage through the embankment of tailings and/or water management pond.

This ERP describes specific response actions, as appropriate for each emergency situations identified above. The response actions include clearing site personnel and potentially affected communities from the area of exposure, notification to operational, management and response personnel, use of antidotes and first aid measures for chemical exposure, control of releases at their source, containment of releases, assessment of the release and mitigation, procedures to examine the cause of the release, and implementation of measures to prevent reoccurrence of releases.

The company will maintain Emergency Response Centers; one at the mine and the other at Buck Hall. Primary and alternate Emergency Response Coordinators will be located at each center. Each coordinator will have explicit authority to commit the resources necessary to implement the ERP. Emergency response teams would be identified and would be appropriately trained and prepared. After the commencement of construction, this ERP shall be extended to include call-out procedures and 24-hour contact information for the coordinators and response team members.

All personnel involved in mineral processing and process chemical management would be trained to recognize and respond to situations which can result in releases to the environment. The training will include identification of procedures to be followed if a chemical release is discovered, including notification of the appropriate site personnel, measures to assure worker safety, and methods to stop or contain the release, if possible.

The following list of equipment and supplies will be provided for response to emergencies.

1. Earthmoving Equipment
2. Mobile Generators
3. Sand and Gravel
4. Sand Bags
5. Pumps
6. Pipes
7. Booms
8. Absorbents

If there is a slowly developing emergency or unusual situation, where an emergency is not imminent, but could occur if no action is taken, (e.g prolonged and unseasonal rainfall and possible overtopping of the tailings/water management pond) the EPA, GGMC and Office of the Prime Minister (OPM) will be notified. The Regional Democratic Council of Region 7 will be notified of the potential problem and will be kept advised of the situation. During these contacts, the agencies will be requested to indicate if there are any immediate actions that can be taken to reduce the risk of the emergency and if necessary, preventative actions will be implemented. An Emergency Response Coordinator will be assigned the task to continuously monitor the situation and to coordinate emergency action if required.

If an emergency is imminent, but has not yet begun, (e.g. failure of the outer section of tailings/water management pond embankment, but no releases) media houses in Region 7 and nationally would be alerted to inform residents of surrounding area and steps will be initiated to immediately advise persons in the vicinity of the emergency to evacuate due to the potential release. The EPA, GGMC and OPM will be notified. A single Emergency Response Coordinator will be tasked with responding to the potential release to minimize disparate utilization of resources. Equipment and personnel will be deployed to the maximum extent necessary to prevent the potential release to the environment.

If there is a release of fuel oil, cyanide or other hazardous material, all persons downstream and downwind from that release will be notified immediately and efforts will be coordinated with others to reduce impacts associated with the release. The EPA, the GGMC and OPM will be immediately notified. If a spill of fuel oil, cyanide or other hazardous material/waste enters waters adjacent to the access/haul roads, Guyana Water Inc. (GWI) will be added to the entities notified.

All transport vehicles will be fitted with absorbent material and vehicle operators will be provided with a radio to maintain contact with the emergency response centers. If there is a spill/leak of fuel oil, cyanide or other hazardous material onto roadways during transportation to/from the site prompt action will be taken to contain the leakage or spillage. All combustibles/ignition sources such as running engine, likely to result in fires will be removed from the vicinity of the spill and anyone in the area will be advised to stay upwind of the spill. Absorbent material in the transport vehicle will be used to cover small spills. The vehicle operator will immediately notify an Emergency Response Center which will assign an Emergency Response Coordinator to respond to the emergency.

A berm will be constructed around the spill area to control runoff to surface water. All soils impacted by the spills will be excavated from the spill area and disposed in accordance with the hazardous waste management procedures. In the events of spills to surface waters, fauna will be trapped and will be relocated to areas within close proximity of the site, which are the same ecologically as the spill area. Fishes will be trapped with nets and animals will be snared in traps designed to ensure that animals are not injured during trapping. The relocation of fauna impacted by accidental spills is expected to be a very infrequent occurrence and will have insignificant impacts on the areas to which the fauna is relocated. Spills of fuel oil will be responded to by the addition of surfactants and by retrievals with skimmers. Other chemicals, which cannot be recovered manually, chemically or by mechanical means will be allowed to naturally degrade by dilution and dispersion. During the degradation process water quality would be monitored in the spilled area. After monitoring determines that water quality has attained acceptable standards, sensitive fauna will be allowed to naturally reenter the area.

If an earthquake is felt in the vicinity, visual inspections shall be conducted of the tailings and water management facilities, process vessels and pipe network, containment facilities for chemicals and fuel, and sewerage management facilities immediately after. If damage has occurred, but is judged not serious enough to cause failure of any facility, the nature, location, and extent of the damage, as well as the potential for failure will be quickly observed. The EPA, GGMC and OPM will be contacted and a description of damage, including the location, extent and rate and the associated effects on adjoining structures, prevailing weather conditions, and other pertinent facts will be provided.

If any of these facilities is damaged to the extent that a potential release to the environment is possible, the emergency imminent procedures will be immediately implemented. A close watch will be kept on the facilities for the next two to four weeks as some damage may not show up immediately after the quake.

If there is overtopping of ponds, power outages and pump failures, uncontrolled seepage from the tailings or water management pond, and/or leaks from process vessels, all persons downstream from the site will be notified immediately and efforts will be coordinated with others downstream to try and reduce impacts, if applicable. The EPA, the GEA and OPM will be immediately notified. The Emergency Response Center will assign an Emergency Response Coordinator to respond to the emergency. Emergency response procedures will replicate those for a spill during transportation of fuel oil, cyanide or other hazardous materials to the site.

Any time levels in the water management ponds exceed the design levels, these facilities will be inspected daily. If the water surface level rises to within 0.25 m of the crest of the facility the following will be immediately implemented:

- contact EPA, GEA and OPM

- discharge excess water from these facilities to surface water through sediment control structure
- monitor the receiving surface water body for sediment and chemical contamination
- notify downstream residents of the discharge, and perform the discharge in stages to reduce sediment and chemical inflows
- provide water to residents downstream of the discharge until water quality in the receiving waters returns to an acceptable standard.

10.16.2 Spill Prevention and Cleanup Contingency Plan

This Spill Prevention and Cleanup Contingency (SPCC) Plan will become effective coincident with the commencement of construction activities at the mine. Emergency Response Coordinators will have authority to expend funds and recruit employees to implement the Spill Prevention and Cleanup Contingency Plan. The SPCC Plan addresses the following:

- Operating procedures to prevent oil spills;
- Control measures which will be installed to prevent a spill from reaching navigable waters; and
- Countermeasures to contain, clean up, and mitigate the effects of any spill which discharges to surface or ground water.

This SPCC also sets out an organized, planned, and coordinated course of action to be followed in case of a fire, explosion, or release of hazardous material which could threaten human health or the environment. The SPCC Plan would be implemented for on-site, as well as off-site releases that could threaten human health and the environment, even if the Emergency Response Coordinator does not believe that the spill will leave the site. The Plan deals with threats to facility personnel, as well as with threats to people outside the facility.

After the completion of construction works at the site, a site plan detailing the physical layout and a facility diagram will be appended to this SPCC. The appended information shall include contact list and phone numbers for the Emergency Response Coordinator(s), the EPA, cleanup contractors, and other appropriate national and local agencies who will be contacted in case of a discharge. The SPCC shall also be expanded to include a prediction of the direction, rate of flow, and total quantity of fuel oil/cyanide/hazardous material which may be discharged after a Hazard Assessment has been conducted for the process equipment failure.

An internal communication or alarm system capable of providing emergency instructions shall be maintained at the mine and at Buck Hall together with device capable of summoning external assistance (telephone or two-way radio). Portable fire extinguishers, fire control equipment, spill control equipment, and decontamination equipment will also be maintained at these two locations.

All fuel storage areas shall be founded on impervious surface and be sited in containment facilities designed to retain 120% of the tank contents. The containment may be either dikes, berms, retaining walls or curbs. Discharge from the containment area shall be directed into gutters which flow to oil-water separators prior to release to the environment. End-of-pipe water quality shall be monitored to ensure adherence to water quality. If there is a discharge from the fuel storage area to the environment, an Emergency Response Coordinator shall respond to that discharge and an alternate source of water will be provided to persons located downstream of the discharge.

Spills of fuel oils will be cleaned by mechanical methods, chemical dispersants, gelling agent or biological agents. The specific method to be used will depend on the quantity and location of the spill.

Mechanical cleanup, using booms and skimmers, will be used to recover spills to surface water. Containment booms would be used to control the spread of spilled product and to concentrate the product in thicker surface layers to make recovery easier. In addition, booms will be used to divert and channel oil slicks along desired paths, making them easier to remove from the surface of the water. Skimmers would be used to recover spilled oil from the surface of the water. Skimmers will be either self-

propelled or operated from the bank of streams/creeks. Chemicals dispersants will be used to accelerate the breakup of fuel oil and refined product spills to surface water. Dispersants would be applied immediately following a spill, before the lightest materials in the oil have evaporated. The use of dispersants in freshwater would be authorized by the Emergency Response Coordinator only if it does not pose any threat to human health or the environment. Gelling agent will be used to respond to small spills of fuel oil. Gelling agents will be applied by hand to small spills and would be left to mix on their own. The gelled oil would be removed from surface water using skimmers. Biological agents will be used to mitigate the impacts of spills of crude oil and refined products to surface water and to soils.

Surface water and soil samples will be recovered from the impacted areas after cleanup to ensure that residual levels of hydrocarbons and other fuel oil constituents do not exceed tolerable limits. If these limits are exceeded in soil, additional soil will be removed from the spill area until the residual levels fall below tolerable limits. The soil excavated from the area shall be disposed in accordance with the Hazardous Waste Management protocol. If surface water quality has not been attained, monitoring will be continued. Persons downstream of the spill will continue to be provided with clean water until water in the affected area again attains acceptable water quality.

If the discharge of fuel oil results in contamination of the aquifer, a detailed investigation will be conducted to define the contaminant plume. A plan to clean-up the aquifer will be prepared after the delineation of the plume. The contaminated groundwater will be treated and would be re-injected into the aquifer. Treatment will cease when analyses of groundwater samples indicate acceptable groundwater quality.

If there is a fire which results in release of toxic fumes and if the fire spreads and is likely to ignite materials at other locations at the site or can cause heat-induced explosions, water and/or chemical fire suppressant shall be used as fire suppressant. In addition to fires, if an explosion has occurred which poses an imminent danger that can result in a safety hazard due to flying fragments or shock waves or if an imminent danger exists that an explosion could result in release of toxic material The EPA, the GEA and OPM will be immediately notified. The Emergency Response Center will assign an Emergency Response Coordinator (ERC) to respond to the emergency. The ERC shall determine whether the situation warrants evacuation of employees and persons within proximity of the fire or explosion. If evacuation is required, all employees shall be picked up from designated assembly points and will be evacuated along pre-planned evacuation routes. Previously identified alternate evacuation routes shall be used if primary exit routes are blocked by releases of toxic substances or fires.

During the emergency control phase, the emergency coordinator will take all reasonable steps necessary to ensure that explosions and releases do not occur, recur, or spread to other areas. These steps will include, where applicable, stopping operations. The emergency coordinator would monitor for leaks, pressure buildup, gas generation, or ruptures in valves, pipes, or other equipment, wherever appropriate. Details would be provided to emergency personnel concerning the types of on-site emergency equipment to be used and the need for personnel protection equipment.

Immediately after an emergency, the emergency coordinator would provide for treating, storing, or disposing of recovered waste, contaminated soil or surface water, or any other material. The recovered material would be handled as a hazardous waste unless it is a characteristic hazardous waste only, which is analyzed and determined not to be hazardous. The emergency coordinator would ensure that in the affected areas, no waste which may be incompatible with the released material is treated, stored, or disposed of until cleanup procedures are completed. All emergency equipment would be cleaned and made fit for its intended use before operations are resumed.

The SPCC Plan will be reviewed, and be immediately amended whenever the following situations apply:

- applicable regulations are revised

- the plan fails in an emergency
- the facility changes its design, construction, operation, maintenance, or other circumstances in a way that materially increases the potential for fires, explosions, or releases
- the list of emergency coordinators changes
- the list of emergency equipment changes.

10.16.3 Implementation Schedule, Responsibility and Costs

Implementation of the Spill Contingency Plan will coincide with commencement of construction activities. GUY will be responsible for its implementation. The costs for its implementation are part of the project costs.

10.17 Social Management Plan

The project can potentially result in influx into the Aurora concession and the problems associated therewith due to mine area development.

GUY will actively discourage influx into the area and not allow outsiders to settle in the periphery of the camp. Guyana Gold is signatory to the Voluntary Principles on Human Rights and the company would train its security forces on site to handle influx sensitively without conflict or security issues. GUY would also promote and run health awareness campaigns especially on HIV and STD amongst the workers as well as local communities upstream and downstream of the project site.

The project may potentially result in an increase in river traffic creating risks of accidents and incidents.

GUY will estimate the exact numbers, volumes and frequency of traffic per day and will work with its employees and other users of the river to minimize the possibility of accidents and incidents by providing safety training for boat/barge transport, coordinating movement of river traffic to and from the site and identifying accident risk areas.

The project will increase expectations of employment and economic opportunities.

The company will dialogue with the local communities especially Kurutuku to understand their expectations and create strategies to generate local employment upstream/downstream of Aurora site. The company will also promote community development projects that enhance local benefits and which create skills, capacities, improve education, health and infrastructure of the local communities.

The project may result in potential issues with artisanal miners.

GUY will consult and engage with artisanal miners who come into the concession and patrol the concession boundaries.

The project can potentially result in reduced employment and other induced economic benefits after closure of the operation.

The company will train and build capacities of the workers and service providers to find economic opportunities with other industries in Guyana

The upgrade of the Barama Road and construction of the new access road may result in increased traffic and safety risks.

GUY will estimate the volume of traffic likely during construction and operations phases and Partner with government and other companies like Barama that use the road to promote safety and reduce risks.

The company will conduct driver safety training programs, identify zones of high risks on the roads and will coordinate movement of traffic with other road users to minimize risks.

The project can result in potential influx into Buckhall and related risks due to wharf development.

The company will partner with the Government and/or other companies to plan sustainable development/growth of Buckhall and will actively discourage influx into the area and not allow outsiders to settle in the periphery of the wharf. GUY is signatory to the Voluntary Principles on Human Rights and the company would train the security forces on site to handle influx sensitively without conflict or security issues. The company will also promote and run health awareness campaigns especially on HIV and STD amongst the workers as well as local communities upstream and downstream of project site.

10.17.1 Implementation Schedule, Responsibility and Costs

Implementation of some aspects of the socio-economic management will begin before commencement of construction work. These include interaction with indigenous communities and training programs for low skilled employees. GUY will be responsible for implementing the plan the costs for which is included in the project costs.

10.18 Traffic Management

The company will enforce speed limits of less than 70 km/hr on the access road and 50 km/hr on site haul and service roads. Signs will be posted along the access road to indicate to other road user safe driving speeds on that road. GUY will place no restrictions on traffic using the access road constructed to the mine site. Restrictions will be imposed on traffic flows into active mining areas. Project vehicles only will be permitted into mining areas. Signs will be posted along the access road indicating to road users that GUY will not accept liability for accidents on the access road and also indicating that road users are responsible for providing their own insurance cover for accidents on the access road.

10.18.1 Implementation Schedule, Responsibility and Costs

The enforcement of speed limits and posting of signs will commence during the construction phase of the works. GUY will be responsible for enforcement. Since enforcement of these measures are part of the operation, the costs for their implementation is a part of the overall project cost and no additional specific costs would be incurred to undertake this aspect of the EMP.

10.19 Catchment Area Management

The concession will be managed to ensure minimal impacts to the watershed. The objective of the catchment management plan will be to maintain as closely as possible the pre-project hydrological runoff characteristics of the watershed in which the project is located. The catchment management plan addresses the protection and conservation of the local natural resources and contains measures for safeguarding water for future development. The plan will also ensure that water quality and security of water supply is provided to transient people who use the waters of the Cuyuni River.

All forest cover outside of the area cleared for the mine site operation will be maintained to control run-off, to limit erosion, to minimize sediment and nutrient supplies, to maximize infiltration and to maintain pre-project rates of evapotranspiration. The adoption of sound catchment management practices for the area will reduce the inflow of debris and other material from both point and diffuse sources into the Cuyuni River thereby ensuring the maintenance of water quality both upstream and downstream of the project.

GUY will provide the EPA and GFC with information on logging operations within the Project Area. The responsible national statutory authority will undertake to ensure that a formal Environmental Impact Assessment is conducted where any new forestry exploitation project is proposed. If the company determines that uncontrolled logging is occurring in the area covered by this ESIA report, both the EPA and GFC will be informed. If timber concessions are granted by the responsible national statutory authority, during the life of these operations, the developer will review the draft ESIA report prepared for logging in the area to ensure implementation of the following:

- appropriate use and choice of cutting implements and machinery
- selective felling
- establishment of buffer areas around the mine
- road construction in accordance with sustainable practices
- closing roads after completion of logging activities.
- regular monitoring of the logging areas to ensure no encroachment.

GUY will report to the EPA instances of clearing for small scale agriculture along access routes and within forested areas that could prove detrimental to the environment if left uncontrolled. The developer will develop in consultation with the responsible national statutory authority, methods to curb or mitigate these problems.

Since GUY has no legal authority the responsible national statutory authority will be required to establish clear demarcation between the areas of different land-use potential and promote awareness of the consequences of encroachment within areas identified for specific land use. The responsible national statutory authority will also provide training on environment friendly methods of agriculture such as selective clearing instead of slash and burn; terracing, mulching, crop rotation or strip cropping and on adopting proper land tenure procedures. The responsible national statutory authority will further be required to ensure that any type of land development meets all relevant legal requirements and be in accordance with any land use plan drawn up by the local authorities.

In those instances where GUY has legal authority, travel along access roads by the public will be controlled. Where this is not the case, the developer will report to the responsible national statutory authority, levels of use and incidents of encroachment.

10.19.1 Implementation Schedule, Responsibility and Costs

The management of the concession to minimize impacts to the watershed is an ongoing process which commenced prior to exploration activities. These activities will continue throughout the construction, operation and closure phases. GUY will be responsible for implementation of the measures outlined above. Since enforcement of these measures is part of the operation, the costs for their implementation are a part of the overall project cost and no additional specific costs would be incurred.

10.20 Erosion and Sediment Control Plan

Mining will be undertaken with long-term erosion and sediment control as a primary consideration. Mining operations conducted during the rainy season will be clearly demonstrated, to the satisfaction of the EPA, that at no stage of the operations will there be any substantial risk of increased sediment discharge from the site. When mining occurs in the rainy season, the smallest practicable area of erodible land will be exposed during mining operations and the time of exposure shall be minimized. Natural features, including vegetation, terrain, watercourses and similar resources shall be preserved wherever possible. Limits of mining shall be clearly defined and marked to prevent damage by mining equipment.

Permanent vegetation and structures for erosion and sediment control shall be installed as soon as possible. Adequate provision shall be made for long-term maintenance of permanent erosion and

sediment control structures and vegetation. No topsoil shall be removed from the area outside the mining limits unless approved by the EPA. Topsoil overburden shall be stockpiled and redistributed to provide a suitable base for seeding and planting. Runoff from the stockpiled area shall be controlled to prevent erosion and resultant sedimentation of receiving waters. Runoff shall not be discharged from the site in quantities or at velocities substantially above those which occurred before grading.

Waste rock and soil from the mining and mineral processing operations will be disposed in spoil piles located in the mined out areas. All spoilpiles would be surrounded by a soil containment berm to preclude the easy flow of surface runoff and sediment from stockpiles. The containment berms would be constructed of soil pervious enough to enable the passage of surface runoff water while trapping sediment contained in that runoff. The height and slope of each spoilpile would be such that foundation and slope failures do not occur.

Stormwater runoff and water from the mining operations would both be channeled to temporary sedimentation ponds. Those ponds would be designed to provide a detention time of 48 hours. Discharge from the sedimentation pond would be via a spillway and would be channeled through a sediment control structure constructed of a matrix of stone, sand and grass to remove sediment prior to discharge to surface water bodies in the site area.

Mining would proceed in such a manner as to minimize disturbance to streams in the area. In instances where this cannot be avoided, sediment control structures and practices would be used to prevent the inflow of sediment to surface water. These control practices would include sediment traps or screens to control run-off and sedimentation. Surface runoff from maintenance workshops and other vehicle service areas would be channeled to an oil/water separator. All water from the oil/water separators would be skimmed prior to discharge.

Sumps would be excavated on the floor of the mine and all groundwater flow and precipitation would be channeled into sumps. Measures would be implemented to prevent surface runoff from entering the open pit and from adding to the volume of groundwater inflow and direct precipitation.

Erosion control operations would be performed under favorable weather conditions. When excessive moisture or other unsatisfactory conditions prevail, the work would be stopped. Erosion control materials shall not be applied in adverse weather conditions which could affect their performance. Erosion control will be accomplished by using one of the following:

- Erosion control blankets
- Geotextile fabric
- Seeding

Before placing the erosion control blankets the subgrade will be graded smooth with no depressions or void areas and would be free from obstructions, such as tree roots, projecting stones or other foreign matter. No vehicles will be permitted directly on the blankets. Before geotextile fabric is placed the subgrade shall be compacted and graded level with no depressions, voids, soft or uncompacted areas and shall be free from obstructions, such as tree roots, projecting stones or other foreign matter. Seeding shall then be applied to the areas.

10.20.1 Implementation Schedule, Responsibility and Costs

Erosion and sediment control procedures will be implemented during both the construction and operation phases of the works. GUY would be responsible for implementation during both phases. The costs incurred for implementation of these measures are part of the BMP. These costs would not be additional to the normal costs. Since enforcement of these measures are part of the construction and

operation, the costs for their implementation is a part of the overall project cost and no additional specific costs would be incurred.

10.21 Cultural and Archaeological Resources

Consideration would be given to both natural and cultural landscapes in the planning and implementation of projects. In addition relics associated with the former operation of the mine and other elements which may be of special importance for the history of the area will be set aside from the operations and will be preserved. The Guyana National Trust will be consulted on the most appropriate mechanism for management of these resources, if any are encountered.

10.21.1 Implementation Schedule, Responsibility and Costs

Implementation of measures for preservation of cultural and archaeological resources will coincide with the commencement of construction activities. GUY will be responsible for program implementation. The cost for implementation is a part of the overall project cost and no additional specific costs would be incurred.

11.0 INSTITUTIONAL REQUIREMENTS FOR MANAGEMENT PLAN

GUY is committed to management of the environment in its mining areas as evidenced by it undertaking this ESIA to comply with the Environmental Protection Act. The company is committed to conformance to reasonable and technically justifiable guidelines established by the GEPA for the management of this mine site.

The company's objective is to ensure that the mining and processing are integrated harmoniously into their host environments, and that the operation will provide an opportunity to play an active part in regional development. The company will provide staff to achieve the following objectives:

- propose management rules and specific measures that are compatible with biodiversity protection while allowing the operation of the facility at competitive costs
- foster the enhancement and multiple use of the facility, in a context of biodiversity;
- promote awareness by its employees and the general public regarding biodiversity protection
- propose concrete means of applying the EPA's biodiversity strategy and action plan.

The Organization Chart for plant operations is depicted as Figure 39. The specific function of each component of the management structure is detailed below. The Process Director will be responsible for all process operations. Included under his jurisdiction would be the Health, safety and environmental (HSE) Department. The HSE Manager will have direct responsibility for health, safety and environmental (HSE) aspects of the operations and would be the primary authority for enforcement of the HSE policy. The Processing Director would be directly responsible for all processing and HSE issues related to processing and will provide support to the HSE manager in the event of emergency responses and HSE emergencies.

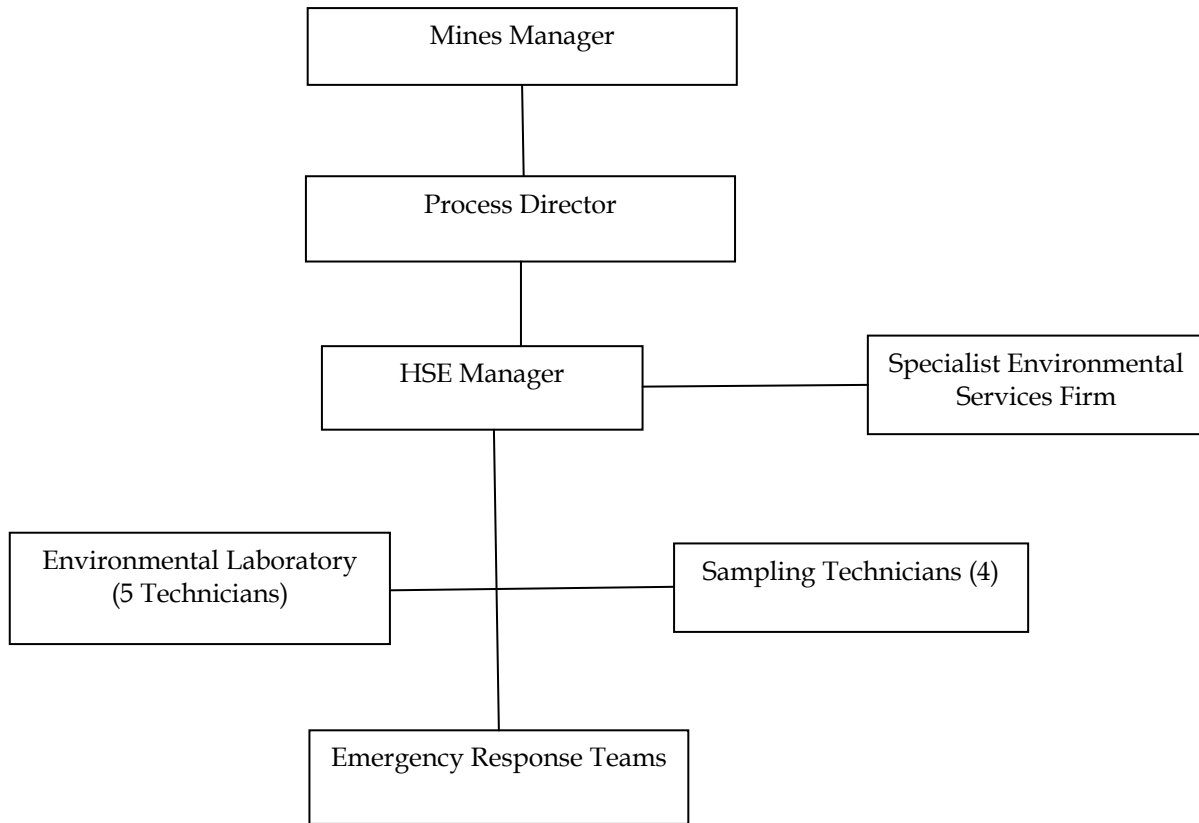
The mines manager will support the Process Director by providing additional expertise and resources on an as needed basis to satisfy operational, maintenance and emergency response needs. GUY will retain a qualified firm to provide support to the HSE Manager to assist with specialized training and emergency response expertise and will provide additional technical resources for operational and emergency response needs. It is anticipated that local government officials in the project vicinity will provide emergency aid if required and that the EPA will review HSE plans prepared by the operations to ensure that all HSE concerns are appropriately addressed.

The HSE Manager will manage all HSE related activities on site and will provide training to employees and will identify equipment and resources needed to satisfactorily perform their duties and responsibilities. The HSE Manager will also provide onsite training and auditing of Health, Safety and Environmental effectiveness.

The HSE manager will have 4 technicians in his department. The primary duties of the technicians will be to inspect the local environmental monitoring stations for water, air and soil and to collect grab samples for routine checks. They also work with the EPA and other authorities to report and assure that discharges are within guidelines.

An environmental laboratory staffed by a complement of five individuals will be located on site. Individuals working in the laboratory will analyze samples of air, surface and groundwater and will serve as response team advisors in Health, Safety and Environment emergencies. The environmental laboratory will be responsible for the analyses of samples to assess environmental compliance. The laboratory will also be responsible for collecting and packing samples for off site quality assurance tests by an independent laboratory approved by the EPA.

Figure 39 - Organization Chart for Environmental and Social Management Plan



The emergency response team will be comprised of employees who have been specially trained to handle potential incidents. These employees will also be responsible for maintaining the operational effectiveness of the emergency response equipment.

All employees will be trained in emergency response procedures. Operations teams will be charged with responsibilities for emergency process shutdown and firewater pump/emergency generator operation. Maintenance teams will supply labor, equipment and tools as needed to assure all support required to handle any emergency situation is available and in good working condition.

12.0 MONITORING PLAN

The environmental monitoring program for the mine will serve as an integral part of the operation and would be implemented to generate information for environmental management and environmental information dissemination. The monitoring plans described in this chapter encompass two distinct categories, environmental and operational. The environmental aspect is structured to monitor the physical, biological and socioeconomic changes in the environment, if any, and the mitigation measures. The operational monitoring will include those variables important for day-to-day operations such as processing methods and camp facilities.

Monitoring will be conducted during all phases of the project; design, construction, operation and closure. The monitoring program will play a pivotal role in ensuring that the trends for specific parameters are tracked and will provide information on compliance with legislative norms, set guidelines or desirable operational limits and will provide a basis for corrective actions and modification of activities if necessary. Sampling intensity during monitoring will depend on the time and location of the development activities and results derived from monitoring data.

Stakeholders in communities in proximity to operational areas will be mobilized to support the monitoring program.

12.1 Terrestrial Resources

As part of the reclamation program, a record will be maintained of all spontaneous and natural regrowth after clearing and the conditions contributing to that regrowth. The record will note plant species, soil type, weather conditions during the period, drainage conditions etc. The records will be used to examine parameters considered necessary for the successful establishment of plant cover after reclamation.

Wildlife monitoring will be conducted concurrently with the vegetation monitoring. Observations will be recorded in a wildlife-sighting logbook and these will be periodically examined to determine if there have been any significant changes in species abundance and/or distribution. All collisions with wildlife on the access and/or haul roads will be recorded. The record will note the proximity to cleared areas, the animal involved in the collision and the time of that collision etc. These records will be used to evaluate the success of the measures outlined in the Management Plan.

A record will be maintained of all animal mortality associated with Tailings and Water Management Ponds. The location of the fatality, the time of day and the process discharge at that time will be among the parameters recorded. Additional fencing around the ponds will be installed as needed based on the results of this monitoring.

The baseline study identified the presence of Harpy Eagles, Sun Parakeets and Giant Otter at the site. The observation of Harpy Eagles, Sun Parakeets and Giant Otters is considered significant especially given their CITES classifications. Otters are indicative of water quality and the general health of the waterway. Sun parakeets were trapped for the export trade to near extinction in Region 9 and the presence of Harpy Eagles indicate the state of health and distribution of other animals on which they prey and the level of disturbance, including human activity, in the area.

Biodiversity sampling will be conducted once every two years utilizing the same methodology as that used for the ecological baseline development to record any alterations in species type and abundance. The biodiversity monitoring program will further establish species distribution, abundance and where necessary, behaviour patterns that have been impacted by activities at the mine site. Areas sampled for the initial baseline study will be re-sampled during the ongoing biodiversity monitoring program. Particular attention will be paid during the biodiversity sampling program to the presence and abundance

of Harpy Eagles, Sun Parakeets and Giant otter. Biodiversity changes in control areas will be identified and the severity rated.

12.2 Spoil Pile Monitoring

The waste rock areas will be monitored to determine the integrity of the containment berm around its base since this berm is intended to prevent sediment flows from the area to surface water bodies. The piles will also be monitored to ensure their height and slopes do not exceed the tolerable limits. Dust emissions from the piles will be visually monitored and corrective action implemented when required.

12.3 Water Monitoring

Water quality standards will be established for all wastewater discharges from the site based on consultation with the Guyana Environmental Protection Agency (EPA) and the Guyana Geology and Mines Commission (GGMC). Samples of water from discharge points of the tailings and water management ponds will be recovered one per week for the first year of operation and twice per month after that time. The results of tests on these samples will be used to determine the effectiveness of the cyanide destruction circuit. Groundwater monitoring wells will be installed both up-gradient and down-gradient of the tailings and water management pond. Samples will be recovered from these wells each month and analyzed for the presence of heavy metals and cyanide. Samples of surface water will be recovered from streams/creeks in proximity to the operations four times each year. Statistical evaluation of the data will be performed to determine if sampling should be conducted at more frequent intervals.

All surface and groundwater samples will be analyzed for the presence and concentration of the following:

- pH
- Total dissolved Solids (TDS)
- Total suspended solids (TSS)
- Turbidity
- Conductivity
- Phenol
- Oil and grease
- Calcium
- Magnesium
- Sodium
- Potassium
- Total Kjeldahl Nitrogen
- Total Ammonia
- Phosphate
- Nitrate
- Nitrite
- Aluminium
- Manganese
- Molybdenum
- Selenium
- Arsenic
- Cadmium
- Chromium
- Cobalt
- Copper
- Iron, Total

- Cyanide
- Lead
- Mercury
- Nickel
- Zinc
- pH

The surface water quality would be considered satisfactory if the World Bank Standards listed in Section 5 are not exceeded.

Three permanent groundwater monitoring wells will be installed on the perimeter of the operations area. Groundwater samples will be recovered from each well once yearly and will be tested for the presence and concentration of parameters listed above.

12.4 Tailings Pond Monitoring

The tailing pond will be monitored at least once weekly or as dictated by the EPA/GGMC to visually determine its structural integrity. The pond will also be inspected to determine seepage through the embankment cross-section and to ensure that adequate freeboard exist for its continued use.

Settlement plates, slope inclinometer and pore water pressure data will be coupled with the visual observation to continually assess the stability of the tailings impoundment. Soil strength gains associated with consolidation of the fill and the widened cross-section of the embankment due to tailings deposition will also be factored into the periodic evaluation of the impoundment stability.

12.5 Hazardous Material Monitoring

Inventories of hazardous material will be monitored to ensure all materials are used for the purposes intended. Waste containment areas will be monitored to ensure that the impervious surface upon which they are sited is not breached. The area will be monitored to determine that incompatible chemicals are not stored together and that stormwater discharges from the area are channeled to the water management pond.

12.6 Solid Waste Monitoring

The solid waste disposal operation will be monitored to determine the effectiveness of the recycling, composting and disposal operations. Manifests will be developed to ensure proper disposal of septic tank waste.

12.7 Reclamation Monitoring

The land reclamation area will be monitored to ensure that compaction of the ground surface does not preclude the infiltration of precipitation. The humus from the composting operation will also be monitored to ensure its use in the land reclamation. The growth of trees planted for revegetation will be monitored. Substitute plant types will be identified if the growth rates are unacceptable. The Guyana Geology and Mines Commission (GGMC) will be advised of the results of the reclamation monitoring.

12.8 Air Quality & Dust Monitoring

Equipment will be visually monitored to ensure emissions do not exceed tolerable levels. Roads will be monitored to ensure that excessive dust is not emitted from surface.

Portable field instruments will be used to monitor air quality in underground openings. Air quality will be monitored for the following:

- Carbon Dioxide
- Oxygen
- Benzene,
- PM₁₀,
- PM_{2.5},
- carbon monoxide,
- NO_x,
- SO₂,
- VOCs
- Hydrocarbons
- Temperature
- Pressure

A record will be maintained of the incidences and relative frequency of any odor complaints. The Operator will record the following data for each odor complaint received at the site:

- Description, time, and date of the incident;
- Current status of all operations that may have triggered the event;
- Description of the measures taken to address the cause of the incident and to prevent a similar occurrence in the future.

The air quality monitoring program will be reviewed periodically as mining progresses. Revisions to the monitoring program will be made based on annual reviews of data compiled from the monitoring program.

13.0 RISK ASSESSMENT

13.1 Landslide Risk Assessment

The landslide risk assessment was conducted based on the qualitative terminology depicted in Table 36 (Lee & Jones, 2004).

Table 48: Landslide Risk Assessment – Qualitative Terminology

Qualitative Measures of Likelihood						
Level	Descriptor	Description	Indicative Annual Probability			
A	Almost Certain	The event is expected to occur	>= 10-1			
B	Likely	The event will probably occur under adverse circumstances	=10-2			
C	Possible	The event could occur under adverse circumstances	=10-3			
D	Unlikely	The event might occur under adverse circumstances	=10-4			
E	Rare	The event is conceivable but only under exceptional circumstances	=10-5			
F	Not Credible	The event is inconceivable or fanciful	=10-6			
Qualitative Measures of Consequences to Property						
Level	Descriptor	Description				
1	Catastrophic	Structure completely destroyed or large scale damage requiring major engineering works for stabilization				
2	Major	Extensive damage to most of structure or extending beyond site boundaries and requiring significant stabilization works				
3	Medium	Moderate damage to some of structure or significant part of site requiring large stabilization works				
4	Minor	Limited damage to part of structure or part of site requiring some reinstatement/stabilization works				
5	Insignificant	Little damage				
Qualitative Risk Analyses Matrix – Level of Risk to Property						
Likelihood		Consequences to Property				
		Catastrophic	Major	Medium	Minor	Insignificant
A – Almost Certain		VH	VH	H	H	M
B – Likely		VH	H	H	M	M – L
C – Possible		H	H	M	L – M	VL – L
D – Unlikely		M – H	M	L - M	VL – L	VL
E – Rare		M – L	L - M	VL - L	VL	VL
F - Not Credible		VL	VL	VL	VL	VL
Risk Level Implications						
Risk Level		Implications				
VH	Very High Risk	Extensive detailed investigation and research, planning and implementation of treatment options essential to reduce risks to acceptable levels, may be too expensive and not practical				
H	High Risk	Detailed investigation, planning and implementation of treatment options required to reduce risks to acceptable levels				
M	Moderate Risk	Tolerable provided treatment plan is implemented to maintain or reduce risks. May be accepted. May require investigation and planning of treatment options				
L	Low Risk	Usually accepted. Treatment requirements and responsibility to be defined to maintain or reduce risks.				
VL	Very Low Risk	Acceptable, manage by normal slope maintenance procedures				

The factors which will contribute to high risks of slope failure are as follows:

- Pronounced increases in porewater pressures in the foundation soils of the tailings and water management ponds,
- Unsustainably steep slopes in the mine and ramp access and on the access road and haul roads,
- Development of highly saturated soil conditions on the slopes of the spoil piles and stock piles.

Slope stability failure can be triggered by one or a combination of these factors. If the proximity of the slope to the access road and/or haul road is small, slope failure may have an impact on the efficient functioning of those facilities. Slope failure in the mine could result in a shutdown of the mine site operations. Slope failure of the tailings or water management pond can result in the release of contaminants to the environment.

Risks of slope failure of the open pit slopes, mine access ramp and tailings and water management ponds will be reduced by undertaking geotechnical investigations and analyses for design of these facilities. The geotechnical investigations will generate data which will be used to design the open pit slopes, mine access ramp and tailings and water management ponds. Slope stability analysis will consider the likelihood of slopes being saturated during the wet season.

Analyses of conceptual cross-sections for the tailings and water management ponds will consider the following failure modes:

- rotational and block failures of the slopes
- foundation failure of embankment
- piping failure of the embankment

The analyses will examine both short and long-term load conditions. Flow nets or an appropriate numerical method will be used to estimate seepage direction and volumes and pore pressures at points within the cross-section.

Analyses for the mine access ramp and sections of the access road, considered likely to be endangered by slope failure, will examine rotational and block failures of the slopes. The assessment of ramp stability will incorporate consequences associated with soil unloading. Allowances will also be made during the analyses for rises in groundwater levels in the slopes associated with flooded conditions at the base of the slope.

An extensive program of rock coring is being undertaken for development of the mine pits. The coring and the associated laboratory testing programs will develop data on rock parameters for design of that section of the open pit founded in rock. Geologic mapping will be conducted during excavation of the open pit in rock. The open pit will be designed to prevent failure planes from 'daylighting' into the cut, thus reducing the likelihood of wedge failures in the open pit.

Geotechnical investigations and analyses will also be conducted in areas identified as ore stock piles and for spoil pile locations, if outside the open pit footprint. The parameters generated by the geotechnical investigations will be used to assess the foundation stability and slope stability for these facilities. The analyses will consider both short and long-term load conditions.

No geotechnical analysis has been conducted to assess slope stability on the access road alignment. However, the majority of the alignment is underlain by thick deposits of white sands of the Berbice Formation. These sands will typically occur at slopes less than or equal to the angle of repose of the material. Additionally, when saturated, these sands will have some apparent cohesion which will result in increases in the safety factor of slopes in these sands provided that there are no rises in water levels.

Monitoring and preventive maintenance would be undertaken to identify potential slope instability areas. Through careful monitoring, areas of concern will be noted and would be quickly repaired, to prevent slope failure. Monitoring will consist of visual observation of the slopes and the monitoring of piezometers, slope indicators and other instrumentation installed to assess the performance of these facilities.

Monitoring will also be made after the occurrence of unusual conditions such as heavy surface runoff or peak floods. The frequency of monitoring will be more pronounced during and immediately after construction and during the wet seasons. Preventive maintenance will be undertaken at all potential trouble spots observed during visual inspection. Preventative maintenance will consist of work on critical slope areas to reduce the forces which will result in slope instability.

Visual monitoring will be done to identify typical distress signals associated with slope failure, such as cracks at the crest of the slope, devegetation of the slope, wet spots on the downstream face of the slope, and critical settlement inwards of the slope crest. The visual observations will be supplemented by instrumentation to enable an accurate interpretation of the extent of any problems likely to be occurring. Instrumentation inclusive of piezometers, settlement plates and inclinometers will be used to show developing trends in the slopes and embankments.

Instrumentation would be installed in the tailing and water management ponds embankment and foundation to monitor changes which are critical to the structures stability, and to predict unstable conditions. Instruments will be installed to measure pore water pressures, seepage flows and embankment movements. Pore water pressure in soils will be measured with piezometers. Seepage flow emerging downstream from the embankment will be collected and directed to a weir for flow measurements. Seepage flows will be used to indicate when significant changes occur and to permit an evaluation of potential problems from piping.

Markers will be installed on the embankment crest and would be aligned in a straight line-of-sight to permit rapid detection of horizontal movement during surveys. In instances where cracks are visible on the embankment surface, successive measurements between two stakes spaced either side of the crack will indicate any widening and acceleration in separation rate. Slope indicators will also be used to measure horizontal movement of the embankment. Settlement will be measured by leveling of temporary benchmarks.

Implementation of the design and monitoring program detailed above will ensure that slope instability is unlikely to develop, with slope instability problems likely to develop only under adverse conditions. If slope instability does develop, damage would be minor and would be limited to small areas. The slope instability would be easily corrected by the utilization of available construction techniques. The risk of slope instability would therefore be low and the design and monitoring program outlined would be adequate to manage that risk.

13.2 Seismic Risk Assessment

Geological features indicating the likelihood of a seismic event include the following (Kramer, 1996):

- Fracture surfaces and indicators of fracturing directly evident at ground surface inclusive of disruption of the ground surface and evidence of the movement and grinding of the two sides of a fault (slickensides, fault gouge, and fault breccia).
- Geologically mappable indicators including juxtaposition of dissimilar materials, missing or repeated strata and the truncation of strata or structures.
- Topographic and geomorphic indicators including topographic scarps or triangular facets on ridges, offset streams or drainage, tilting or changes in elevation of terraces or shorelines, sag ponds and anomalous stream gradients.

- Secondary geologic features inclusive of abrupt changes in groundwater levels, gradients, and chemical composition, alignment of springs or volcanic vents and the presence of hot springs.
- Geophysical indicators of subsurface faulting such as steep linear gravity or magnetic gradients, differences in seismic wave velocities, and offset of seismic reflection horizons.
- Geodetic indicators such as fault movement appearing in geodetic surveys as tilting and changes in the distance between fixed points.

Fieldwork for the mine site and access road was done primarily to determine the biodiversity of the area. While a detailed examination was not conducted to discern the features detailed above, fieldwork has not detected the occurrence of any of the features indicative of the likelihood of a seismic event.

As was indicated in Section 5, an earthquake event was recorded for Guyana, in 1964, at a point defined by 2.64° North and 59.62° West at a depth of 50 km and with a magnitude of 4.50. Additionally as can be inferred from Figure 7 an earthquake of unknown magnitude occurred at a point defined by 5.99° North and 61.48° West in Venezuela in 1975. Strong ground motion information for Guyana from the Caribbean Disaster Management Program has also indicated the possible occurrence of horizontal ground acceleration of 30 cm/sec² due to an earthquake event elsewhere.

This acceleration, while quite low can result in liquefaction of the sands present at shallow depths at the project site. The integrity of structures can be compromised if the sand liquefies during an earthquake event. The geotechnical analyses will consequently examine the liquefaction susceptibility of sands at the project site. If the probability of liquefaction is estimated to be unacceptable, a program of work will be undertaken to either increase the density of the sand or to provide a mechanism for rapid drainage during a likely earthquake event.

Based on the information above the risk of a seismic event occurring within 200 km of the site is very low.

13.3 Flood Risk Assessment

The Aurora project is located in a tropical area with high annual precipitation and intense rainfall events. Various elements of the proposed mine infrastructure will be subjected to flooding risks. However, the following facilities are of special concern: the Open Pit(s), the River Dyke, the Tailings Management Area (TMA), and the Water Management Pond (WMP).

13.3.1.1 Open Pit(s)

Flood risks associated with the proposed Open Pit(s) will be mainly generated from two possibilities: 1) severe runoff resulting from extreme rainfall event(s) in the pit and the surrounding watershed and 2) the overtopping of the River Dyke due to an exceptional river flood level. Flooding of the open pit(s) could be disastrous and would impact the operation in a very significant way. The pit dewatering system will be designed to handle a significant hydrological event and a surface runoff control/diversion system will be provided to minimize surface runoff from reporting into the pit area. The runoff control/diversion system will be designed to be sufficient for the extreme hydrological event.

13.3.1.2 River Dyke

Failure of the River Dyke either by overtopping due to river level that exceeds the design water level or by dam breaching caused by internal erosion could cause the flooding of the open pit(s). The failure of the River Dyke would have an extreme consequence in terms of social and economical losses. Therefore, the River Dyke will be designed in accordance with the technical requirements for such structures, including both the flood and earthquake design requirements. A regular inspection/monitoring program will be in place for inspection of the physical conditions of the dyke and seepage monitoring, and an alarm river level will be established for evacuation of people in the pit(s).

13.3.1.3 Tailing Management Area

The Tailings Management Area (TMA) will contain tailings generated from the processing plant. Extreme floods that exceed the design criteria and intensive internal erosion can cause failure of the structure. A flood resulting from TMA dam failure would generate significant environmental impacts. The dams for the TMA have been classified as "extreme" in terms of failure consequences and have been designed accordingly. The dams and its associated spillway(s) will be designed to handle the extreme floods without overtopping of the dams. A regular inspection/monitoring program will be established during operations and closure to ensure that the TMA dams are stable in the long term.

13.3.1.4 Water Management Pond

The Water Management Pond (WMP) will be designed to act as the center for water management for the pit dewatering and site water management. Its function would be to provide adequate retention time for water to be clarified/polished before discharge to the environment. Extreme floods that exceed the design criteria and intensive internal erosion may cause the failure of the dam structures. Discharge as a result of dam failure in the WMP would generate significant environmental impacts. The dams for the WMP have been classified as "high" in terms of failure consequences. The dams and its spillway(s) will be designed to handle the extreme floods without overtopping. A regular inspection/monitoring program will be established during the operations and the dams will be breached at closure to return the site to its original condition

14.0 CONCEPTUAL CLOSURE PLAN

The sole precedent for closure of a mine site operation in Guyana is closure of Omai Gold Mines. (OGML, 2007). This conceptual closure plan draws from that closure plan since the operation now proposed is similar to that undertaken by Omai Gold Mines with the sole exception of the underground mining operation.

The proposed Project will likely include the following components:

- Open pit mine;
- Underground mine and underground support facilities;
- Ore processing plant;
- Administration, warehouse, maintenance and outbuildings;
- Stockpiles (ore and mine rock);
- Spoilpiles (overburden)
- Tailings Management Area(TMA);
- Laydown and materials storage facilities;
- Onsite air strip, haul roads and pipelines;
- Onsite power infrastructure and fuel storage facilities;
- Domestic and industrial waste handling facilities;
- Water management facilities and drainage works;
- Offsite power infrastructure upgrades;
- Port facilities; and,
- Access Road.

The facilities will be progressively closed over the duration of the mine site operations. Progressive closure will reduce the costs of reclamation since closure will be integrated with the production operations. In addition progressive closure will result in the development of expertise on the most appropriate reclamation methods. Progressive closure will be undertaken, however without posing impediments to day-to-day operations of the site. Final closure of the mine site will be undertaken following completion of all mining operations, once treatment of site waters is no longer required, and indications that further mining of the Aurora Mine is not warranted.

Final closure of the facility will occur in two stages. The first stage will entail the following activities, if not undertaken during progressive closure phases:

- All fuel, chemicals, waste hydrocarbon products, and any potentially hazardous materials will be removed from this site;
- The portal, vent raises, and openings will be sealed;
- Underground pumping and pit dewatering will cease; and,
- Water treatment will cease once runoff water no longer requires treatment.

During the second stage of the final closure all equipment, machinery, and storage tanks will be removed for reuse or recycle. Where such uses are not practical, any remaining such materials will be disposed of at a suitable storage site. All structures will be removed and/or be demolished. Structures that are suitable for reuse or recycling will be salvaged. Structures not suitable for use will be disposed. The Tailing Management Area (TMA) and other water management ponds will be closed and all disturbed areas will be reclaimed, with the exception of roads needed for monitoring access.

After the major closure activities are complete, a monitoring program may be implemented including the site water quality monitoring and dams inspections.

Historical information for the site indicates that the site has been the subject of mining and mineral exploration for close to 100 years. Those activities have resulted in significant disturbance to the area, including excavations, road building, construction of infrastructure and forest clearing. Previous operations have used steam powered water pumps, and wood-fired boilers. A large part of the old growth timber was removed during those operations and a large part of the site is covered by secondary growth and ponded areas indicative of former operations at the site.

The conceptual closure is intended to ensure the “return to nature” of the mine site. At the conclusion of the closure process, no buildings or supporting infrastructure or facilities would remain at the site. The areas will be fully replaced by a sustainable environment comprised of productive and diverse lake and pond ecosystems. Spoil piles, stockpiles, borrow areas etc would be vegetated with general sustainable grass as well as emerging forest (primarily early stages in rainforest succession are expected to dominate the period immediately following closure). The site will be monitored for success of the closure plan. A few routes will be left for access to points of interest for the monitoring program. These routes will be closed after successful reclamation.

14.1 Closure Objectives

The objectives of the Closure Plan are to:

1. Prevent, reduce or mitigate the adverse environmental effects associated with the Project;
2. Provide for the reclamation of all affected sites and landscapes to a stable and safe condition;
3. Provide for the return of all affected ecosystems to healthy and sustainable functioning;
4. Reduce the need for long-term monitoring and maintenance by designing for closure and instituting progressive reclamation;
5. Provide for long-term monitoring and maintenance of the sites affected by the Project as required;
6. Provide for mine closure using the most current available proven technologies in a manner consistent with sustainable development.

The overall intent of the closure plan is to achieve GUY’s objective for restoring the site and aquatic environment to a high ecological value. In addition closure will result in the establishment of conditions that support public safety through physical stability (**Physical Stability**), it would encourage productive end land use by promotion of revegetation and promote conditions for biological stability (**Biological Stability**) in addition to ensuring that mechanism are in place to protect water resources and the receiving environment thereby providing chemical stability (**Chemical Stability**). Criteria/performance standards, which would function as measures of accomplishment of the closure objectives, are:

- **Physical Stability-** Preservation of protective safety measures (in a state in which the measures can be effective) throughout the post-closure monitoring period, once there has been no external human influence.
- **Biological Stability-** Effective revegetation and restoration evidenced by vegetative proliferation on 70% of the site areas intended for revegetation by the end of the post-closure monitoring period.
- **Chemical Stability-** Water quality similar or improved when compared with historic data at the end of the post-closure monitoring period, once there has been no human or related influence.

The conceptual closure plan incorporates the use of storm-water management practices and soil and wildlife conservation. The storm-water management practices will provide systems that minimise environmental damage by:

- Maximising retention time within the system by use of detention ponds
- Minimising increases in surface runoff flow and volume

- Channelling and diverting runoff
- Use of bench terraces

Soil conservation techniques to be employed to ensure closure success include

- Modifying the soil slope
- Maintaining and establishing natural vegetative cover
- Securing favourable soil conditions to facilitate vegetative growth

Wildlife conservation techniques will include:

- Providing food resources through establishment of vegetation
- Providing habitats for wildlife through encouragement of vegetative proliferation, as well as creation of aquatic habitats
- Providing surface water and soils of good quality for wildlife consumption and use.

14.2 Reclamation Concept

The mine site reclamation will be coordinated with the Guyana Geology and Mines Commission. Borrow pits used to source material for embankment construction will be profiled and partially vegetated with grass. Grass shoots shall be manually harvested from other areas and will be transplanted at borrow pits locations.

A containment berm will be constructed around the perimeter of each spoil pile to control erosion and the migration of solids. The spoil pile will then be graded to blend with the natural topography. A layer of saprolite will be applied to selected areas of the dump face where waste rock only is exposed. Soil will then be applied over the spoil piles and vegetated 'islands' will be planted and observed. If the "islands" indicate that the soils are adequately fertile to develop a diverse community of plants, no additional action will be taken and the vegetation will be allowed to naturally spread. If observations of the "island" indicate very little development and spreading of vegetation, seedlings from a nursery plot at the site will be transplanted into the spoil pile.

Each mine pit will be provided with a spillway to enable discharge to surface water features around the pits. The discharge spillway will be sloped and will be covered with geotextile and rip rap (waste rock) to minimize the possibility of erosion. All power and water line will be disconnected and will be removed from the site.

All stockpile areas will be excavated back to original ground level, profiled and covered with natural organic-rich soils to encourage natural revegetation.

The water management pond will be breached to reduce the pond to one-half of its designed height and a spillway will link the pond to nearby surface water features. The spillway will be covered with geotextile and rip rap (waste rock) to minimize the possibility of erosion.

All haul and access roads will be regraded, reclaimed, and closed except for agreed upon access routes. To match adjacent slopes and roads material will be pulled from the fill portion of the roads and placed in the cut portion to aid in regrading. All exploration roads at the mine site will be reclaimed in a similar manner to haul and access roads. This will include all areas outside the active mining area.

The process plant and its associated treatment facilities will be removed from the site. Concrete slabs and footings will be broken up and placed into open facilities such as ponds or will be placed on waste rock dumps in such a manner that the concrete will be incorporated into anticipated reclamation. Facility sites will be graded to blend in with existing topography, and compacted areas will be ripped and the whole

area will be covered with topsoil and revegetated. All topsoil areas will be regraded and revegetated. The primary materials to be used would be cover soil, subsoils, and non-acid generating (NAG) and acid neutralizing materials such as gravels and selected waste rock. Impervious ground covers will be installed using clays excavated from the mine pits.

The remaining areas not constructed on or of potentially AMD generating materials such as workshops, topsoil stockpiles, and some haul roads, will be covered with 12 inches of topsoil and up to an additional 12 inches of subsoil to provide a suitable substrate for vegetative growth. The subsoil will increase water storage capacity and provide a good substrate for rooting and maximize the likelihood of long-term vegetative success.

The closure plan will lead to the re-establishment of ecological processes that will allow for the development of appropriate habitats on the areas previously disturbed by mining. Where needed to provide slope and soil stabilization, permanent seed mixtures will include native species appropriate for the area. Non-invasive introduced vegetation species will be considered for their benefits to add organic matter to soils.

Closed facilities will be inspected and annual reports provided to evaluate the success of progressive reclamation. Reclamation monitoring would be coordinated with the EPA and GFC. Reclamation success will be evaluated both in terms of vegetation and erosion. The existing monitoring programs for surface and groundwater will continue in accordance with the proposed monitoring plans. Monitoring would be modified to address progressive reclamation as it proceeds.

Post closure monitoring of the tailings pond will be continued to ensure the integrity of the embankment cross-section. The cyanide concentration and water content of tailings will also be monitored to determine when these parameters fall within acceptable limits. Monitoring will only cease after both cyanide concentrations and tailings moisture content are within acceptable limits and only after the safety factor of embankment cross-section is determined to exceed 1.5 based on the soil strength gains over time and the widened embankment footprint based on deposition of the coarse fraction of the tailings adjacent to the dam itself.

At the end of underground mining operations, all surface structures will be removed, and all underground openings to the surface, e.g. shafts, ventilation raises, etc., will be capped, plugged or backfilled to eliminate safety hazards and restore the topography to the pre-mining condition. The levels/sublevels, magazines and workshops will occupy relatively small areas and these area would not be backfilled.

Stopes will be progressively backfilled as mining progresses upwards. Consolidated backfill techniques will be used to fill the open stopes. The mined-out stope will be backfilled with either cemented paste fill and/or cemented rock fill (CRF). Cemented paste fill is a high density mixture of de-slimed tailings mixed with cement. The mixture would be prepared on the ground surface and would be pumped underground via a network of drillholes and pipes. CRF is a mixture of cement slurry and crushed rock or underground development waste. This mixture would be prepared underground and would be dumped into the stopes via fill raises.

15.0 INTER-AGENCY AND PUBLIC/NGO INVOLVEMENT

Meetings were held with several Government agencies and Non-Governmental Organisations (NGO's). The objectives of the meetings were as follows:

1. To determine whether the agency/organization have any legislation or regulations that would impact on the proposed development.
2. To discuss the agency/organization's position on the proposed development.
3. To discuss areas of environmental concern as it relates to the environment in the project area.
4. To collect all information or data on the environment within the project vicinity.

The results of the meetings are detailed below. The agency/organization and the representative(s) with whom each meeting was held are also identified for clarity.

Minutes of the first meeting with Ministry of Amerindian Affairs, held on 25th May 2009 with Mr. Clive Patterson.

Present at the meeting were:

Mr. Clive Patterson- Ministry of Amerindian Affairs
Ms Ayaana Jean-Baptiste- GSEC Consultant

Discussed Issues

Mr. Clive Patterson is more involved with Amerindian communities located in Region 1,2,6,9 and 10. He has not personally been active in Region 7, where the project site is located. Since Mr. Ovid Williams who is more familiar with Region 7 is on leave, he was the only person that could meet to discuss the issues at this time.

Mr. Clive Patterson acknowledged that the Ministry of Amerindian Affairs has not been heavily active in Region 7, specifically in Kurutuku, due to its remote location.

Since there have been no active visits from the Ministry of Amerindian Affairs to Region 7 Amerindian communities, he was unable to discuss any concerns for the area. He did note his concern for the Ministry to become more active in this region for the near future.

Minutes of the first meeting with Amerindian People's Association, held on 25th May 2009 with Mr. Lawrence Anselmo

Present at the meeting were:

Mr. Lawrence Anselmo- Amerindian People's Association
Ms. Ayaana Jean-Baptiste- GSEC Consultant

Discussed Issues

Mr. Lawrence Anselmo mentioned his recollection of meeting up with GUY and IFC representatives in the past and their lack of properly following up with his organization after this meeting held in 2006. As a result he is not that clear of the exact position of the mining site and if any Amerindian communities are affected by this project site. Hence, supporting his request to visit the project site as well as Kurutuku in the near future with GUY assistance.

Mr. Anselmo has visited Kurutuku some 8-10 years ago and conducted a social survey to determine their socio-economic needs and concluded that it is a highly neglected area. He did not have the results of the survey on hand but he will attempt to locate it and disclose with Ms. Ayaana Jean-Baptiste.

A main concern expressed by Mr. Anselmo was that residents in Kurutuku usually have to seek assistance by the miners in their vicinity. The same miners that tend to create problems for this society with illegal activity and whom are usually responsible for environmental destruction. Examples cited were the pollution of the River, building of sand bars, exploitation of the Indigenous people, and disruption of farming lands.

Amerindian communities have been made to feel that they can only remain on their government ascribed titled lands. He explained the two categories of Amerindian settlements as ascribed by the government as 'titled' and 'untitled'. Made note of by Mr. Anselmo is that in section 112 of the 1989 Mining Act, it states that:

"For the purposes of this Act, all land occupied or used by Amerindian communities and all land necessary for the quiet enjoyment by Amerindians of any Amerindian settlement, shall be deemed lawfully occupied by them."¹⁹

Considering this Act, Mr. Anselmo insists that there is no need to differentiate two categories of Amerindian settlements, it is all one settlement and the people within these settlements have rights. Rights misunderstood by them, since they are lacking education in regards to their human rights. The government claims that the rights of Amerindians are protected; however on a regular basis Amerindians are highly disrespected.

Many members of Amerindian communities are made to feel that they can only stay in their 'titled' land as determined by the government and it's agencies (e.g. GGMC). There is a need for these communities to be aware that the area outside of their ascribed 'titled' land are still traditional lands necessary for their sustained livelihood. This sort of education is what APA attempts to provide to residents in Amerindian settlements. Currently the APA provides 'Capacity Building Workshops' in Amerindian communities. These workshops are designed to strengthen the community with the ability to defend themselves rather than succumb to the pressures of the government and its agencies. The APA office is in contact with Amerindians in every region in Guyana, however since it is a non-profit agency, the resources are not always available to visit some of the more remote areas, such as Kurutuku.

When discussing the absence of teachers in Kurutuku at the Kurutuku school he described teacher allocation there as a prison sentence. Since there is not in existence any proper means of outside communication, food, and basic everyday needs for livelihood. With such conditions it is no surprise that teachers are not willing to reside and be employed in that location. This lack of education results in a high illiteracy rate and leaves the community as an open target for exploitation by mining operations. An example provided was that mining areas tend to attract young people who have no means of sustainable employment within their communities. That they are sometimes lured under false pretense that they will be granted work in the bars or shops, where upon their arrival they are used as sex workers and other detrimental positions.

In regards to the GUY proposed mining operation, Mr. Anselmo expressed his concern of this project having similar negative impacts as that of Omai in that while it can lead to employment opportunities for Amerindians, it can also lead to labour abuse. This is an issue that happens currently at mining operation, where Amerindians are exploited and treated differently than other employees, examples provided were Amerindians being both overworked and underpaid.

¹⁹ Extract from Report entitled, "Indigenous Peoples, Land Rights and Mining in the Upper Mazaruni, prepared by the Upper Mazaruni Amerindian District Council, Amerindian Peoples Association of Guyana and Forest Peoples Programme (2000).

Representatives from GOIP and TAMMOG did not show up for the scheduled meetings.

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- Website 6: University of Guyana <http://www.uog.edu.gy/node/71>

APPENDICES

**Terms of Reference
Environmental Impact Assessment
Guyana Goldfields, Aurora**

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INTRODUCTION

The proposed mine site covers a total area of approximately 800 hectares, at Aurora, on the Cuyuni River, in the north western part of Guyana. The mine site is understood to consist of 11 Prospecting Licences (PL).

Gold is known to exist in the area since 1911. Some mine development and production took place in the 1940's. Throughout the late 1980's and 1990's exploration for gold was conducted on and around the original Aurora PL. The project was acquired by Guyana Goldfields in 1998.

In 2000, Guyana Goldfields Inc (GUY) undertook a small exploration program with 39 shallow diamond drill holes (1,067m). The exploration resulted in the discovery of a number of new mineralized gold zones and deposits, as well as the expansion of previously known mineralized zones. Since, the work at Aurora has primarily consisted in exploration drilling activities.

Samples of drill cores were tested to establish ore grades. The resulting mineral resources from the block model, as reported using the 1.0g/t Au cut-off, are presented in the table below.

Area	Indicated Resource				Inferred Resource			
	Million Tonnes	Grade (g/t Au)	Contained Metal		Million Tonnes	Grade (g/t Au)	Contained Metal	
			Tonnes of Gold	Million Ounces			Tonnes of Gold	Million Ounces
Aleck Hill	5.27	3.55	18.71	0.60	1.60	2.07	3.31	0.11
Rory's Knoll	11.73	3.35	36.24	1.26	20.24	3.46	69.99	2.25
East Walcott					1.45	3.77	5.45	0.18
Total	17.00	3.41	57.95	1.86	23.29	3.38	78.75	2.53

Source: Snowden, 2008

To facilitate the issuance of a Mining License Guyana Goldfields Inc. must submit a feasibility study to the Guyana Geology and Mines Commission (GGMC) for the approval of the Aurora project. GGMC mandates that the feasibility study must include an Environmental and Social Impact Assessment (ESIA) for the property. The ESIA process in Guyana has several phases.

The initial phase is submission of an EIA application to the Guyana Environmental Protection Agency (EPA). That phase has been completed. The second phase is submission of a document, referred to as the Terms of Reference (TOR) to the EPA detailing the extent of the ESIA study and the major likely environmental and social impacts associated with the proposed action. The draft TOR was submitted in March 2009.

Subsequent to submission of the draft TOR, several comments were received from the public, Non-Governmental Organizations (NGOs), Government Agencies, (Sectoral Agencies), the EPA and the Environmental Assessment Board (EAB). Sectoral Agencies provided comments at a meeting held in the boardroom of the EPA on April 28, 2009. Additional public comments were also provided on the draft TOR at a public meeting held at Bartica on April 29, 2009 and chaired by the EPA.

The final TOR, detailed herein, incorporates additional issues related to performance of the ESIA identified during the public comment period in addition to issues highlighted by participants at the scoping meeting. The Final TOR excludes consideration of the

hydropower plant since that facility will be addressed by a separate ESIA, if current studies evaluates it as being the most feasible option for power generation for the proposed mine site.

This document has been prepared to identify the major issues of environmental and socio-economic concern related to the operation of the gold mine and ancillary facilities and presents the proposed methodology for the ESIA.

DESCRIPTION OF PROJECT

The development and operation of the mine site will involve several distinct phases. These phases are expected to include the following:

- Construction and operation of the mine site;
- Construction of an access road to the mine site;
- Construction and operation of a wharf at Buck Hall on the Essequibo River.

A hydropower facility may be constructed upstream of the mine site to provide power to the operation. A feasibility study is currently being undertaken for the hydropower plant. If the plant is considered feasible, a separate ESIA will be prepared for that facility.

The project envisages that several aspects of the mine site development will occur concurrently. During all phases of construction and during the mine site operation, worker accommodation will be provided on site. GUY will also provide medical and other facilities at the mine site required for the efficient functioning of a community. These facilities will include pure water supply and waste management. Workers will be transported to and from certain centers, such as Bartica and Georgetown to the mine site and will operate on a six week on/two week off rotation.

Three independent resource areas have been established by the exploration program. These resource areas are as follows:

- Aleck Hill;
- Rory's Knoll; and
- East Walcott.

Ore recovery will consist of a combination of open pit and underground mining. A preliminary open pit design undertaken by Snowden envisages the mine site development schedule to be as follows:

- Rory Knoll/East Walcott open pit;
- Aleck Hill open pit, while Rory' Knoll underground is developed;
- Aleck Hill underground; and
- Rory Knoll/East Walcott underground.

The combined schedule will result in a mine life of approximately 12 years. Exploration work is currently ongoing at the mine site. The location of the processing plant, ore stockpiles, waste dumps and tailing facilities will be decided after the exploration programs establishes the absence of viable resources in the areas indentified for these facilities. The location of these facilities on site is detailed in Figure 1.

Power for the process plant operation and for ancillary services will be provided either by a run-of-the-river with pondage hydropower plant to be constructed on the Cuyuni River approximately 8 km from the mine site or by fossil fuel generators.

The mine site operation will be serviced by both land and water. A wharf will be constructed at Buck Hall on the Essequibo River for the management of cargo related to the mine site operation. A roadway, constructed by the Barama Timber Company, currently runs north of the mine site and at its closest point is approximately 25 km from the mine site. GUY proposes to construct a road from the mine site to link with this existing road to provide land access to the mine site. The road proposed by GUY must cross the Cuyuni



LEGEND:

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PRELIMINARY

FIGURE 1: LAYOUT OF MINE SITE

PROPRIETARY INFORMATION:
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APPROVED FOR _____			GUYANA GOLDFIELDS INC.
CLIENT PROJECT MGR.	DEPARTMENT MGR.		
PROJECT PHASE _____		AREA _____	
PROJECT NO.	ACTIVITY NO.	BY _____	DOMMMYY _____
		SUBJECT _____	AURORA GOLD PROJECT

River. The river crossing will be accomplished using barges or a bridge will be built across the Cuyuni River. The exact configuration of the crossing will be decided based on a feasibility study being currently undertaken for the proposed operation.

2.1 PROPOSED ACTION

For the purposes of conducting this environmental and social impact assessment, the proposed action is the operation of an open pit and underground mining and mineral processing operation for the recovery of gold in the GUY Concession at Aurora on the Cuyuni River. Mining will entail ore recovery primarily from three areas at the site; Aleck Hill, Mad Kiss and Rory Knoll. A processing plant with three primary circuits; gravity, Carbon-in-Leach (CIL) and Electrowinning will be utilized for gold recovery from the mined ore.

Several facilities will be constructed on site for the operations in addition to the processing plant. These facilities will include personnel housing, equipment repair shops and fuel oil storage facilities. The proposed layout of the mine site is shown on Figure 1.

2.2 MINING OPERATIONS

Examination of the Aurora Property (Snowden, 2008) has identified the existence of three mineralized zones referred to as Aleck Hill, East Walcott and Rory's Knoll respectively. The mineral recovery operations will consist of a combination open pit and underground mine operation followed by a tank contained cyanide leaching plant for gold recovery. The plant will process approximately 3.5 million tonnes of ore each year.

The mine site will be sequentially developed. The first phase of the development sequence will see the recovery of ore by open pit mining methods from Rory's Knoll and East Walcott. This will be followed by open pit mining of Aleck's Hill. While open pit mining is occurring at Aleck's Hill, the underground potential of Rory's Knoll will be developed. Aleck's Hill will subsequently be mined by underground methods followed by the recovery of ore by underground mining from Rory's Knoll/East Walcott. The proposed mining sequence will result in a twelve year mine life.

Historic surface water levels in the Cuyuni River may result in encroachment of water from the Cuyuni River into the open pit created for exploitation of ore at Rory's Knoll. A flood mitigation barrier will be constructed between the mine pit and the Cuyuni River at this point.

2.3 PRELIMINARY WORKS

It is anticipated that the preliminary works or setup phase will be conducted prior to the access road being serviceable. However, it is assumed that a trail would be open to the Barama Company Limited (Barama) road network providing tote road access. The tote road will allow a starter suite of construction equipment, fuel and materials to move onto the Aurora site. If trail access is unavailable then the current method of road, river and air access will be utilized.

Off site setup activities will include setting up a consolidation facility and port and access road development. Access road construction will be required to connect Aurora to the port facility to be constructed at Buckhall. Materials handling equipment will be staged at the port and materials and equipment will start to ship.

Site activities during the setup phase will be focused on preparing a construction starter camp, kitchen and construction offices. Communications will be installed and onsite administration and management readied. Rudimentary utilities for sewer and water would be provided for the starter camp on a design that contemplates connection to services to be later installed for the permanent workforce accommodations and kitchen.

Core setup activities would include:

1. Tote road access to the Aurora exploration camp and airstrip
2. Brushing and grubbing of the construction camp location
3. Fuel and lubricant containment and storage
4. Setup and operation of a portable sawmill with planer and jointing capabilities
5. Installation of sewer, water and power services
6. Accommodation, kitchen and office construction
7. Boardwalk construction connecting buildings
8. Outbuildings and shelter for minor repair and maintenance, power generators, water pumps, storage lockups etc.

The portable sawmill will continue operations producing beams and timbers, forming boards and dimensional lumber. Timbers will be used for embankment cribbing and decking for vehicles at stream crossings. Temporary post and beam covered structures to accommodate carpentry, fabrication, and maintenance will be erected. Skid mounted sheds, tool cribs, tanks, and portable offices will be assembled for deployment to work areas.

Site access and drainage will be improved and brushing and grubbing activities will be expanded. Brushing and grubbing would be controlled by survey to ensure that the required designed footprint of the operations is managed. Dock and loading ramps will be prepared to provide workable river access. Laydown area will be developed. Access to a rock or aggregate source will be developed. Survey control and site layout activities will commence. It is anticipated that exploration drilling to improve confidence and provide condemnation of mine footprint real estate will be ongoing. Geotechnical investigations will continue and drainage management will be laid out and detailed in the field for construction.

Site capture will kick into high gear when road access and river crossing infrastructure is useable. Materials for permanent camp construction and fuel storage and tank fabrication will arrive and these activities will be undertaken. The construction equipment fleet will be expanded.

Quarrying equipment and starter aggregate crushing operations will start to produce limited quantities of concrete for camp construction. Permanent camp sewage, water treatment and solid waste equipment and power services will be installed.

A permanent airstrip will be constructed and a security and terminal building constructed.

When the facilities to support a construction workforce are complete and land has been cleared and surveyed, construction of site infrastructure will be undertaken. Significant works will include the process plant, crushing and conveying, maintenance shops, administration facilities, warehouse and laydown for stores, mine operations access road construction, power lines, tailings containment and water management structures.

At the completion of construction the mine will be producing ore and the process plant will be operational. Construction personnel and equipment will be demobilized and mining activities will commence.

It is anticipated that construction period will take 24-30 months and manpower levels will peak at 400-500 persons.

2.4 MINING AND MINERAL PROCESSING

2.4.2 Open Pit Mining

Conventional truck and shovel surface mining methods would be used for the open pit mining phase of the operation. The trucks would be nominally 36 cubic meter capacity and the excavators 12 cubic meter capacity. Mining will be conducted within the boundaries of the deposit as identified by exploration work. The mine limits will be defined by location survey in the field. Mining depths of up to 150 meters are generally achievable with conventional open pit methods. Mine design work will establish the economic pit extent. Overburden and organic materials will be removed and stockpiled and reserved for environmental reclamation activities.

Materials to be mined will be sampled to determine whether they are waste or ore. The in situ material would be marked by flags and pickets prior to excavation. Waste materials will be sorted from mineral bearing materials and loaded into mining trucks. The trucks will transport mineralized ores to the process plant and waste materials to waste stockpile locations. Tracked 400hp dozers will maintain the stockpiles. Some ore will be fed directly into the process plant and some will be stockpiled to ensure adequate supplies of ore feed are maintained. The mining and the processing will take place 24 hours per day and 7 days per week 365 days per year.

The weathered material close to surface will be excavated without blasting. As mining progresses fresh hard un-weathered material will be drilled and blasted. Blast patterns will be engineered to ensure a design allowing adequate fragmentation and maximum control. A small bulk explosives plant will be constructed to blend blasting agents at the mine site for use in the mine. This process allows for the shipping of oxidizer and other components separately. These ingredients are not explosive until blended together in exact proportions at the mine site and sensitized. Bulk explosives will be delivered directly from the bulk plant to the blast holes in specially designed bulk explosive blending trucks.

The mine area will be engineered to ensure the design controls the mine footprint and limits the clearing of forest to the area required to conduct mining activities. The footprint design will contemplate the minimum removal of forested areas.

2.4.3 Underground Mining

Underground mining will be done using narrow vein open stope (NVOS) sublevel open stope (SLOS) or longhole open stope (LH) mining methods with delayed backfill. The mine deposit would be accessed by a shaft and/or a decline/ramp with several adits main levels and sublevels at different levels horizons. The main levels would be connected to the shaft while the sublevels would not. All main levels and sublevels will be driven parallel to the deposit and connected by the decline/ramp.

The underground mine development will involve activities such as drilling, blasting, mucking and hauling, ground support and installations of services. The underground

production will include unit operations such as longhole drilling, explosive loading and blasting, ore mucking, and backfilling.

The underground mine services will include the following subsystems:

1. ventilation
2. material handling (load-haul-dumping and/or trucking and hoisting)
3. dewatering
4. backfill
5. compressed air
6. process water and portable water
7. power supply
8. communications
9. egress and refuge, etc.

The details of the underground ore recovery extraction system would be finalized prior to implementation of the open pit phase of the mining operation.

2.4.4 Mineral Processing

The major process units would be:

- o Primary crushing, ore handling and storage
 - o Mineral Sizer
 - o Jaw Grinder
- o Grinding
 - o Sag Mill
 - o Ball Mill
- o Classification-Cyclones
- o Gravity Circuit
 - o Knelson Concentrator
 - o Intensive Cyanidation Unit
- o Thickener
- o Cyanidation -Leach Tanks-Adsorption (CIP or CIL)
- o Elution
- o Refining and Smelting
- o Tailings-Cyanide Destruction

Crushing/Material Handling

Two crushing circuits will be proposed in the design to account for crushing oxidic or sulphidic ore types. During the first two years of mining, the processing plant will treat the saprolite ore at a rate of 8000 tpd. SGS has established that Saprolite is a fairly soft rock whose work index is 7.0 kWh/t. The Saprolite will require minimal crushing so we are proposing the utilization of a Mineral Sizer as the primary crusher when handling saprolite. A typical Mineral Sizer is depicted in Figure 2. When the oxide layer is depleted, hard rock with a work index of 14.2 kWh/t will be encountered. A jaw crusher or gyratory crusher would be installed in year two. The Mineral Sizer will remain in the circuit to possibly handle other saprolitic material likely to be encountered.

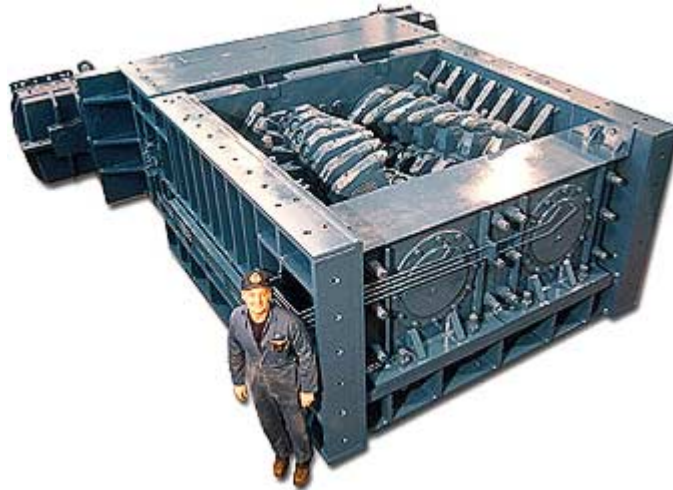


Figure 2 - Typical Mineral Sizer

Milling and Pebble Crushing

The Mineral Sizer or the Jaw/gyratory crusher will feed a SAG mill, which will be designed for a throughput of 4000 tonnes per day. The work index for the oxides is 7 kwh/t and that for the sulphides is 14 kWh/t. Theoretically the throughput would be 8000 tpd when milling a softer ore (and smaller feed size of the oxidized saprolite). The SAG mill could even be operated as an AG mill (Autogenous) and will be converted to a SAG when the harder ores are encountered. Foundations will be designed for a SAG Mill. A circulating load, 20%, of the SAG mill discharge, will be conveyed to a pebble crusher. A cone crusher rated at 35-45 tph will be selected for pebble crushing. The SAG mill discharge would be spilt equally and feed two parallel ball mills in closed circuit with a cyclone pack. Cyanidation tests have been conducted at three grinds, ranging from K_{80} of 95 μm to 160 μm and as expected higher recoveries (>96%) have been achieved at finer grinds). The grind will be optimized at K_{80} of 75 μm . A conceptual schematic flowsheet and process flow diagram which covers all process units is illustrated in Figure 3.

Classification Thickening

Each ball mill will be operated in closed circuit with a cyclone cluster. The cyclone overflow from each mill will be fed to a high rate thickener, to achieve an underflow density of at least 45%. The thickener underflow would be fed to an aeration tank prior to cyanidation, and the thickener overflow would be pumped to a process water tank. Due to anticipated low settling rates for saprolitic ores, a flocculant would be added to the thickener feed to improve settling rates.

Gravity Recoverable Gold

To maximise recovery of gravity recoverable gold for the 8000 tpd throughput, a portion of the cyclone underflow would be diverted to a Knelson concentrator. Based on preliminary metallurgical results it is anticipated that at least 30-35% of the gold would be recovered by gravity.

Intensive Cyanidation

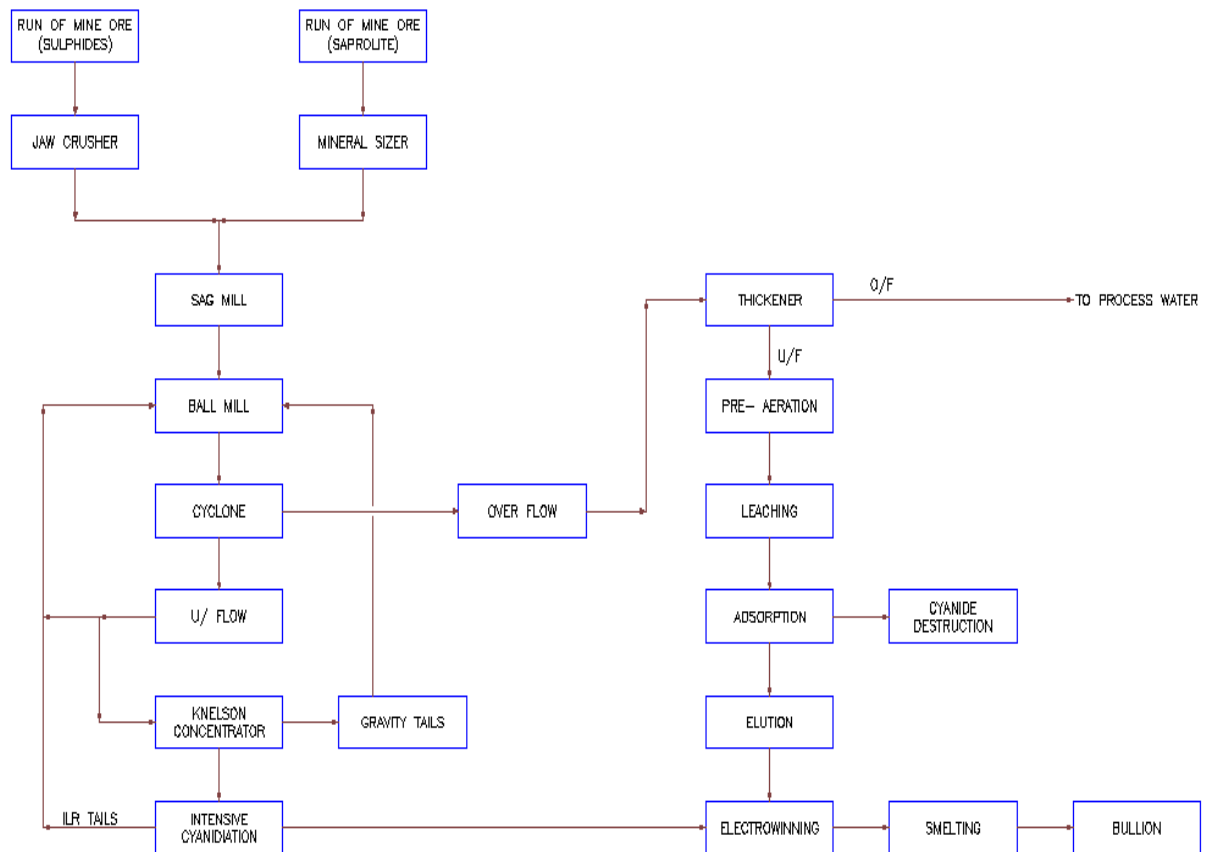
The gravity concentrate would be treated in an **Intensive Cyanidation Unit (ICU)**. The intensive cyanidation technology is attractive in that it would result in:

- o significant improvements in recovery of gravity gold (no recycle streams from the shaking table)
- o Improved security
- o Capital cost reductions for increased leach throughput. The Knelson concentrator and intensive leach reactor (ILR) is normally supplied as a package.

Leaching

To improve the cyanidation kinetics the thickener underflow will feed a pre-aeration tank before the leach tanks. Leach tanks will be designed and sized for a pulp density of 45% solids and 48 hour residence time. The leach circuit will consist of the nominal 5 or 6 agitated tanks. Sodium cyanide would be metered into the first and second leach tank to maintain a nominal 0.5-0.8 g/L concentration. Air will be supplied to all tanks and a provision made for bypassing of any one tank.

Figure 3 - GUY Schematic Flow Sheet



Carbon Circuits

The slurry from the leach tanks will be pumped to the carbon in pulp (CIP) circuit, which conceptually would be a train of 5 or 6 agitated tanks. Each tank will be equipped with an inter-stage screen for carbon retention. Loaded carbon will be directed to the carbon stripping circuit. Stripped carbon from the carbon elution and activation kiln will be

delivered to the last CIP tank. Slurry from the last CIP tank would be screened to ensure that no carbon is inadvertently lost. Loaded carbon from CIP would be transferred to a pressure vessel where gold is eluted with weak caustic-cyanide solution at an elevated temperature. Stripped carbon will be screened and reactivated in a horizontal kiln.

Electrowinning and Refining

Pregnant strip solution from the elution process would be accumulated in the pregnant solution tanks and fed continuously to the electrowinning cells for gold recovery. The electrowinning (EW) will be divided in two sections, with one handling the pregnant solution coming from the ICU and the other dealing with the eluate from the carbon stripping vessel. Cathode gold would be periodically removed under tight security, refined to dore in a furnace and cast into bars for shipment and sale.

Cyanide Destruction

Tailings from the last CIP tank will be discharged to a cyanide destruction plant. The leach circuit tailings will report to a carbon safety screen, from which they pass through a sampler for collection of metallurgical accounting sample before entering the agitated cyanide destruction tank. In this tank the residual cyanide content is reduced below permissible levels through oxidation, using SO₂-air process.

Process Residuals

The residuals from the operation will consist of waste from the mining and mineral processing operations. The waste will be fed to the tailings pond.

2.4.5 Support Services

Support services such as equipment maintenance, provision of project housing and other services activities would be performed to reduce accidental spillage of solid matter, contaminants, debris, and other objectionable pollutants and wastes into waterways in the project area. Such pollutants and wastes include, but are not restricted to, refuse, garbage, cement, concrete, oil and grease, and other petroleum products. All water discharges from the area will be done in a manner to ensure minimal discharge of sediments to any waterway. Excavated soil will not be stockpiled or deposited near or on the banks of waterways where they can be washed away by storm runoff.

Site Utilities Supply

Two water supplies services will be provided to the camp. These will provide water for the following purposes:

- drinking/cooking
- washing, showers, toilets, etc. (Shower water)

Adequate supply will be provided for the needs of approximately six hundred people. Water for drinking/cooking will either be imported from Georgetown or obtained from onsite wells set at some distance and at higher elevations from the mining operations and sewerage treatment facilities.

2.4.6 Buck Hall Port Facility

The port facility will occupy approximately 10 fenced hectares on the west bank of the Essequibo River in the area of Buck Hall and will be designed to handle general cargo. The facility will be used as a transfer point for materials in transit to and from the Aurora mine. Materials will be delivered to the port by barges and small and mid-sized ocean-going vessels and transported off-site by trucks. The facility will include the following:

- A dock facility which will consist of a wharf and a short pier that connects the wharf to the shoreline
- A covered storage area and workshop for maintaining equipment and vehicles
- Fuel storage and dispensing facility
- Offices and housing facilities for a wharfinger and support workers
- Utilities, including potable water, solid waste and sewerage disposal, fire protection, and electricity
- Security fencing and structures
- A small-boat landing
- An open lay-down/storage area

The dock and short pier will consist of a reinforced concrete deck supported by timber piles. A timber revetment will be constructed along a part of the shoreline adjoining the pier.

The on-shore covered storage area and workshop will consist of a steel frame structure with metal roof, reinforced concrete floor, and concrete block siding where needed.

Fuel (gasoline and diesel) storage tanks and dispensing facilities will be constructed on-shore and close to the dock. Steel storage tanks will be constructed on raised concrete or wooden supports enclosed in a berm designed to contain any spillage and with a volume of 110% of the total tank capacities.

Offices, conference room, housing, and utilities will be provided for about 25 personnel. The buildings will be single-story concrete or wood structures.

Potable water will be trucked to the facility and stored in separate tanks in the office buildings, housing facilities, and covered storage area. A septic tank and leach tiled system will be provided for sanitary sewer waste disposal. Solid waste will be collected in dumpsters and disposed off-site by a local trash collector. Fire protection will be provided for the entire facility. The fire protection water supply system will consist of a storage tank (for non-potable river water) on its own concrete foundation, a pump station with its intake system at the river, and a distribution system with appropriately design and located hydrants and pipelines. Electricity will be provided by an on-site diesel-powered generator.

Security will be provided by a 3 m high chain-link fence that will completely surround the site. A security building will be located at the front gate. An elevated security tower will be located strategically on the perimeter of the facility. Cameras will be strategically installed to continuously monitor the facility.

A landing for small boats will be provided adjacent to wharf. This will be designed to allow access to the dock by passengers and light cargo.

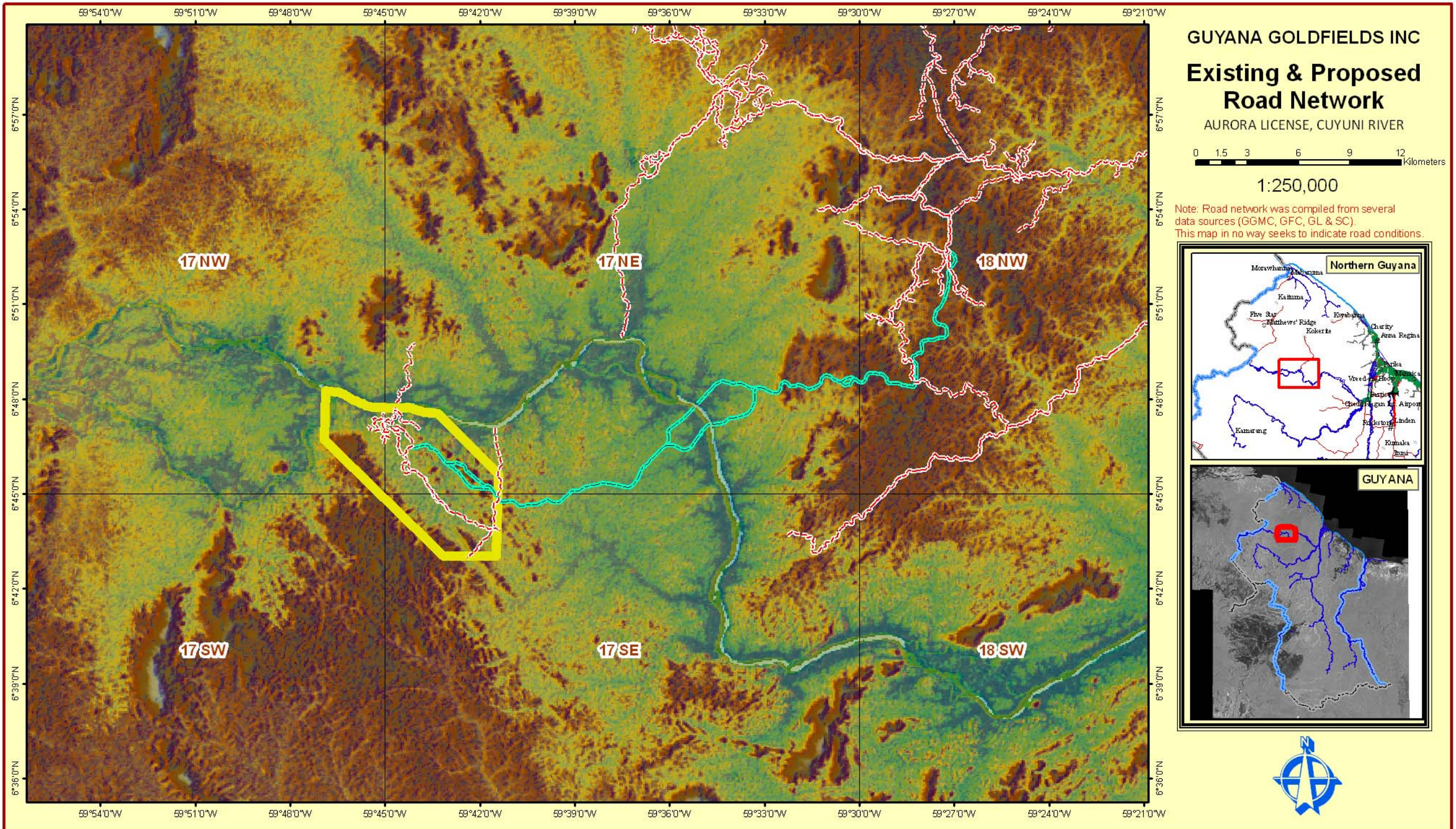
The lay-down/storage area will consist of an engineered subgrade and gravel surface designed to support the heavy equipment, trucks, and mobile truck cranes that will be used and stored in this area. The site will be provided with adequate drainage.

All structures and facilities will be designed to meet acceptable national and international requirements and standards.

2.4.7 Access Road

The alignment of the access road is shown on Figure 6. The access road will be approximately 25 m wide. It would be constructed by clearing the vegetation on the alignment. The access road will be surfaced using lateritic material available on the roadway alignment. Horizontal and vertical alignment on the access road will confirm to the Guyana Forestry Commission (GFC) guidelines. The access road will be drained by excavating several pits adjacent to the roadway at discrete intervals on the alignment. Runoff from the roadway will be channeled to these pits. The proposed access road alignment is shown on Figure 4.

In instances where the roadway crosses streams/creeks, timber bridges would be constructed where spans are in excess of 3 m. In those instances where the spans are less than 3, the stream crossing will be made using High Density Polyethylene (HDPE) culverts.



Map prepared for:
Ground Structures Engineering Consultants

FIGURE 4: ACCESS ROAD ALIGNMENT

Existing Road Network Proposed Road Aurora License

3.1 APPLICABLE GUYANESE REGULATORY FRAMEWORK

The environmental compliance element of the project will be regulated under several statutes. These statutes outline measures that must be implemented to ensure compliance with policy guidelines and legislation.

A review and assessment will be done of relevant legislations and policies in Guyana that are applicable to the project. These will include:

- The National Environmental Action Plan, 2000
- The Environmental Protection Act, 1996
- The Wild Birds Protection Act, 1973
- The Aquatic Wildlife Control Regulation, 1996
- The Forestry Act, 2000
- The Guyana Geology and Mines Commission Act, 1979
- Environmental Protection Water Quality Regulations, 2000
- Environmental Protection Air Quality Regulations, 2000
- Environmental Protection Hazardous Waste Regulations, 2000
- Occupational Safety and Health Act, 1997
- National Biodiversity Action Plan, 2007
- Wildlife Conservation Regulation (draft), 2000
- Public Health Ordinance, 1953
- National Trust Act,
- The Town and Country Planning Act,
- The Drainage and Irrigation Act

Additionally, Guyana is a signatory to a number of international and regional conventions and protocols aimed at addressing environmental concerns. Some of these which are applicable to the project, and which will be included in the international and regional conventions to be considered, are:

- Convention on International Trade in Endangered Species of Fauna and Flora (CITES), 1973;
- Convention on Biological Diversity, UNCED, 1992;
- Treaty on Cooperation for the Development of the Amazon Basin, Brasilia, 1978;
- United Nations Framework Convention on Climate Change, UNCED, 1992;
- Convention on the Protection of the World Cultural and National Heritage, 1972; and
- Agenda 21.

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. These regulations will be reviewed and their relevance to this project will be established.

3.2 IFC PERFORMANCE STANDARDS AND APPLICABLE EHS GUIDELINES

The ESIA will also be structured to address the relevant International Finance Corporation (IFC) Performance Standards (PSs). Depending on circumstances, the likely PSs to be triggered include:

- PS1 – Social and Environmental Assessment and Management Systems;
- PS2 – Labor and Working Conditions;
- PS 4 - Community Health, Safety and Security;
- PS3 - Pollution Prevention and Abatement.

Other relevant PSs may include:

- PS 5 – Land Acquisition and Involuntary Resettlement;
- PS 6 – Biodiversity Conservation and Sustainable Natural Resource Management; and
- PS 7 – Indigenous Peoples.

The degree of relevance of these other PSs will be dependent on conditions in the field and be determined during the tasks described in *Section 6, Study Methodology*.

An assessment would be conducted of the consequences for the project of enforcing all the environmental legislation and regulations and the sectoral requirements related to the project.

OBJECTIVES

The ESIA for the GUY project at Aurora will be prepared to identify and evaluate the environmental, socio-economic and health consequences of the proposed project and to develop plans to mitigate the possible negative environmental, socio-economic and health impacts and to enhance the positive environmental, socio-economic and health impacts. A monitoring plan will also be prepared to monitor the effectiveness of the mitigation plan and to re-orient that plan if necessary.

The socio-economic impact assessment will be carried out using methods such as focused consultations especially consultations/meetings with representatives of indigenous groups in Guyana. Wherever possible, information will be gathered on the communities living close to the site(s) by administering semi structured questionnaires or conducting focused consultations. Environmental and social impact management plans and guidelines for closure plans for the facilities will be prepared to conform to IFC PSs, Guyana Environmental Protection Agency (EPA) guidelines and regulations recently promulgated by the Guyana Geology and Mines Commission.

The results of the study shall include the following:

- Discussion of the proposed project and a description of alternatives to the proposed project including the do-nothing alternative;
- Description of the technology to be utilized for ore recovery and for mineral processing;
- Definition of baseline physical, biological and socio-economic conditions in the area likely to be impacted by the project;
- Identification of the environmental and socio-economic consequences associated with the proposed project and all alternatives;
- Plan for mitigation of environmental impacts;
- Plan for monitoring the effectiveness of the mitigation plan;
- Emergency response plan and contingency plan/community compensation plan; and
- Closure plan.

STUDY AREAS

The proposed mine site is located in the north western part of Guyana and has a total area of approximately 800 hectares. The site is accessed either overland or by air. Overland access is by boat up the Essequibo and Mazaruni Rivers to Itaballi, then by four wheel drive truck to a landing on the Cuyuni River then upriver by boat to the proposed mine site. An airstrip at the site facilitates the landing of light aircraft or helicopters. Several logging roads border the property; however, none allow direct access to the site.

The mining concession itself is located on the south bank of the Cuyuni River and defined by the following coordinate pairs:

- 59° 41.4' W, 6° 43' N
- 59° 41.4' W, 6° 45.2' N
- 59° 42.8' W, 6° 47.5' N
- 59° 46.9' W, 6° 48.2' N
- 59° 46.9' W, 6° 46.7' N
- 59° 43.2' W, 6° 43' N

The area within the concession itself, identified for possible development into the mine is defined by the following coordinate pairs:

- 59° 44.5' W, 6° 47.7' N
- 59° 45.43' W, 6° 47.7' N
- 59° 44.5' W, 6° 46.8' N
- 59° 45.43' W, 6° 46.8' N

The extent of the study area is shown on Figure 5. This area identified as likely to be impacted by the study extends from upstream of the mine site to the location of the wharf on the Essequibo River. There would be some indirect impacts on communities remote from the study area shown since communities outside of the area depicted on Figure 5 will provide labor to the project.

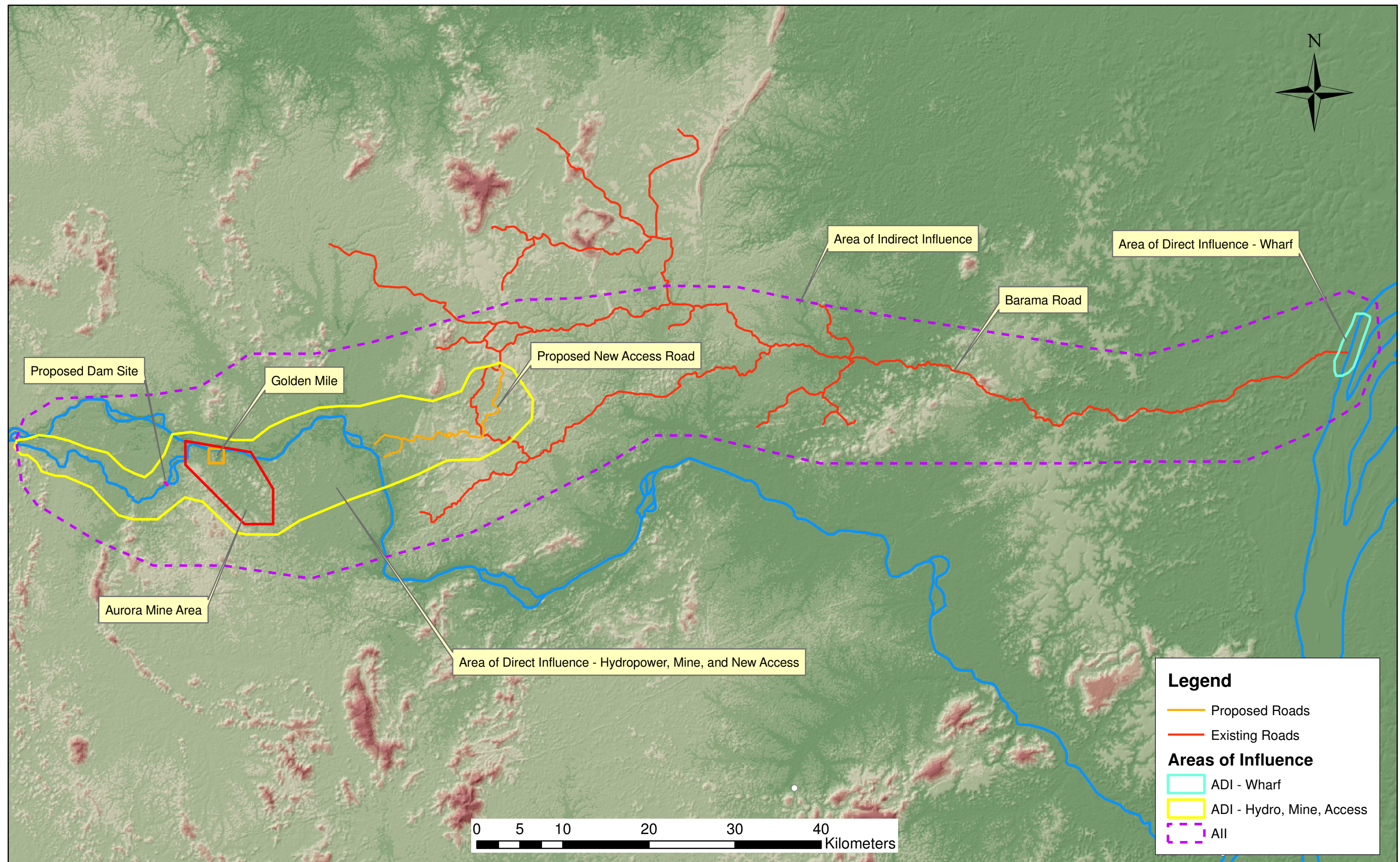


FIGURE 5: PROJECT AREA OF INFLUENCE

ANTICIPATED IMPACTS

This section documents the major impacts anticipated to be associated with the proposed project. Several of these impacts are unlikely to be realized due to the implementation of an Environmental Management Plan. These impacts are, however, detailed in this section to inform potential stakeholders of impacts to be considered during the performance of the ESIA.

Although the ESIA investigation is in the preliminary stages, there is sufficient information on the project to begin to determine the likely significant impacts, and the assignment of resources to adequately investigate and characterize those impacts.

The impacts are outlined separately, as appropriate for the various project components.

Potential impacts to the physical environment may include the following:

- Air quality
- Degradation of aesthetics
- Soil erosion
- Impacts from excavation and disposal of excavated materials
- Impacts on geology, hydrogeology
- Impacts on groundwater resources

Potential impacts to the biological environment may include:

- Loss of forested lands
- Alterations to dissolved oxygen levels
- Increase in nutrient levels leading to algae blooms
- Changes to wetland areas
- Impacts to the ecosystems foodchains

Potential impacts to the social and economic structure of the area:

- Economic opportunities during construction
- Economic opportunities after project completion
- Increase in water-related diseases, contagious diseases or pest outbreaks
- Uncontrolled migration of people into the area made possible by access road
- Improved access to markets, educational facilities, health care and other social services
- Pressure on existing resources and infrastructure in the form of competition for fuelwood, housing materials, electricity, water supplies, waste disposal, fisheries and land
- Possible rise in the cost of living due to inflation

The ESIA will cover the project area of influence.

6.1 AIR QUALITY

During construction works, gaseous exhaust (consisting primarily of carbon monoxide and unburned hydrocarbons) would be emitted from heavy construction equipment. During mining operations, fugitive dust would be emitted from earth-moving equipment. The milling process will emit particulates, carbon monoxide, nitrogen oxides and carbon

dioxide. Dust emissions would be short-term, sporadic, and localized at the construction sites, open pit mine and haul roads, and off-site impacts to ambient air quality would not result. To minimize fugitive dust, disturbed areas can be regularly sprayed with water or another dust suppressant as construction progresses. The design of the mill will incorporate emission controls to reduce air contaminants to acceptable levels.

Clearing for the mine, process plant and related facilities and the access road will require the clearing of vegetation. If any of that cleared vegetation is burned, gases and particulate matter will be emitted. Burning of cleared vegetation will be minimized to reduce emissions associated with that activity.

Additionally, air quality may be impacted by emissions from passenger vehicles and engines. Vehicles will be equipped with emission controls to reduce these to acceptable levels.

6.2 CLIMATE

A tailings pond and several water management ponds will be constructed as part of the project facilities. The increased area of surface water bodies will result in increased evaporation in the immediate area of the ponds themselves. This may impact the microclimate of the project area by lowering temperatures in the site area.

6.3 GEOLOGY AND SOILS

The mining operation will result in the excavation of the soil and rock present at the site. The surficial geology of the area presently consists of a zone of saprolite (sandy silty clay) overlying rock in the area to be mined. During mining, soils will not be segregated by material type. Mining will consequently result in an alteration of the surficial soils present at the site. The excavation and spoil disposal will result in changes in the topographic height, slope relief intensity, degree of shaping and exposure of the area. The mining operation will therefore alter the surficial geology within the area mined.

The haul roads and access road will alter the existing ground surface slopes in the area. Since roadway slopes must be safe for the passage of equipment and personnel, the new slopes will be less unstable than the natural slopes at the site. Further, surface water management will preclude saturation of slopes within the area. The slopes created by the operation will therefore be more stable than those currently occurring at the site and the possibility of slope failures will be significantly decreased. However, slope failures may have served as an indirect method of nutrient replenishment to areas down gradient from the slopes. This source of nutrient replenishment will be eliminated by enhanced slope stability in the area.

6.4 WATER RESOURCES

Surface Water

Site clearing for construction would produce increased discharges to surface water since interception and evapotranspiration would be reduced. The volume of additional inflow may result in increased surface water levels during construction if large areas are cleared rapidly.

Water quality in the Cuyuni River may be impacted by the mine operations. Water quality may be impacted by wastewater discharges from the mining and processing operations

coupled with discharges from the onsite sewerage system, domestic wastewater or by rainwater run-off from developed areas such as workshops and other onsite facilities.

The wastewater produced by the mining operation will consist of water from the mine itself and wastewater from the mineral processing circuit. Waste water from the mine will be fed to the wash plant to assist in converting the mined ore into a slurry for feeding to the gravity circuit. No water from the mining operation will be discharged to surface water. All water from the processing circuit will be fed to the tailings pond. Excess water from the tailings pond will be fed back to the gravity circuit. Since no water will be discharged from the process stream, processing water will have no impacts on water quality. Any impacts on water quality due to process discharge are probable impacts which will be addressed by the Environmental Management Plan.

Waste material from both the mining and mineral processing phases will be placed in spoil piles in the mining area. Precipitation can induce leaching of chemicals from these spoil piles. Surface runoff from mining and mineral processing waste containing large amounts of water-soluble substances or heavy metals can result in degradation of surface water quality. In the event of large amounts of rainfall, waste dumps may erode and landslides may result and cause sediment to spread over large areas. Breaches in the tailings pond may also occur during such conditions.

The surface water quality can also be impacted by sediment and nutrients in wastewater discharged to surface water from workshops and other service area. Changes in natural water quality may affect the organisms found in aquatic systems, e.g. bacteria, algae and water plants by causing changes in dissolved oxygen content and temperature. The behavior, reproduction and physiology of organisms may all be affected. If bacteria, algae and water plants develop resistance to these pollutants and fish feed on the bacteria, algae and water plants these substances may be passed onto the food chain if eaten.

Surface runoff from onsite areas, such as site access roads, can introduce sediments and nutrients loads into surface water bodies into which it is discharged. Eroded matter transported by surface runoff to creeks in the site vicinity may reduce water quality and cause undesirable deposition and sedimentation in the water source. The rate of nutrient added by eroded material may exceed the natural rate and contribute to eutrophication in water resources. As a consequence spawning areas for fish may be damaged. Sediments in surface water may also lead to reduced light penetration.

Groundwater

The modification of surficial soils will influence the water balance in the area since the new surficial soils may be less permeable than those current at ground surface and the quantity, physical distribution and time-related recharge of precipitation to groundwater will consequently change. In addition, clearing of the area will change the vegetation cover and may alter groundwater recharge and runoff conditions.

Mining operations will intercept groundwater. Mining activity will entail excavation below the existing groundwater level. This will interfere with the existing groundwater flow regime and will result in the temporary reversal of groundwater flow direction. This impact will be localized to the pit itself. The pit is very small in comparison to the surrounding area and there will no impacts on groundwater availability to the community in closest proximity to the site some 40 km away. Groundwater will flow into the excavation during the mining operation. If adequate pumping capacity is not provided groundwater flow into the pit may result in flooding.

After mine closure there will be residual depressions as a result of extraction of the ore and removal of overburden. These depressions may eventually produce groundwater filled ponds in the mined out area. The surface water levels in these ponds will correspond to the new groundwater levels and surface water in the ponds would be fed by groundwater. This will result in dis-equilibrium of the groundwater flow regime. Groundwater flow may not return to equilibrium for a considerable period of time.

Clearing of the area for mining will change the vegetation cover and will alter groundwater recharge and runoff conditions. The change in groundwater recharge and any falls in groundwater levels will lead to the loss of some specific plant communities that depend on shallow depths to groundwater for survival. The lower recharge and lowered groundwater depths may also result in less discharge of groundwater to surface water. This loss will, however, be compensated for by increased surface runoff from cleared areas.

Mining and mineral processing waste containing large amounts of water-soluble substances or heavy metals can jeopardize the groundwater, unless the soil under the dump is sufficiently impermeable. All mining and mineral processing waste will be located in low permeability areas to ensure no impact on groundwater quality.

Groundwater quality may also be impacted by infiltration of wastewater from the tailings management area and by leaching of minerals into solution from the mine itself. In addition, groundwater quality may be impacted by seepage from waste management facilities on the site.

Since there may be soluble minerals in soils at the site, the dis-equilibrium in the groundwater flow regime caused by gradient reversals during mining may impact groundwater quality by periodically introducing dissolved minerals into the groundwater flow regime. The presence of dissolved minerals in the groundwater can change the pH of groundwater in the area. The minerals present in the soils constitute a part of the geochemistry of the area. The impact of their dissolution will consequently be minimal.

6.5 WILDLIFE

Stocks of animals depend on the existence of habitats of a certain size. Clearing for the power plant, mine, process and personnel facilities and access roads will fragment the area. In addition, some animal species depend on the existence of other plant and animal species within the habitat for nutrients/food, cover, etc. Clearing and encroachment will alter several of the physical conditions including light, humidity and temperature. The installation of facilities and other construction works will form temporary barriers to the movement of animals, including access to water bodies. People working on the project may harvest commercially valuable animal and plant species. Species population may therefore decrease due to hunting and trapping.

Persistent acid mine drainage and discharges to surface water may also contaminate the water available to wildlife in the area. The acid runoff further dissolves heavy metals such as copper, lead, mercury into ground or surface water.

During operations, wildlife will move away from the affected area. This displacement will increase competition with wildlife on the periphery of the area. The physical disturbance and noise produced by mining activities may impose additional stresses upon wildlife and may lead to increased migration. While disturbances may be stressful for some wildlife, other species may easily adapt to and thrive successfully in affected zones owing to the phenomenon of habituation.

Animals tend to follow established patterns in their daily and seasonal movements. If the access road intersects or blocks wildlife corridors, it may result in cessation of use of the corridor because animals are reluctant to cross the road and/or an increase in mortality because of collisions with vehicles, or a delay in migration which may result in the weakening or disappearance of an entire generation of the population. In addition, some animals are attracted to roads for various reasons, including protection from predators, good food supplies and better travel conditions. This may lead to accidental death.

Many species of migratory birds including waterfowl and waders will be attracted to open bodies of water represented by the tailings pond and water management ponds in the area. These birds may be harvested by people in the project area. Many tree species are unisexual and are pollinated with the help of birds. Clearing causes birds to find other habitat. Consequently, pollination and dissemination of seeds by birds no longer occur.

The operation of the mine itself will have no direct impacts on fishes in the area. The mining operation can, however, result in indirect impact on fishes. The introduction of sediment by surface runoff may introduce additional nutrient loads to the streams. The altered nutrient levels can potentially result in eutrophication. Pollution by contaminated surface runoff can also impact water quality in the streams that may lead to denitrification and increased oxygen consumption resulting in an environment less conducive to the survival of fishes. No discharges to surface water will occur during mining or processing. The effects on fishes will therefore be minimal.

6.6 *VEGETATION*

The loss of vegetation and deforestation would constitute the main impact on terrestrial resources in the power plant area. The access road would create a continuous line through the landscape which connect several geographical areas. The location of the site is very remote. Consequently movement of animals across the roadway would only be affected during construction operations. Thereafter the road should not impede movement and communication between animals.

Clear-cutting of large tracts of tropical rain forest on poor soil, for mining, may make plant regeneration difficult. The conditions required for regeneration will also disappear with the clear-cutting required for the mine operation. Aggressive grass species and shrubs may effectively prevent seed-bearing plants from finding satisfactory living conditions.

During plant regeneration the area may encounter encroachment by particularly aggressive and unwanted plant species (pests) that exist in the area. These pests may result in the loss of some vegetation and animal species. Regrowth in the area will alter the diverse nature of the trees present in the area. The areas occupied by the process facilities, personnel facilities and operational mines will be subtracted from the total area available to flora.

6.7 *LAND USE*

The Project would generate long term effects on existing and future land uses. The primary change in land use may be as a consequence of the construction of the access road to the mine site. The opening of a new access road to the site would result in better access to an isolated and undeveloped area. This may lead to the creation of new human settlements and the clearing of forest for housing and new agricultural lands. Guyana has a very low population density. The population of the area is not expected to exceed 1500 persons. The effect of clearing for housing and agriculture would therefore be almost negligible.

The area may also experience an increase in exploration and mining of mineral deposits and the uncontrolled presence of visitors and tourists. Such changes to land use patterns in areas upstream of the reservoir may result in increased soil erosion and sedimentation, loss of forestry resources and of wildlife habitats, and increased pollution.

While there is no land use plan for the area, land use conflicts are unlikely to arise due to the sparsely populated nature of the area.

6.8 NOISE, ODOR AND DUST

Dust emissions would be produced during the construction operation by vehicles using the site roads, from material stockpiles onsite and from mining operations. Dust emissions will be produced during the mining operation by vehicles using site roads, and from material management operations onsite.

Noise levels above the alert threshold of 86 decibels and hazard threshold of 95 decibels would be produced from heavy-duty machines operation. Exposure to noise levels above the internationally accepted level of 90 decibels can cause noise induced hearing loss. Noise levels above the tolerable threshold of 72 decibels can cause/result in fatigue, tiredness, low morale and decreased production levels and productivity. Tired workers are also prone to accidents and this can contribute to an increase in accidents in the working environment.

The construction operation would occur in close proximity to existing habitats. The operation would emit noise. There would have been minimal noise stresses in the Project area prior to the Project. Continuous noise may therefore disrupt acoustic communication between fauna and may lead to changes in behavior as it relates to mating, food gathering, warning signals and brood care in areas near the emission sources. Further individual noises, which may sometime occur in conjunction with visual signals, may give rise to panic reactions during territory-seeking or brood care and may lead to habitats being permanently abandoned.

6.9 HEALTH AND SAFETY

The need for people to relocate to the site for construction may see the introduction of behavioral diseases due to increases in population densities. The arrival of large numbers of workers and migrant settlers from various localities and regions with diverse cultural and social backgrounds would increase the concentration of people in a formerly isolated rural area and may result in increases in sexually transmissible diseases, the spread of locally prevalent contagious diseases and the introduction of new diseases as yet unknown in the area of the Project.

Industrial, commercial and residential development in the vicinity of the Project may modify local air and water quality. The release of untreated sewage from housing areas may be a source of public health problems. Local air and water quality degradation may induce respiratory problems and various intestinal diseases.

The access roads may result in the easy spread of pests or diseases because floral and faunal vectors can gain easy access to wilderness areas along the new road corridor.

Transportation of plant products, such as fruit, along the roadway and from the Project site may also aid in the spread of diseases.

Prostitution, HIV/Aids, other sexually transmitted disease, alcohol, drug abuse, and malaria may be aggravated by the project.

Public health and safety would not be threatened by the proposed action because hazardous emissions and effluents would be reduced to acceptable levels at receptor locations in close proximity to the site. Facility workers would be exposed to standard industrial hazards associated with the operation of heavy equipment and machinery. The proposed action would not present any unique hazards to occupational health and safety.

6.10 SOCIO-ECONOMIC CONDITIONS

Human settlements are several kilometers upstream and downstream of the mine site. There is little evidence that the project area is of physical significance to these settlements. There are no timber operations in close proximity to the mine site. Plants utilized for medicinal purposes by indigenous people are present in the area, however, these plants are found elsewhere and in closer proximity to indigenous settlements and there is no exploitation of this resource in the mine site area. Traditional hunting occurs in areas around the indigenous settlements, but is said not to progress to the site limits. (Treweek, 2000)

The development of the project may aggravate the current legal disputes between the government and Indigenous Peoples' advocacy groups regarding mining and land titling. The construction of the access road could improve transportation to and from the area. In addition, the construction and operation of the mine could provide employment opportunities for the local communities, thus increasing their sources of income and living conditions.

The Project would result in the transfer to the Project site of large numbers of construction workers. This work force would diminish rapidly after construction and would be replaced by a small number of operation and maintenance personnel. The Project may therefore lead to the creation of a "boom town" associated with construction activities and related to the arrival of a migrant population and the development of a new community around the mine site. The population migration may cause land use conflicts and increase demands on local services and infrastructure.

The Project would create major employment opportunities for residents of the study area. Employment of both skilled and unskilled labor may bring financial benefits to the communities if residents are considered for the jobs. The Project would also create a demand for technical skills. The demand for skills may result in improved education standards and services in communities within the study area.

Opportunities of paid employment may also change the traditional division of labor between men and women in the indigenous communities in close proximity to the site. Residents may alter their lifestyles after exposure to culture and lifestyles introduced by Project employees, from areas remote to the communities in the Project area.

Social interaction with other groups is likely to bring about an increase in alcohol and drug abuse, prostitution and crime. The circulation of money from wages and salaries would sustain all of the workers leisure activities. This may increase the demand for alcohol, drugs and sexual services especially for those migrant and expatriate workers. In the mid-term this may bring about an increase in sexually transmitted diseases.

Amerindians in the area who practice traditional farming generally use "slash and burn" agricultural practices. The road may provide access to areas where these farming practices

may be used. The road is remote from existing Amerindian communities. The remoteness may preclude this farming option.

The road would impact positively on the social sectors particularly in health and education. With improved access health workers would be able to visit communities more regularly and sick persons would be able to reduce the time needed to receive medical attention by using the improved access to get to hospital.

6.11 *TRAFFIC*

The project will introduce some traffic into the area. The traffic will, however be limited to trucks and four wheel drive vehicles. The increased traffic may result in some instances of vehicular accidents on the road to the mine site.

6.12 *CULTURAL AND ARCHAEOLOGICAL RESOURCES*

There are some archaeological resources related to the former operation of Aurora Mine. These resources are unlikely to be significantly affected by the construction or operation of the proposed development.

The ESIA will also identify existing and planned developments within the project area of influence and their associated environmental and socio-economic impacts. The cumulative impacts of the proposed project and of existing and planned developments within the project area of influence will also be examined.

STUDY METHODOLOGY

The study will be undertaken to confirm with the Guyana EPA standards and will be undertaken in the following distinct phases:

- Public consultations and scoping meetings
- Data collection,
- Characterization of the baseline conditions,
- Identification and characterization of potential impacts,
- Identification of impact mitigation measures and enhancement of benefits,
- Preparation of an Environmental Management Plan
- Preparation of Emergency Response Plan
- Preparation of Closure Plan

7.1 PUBLIC CONSULTATION AND SCOPING MEETINGS

Public consultation meetings will be held in an area identified by the EPA. The Developer's Representative will present the proposed project and the Consultant will identify the physical, biological and social issues of concern that will be investigated during the EIA process. An open discussion will follow where members of the public will voice their concerns over the proposed project and its impacts. Members of the public will also be invited to discuss issues they consider as relevant which were not assumed to be issues of concern by consultants.

7.2 DATA REVIEW

The Study Team will assemble and evaluate relevant baseline data related to the physical environment, biological environment and socio-cultural environment. The baseline data to be assembled and evaluated will include:

- topography of the areas;
- baseline data on climate and weather
- local general geological structure, classification, composition and distribution of superficial deposits;
- the existence and movement of groundwater;
- determination of hydrogeological data;
- determination of hydraulic data
- physical and chemical properties of the surficial soil;
- background contamination of the surficial soil, surface water and/or groundwater;
- the risk of natural hazards (e.g. flooding) and subsidence;
- local meteorological data; and
- biological data.

7.3 FIELD SURVEYS

Baseline data has already been compiled for the mine during the period of 2006 to 2007. This baseline data did not, however, incorporate the area for the power plant, access road and wharf. This data adequately established baseline parameters for the mine site only. To ensure adherence to local regulatory requirements and those of IFC (i.e., the *PSs on Social and Environmental Sustainability* and relevant *Environmental, Health and Social [EHS]*

Guidelines) and to further expand the scope of the baseline to address the power plant, access road and wharf, the existing baseline will be upgraded as necessary.

Additional field surveys will be undertaken, over a two weeks period, to confirm the data initially acquired and to acquire additional baseline data to eliminate gaps in the environmental and socioeconomic baseline data for the project area and areas likely to be impacted by the project.

Surface water samples will be recovered from waterways in the project area and from both upstream and downstream of the mine site and power plant. Groundwater samples will be recovered from monitoring wells installed in the project area. Water elevations in the monitoring wells will be recorded to assist with the hydrogeological evaluation. All water samples will be analyzed to determine the presence and concentration of chemical substances, including volatile and semi-volatile organics, heavy metals, oil and grease and total petroleum hydrocarbon.

7.4 NATURAL AND SOCIO-ECONOMIC ENVIRONMENT

During the consultation respondents will be educated about the project and its likely impacts on the social environment. A socio-economic baseline will be prepared for the project area. The baseline will incorporate the data compiled during 2006 – 2007 and will include population distribution in the area, skills available, existing economic activities, educational facilities, current school dropout rate, industries in the area and the skills used by those industries, any social inequalities currently existing in the project area, adequacy and costs of transportation, and current & projected labor supply and wage levels.

Additionally, the social scientist will note the location of residents, communities and institutional features. The socioeconomic impact assessment will include a discussion of the health, education and social infrastructure sectors. The socio-economic survey will include both the positive and negative impacts on communities to be impacted by the project.

Baseline information of the neighbouring land uses associated with the project will be provided.

The social impact baseline and assessment will be based on consultation with the residents of the study area identified above and other locations likely to be impacted by the project as determined during the public consultation phase.

The consultations will include interaction with riverain homesteads along the Cuyuni River and other communities within the proposed area of influence such as Itaballi. Additional consultations will be held with the Ministry of Amerindian Affairs, National Parks Commission, Guyana Forestry Commission, Ministry of Labor, Human Services and Social Security, the Guyana Tourism Authority, Ministry of Tourism, Industry and Commerce, relevant NGOs and all other stakeholders deemed necessary.

7.5 BIOLOGICAL ENVIRONMENT

A field sampling program will be designed, and all relevant biological features will be inventoried. An inventory of animal, plant, and aquatic life will be prepared for selected sub-areas of the total area. A random number generator will be used to identify sample locations. The distribution and density of flora and fauna will be determined if possible, habitats will be identified and the ecological interaction of species will be studied. The

species of vegetation and the prospects for the use of those of commercial value will also be explored.

The biodiversity survey will cover both terrestrial and aquatic environments. The methodology to be utilized for these surveys will be as detailed in Appendix A attached.

7.6 *IMPACT ASSESSMENT OF PROJECT*

The Study Team will assess the environmental and socio-economic impacts for each element of the project. The “elements” to be assessed will include:

- Site Clearing operations
- Construction works
- Power Plant Operations
- Processing Plant Operations;
- Wastewater Management;
- Storm Water Management;
- Complementary installations including site buildings and equipment maintenance yard.
- Description of the quantities and types of waste to be disposed at the facility;
- Spill contingency plan for the operational phase;
- Pollution prevention and abatement methods envisaged;

The impact assessment will include an evaluation of limitations/constraints. Impacts will be assessed for the preconstruction, construction, operational and maintenance and closure phases of the project.

The ESIA will include a description of alternatives for crossing the Cuyuni River with a rationale for the preferred option.

The ESIA report will identify the project boundaries and present justification for the boundaries identified. All existing operations in the project vicinity that are likely to contribute to cumulative environmental impacts in the project area will be identified. The cumulative impacts on both surface and ground water will be assessed based on baseline water quality established during the field sampling program.

The ESIA report will include a discussion of the impacts related to ancillary facilities such as the access road and electricity supply. It will delineate the area of influence of the project and examine cumulative impacts related to other project and development in that area. The EIA report will also discuss alternatives to the project.

The environmental, socioeconomic and health impacts of the project components will be assessed separately as well as cumulatively. In addition, the environmental, socioeconomic and health impacts of open pit mining will be assessed separately from those of underground mining.

MANAGEMENT PLAN

A Management Plan will be developed to minimize identified potential/acute environmental impacts on the site due to site activities using the following steps:

- Through evaluation of environmental impacts, identify site activities whose impacts can be reduced or eliminated by mitigation
- Summarize site activities requiring mitigation or restoration and categorize into common types, where feasible;
- Estimate cost for implementation in terms of financial, personnel resources, material requirements, training requirements, and support services;
- Identify and estimate the impacts which cannot be mitigated.

The company plans for transporting and management of process inputs via road will be presented in the Management Plan. The management plan will include proposals for the use/disposal of vegetation cleared from the site and for the management of solid waste. The management plan will also address issues related to employees' health and safety including vector borne diseases. The management plan will also examine the need for developer to cultivate partnership(s) with adjacent communities and to explore options for enhancing positive benefits to these communities.

A budget will be prepared for each component of the Environmental Mitigation Plan and the institutional requirements for successful implementation of that plan will be identified.

MONITORING PROGRAM

The Study Team will develop a follow-up and Monitoring Program based on the results of the EIA and the Management Plan. This Monitoring Program will be designed to evaluate the suitability and effectiveness of the proposed mitigation measures, as well as to verify the prediction of impacts during development and operation. The Monitoring Plan will identify parameters to be monitored and the frequency of monitoring. Services such as analytical laboratory equipment, weather stations equipment and sampling equipment necessary for effective monitoring will also be identified in the EIA report. The monitoring plan will identify the monitoring to be done and the training requirements for monitoring staff. Budgets will be prepared for the implementation of the Monitoring Plans.

RISK ASSESSMENT

The ESIA will examine the risks associated with project implementation. These risks are expected to include the following:

- Slope instability in the mine
- Tailing/Water management pond embankment failure
- Modified Mercalli Event at the site

Measures to reduce/eliminate the likelihood of catastrophic failure will be detailed in the ESIA.

CLOSURE PLAN

A conceptual closure plan will be prepared for the operation. The project is still in the Feasibility Study phase and the exact extent of the mine site footprint is not known. Costs estimates for closure will be submitted as part of detailed closure plans to be developed for the operations after the commencement of mining at the site.

PREPARATION OF EIA REPORT

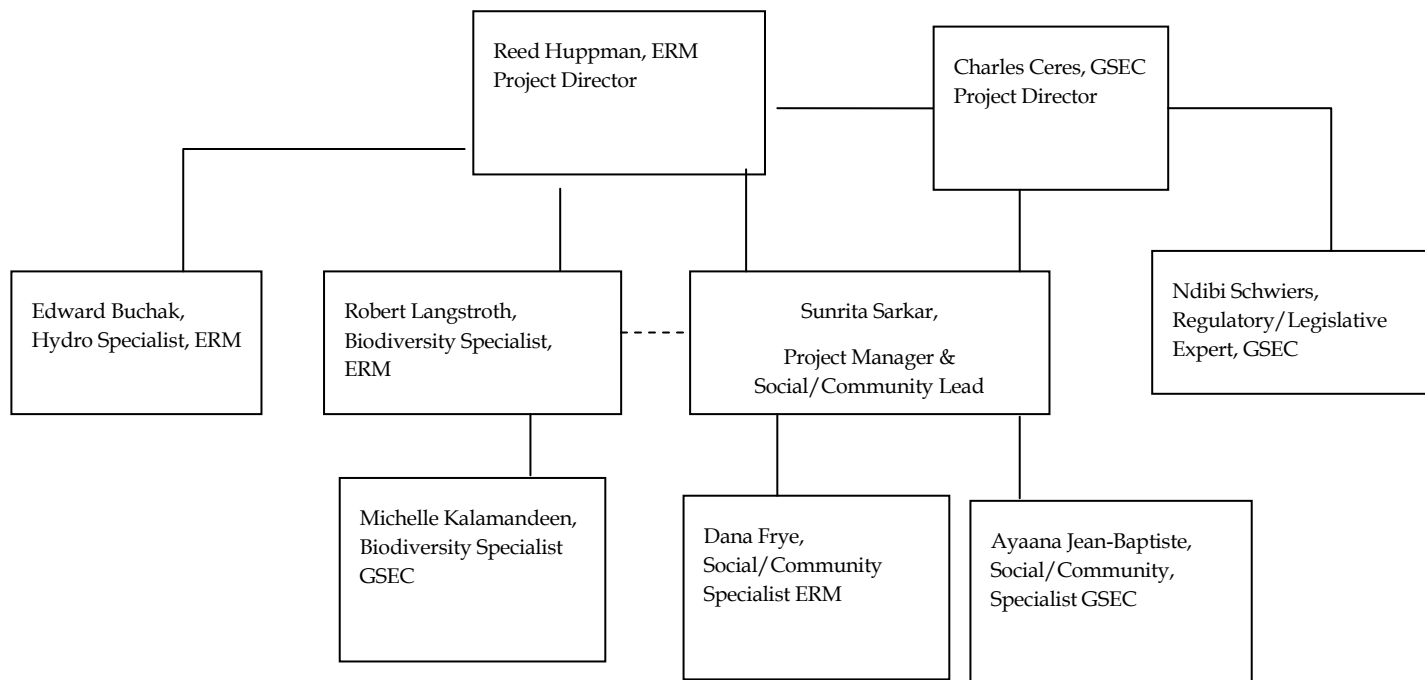
The Study Team will prepare the ESIA and supporting documentation, as required. The assessment document will include the following items:

- Executive Summary;
- Policy, Legal and Administrative Framework;
- Description of the Project;
- Description of the Environment;
- Community Consultations;
- Significant Environmental Impacts;
- Analysis of Alternatives;
- Environmental Management and Mitigation Plan
- Monitoring Program;
- Emergency response/Contingency Plans
- Closure Plan;
- Inter-Agency and Public/NGO Involvement
- List of References; and
- Appendices

Records of Inter-Agency and Public/NGO Communication
 Data and Unpublished Reference Documents
 Terms of Reference
 Relevant Notices
 Minutes of Scoping Meetings

The report will be prepared using matrices, tables, figures, etc. as much as possible to ensure readability and conciseness. Maps in the ESIA report will have appropriate scales and keys. The format will be determined in consultation with EPA, and other appropriate authorities. Six to eight copies of the draft EIA report will be submitted to the EPA along with an electronic version of the document in PDF format.

The Environmental and Social Impact Assessment would be undertaken by Environmental Resource Management (ERM) and the firm of Ground Structures Engineering Consultants Inc (GSEC). The study team assembled for this assignment consists of individuals who are recognised experts in conducting environmental impact assessments in Guyana. This collaboration has resulted in the creation of a unique group of professionals, all of whom have the necessary range and depth of experience and a thorough understanding of local conditions to conduct the ESIA's to World Bank, IFC, IDB and Guyana EPA Standards.



Reed Huppman, ERM Project Director

Mr. Huppman is a partner, manages ERM's Washington, DC office and has over 25 years of experience in applied sustainability consulting. Reed will provide overall strategic advice and guidance to the team as well as quality assurance and quality control.

He has managed and contributed to numerous interdisciplinary studies including environmental and social impact assessments, environmental due diligence audits for financial transactions, public consultation and assessment programs, and capacity building and training in sustainable finance. His project experience encompasses mining, oil and gas development, major infrastructure projects, corridor projects including major pipelines and roads, industrial and agricultural operations, forest and watershed management, coastal zone management, clean production and energy efficiency, climate change, and ecosystem restoration, having received two awards for restoration design projects.

He has worked extensively for the private sector as well as the IFC and the World Bank, including two years of secondments at IFC. He is also an IFC certified trainer on the IFC's Performance Standards on Social and Environmental Sustainability, and has delivered training to a number of Equator Principle financial institutions, investment funds and private equity firms in the US, Europe and emerging market countries. Prior to joining ERM, he worked as an environmental specialist consultant for the World Bank in the

Eastern Europe Central Asia Region. He has also consulted for a number of corporations seeking project financing from multilateral and bi-lateral lenders (e.g., IFC, OPIC, and EXIM Bank) and a number of Equator Principle banks, in particular Citigroup, Barclays, JPMorganChase, West LB, and Mizuho.

Mr. Huppman has worked in Guyana on several occasions in the past, most recently for the Inter-American Development Bank in the privatization of the electrical sector. He is currently working on mining projects in Irian Jaya, Guinea, Madagascar, Cameroon and the Democratic Republic of Congo, power projects in Guatemala, Peru and Jamaica, a review of the Panama Canal Expansion project for lenders, and an LNG export project in Peru. He has worked in over 35 countries in Latin America and the Caribbean, Africa, Eastern Europe and the former Soviet Union, and South and Southeast Asia

Charles P. Ceres, GSEC Project Director, GSEC

Charles P. Ceres is the Managing Principal of Ground Structures Engineering Consultants Ltd. of Guyana. He will be the Project Director and will provide strategic guidance to the team and will be responsible for project co-ordination and logistics. Mr. Ceres will oversee the fieldwork and baseline studies in Guyana. Mr. Ceres has been responsible for the management and execution of a wide variety of environmental projects in Guyana, the United States and the Caribbean. Mr. Ceres has also managed several EIAs and EAs in Guyana. He has managed the EIA for the expansion of the Guyana Sugar Corporation Skeldon Estate and has served as a consultant to the Guyana Environmental Protection Agency. Mr. Ceres has supervised several environmental monitoring and remediation projects both in Guyana and overseas. His experience in Guyana includes supervision of the installation of groundwater monitoring equipment at Omai Gold Mines Tank Farm and the environmental audits for the privatization of Linmine and Bermine. His experience in the Northeastern United States includes supervising the installation of equipment for the remediation of soil and groundwater contamination and managing several National Pollution Discharge Elimination Systems (NPDES) installations.

Sunrita Sarkar, Project Manager and Social specialist, ERM

Sunrita will be the project manager and coordinate team activities and deliverables. She will support Charles in day to day interaction with the clients and administrative requirements like invoicing, managing the budget, coordinating logistics. She will also be the social lead for the project and coordinate the deliverables of the 'social' aspects of the impact assessment.

Sunrita Sarkar is a Sociologist and is based in ERM's Washington DC office. Her responsibilities in ERM include project planning, management and execution related to social impact assessment, resettlement & rehabilitation, social audits/due diligence, social risks, community participation and natural resources. She has more than 9 years experience of working on social impact assessments and resettlement & rehabilitation issues of a number of development projects in mining, oil and gas, power, dams, roads and highways. She has extensive experience in stakeholder, community management and indigenous people's issues. She has undertaken several poverty and livelihood assessments, as a part of the impact assessments and formulation of Resettlement Action Plans (RAPs).

During her work, she has gained experience in understanding and adhering to international donor agency guidelines on social issues (involuntary resettlement, social assessments, gender and poverty issues etc) and has worked on projects funded by donor agencies such as the World Bank, the International Financial Corporation and the Asian Development Bank. She also has extensive experience of Labor and human rights issues and is a certified SA 8000 lead auditor. She has conducted labor rights, equality and workplace audits of manufacturing plants, mines and corporations.

She has extensive exposure to the mining sector and has worked for companies like Newmont, Freeport, Alcoa, BHP Billiton and Rio Tinto. Sunrita has conducted equator principle reviews of several mining projects and is well versed with IFC performance standards. She has recently conducted an ESIA in Suriname. She has worked in Asia, Caribbean, Latin America and Africa.

Dr. Robert Langstroth, Biodiversity Lead Specialist, ERM

Robert will be the lead for the biodiversity and ecological aspects of the assignment. He will be assisted by the GSEC specialist in conducting the assignment.

Dr. Langstroth's professional experience with biological, environmental, and geographic studies spans over more than 20 years. He has become a specialist in South American biodiversity and ecosystems studies, with expertise in the development of baselines, impact assessments, management plans, as well as field implementation, monitoring, and auditing. Dr. Langstroth has examined the impacts of energy infrastructure (such as pipelines, terminals, and plants) development on ecosystems and local stakeholders, such as comparative social management studies, fire and grazing management of pipeline rights-of-ways, and conservation impacts.

Before entering private sector consulting, he gained experience in biological and geographic research in Amazonian and Andean South America and worked for more than six years on multiple environmental impact assessments for the State of Wisconsin under WEPA/NEPA guidelines. Dr. Langstroth's professional experience also includes the arenas of land use policy, agricultural and livestock systems, wastewater treatment, nonpoint pollution control, geomorphology, and Geographic Information Systems. In the private sector, Dr. Langstroth has served as consultant in eight Latin American countries, branch manager in Bolivia, and area manager in Mexico for a major environmental consulting firm, where his responsibilities included technical direction, project management, and business development.

Edward M. Buchak, P.H., Surface Water Modeling Specialist, ERM

Mr. Buchak has civil engineering degrees from MIT and the University of Pennsylvania. His experience since 1972 has been in developing and applying hydrodynamic and water quality models to rivers, lakes, reservoirs, estuaries, and coastal water bodies. He is the co-developer of the primary version of CE-QUAL-W2, the Corps' hydrodynamic and water quality model for reservoirs and of GEMSS, a public domain 3-D hydrodynamic and water quality model. Ed contributes expertise in problem definition, project management, data examination, modeling, and presentations to clients, stakeholders, and the general public.

He has worked extensively for the electric utility, manufacturing, mining, oil and gas industries as well as for public agencies. He manages ERM's Surfacewater Modeling Group.

Dana Frye, Social and natural resources specialist, ERM

Dana will support Sunrita in conducting baseline studies, impact assessment and report writing. Dana R. Frye is a consultant with ERM based in Washington, D.C. Since joining ERM, Dana's work has focused on the identification, mitigation and compensation of social impacts and risks which has included leading social audits, developing social management plans and ensuring compliance of existing plans with international best practice.

Prior to joining ERM, Dana worked for 2 years at the World Bank on agricultural development and natural resource management projects in Latin America. Then she joined UNDP/GEF in Brazil as project design specialist on a project on the effective conservation and sustainable use of mangrove ecosystems.

Dana has also worked with indigenous and peasant communities doing project design and evaluation work on agricultural development, biodiversity conservation and natural resources management projects. She has worked as an election observer in Colombia and Ecuador and as a researcher on a variety of different environmental and international political issues. Dana possesses in-depth knowledge of the multi-laterals, the different phases in the project cycle and relevant performance standards.

Dana speaks English, German, Portuguese and Spanish and has worked or lived in Argentina, Austria, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Paraguay, Peru and Uruguay. Dana has also completed SA8000 Lead Social Auditor training.

Ndibi Schwiers, Regulatory/Legislative Expert, GSEC

Ms. Ndibi Schwiers is an Environmental Scientist and Forester, has several years of experience both in the forestry and environmental areas in Guyana. Her responsibilities have included developing protocols for baseline definition of forest resources and the development of management and mitigation plans to minimize impacts on these resources.

Michelle Kalamandeen, Biodiversity Specialist GSEC

Michelle is an extremely well qualified biodiversity specialist with extensive credential and experience in Guyana. Michelle will work closely with Robert Langstroth to cover biodiversity aspects.

Ayaana Jean-Baptiste, Social/Community, Specialist GSEC

Ayaana will support Sunrita in the social/ community aspect of the assessment. She will be the local specialist who will provide support in the surveys, community consultations and analysis.

APPENDIX A PROTOCOLS FOR BIODIVERSITY SURVEY

FAUNAL SURVEY

These protocols will guide the faunal survey team to ensure complete characterization of the biodiversity of the area. Guidelines for the application of the various methods are outlined in this methodology statement. Two distinct sections are detailed and each respectively covers the application of methods to survey the aquatic system (including the banks) and the terrestrial system. In general the protocols are intended to provide an integrated approach to survey the fauna to ensure efficient use of survey personnel and resources.

SURVEY OF AQUATIC ENVIRONMENT

Classes and groups to be surveyed

Surveys in the aquatic environment will focus on the following groups of fauna;

<i>Classes</i>	<i>Groups</i>
<i>Macro-Invertebrates</i>	Aquatic
	Terrestrial
	Insects
<i>Fish</i>	All
<i>Amphibians</i>	Frogs
<i>Reptiles</i>	Caiman
<i>Mammals</i>	Bats
	Aquatic Mammals

Other groups will be noted if encountered.

Sample Plots

Sampling of the aquatic environment will be stratified and will follow the dendritic stream pattern at the site. Review of the site map has established the locations of two main catchments in the area; the Gold River basin and the Cuyuni River basin. Several smaller catchments are also present in the area. The sample stratification is focused on ensuring that sample plots are located in the main catchments. Additional sample plots will be established in other catchments based on their size. There are rapids on the Cuyuni River in the site vicinity. Rapids support a distinctive aquatic community. A targeted sampling program will consequently be executed in the area of the rapids. Except in instances where streams size does not permit, sample plots will run for lengths of 200m and will extend 10m unto stream/ river banks. If 2km river transects are required, these transects will extend from the beginning of the sample plot, provided that the end does not exceed the general area of the survey. In such instances, transects will begin at a distance up stream of the sample plot to ensure the end of the transect falls within the study area.

Sample Program

Field survey personnel will establish sample areas by flagging the beginning and end of the sample plot with brightly colored tape.

Dredging

Dredging would be done from a boat. Five (5) grabs samples will be taken from the bottom of the stream using an Ekman Dredge. The contents of the dredge will each be emptied into a single sorting tray. The contents of the trays will be sorted and examined for any form of invertebrate life. All invertebrates will be collected and be placed into plastic collecting jars with 10% formalin. Each jar will be labeled with date, time, sample plot number and sample number and be sealed. This sampling procedure will be repeated five times in each sample plot. At a convenient time and place the specimens will be removed from the jars and identified using the keys and material provided.

Kick-netting

This sampling program will be executed where a person of average height is not submerged above breast level. The individual will enter the stream facing downstream. The invertebrate net will be placed approximately 3' further downstream and the surface of the submerged soil will be kicked gently for 30 seconds. The net will be extracted and sorted for invertebrate life. All invertebrates will be collected and will be placed in plastic jars with 10% formalin. Each jar will be labeled with date, time, sample plot number and sample number and be sealed. This sampling procedure will be repeated five times in each sample plot. At a convenient time and place the specimens will be removed from the jars and identified using the keys and material provided.

Rock Turning

When loose rocks are encountered in the sample plots, five rocks of similar size will be placed into a sturdy net. The surface and crevices of each rock will be examined for invertebrates and fishes. All invertebrates and fishes recovered from the rocks will be placed into plastic jars with 10% formalin. Label the jar with date, time, sample plot number and sample number and seal it. Each jar will be labeled with date, time, sample plot number and sample number and be sealed. This sampling procedure will be repeated five times in each sample plot. At a convenient time and place the specimens will be removed from the jars and identified using the keys and material provided.

Trapping

The Hester-Dendy traps will be suspended in a still corner of the sample plot and be allowed to rest for full period of sampling. At the end of sampling period, the traps will be removed and the colonies on each board will be brushed into a pan of water. The excess water will be removed and the samples will be concentrated in plastic jars with 10% formalin. Each jar will be labeled with date, time, sample plot number and sample number and be sealed. At a convenient time and place the specimens will be removed from the jars and identified using the keys and material provided.

Sweep-netting/hoop-netting

The fish hoop-nets and the aquatic invertebrate nets will be swept through free flowing water and amongst vegetation. The nets will be searched for fish, aquatic invertebrates and aquatic adult frogs and tadpoles. All animals collected will be placed into plastic collecting jars with 10% formalin. Label the jar with date, time, sample plot number and sample number and seal it. Each jar will be labeled with date, time, sample plot number and sample number and be sealed. This sampling procedure will be repeated five times in each sample

plot. At a convenient time and place the specimens will be removed from the jars and identified using the keys and material provided.

Pitfall Trapping

Traps will be placed based on a demonstration by the team leader. Four traps will be placed in each study plot; 2 on the open beach/bank and 2 in the vegetated areas. The location of each trap will be marked by flagging. Traps will be checked at least once each hour or as often as possible. Trapped animals will be removed and information will be recorded on date, time and trap in which animal was caught in. Trapping will be conducted for the full period of sampling in each plot sampled. Animals will be identified and be returned to the wild unless vouchers specimens are required, in which case animals will be placed into 10% formalin.

Leaf litter and surface soil searches

Five 1 m² quadrats will be established in the vegetated areas of each sample plot using random throws. All leaf litter will be removed in each quadrat using a rake head and will be placed into a garbage bag. All bags will be labeled appropriately. The surface soil in the quadrat down to 6" will be removed with a spade and will be placed on a polyethylene bag. The soil and leaves will be searched in sorting pans and all animals will be removed. Animals are to be identified and be returned to the wild unless vouchers are required, in which case they will be placed into 10% formalin. This sample procedure will be repeated for two days.

Sweep nets/Butterfly nets/pooters/canopy beating

These methods will be used for 30 minutes three times a day (morning, noon-time and evening) for two days. All insects collected by this method will be placed into 75% alcohol and each container will be appropriately labeled and store. At a convenient time and place the specimens will be removed from the jars and identified using the keys and material provided.

Visual Encounter & Vocal Surveys

Observers will walk the full length of the sample plot beginning at 19:00 hrs and spend 30 minutes searching the vegetation and the ground for frogs and snakes mainly. All animals encountered will be examined, identified and recorded appropriately then returned to the wild. If vouchers are necessary those animals will be placed in 10% formalin. While searching, recordings will be made of the vocalizations of frogs. Each recording will be preceded by a note of date time and sample plot number and followed by simply saying end. Tapes must be appropriately labeled.

River Transects

River transects will be run twice daily, firstly in the morning between 09:00 hrs and 11:00 hrs and again in the evening at 19:00 hrs. Transects will be run in an upstream to downstream flow. The morning transect will focus on aquatic mammals, noting sightings of animals and their dens and feeding sites. Care will be exercised to distinguish between the two species of river otters. The transect run will be done with the engine at low throttle. The evening transect run will focus on caimans. Observers will paddle along the transect looking for eye shine. Paddling will enable observers to get closer to the animals to estimate size and verify identification. The observers will approach each eye shine to record the

required data. The Spectacled Caiman will be identified by a whitish eye shine while the eye shine of the Black Caiman appears coal red. Required data are: species, head size or total body size (if possible), time observed, number of individuals seen, comments.

Mist-netting

One mist net will be opened at alternate locations just off the side of the stream within the sample plots on each night of sampling. The net will be opened at sundown and closed at 21:00 hrs. Once opened, the net will be checked every hour and all bats removed, identified and returned. If deemed necessary, vouchers will be taken. A record will be kept of the date, time, and sample plot within which each bat is captured.

Opportunistic records

Should any animal not specifically mentioned in this section be encountered while carrying out these procedures, a note will be made and it would be reported as an opportunistic observation. E.g. Observation of birds while traveling along transects.

SURVEY OF TERRESTRIAL ENVIRONMENT

Surveys in the terrestrial environment will focus on the following groups of fauna;

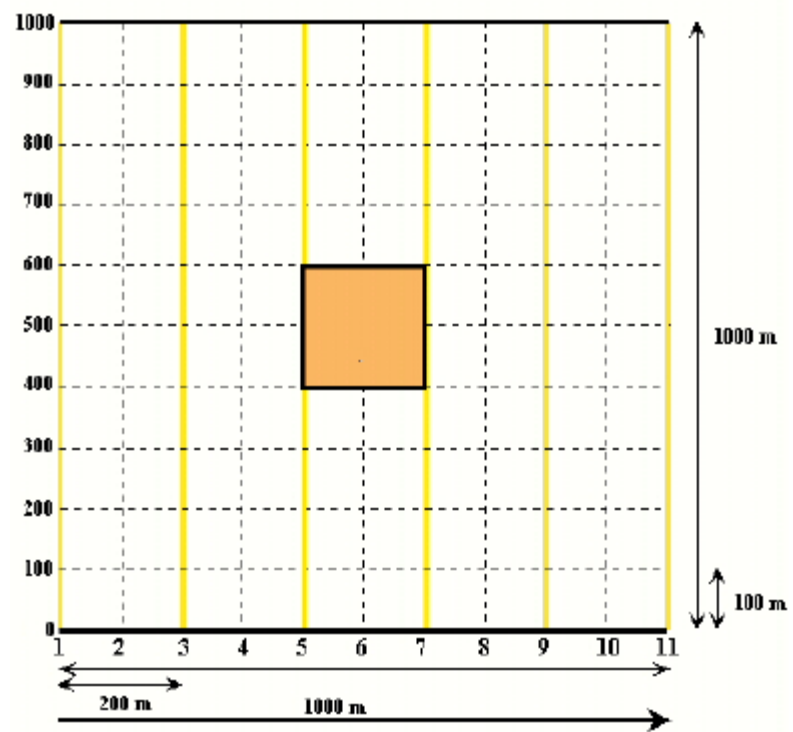
<i>Classes</i>	<i>Groups</i>
<i>Macro-Invertebrates</i>	Terrestrial
	Insects
<i>Amphibians</i>	Frogs
	Caecilians
<i>Reptiles</i>	Terrestrial (Snakes, Lizards, Turtles)
<i>Birds</i>	Understorey Birds
	Canopy Birds
	Large Ground Birds
<i>Mammals</i>	Small Terrestrial Mammals
	Large Terrestrial Mammals
	Arboreal mammals
	Bats

Other groups will be noted if encountered.

Sample plots

Sample plots for the terrestrial animal survey will equate to those used for plant survey. Sample plots will be laid out as depicted in the Figure below, with each plot having a total area of 1 km². Each sample plot of 1 km² will be divided, with 1 km transect lines long running perpendicular to its sides. A sample sub-plot (Study Plot) of 200x200 m (4ha) will be established in the center of each sample plot.

Each Sample plot will be surveyed for a minimum of 2 days. Data will be recorded only on the data sheets provided. Additional notes will be taken in journals/notebooks. All data sheets will be stored in ziplock bags and will be returned to the team leader when filled. Appropriate safety measures will be exercised during the entire exercise. The safety of every team member is the business of the team and the safety of the team is the business of every team member.



SAMPLE PROGRAM

Pitfall Traps

Four or five pitfall traps will be set in the study plot. One will be set per hectare of the study plot and the fifth would be set in the center of the study plot. These traps will be checked as often as possible but at intervals not exceeding 2 hrs. Trapped animals will be removed and data recorded on date, time and trap which snared animal. The period of trapping will extend over the full period of sampling in the plot. Trapped animals will be identified and returned unless vouchers are required. Vouchers will be placed into 10% formalin.

Leaf litter and surface soil searches

Ten 1 m² quadrats will be established in the study plot using random throws. All leaf litter in each quadrat will be removed with a rake head and be placed into a garbage bag and the bag appropriately labeled. Surface soil in the quadrat will then be removed to a depth of 6" and be placed in a polyethylene bag. The soil and leaf will be thoroughly examined using sorting pans and all animals will be removed. Animals will be identified and be returned to the wild unless vouchers are required, in which case they will be placed into 10% formalin. This sample procedure will be repeated for two days.

Sweep nets/Butterfly nets/pooters/canopy beating

The Sweep nets/Butterfly nets/pooters/canopy beating exercise will be undertaken for one hour periods, three times per day (morning, noon-time and evening) over a period of two days in the study plot. Insects recovered during this exercise will be stored in 75% alcohol and the containers appropriately labeled and stored. The specimens will subsequently be removed from the jars and identified using the keys and material provided.

Visual Encounter & Surveys

These surveys will be undertaken in the 4 ha study plot. Observers will fan out to do a wide area search of the plot beginning at 08:00 hrs in the morning and again at 19:00 hrs and spend 1 hr searching the vegetation and the ground. Morning surveys will focus on birds and reptiles mostly while the evening surveys will focus on for frogs, caecilians, snakes and nocturnal small mammals mainly. All animals encountered will be examined identified and recorded appropriately then returned (if captured). If vouchers are deemed necessary those animals will be placed in 10% formalin.

Transects/Point counts Vocal Surveys

Surveyors will walk transects 1, 3 and 5 either concurrently or consecutively and make recordings three minutes long every 100m along the transect beginning at the 50m mark. Each recording will be preceded by a note of date time and sample plot number, transect number and will be followed by simply saying end. Tapes will be appropriately labeled. These surveys will be conducted twice per day; in the morning between 06:30 hrs and 09:00 hrs for birds and in the evenings between 19:00 hrs and 21:00 hrs for frogs. Visual surveys will be done while walking between points and while at points.

Line Transects

Twice per day (03:00 hrs and 15:00 hrs on one day then 06:00 hrs and 18:00 hrs the other day) transect survey will be conducted. Three teams will walk two transects each. The teams

will begin walking transects 1, 3 and 5 respectively in one direction and then transects 2, 4 and 6 in the other direction. Both surveys will focus on Mammals (except bats and aquatic mammals) and large ground birds. All animals seen will be recorded using the appropriate data sheets.

Mist-netting

Mist-netting will be used to survey understorey birds and bats. Mistnets will be set up along the diagonal of the 4 ha study plot (entrance from transect 3 and exit from transect 4). Nets will be opened at sunrise and will be checked every 30 minutes until 09:00hrs and then every hour thereafter until sundown. Birds caught will be removed carefully from the nets and will be identified, measured, weighed, and have other data recorded before being released back into the sample plot. When birds are captured for the first time they will be marked with a tail clipping and recaptures are to be noted by checking for the clipping. If rain falls the nets will be closed and the time noted. Nets will be reopened once the rain has ceased and the time would again be noted. Nets will be closed at sundown for 30 minutes to allow for a full transition between bird and bat fauna. Once reopened, the nets will stay open until 21:00 hrs and checked every hour for bats. All bats removed from the nets will be identified and returned. To enhance the survey of bats, a single net will be located at any roost identified. If deemed necessary, vouchers will be taken. A record would be made of the date, time, and sample plot within which each bat is captured.

FLORAL SURVEY

The protocols detailed below are intended as a guide to the floral survey team in conducting the biodiversity survey of the study area. They complement the sampling methodology by explicitly detailing the application of sampling procedures in the aquatic and terrestrial environment.

SAMPLING THE AQUATIC ENVIRONMENT

Laying out Sample Plots

The sample plots for the aquatic plants will be the same used for animals with the exception of the river transects. Each sample plot will be 10m² providing that the end does not encroach upon the bank of the stream. In such instances, a similar size square that best fits within the sample plot will be used to survey the vegetation. Brightly coloured flagging tape will be used to demarcate the boundaries of the sample plots.

Sampling

All plants within sample plots will be identified and counted. A designated scribe will complete as far as possible every data sheet on a plot, including the sample plot number within which that plot is found. More than one data sheet will be used for a plot if necessary. All data sheets will be stored in well labeled Ziploc bags.

Unidentified Plants

For unidentified plants, the leaves, flowers, fruits or all three will be collected and will be placed into plastic collecting jars with 10% formalin. The jar will be labeled **UNIDENTIFIED PLANTS** along with the sample plot number and will be sealed. Vouchers will be identified at a later time and date.

SAMPLING THE TERRESTRIAL ENVIRONMENT

Sampling in the terrestrial environment will be stratified by elevation. Elevations in the concession range up to approximately 600 GD. The area would be stratified into two elevation intervals. These are respectively:

0-300 GD and 300-600 GD.

Laying out the Sample Plots in Flat to Undulating Terrain

Each sample plot will be 1000m² and will be divided into two halves 500m wide. Each half will be further divided into 10 strips, 50m wide. A 20 m² quadrat will be marked at the beginning, midway and end of alternating strips (see figure 1). Brightly colored flagging tape will be used to demarcate the boundaries of the sample plots

Sampling

The 500 m mark will serve as the starting point for samplers who will work in opposite directions of the square in pairs. Each pair will identify and count all plants within the quadrat. Height will be measured in meters. The diameter of commercial trees will be recorded at 1.3 meters from the ground at breast height on the uphill side of the tree. Record the canopy height of the plants in the forest. The designated scribe will complete as far as possible every data sheet on a quadrat, including the sample plot number within which that quadrat is found. Use more than one sheet for a quadrat if necessary. Store all data sheets in well labeled Ziploc bags.

Unidentified Plants

For unidentified plants collect the leaves, flowers, fruits or all three and place it into plastic collecting jars with 10% formalin. Label the jar as **UNIDENTIFIED PLANTS** along with the sample plot number and seal it. Vouchers will be identified at a later time and date. Remember to complete the data sheet as usual.

Laying Out Sample Plots in Undulating to Hilly Terrain

In areas too steep to feasibly establish the 1000m² sample plots, the 1000 m² sample plot would be replaced by three transects. These will run a length of 1000m in an upward direction parallel to one another and 500m apart (see figure 2).

Sampling

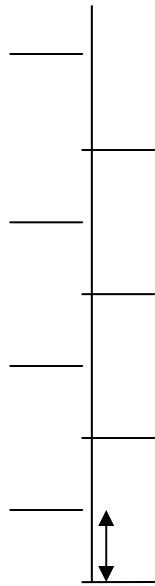
The plants within and closest to the transect in a 10 m wide area on either side would be identified and counted. Estimate height in meters. Take diameter measurements of commercial trees at 1.3 meters from the ground at breast height on the uphill side of the tree. Record the canopy height of the plants in the forest. A designated scribe will complete as far as possible every data sheet on transect, including the transect number. Use more than one sheet for transect if necessary. Store all data sheets in well labeled Ziploc bags.

Unidentified Plants

For unidentified plants collect the leaves, flowers, fruits or all three and place it into plastic collecting jars with 10% formalin. Label the jar as **UNIDENTIFIED PLANTS** along with

Figure 1: Laying out sample plots in flat to undulating terrain

Figure 2: Laying out sample plots in undulating to hilly terrain



2006-2007 BIOLOGICAL BASELINE DATA AURORA MINING CONCESSION

INTRODUCTION

This report presents the results of work undertaken over a one year period to characterize the environmental baseline at the site of the proposed Aurora Gold Mine Project. The baseline characterization work consisted of a compilation of environmental and social variables for the mine site and its immediate vicinity over a period of one year commencing in January 2006. Baseline data, detailed in this report, was developed through surveys, direct observation, and where appropriate, through interviews and questionnaires.

The periods during which field information was compiled for the mine site and its vicinity coincided with the wet and dry seasons in Guyana. A series of field surveys was each conducted in the long and short wet and dry season respectively. The actual date of each field survey was as follows:

- January 17 to February 04 2006 – First wet season survey
- July 1 to July 7 2006 – Second Wet season survey
- October 06 to October 13 2006 – First Dry season Survey
- February 22 to March 05 2007 – Second Dry Season Survey

The concession occupies a total area of approximately 14,000 acres on the south bank of the Cuyuni River. The area has been worked before as evidenced by the presence of abandoned machinery, secondary growth and mine shafts. Ground surface contours in the concession range up to approximately elevation 600 Georgetown Datum (GD). The area was demarcated based on two elevation intervals; 0 – 300 GD and 300 – 600 GD. Random sample squares were established over the area defined by each elevation interval.

Field surveys conducted in the mining concession, to characterize the terrestrial resources in the area coincided with seasonal weather patterns in Guyana. All surveys were conducted using a similar layout of transects. Transects were surveyed by two individuals who walked the entire length of each transect and recorded observations. During floral surveys, researchers traversed each transect line and recorded plant types encountered one meter either side of that transect line. Trees were identified, their heights noted and the supporting soils observed and noted. The common name and scientific name/family of each type was recorded along with the other feature. The leaves, twigs, flowers and fruits of unknown vegetation were collected and placed between sheets of newspaper for later identification.

Mammals were surveyed in a similar manner as the floral survey. The mammalian researchers walked the transect lines as quietly as possible to present the least disturbance to animals in the area. All mammals were noted, identified and the features recorded in data sheets. Several animal traps were set and baited with food. These traps were inspected at discrete intervals, during each survey and trapped specimens were identified, described, measured and released after features were recorded. Footprints and faecal droppings were also used to identify mammals which were not visually observed. Specimens of birds, bats, and flying arthropods were identified by setting mist nets at points along each transect in the area. The mist nets were inspected at discrete intervals and specimens of birds, bats, and flying arthropods caught by the net were inspected, photographed, identified and released. Some arthropods were preserved in alcohol for later identification. The mist nets were also inspected during the daytime. Insect nets were used to catch butterflies, moths, bugs etc. along transect lines and in buildings in the camp at different times of day and night.

The mine itself has a very high likelihood of being established in an area referred to as The Golden Mile. Targeted surveys program for both flora and faunal resources were consequently conducted in the Golden Mile area for each season.

Biological resource surveys conducted in the rainy seasons were characterized by several hours of continuous rainfall every day and night. The primary river and several streams in the area were full to the point of overflowing their banks during each wet season sampling event. Continuous rainfall also created several swamps in the concession area. Swamps created by the rainfall are generally slushy and deep with some being quite wide. During the dry seasons the areas sampled were dry in comparison to conditions encountered during the rainy seasons. Rain, however still occurred, but in short bursts mostly in the afternoon and at nights. Mornings were typically hot periods of bright sunshine. Water levels in the Cuyuni River and its tributaries in the mine site vicinity were quite low when compared to wet season and many swamps observed during the wet seasons were now dry.

Surficial soils in the area is primarily loam with sand and lateritic fractions being evident in several locations but occurring most often on some steep hillsides. There are several areas of secondary growth at the site where the understorey is thick. In virgin areas there is thin undergrowth and faunal activity is less pronounced.

Summaries of the flora and fauna encountered within the mining concession and within the area identified as the Golden Mile during each sample event are detailed in the tables which follow.

Table 1. Flora Encountered in the Mine Concession during the Final Dry Season Survey

FAMILY/SCIENTIFIC NAME	COMMON NAME	FAMILY/SCIENTIFIC NAME	COMMON NAME
ANACARDIACEAE		LECYTHIDACEAE	
<i>Anacardium giganteum</i>	Habudiballi	<i>Couratari guianensis</i>	Wadara
<i>Tapirira merchandii</i>	Duka	<i>Eschweilera alata</i>	Kakarmi
<i>T. obtuse</i>	Duka	<i>E. coriacea</i>	B. Kakaralli
ANNONACEAE		<i>E. corrugate</i>	Wino Kakaralli
<i>Anaxagorea acuminata</i>	Kurihikoyoko	<i>E. decolorans</i>	Sm. Leaf Kakaralli
<i>Annona symphyocarpa</i>	Duru	<i>E. grata</i>	Fine Leaf kakaralli
<i>Duguetta calycina</i>	Yari Yari	<i>E. sagotiana</i>	B. Kakaralli
<i>D. guianensis</i>	Yari Yari	<i>Lecythis zabucajo</i>	Monkey Pot
<i>D. pycnastera</i>	W. Yari Yari	MARANTACEAE	
<i>Rollinia exsucca</i>	Koyechi	<i>Ischnosiphon arouma</i>	Mukru
<i>Unonopsis glaucopetala</i>	Arara	<i>I. gracilis</i>	Warakabakoromukru
<i>U. glaucopetala</i>	B. Yari Yari	MARCGRAVIACEAE	
APOCYNACEAE		<i>Norantea guianensis</i>	Kara kara
<i>Aspidosperma desmonthui</i>	Shibadan	<i>Sourouba guianensis</i>	Kara kara
<i>A. marcgravianum</i>	Yarola	MELASTOMATACEAE	
<i>A. excelsum</i>	Yarola	<i>Merianja urceolata</i>	Waraia
<i>A. vargasii</i>	Shibadan	<i>Miconia guianensis</i>	Mukru
<i>Macoubia guianensis</i>	Dukali	MELIACEAE	
<i>Tabernaemontana undulata</i>	Dog Seed	<i>Carapa guianensis</i>	Crabwood
ARACEAE		<i>Trichilia rubra</i>	Uriballi
<i>Heteropsis jenmanii</i>	Nibi	MENISPERMACEAE	
ARALIACEAE		<i>Courarea candicans</i>	Granny Backbone
<i>Schefflera morototoni</i>	Karahora	MIMOSOIDAE	
BIGNONIACEAE		<i>Inga capitata</i>	Warakosa
<i>Jacaranda copaia</i>	Simaroupa	<i>I. melinonis</i>	Warakosa
<i>Tabebuia stenocalyx</i>	White Cedar	<i>I. pezizifera</i>	Warakosa
BOMBACACEAE		<i>Pentaclethra macroloba</i>	Trysil
<i>Catostemma commune</i>	Baromalli	<i>Pithecellobium racemosum</i>	Snake wood

BORAGINACEAE		MORACEAE	
<i>Cordia nodosa</i>	Ants Tree	<i>Brosium guianensis</i>	Tibikushi
BURSERACEAE		<i>Cecropia peltata</i>	Conga Pump
<i>Protium alatonii</i>	Haiawa	<i>C. sciadophylla</i>	Conga Pump
<i>P. crenatum</i>	Kurokai	<i>C. surinamensis</i>	Comga Pump
<i>P. decandrum</i>	Kurokai	<i>Pourouma guianensis</i>	Guianensis
<i>P. tenuifolium</i>	Haiawaballi	MYRISTICACEAE	
<i>P. unifolium</i>	Kurokai	<i>Iryanthera sagotaiana</i>	Kirikaua
<i>Tetragastris altissima</i>	Haiawaballi	<i>Virola elongata</i>	Dalli
CAESALPINIOIDEAE		<i>V. guianensis</i>	Hillballi
<i>Bauhinia guianensis</i>	Monkey Ladder	<i>V. michelii</i>	Hillballi
<i>B. kunthiana</i>	Turtle steps	MYRTACEAE	
<i>Brownea latifolia</i>	Rose of the Mountain	<i>Marlierea montana</i>	Quackoo
<i>Cassia cowanii</i>	Warua	<i>Myrcia rufipila</i>	Wild Guava
<i>Eperua falcate</i>	Soft Walaba	PALMAE	
<i>E. grandiflora</i>	Ituri Walaba	<i>Bactris brongniartii</i>	Pimpla Banga
<i>Hymenaea courbaril</i>	Locust	<i>B. humilis</i>	Pimpla Palm
<i>Mora excels</i>	Mora	<i>B. humilis</i>	Yuruwe
<i>M. gongrijpii</i>	Morabukea	<i>Desmoncus orthoacanthos</i>	Kamwari
<i>Peltogyne venosa</i>	Purpleheart	<i>D. polyacanthos</i>	Hold me Back
<i>Pouteria venosa</i>	Kamakoro	<i>Euterpe oleracea</i>	Manicole
<i>Sclerolobium guianensis</i>	Kaditeri	<i>Geonoma acaulis</i>	Dalibana
<i>S. micropetalum</i>	Kaditeri	<i>G. baculifera</i>	Dalibana
CELASTRACEAE		<i>Jessenia bataua</i>	Turu
<i>Goupia glabra</i>	Kabakalli	<i>Maximiliana maripa</i>	Kokerite
CHRYSOBALANACEAE		<i>Attalea regia</i>	Kokeritre
<i>Licania alba</i>	Kautaballi	PAPILIONOIDEAE	
<i>L. densifolia</i>	Marishiballi	<i>Alexa imperatricis</i>	Haiariballi
<i>L. guianensis</i>	Marishiballi	<i>Clathrotropis brachypetala</i>	Aromata
<i>L. heteromorpha</i>	Kairiballi	<i>C. macrocarpa</i>	Aromata
<i>L. mollis</i>	Marishiballi	<i>Hymenolobium flavum</i>	Darina
<i>L. licaniiflora</i>	Marishiballi	<i>Pterocarpus officinalis</i>	Corkwood
<i>L. laxiflora</i>	Kauta	<i>P. santalinoides</i>	Corkwood
<i>L. persaudii</i>	Kauta	<i>Swartzia leiocalycina</i>	Wamara
<i>Parinari campastris</i>	Burada	<i>S. jenmanii</i>	Parakusan
CONVOLVULACEAE		PROTEACEAE	
<i>Ipomoea phyllomega</i>	Haiachiballi	<i>Panopsis sessilifolia</i>	Wild Calabash
CYCLANTHACEAE		QUIINACEAE	
<i>Thoracocarpus bissectus</i>	Manuri	<i>Quiina guianensis</i>	Okokonshi
<i>T. bissectus</i>	Scrapping nibi	<i>Q. obovata</i>	Okokonshi
DICHAPETALACEAE		RUTACEAE	
<i>Tapura guianensis</i>	Waiaaballi	<i>Zanthohylum apiculata</i>	Sada
<i>T. guianeasis</i>	Waiadan	SAPINDACEAE	
DILLENACEAE		<i>Mataba guianensis</i>	Kulishiri
<i>Davilla alata</i>	Kabadulli	SAPOTACEAE	
<i>D. kunthii</i>	Kabadulli	<i>Micropholis venolosa</i>	Kudibushi
<i>Tetracera volubilis</i>	Kapadula	<i>Pouteria cuspidata</i>	Kokoritaballi
ELAEOCARPACEAE		<i>P. duru</i>	Kokoritaballi

<i>Sloanea guianensis</i>	Aruadan	<i>P. guianensis</i>	Asepoko
<i>S. guianensis</i>	Parakusan	<i>P. minutiflora</i>	Moraballi
<i>S. schomburgkiana</i>	Ubudiballi	OLACACEAE	
EUPHORBIACEAE		<i>Dulacia guianensis</i>	Hishirudan
<i>Drypetes variabilis</i>	Shibadan	<i>Miconia guianensis</i>	Wanania
<i>Hyeronima alchorneoides</i>	Surudani	SIMAROUBACEAE	
<i>Mabea piriri</i>	Baribada	<i>Quassia amara</i>	Quashi bitters
EBENACEAE		<i>Q. simarouba</i>	Simarupa
<i>Diosporos ierensis</i>	Barabara	SOLANACEAE	
FLACOURTIACEAE		<i>Solanum crinitum</i>	Barabara
<i>Laetia procera</i>	Warakairo	STERCULIACEAE	
GUTTIFERAE		<i>Sterculia guianensis</i>	Maho
<i>Clusia grandiflora</i>	Kufa	<i>S. prurians</i>	Maho
<i>C. palmicida</i>	Kufa	<i>S. rugosa</i>	Maho
<i>Tovomita albiflora</i>	W. Mangrove		
<i>T. calodictyos</i>	W. Mangrove	TILIACEAE	
<i>T. obscura</i>	Awasokuli	<i>Apeiba petoumo</i>	Duru
<i>Vismia cayennensis</i>	Blood wood	<i>Tovomita obscura</i>	Awasokuli
LAURACEAE		VIOLACEAE	
<i>Ocotea cernua</i>	Keriti	<i>Paypayrola longifolia</i>	Adabero
<i>O. tormentalla</i>	Baradan	VOCHYSIACEAE	
<i>O. wachenheim</i>	Keriti	<i>Vochysia tetraphylla</i>	Itae balli
		ZINGIBERACEAE	
		<i>Renealmia floribunda</i>	Kuruati

Table 2. Flora Encountered in the Golden Mile during the Final Dry Season Survey

FAMILY/ SCIENTIFIC NAME	COMMON NAME	FAMILY/ SCIENTIFIC NAME	COMMON NAME
ANNONACEAE		MARANTACEAE	
<i>Duguetia guianensis</i>	Yari Yari	<i>Ichnosiphon arouma</i>	Mukru
<i>Unonopsis glaucopetala</i>	B. Yari Yari	<i>I. gracilis</i>	Warakabakoromukru
APOCYNACEAE		MELASTOMATCEAE	
<i>Tabermontana undulata</i>	Dog Seed	<i>Miconia guianensis</i>	Waria
ARACEAE		MIMOSOIDEAE	
<i>Heteropsis jenmanii</i>	Nibi	<i>Inga capitata</i>	Warakosa
BIGNONIACEAE		MORACEAE	
<i>Tabebuia stenocalyx</i>	White Cedar	<i>Cecropia surinamensis</i>	Conga Pump
BOMBACACEAE		<i>Pourouma guianensis</i>	Buruma
<i>Catostemma commune</i>	Baromalli	PALMAE	
CAESALPINIOIDEAE		<i>Bactris brongniartii</i>	Pimpla Banga
<i>Cassia cowanii</i>	Warua	<i>Geonoma baculifera</i>	Dalibana
<i>Mora excels</i>	Mora	PAPILIONOIDEAE	
<i>M. gangripii</i>	Morabukea	<i>Alexa imperatricis</i>	Haiairiballi
CHRYSOBALANACEAE		<i>Clathrotropis macrocarpa</i>	Aromata
<i>Licania alba</i>	Kautaballi	<i>Pterocarpus santalinoides</i>	Cork Wood
<i>L. laxiflora</i>	Kauta	<i>Swartzia jenmanii</i>	Parakusan
CONVOLVULACEAE		SAPOTACEAE	
<i>Ipomoea phyllomega</i>	Haichiballi	<i>Pouteria guianensis</i>	Asepoko
DILLENIACEAE		SOLANACEAE	
<i>Davilla kunthii</i>	Kabadulli	<i>Solanum crinitum</i>	Barabara
GUTTIFERAE		STERCULIACEAE	

<i>Vismia cayanensis</i>	Blood wood	<i>Sterculia rugosa</i>	Maho
LECYTHIDACEAE			
<i>Escheweilera sagotiana</i>	B. Kakaralli		

Table 3. Summary of Mammals Encountered in Mining Concession during Last Dry Season Survey

FAMILY/ SCIENTIFIC NAME	COMMON NAME
CEBIDAE	
<i>Alouatta seniculus</i>	Red Howler Monkey
<i>Cebus</i> sp.	Capuchin Monkey
TAPIRIDAE	
<i>Tapirus terrestris</i>	Lowland Tapir
DASYPROCTIDAE	
<i>Dasyprocta leporine</i>	Red-rumped Agouti
CERVIDAE	
	Deer
STEMODERMATINAE	
	Fruit Bat
DASYPODIDAE	
	Armadillo
TAYASSUIDAE	
<i>Pecari tajacu</i>	Collared Peccary
<i>Tayassu pecari</i>	White-lipped Peccary

Table 4. Summary of Invertebrates Encountered in Mining Concession during Last Dry Season Survey

INVERTEBRATES	COMMON NAME
INSECTA	
Blattodea	Cockroaches
Coleoptera	Beetles
Diptera	Flies , Mosquitoes
Hemiptera	True bugs
Hymenoptera	Wasps, Ants, Bees
Isoptera	Termites
Lepidoptera	Butterflies, Moths
Mantodea	Praying Mantis
Odonata	Dragonflies
Orthoptera	Grasshoppers
ARACHNIDA	
Aranae	Spiders
Scorpiones	Scorpions
CHILOPODA	Centipedes
DIPLOPODA	Milipedes
GASTROPODA	Snails
ANNELIDA	Earthworms

Table 5. Summary of Fishes Encountered in Mining Concession during Last Dry Season Survey

FAMILY/ SCIENTIFIC NAME	COMMON NAME
PIMELODIDAE	
	Catfish
CHARACIDAE	
<i>Myelinae</i> sp.	Silver Dollar

CICHLIDAE	
<i>Cichlasoma bimaculatum</i>	Common Patwa
ERYTHRINIDAE	
<i>Hoplias malabaricus</i>	Huri

Table 6. Summary of Amphibians Encountered in Mining Concession during Last Dry Season Survey

FAMILY / SCIENTIFIC NAME	COMMON NAME
BUFONIDAE	
<i>Rhinella marina</i>	Crapo
DENDROBATIDAE	
	Poison Arrow Frog
HYLIDAE	
	Frog

Table 7. Summary of Reptiles Encountered in Mining Concession during Last Dry Season Survey

FAMILY / SCIENTIFIC NAME	COMMON NAME
ALLIGATORIDAE	
<i>Caiman</i> sp.	Alligator
POLYCHROTIDAE	
<i>Anolis</i> sp.	Anole lizard
BOIIDAE	
<i>Eunectes murinus</i>	Camoodie
TROPIDURIDAE	
<i>Plica umbra</i>	Tree lizard
AMPHISBAENIDAE	
<i>Amphisbaena</i> sp.	Worm lizard
VIPERIDAE	
<i>Bothriopsis bilineata</i>	Parrot snake
TEIIDAE	
<i>Tupinambis teguixin</i>	Salipenter
TESTUDINIDAE	
<i>Geochelone denticulata</i>	Tortoise

Table 8. Summary of Birds Encountered in Mining Concession during Last Dry Season Survey

FAMILY / SCIENTIFIC NAME	COMMON NAME	FAMILY / SCIENTIFIC NAME	COMMON NAME
ACCIPITRIDAE		PSITTACIDAE	
	Black raptor	<i>Aratinga leucophthalmus</i>	White-eyed Parakeet
<i>Buteo</i> sp.	Hawk	<i>Pionus fuscus</i>	Dusky Parrot
ALCEDINIDAE		<i>Pionopsitta caica</i>	Caica Parrot
<i>Chloroceryle aenea</i>	American Pygmy Kingfisher	<i>Amazona farinosa</i>	Mealy Parrot
CATHARTIDAE		<i>Ara chloroptera</i>	Red-and-green Macaw
<i>Cathartis melambrotus</i>	Greater Yellow-headed Vulture	<i>Forpus sclateri</i>	Dusky-billed Parrotlet
COTINGIDAE		THAMNOPHILIDAE	
<i>Schiffornis turdinus</i>	Thrush-like Schiffornis	<i>Thamnophilus punctatus</i>	Northern Slaty-antshrike
<i>Lipangus vociferans</i>	Screaming Piha	<i>T. murinus</i>	Mouse-coloured Antshrike
CRACIDAE		<i>Thamnomanes ardesiacus</i>	Dusky-throated

			Antshrike
<i>Penelope jacquacu</i>	Spix's Guan	<i>Myrmotherula menetriesi</i>	Gray Antwren
CUCULIDAE		<i>Myrmotherula gutturalis</i>	Brown-bellied Antwren
<i>Coccyzus americanus</i>	Yellow-billed Cuckoo	<i>M. axillaris</i>	White-flanked Antwren
DENDROCOLAPTIDAE		TINAMIDAE	
<i>Dendrocincla fuliginosa</i>	Brown Woodcreeper	<i>Tinamus tao</i>	Gray Tinamou
<i>Dendrocincla merula</i>	Plain Woodcreeper	<i>Crypturellus soui</i>	Little Tinamou
<i>Sittasomus griseicapillus</i>	Olivaceous Woodcreeper	TROGLODYTIDAE	
<i>Dendrocolaptes certhia</i>	Amazonian Woodcreeper	<i>Henicorhina leucosticta</i>	White-breasted Wood-wren
<i>D. picumnus</i>	Black-banded Woodcreeper	<i>Cyphorhinus arada</i>	Musician Wren
<i>Xyphorhynchus pardalotus</i>	Chestnut Woodcreeper	TROCHILIDAE	
<i>X. guttatus</i>	Buff-throated Woodcreeper	<i>Chlorestes</i> sp.	Sapphire
<i>Campylorhynchus pusillus</i>	Curved-billed Scythebill	<i>Thalurania furcata</i>	Fork-tailed Woodnymph
FALCONIDAE		<i>Phaethornis rufurumii</i>	Streak-throated Hermit
<i>Daptrius ater</i>	Black Cara cara	<i>Phaethornis hispidus</i>	White-bearded Hermit
FURNARIIDAE		<i>Hylocharis cyanus</i>	White-chinned Sapphire
<i>Automolus infuscatus</i>	Olive-backed Foliage-gleaner	<i>Adelomyia melanogenys</i>	Speckled Hummingbird
<i>Synallaxis rutillans</i>	Ruddy Spinetail		
GALBULIDAE			
<i>Galbula dea</i>	Paradise Jacamar		
HIRUNDINIDAE			
<i>Atticora melanoleuca</i>	Black-collared Swallow		
ICTERIDAE			
<i>Icterus chryscephalus</i>	Moriche Oriole		
<i>Psarocolius decumanus</i>	Crested Oropendola		
ODONTOPHORIDAE			
<i>Colinus cristatus</i>	Crested Bobwhite		
PICIDAE			
<i>Picumnus exilis</i>	Golden-spangled Piculet		
<i>Celeus elegans</i>	Chestnut Woodpecker		
<i>Colaptes rubiginosus</i>	Golden-olive Woodpecker		

Table 9. Summary of Mammals Encountered in Golden Mile area during Last Dry Season Survey

FAMILY / SCIENTIFIC NAME	COMMON NAME
PHYLLOSTOMIDAE	
<i>Glossophaga</i> sp.	Leaf-nosed Bat
CEBIDAE	

<i>Alouatta seniculus</i>	Red Howler Monkey
TAPIRIDAE	
<i>Tapirus terrestris</i>	Lowland Tapir
DASYPROCTIDAE	
<i>Dasyprocta leporina</i>	Red-rumped Agouti
CERVIDAE	
<i>Mazama sp.</i>	Brocket Deer

Table 10. Summary of Invertebrates Encountered in Golden Mile area during Last Dry Season Survey

INVERTEBRATES	COMMON NAME
INSECTA	
Blattodea	Cockroaches
Coleoptera	Beetles
Diptera	Flies , Mosquitoes
Hemiptera	True bugs
Hymenoptera	Wasps, Ants, Bees
Isoptera	Termites
Lepidoptera	Butterflies, Moths
Mantodea	Praying Mantis
Odonata	Dragonflies
Orthoptera	Grasshoppers
ARACHNIDA	
Aranae	Spiders
Scorpiones	Scorpions
DIPLOPODA	Milipedes
ANNELIDA	Earthworms

Table 11. Summary of Fishes Encountered in Golden Mile area during Last Dry Season Survey

FAMILY / SCIENTIFIC NAME	COMMON NAME
PIMELODIDAE	
	Catfish

Table 12. Summary of Amphibians Encountered in Golden Mile area during Last Dry Season Survey

FAMILY / SCIENTIFIC NAME	COMMON NAME
BUFONIDAE	
<i>Rhinella marina</i>	Crapo
DENDROBATIDAE	
	Poison Arrow Frog

Table 13. Summary of Reptiles Encountered in Golden Mile area during Last Dry Season Survey

FAMILY / SCIENTIFIC NAME	COMMON NAME
ALLIGATORIDAE	
<i>Caiman</i> sp.	Caiman
TROPIDURIDAE	
<i>Plica umbra</i>	Tree lizard
AMPHISBAENIDAE	
<i>Amphisbaena</i> sp.	Worm Lizard

Table 14. Summary of Birds Encountered in Golden Mile area during Last Dry Season Survey

FAMILY / SCIENTIFIC NAME	COMMON NAME	FAMILY / SCIENTIFIC NAME	COMMON NAME
ACCIPITRIDAE		PSITTACIDAE	
<i>Buteo</i> sp.	Hawk	<i>Aratinga leucophthalmus</i>	White eyed Parakeet
CATHARTIDAE			
<i>Cathartis melambrotus</i>	Greater Yellow-headed Vulture		
CRACIDAE		<i>Pionus fuscus</i>	Dusky Parrot
<i>Penelope jacquacu</i>	Spix's Guan	<i>Pionopsitta caica</i>	Caica Parrot
CUCULIDAE		<i>Amazona farinosa</i>	Mealy Parrot
<i>Coccyzus americanus</i>	Yellow-billed Cuckoo	THAMNOPHILIDAE	
		<i>Thamnophilus punctatus</i>	Northern Slaty-antshrike
		TINAMIDAE	
FURNARIIDAE		<i>Tinamus tao</i>	Gray Tinamou
<i>Automolus infuscatus</i>	Olive-backed foliage-gleaner	TROGLODYTIDAE	
HIRUNDINIDAE		<i>Henicorhina leucosticta</i>	White-breasted Wood-wren
<i>Atticora melanoleuca</i>	Black-collared Swallow	TROCHILIDAE	
ICTERIDAE		<i>Chlorestes</i> sp.	Sapphire
<i>Psarocolius decumanus</i>	Crested Oropendola		

Table 15. Aurora Mine Site

FAUNA	W ₁		W ₂		D ₁		D ₂	
	F	Spp.	F	Spp.	F	Spp.	F	Spp.
MAMMALS	15	27	4	5	7	8	7	9
FISHES	10	18	0	0	5	9	4	4
REPTILES	14	36	8	8	4	4	7	9
AMPHIBIANS	6	11	4	5	3	4	3	3
BIRDS	22	55	10	21	20	37	19	49
	Ord.	Cl.	Ord.	Cl.	Ord.	Cl.	Ord.	Cl.
INVERTE.	10	5	12	4	15	4	10	6
FLORA	W ₁		W ₂		D ₁		D ₂	
	52	161	21	105	46	103	46	155

Table 16. Golden Mile

FAUNA	W ₁		W ₂		D ₁		D ₂	
	F	Spp.	F	Spp.	F	Spp.	F	Spp.
MAMMALS	4	5	3	4	3	3	5	5

FISHES	7	9	0	0	2	3	1	1
REPTILES	3	10	3	4	2	2	2	3
AMPHIBIANS	2	4	2	2	1	1	2	2
BIRDS	16	23	8	10	8	10	8	10
	Ord.	Cl.	Ord.	Cl.	Ord.	Cl.	Ord.	Cl.
INVERTE.	6	1	9	4	7	4	10	4
FLORA								
	W_1		W_2		D_1		D_2	
	24	44	28	61	25	54	20	30

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Table 17. Vegetation in Area

Scientific Name	Common Name	Scientific Name	Common Name
APOCYNACEAE <i>Aspidosperma excelsum</i> <i>A.vargassi</i> <i>Sapium paucinervium</i> <i>Tabernaemontana undulata</i> <i>Allamanda cathartica</i>	Yaruru Shebadan Gum tree Peroishiokado aka Dog seed. Barudaballi	ANNONACEAE <i>Guateria arara</i> <i>Duguetia decurrens</i> <i>Anaxagorea dolichocarpa</i> <i>Rollinia exsucca</i> <i>Guateria atra</i> <i>Xylopia pulcherrima</i>	Arara YariYari Kurihikoyoko Koyechi aka Brown Maho B. Yari Yari Kuyama
ARALIACEAE <i>Schefflera decaphylla</i>	Match wood	ANACARDIACEAE <i>Tapirira marchandii</i>	Duka
ARACEAE <i>Philodendron spp.</i> <i>Heteropsis flexuosa</i>	Hanakwablar Nibi	BIGNONIACEAE <i>Jacaranda copaia</i> <i>Schlegelia violacea</i> <i>Jacaranda obtusifolia</i> <i>Tabebuia insignis</i> <i>Tabebuia sp.</i>	Kopaia aka Futui Butata kubla Sand Trysil White Cedar Wachiba
BOMBACACEAE <i>Catastemma commune</i> <i>Ceiba pentandra</i> <i>Bombax flaviflorum</i>	Baromalli Kumae Kamakuti	BORAGINACEAE <i>Cordia nodosa</i> <i>C. sericalyx</i> <i>C. bicolor</i>	Ants tree Clammy Cherry Table tree
BURSERACEAE <i>Trattinnickia rhoifolia</i> <i>Tetragastris altissima</i> <i>Protium decandrum</i> <i>Protium heptaphyllum</i>	Ulu Haiawaballi Kurok Haiawa	CAESALPINIOIDEAE <i>Eperua falcate</i> <i>E. jenmanii</i> <i>Bahinia kunthiana</i> <i>Swartzia leiocalycina</i> <i>S. jenmanii</i> <i>Mora exelsa</i> <i>M. gongrijpii</i> Unknown A	Soft Wallaba Ituri Wallaba Turtle Ladder Wamara Parakusan Mora Morabukea
CHRYSOBALANACEAE <i>Licania laxiflora</i> <i>L. alba</i> <i>L. heteromorpha</i> <i>L. densiflora</i> <i>L. sp.</i> <i>Couepia exflexa</i> <i>Parinari campestris</i>	Kauta Kantaballi Kairiballi Marishiballi Counta (er) Aruadan Burada	CONVOLVULACEAE <i>Maripa scandens</i>	Monkey Syrup
CELASTRACEAE <i>Goupia glabra</i>	Kabukalli	CYCLANTHACEAE <i>Thoracocarpus bissectus</i>	Memuri
COMBRETACEAE <i>Terminalia dichotama</i> Also <i>T. amazon</i>	Coffee mortar	COMPOSITAE <i>Mikania hookeriana</i>	Bitter Tally
DILLIENIACEAE <i>Davilla alata</i> <i>Tetracera aspera</i>	Kapadulla Fire rope	DICHAPETALACEAE <i>Tapura guianensis</i>	Waiaballi
EUPHORBIACEAE <i>Chaetocarpus stipularis</i> <i>Mabea piriri</i>	Ruri Baririkuti	EBENACEAE <i>Diospyros guianensis</i>	Barabara

<i>Hyeronima alchorneoides</i>	Surudan		
FLACOURTIACEAE <i>Casearia arguta</i>	Shibidan		
GUTTIFERAE <i>Tovomita</i> sp. <i>T. obovata</i> <i>Vismia cayenensis</i> <i>Clusia fockeana</i> <i>Symphonia globulifera</i>	Wild mang(r)o Wild mang(r)o Loodwood Kufu Manni	HAEMODORACEAE <i>Heteropsis flexuosa</i>	Nibi
LECYTHIDACEAE <i>Eschweilera sagotiana</i> <i>E. alata</i> <i>E. wachenheimii</i> <i>Lecythis zabuca</i> <i>Couratari guianensis</i>	B. Kakaralli Kakaralli Kakaralli (Fine L) Monkey pot Wadata	LOGANIACEAE <i>Strychnos guianensis</i>	Devil doer
LAURACEAE <i>Aniba hypoglauca</i> <i>A. jenmanii</i>	Gale Silverballi Kereti	MYRTACEAE <i>Myrcaria ibibianaro</i> <i>Marlierea montana</i>	Wild Guava Kwako
MARCGRAVIACEAE <i>Souroubea guianensis</i>	Kamkara	MARANTACEAE <i>Ischnosiphon gracilis</i> <i>Ischnosiphon</i> sp. <i>I. obliquus</i>	Warakabakoromukru Mukru Itiriti
MORACEAE <i>Cecropia angulata</i> <i>Brosimum guianensis</i>	Congo Pump Snake wood	MALPIGHIACEAE <i>Byrsonima aerugo</i> <i>Byrsonima</i> sp.	Arikadako Hittia
MIMOSOIDEAE <i>Inga alba</i> <i>I. rubiginosa</i> <i>I. edulis</i> <i>Pentaclethra macrocarpa</i> <i>Pterocarpus officinalis</i>	Warakosa Warakosa Warakosa Trysil Corkwood	MELASTOMATACEAE <i>Meriania urceolata</i> <i>Mouriri sagotiana</i> <i>Miconia hypoleuca</i> <i>Miconia guianensis</i>	B.leave Waraia Manuriballi Wakaradan Waraia
MELIACEAE <i>Trichilia</i> sp.	Yuriballi	MENISPERMACEAE <i>Curarea candicans</i>	Granny back bone
MONIMIACEAE <i>Siparuna guianensis</i>	Ant bush	ORCHIDACEAE <i>Vanilla</i> sp.	Orchid
PAPILIONOIDEAE <i>Alexa imperatris</i> Unknown A <i>Clathrotropis macrocarpa</i> <i>Derris pterocarpa</i> <i>Swartzia jenmanii</i> <i>Tetragastris altissima</i> <i>Swartzia leiocalycina</i> <i>Pterocarpus officinalis</i> <i>Machaerium lunatum</i>	Haiariballi Aromata Red belly liana Parakusan Haiawaballi Wamara Corkwood Bunduri pimpla	PROTEACEAE <i>Panopsis sessilifolia</i>	Idaballi
PALMAE <i>Geonoma baculifera</i> <i>Oenocarpus bacaba</i> <i>Euterpe oleracea</i> <i>Desmoncus orthacanthos</i>	Dalbana Lu Manicole Kamwari	QUINACEAE <i>Coupia guianensis</i> <i>Touroulia guianensis</i> <i>Quiina guianensis</i>	Aruadan Fern Okokonshi

<i>Jessenia bataua</i> <i>Bactris humilis</i> <i>Desmoncus guianensis</i> <i>Geonoma acaulis</i> <i>Atalea regia</i>	Turu Yuruwe Hold-me-back Dhalebana aka Whale bone Kokorite Palm		
RUBIACEAE <i>Psychotria poeppigiana</i>	Soldier's cap	SAPOTACEAE <i>Pouteria guianensis</i> <i>P. dura</i> <i>Ichthyophora elegans</i> <i>P. minutiflora</i> <i>Chrysophyllum pomiferum</i> <i>Pouteria cuspidata</i>	Asepoko Kokoritaballi Kokoritaballi Moraballi Paripiballi Kokoritaballi
SAPINDACEAE <i>Matayba opaca</i> <i>Talisia squarrosa</i>	Kulishiri Moroballi	STERCULIACEAE <i>Sterculia rugosa</i>	Maho
SMILACACEAE <i>Smilax schomburgkiana</i>	Dorokwaro pimpla	TILIACEAE <i>Apeiba echinata</i>	Duru
ULMACEAE <i>Trema guianensis</i>	Kwabuyakoro	VIOLACEAE <i>Paypayrola longifolia</i>	Adebero
VERBENACEAE <i>Protium heptaphyllum</i> <i>P. subserratum</i> <i>P. decaadrum</i>	Haiawa Haiawa Hurokai	ZINGERBERACEAE <i>Renealmea floribunda</i>	Kuruati

Table 18. Summary of Mammals Present in the Concession Area

MAMMALS	COMMON NAME	MAMMALS	COMMON NAME
AGOUTIDAE		HYDROCHOERIDAE	
<i>Agouti paca</i>	Paca	<i>Hydrochoerus hydrochaeris</i>	Capybara
CEBIDAE		MEGALONYCHIDAE	
<i>Alouatta seniculus</i>	Red Howler Monkey	<i>Choloepus didactylus</i>	Southern Two-toed Sloth
<i>Ateles paniscus</i>	Guiana Spider Monkey	MYRMECOPHAGIDAE	
<i>Cebus olivaceus</i>		<i>Myrmecophaga tridactyla</i>	Giant Anteater
<i>Saimiri sciureus</i>	South American Squirrel Monkey	<i>Tamandua tetradactyla</i>	Tamandua
<i>Cebus</i> sp.	Weeper Capuchin Monkey	MUSTELIDAE	
CERVIDAE		<i>Pteronura brasiliensis</i>	Giant Otter
<i>Odocoileus virginianus</i>	White-tailed Deer	PHYLLOSTOMIDAE	
<i>Mazama americana</i>	Red Brocket Deer	<i>Artibeus</i> sp.	Leaf-nosed Bat
<i>Mazama gouazoubira</i>	Grey Brocket Deer	<i>Glossophaga</i> sp.	Leaf-nosed Bat
DASYPODIDAE		PROCYONIDAE	
<i>Dasyus novemcinctus</i>	Nine-banded Armadillo	<i>Nasua nasua</i>	Coati
DASYPROCTIDAE		TAPIRIDAE	
<i>Dasyprocta leporina</i>	Red-rumped Agouti	<i>Tapirus terrestris</i>	Lowland Tapir
DIDELPHIDAE		TAYASSUIDAE	
<i>Didelphis marsupialis</i>	Common Opossum; Yawari	<i>Pecari tajacu</i>	Collared Peccary
FELIDAE		<i>Tayassu pecari</i>	White-lipped Peccary

<i>Panthera onca</i>	Jaguar		
<i>Leopardus pardalis</i>	Ocelot		
<i>Leopardus tigrinus</i>	Oncilla		
<i>Leopardus wiedii</i>	Margay		

Table 19. Invertebrates Present in Concession Area

INVERTEBRATES	COMMON NAME	INVERTEBRATES	COMMON NAME
Aranae	Spiders	Hymenoptera	Bees
Blattodea	Cockroaches	Lepidoptera	Butterflies and Moths
Coleoptera	Beetles	Odonata	Dragonflies
Decapoda	Land crabs	Orthoptera	Grasshoppers; crickets
Diplura	Diplurans	Pharmatoptera	Walking Sticks
Haplotaxida	Earthworms	Scorpiones	Scorpions
Hemiptera	Bugs; Water striders		
Chilopoda	Centipedes	Diplopoda	Millipedes

Table 20. Summary of Fishes in Concession Area

FAMILY / SCIENTIFIC NAME	COMMON NAME
AGENEIOSIDAE	
<i>Ageneiosus</i> sp. A	
<i>Ageneiosus</i> sp. B	
ANOSTOMIDAE	
<i>Leporinus</i> sp.	Dare
<i>Leporinus faciatu</i> s	Head stander
AUCHENIPTERIDAE	
<i>Auchenipterus</i> sp.	
<i>Parauchenipterus galeatus</i>	Wood cot
CHARACIDAE	
<i>Serrasalmus</i> sp.	Peraí
<i>Triportheus rotundatus</i>	Kabadel
<i>Brycon pesu</i>	Tetra
Unidentified 1	
Unidentified 2	
CYNODONTIDAE	
<i>Cynodon gibbus</i>	Small biara
DORADIDAE	
<i>Platydoras</i> sp.	
ENGRAULIDAE	
<i>Lycengraulis batesii</i>	
ERYTHRINIDAE	
<i>Hoplias malabaricus</i>	Haimara
HEMIODONTIDAE	
<i>Hemiodopsis qundrimaculatus</i>	
RHAMPHICHTHIDAE	
<i>Gymnorhamphichthys</i> sp.	Knife fish

Table 21. Summary of Amphibians in Concession Area

FAMILY / SCIENTIFIC NAME	COMMON NAME
BUFONIDAE	
<i>Rhinella marina</i>	Marine Toad, Crapo
<i>Rhinella</i> sp.	Toad, Crapo
<i>Rhinella cf. margartifera</i>	Toad, Crapo
AROMOBATIDAE	
<i>Allobates femoralis</i>	Brillant-thighed Poison frog
HYLIDAE	
<i>Scinax cf. ruber</i>	Tree frog
<i>Hypsiboas boans</i>	Giant Gladiator Tree Frog
<i>Dendropsophus cf. marmaratus</i>	Tree frog
LEPTODACTYLIDAE	
<i>Leptodactylus lineatus</i>	Gold-striped Frog
<i>Leptodactylus</i> sp.	
PIPIDAE	
<i>Pipa</i> sp.	Surinam Toad
RANIDAE	
<i>Lithobates palmipes</i>	Amazon River Frog

Table 22. Summary of Reptiles in Concession Area

FAMILY / SCIENTIFIC NAME	COMMON NAME
ALLIGATORIDAE	
<i>Caiman crocodilus</i>	Spectacled Caiman; alligator
<i>Paleosuchus palpebrosus</i>	Cuvier's Dwarf Caiman
<i>Melanosuchus niger</i>	Black Caiman
AMPHISBAENIDAE	
<i>Amphisbaenia fuliginosa</i>	Worm lizard
ANILIIDAE	
<i>Anilus scytale</i>	False Coral Snake or Red Pipe Snake
BOIDAE	
<i>Corallus hortulanus</i>	Amazon Tree Boa
<i>Epicrates cenchria</i>	Rainbow Boa
<i>Boa constrictor</i>	Land Boa
<i>Eunectes murinus</i>	Anaconda or Water Boa
<i>Corallus caninus</i>	Emerald Tree Boa
COLUBRIDAE	
<i>Chironius</i> sp.	
<i>Dipsas</i> sp.	
<i>Imantodes</i> cf. <i>cenchoa</i>	
<i>Imantodes</i> sp.	
<i>Liophis</i> sp.	
Unidentified sp.	
ELAPIDAE	
<i>Micrurus surinamensis</i>	Coral Snake or Himurali
GYMNOPHTHALMIDAE	
<i>Gymnophthalmus underwoodi</i>	Skink
IGUANIDAE	
<i>Iguana iguana</i>	Iguana
PELOMEDUSIDAE	
<i>Podocnemis</i> sp.	River turtle
POLYCHROTIDAE	
<i>Anolis</i> sp.	Anole
<i>Norops</i> cf. <i>nitens</i>	Anole
Cf. <i>Norops</i>	Anole
TEIIDAE	
<i>Ameiva ameiva</i>	
<i>Cnemidophorus lemniscatus</i>	
<i>Cnemidophorus</i> sp.	
<i>Kentropyx</i> cf. <i>borckiana</i>	
<i>Kentropyx</i> cf. <i>calcarata</i>	
<i>Tupinambis teguixin</i>	Salipenter
TESTUDINAE	
<i>Geochelone carbonaria</i>	Red-footed Tortoise
<i>Geochelone denticulata</i>	Yellow-footed Tortoise
TROPIDURIDAE	
<i>Plica plica</i>	Plica
<i>Uranoscodon superciliosus</i>	Tree Climber

VIPERIDAE	
<i>Bothrops atrox</i>	Labaria or Fer-de-Lance
<i>Bothriopsis</i> sp.	Green labaria
<i>Lachisis muta</i>	Bushmaster

Table 23. Summary of Birds Encountered in Concession Area

FAMILY / SCIENTIFIC NAME	COMMON NAME	FAMILY / SCIENTIFIC NAME	COMMON NAME
ALCEDINIDAE		RAMPHASTIDAE	
<i>Chloroceryle amazona</i>	Amazon Kingfisher	<i>Ramphastos tucanus</i>	Red-billed Toucan
ANHIMIDAE		<i>Pteroglossus aracari</i>	Black-necked Aracari
<i>Anhima cornuta</i>	Horned Screamer	<i>Ramphastos vitellinus</i>	Channel-billed Toucan
ANHINGIDAE		SCOLOPACIDAE	
<i>Anhinga anhinga</i>	Anhinga	<i>Tringa solitaria</i>	Solitary Sandpiper
ARDEIDAE		THAMNOPHILIDAE	
<i>Florida caerulea</i>	Little Blue Heron	<i>Hylophylax naevia</i>	Spotted-back Antbird
<i>Tigrisoma lineatum</i>	Rufescent Tiger-Heron	<i>Thamnomanes caesius</i>	Cinereus Antshrike
<i>Butorides striata</i>	Striated Heron	<i>Sclateria naevia</i>	Silvered Antbird
CICONIIDAE		<i>Cercomacra tyrannina</i>	Dusky Antbird
<i>Mycteria americana</i>	Wood Stork	<i>Thamnophilus aethions</i>	White-shouldered Antshrike
COLUMBIDAE		<i>Pithys albifrons</i>	White-plumed Antbird
<i>Patagioenas subvinacea</i>	Ruddy Pigeon	THRAUPIDAE	
COTINGIDAE		<i>Ramphocelus carbo</i>	Silver-beaked Tanager
<i>Lipaugus vociferans</i>	Screaming Piha	<i>Paroaria gularis</i>	Red-capped Cardinal
CRACIDAE		<i>Thraupis episcopus</i>	Blue-grey Tanager
<i>Crax alector</i>	Black Curassow	<i>Thraupis palmarum</i>	Palm Tanager
CUCULIDAE		TINAMIDAE	
<i>Piaya cayana</i>	Squirrel cuckoo	<i>Tinamus major</i>	Great Tinamou
EURYPYGIDAE		<i>Crypturcellus soui</i>	Little Tinamou
<i>Eurypyga helias</i>	Sun bittern	TROCHILIDAE	
FALCONIDAE		<i>Amazilia chionopectus</i>	White-crested Emerald
<i>Ibycter americanus</i>	Red-throated Caracara	<i>Amazilia sp.</i>	Hummingbird
ICTERIDAE		TYRANNIDAE	
<i>Psarocolius decumanus</i>	Crested Oropendola	<i>Pitagus sulphuratus</i>	Great Kiskadee
<i>Quiscalus lugubris</i>	Carib Grackle	<i>Tyrannus melancholicus</i>	Tropical Kingbird
<i>Cacicus cela</i>	Yellow-rumped Cacique	<i>Philophydor lector</i>	Lesser Kiskadee
<i>Icterus nigrogularis</i>	Yellow Oriole	<i>Fluvicola pica</i>	Pied Water-t Tyrant
PICIDAE			
<i>Celeus torquatus</i>	Ringed Woodpecker		
<i>Dryocopus lineatus</i>	Lineated Woodpecker		
Unidentified sp.	Woodpecker		
<i>Campephilus melanoleucos</i>	Crimson-crested Woodpecker		
PSOPHIDAE			
<i>Psophia crepitans</i>	Grey-winged Trumpeter		
PSITTACIDAE			
<i>Amazona sp.</i>	Parrot		

<i>Ara ararauna</i>	Blue-and-yellow Macaw		
<i>Ara chloropterus</i>	Red-and-green Macaw		
<i>Ara sp.</i>	Macaw		
<i>Aratinga solstitialis</i>	Sun Parakeet		
<i>Pionopsitta caica</i>	Caica Parrot		
<i>Pionus fuscus</i>	Dusky Parrot		
<i>Pionites melanocephala</i>	Black headed Parrot		
<i>Amazona ochrocephala</i>	Yellow-crowned Parrot		
<i>Amazona farinosa</i>	Mealy Parrot		
<i>Deroptyus accipitrinus</i>	Red-fan Parrot		

Table 24. Summary of Fishes in Concession Area

FAMILY / SCIENTIFIC NAME	COMMON NAME
ANOSTOMIDAE	
<i>Leporinus</i> sp.	
CHARACIDAE	
<i>Serrasalmus</i> sp.	
<i>Triportheus rotundatus</i>	
CYNODONTIDAE	
<i>Cynodon gibbus</i>	
RHAMPHICHTHIDAE	
<i>Gymnorhamphichthys</i> sp.	
AGENEIOSIDAE	
<i>Ageneiosus</i> sp. A	
<i>Ageneiosus</i> sp. B	
AUCHENIPTERIDAE	
<i>Parauchenipterus galeatus</i>	
DORADIDAE	
<i>Platydoras</i> sp.	

Table 25. Other Vertebrates Encountered in Golden Mile

Common Name	Scientific Name	Location Encountered
Amphibians		
Order: Anura		
Family: Bufonidae		
Marine toad or Crapo	<i>Rhinella marina</i>	Around camp area and in clearings
Toad	<i>Rhinella</i> cf. <i>margaritifera</i> group	Around camp area and in clearings
Toad	<i>Rhinella</i> sp.	Around camp area and in clearings
Family: Hylidae		
Tree frog	<i>Scinax</i> cf. <i>ruber</i>	In living quarters
Reptiles		
Order: Crocodylia		
Family: Alligatoridae		
Spectacled caiman	<i>Caiman crocodilus</i>	In swamp south of camp
Order: Squamata		
Family: Gymnophthalmidae		
Skink	<i>Gymnophthalmus underwoodi</i>	In clearings under logs
Family: Polychrotidae		
Anole	<i>Anolis</i> sp.	In clearings
Family: Teiidae		
	<i>Ameiva ameiva</i>	In clearings
	<i>Cnemidophorus lemniscatus</i>	In clearings
	<i>Cnemidophorus</i> sp.	In clearings
	<i>Kentropyx striata</i>	In clearings
	<i>Kentropyx</i> cf. <i>borckiana</i>	In clearings
	<i>Kentropyx</i> cf. <i>calcarata</i>	In clearings
Salipenter/Bush motorbike	<i>Tupinambis teguixin</i>	In clearing near river
Birds		
Family: Anhingidae		

Anhinga	<i>Anhinga anhinga</i>	On river
Family: Ardeidae		
Little Blue heron	<i>Florida caerulea</i>	In tree near swamp
Family: Falconidae		
Red-throated caracara	<i>Ibycter americanus</i>	In trees on hill south of air strip
Family: Cracidae		
Black Curassow	<i>Crax alector</i>	In forest on hills near southern end
Family: Psophidae		
Gray-winged Trumpeter	<i>Psophia crepitans</i>	In forest in southern end and south of air strip
Family: Scolopacidae		
Solitary Sandpiper	<i>Tringa solitaria</i>	At flooded area at airstrip
Family: Columbidae		
Ruddy Pigeon	<i>Patagioenas subvinacea</i>	In small clump of trees (previously forested area)
Family: Psittacidae		
Red-and-green Macaw	<i>Ara chloropterus</i>	In trees on hill south of Airstrip
Parrot	<i>Amazona</i> sp.	In trees on hill south of Airstrip
Family: Alcedinidae		
Amazon kingfisher	<i>Chloroceryle amazona</i>	In vegetation at river's edge
Family: Trochilidae - Hummingbirds		
White-chested Emerald	<i>Amazilia chionopectus</i>	Southern section
Family: Alcedinidae		
Amazon Kingfisher	<i>Chloroceryle amazona</i>	In vegetation on bank of Cuyuni
Family: Ramphastidae		
Toucan	cf. <i>Ramphastos tucanus</i>	In forest on hill south of airstrip
Family: Picidae		
Woodpecker	cf. <i>Celeus torquatus</i>	On rotting tree at hill foot south of airstrip
Woodpecker	cf. <i>Campephilus melanoleucos</i>	On rotting tree at hill foot south of airstrip
Family: Tyrannidae		
Great Kiskadee	<i>Pitangus sulphuratus</i>	In vegetation on bank of Cuyuni
Tropical Kingbird	<i>Tyrannus melancholicus</i>	In vegetation on bank of Cuyuni
Pied Water-tyrant	<i>Fluvicola plica</i>	Over Cuyuni river
Family: Cotingidae		
Screaming Piha	<i>Lipaugus vociferans</i>	In forested area south of airstrip
Family: Thraupidae		
Silver-beaked tanager	<i>Ramphocelus carbo</i>	In burnt area at north eastern side of the golden mile
Red-capped Cardinal	<i>Paroaria gularis</i>	Along river bank
Family: Icteridae		
Crested Oropendola	<i>Psarocolius decumanus</i>	In forest about 75m from river edge
Carib Grackle	<i>Quiscalus lugubris</i>	At airstrip
Yellow-rumped Cacique	<i>Cacicus cela</i>	In forest about 75m from river edge
Mammals		
ORDER: PRIMATES		

Family Cebidae Subfamily Alouattinae		
Red Howler monkey	<i>Alouatta seniculus</i>	In trees on hill south of airstrip
Family Cebidae Subfamily Atelinae		
Guiana Spider monkey	<i>Ateles paniscus</i>	In trees on hill south of airstrip
Family Cebidae Subfamily Cebinae		
Weeper Capuchin	<i>Cebus olivaceus</i>	In trees on hill south of airstrip
South American Squirrel Monkey	<i>Saimiri sciureus</i>	In trees on hill south of airstrip
ORDER RODENTIA		
Family Agoutidae Subfamily Agoutinae		
Paca or Labba	<i>Agouti paca</i>	Tracks on hill south of airstrip

July 2006 Survey Findings
Table 26. Vegetation in Area

Scientific Name	Common Name	Scientific Name	Common Name
APOCYANACEAE <i>Aspidosperma excelsum</i> <i>A.vargassi</i> <i>Sapium paucinervium</i> <i>Tabernaemontana undulata</i> <i>Allamanda cathartica</i>	Yaruru Shebadan Gum tree Peroishiokado aka Dog seed. Barudaballi	ANNONACEAE <i>Guateria arara</i> <i>Duguetia decurrens</i> <i>Anaxagorea dolichocarpa</i> <i>Rollinia exsucca</i> <i>Guateria atra</i> <i>Xylopia pulcherrima</i>	Arara YariYari Kurihikoyoko Koyechi aka Brown Maho B. Yari Yari Kuyama
ARALIACEAE <i>Schefflera decaphylla</i>	Match wood	ANACARDIACEAE <i>Tapirira marchandii</i>	Duka
ARACEAE <i>Philodendron spp.</i> <i>Heteropsis flexuosa</i>	Hanakwablar Nibi	BIGNONIACEAE <i>Jacaranda copaia</i> <i>Schlegelia violacea</i> <i>Jacaranda obtusifolia</i> <i>Tabebuia insignis</i> <i>Tabebuia sp.</i>	Kopaia aka Futui Butata kubla Sand Trysil White Cedar Wachiba
BOMBACACEAE <i>Catappa communis</i> <i>Ceiba pentandra</i> <i>Bombax flaviflorum</i>	Baromalli Kumae Kamakuti	BORAGINACEAE <i>Cordia nodosa</i> <i>C. sericicalyx</i> <i>C. bicolor</i>	Ants tree Clammy Cherry Table tree
BURSERACEAE <i>Trattinnickia rhoifolia</i> <i>Tetragastris altissima</i> <i>Protium decandrum</i> <i>Protium heptaphyllum</i>	Ulu Haiawaballi Kurok Haiawa	CAESALPINIOIDEAE <i>Eperua falcata</i> <i>E. jenmanii</i> <i>Bahinia kunthiana</i> <i>Swartzia leiocalycina</i> <i>S. jenmanii</i> <i>Mora exelsa</i> <i>M. gongrijpii</i> Unknown A	Soft Wallaba Ituri Wallaba Turtle Ladder Wamara Parakusan Mora Morabukea
CHRYSOBALANACEAE <i>Liana laxiflora</i> <i>L. alba</i> <i>L. heteromorpha</i> <i>L. densiflora</i> <i>L. spp.</i> <i>Couepia exflexa</i> <i>Parinari campestris</i>	Kauta Kantaballi Kairiballi Marishiballi Counta (er) Aruadan Burada	CONVOLVULACEAE <i>Maripa scandens</i>	Monkey Syrup
CELASTRACEAE <i>Goupia glabra</i>	Kabukalli	CYCLANTHACEAE <i>Thoracocarpus bissectus</i>	Memuri
COMBRETACEAE <i>Terminalia dichotoma</i> <i>T. amazonia</i>	Coffee mortar	COMPOSITAE <i>Mikania hookeriana</i>	Bitter Tally
DILLIENIACEAE <i>Davilla alata</i> <i>Tetracera aspera</i>	Kapadulla Fire rope	DICHAPETALACEAE <i>Tapura guianensis</i>	Waiaballi
EUPHORBIACEAE <i>Chaetocarpus stipularis</i> <i>Mabea piriri</i>	Ruri Baririkuti	EBENACEAE <i>Diospyros guianensis</i>	Barabara

<i>Casearia arguta</i> <i>Hyeronima alchorneoides</i>	Shibidan Surudan		
FLACOURTIACEAE <i>Casearia arguta</i>	Shibidan		
GUTTIFERAE <i>Tovomita spp.</i> <i>T. obovata</i> <i>Vismia cayennensis</i> <i>Clusia fockeana</i> <i>Symphonia globulifera</i>	Wild mang(r)o Wild mang(r)o Bloodwood Kufu Manni	HAEMODORACEAE <i>Heteropsis flexuosa</i>	Nibi
LECYTHIDACEAE <i>Eschweilera sagotiana</i> <i>E. alata</i> <i>E. wachenheimii</i> <i>Lecythis zabuca</i> <i>Couratari guianensis</i>	B. Kakaralli Kakaralli Kakaralli (Fine L) Monkey pot Wadata	LOGANIACEAE <i>Strychnos guianensis</i>	Devil doer
LAURACEAE <i>Aniba hypoglauca</i> <i>A. jenmanii</i>	Gale Silverballi Kereti	MYRTACEAE <i>Myrcaria ibibianaro</i> <i>Marlierea montana</i>	Wild Guava Kwako
MARCGRAVIACEAE <i>Souroubea guianensis</i>	Kamkara	MARANTACEAE <i>Ischnosiphon gracilis</i> <i>I. obliquus</i> <u><i>I. sp.</i></u>	Warakabakoromukru Mukru Itiriti
MORACEAE <i>Cecropia angulata</i> <i>Brosimum guianensis</i>	Congo Pump Snake wood	MALPIGHIACEAE <i>Byrsonima aerugo</i> <i>Byrsonima sp.</i>	Arikadako Hittia
MIMOSOIDEAE <i>Inga alba</i> <i>I. rubiginosa</i> <i>I. edulis</i> <i>Pentaclethra macrolpha</i> <i>Pterocarpus officinalis</i>	Warakosa Warakosa Warakosa Trysil Corkwood	MELASTOMATACEAE <i>Meriania urceolata</i> <i>Mouriri sagotiana</i> <i>Miconia hypoleuca</i> <i>Miconia guianensis</i>	B.leave Waraia Manuriballi Wakaradan Waraia
MELIACEAE <i>Trichilia sp.</i>	Yuriballi	MENISPERMACEAE <i>Curarea candicans</i>	Granny back bone
MONIMIACEAE <i>Siparuna guianensis</i>	Ant bush	ORCHIDACEAE <i>Vanilla sp.</i>	Orchid
PAPILIONOIDEAE <i>Alexa imperatris</i> Unknown A <i>Clathrotropis macrocarpa</i> <i>Derris pterocarpa</i> <i>Swartzia jenmanii</i> <i>Tetragastris altissima</i> <i>Swartzia leiocalycina</i> <i>Pterocarpus officinalis</i> <i>Machaerium lunatum</i>	Haiariballi Aromata Red belly liana Parakusan Haiawaballi Wamara Corkwood Bunduri pimpla	PROTEACEAE <i>Panopsis sessilifolia</i>	Idaballi
PALMAE <i>Geonoma baculifera</i> <i>Oenocarpus bacaba</i> <i>Euterpe oleracea</i> <i>Desmoncus orthacanthos</i>	Dalbana Lu Manicole Kamwari	QUIINACEAE <i>Coupia guianensis</i> <i>Touroulia guianensis</i> <i>Quiina guianensis</i>	Aruadan Fern Okokonshi

<i>Jessenia bataua</i> <i>Bactris humilis</i> <i>Desmoncus guianensis</i> <i>Geonoma acaualis</i> <i>Atalea regia</i>	Turu Yuruwe Hold-me-back Dhalebana aka Whale bone Kokorite Palm		
RUBIACEAE <i>Psychotria poeppigiana</i>	Soldier's cap	SAPOTACEAE <i>Pouteria guianensis</i> <i>P. dura</i> <i>Ichthyophora elegans</i> <i>P. minutiflora</i> <i>Chrysophyllum pomiferum</i> <i>Pouteria cuspidata</i>	Asepoko Kokoritaballi Kokoritaballi Moraballi Paripiballi Kokoritaballi
SAPINDACEAE <i>Matayba opaca</i> <i>Talisia squarrosa</i>	Kulishiri Moroballi	STERCULIACEAE <i>Sterculia rugosa</i>	Maho
SMILACACEAE <i>Smilax schomburgkiana</i>	Dorokwaro pimpla	TILIACEAE <i>Apeiba echinata</i>	Duru
ULMACEAE <i>Trema guianensis</i>	Kwabuyakoro	VIOLACEAE <i>Paypayrola longifolia</i>	Adebero
VERBENACEAE <i>Protium heptaphyllum</i> <i>P. subserratum</i> <i>P. decaadrum</i>	Haiawa Haiawa Hurokai	ZINGERBEIACEAE <i>Renealmea floribunda</i>	Kuruati

Table 27. Summary of Flora Present in Golden Mile

ANACARDIACEAE	COMBRETACEAE	MIMOSOIDEAE
Duka <i>Tapirira obtusa</i>	Fukadi <i>Terminalia amazonia</i>	Hurasa <i>Pithecellobium</i> sp.
Sand Mora <i>Thyrosodium guianense</i>	CYCLANTHACEAE	Maporicon <i>Inga alba</i>
ANNONACEAE	Mamuri <i>Thoracocarpus bissectus</i>	Trysil <i>Pantaclethra macroloba</i>
B. Yari Yari <i>Unonoposi glaucope</i>	DICHAPETALACEAE	Warakosa <i>I. lateriflora</i>
W. Yari Yari <i>Duguettia pycnasteria</i>	Waiaballi <i>Tapura guianensis</i>	Warakusi <i>I. pezzifera</i>
Yarri Yarri <i>D. neglecta</i>	DILLIENIACEAE	MORACEAE
APOCYNACEAE	Kapaduli <i>Tetracera</i> sp.	Conga Pump <i>Cecropia peltata</i>
Dukali <i>Parabancomia fasciculata</i>	EBENACEAE	Cow wood <i>Bassa guianensis</i>
Shibadan <i>Aspidosperma cruentum</i>	Bara Bara <i>Diospyros ierensis</i>	MYRISTICACEAE
Yarola <i>A. excelsum</i>	EUPHORBIACEAE	Dalli <i>Viola elongata</i>
ARACEAE	Hachiballi <i>Pera schomburgkiana</i>	Kirkaua <i>Irianthera lancifolia</i>
Hanakawblar <i>Philodendron grandiflora</i>	Suradan <i>Hyeronima alchmeoides</i>	PALMAE
Nibi <i>Heteropsis flexuosa</i>	Ulu <i>Chaetocarpus schomburgkianus</i>	Kokorit <i>Maximiliana maripa</i>
ARALIACEAE	FLACOURTIACEAE	Manicole <i>Euterpe precatoria</i>
Karaboro <i>Schefflera morototoni</i>	Warakairo <i>Laetia procera</i>	Turu <i>Jessinia bataua</i>
ARISTOLOCHIACEAE	GUTTIFERAE	PAPILIONOIDAE
Boyari <i>Aristolochia daemoninoxia</i>	Asashi <i>Rhedia benthamiana</i>	Aromata <i>Clathrotropis brachispetala</i>
BIGNONIACEAE	Awasakuli <i>Tovomita brevistamina</i>	Barakaro <i>Ormosia coaritata</i>
Bultatakubia <i>Schlegelia violacea</i>	Awasakuli <i>T. cephalostigma</i>	Corkwood <i>Pterocarpus officinalis</i>
Futui <i>Jacaranda copaia</i>	Bloodwood <i>Vismia macrophylla</i>	Hairiballi <i>Alexa imperatricis</i>
BOMBACACEAE	Kufu <i>Clusia grandiflora</i>	Karokororo <i>O. coutinhoi</i>
Baromalli <i>Catostemma commune</i>	Manni <i>Symphonia globulifera</i>	Parakusan <i>Swartzia jenmanii</i>

Kamakuti <i>Bombax flaviflorum</i>	Manballi <i>Moronobes occinia</i>	Wamara <i>S.leicoalcina</i>
BURSERACEAE	HUMIRIACEAE	QUIINACEAE
Ariwau <i>Protium decandrum</i>	Dukuria <i>Sacoglottis guianensis</i>	Kairiballi <i>Quiina guianensis</i>
Haiawa <i>P. unifoliatum</i>	LAURACEAE	RUBIACEAE
Haiawaballi <i>Tetragastris altissima</i>	Baradan <i>Ocotea tomentella</i>	Kamaramara <i>Amaloua guianensis</i>
Kurokai <i>P. decandrum</i>	Buck Vomit <i>O. splendens</i>	SAPINOACEAE
Ulu <i>Trattinnickia rhoifolia</i>	Kereti <i>O. oblonga</i>	Kulishiri <i>Matayba opaca</i>
CAESALPIONOIDEAE	Silverballi <i>Lauraceae sp.</i>	Sand Mora <i>Talisia equarrosa</i>
Ituri Walaba <i>Eperua jenmanii</i>	Y. Silverballi <i>Aniba hypoglauc</i>	SAPOTACEAE
Kaditeri <i>Schlerobolium guianense</i>	LECYTHIDACEAE	▪ Animora kushi <i>Pouteria coriacea</i>
▪ Locust <i>Hymenaea courbaril</i>	▪ B. Kataballi <i>Escheweilera decolorans</i>	▪ Asepoko <i>P. guianensis</i>
▪ Monkey Ladder <i>Bauhinia guianensis</i>	▪ G. Kakaralli <i>E. alata</i>	▪ Barataballi <i>Ecclinusa sanguinolenta</i>
▪ Mora <i>Mora excelsa</i>	▪ Monkey Pot <i>Lecythis zabucajo</i>	▪ Kokoritaballi <i>P. cuspidata</i>
▪ Morabukea <i>M. gonggripii</i>	▪ Wamara <i>Couratari gloriosa</i>	▪ Lemonaballi <i>Chrysophyllum pomiferum</i>
▪ Purpleheart <i>Peltogyne venosa</i>	▪ W. Kakaralli <i>L. corrugata</i>	▪ SIMAROUBACEAE
▪ Soft Walaba <i>E. falcata</i>	▪ LOGANIACEAE	▪ Simarupa <i>Quassia simarouba</i>
▪ CELASTRACEAE	▪ Devil doer <i>Strychnos sp.</i>	▪ STERCULIACEAE
▪ Kabukalli <i>Goupia glabra</i>	▪ MALPIGHIACEAE	▪ Maho <i>Sterculia rugosa</i>
▪ Ruri <i>G. glabra</i>	▪ Arikudako <i>Byrsonima aerugo</i>	▪ TILLIACEAE
▪ CHRYSOBALANACEAE	▪ MELASTOMATACEAE	▪ Duru <i>Apeiba petoumo</i>
▪ Baruda <i>Parinari rodolphii</i>	▪ Bird Seed <i>Miconia pubicalyx</i>	▪ Koychiballi <i>Lueheopsis rugosa</i>
▪ Huruasa <i>Licania heteromorpha</i>	▪ Giggernet <i>Loreya mespiloides</i>	▪ VIOLACEAE
▪ Kairiballi <i>L. heteromorpha</i>	▪ MELIACEAE	▪ Adiberu <i>Paypayrola longifolia</i>
▪ Kauta <i>L.laxiflora</i>	▪ Crabwood <i>Carapa guianensis</i>	
Kautaballi <i>L. alba</i>	MENISPERMACEAE	
	Granny Backbone <i>Curarea mendicans</i>	

Table 28. Summary of Mammals Present in the Concession Area

MAMMALS	COMMON NAME	MAMMALS	COMMON NAME
AGOUTIDAE		HYDROCHOERIDAE	
<i>Agouti paca</i>	Paca or Labba	<i>Hydrochoeris hydrochaeris</i>	Capybara
CEBIDAE		MEGALONYCHIDAE	
<i>Alouatta seniculus</i>	Red Howler Monkey	<i>Choloepus didactylus</i>	Southern Two-toed Sloth
<i>Ateles paniscus</i>	Guiana Spider Monkey	MYRMECOPHAGIDAE	
<i>Cebus olivaceus</i>	Weeper Capuchin Monkey	<i>Mymecophaga tridactyla</i>	Giant Anteater
<i>Saimiri sciureus</i>	South American	<i>Tamandua tetradactyla</i>	Tamandua

	Squirrel Monkey		
<i>Cebus sp.</i>	Capuchin Monkey	MUSTELIDAE	
CERVIDAE		<i>Pteronura brasiliensis</i>	Giant Otter
<i>Odocoileus virginianus</i>	White-tailed Deer	PHYLLOSTOMIDAE	
<i>Mazama americana</i>	Red Brocket Deer	<i>Artibeus sp.</i>	Leaf-nosed Bat
<i>Mazama gouazoubira</i>	Grey Brocket Deer	<i>Glossophaga sp.</i>	Leaf-nosed Bat
DASYPODIDAE		PROCYONIDAE	
<i>Dasypus novemcinctus</i>	Nine-banded Armadillo	<i>Nasua nasua</i>	Coati
DASYPROCTIDAE		TAPIRIDAE	
<i>Dasyprocta leporina</i>	Red-rumped Agouti	<i>Tapirus terrestris</i>	Lowland Tapir
DIDELPHIDAE		TAYASSUIDAE	
<i>Didelphis marsupialis</i>	Common Opossum; Yawari	<i>Pecari tajacu</i>	Collared Peccary
FELIDAE		<i>Tayassu pecari</i>	White-lipped Peccary
<i>Panthera onca</i>	Jaguar		
<i>Leopardus pardalis</i>	Ocelot		
<i>Leopardus tigrinus</i>	Oncilla		
<i>Leopardus wiedii</i>	Margay		

Table 29. Invertebrates Present in Concession Area

GROUP	COMMON NAME	GROUP	COMMON NAME
Araneae	Spiders	Hymenoptera	Bees
Blattodea	Cockroaches	Lepidoptera	Butterflies and Moths
Coleoptera	Beetles	Odonata	Dragonflies
Decapoda	Land crabs	Orthoptera	Grasshoppers; crickets
Diplura	Diplurans	Pharmatoptera	Walking Sticks
Haplotaxida	Earthworms	Scorpiones	Scorpions
Hemiptera	Bugs; Water striders		
Chilopoda	Centipedes	Diplopoda	Millipedes

Table 30. Summary of Amphibians in Concession Area

FAMILY / SCIENTIFIC NAME	COMMON NAME
BUFONIDAE	
<i>Rhinella marina</i>	Marine Toad or Crapo
<i>Bufo</i> sp.	Toad or Crapo
<i>Bufo</i> cf. <i>Typhonius</i> sp.	Toad or Crapo
AROMOBATIDAE	
<i>Allobates femoralis</i>	Brilliant-thighed Poison frog
HYLIDAE	
<i>Scinax</i> cf. <i>ruber</i>	Tree frog
<i>Hypsiboas boans</i>	Giant Gladiator Tree Frog
<i>Dendropsophus</i> cf. <i>marmoratus</i>	Tree frog
LEPTODACTYLIDAE	
<i>Leptodactylus lineatus</i>	Gold-striped Frog
<i>Leptodactylus</i> sp..	
PIPIDAE	
<i>Pipa</i> sp.	Surinam Toad
RANIDAE	
<i>Lithobates palmipes</i>	Amazon River Frog

Table 31. Summary of Reptiles in Concession Area

FAMILY / SCIENTIFIC NAME	COMMON NAME
ALLIGATORIDAE	
<i>Caiman crocodilus</i>	Spectacled Caiman; alligator
<i>Paleosuchus palpebrosus</i>	Cuvier's Dwarf Caiman
<i>Melanosuchus niger</i>	Black Caiman
AMPHISBAENIDAE	
<i>Amphisbaenia fuliginosa</i>	Worm lizard
ANILIIDAE	
<i>Anilus scytale</i>	False Coral Snake or Red Pipe Snake
BOIDAE	
<i>Corallus hortulanus</i>	Amazon Tree Boa
<i>Epicrates cenchria</i>	Rainbow Boa
<i>Boa constrictor</i>	Land Boa
<i>Eunectes murinus</i>	Anaconda or Water Boa
<i>Corallus caninus</i>	Emerald Tree Boa
COLUBRIDAE	
<i>Chironius</i> sp.	
<i>Dipsas</i> sp.	
<i>Imantodes</i> cf. <i>cenchoa</i>	
<i>Imantodes</i> sp.	
<i>Liophis</i> sp.	
Unidentified sp.	
ELAPIDAE	
<i>Micrurus surinamensis</i>	Coral Snake or Himurali
GYMNOPHTHALMIDAE	
<i>Gymnophthalmus underwoodi</i>	Skink
IGUANIDAE	
<i>Iguana iguana</i>	Iguana

PELOMEDUSIDAE	
<i>Podocnemis sp.</i>	River turtle
POLYCHROTIDAE	
<i>Anolis sp.</i>	Anole
<i>Norops cf. nitens</i>	Anole
<i>Cf. Norops</i>	Anole
TEIIDAE	
<i>Ameiva ameiva</i>	
<i>Cnemidophorus lemniscatus</i>	
<i>Cnemidophorus sp.</i>	
<i>Kentropyx cf. borckiana</i>	
<i>Kentropyx cf. calcarata</i>	
<i>Tupinambis teguixin</i>	Salipenter
TESTUDINAE	
<i>Geochelone carbonaria</i>	Red-footed Tortoise
<i>Geochelone denticulata</i>	Yellow-footed Tortoise
TROPIDURIDAE	
<i>Plica plica</i>	Plica
<i>Uranoscodon superciliosus</i>	Tree Climber
VIPERIDAE	
<i>Bothrops atrox</i>	Labaria or Fer-de-Lance
<i>Bothriopsis sp.</i>	Green labaria
<i>Lachesis muta</i>	Bushmaster

Table 32. Summary of Birds Encountered in Concession Area

FAMILY / SCIENTIFIC NAME	COMMON NAME	FAMILY / SCIENTIFIC NAME	COMMON NAME
ALCEDINIDAE		RAMPHASTIDAE	
<i>Chloroceryle amazona</i>	Amazon Kingfisher	<i>Ramphastos tucanus</i>	Red-billed Toucan
ANHIMIDAE		<i>Pteroglossus aracari</i>	Black-necked Aracari
<i>Anhima cornuta</i>	Horned Screamer	<i>Ramphastos vitellinus</i>	Channel-billed Toucan
ANHINGIDAE		SCOLOPACIDAE	
<i>Anhinga anhinga</i>	Anhinga	<i>Tringa solitaria</i>	Solitary Sandpiper
ARDEIDAE		THAMNOPHILIDAE	
<i>Florida caerulea</i>	Little Blue Heron	<i>Hylophylax naevia</i>	Spotted-back Antbird
<i>Tigrisoma lineatum</i>	Rufescent Tiger-Heron	<i>Thamnomanes caesius</i>	Cinereus Antshrike
<i>Butorides striata</i>	Striated Heron	<i>Sclateria naevia</i>	Silvered Antbird
CICONIIDAE		<i>Cercomacra tyrannina</i>	Dusky Antbird
<i>Mycteria americana</i>	Wood Stork	<i>Thamnophilus aethions</i>	White-shouldered Antshrike
COLUMBIDAE		<i>Pithys albifrons</i>	White-plumed Antbird
<i>Patagioenas subvinacea</i>	Ruddy Pigeon	THRAUPIDAE	
COTINGIDAE		<i>Ramphocelus carbo</i>	Silver-beaked Tanager
<i>Lipaugus vociferans</i>	Screaming Piha	<i>Paroaria gularis</i>	Red-capped Cardinal
CRACIDAE		<i>Thraupis episcopus</i>	Blue-grey Tanager
<i>Crax alector</i>	Black Curassow	<i>Thraupis palmarum</i>	Palm Tanager
CUCULIDAE		TINAMIDAE	
<i>Piaya cayana</i>	Squirrel cuckoo	<i>Tinamus major</i>	Great Tinamou

EURYPYGIDAE		<i>Crypturcellus soui</i>	Little Tinamou
<i>Eurypyga helias</i>	Sun bittern	TROCHILIDAE	
FALCONIDAE		<i>Amazilia chionopectus</i>	White-crested Emerald
<i>Ibycter americanus</i>	Red-throated Caracara	<i>Amazilia sp.</i>	Hummingbird
ICTERIDAE		TYRANNIDAE	
<i>Psarocolius decumanus</i>	Crested Oropendola	<i>Pitagus sulphuratus</i>	Great Kiskadee
<i>Quiscalus lugubris</i>	Carib Grackle	<i>Tyrannus melancholicus</i>	Tropical Kingbird
<i>Cacicus cela</i>	Yellow-rumped Cacique	<i>Philophydor lector</i>	Lesser Kiskadee
<i>Icterus nigrogularis</i>	Yellow Oriole	<i>Fluvicola pica</i>	Pied Water-t Tyrant
PICIDAE			
<i>Celeus torquatus</i>	Ringed Woodpecker		
<i>Dryocopus lineatus</i>	Lineated Woodpecker		
Unidentified sp.	Woodpecker		
<i>Campephilus melanoleucos</i>	Crimson-crested Woodpecker		
PSOPHIDAE			
<i>Psophia crepitans</i>	Grey-winged Trumpeter		
PSITTACIDAE			
<i>Amazona sp.</i>	Parrot		
<i>Ara ararauna</i>	Blue-and-yellow Macaw		
<i>Ara chloropterus</i>	Red-and-green Macaw		
<i>Ara sp.</i>	Macaw		
<i>Aratinga solstitialis</i>	Sun Parakeet		
<i>Pionopsitta caica</i>	Caica Parrot		
<i>Pionus fuscus</i>	Dusky Parrot		
<i>Pionites melanocephala</i>	Black headed Parrot		
<i>Amazona ochrocephala</i>	Yellow-crowned Parrot		
<i>Amazona farinosa</i>	Mealy Parrot		
<i>Derophtys accipitinus</i>	Red-fan Parrot		

Table 33. Fauna Present in Golden Mile Area

FAMILY / SCIENTIFIC NAME	COMMON NAME	FAMILY / SCIENTIFIC NAME	COMMON NAME
AMPHIBIANS			
BUFONIDAE		TEIIDAE	
<i>Rhinella marina</i>	Marine toad or Crapo	<i>Tupinambis teguixin</i>	Salipenta
AROMOBATIDAE		TESTUDINAE	
<i>Allobates femoralis</i>	Brilliant-thighed Poison Frog	<i>Geochelone denticulata</i>	Yellow-footed Tortoise
HYLIDAE		TROPIDURIDAE	
<i>Dendropsophus cf. marmoratus</i>	Tree Frog	<i>Plica umbra</i>	Tree Lizard
Hylidae sp.	Tree Frog	VIPERIDAE	
BIRDS		<i>Bothriopsis bilineata</i>	Parrot snake
ACCIPITRIDAE		MAMMALS	

<i>Buteogallus anthracinus</i>	Common Black Hawk	AGOUTIDAE	
ARDEIDAE		<i>Agouti paca</i>	Paca or Labba
<i>Egretta rufescens</i>	Reddish Egret	CEBIDAE	
DENDROCOLAPTIDAE		<i>Alouatta seniculus</i>	Red Howler Monkey
<i>Deconychura longicanda</i>	Long-tailed Woodcreeper	ECHYMYIDAE	
<i>Sittasomus griseicapillus</i>	Olivaceous Woodcreeper	<i>Proechimys</i> sp.	Spiny Rat
<i>Glyphorhynchus spirurus</i>	Wedge-billed Woodcreeper	FELIDAE	
HIRUNDINIDAE		<i>Panthera onca</i>	Jaguar
<i>Atticora melanolenca</i>	Black-collared Swallow	PHYLLOSTOMIDAE	
PICIDAE		<i>Glossophago</i> sp.	Leaf-nosed bat
<i>Dryocopus lineatus</i>	Lineated Woodpecker	INVERTEBRATES	
PIPRIDAE		Aranae	Spider
<i>Manacus manacus</i>	White-headed Manakin	Blattodea	Cockroach
<i>Pipra erythrocephola</i>	Golden-headed Manakin	Coleoptera	Click Beetle (<i>Pyriphorus</i> sp.)
PSITTACIDAE		Decapoda	Crab (<i>Uca</i> sp.)
<i>Amazona farinosa</i>	Mealey Parrot	Dermaptera	Silver fish
<i>Aratinga pertinax</i>	Brown-throated Parakeet	Diplura	Two tailed insect
RAMPHASTIDAE		Diptera	Flies
<i>Ramphastos</i> sp.	Toucan		Mosquitoes (<i>Anopheles</i> sp.)
THAMNOPHILIDAE		Haplotaxida	Earthworm
<i>Thamnophilus aethiops</i>	White-shouldered Antbird	Hemiptera	Bush bug (<i>Nazera</i> sp.)
<i>Pithys albifrons</i>	White-plumed Antbird		Bugs
<i>Sclateria naevia</i>	Silvered Antbird	Hymenoptera	Acoushi anta (<i>Atta sexdens</i>)
TINAMIDAE			Wasp (<i>Polistes</i> sp.)
<i>Tinnamus tao</i>	Gray Tinamou		Bumble bee (<i>Xylocopa</i> sp.)
TROCHILIDAE			Red ants
<i>Campylopterus largipennis</i>	Grey-breasted Sabrewing	Isoptera	Termites
<i>Phaethornis rupurumii</i>	Streak-throated Hermit	Lepidoptera	Butterflies (<i>Morpho</i> sp.)
TYRANNIDAE			Monarch
<i>Pitangus sulphuratus</i>	Great Kiskadee		Yellow
<i>Ornithion brunneicapillus</i>	Brown-capped Tyrannulet		Moths
<i>Conopius einchonetti</i>	Yellow-throated Flycatcher	Mantodea	Praying Mantis
REPTILES		Odonata	Dragon flies
AMPHISBAENIDAE		Orthoptera	Cricket (<i>Pyrophorus</i> sp.)
<i>Amphisbaena</i> sp.	Worm Lizard		Grass-hopper (<i>Ophullela</i> sp.)
ANILIIDAE		Scorpiones	Scorpions
<i>Anilius scytale</i>	False Coral Snake or Red Pipe Snake	Annelida	Earthworms (<i>Pheretima</i> sp.)
COLUBRIDAE		Chilopoda	Centipedes

<i>Dipsas</i> sp.	Snake	Diplopoda	Millipedes
IGUANIDAE		Mollusca	Snails (<i>Pomacea</i>)
<i>Iguana iguana</i>	Iguana		

October 2006 Survey Findings
Table 34. Summary of Flora Recorded in Concession Area

FAMILY /SCIENTIFIC NAME	COMMON NAME	FAMILY / SCIENTIFIC NAME	COMMON NAME
ANACARDIACEAE		GUTTIFERAE	
<i>Tapirira marchandii</i>	Duka	<i>Rheedia acuminata</i>	Asashi
<i>T. abusa</i>	"	<i>Tovomita albiflora</i>	Awesakuli
ANNONACEAE		<i>T. brevistaminea</i>	"
<i>Annona symphyocarpa</i>	Duru	<i>T. cephalostigma</i>	"
<i>Guatteria sandwithii</i>	Arara	<i>T. grata</i>	"
<i>G. flexilis</i>	"	<i>T. obscura</i>	"
<i>Unonopsis glaucopetala</i>	"	<i>Vismia guianensis</i>	Blood Wood
<i>Anaxogorea acuminata</i>	Kurihikoyoko	<i>Clusia amazonica</i>	Kufa
<i>Duguetia pycnastera</i>	W. Yari Yari	<i>C. grandiflora</i>	"
<i>D. calcina</i>	"	<i>C. jenmanii</i>	"
<i>D. guianensis</i>	Yari Yari	<i>C. palmicida</i>	"
<i>Unopsis glaucopetala</i>	"	LAURACEAE	
APOCYNACEAE		<i>Ocotea tomentella</i>	Boradan
<i>Tabernaemontana undulata</i>	Dog Seed	<i>O. oblonga</i>	Kereti
<i>Parahancornia fasciculata</i>	Dukali	<i>O. wachenheimii</i>	"
<i>Aspidosperma cruentum</i>	Shibadan	LECYTHIDACEAE	
<i>A. excelsum</i>	"	<i>Eschweilera sagotina</i>	B. Kakaralli
<i>A. maregravianum</i>	Yarola	<i>E. coriacea</i>	"
<i>A. excelsum</i>	Yaruru	<i>E. alata</i>	G. Kakaralli
<i>A. album</i>	"	<i>Lecythis zabucaya</i>	Monkey Pot
<i>A. luadum</i>	"	<i>Couratari calycina</i>	Wadara
ARACEAE		<i>C. gloriosa</i>	"
<i>Monstera adansonii</i>	Hanaquablar	LOGANIACEAE	
<i>Hetropsis flexuosa</i>	Nibi	<i>Strychnos guianensis</i>	Devil doer
<i>H. jenmanii</i>	"	MALPIGHIACEAE	
ARALIACEAE		<i>Byrsonima spicata</i>	Hichia
<i>Schefflera decaphylla</i>	Karahoro	MARANTACEAE	
<i>S. morototoni</i>	"	<i>Ischnosiphon arouma</i>	Mukru
BIGNONIACEAE		<i>I. variabilis</i>	"
<i>Schlegelia vicincia</i>	Bultatakobia	MELASTOMATACEAE	
<i>Jacaranda copaia</i>	Futui	<i>Miconia guianensis</i>	Waria
BOMBACACEAE		MELIACEAE	
<i>Catostemma commune</i>	Baromalli	<i>Carapa guianensis</i>	Crabwood
<i>Ceiba pentandra</i>	Silk Cotton	MIMOSOIDAE	
BORAGINACEAE		<i>Aberema jupunba</i>	Huruasa
<i>Cordia nodosa</i>	Ants Bush	<i>Penthacletra macroloba</i>	Trysil
<i>C. sericalyx</i>	Clammy Cherry	<i>Inga alba</i>	Maporokon
<i>C. bicolor</i>	Table Tree	<i>I. capitata</i>	Warkosa
BURSERACEAE		<i>I. edulis</i>	"
<i>Tetragastris altissima</i>	Haiawaballi	<i>I. melinonis</i>	"
<i>Protium guianense</i>	Hawaia	<i>I. pezizifera</i>	"
<i>P. decandrum</i>	Kerikua	MORACEAE	
<i>P. crenatum</i>	Kurakai	<i>Cecropia peltata</i>	Conga pump
<i>P. decandrum</i>	"	<i>C. sciadophylla</i>	"

<i>P. heptaphyllum</i>	“	<i>Bagassa guianensis</i>	Cow wood
<i>Trattinnickia demerarae</i>	Ulu	MYRISTICACEAE	
<i>T. rhoifolia</i>	“	<i>Virola michelli</i>	Kerikaua
		<i>V. surinamensis</i>	Swamo dalli
CAESALPINIOIDAE		MYRTACEAE	
<i>Eperua gradiflora</i>	Ituri Walaba	<i>Iryanthera lanciflora</i>	Kirikaua
<i>Sclerolobium micropetalum</i>	Kadiri	<i>Marlra montana</i>	Kwako
<i>Hymenaea courbaril</i>	Locust	PALMAE	
<i>Bauhinia suranensis</i>	Monkey Ladder	<i>Geonoma acualis</i>	Dhalebana
<i>Mora excelsa</i>	Mora	<i>G. baculifera</i>	“
<i>M. gongrijpii</i>	Morabukea	<i>Desmoncus orthacanthos</i>	Hold-me-back
<i>Brownea latifolia</i>	Rose of the Mountain	<i>D. orthacanthos</i>	Kamwari
<i>E. falcata</i>	Soft walaba	<i>D. polyacanthos</i>	Monkey ladder
<i>Bauhinia kunthiana</i>	Turtle Ladder	<i>Maxmiliania maxima</i>	Kokorit
<i>B. guianensis</i>	Turtle step	<i>Euterpe oleracea</i>	Mancole
CELASTRACEAE		<i>E. precatoria</i>	“
<i>Goupia glabra</i>	Kabukalli	<i>Bactris acaulis</i>	Pimpla
CHRYSOBALANCEAE		<i>B. brongniarii</i>	“
<i>Licania heteromorpha</i>	Kairiballi	<i>B. humilis</i>	“
<i>L. laxifolia</i>	Kauta	<i>B. varbilis</i>	Turu
<i>L. guianensis</i>	“	<i>Jessenia bataua</i>	“
<i>L. alba</i>	Kautaballi	PAPILIONOIDAE	
<i>L. incania</i>	Marishiballi	<i>Clathrotropis brachypetala</i>	Aromata
<i>L. boyanii</i>	“	<i>C. macrocarpa</i>	“
<i>L. densifolia</i>	“	<i>Pterocarpus officinalis</i>	Corkwood
<i>L. heteromorpha</i>	Unikaiakaia	<i>Alexa imperatricis</i>	Hairariballi
COMBRETACEAE		<i>Pterocarpus rohrii</i>	H. Corkwood
<i>Buchenavia fanshawei</i>	Fukadi	<i>Swartzia leiocalycina</i>	Manni
<i>Terminalia amazonica</i>	“	<i>S. jenmanii</i>	Parakusan
<i>T. dichotoma</i>	Swamp Fukadi	<i>S. kunthiana</i>	“
CYCLANTHACEAE		<i>S. leiocalycina</i>	Wamara
<i>Thoracocarpus bissectus</i>	Mamuri	POACEAE	
<i>T. bissectus</i>	Scraping nibi	<i>Olyra longifolia</i>	S. Bamboo
<i>Aspiandia gleasonii</i>	S. nibi	QUIINACEAE	
CYPERACEAE		<i>Quiina guianensis</i>	Okokonshi
<i>Scleria secans</i>	Razor grass	RUBIACEAE	
DICHAPETALACEAE		<i>Duroia eriopila</i>	Kumaramara
<i>Tapura guianensis</i>	Adebero	SAPINDACEAE	
<i>T. guianensis</i>	Waiaballi	<i>Matayba camptoneura</i>	Kulisheri
DILLENIAACEAE		<i>M. aborensis</i>	“
<i>Davilla kunthii</i>	Fire Rope	<i>Talisia squarrosa</i>	Moroballi
<i>D. alata</i>	Kapadulla	SAPOTACEAE	
<i>Tetracera volubilis</i>	“	<i>Pouteria cladantha</i>	Aimorakushi
DRYOPTERIDACEAE		<i>P. durlandi</i>	Asepoko
<i>Polybtrya caudate</i>	Fern	<i>P. guianensis</i>	“
ELAEOCARPACEAE		<i>P. filipes</i>	Kamahora
<i>Slonea guianensis</i>	Aruadan	<i>P. cuspidata</i>	Kokoritaballi
<i>S. guianensis</i>	Parakusan	<i>P. reticulata</i>	“
EUPHORBIACEAE		<i>Chrysophyllum pomiferum</i>	Limonaballi

<i>Mabea piriri</i>	Baririkuti	SIMAROUBACEAE	
<i>Glycydendron amazonicum</i>	Devil doer	<i>Quassia amara</i>	Quashi bitters
<i>Chaetocarpus stipularis</i>	Kuri	STERCULIACEAE	
<i>Hyeronima alchorneoides</i>	Suradan	<i>Sterculia rugosa</i>	Maho
FLACOURTIACEAE		ULMACEAE	
<i>Laetia procera</i>	Warakaioero	<i>Ampelocera edentula</i>	Adabadan
		VERBENACEAE	
		<i>Vitex compressa</i>	Hakiaballi
		<i>V. compressa</i>	W. Cakabash
		<i>V. stahelli</i>	"
		VIOLACEAE	
		<i>Paypayrola longifolia</i>	Adeberu
		VOCHYSIACEAE	
		<i>Vochycia surinamensis</i>	Iteballi

Table 35. Summary of Flora Present in Golden Mile

FAMILY / SCIENTIFIC NAME	COMMON NAME	FAMILY / SCIENTIFIC NAME	COMMON NAME
ANNONACEAE		MARANTACEAE	
<i>Anaxagoraea acuminata</i>	Hurihikoyoko	<i>Ischmosiphon arouma</i>	Mukru
<i>Duguetia pycnastera</i>	W. Yari Yari	<i>I. variabilis</i>	"
<i>D. calcyna</i>	"	MELASTOMATACEAE	
<i>D. guianensis</i>	Yari Yari	<i>Miconia guianensis</i>	Waria
<i>Unonopsis glaucopetala</i>	"	MELIACEAE	
APOCYNACEAE		<i>Carapa guianensis</i>	Crabwood
<i>Tabernaemontana undulata</i>	Dog Seed	MIMOSOIDAE	
ARACEAE		<i>Inga alba</i>	Maporokon
<i>Heteropsis flexuosa</i>	Nibi	<i>I. edulis</i>	Warakosa
BIGNONACEAE		<i>I. pezizifera</i>	"
<i>Jacaranda copaia</i>	Futui	<i>Pentaclethra macroloba</i>	Trysil
BOMBACACEAE		MORACEAE	
<i>Catostemma commune</i>	Baromalli	<i>Cecropia peltata</i>	Conga Pump
BORAGINACEAE		<i>C. seradophylla</i>	"
<i>Cordia nodosa</i>	Ants Bush	MYRTACEAE	
BURSERACEAE		<i>Iryanthera lanciflora</i>	Kirikaua
<i>Protium guianense</i>	Hawaia	<i>Marirera Montana</i>	Kwako
CAESALPINOIDAE		PALMAE	
<i>Sclerolobium micropetalum</i>	Kadiri	<i>Geonoma baculifera</i>	Dalibana
<i>Bauhinia guianensis</i>	Monkey ladder	<i>Desmoncus orthacanthos</i>	Kamwari
<i>B. alata</i>	"	<i>Eutrpe oleracea</i>	Manicole
<i>Mora excels</i>	Mora	<i>Bactris brongniarii</i>	Pimpla
<i>Brownea latifolia</i>	Rose of the Mountain	PAPILIONOIDAE	
<i>Eperua falcate</i>	Soft Walaba	<i>Clathrotropis macrocarpa</i>	Aromata
<i>B. kunthiana</i>	Turtle ladder	<i>Pterocarpus officinalis</i>	Corkwood
DICHAPETALACEAE		<i>Alexa imperatricis</i>	Hairariballi
<i>Tapura guianensis</i>	Adebero	<i>Swartzia leiocalycina</i>	Wamara
<i>T. guianensis</i>	Waiaballi	SAPOTACEAE	
		<i>Pouteria guianensis</i>	Saepoko
		SIMAROUBACEAE	

GUTTIFERAE		<i>Quassia amata</i>	Quashi bitters
<i>Tovomita cephalostigma</i>	Awesakuli	STERCULIACEAE	
<i>Vismia guianensis</i>	Blood wood	<i>Sterculia rugosa</i>	Maho
<i>Clusia grandiflora</i>	Kufa	VERBENACEAE	
<i>C. palmicida</i>	"	<i>Vitex compressa</i>	Hakiaballi
LECYTHIDACEAE		VIOLACEAE	
<i>Escheweilera corriacea</i>	B. Kakaralli	<i>Paypayrola longifolia</i>	
<i>E. sagottina</i>	"		
<i>E. alata</i>	G. Kakaralli		
<i>Couratari gloriosa</i>	Wadara		

Table 36. Summary of Fishes Encountered in Concession Area

FAMILY / SCIENTIFIC NAME	COMMON NAME
CHARACIDAE	
<i>Bryconops</i> sp.	Selabeh
<i>Charax gibbosus</i>	Pirannah
<i>Cynopotamus essequibensis</i>	Biara
<i>Myelus rubripinnis</i>	Pirannah
<i>M. pacu</i>	"
ERYTHRINIDAE	
<i>Hoplias malabaricus</i>	Huri
LORICARIIDAE	
<i>Hypostomus</i> sp.	Smoke hassar
PIMELODIDAE	
<i>Pimelodus</i> sp.	Catfish
TETRAODONTIDAE	
<i>Colomesus psittacus</i>	Puff fish

Table 37. Summary of Amphibians Encountered in Concession Area

FAMILY / SCIENTIFI NAME	COMMON NAME
BUFONIDAE	
<i>Rhinella marina</i>	Crapaud; Marine Toad
DENDROBATIDAE	
<i>Dendrobatidae</i> sp.	Poison Arrow Frog
	Green back Frog
HYLIDAE	
<i>Hylidae</i> sp.	Tree Frog
<i>Scinax</i> sp.	Tree Frog

Table 38. Summary of Reptiles Encountered in Concession Area

FAMILY / SCIENTIFIC NAME	COMMON NAME
CROCODILIA	
<i>Caiman</i> sp.	Caiman or Alligator
VIPERIDAE	
<i>Bothriopsis bilineata</i>	Parrot snake
TEIIDAE	
<i>Tupianambis teguixin</i>	Salipenta
TROPIDURIDAE	
<i>Plica umbra</i>	Tree Lizard

Table 39. Summary of Birds Encountered in Concession Area

FAMILY / SCIENTIFIC NAME	COMMON NAME	FAMILY / SCIENTIFIC NAME	COMMON NAME
APODIDAE		PSITTACIDAE	
<i>Aeronautes montivagus</i>	White-tipped Swift	<i>Amazona farinosa</i>	Mealy Parrot
BUCCONIDAE		<i>Ara chloroptera</i>	Red-and-green Macaw
<i>Chelidoptera tenebrosa</i>	Swallow-wing	<i>Forpus</i> sp.	Parrotlets
CAPRIMULGIDAE		RAMPHASTIDAE	
<i>Caprimulgus paroulus</i>	Little Nightjar	<i>Ramphastos</i> sp.	Toucan
CATHARTIDAE		THAMNOPHILIDAE	
<i>Buteogallus</i> sp.	Hawk	<i>Herpsilochmus dorsimaculatus</i>	Spot-backed Antwren
ALECINIDINIDAE		<i>Thamnomanes caesius</i>	Cinereous Antbird
<i>Chloroceryle amazona</i>	Amazon Kingfisher	<i>Thamnophilus aethiops</i>	White-shouldered

			Antshrike
<i>C. americana</i>	Green Kingfisher	TINAMIDAE	
CINCLIDAE		<i>Crypturellus variegatus</i>	Variegated Tinamou
<i>Cinclus leucocephalus</i>	White-capped Dipper	<i>Tinamus tao</i>	Grey Tinamou; Bush fowl; Maam
DENDROCOLAPTIDAE		THRAUPIDAE	
<i>Dendrocincla fuliginosa</i>	Plain-brown Woodcreeper	<i>Hemispingus superciliaris</i>	Supercilaried Hemispingus
<i>D. merula</i>	White-chinned Woodcreeper	<i>Tachyphonus rufus</i>	White lined Tanager
<i>Deconychura longicauda</i>	Long-tailed Woodcreeper	TROCHILIDAE	
<i>Glyphorhynchus spirurus</i>	Wedge-billed Woodcreeper	<i>Amazilia tobaci</i>	Copper-rumped Hummingbird
		<i>Campylopterus largipennis</i>	Gray-breasted Sabrewing
HIRUDINIDAE		<i>Coeligina coeligina</i>	Bronzy Inca
<i>Atticora melanoleuca</i>	Black-collared Swallow	<i>Colibri thalassinus</i>	Green Violetear
PHALCROCORACIDAE		<i>Doryfera johannae</i>	Blue-fronted Lancebill
<i>Phalacrocorax brasilianus</i>	Neotropic Cormorant	<i>Phaethornis rupurumii</i>	Streak-throated Hermit
ARDEIDAE		TYRANNIDAE	
<i>Egretta rufescens</i>	Reddish Egret	<i>Conopias parva</i>	Yellow-throated Flycatcher
PICIDAE		<i>Fluvicola pica</i>	Pied Water-tyrant
<i>Dryocopus lineatus</i>	Lineated Woodpecker		
PIPRIDAE			
<i>Pipra erythrocephala</i>	Golden-headed Manakin		

Table 40. Summary of Mammals Encountered in the Concession Area

MAMMALS	COMMON NAME
AGOUTIDAE	
<i>Agouti paca</i>	Paca; Labba
MOLOSSIDAE	
<i>Molossus</i> sp.	Tree bat
DASYPROCTIDAE	
<i>Dasyprocta leporina</i>	Red-rumped Agouti; Acouri
MUSTELIDAE	
<i>Lontra longicauda</i>	Neotropical Otter; Water Dog
CEBIDAE	
<i>Alouatta seniculus</i>	Red Howler Monkey
PHYLLOSTOMIDAE	
<i>Glossophaga</i> sp.	Leaf-nosed Bat
ECHYMYIDAE	
<i>Proechimys</i> sp.	Spiny rat
TAPIRIDAE	
<i>Tapirus terrestris</i>	Lowland Tapir; Bush Cow

Table 41. Summary of Invertebrates Present in Concession Area

GROUP	COMMON NAME	GROUP	COMMON NAME
Aranae	Spiders	Hemiptera	Cicadas
	Tarantulas (<i>Avicular sp.</i>)		Stink bug (<i>Nazera sp.</i>)
Blattodea	Cockroaches	Hymenoptera	Bumble bee (<i>Xylocopa sp.</i>)
Coleoptera	Click Beetles (<i>Pyriphorus sp.</i>)		Wasp (<i>Polistes sp.</i>)
	Hard back Beetle (<i>Dyscentetus germinatus</i>)		Acoushi ants (<i>Ata sextens</i>)
Decapoda	Crabs (<i>Uca maracoan</i>)		Sawari ants
Diplura	Two tailed Insects	Isoptera	Termites
Diptera	Blue bottle fly (<i>Musca sp.</i>)	Lepidoptera	Moth (<i>Hamadryas sp.</i>)
	Mosquitoes (<i>Anopheles sp.</i>)		Butterflies (<i>Morpho hyacinghus</i>)
	Flies	Mantodea	Praying Mantis (<i>Tespis trifasciata</i>)
	John Smart	Odonata	Dragonflies (<i>Anax sp.</i>)
Haplotaxida	Earthworm		Damselflies
		Orthoptera	Cricket (<i>Scuiteriscus sp.</i>)
			Grasshopper (<i>Ophulleia sp.</i>)
		Scorpiones	B. Scorpion (<i>Centruroides sp.</i>)
Annelida	Earthworms (<i>Pheretima sp.</i>)	Gastropoda	Snails (<i>Pomacea sp.</i>)
Chilopoda	Centipedes	Diplopoda	Millipedes

Table 42. Mammals Encountered in Golden Mile Area

MAMMALS	COMMON NAME
DASYPROCTIDAE	
<i>Dasyprocta leporina</i>	Red-rumped Agouti; Acouri
MUSTELIDAE	
<i>Lutra longicauda</i>	Neotropical Otter; Water Dog
CEBIDAE	
<i>Alouatta seniculus</i>	Red Howler Monkey

Table 43. Invertebrates Encountered in Golden Mile Area

INVERTEBRATES	COMMON NAME
Aranae	Spiders
Blattodea	Cockroaches
Diptera	Mosquitoes
	Flies
Hymenoptera	Bees
Isoptera	Termites
Lepidoptera	Butterflies
	Moths
Odonata	Dragonflies
	Damselflies
Orthoptera	Grasshoppers
Scorpiones	Black scorpion (<i>Centruroides sp.</i>)
Chilopoda	Centipedes
Diplopoda	Millipedes

Table 44. Fishes Encountered in Golden Mile Area

FAMILY /SCIENTIFIC NAME	COMMON NAME
CHARACIDAE	
<i>Charax gibbosus</i>	Pirannah
<i>Cynopotamus essequibensis</i>	Biara
LORICARIIDAE	
<i>Hypostomus</i> sp.	Smoke hassar

Table 45. Amphibians Encountered in Golden Mile Area

FAMILY / SCIENTIFIC NAME	COMMON NAME
BUFONIDAE	
<i>Rhinella marina</i>	Crapaud; Marine Toad

Table 46. Reptiles Encountered in Golden Mile Area

FAMILY / SCIENTIFIC NAME	COMMON NAME
TEIIDAE	
<i>Tupinambis teguixin</i>	Salipenta
TROPIDURIDAE	
<i>Plica umbra</i>	Tree Lizard

Table 47. Birds Encountered in Golden Mile Area

FAMILY / SCIENTIFIC NAME	COMMON NAME
APODIDAE	
<i>Aeronautes montivagus</i>	White-tipped Swift
ALCEDINIDAE	
<i>Chloroceryle amazona</i>	Amazon Kingfisher
HIRUNDINIDAE	
<i>Atticora melanoleuca</i>	Black-collared Swallow
PICIDAE	
<i>Dryocopus lineatus</i>	Lineated Woodpecker
PSITTICIDAE	
<i>Ara chloroptera</i>	Red-and-green Macaw
THRAUPIDAE	
<i>Hemispingus superciliaris</i>	Supercilaried Hemispingus
TROCHILIDAE	
<i>Colibri thalassimus</i>	Green Violetear
<i>Doryfera johannae</i>	Blue-fronted Lancebill
<i>Phaethornis rupurumii</i>	Streak-throated Hermit
TYRANNIDAE	
<i>Fluvicola pica</i>	Pied Water-tyrant

APPENDIX B - Site Location and Species List of Floral Collection

L. Gillespie from 3 - 20 October, 1989 at Aurora and Cuyuni River, Guyana

Smithsonian Institute Collections: 2042-2408. 3 October 1989 to 20 October 1989

SITE LOCATION	SMITHSONIAN COLLECTION NUMBER AND ASSOCIATED SPECIES
Aurora, Cuyuni River, 180 km upstream from mouth; vicinity of camp. 3 October 1989. 06°47'30"N 059°44'30"W, Elevation 60 m. Disturbed scrub and lowland evergreen forest edge. Light brown alluvial soil, with some sand. Collections: 2042 - 2056.	2042 Araceae: <i>Monstera adansonii</i> Schott 2043 Cucurbitaceae: <i>Melothria pendula</i> L. 2044 Commelinaceae: <i>Dichorisandra hexandra</i> (Aubl.) Standl. 2045 Piperaceae: <i>Piper divaricatum</i> G. Mey. 2046 Rubiaceae: <i>Psychotria cupularis</i> (Müll. Arg.) Standl. 2047 Passifloraceae: <i>Passiflora quadriglandulosa</i> Rodschied 2048 Erythroxylaceae: <i>Erythroxylum macrophyllum</i> Cav. 2049 Dilleniaceae: <i>Davilla</i> sp. 2050 Fabaceae-Mimos.: <i>Mimosa myriadenia</i> (Benth.) Benth. 2051 Piperaceae: <i>Piper</i> sp. 2052 Loranthaceae: <i>Phthirusa retroflexa</i> (Ruiz & Pav.) Kuijt (=Phthirusa stelis) 2053 Clusiaceae: <i>Vismia sessilifolia</i> (Aubl.) Choisy 2054 Heliconiaceae: <i>Heliconia spathocircinata</i> Aristeg. 2055 Asteraceae: <i>Rolandra fruticosa</i> (L.) Kuntze 2056 Orchidaceae
Aurora, 180 km. upstream on Cuyuni R; along track 0-1 km S of camp. 4 October 1989. 06°47'30"N 059°44'30"W, Elevation 60 to 90 m. Semi-disturbed tall evergreen forest. Collections: 2057 - 2077.	2057 Marantaceae: <i>Calathea micans</i> (Mathieu) Körn. 2057 a Euphorbiaceae: <i>Mabea taquari</i> Aubl. 2058 Dennstaedtiaceae: <i>Saccoloma elegans</i> Kaulf. 2059 Adiantaceae: <i>Adiantum latifolium</i> Lam. 2060 Polypodiaceae: <i>Microgramma reptans</i> (Cav.) A.R. Sm. 2061 Adiantaceae: <i>Adiantum latifolium</i> Lam. 2062 Tectariaceae: <i>Triplophyllum funestum</i> (Kunze) Holttum 2063 Dennstaedtiaceae: <i>Lindsaea lancea</i> (L.) Bedd. var. <i>lancea</i> 2064 Cyatheaceae: <i>Cyathea surinamensis</i> (Miq.) Domin 2065 Dryopteridaceae: <i>Polybotrya caudata</i> Kunze 2066 Rapateaceae: <i>Spathanthus unilateralis</i> (Rudge) Desv. 2067 Annonaceae: <i>Duguetia megalophylla</i> R.E. Fr. 2068 Gesneriaceae: <i>Nautilocalyx mimuloides</i> (Benth.) C.V. Morton 2069 Araceae: <i>Anthurium gracile</i> (Rudge) Schott 2070 Cyperaceae: <i>Hypolytrum longifolium</i> (Rich.) Nees ssp. <i>Longifolium</i> 2071 Melastomataceae: <i>Leandra divaricata</i> (Naudin) Cogn. 2072 Melastomataceae: <i>Aciotis ornata</i> (Miq.) Gleason 2073 Erythroxylaceae: <i>Erythroxylum macrophyllum</i> Cav. 2074 Marantaceae: <i>Monotagma spicatum</i> (Aubl.) J.F. Macbr. 2075 Poaceae: <i>Olyra latifolia</i> L. 2076 Piperaceae: <i>Piper hispidum</i> Sw. 2077 Cyperaceae: <i>Calyptrrocarya glomerulata</i> (Brongn.) Urb.
Aurora, helicopter landing site, 0.3 km S of camp. 4 October 1989. 06°47'30"N 059°44'30"W, Elevation 60 m. Edge of	2078 Violaceae: <i>Rinorea pubiflora</i> (Benth.) Sprague & Sandwith 2079 Violaceae: <i>Paypayrola longifolia</i> Tul. 2080 Simaroubaceae: <i>Quassia amara</i> L. 2081 Fabaceae-Mimos.: <i>Inga nobilis</i> Willd. 2082 Araceae: <i>Monstera obliqua</i> Miq.

disturbed tall evergreen forest. Collections: 2078 - 2084.	2083 Clusiaceae ? 2084 Gesneriaceae: <i>Paradrymonia maculata</i> (Hook. f.) Wiehler
Aurora, along track 0-1 km S of camp. 4 October 1989. 06°47'30"N 059°44'30"W, Elevation 60 to 75 m. Semi-disturbed tall evergreen forest. Volcanic greenstone. Collections: 2085 - 2104.	2085 Poaceae: <i>Panicum pilosum</i> Sw. 2086 Araceae: <i>Philodendron fragrantissimum</i> (Hook.) G. Don 2087 Arecaceae: <i>Geonoma baculifera</i> (Poit.) Kunth 2088 Arecaceae: <i>Bactris simplicifrons</i> Mart. 2089 Marattiaceae: <i>Danaea ? leprieurii</i> Kunze 2090 Lauraceae: <i>Licaria debilis</i> (Mez) Kosterm. 2091 Arecaceae: <i>Geonoma baculifera</i> (Poit.) Kunth 2092 Poaceae: <i>Pharus latifolius</i> L. 2093 Adiantaceae: <i>Pityrogramma calomelanos</i> (L.) Link 2094 Araceae: <i>Caladium bicolor</i> (Aiton) Vent. 2095 Apocynaceae: <i>Odontadenia puncticulosa</i> (Rich.) Pulle 2096 Cyperaceae: <i>Cyperus simplex</i> Kunth 2097 Costaceae: <i>Costus scaber</i> Ruiz & Pav. 2098 Heliconiaceae: <i>Heliconia acuminata</i> Rich. 2099 Apocynaceae: <i>Bonaefousia undulata</i> (Vahl) A. DC. (= <i>Tabernaemontana undulata</i>) 2100 Thelypteridaceae: <i>Thelypteris opulenta</i> (Kaulf.) Fosberg 2101 Piperaceae: <i>Piper hispidum</i> Sw. 2102 Myrtaceae: <i>Myrcia graciliflora</i> Sagot 2103 Fabaceae-Papil.: <i>Desmodium axillare</i> (Sw.) DC. 2104 Lamiaceae: <i>Hyptis</i> sp.
Aurora, Madd Kiss Hill, ±1 km S of camp. 5 October 1989. 06°47'30"N 059°44'30"W, Elevation 75 to 90 m. Semi-disturbed tall evergreen forest. Collections: 2105 - 2118.	2105 Cyatheaceae: <i>Cyathea surinamensis</i> (Miq.) Domin 2106 Annonaceae: <i>Anaxagorea dolichocarpa</i> Sprague & Sandwith 2107 Annonaceae: <i>Duguetia pauciflora</i> Rusby 2108 Marantaceae: <i>Ischnosiphon arouma</i> (Aubl.) Körn. 2109 Marantaceae: <i>Ischnosiphon centricifolius</i> L. Andersson 2110 Boraginaceae: <i>Cordia nodosa</i> Lam. 2111 Araceae: <i>Anthurium gracile</i> (Rudge) Schott 2112 Cyperaceae: <i>Diplasia karataefolia</i> Rich. 2113 Annonaceae: <i>Anaxagorea dolichocarpa</i> Sprague & Sandwith 2114 Chrysobalanaceae 2115 Arecaceae: <i>Bactris oligoclada</i> Burret 2116 Adiantaceae: <i>Adiantum fuliginosum</i> Fée 2117 Annonaceae: <i>Duguetia yeshidan</i> Sandwith 2118 Arecaceae: <i>Astrocaryum gynacanthum</i> Mart.
Aurora, along track 0-1 km S of camp. 5 October 1989. 06°47'30"N 059°44'30"W, Elevation 60 to 75 m. Secondary scrub at forest edge. Collections: 2119 - 2122.	2119 Melastomataceae: <i>Aciotis fragilis</i> (DC.) Cogn. (= <i>Aciotis purpurascens</i>) 2120 Rubiaceae: <i>Psychotria gracilentia</i> Müll. Arg. 2121 Apocynaceae: <i>Tabernaemontana heterophylla</i> Vahl 2122 Arecaceae: <i>Bactris monticola</i> Barb. Rodr. (= <i>Bactris maraja</i>)
Aurora, vicinity of camp. 5 October 1989. 06°47'30"N 059°44'30"W, Elevation 60 m. Open	2123 Lythraceae: <i>Cuphea melvilla</i> Lindl. 2124 Solanaceae: <i>Physalis pubescens</i> L. 2125 Bignoniaceae: <i>Cydista aequinoctialis</i> (L.) Miers 2126 Euphorbiaceae: <i>Croton cuneatus</i> Klotzsch

secondary scrub. Collections: 2123 - 2126.	
Aurora, ±3 km S of camp. 6 October 1989. 06°47'30"N 059°44'30"W, Elevation 70 m. Swamp forest with Mora excelsa dominant. Lianas and bryophytes abundant. Collections: 2127 - 2136.	2127 Bignoniaceae: Schlegelia sp. 2128 Clusiaceae: Tovomita aff. Cephalostigma Vesque (=Tovomita umbellata) 2129 Bignoniaceae: Anemopaegma chrysoleucum (Kunth) Sandwith 2130 Bryophyte 2131 Polypodiaceae: Campyloneurum repens (Aubl.) C. Presl 2132 Annonaceae: Duguetia calycina Benoist 2133 Cyclanthaceae: Evodianthus funifer (Poit.) Lindm. 2134 Selaginellaceae: Selaginella epirrhizos Spring 2135 Nyctaginaceae: Guapira olfersiana (Link, Klotzsch & Otto) Lundell 2136 Arecaceae: Bactris monticola Barb. Rodr. (=Bactris maraja)
Aurora, along track 1-3 km S of camp. 6 October 1989. 06°47'30"N 059°44'30"W, Elevation 60 m. Disturbed evergreen forest. Collections: 2137 - 2156.	2137 Araceae 2138 Monimiaceae: Siparuna guianensis Aubl. 2139 Rubiaceae: Psychotria gracilentia Müll. Arg. 2140 Poaceae: Paspalum conjugatum Bergius 2141 Melastomataceae: Leandra divaricata (Naudin) Cogn. 2142 Piperaceae: Piper hostmannianum (Miq.) C. DC. (=Piper berbicense) 2143 Piperaceae: Peperomia macrostachya (Vahl) A. Dietr. 2144 Poaceae: Panicum pilosum Sw. 2145 Marantaceae: Ischnosiphon puberulus Loes. var. scaber (Petersen) L. Andersson 2146 Marantaceae: Ischnosiphon obliquus (Rudge) Körn. 2147 Apocynaceae: Bonafousia undulata (Vahl) A. DC. (=Tabernaemontana undulata) 2148 Fabaceae-Caesal.: Senna quinquangulata (Rich.) H.S. Irwin & Barneby 2149 Melastomataceae: Clidemia dentata D. Don 2150 Melastomataceae: Leandra rufescens (DC.) Cogn. 2151 Fabaceae-Papil.: Desmodium incanum DC. 2152 Annonaceae: Guatteria sp. 2153 Dilleniaceae: Davilla kunthii A. St.-Hil. 2154 Cyperaceae: Calyptrocarya glomerulata (Brongn.) Urb. 2155 Cyperaceae: Cyperus luzulae (L.) Rottb. ex Retz. 2156 Gentianaceae: Voyria sp.
Aurora, ±0.3 km S of camp, just E of helicopter landing site. 7 October 1989. 06°47'30"N 059°44'30"W, Elevation 60 m. Swamp forest, Mora excelsa dominant. Alluvial soil. Collections: 2157 - 2166.	2157 Smilacaceae: Smilax sp. 2158 Asclepiadaceae: Matelea stenopetala Sandwith 2159 Rubiaceae: Sipanea sp. 2160 Annonaceae: Duguetia megalophylla R.E. Fr. 2161 Arecaceae: Bactris monticola Barb. Rodr. (=Bactris maraja) 2162 Arecaceae 2163 Rubiaceae: Psychotria lupulina Benth. 2164 Arecaceae: Geonoma baculifera (Poit.) Kunth 2165 Lacistemataceae: Lacistema sp. 2166 Arecaceae
Aurora, along track ±0.5 km S of camp. 7 October 1989. 06°47'30"N 059°44'30"W, Elevation 60 m. Disturbed Mora swamp forest.	2167 Cyperaceae: Calyptrocarya glomerulata (Brongn.) Urb. 2168 Cyperaceae: Rhynchospora radicans (Schltdl. & Cham.) H. Pfeiff. ssp. microcephala (Bertero ex Spreng.) W.W. Thomas 2169 Cyperaceae: Cyperus odoratus L. 2170 Annonaceae: Annona hypoglauca Mart. 2171 Annonaceae: Rollinia exsucca (DC. Ex Dunal) A. DC.

Collections: 2167 - 2176.	2172 Rubiaceae: <i>Sabicea glabrescens</i> Benth. 2173 Piperaceae: <i>Piper arboreum</i> Aubl. 2174 Gesneriaceae: <i>Codonanthe calcarata</i> (Miq.) Hanst. 2175 Onagraceae: <i>Ludwigia affinis</i> (DC.) H. Hara 2176 Annonaceae: <i>Duguetia pycnastera</i> Sandwith
Aurora, ±2 km S of camp. 7 October 1989. 06°47'30"N 059°44'30"W, Elevation 70 m. Mora swamp forest. Collections: 2177 - 2180.	2177 Arecaceae 2178 Clusiaceae: <i>Tovomita</i> aff. <i>Gracilipes</i> Planch. & Triana 2179 Cyperaceae: <i>Hypolytrum longifolium</i> (Rich.) Nees ssp. <i>sylvaticum</i> (Poepp. & Kunth) T. Koyama 2180 Cyperaceae: <i>Calyptrrocarya glomerulata</i> (Brongn.) Urb.
Aurora, along track 0-2 km S of camp. 7 October 1989. 06°47'30"N 059°44'30"W, Elevation 60 to 90 m. Disturbed tall evergreen forest. Collections: 2181 - 2185.	2181 Vitaceae: <i>Cissus</i> sp. 2182 Arecaceae: <i>Bactris</i> cf. <i>monticola</i> Barb. Rodr. (= <i>Bactris maraja</i>) 2183 Arecaceae: <i>Bactris oligoclada</i> Burret 2184 Thelypteridaceae: <i>Thelypteris guyanensis</i> (Fée) C.V. Morton (= <i>Thelypteris macrophylla</i>) 2185 Acanthaceae: <i>Blechum pyramidatum</i> (Lam.) Urb. 2185 a Arecaceae
Cuyuni R., between Aurora and ±4 km upstream (S bank). 8 October 1989. 06°47'30"N 059°44'30"W, Elevation 60 m. Mora swamp forest bordered by riparian forest. <i>Inga</i> spp; <i>Triplaris</i> <i>surinamensis</i> , <i>Montrichardia</i> . Sp Collections: 2186 - 2214.	2186 Violaceae: <i>Corynostylis arborea</i> (L.) S.F. Blake 2187 Solanaceae: <i>Solanum monachophyllum</i> Dunal 2188 Bignoniaceae: <i>Cydista aequinoctialis</i> (L.) Miers 2189 Fabaceae-Mimos.: <i>Pentaclethra macroloba</i> (Willd.) Kuntze 2190 Fabaceae-Mimos.: <i>Inga nobilis</i> Willd. 2191 Costaceae: <i>Costus arabicus</i> L. 2192 Apocynaceae: <i>Mesechites trifida</i> (Jacq.) Müll. Arg. 2193 Malpighiaceae: <i>Hiraea faginea</i> (Sw.) Nied. 2194 Combretaceae: <i>Combretum</i> cf. <i>rotundifolium</i> Rich. 2195 Cecropiaceae: <i>Cecropia latiloba</i> Miq. 2196 Polygonaceae: <i>Triplaris surinamensis</i> Cham. (= <i>Triplaris weigeltiana</i>) 2197 Sapindaceae: <i>Paullinia pinnata</i> L. 2198 Myrsinaceae: <i>Stylogyne longifolia</i> (Mart. ex Miq.) Mez 2199 Myrtaceae 2200 Polygonaceae: <i>Triplaris surinamensis</i> Cham. (= <i>Triplaris weigeltiana</i>) 2201 Sapotaceae ? 2202 Hippocrateaceae: <i>Hippocratea volubilis</i> L 2203 Loranthaceae: <i>Phthirusa retroflexa</i> (Ruiz & Pav.) Kuijt (= <i>Phthirusa stelis</i>) 2204 Fabaceae-Mimos.: <i>Zygia cataractae</i> (Kunth) L. Rico 2205 Araceae: <i>Montrichardia arborescens</i> (L.) Schott 2206 Asteraceae: <i>Mikania congesta</i> DC. 2207 Asclepiadaceae: <i>Cynanchum</i> aff. <i>montevidense</i> Spreng. 2208 Rubiaceae: <i>Genipa spruceana</i> Steyererm. 2209 Burseraceae: <i>Protium</i> ? sp. 2210 Lauraceae: <i>Nectandra</i> aff. <i>globosa</i> (Aubl.) Mez 2211 Polypodiaceae: <i>Microgramma lycopodioides</i> (L.) Copel. var. <i>prominula</i> (Maxon) 2212 Fabaceae-Mimos.: <i>Inga meissneriana</i> Miq. (= <i>Inga vera</i> subsp. <i>affinis</i>) 2213 Gentianaceae: <i>Coutoubea ramosa</i> Aubl. 2214 Euphorbiaceae: <i>Croton cuneatus</i> Klotzsch

Aurora, 0-1.5 km S of camp along track. 9 October 1989. 06°47'30"N 059°44'30"W, Elevation 60 to 75 m. Secondary scrub and forest. Collections: 2215 - 2231.	2215 Thelypteridaceae: Thelypteris serrata (Cav.) Alston 2216 Aspleniaceae: Asplenium serratum L. 2217 Myrsinaceae 2218 Araceae: Monstera adansonii Schott 2219 Fabaceae-Caesal.: Senna multijuga (Rich.) H.S. Irwin & Barneby 2220 Scrophulariaceae: Scoparia dulcis L. 2221 Scrophulariaceae: Lindernia crustacea (L.) F. Muell. 2222 Commelinaceae: Commelina diffusa Burm. f. 2223 Euphorbiaceae: Phyllanthus stipulatus (Raf.) G.L. Webster 2224 Gesneriaceae: Codonanthe calcarata (Miq.) Hanst. 2225 Arecaceae: Bactris simplicifrons Mart. 2226 Orchidaceae 2227 Rhizophoraceae: Cassipourea guianensis Aubl. 2228 Annonaceae: Annona hypoglauca Mart. 2229 Cyperaceae: Cyperus miliifolius Poepp. & Kunth 2230 Cyperaceae: Cyperus luzulae (L.) Rottb. ex Retz. 2231 Orchidaceae
Cuyuni R., between Aurora and ±7 km upstream. 10 October 1989. 06°47'30"N 059°44'30"W, Elevation 60 m. Riparian forest (Inga spp., Triplaris surinamensis). Collections: 2232 - 2271.	2232 Fabaceae-Mimos.: Inga meissneriana Miq. (=Inga vera subsp. affinis) 2233 Fabaceae-Caesal.: Brownea coccinea Jacq. 2234 Orchidaceae 2235 Fabaceae-Caesal.: Bauhinia kunthiana Vogel 2236 Apocynaceae: Prestonia quinquangularis (Jacq.) Spreng. 2237 Apocynaceae: Mesechites trifida (Jacq.) Müll. Arg. 2238 Fabaceae-Papil.: Pterocarpus rohrii Vahl 2239 Myrtaceae: Psidium acutangulum DC. 2240 Euphorbiaceae: Mabea taquari Aubl. 2241 Violaceae: Corynostylis arborea (L.) S.F. Blake 2242 Fabaceae-Mimos.: Mimosa pellita Humb. & Bonpl. ex Willd. (=Mimosa pigra) 2243 Lauraceae: Nectandra amazonum Nees 2244 Melastomataceae: Miconia splendens (Sw.) Griseb. 2245 Fabaceae-Mimos.: Inga meissneriana Miq. (=Inga vera subsp. affinis) 2246 Vitaceae: Cissus sp. 2247 Myrtaceae: Eugenia egensis DC. 2248 Bromeliaceae 2249 Combretaceae: Combretum laxum Jacq. 2250 Bromeliaceae: Aechmea mertensii (G. Mey.) Schult. & Schult. f. 2251 a Bromeliaceae: Aechmea angustifolia Poepp. & Endl. 2251 b Bromeliaceae: Aechmea nudicaulis (L.) Griseb. 2252 Moraceae: Brosimum guianense (Aubl.) Huber 2253 Combretaceae: Combretum cf. laxum Jacq. 2254 Myrtaceae: Eugenia egensis DC. 2255 Sterculiaceae: Byttneria divaricata Benth. 2256 Rubiaceae: Uncaria guianensis (Aubl.) J.F. Gmel. 2257 Malpighiaceae: Mascagnia sepium (A. Juss.) Griseb. 2258 Bromeliaceae: Aechmea mertensii (G. Mey.) Schult. & Schult. f. 2259 Rubiaceae: Posoqueria latifolia (Rudge) Roem. & Schult. 2260 Lygodiaceae: Lygodium micans J.W. Sturm (=Lygodium volubile) 2261 Euphorbiaceae: Acalypha scandens Benth. 2262 Melastomataceae: Miconia serrulata (DC.) Naudin 2263 Myrtaceae 2264 Polygonaceae: Coccoloba ovata Benth.

	2265 Meliaceae 2266 Rubiaceae: <i>Uncaria guianensis</i> (Aubl.) J.F. Gmel. 2267 Apocynaceae: <i>Forsteronia acouci</i> (Aubl.) A. DC. 2268 Annonaceae: <i>Unonopsis guatteroides</i> (A. DC.) R.E. Fr. 2269 Violaceae: <i>Rinorea pubiflora</i> (Benth.) Sprague & Sandwith 2270 Asteraceae: <i>Mikania congesta</i> DC. 2271 Melastomataceae: <i>Miconia splendens</i> (Sw.) Griseb.
Aurora, old mine site on Alec Hill, ±1 km S of camp. 10 October 1989. 06°47'30"N 059°44'30"W, Elevation 75 m. Disturbed evergreen forest. Collections: 2272 - 2272.	2272 Annonaceae: <i>Cymbopetalum brasiliense</i> (Vell.) Benth. ex Baill.
Aurora, 2-4 km S of camp (along track & 10,000 line). 11 October 1989. 06°47'30"N 059°44'30"W, Elevation 75 to 90 m. Evergreen forest; <i>Clathrotropis</i> sp. Very common. Also <i>Lecythydaceae</i>. Collections: 2273 - 2283.	2273 Myrtaceae: <i>Myrcia graciliflora</i> Sagot 2274 Euphorbiaceae: <i>Pausandra martinii</i> Baill. 2275 Sapotaceae 2276 Annonaceae: <i>Duguetia pycnastera</i> Sandwith 2277 Violaceae: <i>Paypayrola longifolia</i> Tul. 2278 Boraginaceae: <i>Cordia nodosa</i> Lam. 2279 Annonaceae: <i>Anaxagorea dolichocarpa</i> Sprague & Sandwith 2280 Arecaceae: <i>Bactris oligoclada</i> Burret 2281 Chrysobalanaceae: <i>Hirtella silicea</i> Griseb. 2282 Annonaceae: <i>Duguetia pauciflora</i> Rusby 2283 Loganiaceae
Aurora, 2-3 km S of camp. 11 October 1989. 06°47'30"N 059°44'30"W, Elevation 60 to 75 m. Mora swamp forest. Collections: 2284 - 2286.	2284 Piperaceae: <i>Piper perstipulare</i> Steyerf. 2285 Lomariopsidaceae: <i>Lomariopsis japurensis</i> (Mart.) J. Sm. 2286 Lomariopsidaceae: <i>Elaphoglossum rigidum</i> (Aubl.) Urb. (<i>Elaphoglossum flaccidum</i>)
Aurora, vicinity of camp. 11 October 1989. 06°47'30"N 059°44'30"W, Elevation 60 m. Mora swamp forest. Collections: 2287 - 2287.	2287 Sapindaceae: <i>Paullinia</i> cf. <i>capreolata</i> (Aubl.) Radlk.
Aurora, creek ±1 km WSW of camp. 12 October 1989. 06°47'30"N 059°44'30"W, Elevation 70 to 75 m. Terra firme forest. Collections: 2288 - 2294.	2288 Dryopteridaceae: <i>Cyclodium inerme</i> (Fée) A.R. Sm. 2289 Adiantaceae: <i>Adiantum phyllitidis</i> J. Sm. 2290 Araceae: <i>Spathiphyllum schomburgkii</i> Schott 2291 Metaxyaceae: <i>Metaxya rostrata</i> (Kunth) C. Presl 2292 Dryopteridaceae: <i>Cyclodium meniscioides</i> (Willd.) C. Presl var. <i>meniscioides</i> 2293 Dryopteridaceae: <i>Olfersia cervina</i> (L.) Kunze 2294 Monimiaceae: <i>Siparuna decipiens</i> (Tul.) A. DC.
Aurora, 0.5 km WSW of camp. 12 October 1989. 06°47'30"N 059°44'30"W, Elevation 70 m. Gap in Mora swamp forest (large	2295 Araceae: <i>Anthurium gracile</i> (Rudge) Schott 2296 Piperaceae: <i>Peperomia obtusifolia</i> (L.) A. Dietr. 2297 Solanaceae: <i>Solanum stramonifolium</i> Jacq. 2298 Orchidaceae: <i>Stelis argentata</i> Lindl. 2299 Poaceae: <i>Ichnanthus pallens</i> (Sw.) Munro ex Benth.

tree fall). Collections: 2295 - 2305.	2300 Cyperaceae: Calyptrocarya glomerulata (Brongn.) Urb. 2301 Cyperaceae: Calyptrocarya glomerulata (Brongn.) Urb. 2302 Asclepiadaceae: Matelea stenopetala Sandwith 2303 Poaceae: Olyra longifolia Kunth 2304 Cyperaceae: Hypolytrum longifolium (Rich.) Nees ssp. sylvaticum (Poepp. & Kunth) T. Koyama 2305 Cyperaceae: Hypolytrum longifolium (Rich.) Nees ssp. sylvaticum (Poepp. & Kunth) T. Koyama
Aurora, 0-1 km WSW of camp. 12 October 1989. 06°47'30"N 059°44'30"W, Elevation 70 to 80 m. Evergreen forest. Collections: 2306 - 2314.	2306 Cyatheaceae: Cyathea surinamensis (Miq.) Domin 2307 Annonaceae: Anaxagorea dolichocarpa Sprague & Sandwith 2308 Lauraceae: Licaria debilis (Mez) Kosterm. 2309 Annonaceae: Duguetia pauciflora Rusby 2310 Chrysobalanaceae: Hirtella silicea Griseb. 2312 Violaceae: Paypayrola longifolia Tul. 2313 Passifloraceae: Passiflora cf. glandulosa Cav. 2314 Piperaceae: Peperomia rotundifolia (L.) Kunth
Cuyuni River, between Aurora & Takar-opati Island (6 mi. downstream of Aurora). 13 October 1989. 06°47'30"N 059°43'W, Elevation 60 m. Riparian forest with Triplaris surinamensis, Inga spp. and Mora excelsa. Collections: 2315 - 2356.	2315 Apocynaceae: Odontadenia macrantha (Roem. & Schult.) Markgr. 2316 Bignoniaceae: Memora schomburgkii (DC.) Miers 2317 Annonaceae: Unonopsis guatteroides (A. DC.) R.E. Fr. 2318 Orchidaceae: Epidendrum nocturnum Jacq. 2319 Fabaceae-Caesal.: Tachigali sp. 2320 Fabaceae-Mimos.: Inga nobilis Willd. 2321 Rubiaceae: Rosenbergiodendron longiflorum Fagerl. 2322 Orchidaceae: Epidendrum flexuosum G. Mey. 2323 Apocynaceae: Bonafousia siphilitica (L. f.) L. Allorge (=Tabernaemontana siphilitica) 2324 Asclepiadaceae 2324 a Myrtaceae: Myrcia graciliflora Sagot 2325 Bignoniaceae: Martinella obovata (Kunth) Bureau & K. Schum. 2326 Myrsinaceae: Stylogyne cf. longifolia (Mart. ex Miq.) Mez 2327 Solanaceae: Schwenckia grandiflora Benth. 2328 Myrtaceae: Myrcia graciliflora Sagot 2329 Fabaceae-Caesal.: Swartzia guianensis (Aubl.) Urb. 2330 Rubiaceae: Faramea sessilifolia (Kunth) DC. 2331 Melastomataceae: Miconia serrulata (DC.) Naudin 2332 Fabaceae-Papil.: Dioclea sp. 2333 Fabaceae-Caesal.: Crudia tomentosa (Aubl.) J.F. Macbr. 2333 a Rubiaceae: Faramea sessiliflora (Kunth) DC. 2334 Bromeliaceae: Aechmea mertensii (G. Mey.) Schult. & Schult. f. 2335 Loranthaceae: Oryctanthus alveolatus (Kunth) Kuijt 2336 Euphorbiaceae: Croton cuneatus Klotzsch 2337 Sapotaceae 2338 Myrtaceae: Eugenia egensis DC. 2339 a Melastomataceae: Miconia longifolia (Aubl.) DC. 2339 b Melastomataceae: Miconia splendens (Sw.) Griseb. 2340 Apocynaceae: Prestonia acutifolia (Benth. ex Müll. Arg.) K. Schum. 2341 Bromeliaceae: Aechmea mertensii (G. Mey.) Schult. & Schult. f. 2342 Euphorbiaceae: Acalypha scandens Benth. 2343 Fabaceae-Mimos.: Albizia subdimidiata (Splitg.) Barneby & J.W. Grimes 2344 Cecropiaceae: Cecropia latiloba Miq. 2345 Myrtaceae: Myrcia graciliflora Sagot

	2346 Moraceae: <i>Ficus nymphaeifolia</i> Mill. 2347 Violaceae: <i>Rinorea pubiflora</i> (Benth.) Sprague & Sandwith 2348 Bignoniaceae: <i>Cydista aequinoctialis</i> (L.) Miers 2349 Hippocrateaceae: <i>Peritassa huanucana</i> (Loes.) A.C. Sm. 2350 Chrysobalanaceae: <i>Licania densiflora</i> Kleinhoonte 2351 Connaraceae: <i>Connarus lambertii</i> (DC.) Sagot 2352 Fabaceae-Papil.: <i>Dioclea</i> sp. 2353 Sapotaceae 2354 Fabaceae-Caesal.: <i>Brownea</i> sp. 2355 Lecythidaceae: <i>Eschweilera wachenheimii</i> (Benoist) Sandwith 2356 Fabaceae-Papil.: <i>Pterocarpus rohrii</i> Vahl
Aurora, vicinity of camp. 14 October 1989. 06°47'30"N 059°44'30"W, Elevation 60 m. Forest edge. Collections: 2357 - 2361.	2357 Euphorbiaceae: <i>Sapium jenmanii</i> Hemsl. 2358 Araceae: <i>Monstera adansonii</i> Schott 2359 Myrtaceae: <i>Psidium guajava</i> L. 2360 Fabaceae-Caesal.: <i>Senna multijuga</i> (Rich.) H.S. Irwin & Barneby 2361 Fabaceae-Mimos.: <i>Pentaclethra macroloba</i> (Willd.) Kuntze
Julian Ross Itabu River, 2-7 km upstream off Cuyuni R, mouth of Haimaralli Falls. 15 October 1989. 06°47'30"N 059°44'30"W, Elevation 60 m. Riparian forest of <i>Mora excelsa</i>, <i>Triplaris surinamensis</i>. Also <i>Inga</i> spp. Collections: 2362 - 2375.	2362 Piperaceae: <i>Piper divaricatum</i> G. Mey. 2363 Hippocrateaceae: <i>Salacia</i> sp. 2363 a Melastomataceae 2364 Vochysiaceae: <i>Vochysia tetraphylla</i> (G. Mey.) DC. 2365 Fabaceae-Papil.: <i>Machaerium quinata</i> (Aubl.) Sandwith var. <i>quinata</i> 2366 Malpighiaceae: <i>Hiraea faginea</i> (Sw.) Nied. 2367 Chrysobalanaceae: <i>Couepia comosa</i> Benth. 2368 Rubiaceae: <i>Chomelia angustifolia</i> Benth. 2369 Fabaceae-Caesal.: <i>Cassia multijuga</i> Rich. (= <i>Senna multijuga</i>) 2370 Cactaceae: <i>Epiphyllum phyllanthus</i> (L.) Haw. 2371 Melastomataceae: <i>Miconia serrulata</i> (DC.) Naudin 2372 Poaceae: <i>Panicum hylaeicum</i> Mez 2373 Euphorbiaceae: <i>Acalypha scandens</i> Benth. 2374 Bromeliaceae: <i>Aechmea mertensii</i> (G. Mey.) Schult. & Schult. f. 2375 Chrysobalanaceae: <i>Licania guianensis</i> (Aubl.) Griseb.
Aurora, across river from camp. 15 October 1989. 06°47'30"N 059°44'30"W, Elevation 60 m. Riparian forest of <i>Mora excelsa</i>, <i>Triplaris surinamensis</i>. Also <i>Inga</i> spp. Collections: 2376 - 2377.	2376 Arecaceae: <i>Euterpe oleracea</i> Mart. 2377 Arecaceae: <i>Geonoma baculifera</i> (Poit.) Kunth
Aurora, vicinity of camp. 15 October 1989. 06°47'30"N 059°44'30"W, Elevation 60 m. Riparian forest of <i>Mora excelsa</i>, <i>Triplaris surinamensis</i>. Also <i>Inga</i> spp. Collections: 2378 - 2378.	2378 a Melastomataceae: <i>Clidemia japurensis</i> DC. var. <i>heterobasis</i> (DC.) Wurdack 2378 b Melastomataceae: <i>Clidemia dentata</i> D. Don
Aurora, main track, 2-3.5 km S of camp. 16 October 1989. 06°47'30"N	2379 Euphorbiaceae: <i>Sandwithia guyanensis</i> Lanj. 2380 Oleandraceae: <i>Nephrolepis rivularis</i> (Vahl) Mett. ex Krug 2381 Hymenophyllaceae: <i>Trichomanes pinnatum</i> Hedw.

059°44'30"W, Elevation 75 to 90 m. Terra firma forest, upland evergreen forest. Collections: 2379 - 2383.	2382 Hookeriaceae: <i>Hookeriopsis</i> sp. 2383 Bromeliaceae: <i>Aechmea mertensii</i> (G. Mey.) Schult. & Schult. f.
Aurora, creek ±1 km WSW of camp, 1 km W of camp along 10,400 line. 16 October 1989. 06°47'30"N 059°44'30"W, Elevation 70 m. Growing on rocks along creek, upland evergreen forest. Collections: 2384 - 2387.	2384 Begoniaceae: <i>Begonia humilis</i> Dryand. 2385 Cyperaceae: <i>Cyperus simplex</i> Kunth 2386 Poaceae: <i>Ichnanthus pallens</i> (Sw.) Munro ex Benth. 2387 Rubiaceae: <i>Sipanea biflora</i> (L. f.) Cham. & Schltdl.
Aurora, main track, 0-1 km S of camp. 18 October 1989. 06°47'30"N 059°44'30"W, Elevation 60 to 75 m. Secondary forest. Collections: 2388 - 2391.	2388 Passifloraceae: <i>Passiflora quadriglandulosa</i> Rodschied 2389 Rubiaceae: <i>Psychotria paniculata</i> (Aubl.) Raeusch. 2390 Piperaceae: <i>Piper arboreum</i> Aubl. 2391 Annonaceae: <i>Duguetia megalophylla</i> R.E. Fr.
Aurora, 1-2 km SSW of camp, (1-2 km along 10,400 line). 19 October 1989. 06°47'30"N 059°44'30"W, Elevation 70 to 120 m. Evergreen forest. Collections: 2392 - 2400.	2392 Clusiaceae: <i>Clusia palmicida</i> Rich. ex Planch. & Triana 2393 Burseraceae: <i>Protium</i> sp. 2394 Marantaceae: <i>Calathea cyclophora</i> Baker 2395 Lomariopsidaceae: <i>Bolbitis semipinnatifida</i> (Fée) Alston 2396 Araceae: <i>Stenospermation multiovulatum</i> (Engl.) N.E. Br. 2397 Lauraceae: <i>Aniba</i> aff. <i>citrifolia</i> (Nees) Mez 2398 Rubiaceae 2399 Araceae: <i>Philodendron rudgeanum</i> Schott 2400 Euphorbiaceae: <i>Pausandra martinii</i> Baill.
Aurora, vicinity of camp. 19 October 1989. 06°47'30"N 059°44'30"W, Elevation 60 m. Secondary scrub, path edge. Collections: 2401 - 2401.	2401 Euphorbiaceae: <i>Phyllanthus urinaria</i> L.
Cuyuni River, Matope Falls. 20 October 1989. 06°40'N 059°00'W, Elevation 40 to 50 m. Riparian scrub growing on rock outcrop beside rapids. Collections: 2402 - 2408.	2402 Rubiaceae: <i>Alibertia edulis</i> (Rich.) A. Rich. ex DC. 2403 Fabaceae-Papil.: <i>Clitoria arborescens</i> R. Br. 2404 Euphorbiaceae: <i>Phyllanthus caroliniensis</i> Walter ssp. <i>Guianensis</i> (Klotzsch) G.L. Webster 2405 Erythroxylaceae 2406 Chrysobalanaceae: <i>Hirtella paniculata</i> Sw. 2407 Acanthaceae: <i>Aphelandra scabra</i> (Vahl) Sm. 2408 Myrtaceae: <i>Calypttranthes pullei</i> Burret ex Amshoff

APPENDIX C - Combined Species List for Aurora, Guyana

SPECIES NAME
<i>Acalypha scandens</i> Benth.
<i>Aciotis fragilis</i> (DC.) Cogn. (= <i>Aciotis purpurascens</i>)
<i>Aciotis ornata</i> (Miq.) Gleason
<i>Adiantum fuliginosum</i> Fée
<i>Adiantum latifolium</i> Lam.
<i>Adiantum phyllitidis</i> J. Sm.
<i>Aechmea angustifolia</i> Poepp. & Endl.
<i>Aechmea mertensii</i> (G. Mey.) Schult. & Schult. f.
<i>Aechmea nudicaulis</i> (L.) Griseb.
<i>Albizia subdimidiata</i> (Splitg.) Barneby & J.W. Grimes
<i>Alibertia edulis</i> (Rich.) A. Rich. ex DC.
<i>Anacardium giganteum</i>
<i>Anaxagorea dolichocarpa</i> Sprague & Sandwith
<i>Anemopaegma chrysoleucum</i> (Kunth) Sandwith
<i>Aniba</i> aff. <i>citrifolia</i> (Nees) Mez
<i>Annona hypoglaucula</i> Mart.
<i>Annona symphyocarpa</i>
<i>Anthurium gracile</i> (Rudge) Schott
<i>Aphelandra scabra</i> (Vahl) Sm.
<i>Asplenium serratum</i> L.
<i>Astrocaryum gynacanthum</i> Mart.
<i>Bactris</i> cf. <i>monticola</i> Barb. Rodr. (= <i>Bactris maraja</i>)
<i>Bactris monticola</i> Barb. Rodr. (= <i>Bactris maraja</i>)
<i>Bactris oligoclada</i> Burret
<i>Bactris simplicifrons</i> Mart.
<i>Bauhinia guianensis</i>
<i>Bauhinia kunthiana</i> Vogel
<i>Begonia humilis</i> Dryand.
<i>Blechum pyramidatum</i> (Lam.) Urb.
<i>Bolbitis semipinnatifida</i> (Fée) Alston
<i>Bonafousia siphilitica</i> (L. f.) L. Allorge (= <i>Tabernaemontana siphilitica</i>)
<i>Bonafousia undulata</i> (Vahl) A. DC. (= <i>Tabernaemontana undulata</i>)
<i>Bromeliads</i>
<i>Brosimum guianense</i> (Aubl.) Huber
<i>Brownea coccinea</i> Jacq.
<i>Brownea latifolia</i>
<i>Brownea</i> sp.
<i>Bryophyte</i>
<i>Byttneria divaricata</i> Benth.
<i>Caladium bicolor</i> (Aiton) Vent.
<i>Calathea cyclophora</i> Baker
<i>Calathea micans</i> (Mathieu) Körn.
<i>Calyptranthes pullei</i> Burret ex Amshoff
<i>Calyptracarya glomerulata</i> (Brongn.) Urb.
<i>Campyloneurum repens</i> (Aubl.) C. Presl
<i>Carapa guianensis</i>

<i>Casostoma commune</i>
<i>Cassia multijuga</i> Rich. (= <i>Senna multijuga</i>)
<i>Cassipourea guianensis</i> Aubl.
<i>Cecropia latiloba</i> Miq.
<i>Cecropia peltata</i>
<i>Cecropia scrdophylla</i>
<i>Cecropia surinamensis</i>
<i>Chomelia angustifolia</i> Benth.
<i>Cissus</i> sp.
<i>Clathrotropis brachypetala</i>
<i>Clathrotropis macrocarpa</i>
<i>Clidemia dentata</i> D. Don
<i>Clidemia japurensis</i> DC. var. <i>heterobasis</i> (DC.) Wurdack
<i>Clitoria arborescens</i> R. Br.
<i>Clusia amazonica</i>
<i>Clusia palmicida</i> Rich. ex Planch. & Triana
Clusiaceae ?
<i>Coccoloba ovata</i> Benth.
<i>Codonanthe calcarata</i> (Miq.) Hanst.
<i>Combretum</i> cf. <i>laxum</i> Jacq.
<i>Combretum</i> cf. <i>rotundifolium</i> Rich.
<i>Combretum laxum</i> Jacq.
<i>Commelina diffusa</i> Burm. f.
<i>Connarus lambertii</i> (DC.) Sagot
<i>Cordia nodosa</i> Lam.
<i>Corynostylis arborea</i> (L.) S.F. Blake
<i>Corynostylis arborea</i> (L.) S.F. Blake
<i>Costus arabicus</i> L.
<i>Costus scaber</i> Ruiz & Pav.
<i>Couepia comosa</i> Benth.
<i>Coutoubea ramosa</i> Aubl.
<i>Croton cuneatus</i> Klotzsch
<i>Crudia tomentosa</i> (Aubl.) J.F. Macbr.
<i>Cupa</i>
<i>Cupa</i> (liana)
<i>Cuphea melvilla</i> Lindl.
<i>Cyathea surinamensis</i> (Miq.) Domin
<i>Cyclodium inerme</i> (Fée) A.R. Sm.
<i>Cyclodium meniscioides</i> (Willd.) C. Presl var. <i>Meniscioides</i>
<i>Cydista aequinoctialis</i> (L.) Miers
<i>Cymbopetalum brasiliense</i> (Vell.) Benth. ex Baill.
<i>Cynanchum</i> aff. <i>montevidense</i> Spreng.
<i>Cyperus luzulae</i> (L.) Rottb. ex Retz.
<i>Cyperus miliifolius</i> Poepp. & Kunth
<i>Cyperus odoratus</i> L.
<i>Cyperus simplex</i> Kunth
<i>Dali</i>
<i>Danaea</i> ? <i>leprieurii</i> Kunze

<i>Davilla kunthii</i> A. St.-Hil.
<i>Davilla</i> sp.
<i>Desmodium axillare</i> (Sw.) DC.
<i>Desmodium incanum</i> DC.
<i>Desmoncus orthoacanthos</i>
<i>Desmoncus polyacanthos</i>
<i>Dichorisandra hexandra</i> (Aubl.) Standl.
<i>Dioclea</i> sp.
<i>Diplasia karataefolia</i> Rich.
<i>Duguetia calycina</i> Benoist
<i>Duguetia megalophylla</i> R.E. Fr.
<i>Duguetia neglecta</i>
<i>Duguetia pauciflora</i> Rusby
<i>Duguetia pycnastera</i> Sandwith
<i>Duguetia yeshidan</i> Sandwith
<i>Duguetia calycina</i>
<i>Duguetia guianensis</i>
<i>Elaphoglossum rigidum</i> (Aubl.) Urb. (<i>Elaphoglossum flaccidum</i>)
<i>Eperua falcate</i>
<i>Epidendrum flexuosum</i> G. Mey.
<i>Epidendrum nocturnum</i> Jacq.
<i>Epiphyllum phyllanthus</i> (L.) Haw.
<i>Erythroxylum macrophyllum</i> Cav.
<i>Eschweilera wachenheimii</i>
<i>Eschweilera coriacea</i>
<i>Eschweilera subglandulosa</i>
<i>Eschweilera wachenheimii</i> (Benoist) Sandwith
<i>Eugenia egensis</i> DC.
<i>Euterpe oleracea</i> Mart.
<i>Evodianthus funifer</i> (Poit.) Lindm.
<i>Faramea sessilifolia</i> (Kunth) DC.
<i>Ferns</i>
<i>Ficus nymphaeifolia</i> Mill.
<i>Fine leaf counta</i>
<i>Forsteronia acouci</i> (Aubl.) A. DC.
<i>Genipa spruceana</i> Steyerem.
<i>Geonoma baculifera</i> (Poit.) Kunth
<i>Ginger</i> sp.
<i>Guapira olfersiana</i> (Link, Klotzsch & Otto) Lundell
<i>Guatteria foliosa</i>
<i>Guatteria</i> sp.
<i>Heliconia acuminata</i> Rich.
<i>Heliconia spathocircinata</i> Aristeg.
<i>Heteropsis jenmanii</i>
<i>Hippocratea volubilis</i> L
<i>Hiraea faginea</i> (Sw.) Nied.
<i>Hirtella paniculata</i> Sw.
<i>Hirtella silicea</i> Griseb.

<i>Hookeriopsis</i> sp.
<i>Hypolytrum longifolium</i> (Rich.) Nees ssp. <i>Longifolium</i>
<i>Hyptis</i> sp.
<i>Ichnanthus pallens</i> (Sw.) Munro ex Benth.
<i>Inga capitata</i>
<i>Inga meissneriana</i> Miq. (= <i>Inga vera</i> subsp. <i>affinis</i>)
<i>Inga melinonis</i>
<i>Inga nobilis</i> Willd.
<i>Inga pezizifera</i>
<i>Inga</i> sp.
<i>Ischnosiphon arouma</i> (Aubl.) Körn.
<i>Ischnosiphon centricifolius</i> L. Andersson
<i>Ischnosiphon obliquus</i> (Rudge) Körn.
<i>Ischnosiphon puberulus</i> Loes. var. <i>scaber</i> (Petersen) L. Andersson
<i>Jacaranda copaia</i>
<i>Jessenia bataua</i>
<i>Lacistema</i> sp.
<i>Leandra divaricata</i> (Naudin) Cogn.
<i>Leandra rufescens</i> (DC.) Cogn.
<i>Lianas</i>
<i>Licania alba</i>
<i>Licania densiflora</i> Kleinhoonte
<i>Licania guianensis</i> (Aubl.) Griseb.
<i>Licania heteromorpha</i>
<i>Licania laxiflora</i>
<i>Licania persaudii</i>
<i>Licaria debilis</i> (Mez) Kosterm.
<i>Lindernia crustacea</i> (L.) F. Muell.
<i>Lindsaea lancea</i> (L.) Bedd. var. <i>Lancea</i>
<i>Loganiaceae</i>
<i>Lomariopsis japurensis</i> (Mart.) J. Sm.
<i>Ludwigia affinis</i> (DC.) H. Hara
<i>Lygodium micans</i> J.W. Sturm (= <i>Lygodium volubile</i>)
<i>Mabea taquari</i> Aubl.
<i>Machaerium quinata</i> (Aubl.) Sandwith var. <i>Quinata</i>
<i>Martinella obovata</i> (Kunth) Bureau & K. Schum.
<i>Mascagnia sepium</i> (A. Juss.) Griseb.
<i>Matelea stenopetala</i> Sandwith
<i>Melastome</i> sp.
<i>Meliaceae</i>
<i>Melothria pendula</i> L.
<i>Memora schomburgkii</i> (DC.) Miers
<i>Mesechites trifida</i> (Jacq.) Müll. Arg.
<i>Metaxya rostrata</i> (Kunth) C. Presl
<i>Miconia longifolia</i> (Aubl.) DC.
<i>Miconia serrulata</i> (DC.) Naudin
<i>Miconia splendens</i> (Sw.) Griseb.
<i>Microgramma lycopodioides</i> (L.) Copel. var. <i>puminula</i> (Maxon)

<i>Microgramma reptans</i> (Cav.) A.R. Sm.
<i>Mikania congesta</i> DC.
<i>Mimosa myriadenia</i> (Benth.) Benth.
<i>Mimosa pellita</i> Humb. & Bonpl. ex Willd. (= <i>Mimosa pigra</i>)
Monkey pot
<i>Monotagma spicatum</i> (Aubl.) J.F. Macbr.
<i>Monstera adansonii</i> Schott
<i>Monstera obliqua</i> Miq.
<i>Montrichardia arborescens</i> (L.) Schott
<i>Mora excels</i>
<i>Myrcia graciliflora</i> Sagot
<i>Nautilocalyx mimuloides</i> (Benth.) C.V. Morton
<i>Nectandra aff. globosa</i> (Aubl.) Mez
<i>Nectandra amazonum</i> Nees
<i>Nephrolepis rivularis</i> (Vahl) Mett. ex Krug
<i>Odontadenia macrantha</i> (Roem. & Schult.) Markgr.
<i>Odontadenia puncticulosa</i> (Rich.) Pulle
<i>Olfersia cervina</i> (L.) Kunze
<i>Olyra latifolia</i> L.
<i>Olyra longifolia</i> Kunth
Orchids
<i>Oryctanthus alveolatus</i> (Kunth) Kuijt
<i>Panicum hylaeicum</i> Mez
<i>Panicum pilosum</i> Sw.
<i>Paradrymonia maculata</i> (Hook. f.) Wiehler
<i>Parinari campestris</i>
<i>Paspalum conjugatum</i> Bergius
<i>Passiflora cf. glandulosa</i> Cav.
<i>Passiflora quadriglandulosa</i> Rodschied
<i>Paullinia cf. capreolata</i> (Aubl.) Radlk.
<i>Paullinia pinnata</i> L.
<i>Pausandra martinii</i> Baill.
<i>Paypayrola longifolia</i> Tul.
<i>Peltogyne densiflora</i>
<i>Pentaclethra macroloba</i> (Willd.) Kuntze
<i>Peperomia macrostachya</i> (Vahl) A. Dietr.
<i>Peperomia obtusifolia</i> (L.) A. Dietr.
<i>Peperomia rotundifolia</i> (L.) Kunth
<i>Peritassa huanucana</i> (Loes.) A.C. Sm.
<i>Pharus latifolius</i> L.
<i>Philodendron fragrantissimum</i>
<i>Philodendron fragrantissimum</i> (Hook.) G. Don
<i>Philodendron rudgeanum</i> Schott
<i>Phthirusa retroflexa</i> (Ruiz & Pav.) Kuijt (= <i>Phthirusa stelis</i>)
<i>Phyllanthus caroliniensis</i> Walter ssp. <i>Guianensis</i> (Klotzsch) G.L. Webster
<i>Phyllanthus stipulatus</i> (Raf.) G.L. Webster
<i>Phyllanthus urinaria</i> L.
<i>Physalis pubescens</i> L.

<i>Piper arboreum</i> Aubl.
<i>Piper divaricatum</i> G. Mey.
<i>Piper hispidum</i> Sw.
<i>Piper hostmannianum</i> (Miq.) C. DC. (= <i>Piper berbicense</i>)
<i>Piper perstipulare</i> Steyerem.
<i>Piper</i> sp.
<i>Pityrogramma calomelanos</i> (L.) Link
<i>Polybotrya caudata</i> Kunze
<i>Posoqueria latifolia</i> (Rudge) Roem. & Schult.
<i>Pouteria guianensis</i>
<i>Prestonia acutifolia</i> (Benth. ex Müll. Arg.) K. Schum.
<i>Prestonia quinquangularis</i> (Jacq.) Spreng.
<i>Protium decandrum</i>
<i>Protium guianense</i>
<i>Protium</i> sp.
<i>Psidium acutangulum</i> DC.
<i>Psidium guajava</i> L.
<i>Psychotria cupularis</i>
<i>Psychotria cupularis</i> (Müll. Arg.) Standl.
<i>Psychotria gracilentia</i> Müll. Arg.
<i>Psychotria lupulina</i> Benth.
<i>Psychotria paniculata</i> (Aubl.) Raeusch.
<i>Pterocarpus officinalis</i>
<i>Pterocarpus rohrii</i> Vahl
<i>Pterocarpus santalinoides</i>
<i>Quassia amara</i> L.
<i>Quassia simarouba</i>
<i>Rhynchospora radicans</i> (Schltdl. & Cham.) H. Pfeiff. ssp. <i>microcephala</i> (Bertero ex Spreng.) W.W. Thomas
<i>Rinorea pubiflora</i> (Benth.) Sprague & Sandwith
<i>Rolandra fruticosa</i> (L.) Kuntze
<i>Rollinia exsucca</i> (DC. Ex Dunal) A. DC.
<i>Rosenbergiodendron longiflorum</i> Fagerl.
Rubiaceae (red flowers)
<i>Sabicea glabrescens</i> Benth.
<i>Saccoloma elegans</i> Kaulf.
<i>Salacia</i> sp.
<i>Sandwithia guyanensis</i> Lanj.
<i>Sapium jenmanii</i> Hemsl.
Sapotaceae
<i>Schlegelia</i> sp.
<i>Schwenckia grandiflora</i> Benth.
<i>Scoparia dulcis</i> L.
<i>Selaginella epirrhizos</i> Spring
<i>Senna multijuga</i> (Rich.) H.S. Irwin & Barneby
<i>Senna quinquangulata</i> (Rich.) H.S. Irwin & Barneby
<i>Sipanea biflora</i> (L. f.) Cham. & Schltdl.
<i>Sipanea</i> sp.
<i>Sipanea</i> sp.

<i>Siparuna decipiens</i> (Tul.) A. DC.
<i>Siparuna guianensis</i> Aubl.
<i>Smilax</i> sp.
<i>Solanum monachophyllum</i> Dunal
<i>Solanum stramonifolium</i> Jacq.
<i>Spathanthus unilateralis</i> (Rudge) Desv.
<i>Spathiphyllum schomburgkii</i> Schott
<i>Spiny palm</i>
<i>Squashi bitters</i>
<i>Stelis argentata</i> Lindl.
<i>Stenospermation multiovulatum</i> (Engl.) N.E. Br.
<i>Sterculia guianensis</i>
<i>Stylogyne</i> cf. <i>longifolia</i> (Mart. ex Miq.) Mez
<i>Stylogyne longifolia</i> (Mart. ex Miq.) Mez
<i>Swartzia guianensis</i> (Aubl.) Urb.
<i>Swartzia leiocalycina</i>
<i>Swartzia schomburgkii</i>
<i>Tabernaemontana heterophylla</i> Vahl
<i>Tachigali</i> sp.
<i>Tapiraira marchandii</i>
<i>Tapiraira obtuse</i>
<i>Thelypteris guyanensis</i> (Fée) C.V. Morton (= <i>Thelypteris macrophylla</i>)
<i>Thelypteris opulenta</i> (Kaulf.) Fosberg
<i>Thelypteris serrata</i> (Cav.) Alston
<i>Tovomita</i> aff. <i>Cephalostigma</i> Vesque (= <i>Tovomita umbellata</i>)
<i>Tovomita</i> aff. <i>Gracilipes</i> Planch. & Triana
<i>Trichomanes pinnatum</i> Hedw.
<i>Triplaris surinamensis</i> Cham. (= <i>Triplaris weigeltiana</i>)
<i>Triplophyllum funestum</i> (Kunze) Holttum
<i>Uncaria guianensis</i> (Aubl.) J.F. Gmel.
<i>Uncaria guianensis</i> (Aubl.) J.F. Gmel.
<i>Unonopsis guatterioides</i> (A. DC.) R.E. Fr.
<i>Vismia sessilifolia</i> (Aubl.) Choisy
<i>Vochysia tetraphylla</i> (G. Mey.) DC.
<i>Voyria</i> sp.
<i>Wild mango</i>
<i>Zygia cataractae</i> (Kunth) L. Rico

APPENDIX D – MINUTES OF PUBLIC CONSULTATION MEETINGS

Minutes of the Aurora Consultation held on 7th January 2006 at Ground Structures Engineering Consultants Ltd.

At D'Andrade Street, Newtown, Georgetown

Present at the meeting were the following persons:

Ms. Violet Smith	-	Area Manager GUY.
Mr. Charles Ceres	-	Consultant/ Team Leader
Dr. Paulette Bynoe	-	Consultant
Ms. Alana Lancaster	-	Consultant
Mr. Peter Persaud	-	The Amerindian Action Movement of Guyana (TAAMOG)
Ms. Mary Valenzuela	-	Guyana Organization of Indigenous Peoples (GOIP)

Main Issues Discussed

Mr. Ceres welcomed participants to the meeting and briefly introduced each person.

Ms. Smith then provided an overview of the exploratory phase/feasibility study of the proposed gold mine and run of the river hydropower project at the GUY. Aurora Site. Ms. Smith presentation was supplemented by summaries of the Project Information and Environmental Review Summary for the exploration phase of the project.

Mr. Ceres outlined Component 1 of the Environmental Study which will focus on the environmental and social baseline characterization. This baseline work is expected to extend over a one-year period. An extensive phase of baseline characterization will occur in January-February 2006 and would be updated quarterly. The intent would be to track the environmental variables over a one year period and would factor in seasonal effects

Dr. Bynoe outlined the activities to be undertaken for the socio-economic base characterization as:

- Identification of the historical significance of the study area;
- Identification of the dominant issues in the study area;
- Determination of the land ownership patterns for the study area;
- Characterization of each stakeholder group in terms of demographics, quality of life and their interactions with the environment (existing and proposed);
- Identification of the level of awareness among the stakeholders with regard to mining operations in the area
- Identification and characterization of community cohesion and management.

Mr. Persaud (TAAMOG) identified several concerns of Amerindians related to mining operations. These include surface water pollution, abuse of alcohol and drugs, and the potential health risks, especially HIV/AIDS posed to Amerindians due to the influx of workers at mine sites in proximity to Amerindian settlements. The collapse of the Omai Gold Mines Tailing dam and its impacts were particularly traumatic for Amerindian Communities downstream of the operations. He also pointed out the existence

of the titled Amerindian Community of Kurutuku in the Upper Cuyuni Area. He estimated that there are approximately 200 persons in that community.

Ms. Valenzuela (GOIP) expanded the Amerindian concerns to include the need for an employment regime different from that which typically obtains in normal practice. Amerindians are unlikely to be reliable employees if the employment regime demands a typical daily commitment to be at work. She suggested that a modified employment regime be implemented to allow Amerindian workers time for their family and to pursue their cultural chores, such as fishing and hunting at times dedicated to those exercises. She considered this to be a critical issue since wages is a primary means for wealth creation in Amerindian communities. Ms Valenzuela expanded the GOIP concerns to include the absence of male role models from homes created by employment opportunities at the mine sites and its impacts on household dynamics and community cohesion.

Amerindian Culture has unique characteristics. Both Mr. Persaud and Ms. Valenzuela identified the negative impacts on the propagation of Amerindian Culture as major issues related to development in areas in proximity to settlements. This was not expressly a function of mine site development only. This is best manifested by Amerindian households moving away from traditional self-sufficiency concepts into the cash economy. While this was considered a good thing, it was felt that some efforts should be expended to ensure that Amerindian Culture was passed on to future generations.

Mr. Ceres expressed gratitude to everyone for their presence and participation and the frankness with which views were expressed. While no assurances could have been given at this juncture, a promise was made to continue the consultation process with both NGOs and Amerindian Communities in proximity to the mine site.

Minutes of the Second Aurora Consultation held on 11th January 2006
at The Le Meridian Pegasus Hotel, Georgetown

Present at the meeting were the following persons:

Ms. Natalie Halich	-	IFC
Mr. John Middleton	-	IFC
Mr. Kirk Inniss	-	IFC - Caribbean
Mr. Patrick Sheridan	-	GUY.
Ms. Violet Smith	-	Area Manager GUY.
Mr. Charles Ceres	-	Consultant/ Team Leader
Dr. Paulette Bynoe	-	Consultant
Mr. Kwesi Nkofi	-	Consultant
Ms. Alana Lancaster	-	Consultant
Mr. Martin Cheong	-	Amerindian Peoples Association (APA)
Mr. Lawrence Anselmo	-	Amerindian Peoples Association (APA)
Mr. Peter Persaud	-	The Amerindian Action Movement of Guyana (TAAMOG)

Main Issues Discussed

Mr. Middleton explained that the IFC was considering an equity investment in a potential gold mining project at Aurora on the Cuyuni River. The project is currently in the exploration phase and a decision on a move to mining would be based on the results of the exploration programme and the findings of a feasibility report on profitability of a gold mining operation. The IFC had visited Guyana late last year and had consultations with the EPA, the Minister with responsibility for Mining, and the GGMC. The current visit was a continuation of the consultation process prior to a decision to invest in the project. The objective of this specific meeting was to consult with Indigenous groups to obtain their perspective of the impacts of mining related activities.

Ms. Natalie Halich in her introductory comments indicated the International Financial Corporation (IFC) was the private sector arm of the World Bank. It took a similar approach to that of the World Bank in identifying projects for investment. Further public consultation and disclosure are integral components of its decision to advance its involvement. The IFC was particularly concerned about the impact of mining related activities on indigenous communities. This opportunity was consequently being used to solicit comments from Indigenous NGOs about mining related impacts. The two NGOs present were then invited to detail their objectives and to discuss their concerns related to mining activities.

Mr. Cheong indicated that the Amerindian Peoples Association (APA) is a non profit organization founded in 1991. The primary objective of the APA is to protect the socio-economic, political and cultural interests of indigenous peoples in Guyana. The APA is managed by an Executive Body comprised of representatives of Regions 1, 2, 7, 8 and 9. The APA has an Executive Body which makes policies. Currently, APA has 7 members of staff; one of whom is the Programme Administrator, the only paid staff member. APA's has a network based on operatives in 40 indigenous communities.

Mr. Persaud explained that the Amerindian Action Movement of Guyana (TAAMOG) was established in 1993 to defend the rights of indigenous peoples. Members of this organisation work on a voluntary basis. Mr. Persaud said that he was glad that the GUY. summoned the indigenous organisations to a consultation and that this approach was 'the way forward'. He explained that mining is linked to several issues- both positive and negative. These include money, social consequences (disrespect shown to indigenous people by miners, drugs, prostitution and the migration of male heads of households which

affects the social cohesion at two levels: the household, and the community. Mr. Persaud made specific reference to Port Kaituma and Moruca in Region 1, and noted that the Ministry of Amerindian Affairs is weak institutionally and is unable to take appropriate actions to safeguard Amerindian communities.

Both the APA and TAAMOG are involved in several activities aimed at ensuring the maintenance of the traditional way of life. A primary issue of concern to both groups is the clarification and settlement of several outstanding land claims. In fact, the Amerindian Land Commission had recommended, back in 1966, that 24,000 square miles of land be granted to indigenous communities. To date a total of 8000 square miles have been granted. The major concern about mining operation is the proximity of these operations to Indigenous settlements. In spite of Indigenous communities having titles to land, no title was granted to waterways flowing through those lands. The GGMC were consequently free to and have awarded mining concessions to waterways flowing through indigenous communities. Wet mining methods in these locations have reduced surface water quality and negatively affected the presence of fishes in these rivers.

Further, there is little consultation with Indigenous communities on plans for development in areas adjacent to their communities. This is reflected by the expansion of forestry and ecotourism and the proposed National Protected Areas System (NPAS). In several instances, these developments have occurred in the absence of defensible Environmental Impact Assessment Statements.

Additional concerns expressed by the Indigenous Group's representatives are as follow:

- Increased mining activities in the Upper Mazaruni River and associated impacts, including water pollution, deforestation, use of mercury, and concessions granted on ancestral lands.
- The Amerindian Bill (2005) invests significant powers in the Minister, totally ignoring the concept of self-determination. In addition, the Bill as presently constituted will require that communities obtain the approval of the Minister, rather than the Village Council, to develop and enforce rules.
- While the bill grants communities the rights to agree to mining activities and to form partnerships with miners, the Minister also has the right to overrule a community's refusal to allow mining if mining is determined to be in the National Interest.
- There is a lack of protection for communities that are without land titles. Mining and other concessions can be given on untitled lands, which are currently the subject of Indigenous Land claims. The criterion for issuance of land titles is 25 years residence, a minimum 150 persons and the presence of social infrastructure.
- The NGOs think that these locations of land claims should be surveyed and a buffer zone should be established around non-titled communities.

It was noted that while the 1969 Amerindian Lands Commission Report identified the need for 43,000 sq. miles of land, only 24, 000 sq. miles were recommended, and of this amount, 8000 sq. miles were issued, without consultation or negotiation with Amerindians. Thus, land titles were best considered as an imposition, since the issuance process ignored the cultural linkages between the Amerindians and the land. Of particular importance is the fact that land use is not confined to a specific geographic location and a legal guarantee is required to ensure that use of land is not prohibited.

Reference was made to existing pieces of legislation:

- Section 112 of the Mining Act allows miners to negotiate with communities with regards to access to untitled lands. Currently, there are problems with its implementation.
- State Land Act does not grant Amerindians title to rivers that flow through their lands.

- Based on the formulation of the new Amerindian Act, indigenous communities land titles commence at a point 66 ft landwards of the low water mark of any river flowing through the community.

Other Critical Issues:

- Ministry of Amerindian Affairs (MOAA) does not provide all the information; thus, the GGMC issues concessions on Amerindian lands. The MOAA lacks the capacity to monitor GGMC authorization of mining permits.
- Lack of representation of indigenous people in mining activities.
- Mining should be done in an environmentally sound manner.
- Communities should benefit for mining.
- Lack of coordination among government entities.
- Consultations must be held and studies must be conducted to determine the positive and negative impacts of mining.

Mr. Persaud suggested that APA and TAAMOG elect an individual to liaise with the project team. It was agreed that Mr. Anselmo and a representative from Kurutuku, as well as one person from each community (if additional villages are in the area of influence) will comprise the liaison group. Also, an arrangement will be put in place to communicate concerns/data to GUY. after the first meeting.

The distribution of benefits from royalties/taxes was raised by Ms. Halich. She noted that the IFC would like to see examination of an option for a percentage of those royalties/taxes to go towards Amerindian development.

The significant increase in Amerindian population was noted and the issue regarding the location of disputed lands in the project area of influence was raised.

**GUY. – Proposed Large Scale Gold Mining Operations
Sector Scoping Meeting**

GUY. Sector Scoping Meeting

Date: April 28, 2009

Time: 13:30 hours

Venue: EPA Boardroom, 7 Broad & Charles Streets, Charlestown

Objective: To hold a sector scoping exercise for the Environmental Impact Assessment of the above-mentioned project, and to provide Sector Agencies with the opportunity to highlight concerns they may have regarding the project so that they can be incorporated into the final Terms of Reference (TOR) for the EIA study.

EPA Representatives:

1. Ms. Geeta Devi Singh – Director, Environmental Management Division
2. Mr. Hance Thompson – SEO (Auth), Environmental Management Division
3. Ms. Indira Mattai – SEO (M&E), Environmental Management Division
4. Ms. Teijvarti Persaud - EO II, Environmental Management Division

Representatives from GUY. (GGI):

5. Mr. Claude Lemasson – President & COO
6. Ms. Christina Robinson – Operations Manager
7. Mr. Svorman Mg-A-Qui – Senior Consultant

Representatives from EIA Consultant Team:

8. Mr. Charles Ceres – Project Manager, Ground Structures Engineering
9. Ms. Ayaana Jean Baptiste – Research Consultant, Ground Structures Engineering
10. Mr. Robert Langstroth – Biodiversity Specialist, ERM
11. Mr. Reed Huppman – Environmental Specialist, ERM
12. Ms. Sunrita Sarkar – Senior Consultant, ERM

Representatives from Sector Agencies:

13. Ms. Nadia Madho – Research & Documentation Officer, National Trust of Guyana
14. Ms. Anne-Marie Ford – Consultant, Iwokrama
15. Ms. Karen Livan – Manager, Environmental Department, Guyana Geology & Mines Commission
16. Ms. Eulene Watson – SEO II, Guyana Geology & Mines Commission
17. Mr. Puran Persaud – SRDO, Ministry of Local Government
18. Mr. Eustace Alexander – Biodiversity Analyst, Conservation International
19. Mr. Amarnauth Maraj – Principal Environmental Health Officer, Ministry of Health

Environmental Assessment Board (EAB) Representative:

20. Ms. Denise Simmons – Chairperson, EAB

AMEC Representatives:

21. Mr. John Clarke – Planning & Logistics
22. Mr. Manuel Montejo – Project Manager

IFC Representatives:

23. Mr. John Butler – Development Specialist
24. Mr. Larry Jiang – Environmental Specialist

The Sector Agency scoping meeting for the Guyana Goldfield Inc. proposed large-scale goldmining operation was held in the EPA Boardroom, Charlestown, Georgetown. The meeting commenced at 13:40 hours.

The Chairperson, Mr. Thompson, welcomed and thanked representatives from the Sector Agencies for attending the meeting and invited stakeholders to introduce themselves. Mr. Thompson gave a brief outline of the project background and noted that the application was submitted on January 14, 2009. He further proceeded to explain the purpose of the meeting, which was to provide a forum for the Sector Agencies to outline any concerns they may have about the project so that they can be included in the final Terms of Reference (TORs) for the EIA.

The Chair then invited Ms. Geeta Singh to give an overview of the EIA process.

Mr. Thompson then invited the developer, Mr. Lemasson to give a summary of the project. He indicated that GUY has been conducting exploratory works in Guyana since 1996; however, the initial significant find did not come until 2004.

He informed the meeting that the development and operation of the project will comprise four major components as follows:

1. Construction and operation of the mine site.
2. Construction of an access road.
3. Construction and operation of a hydropower plant on the Cuyuni River.
4. Construction and operation of a wharf at Buck Hall on the Essequibo River.

Mr. Lemasson went on to briefly explain each component in further detail for the benefit of the attendees. He informed the meeting that the mine life is expected to be between 12 - 15 years dependent on what the outcomes of the feasibility study currently being conducted. He indicated that GGI aims to employ qualified Guyanese and will conduct intensive training programmes.

Mr. Charles Ceres, representing the team of consultants, then gave an overview of what the EIA study would encompass and the study methodology the consultants would employ in conformity with EPA's guidelines. Mr. Ceres further highlighted some potential environmental, biodiversity, and social and economic impacts.

At this point, the Chairperson then invited representatives from various sector agencies to make any suggestions and comments on the project as well as any issues or concerns they may have.

Questions/Comments/Suggestions

1. **Ms. Karen Livan – Guyana Geology & Mines Commission** indicated that they were pleased with the initiative and were looking forward to the learning experience with regard to underground mining. The Commission however, had a number of concerns and/or interests:
 - i. The outcomes of the baseline study, highlighting that when these studies are usually conducted, very little information is presented on water quality.
 - ii. Reports/results on ore constitution.
 - iii. Underground mining – highlighting the technical parameters e.g. tailings treatment and cyanide.
 - iv. An ongoing technical monitoring programme of the earthen dam to be constructed for the closure of a branch of the Cuyuni River for the establishment of the hydropower plant.

- v. Plans for closure and progressive reclamation.
- vi. Information regarding underground mining as new techniques will be employed. The closure plan would need to address the issues with regard to underground mining into consideration.
- vii. The concern of sedimentation resulting from the mine operation.

The GGMC representative informed the meeting that there were procedures/guidelines available at the Commission for dealing with mining and forestry issues if the need arose. They were also pleased to hear of the training component and hoped that it would be extended to the University of Guyana and other major stakeholders especially pertaining to underground mining.

2. **Ms. Nadia Madho – National Trust of Guyana** – indicated that the Trust was interested in preserving Guyana's nature heritage and should GGI discover any archaeological deposits/historic objects, they should be notified immediately.
3. **Mr. Amarnauth Maraj – Ministry of Health** – indicated that the Ministry would want to see appropriate accommodation/housing be prepared for workers and enquired on how the Company plans to deal with sewage treatment and disposal. He requested that food handlers be trained in proper food hygiene and preparation and for the Company to highlight their sources of water and treatment methods for human consumption. Mr. Maraj also enquired about GGI's plans for dealing with insect/vector borne diseases.
4. **Mr. Eustace Alexander – Conservation International (CI)** – highlighted that CI would like to see the functionality of the area restored or enhanced after mine life. He went on to highlight several issues they would want to see emphasized:
 - i. A watershed management programme.
 - ii. A fire management programme.
 - iii. Baseline studies to cover biodiversity of the area, highlighting any globally important species.
 - iv. A detailed closure plan.
 - v. Go beyond the EPA and engage NGOs in consultations with regard to environmental management.

5. **Ms. Ann-Marie Ford – Iwokrama** – was also interested in the closure plan and drew attention to the fact that road construction may become very problematic and recommended that they contract a road engineer.
6. **Ms. Denise Simmons – Environmental Assessment Board** – wanted to see a detailed baseline study conducted and for GGI to address any alternatives to the hydropower plant and reasons for selecting that option. She also requested the consultants to discuss the different components of the operation as Mr. Lemasson highlighted earlier, separately, and address the cumulative impacts. Ms. Simmons also expressed interest in the closure plan and indicated that this would also be a learning experience for all.
7. There being no other questions or concerns raised, EPA thanked the representatives from the various sector agencies for attending the meeting and outlined the next steps of the project.

The meeting was concluded at 14:30hours.

**GUY. – Proposed Large Scale Gold Mining Operation
Public Scoping Meeting (Bartica)**

GUY. Public Scoping Meeting

Date: April 29, 2009

Time: 12:00 hours

Venue: New Modern Hotel, 9 First Avenue, Bartica, Essequibo River

- Objectives:**
- i. To hold a scoping exercise for the Environmental Impact Assessment for the abovementioned project.
 - ii. To highlight some of the perceived environmental impacts and to incorporate the concerns of all stakeholders, and more importantly, the public's concerns into the final Terms of Reference for the EIA study.

EPA Representatives:

1. Ms. Geeta Devi Singh – Director, Environmental Management Division
2. Mr. Hance Thompson – SEO (Auth), Environmental Management Division
3. Ms. Indira Mattai – SEO (M&E), Environmental Management Division
4. Ms. Teijvarti Persaud - EO II, Environmental Management Division

Representatives from GUY.:

5. Mr. Claude Lemasson – President & COO
6. Ms. Christina Robinson – Operations Manager
7. Mr. Svorman Mg-A-Qui – Senior Consultant

Representatives from EIA Consultant Team:

8. Mr. Charles Ceres – Project Manager, Ground Structures Engineering
9. Ms. Ayaana Jean Baptiste – Research Consultant, Ground Structures Engineering
10. Mr. Robert Langstroth – Biodiversity Specialist, ERM
11. Mr. Reed Huppman – Environmental Specialist, ERM
12. Ms. Sunrita Sarkar – Senior Consultant, ERM

Environmental Assessment Board Representative:

13. Ms. Denise Simmons – Chairperson, EAB

The Public Scoping Meeting for GUY. proposed large-scale gold mining operation held in Bartica commenced at 12:20 hours.

The Chairperson, Mr. Thompson, welcomed and thanked members of the public for attending the meeting and further proceeded to introduce members of the head table. He went on to outline the mandate of the Agency, purpose of the meeting and informed attendees that the main focus of the gathering is to hear the concerns and issues that they may have on the proposed operations by GUY. The Chair further stated that the concerns and issues identified at this meeting would assist the EPA in finalizing the TOR for the EIA study.

The Chair then invited Ms. Indira Mattai to give a brief presentation on the EIA process and the role the public plays in this process.

The developer, Mr. Lemasson, gave an outline of the proposed project. He indicated that GUY has been conducting exploratory works in Guyana since 1996; however, the initial significant find did not come until 2004.

He informed the meeting that the development and operation of the project will comprise four major components as follows:

5. Construction and operation of the mine site.
6. Construction of an access road.
7. Construction and operation of a hydropower plant on the Cuyuni River.
8. Construction and operation of a wharf at Buck Hall on the Essequibo River.

Mr. Lemasson went on to briefly explain each component in further detail for the benefit of the attendees.

Mr. Charles Ceres, representing the team of consultants, then gave an overview of what the EIA study would encompass and how the consultants would undertake the study. He stressed that the Public's input was vital to the EIA process. Mr. Ceres further highlighted some anticipated environmental impacts on the physical, biological and social and economic environment.

At this point, the Chairperson then invited the public to make suggestions and comments on the project as well as any issues and concerns they may have.

Questions/Comments/Suggestions

8. **Mr. Richard Williams – Deputy Chairman Regional Democratic Council of Region 7** indicated that he had three (3) major concerns:

- i.) He was hoping and seeking assurances that GUY. would do as much as possible to prevent a cyanide spill as the Community suffered tremendously when there was the OMAI spill.
- ii.) Since the water quality in the area can change, the persons living along the river and at its mouth may not have easy access to purified drinking water and the Company should make this necessity available for those Communities.
- iii.) He enquired how would Bartica benefit from this Project, since it was Linden that benefited from OMAI. All that Bartica received were a few computers for the School.

9. **Mr. Prembishal Persaud – Resident** – raised several concerns and enquired about some of the issues pertaining to the potential effects to the environment associated with the mining operations as follows:

- i.) Would there be any conflicts with small miners?
- ii.) What chemicals would the Company utilize for the refining purposes?
- iii.) What will the cleared forests/logs be utilized for?
- iv.) What will happen to the fishes since the water quality will deteriorate and many persons rely on the water for drinking and cooking purposes?
- v.) What benefits will there be for the Amerindian Communities upstream and down stream of the Cuyuni River and what systems will be put in place for compensation?
- vi.) How will water-borne diseases emanating from the mine operations be dealt with?
- vii.) How many Guyanese personnel will be employed and at what positions?
- viii.) The Amerindian Communities and small miners would be totally displaced since this is such a large-scale project. How would the company compensate for the displacement of persons in the area?
- ix.) The construction of roads is appreciated, but will the Company charge tolls? Tools may be too expensive for the common man/small miner.
- x.) After the mine life, what should communities do? What would be the economic benefits other than job creation?

- 10. Mr. Colin Hopkinson – Miner – Hopkinson Mining** – indicated that he was a miner in the Cuyuni River for many years and this would be a vast development for the area. However, good water quality is essential for the Homesteads along the River. He informed the meeting that he would usually dig wells and treat the water for his workers and that GUY. should consider doing the same. Mr. Hopkinson also indicated that water from the river is not used for drinking since that water quality is currently significantly deteriorated. Further, Amerindian communities view this Project as a tremendous opportunity for jobs and skills enhancement. He stated that the main issue is development but having effective measures in place for its management is necessary.
- 11. Mr. Eustace Prince – Resident** – Informed the meeting that the only established Amerindian Community in the area is at Kartabu – Culutaca which is about 120 miles upstream of Aurora. Mr. Prince recommended that wells be dug for drinking purposes as the river water is already contaminated and reiterated that no Amerindian Communities will be affected.
- 12. Mr. Shawn Hopkinson – Miner – Hopkinson Mining** – welcomes the venture and indicated that he has been working in the Cuyuni River for many years and knows that the water from the River is not usable. Further, there were no Amerindian villages in the area and the airstrip at Aurora Goldfields, constructed by GUY., has proven very helpful to many small miners and the Amerindians residing upstream in cases of medical emergencies. He stressed that OMAI and Aurora are two (2) different situations and that the EPA is on board this time round to ensure that everything is done in an environmentally friendly manner. Mr. Hopkinson made the suggestion that a meeting should be held in Aranka, which has already received much help from the Company. The Company facilitated the entire community through its medex and medical centre at Aurora since the Government has not yet set up any medical outposts in Aranka.
- 13.** There being no other questions or concerns raised, EPA thanked the members of the public for attending the meeting and outlined the next steps of the project.

The meeting was concluded at 13:35hours.

Members of the Public in attendance (Bartica)

#	Name	Agency	Designation	Tel. #/ Fax#	Address / Email Address
1	Geeta Singh	EPA	Director, EMD	225-0506 Ext. 21	7 Broad & Charles Streets, Charlestown

2	Hance Thompson	EPA	SEO (Auth)	225-0506 Ext. 23	7 Broad & Charles Streets, Charlestown
3	Indira Mattai	EPA	SEO (M&E)	225-0506 Ext. 23	7 Broad & Charles Streets, Charlestown
4	Teijvarti Harnanan	EPA	EO II	225-0506 Ext. 24	7 Broad & Charles Streets, Charlestown
5	Mr. Claude Lemasson	GUY.	President & COO	416-561-1512	Toronto, Canada clemasson@GUY.com
6	Ms. Christina Robinson Operations Manager	GUY.	Operations Manager	416-628-5936	Toronto, Canada crobinson@GUY.com
7	Mr. Svorman Mg-A- Qui	GUY.	Senior Consultant	225-2974	Georgetown, Guyana nippy@msn.com
8	Mr. Charles Ceres	Ground Structures Engineering	Project Manager	225-2974	212 D'Andrade Street charlespceres@gmail.com
9	Ms. Ayana Jean- Baptiste	Ground Structures Engineering	Research Consultant	628-7350	17 Lamaha Street, Queenstown ajbatuoft@yahoo.ca JBAPTISTE@GUY.COM
10	Ms. Sunrita Sarkar	ERM	Senior Consultant	202-466-9090	Washington, D.C. sunrita.sarkar@erm.com
11	Mr. Reed Huppman	ERM	Environmental Specialist	202-471-2114	Washington, D.C. reed.huppman@erm.com
12	Robert Langstroth	ERM	Biodiversity Specialist	202-466-9090	Washington, D.C. robert_langstroth@erm.com
13	John Clarke	AMEC	Planning & Logistics	905-829-7086	Oakville, Ontario, Canada john.d.clarke@amec.com
14	Manuel Montejo	AMEC	Project Manager	905-330-5778	Oakville, Ontario, Canada manuel.montejo@amec.com
15	John Butler	IFC	Development Specialist	202-413-4827	Washington, D.C. jbutler@ifc.org

16	Larry Jiang	IFC	Environmental Specialist	202-468-7446	Washington, D.C. ljiang1@ifc.org
17	Denise Simmons	EAB	Chairperson	623-1818	C/o University of Guyana den_simmons100@yahoo.com
18	Eric Phillips	Dance Alive	Chairman	233-2658	Eccles, Guyana
19	Cornel King	-	Project Coordinator	225-0289	
20	Gaulbert Sutherland	Stabroek News	Reporter	628-1938	Myster-gaulbert@yahoo.com
22	Eustace Prince		Resident		36, First Avenue, Bartica
23	Reginald Lowe	GUY.	PRO & LOG Officer	225-0289	7, North Road, G/town reginaldlowe44@yahoo.com
24	Shawn Hopkinson	Hopkinson Mining	CEO	455-0052	9, First Avenue, Bartica hopkinsonshawn@yahoo.com
25	Kwame Calbeira	GUY.	Research Assistant	626-2646	7, North Road , G/town
26	Colin Hopkinson	Hopkinson Mining		455-2617	Bartica
27	Orin Belle	Water Taxi	Resident	455-2405	26, Caribeseltill, Bartica
28	Richard Williams	Bartica NDC	Deputy Chairman	455-2229	18, First Avenue, Bartica
29	James Wyatt		Miner	455-9061	43, Third Avenue, BArtica
30	Morris Hopkinson	Hopkinson Mining	Miner	455-3054	Bartica
31	Mohamed S. Harry	Sheriff Mining	Managing Director	602-1353	50, Second Avenue, Bartica sherifqualitygold@yahoo.com
32	Pierre Wallace	Success Partners Inc.		670-9273	44, First Avenue, Bartica pierrewallace@yahoo.com
33	Wayne S. Nurse		Resident	670-2587	11-4 Avenue, Bartica
34	Norris Nurse		Resident	455-3184	11-4 Avenue, Bartica
35	Prembishal Persaud			455-2497	38-4 Avenue, Bartica

Pictures



Plate 1 showing the head table



Plate 2 showing the attendees