Eagle Mountain Gold Project, Guyana

Environmental Impact Assessment Report: Volume 2

PREPARED FOR

Stronghold Guyana Inc.
(subsidiary of Mako Mining Corp.)

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1. GEOGRAPHIC SETTING

1.1 INTRODUCTION

This chapter describes the Project's geographic setting. The location of the Project is shown in Figure 1.1.

1.2 BASELINE CONDITIONS

The Project area is located in west-central Guyana, approximately 200 kilometres south-southwest of Georgetown, the capital of Guyana, between latitudes of 573,600 N and 581,500 N and longitudes of 261,000 E and 271,800 E (UTM WGS84, Zone 21N).

The Project site is located approximately 8 kilometres south of Mahdia Township, Campbelltown, and the Mahdia commercial airstrip. Mahdia has a population of approximately 3,000 inhabitants and is the administrative capital of Potaro-Siparuni Region 8. Mahdia can be accessed by road from Georgetown in six to eight hours, a distance of approximately 310 kilometres. The road is paved from Georgetown to Linden (109 kilometres).

A wide laterite road extends between Linden and Mabura (122 kilometres). This section is currently being upgraded to an asphalt/concrete surface. From there an all-weather unpaved road connects Mabura to Mahdia. On this section, access can be challenging during the rainy season, and there are only limited days in the year in which travel is restricted.

The Mahdia airstrip is hard surfaced and is suitable for small commercial and charter passenger aircraft.

Unpaved roads and tracks from Mahdia provide access to and within the Eagle Mountain Prospecting License (EMPL).

FIGURE 1.1 PROJECT LOCATION

Source: Esri; Garmin International, Inc., Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community, Esri, USGS

Path: \\vmukspgisfs01\Data\London\Projects\0763224 - Mako Mining EIA\Map\0763224 - Mako Mining EIA - V01C01 - Introduction.aprx\0763224 - V01C01 - Introduction - 01.XX - Prospecting Licence Area

2. AIR QUALITY

2.1 AIR QUALITY BASELINE

2.1.1 INTRODUCTION

This section describes the air quality baseline conditions in the Project area. It sets out the relevant criteria, describes the methodology for the baseline survey, and summarises the survey measurements and conclusions.

2.1.1.1 ASSUMPTIONS AND LIMITATIONS

Based on the remote location of the mine site and ancillary facilities, air quality concentrations were expected to be near or below global baseline levels. The monitoring location was selected based on the expected proximity to the proposed processing plant. Data collected from Stronghold Guyana's on-site meteorological station were also utilised during the study. It is assumed that the meteorological station was operating within manufacturer specifications.

2.1.1.2 AIR QUALITY CRITERIA

In the absence of applicable Guyana regulatory guidance, ERM used International Finance Corporation (IFC) guidance for selecting air pollutants to monitor, determining the monitoring site, and establishing other program parameters. Resulting measurements were compared to the World Health Organisation's (WHO) Global Air Quality Guidelines (AQG) Interim Target 1 (IT-1) (WHO 2021).

There is no clear consensus as to the level of dust deposition that is likely to result in nuisance issues. However, on the basis of pragmatic consideration of various criteria found in literature[1], the magnitude criteria presented in the table below have been developed.

Volatile organic compounds (VOCs) were sampled for assessment of baseline concentrations over the monitoring period and not compared to any standards.

The governing organisations and their standard's concentrations selected as the air quality criteria to compare against baseline air quality concentrations are presented in Table 2.1.

TABLE 2.1 AIR QUALITY CRITERIA

Pollutant	Averaging Period	WHO 2021 AQG IT-1	Units
$PM_{2.5}$	Annual	35	µg/m^3
	24-hour[1]	75	µg/m^3
PM_{10}	Annual	70	µg/m^3
	24-hour[1]	150	µg/m^3
NO_2	Annual	40	µg/m^3
	24-hour[1]	120	µg/m^3
SO_2	24-hour[1]	125	µg/m^3
CO	24-hour[1]	7	mg/m^3

[1] United Kingdom (UK) technical Guidance Note M17 and Germany, TA-Luft regulation

Pollutant	Averaging Period	WHO 2021 AQG IT-1		Units
VOCs	No AQG			
Dustfall	24-hour	<120	Negligible	$mg/m^2/day$
		120-200	Small	$mg/m^2/day$
		200-350	Medium	$mg/m^2/day$
		>350	Large	$mg/m^2/day$

[1]Assessed as the 99th percentile of daily averages

2.1.2 DATA COLLECTION AND METHODOLOGY

ERM conducted an ambient air quality monitoring program for the Project from 10 April 2025 through to 08 May 2025 (wet season) and 15 October 2025 to 12 November 2025 (dry season). The survey period for each season was four weeks long and was designed to characterise existing ambient air quality conditions at the mine site.

2.1.2.1 LOCATIONS AND MONITORING PERIOD

Ambient air quality was monitored at one location on the Project camp site ('Stronghold Guyana Camp Site') since a single monitoring site was deemed sufficient to adequately capture the baseline air quality conditions for the proposed mining project. This location was selected based not only on the expected proximity to the proposed processing plant but also on its ease of accessibility. Easy accessibility facilitated regular maintenance, timely data collection, and efficient operational oversight of the monitoring station.

The monitoring location is shown in Figure 2.1 and the coordinates are presented in Table 2.2.

TABLE 2.2 MONITORING LOCATIONS

Location	Monitored Parameters	UTM Coordinates[1]		Elevation (masl[2])
		Easting	Northing	
Stronghold Guyana Camp Site	Dustfall, NO_2, SO_2, VOC, TSP, PM_{10}, $PM_{2.5}$, CO, Meteorology	265346	575663	335

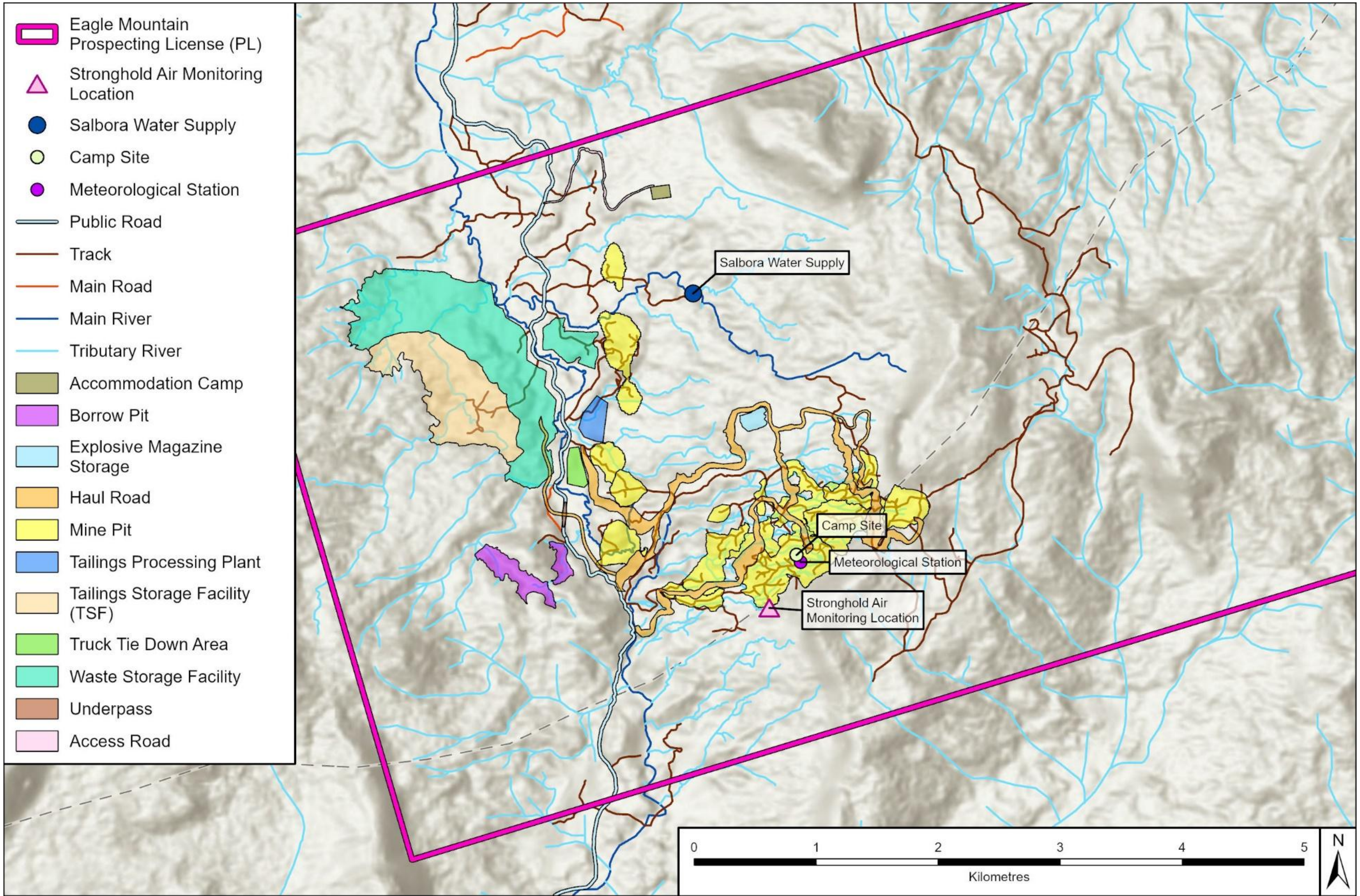
[1]Based on the global projection system PSAD 56 datum for UTM zone 21N.
[2]Meters above sea level

Table 2.3 includes the monitoring periods for the wet and dry seasons.

TABLE 2.3 MONITORING PERIODS

Season	Monitoring Period	
	Start Date	End Date
Wet	10 April 2025	07 May 2025
Dry	15 October 2025	12 November 2025

FIGURE 2.1 EAGLE MOUNTAIN AMBIENT AIR MONITORING LOCATION



Source: Esri, NASA, NGA, USGS, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

Path: \\vmukspgisfs01\Data\London\Projects\0763224 - Mako Mining EIA\Map\0763224 - Mako Mining EIA - V02C02 - AIR.aprx\0763224 - V02C02 - AIR - 02.XX - Ambient Air Monitoring Locations

2.1.2.2 SURVEY METHODOLOGY

The purpose of the study was to collect data on the baseline air quality in the Project area, as follows:

- TSP, PM10, and PM2.5 were continuously monitored using an Aeroqual AQS1 capable of providing real-time 1-hour average concentrations. The sampler was mounted on a tripod and data was manually collected off the instrument by Stronghold Guyana staff on a weekly basis for subsequent data analysis by an ERM air quality specialist.
- NO_2 and SO_2 were monitored using passive diffusion tubes placed near the other air quality equipment. These tubes have special caps to collect gases while blocking particles. The tubes were analysed at an accredited lab using Ion Chromatography. Detection limits are 0.5 µg/m³ for NO_2 and 1.5 µg/m³ for SO_2
- Dust fall was continuously collected over the survey period using a DustScan DustDisc. The DustDisc is a dust settlement sampler that is composed of an adhesive pad in a secured casing that is mounted horizontally to collect dust fall. The DustDisc was deployed to collect a four-week sample. The DustDisc sample was sent to DustScan and analysed using gravimetric analysis to quantify dust deposition mass (mg/m²/day). The lab's control blank was used as quality control for the sample analysis.
- Evacuated summa cannisters[2] were deployed to quantify baseline VOC and CO concentrations at the monitoring location. The summa cannisters were deployed with a flow controller calibrated to collect one week (7 days) air samples for subsequent Method TO-15 and EPA CO 25C laboratory analysis.
- Data from an existing onsite meteorological station was used to support air quality data at the mine and that data was validated by an air monitoring specialist. Meteorological data consisted of wind speed, wind direction, ambient temperature, relative humidity, barometric pressure and rainfall.

At the conclusion of the air quality sampling program, the results of the air quality baseline data were documented and compared against IFC air quality guidelines, which adopt WHO guidelines.

2.1.2.3 MONITORING STATION MICRO SITING

Micro siting was undertaken by an air monitoring technician during installation. The selected site was chosen in a location on the mine site away from the influence of local emission sources, dripline, roads and structures. The air monitoring equipment location remained stationary throughout both the wet and dry season monitoring period. Figure 2.2 shows the ambient air monitoring station setup.

[2] Summa canisters are stainless-steel, passivated sampling vessels used to collect air samples for laboratory analysis,

FIGURE 2.2 MINE SITE AIR MONITORING STATION

2.1.2.4 MONITORING EQUIPMENT AND METHODS

Monitoring required a combination of real-time analysers and time-integrated sampling equipment. These are discussed in the following sections.

Particulate Matter: TSP, PM_{10} & $PM_{2.5}$

Continuous TSP, PM_{10} and $PM_{2.5}$ concentrations were monitored using an Aeroqual AQS1 particulate analyser, SN: 03072024-2722, configured to provide 1-hour average concentrations. The sampler was mounted on a tripod with the sampling inlet positioned 2 meters above ground level. The system was solar powered by a photovoltaic array and two 12-volt deep cycle batteries wired in parallel, to provide continuous power to the instrument.

The real-time TSP, PM_{10} and $PM_{2.5}$ measurements were made using an optical light scattering technique that is dependent on volumetric flow rate and atmospheric pressure. Weekly site checks were performed by a field technician and included monitoring the instrument diagnostics, retrieving data for air monitoring specialist review, and performing minor maintenance tasks to ensure the instrument was operating within the manufacturer's specifications.

QA/QC procedures were also performed to assist data recovery. Particulate matter data recovery is presented in Table 2.4.

TABLE 2.4 PARTICULATE MATTER DATA RECOVERY

Location	Season	Monitoring Period	Parameter	Data Recovery
Mine Site	Wet	11 April – 07 May, 2025	$PM_{2.5}$	100%
			PM_{10}	100%
			TSP	100%
Mine Site	Dry	15 October – 12 November, 2025	$PM_{2.5}$	100%
			PM_{10}	100%
			TSP	100%

While a data recovery goal was not specified for this program, actual data recovery exceeded standard data recovery goals of 75%, set by international air quality monitoring agencies such as USEPA.

Nitrogen Dioxide and Sulphur Dioxide

Individual NO_2 and SO_2 samples were collected using passive diffusion tubes for the duration of the four-week monitoring period. The diffusion tubes are acrylic tubes fitted with thermoplastic rubber caps at each end. The NO_2 diffusion tube has a coloured cap containing the absorbent, and a white cap that was removed during sampling and reattached post sampling for shipping. Similarly, the SO_2 diffusion tube has a coloured cap at one end containing the absorbent, and a white cap on the other end of the tube which is fitted with a filter to prevent the ingress of particulates.

Triplicate samples were collected to provide redundant measurements and provide a quality control assessment. These were sampled over the 4-week period. At the conclusion of the monitoring period, all samples were vacuum sealed and sent to an analytical laboratory and analysed. Analysis was performed by ion chromatography following GRADKO International LTD Laboratory's in-house Method GLM7 and GLM1 for NO_2 and SO_2, respectively.

Dustfall

Dustfall was collected for laboratory analysis using a DustScan DustDisc. This is a dust settlement sampler composed of an adhesive pad in a secured casing. The entire casing was mounted horizontally to collect dustfall samples over a four-week period. Collected samples were shipped to DustScan and analysed using gravimetric analysis to quantify dust deposition mass in units of $mg/m^2/day$. Laboratory blanks were used as quality control for the sample analysis.

The dust disc samples were collected by an ERM trained technician while wearing nitrile gloves avoiding contact with the adhesive surface (collection surface) of the dust disc. The adhesive pad was removed from its casing and sealed against a polyester transparency film to trap the dust collected and to avoid potential sample contamination from external sources.

Volatile Organic Compounds and Carbon Monoxide

Evacuated summa cannisters were deployed to quantify baseline VOC and CO concentrations at the monitoring location. Each summa cannister was deployed with a flow controller configured to collect seven-day integrated air samples for laboratory analysis using United States Environmental Protection Agency (USEPA) Method TO-15 to determine VOC concentrations, and USEPA Method 25C to determine CO concentrations. The summa canisters were swapped out on a weekly basis by an ERM trained air monitoring technician.

Canister pressure was documented prior to and after sample acquisition. Sample integrity was maintained by use of shutoff valves, which were closed tightly at the end of sample collection. Additionally, a quarter inch cap was tightened to the inlet of the summa to further prevent contamination of the collected sample.

Meteorological Monitoring

Onsite meteorological measurements were obtained to support interpretation of the air quality data. Stronghold Guyana previously established an on-site meteorological monitoring station using a Davis Vantage Vue weather station, configured to provide 15-minute average measurements of wind speed, wind direction, ambient temperature, relative humidity, barometric pressure, and precipitation. This meteorological station was used to quantify local meteorological conditions at the mine site. The data has not been validated by ERM. It is assumed to be operating within manufacturer specifications.

2.1.2.5 DOCUMENTATION AND REPORTING

Field Forms

Field forms were maintained throughout the project to document relevant project information. Site check forms were used to document site activities, weather conditions, real-time observations, and equipment status and maintenance. Chain of Custody (CoC) forms were used to document sample collection information. Field forms are provided in Appendix F-3.

Real-Time Monitoring Data

The real-time TSP, PM_{10}, $PM_{2.5}$, and meteorological data were collected from dataloggers on a weekly basis by a field technician. The data was submitted to and reviewed by ERM air monitoring specialists for completeness.

Composite Air Sampling Data

At the end of the monitoring period, the exposed composite samples and blanks were prepared and shipped to the laboratory for method GLM7 and GLM1 analysis for NO_2 and SO_2, respectively.

Whole Air Sample Data

At the end of the monitoring period, the integrated whole air samples were shipped for method TO-15a laboratory analysis of VOCs.

Dustfall Deposition Data

At the end of the monitoring period, the dustfall deposition collection adhesive pads were shipped to the laboratory for gravimetric analysis.

2.1.3 MONITORING RESULTS

This section provides the results of the wet season ambient air monitoring survey. Results include composite air sample analysis for NO_2 and SO_2, integrated whole air sample analysis for VOCs, gravimetric analysis for dustfall deposition, and real-time 24-hour average TSP, PM_{10} and $PM_{2.5}$ concentrations and meteorological parameters.

2.1.3.1 PARTICULATE MONITORING RESULTS

The wet season particulate air monitoring consisted of continuous air monitoring from 09 April 2024, at 05:00 pm until 07 May 2025 at 01:00 pm. The maximum and minimum 24-hour average TSP, PM_{10} and $PM_{2.5}$ concentrations are shown below in Table 2.5.

TABLE 2.5 PARTICULATE MATTER RESULTS

Particulate Matter – 2025 Period Summary for Eagle Mountain								
Parameter	WHO 2021 AQG IT-1 (μg/m³)		Monitoring Results (μg/m³)					
			Wet Season			Dry Season		
	Annual	24-Hour[1]	24-Hour Minimum	24-Hour Maximum	Period Average	24-Hour Minimum	24-Hour Maximum	Period Average
$PM_{2.5}$	35	75	2.2	27.3	10.3	3.18	21.9	9.41
PM_{10}	70	150	9.6	61.6	24.8	15.9	48.1	25.3
TSP	NG	NG	13.4	75.8	31.2	20.6	70.5	34.0

[1] Assessed as the 99th percentile of daily averages.
NG: No WHO AQG

At the proposed mine site, the 2025 wet season background $PM_{2.5}$, PM_{10} and TSP concentrations were 10.3 μg/m³, 24.8 μg/m³ and 31.2 μg/m³, respectively while the dry season background $PM_{2.5}$, PM_{10} and TSP concentrations were 9.41 μg/m³, 25.3 μg/m³ and 34.0 μg/m³, respectively. Though a true comparison cannot be completed as a full year of monitoring has not been performed, neither PM_{10} nor $PM_{2.5}$ concentrations exceeded the WHO annual nor the 24-hour average AQG. There was no lapse in PM data recovery during the monitoring periods.

2.1.3.2 DUSTFALL SAMPLING RESULTS

The dustfall sampling consisted of continuous dustfall deposition collection during both the wet and dry season monitoring periods. The daily dustfall deposition rates are shown below in Table 2.6.

TABLE 2.6 DUSTFALL RESULTS

Dustfall Deposition – 2025 Period Summary						
			Monitoring Results			
Season	Sampling Period	WHO 2021 AQG	**Interval (days)**	**Mass of dust as released solids (mg)**	**Inferred Deposition Rate as Released Solids (mg/m²/day)**	**Magnitude**
Wet	10 April – 07 May	NG	27	32.64	286.1	Medium
Dry	15 October – 12 November	NG	28	21.9	185.5	Small

NG: No WHO AQG

The wet season background dustfall deposition was 286.1 mg/m^2/day, and 185.5 mg/m^2/day during the dry season for the proposed Mine Site. No AQG has been set by WHO for dustfall. Compared against the magnitude criteria presented in Table 2.1, dustfall at the proposed mine site during the wet season corresponds to a medium dust deposition magnitude indicating moderate dust accumulation that may require mitigation.

2.1.3.3 CO SAMPLING RESULTS

Air quality monitoring for carbon monoxide (CO) was conducted using whole air samples during the wet and dry season monitoring periods. The analysis of these samples was performed in accordance with U.S. Environmental Protection Agency (EPA) Method 25C, a standardised and widely recognised laboratory procedure for the quantitative determination of nonmethane organic compounds and related gases, including CO, in air samples. The results of this analysis are presented in Table 2.7.

TABLE 2.7 CO RESULTS

CO Concentration – 2025 Period Summary				
Season	**Location**	**Sampling Period**	**WHO 2021 AQG** (mg/m^3)	**Average Concentration** (mg/m^3)
Wet	Proposed Mine Site	10 April – 05 May	7	ND
Dry	Proposed Mine Site	15 October – 12 November	7	2.61

ND: Non detect

No carbon monoxide was detected in the samples collected during the wet season monitoring period. This non-detection during the wet season monitoring period indicates that ambient CO concentrations during that monitoring period were below the analytical detection limits of the method employed. In contrast, the dry season monitoring period recorded an average concentration of 2.61 mg/m^3, substantially below the WHO AQG for 24-hour exposures.

2.1.3.4 VOC SAMPLING RESULTS

The VOC sampling consisted of whole air samples collected over a seven-day period during both the wet and dry season surveys. The average VOC concentrations are presented in Table 2.8 and

Table 2.9.

TABLE 2.8 VOC RESULTS – WET SEASON

VOC—Period Summary (µg/m³)	
Wet Season: 10 April 2025– 05 May 2025	
Compound	Monitoring Results
	Proposed Mine Site Average Concentration
Propene	ND
Dichlorodifluoromethane (CFC 12)	1.46
Chloromethane	4.06
1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND
Vinyl Chloride	ND
1,3-Butadiene	ND
Bromomethane	ND
Chloroethane	0.14
Acetone	88
Trichlorofluoromethane	0.22
2-Propanol (Isopropyl Alcohol)	12.2
1,1-Dichloroethene	ND
Dichloromethane (Methylene Chloride)	0.2
1,1,2-Trichlorotrifluoroethane	ND
Carbon Disulfide	67.5
trans-1,2-Dichloroethene	ND
1,1-Dichloroethane	ND
Methyl tert-Butyl Ether	ND
Vinyl Acetate	ND
2-Butanone (MEK)	13.24
cis-1,2-Dichloroethene	ND
Ethyl Acetate	338
Hexane	6.8
Chloroform	ND
Tetrahydrofuran (THF)	ND

VOC—Period Summary (µg/m³)	
1,2-Dichloroethane	ND
1,1,1-Trichloroethane	ND
Benzene	2.6
Carbon Tetrachloride	ND
Cyclohexane	ND
1,2-Dichloropropane	ND
Bromodichloromethane	ND
Trichloroethene	ND
1,4-Dioxane	4.6
n-Heptane	20.8
cis-1,3-Dichloropropene	ND
4-Methyl-2-pentanone	ND
trans-1,3-Dichloropropene	ND
1,1,2-Trichloroethane	ND
Toluene	13.44
2-Hexanone	ND
Dibromochloromethane	ND
1,2-Dibromoethane	ND
Tetrachloroethene	ND
Chlorobenzene	ND
Ethylbenzene	ND
m,p-Xylenes	1.52
Bromoform	ND
Styrene	ND
o-Xylene	0.78
1,1,2,2-Tetrachloroethane	ND
Cumene	ND
4-Ethyltoluene	ND
1,3,5-Trimethylbenzene	ND
1,2,4-Trimethylbenzene	1.9
Benzyl Chloride	ND
1,3-Dichlorobenzene	ND
1,4-Dichlorobenzene	ND
1,2-Dichlorobenzene	ND

VOC—Period Summary (µg/m³)	
1,2,4-Trichlorobenzene	ND
Naphthalene	ND
Hexachlorobutadiene	ND

ND: Non detect

TABLE 2.9 VOC RESULTS – DRY SEASON

VOC—Period Summary (µg/m3)	
Dry Season: 15 October 2025– 12 November 2025	
Compound	Monitoring Results
	Proposed Mine Site Average Concentration
Propene	2.75
Dichlorodifluoromethane (CFC 12)	1.48
Chloromethane	0.67
1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND
Vinyl Chloride	ND
1,3-Butadiene	ND
Bromomethane	ND
Chloroethane	ND
Acetone	64.25
Trichlorofluoromethane	0.45
2-Propanol (Isopropyl Alcohol)	13.75
1,1-Dichloroethene	ND
Dichloromethane (Methylene Chloride)	2.18
1,1,2-Trichlorotrifluoroethane	ND
Carbon Disulfide	15.68
trans-1,2-Dichloroethene	ND
1,1-Dichloroethane	ND
Methyl tert-Butyl Ether	ND
Vinyl Acetate	8.75
2-Butanone (MEK)	12.65
cis-1,2-Dichloroethene	ND
Ethyl Acetate	15
Hexane	3.25
Chloroform	ND

VOC—Period Summary (µg/m3)	
Tetrahydrofuran (THF)	ND
1,2-Dichloroethane	ND
1,1,1-Trichloroethane	ND
Benzene	1.25
Carbon Tetrachloride	ND
Cyclohexane	3.56
1,2-Dichloropropane	ND
Bromodichloromethane	ND
Trichloroethene	1.18
1,4-Dioxane	ND
n-Heptane	1.1
cis-1,3-Dichloropropene	ND
4-Methyl-2-pentanone	ND
trans-1,3-Dichloropropene	ND
1,1,2-Trichloroethane	ND
Toluene	24.33
2-Hexanone	ND
Dibromochloromethane	ND
1,2-Dibromoethane	ND
Tetrachloroethene	2.43
Chlorobenzene	ND
Ethylbenzene	1.45
m,p-Xylenes	4.05
Bromoform	ND
Styrene	0.8
o-Xylene	1.63
1,1,2,2-Tetrachloroethane	ND
Cumene	ND
4-Ethyltoluene	ND
1,3,5-Trimethylbenzene	ND
1,2,4-Trimethylbenzene	0.48
Benzyl Chloride	ND
1,3-Dichlorobenzene	ND
1,4-Dichlorobenzene	0.22

VOC—Period Summary (µg/m3)	
1,2-Dichlorobenzene	ND
1,2,4-Trichlorobenzene	ND
Naphthalene	2.03
Hexachlorobutadiene	ND
ND: Non detect	

The highest average VOC concentrations detected at the proposed mine site during the wet season monitoring period were 338 µg/m^3 and 88 µg/m^3 for ethyl acetate and acetone, respectively. Acetone was the predominant VOC detected during the dry season monitoring period with an average concentration of 64.25 µg/m^3. Ethyl acetate is a byproduct of vehicle exhaust and found in solvents of various manufactured commodities. Acetone is both naturally occurring, from decomposition of organic material, and found in solvents, consumer products and vehicle emissions.

Flow controller malfunctions during the wet season monitoring campaign resulted in reduced data recovery at the monitoring location with the proposed Mine Site being sampled for a total of twenty-five (25) days which resulted in 96% data recovery. No flow controller malfunctions were noted during the twenty-eight (28) day dry season monitoring period, therefore resulting in 100% data recovery.

2.1.3.5 NO_2 AND SO_2 SAMPLING RESULTS

Individual passive sample sorbent tubes were installed to sample NO_2 and SO_2. Triplicate samples were installed for redundant measurements and quality control. The samples were all deployed for four-week periods during the wet, and dry seasons. The sample summary results for NO_2 are presented in Table 2.10 and Table 2.11 while SO_2 results are displayed in Table 2.12 and Table 2.13.

TABLE 2.10 WET SEASON NO_2 DATA SUMMARY RESULTS

NO_2 Sampling – Wet Season Summary			
Sample ID	**Date Installed**	**Date Removed**	**NO_2 Concentration (µg/m^3)**
1976903	10/04/2025	07/05/2025	3.01
1976904	10/04/2025	07/05/2025	8.33
1976905	10/04/2025	07/05/2025	4.65
Gradko Labs	-	-	0

TABLE 2.11 DRY SEASON NO_2 DATA SUMMARY RESULTS

NO_2 Sampling – Wet Season Summary			
Sample ID	**Date Installed**	**Date Removed**	**NO_2 Concentration (µg/m^3)**
1977367	15/10/2025	12/11/2025	2.33

NO_2 Sampling – Wet Season Summary			
1977368	15/10/2025	12/11/2025	1.87
1977369	15/10/2025	12/11/2025	1.82
Gradko Labs	-	-	<0.32

TABLE 2.12 WET SEASON SO_2 DATA SUMMARY RESULTS

SO_2 Sampling – Wet Season Summary			
Sample ID	**Date Installed**	**Date Removed**	**SO_2 Concentration (µg/m³)**
1976913	10/04/2025	07/05/2025	2.38
1976913	10/04/2025	07/05/2025	13.8
1976913	10/04/2025	07/05/2025	5.66
Gradko Labs	-	-	0.15

TABLE 2.13 DRY SEASON SO_2 DATA SUMMARY RESULTS

SO_2 Sampling – Wet Season Summary			
Sample ID	**Date Installed**	**Date Removed**	**SO_2 Concentration (µg/m³)**
1976913	10/04/2025	07/05/2025	2.38
1976913	10/04/2025	07/05/2025	13.8
1976913	10/04/2025	07/05/2025	5.66
Gradko Labs	-	-	0.15

Following four weeks of continuous monitoring during both the wet and dry seasons, the average concentrations of NO_2 were found to be 5.33 µg/m³ and 2.01 µg/m³ respectively, while the average SO_2 concentrations were 7.28 µg/m³ and 22.29 µg/m³ respectively. All values are well below the WHO Air Quality Guidelines, indicating that the ambient levels of these pollutants at the mine site are currently within acceptable health-based limits. This suggests low potential for adverse health impacts related to NO_2 and SO_2 exposure.

2.1.3.6 METEOROLOGICAL RESULTS

Meteorological parameters were continuously monitored by a Davis Vantage Vue weather station and are summarised in Table 2.14 and Table 2.15.

TABLE 2.14 METEOROLOGICAL DATA SUMMARY – 2025 WET SEASON

Meteorological Condition Summary – Hourly Averages					
2025 Wet Season: 10 April 2025 – 07 May 2025					
Parameter	**Minimum**	**Maximum**	**Average**	**Frequency**	**Data Recovery**

Meteorological Condition Summary – Hourly Averages					
Wind Speed (mph)	0	4.8	0.3	-	100%
Wind Direction (deg.)	-	-	WSW	45%	100%
Temperature (°C)	21.7	33.4	25.1	-	100%
Relative Humidity (%)	65	100	93.6	-	100%
Barometric Pressure (mmHg)	1005.2	1014.4	1010.1	-	100%
Precipitation (mm)					
Maximum Hourly		**Maximum Daily**		**Total**	
5.0		12.5		422.2	

TABLE 2.15 METEOROLOGICAL DATA SUMMARY – 2025 DRY SEASON

Meteorological Condition Summary – Hourly Averages					
2025 Dry Season: 15 October 2025 – 12 November 2025					
Parameter	**Minimum**	**Maximum**	**Average**	**Frequency**	**Data Recovery**
Wind Speed (mph)	0	4.8	0.2	-	100%
Wind Direction (deg.)	-	-	SE	11%	100%
Temperature (°C)	21.1	35.6	26	-	100%
Relative Humidity (%)	54	98	88.8	-	100%
Barometric Pressure (mmHg)	1005.8	1014.3	1010.1	-	100%
Precipitation (mm)					
Maximum Hourly		**Maximum Daily**		**Total**	
5.9		0.3		163.4	

The wind measurements indicate that the predominant wind direction during the wet season monitoring period was from the west southwest, which was observed approximately 25 percent of that monitoring period, and from the Southeast during the dry season monitoring period at a frequency of 11%. The majority of recorded wind speeds were lower than 0.5 mph during both monitoring periods indicating "Calm" conditions. Wind measurements were calm for approximately 80 percent of the monitoring periods. Such calm wind conditions are typical for this area during the wet season. Relative humidity remained high during the wet season monitoring period averaging at 93.6%, reflecting moist air which is typical in a wet season, then decreased to an average of 88.8% during the dry season monitoring period. Although wind direction at the Stronghold Guyana camp site was primarily from the west southwest, winds in the wider region generally originate from the north and northeast. This localised variation at Eagle Mountain is likely influenced by the steep topography and valley formations, which deflect air flow and create site-specific wind pattern.

Total recorded precipitation for the wet season monitoring period markedly exceeded that of the dry season with the wet season seeing a substantial 422.2 mm of rainfall compared to only

163.4mm in the dry season. Peak precipitation events included a maximum hourly rainfall of 5.0 mm and a highest daily accumulation of 12.5 mm – both of which occurred during the wet season monitoring period. These rainfall intensities are consistent with typical wet season patterns in the region, characterised by frequent and sometimes intense precipitation events.

2.1.4 CONCLUSION

The program was designed and successfully implemented to assess background concentrations of VOCs, CO, NO_2, SO_2, dustfall, TSP, PM_{10}, and $PM_{2.5}$ during a four-week period during the 2025 wet and dry seasons at the project area. This conclusion represents data collected at the proposed mine site.

While data recovery was diminished for VOCs during the wet season, lab analysis QC checks confirmed the samples collected were valid for analysis. Lab analysis results for both seasons confirmed low concentrations and non-detects for most VOCs. Two compounds, ethyl acetate and acetone, were found at elevated concentrations. These compounds are frequently found in hand sanitisers and lotions, vehicle exhaust, and as a byproduct of decomposition.

While CO was not detected in the air samples from the wet season survey, the average concentration detected during the dry season period was below the WHO AQG. This indicates that CO was either absent or present at negligible concentrations during the sampling periods.

Implementing enhanced passive sample handling procedures where samples were individually contained, and vacuum sealed, yielded high data quality for NO_2 and SO_2 samples during the 2025 wet and dry season surveys. All NO_2 and SO_2 concentrations were below WHO annual, and 24-hour average AQG at the proposed mine site. These low results confirm expectations of air quality in this remote area.

Dustfall monitoring was successfully implemented during this monitoring campaign. Gravimetric analysis indicated medium and small dust deposition magnitudes during the wet and dry seasons respectively. The medium dust deposition magnitude recorded during the wet season indicates moderate dust accumulation that may require mitigation. Elevated dustfall rates were expected due to the location; however, this gives a good picture of baseline conditions in the most sensitive areas. Increased vehicle traffic on the dirt roads near the monitoring station during this survey may have deposited particulate matter on the adhesive pad resulting in elevated concentrations.

Monitoring for TSP, PM_{10} and $PM_{2.5}$ was successfully implemented at the proposed mine site. Though a true comparison cannot be completed as a full year of monitoring has not been performed, neither PM_{10} nor $PM_{2.5}$ concentrations exceeded the WHO annual nor 24-hour average AQG during the wet and dry season monitoring periods.

Overall, the results of the baseline air quality monitoring program at the proposed mine site indicate generally low concentrations of key air pollutants, reflecting favourable ambient conditions typical of this remote area and this season and indicating an undegraded airshed which may allow for a less restrictive significance framework for the air quality impact assessment.

3. NOISE BASELINE

3.1 INTRODUCTION

This section describes the baseline noise conditions in the Project area. It also sets out relevant noise criteria, describes the methodology for the baseline survey, and summarises the survey measurements and conclusions.

An essential part of the noise assessment is the comprehension of the existing acoustic environment that prevails in the absence of the Project. The quantification of the baseline noise levels at Noise Sensitive Receptors (NSRs)[1] serves as the foundation for evaluating the potential noise impacts resulting from the construction and operation of the Project.

Baseline noise levels were measured during the site visit in April 2025.

3.2 ASSUMPTIONS AND LIMITATIONS

Long-term noise measurements over typical monitoring periods may last 48 hours during a baseline survey[2]. However, due to constraints imposed by local conditions, the baseline noise surveys for the Project were limited in duration.

3.3 NOISE BASELINE CRITERIA

This baseline has been established according to the following acoustic standards and guidelines:

- Guyana National Bureau of Standards (GNBS) Guidelines For Noise Emission (GYS 263:2010)
- Environmental Protection Agency (EPA) Noise Management Regulations 2013

GYS263:2010 and EPA Noise Management Regulations 2013

Under the GNBS regulations[3], operations that emit noise are required to apply to the EPA for environmental authorisation. The regulations include the general requirements to apply for authorisation, the permissible noise levels, factors involved in the determination of the point of noise emissions, applications for variance, requirements related to new and altered sources of noise pollution, requirements and approval of plans, and restrictions on construction activities (and the power to waive these restrictions). The GNBS is responsible for establishing standards for permissible noise levels in industry, construction, and other areas.

The EPA has developed the following interim noise standards, established according to categories of activities, in collaboration with the GNBS[4]:

- Residential: 75 decibels (dB) during the day, 60 dB during the night;
- Industrial: 100 decibels (dB) during the day, 80 dB during the night;
- Commercial: 80 dB during the day, 65 dB during the night;
- Construction: 90 dB during the day, 75 dB during the night; and
- Transportation: 100 dB during the day, 80 dB during the night.

[1] NSRs are local residences, commercial areas, and any local populated areas.
[2] IFC (International Finance Corporation) 2007. Environmental, Health, and Safety (EHS) General Guidelines, April 30, 2007.
[3] Guyana Standard Provides Guidelines For Noise Emission – Guyana National Bureau of Standards 2010
[4] Environmental Protection (Noise Management) Regulations 2013 07.16 Noise Regulations

3.4 DATA COLLECTION AND METHODOLOGY

3.4.1 EQUIPMENT AND SETUP

The ambient noise survey was undertaken to gather noise level data aimed at characterising the existing acoustic environment within the Project Area. Noise was monitored in accordance with GYS 263:2010 and, ASTM International (ASTM) E1686-03 Standard Guide for Selection of Environmental Noise Measurements and Criteria (ASTM 2008). The noise monitoring program was designed to collect data sufficient for comparison to EPA Guyana noise standards.

A single Casella CEL 633 sound level meter was used to conduct measurements at five (5) locations. The Casella CEL 633 sound level meter, equipped with an internal microphone and data acquisition system, was selected for this survey due to its compliance with relevant standards and suitability for environmental noise monitoring. The microphone was fitted with a standard 3.5-inch diameter windscreen to minimise wind-induced noise and was mounted on a tripod approximately 1.5 feet above ground level. Care was taken to position the equipment in free-field conditions (i.e., at least 3.5m away from the nearest hard acoustically reflective surface) to avoid measurement distortions.

The sound level meter was calibrated before and after each measurement using a lab certified Casella CEL calibrator. This procedure ensured that calibration deviations remained within ±0.5 dBA, thereby maintaining the accuracy and reliability of the recorded noise data. The sound level meter setup is shown in Figure 3.1.

FIGURE 3.1 NOISE MONITORING SETUP

3.4.2 DATA RECORDING

Noise level measurements were conducted for a one-hour period during the day (07:00 to 22:00 hours) and during the night (22:00 to 07:00 hours) in accordance with Guyana EPA standards, to understand the variation of the baseline environment. The noise surveys were conducted during the dry season.

These measurements recorded different metrics, including the L_{Aeq}, L_{A90}, L_{Amax}, L_{Amin}, and L_{A10}. A brief description of these metrics is provided in this section.

The L_{Aeq} metric is the steady, continuous equivalent sound level, which has the same acoustic energy as the actual varying sound levels over the same time. The letter "A" in both metrics denotes that "A"-weighting has been used. The "A" suffix indicates that the sound levels have been "A-weighted" to account for the non-linear nature of human hearing. The "eq" in L_{Aeq} indicates that an equivalent level has been calculated. Therefore, $L_{Aeq\ (T)}$ is the A-weighted continuous sound level, measured over period "T."

The L_{A90} metric is a percentile noise level, which represents the noise level exceeded for 90 per cent of the monitoring period (T). It represents the quiet lulls between noise events, such as car or locomotive pass-bys or planes flying overhead. The L_{A90} metric is the near-minimum baseline level that occurs, by definition, only 10 per cent of the time. The L_{A90} level is often referred to as the "background" noise level and is commonly used as a basis for determining noise criteria for assessment purposes. For this monitoring assessment, the L_{A90} metric was used to represent background noise levels.

Aside from the L_{Aeq} and L_{A90}, other sound metrics typically collected during sound surveys are L_{Amax}, L_{Amin}, and L_{A10}. The L_{Amax} and L_{Amin} metrics are the maximum and minimum noise levels in a noise sample, respectively. The L_{A10} metric is also a percentile representing the noise level exceeded for 10 per cent of the monitoring period (T).

The noise meter automatically logs these environmental noise measurement parameters. For the purposes of this study, the L_{Aeq} is the noise parameter of most interest, as it is this parameter that needs to be directly compared to the applicable noise standards of the Guyana EPA.

3.4.3 NOISE BASELINE LOCATIONS

The baseline locations were selected by ERM acoustic experts and checked in the field by local ERM personnel to provide a broad understanding of the existing background noise levels across the Project's area of influence (AoI). The recorded data were analysed by the ERM acoustic team.

Noise baseline measurements were conducted at five locations during April 2025. These sites were considered to be representative of the acoustic environment of the receptors in the vicinity of the Project. Two locations were identified as non-residential (L3 and L5) while the remaining locations were identified as residential (L1, L2 and L4). This classification recognises that residential receptors are particularly sensitive to noise increases as high noise levels can impact the quality of life of the residents, especially during nighttime hours, when people are more likely to be resting or sleeping.

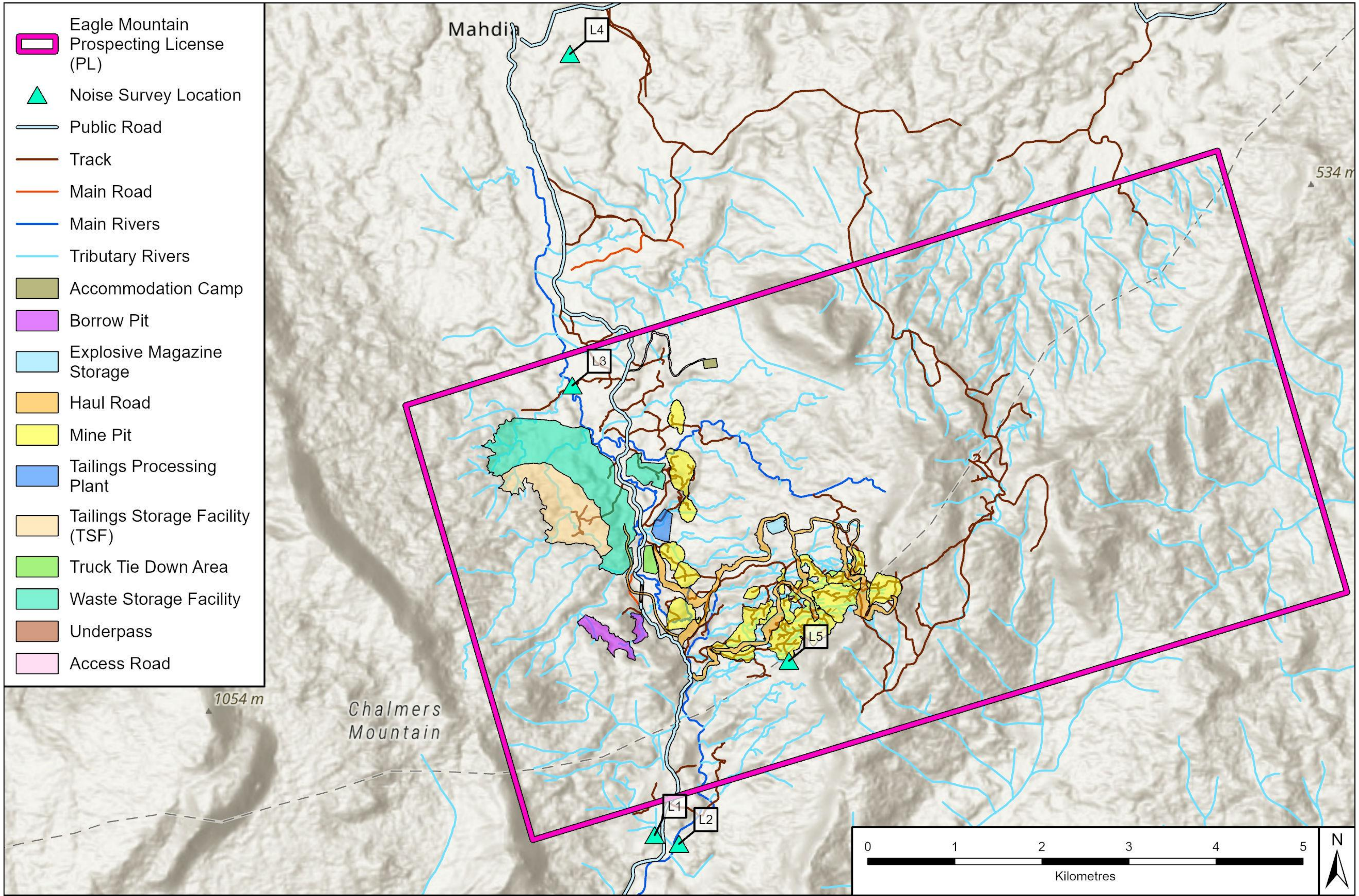
Nighttime monitoring was not conducted at L4 due to the considerable distance between the camp site and the monitoring site which posed safety risks to the survey personnel. The steep gradient and dense vegetation of the surrounding terrain presented substantial navigational challenges at night, thereby increasing the potential of accidents under low-visibility conditions. Therefore, only daytime measurements were recorded at this monitoring location (L4).

The coordinates and the description of each measurement location are provided in Table 3.1. Figure 3.2 shows the location of each measurement site.

TABLE 3.1 DESCRIPTION OF NOISE BASELINE LOCATIONS – APRIL 2025 SURVEY

ID	Location	Type of Receptor	Date of survey	Coordinates UTM 21N		Noise sources
				Easting	Northing	
L1	Southern Boundary	Residential	April 10-11th 2025	263819	573654	Birds, residents chatting, music from shops nearby, motorcycles, generators in distance, ATVs, cars and pickup truck
L2	Southern Boundary	Residential	April 10th - 11th 2025	264098	573554	Birds, cicadas ATVs passing, music from nearby settlement, residents singing, motorcycles and cars
L3	Northern Boundary	Industrial	April 09th - 11th 2025	262873	578818	Birds (parrots), cicadas, stream flowing about 50m away, dogs barking in the distance, dredging activities from small scale miner, residents chatting in distance
L4	Residential Area	Residential	April 8th-9th 2025	262845	582623	Chickens, birds, dogs barking, motorcycles, residents, generators from homes in surrounding area, music from homes in the distance, aircrafts flying overhead, pickup trucks
L5	Campsite	Industrial	April 09-11, 2025	265361	575655	Birds, cicadas, howler monkey in distance, ATVs passing on road, generator from campsite, insects, frogs, crested owl, generator

FIGURE 3.2 NOISE BASELINE LOCATIONS



Source: Esri, NASA, NGA, USGS, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

Path: \\vmukspgisfs01\Data\London\Projects\0763224 - Mako Mining EIA\Map\0763224 - Mako Mining EIA - V02C03 - NAV.aprx\0763224 - V02C03 - NAV - 03.XX - Noise Monitoring Locations

3.5 BASELINE CONDITIONS

Measurements at each baseline location are summarised in Table 3.2.

TABLE 3.2 NOISE BASELINE MEASUREMENTS – APRIL 2025 SURVEY

ID	Type of Receptor	Period (T)	Guyanese Criteria	Measurement Parameter, dB(A)		
			Noise Limit, dB(A)	L_{Aeq}*	L_{A10}**	L_{A90}**
L1	Residential	Daytime	75	58	50-69	42-57
		Night-time	60	52	50-52	42-47
L2	Residential	Daytime	75	42	40-47	37-40
		Night-time	60	49	49-54	44-48
L3	Industrial	Daytime	100	43	42-46	41-44
		Night-time	80	41	41-43	40-42
L4	Residential	Daytime	75	46	35-44	0-37
L5	Industrial	Daytime	100	46	40-53	38-40
		Night-time	80	47	46-55	42-44

Period T = 15 hours for Daytime (07:00–22:00) and 9 hours for night-time (22:00–07:00)
** Log-average values*
*** Range values*

Existing noise levels were below the Guyanese criteria at all measurement locations. Location L3 had the lowest noise levels when analysing both daytime and night-time data. All locations in residential areas comply with the Guyanese guidelines and criteria for noise levels during both day and night-time periods. No significant drifts in calibration (i.e., greater than 0.5 dB) were noted.

3.6 SUMMARY

Baseline noise levels were measured during the dry season at five locations in the Project area during April 2025. Three of the monitoring locations (L1, L2 & L4) contained residential receptors while the other two (L3 and L5) had industrial receptors. The existing baseline noise levels recorded at all measurement sites were below the Guyanese standards. Background noise during the daytime was dominated by traffic noise (cars, trucks, and motorcycles), domestic sounds such as music from the community shops, barking dogs, chickens, and residents talking. Additionally, noise came from nearby work activities, such as generators, dredging activities from small scale miners, along with frequent overhead planes. Natural noise sources like birds (especially parrots), howler monkeys, and insects (cicadas) were also present.

During the nighttime period, sound was predominantly from natural noise sources like insects, frogs and birds.

Potential noise levels from the Project should be limited to the Guyana EPA standards, in areas where baseline noise levels are currently below these thresholds. At locations L1, L2 and L4 daytime noise levels should be maintained at or below 75 dBA and nighttime noise levels should be maintained at or below 60 dBA. At locations L3 and L5, at or below 100 dBA and 80 dBA, for daytime and nighttime respectively. If at any point existing baseline noise levels at the identified residential receptors exceed Guyana EPA criteria, any increase in noise should be restricted to no more than 3 dBA above the standard.

4. CLIMATE, METEOROLOGY, AND CLIMATE CHANGE

4.1 INTRODUCTION

This section describes the climate and meteorological baseline conditions and potential climate change impacts for the Eagle Mountain Gold Mine Project. A desktop review was conducted to obtain meteorological data from publicly available sources including the National Centers for Environmental Information (NCEI), World Bank Group Climate Change Knowledge Portal, the Guyana Hydrometeorological Service (where information was available), and other online sources.

4.2 BASELINE CONDITIONS

4.2.1 CLIMATE AND METEOROLOGY

4.2.1.1 GUYANA / REGION 8 OVERVIEW

Guyana is located in the Equatorial Trough Zone (ETZ). Its weather and climate are influenced primarily by the seasonal shifts of the ETZ and its associated rainbands 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. El Niño/La Niña is primarily responsible for inter-annual variation in rainfall. The Project area has a tropical climate that is similar to the rest of Guyana. The area is not subject to extreme variations in temperature and humidity.

Guyana falls under the Köppen climate classification as "Af", defined as a wet equatorial climate (World Bank Group 2025). Its location within a region in which available net solar radiation is large and relatively constant from month to month ensures both high temperatures (generally in excess of 18 °C) and a virtual absence of thermal seasons (Britannica 2024). The climate is therefore equatorial and humid, with two wet and dry seasons as shown in Table 4.1. The dry seasons' onset and duration vary from year to year. The heaviest precipitation is expected in May and June. The average yearly temperature is approximately 26.5 degrees Celsius (°C) (World Bank Group 2025).

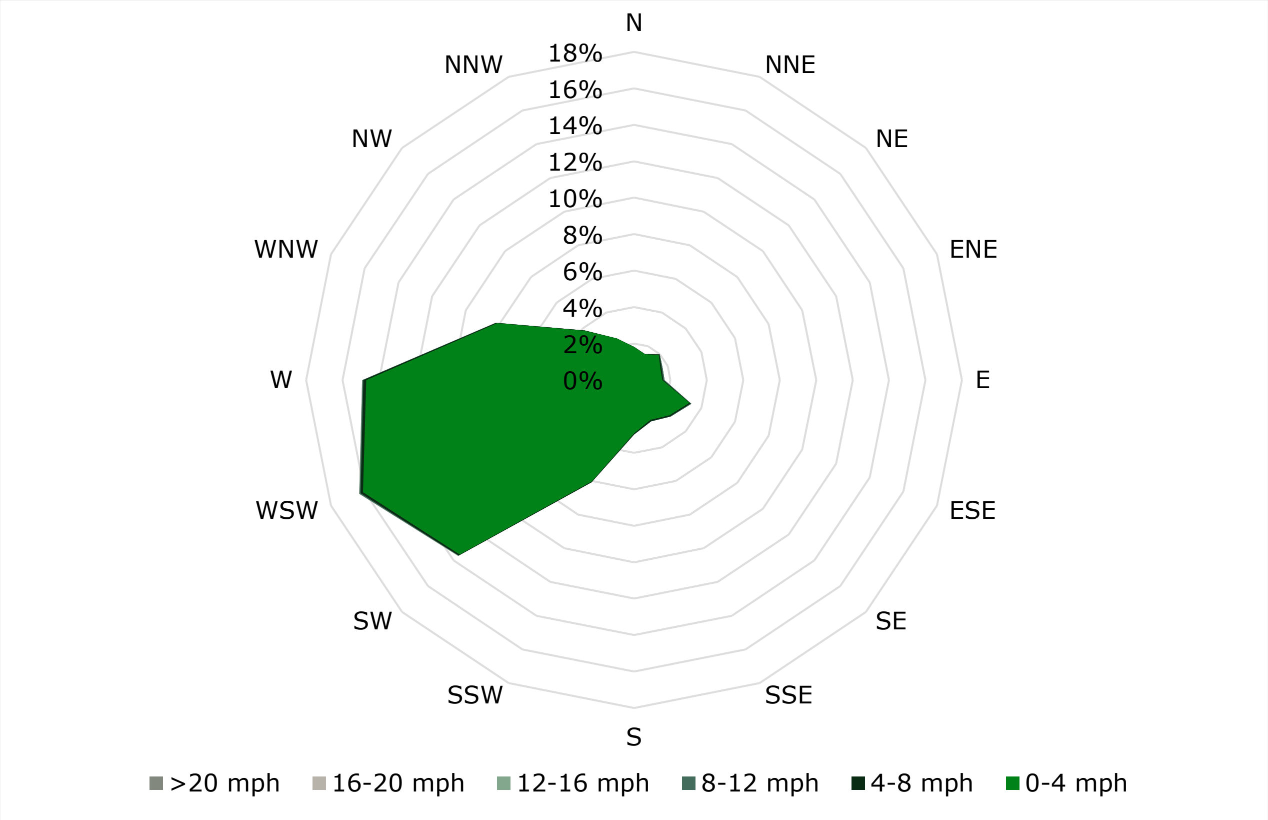
TABLE 4.1 WET AND DRY SEASONS IN THE PROJECT AREA

Dry Season	Wet Season
February to Mid-April	Mid-April to Mid-August
Mid-August to November	November to February

4.2.1.2 AREA OF INFLUENCE

Wind speed data for was collected from the nearest meteorological station located at the Eagle Mountain camp site operated by Stronghold Guyana. Records of wind speed and direction were collected between May 2021 to September 2025. The wind rose in Figure 4.1 indicates that wind speeds are primarily out of the west-southwest direction at the Eagle Mountain Project area and in general are between 1 to 2 mph. Although winds in Mahdia generally come from the north and northeast, the steep topography of Eagle Mountain may impact the wind direction, deflecting air flow and creating a localised wind system resulting in winds coming from a southwest direction.

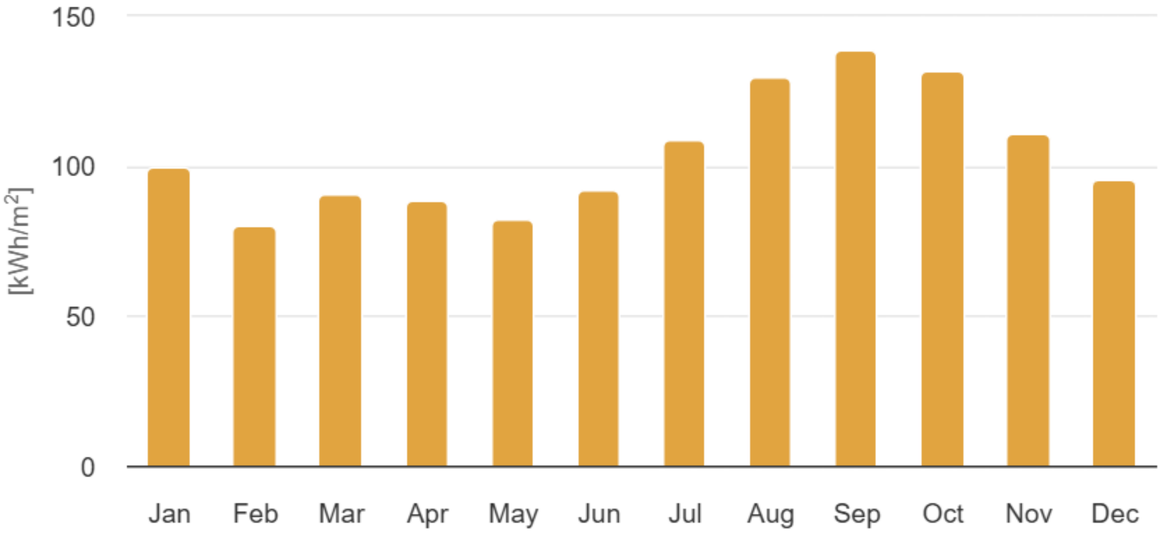
FIGURE 4.1 WIND ROSE FOR MAHDIA METEOROLOGICAL STATION BETWEEN MAY 2021 AND SEPTEMBER 2025



Source: ERM, 2025 (Data from Stronghold Guyana Mahdia Meteorological Station)

The monthly average for direct normal irradiation (DNI) in the Potaro-Siparuni region is shown in Figure 4.2, with an annual average of approximately 1154 kWh/m^2 (Global Solar Atlas 2025). DNI represents the potential energy generation in the area and to understand long term solar radiation patterns.

FIGURE 4.2 MONTHLY AVERAGE FOR DIRECT NORMAL IRRADIATION IN THE POTARO-SIPARUNI REGION



Source: Global Solar Atlas, 2025

Stronghold Guyana installed a weather station at the Eagle Mountain Prospecting License (EMPL) area and has accumulated temperature and monthly precipitation data between 2010 and 2025 (Table 4.2, Figure 4.3, and Table 4.3, Figure 4.4).

The highest average monthly temperature recorded at Eagle Mountain occurred in October 2010 at 34.6°C, while the lowest recorded temperature is 23.1°C in February 2023.

The data indicates that the months with the highest average precipitation between 2010 and 2025 are May to July, while September and October are the driest months. The overall average monthly precipitation for the proposed mine site area is 382 mm.

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 small amounts from exploration equipment. Airborne discharges and particulate matter are not monitored in the area. However, World Bank guidelines for sulphur emissions specify two levels of allowable emissions. If the region is unpolluted the maximum allowable emissions should not exceed 500 tons 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.

TABLE 4.2 MONTHLY PRECIPITATION AT EAGLE MOUNTAIN (MM)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	99.2	261.0	272.8
2011	229.4	515.2	579.7	171.0	796.7	672.0	347.2	161.2	165.0	263.5	281.4	234.7
2012	474.3	487.2	244.9	372.0	663.4	552.0	620.0	260.4	135.0	68.2	96.0	235.6
2013	217.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2015	ND	ND	ND	369.0	579.7	720.0	ND	ND	ND	ND	ND	ND
2021	ND	ND	ND	ND	821.08	545.1	627.1	563.3	297.8	285.5	556.0	892.8
2022	301.6	476.8	459.9	765.8	696.3	955.2	636.3	230.5	137.3	259.4	607.2	376.7
2023	426.5	600.0	203.5	270.0	672.0	522.4	357.2	118.6	46.0	43.8	182.2	393.4
2024	193.2	106.0	240.5	407.0	884.8	617.2	389.4	262.6	18.6	61.9	162.2	312.6
2025	227.4	497.7	373.0	524.6	526.0	633.4	470.4	308.8	73.8	48.4	336.9	351.2
Average	295.6	447.2	350.3	411.3	705.0	652.2	492.5	266.1	124.8	141.2	310.4	383.7

Note: ND = no data

FIGURE 4.3 AVERAGE MONTHLY PRECIPITATION AT EAGLE MOUNTAIN (MM)

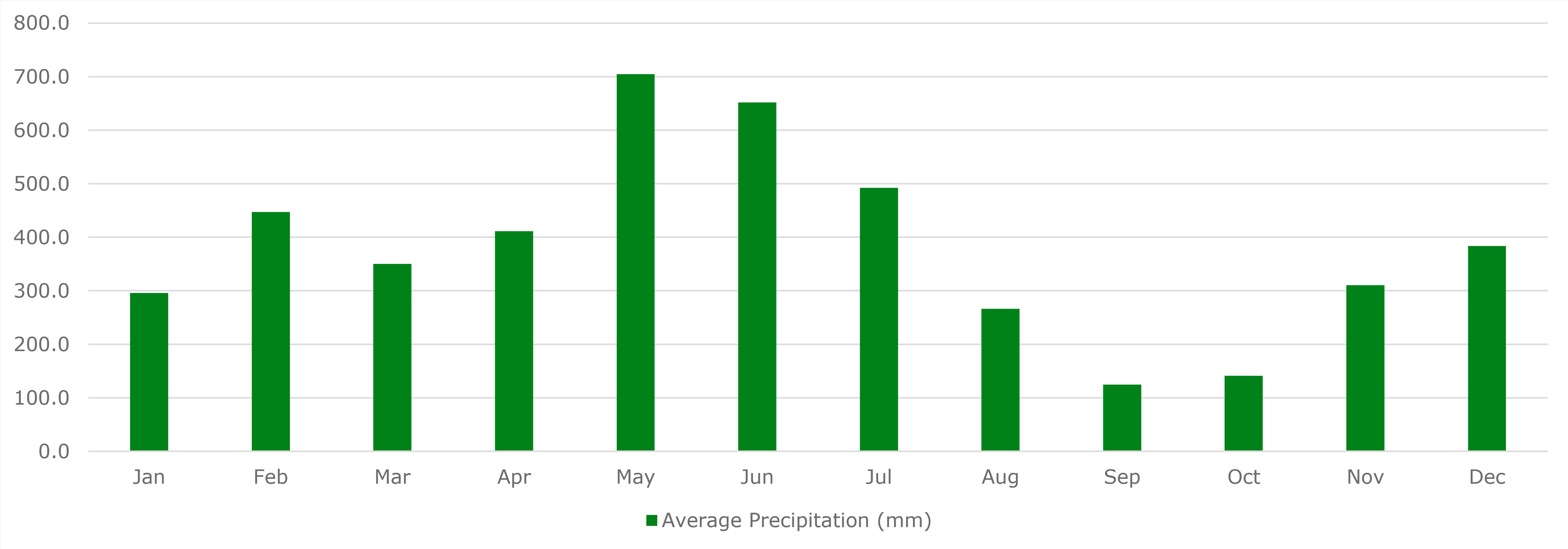
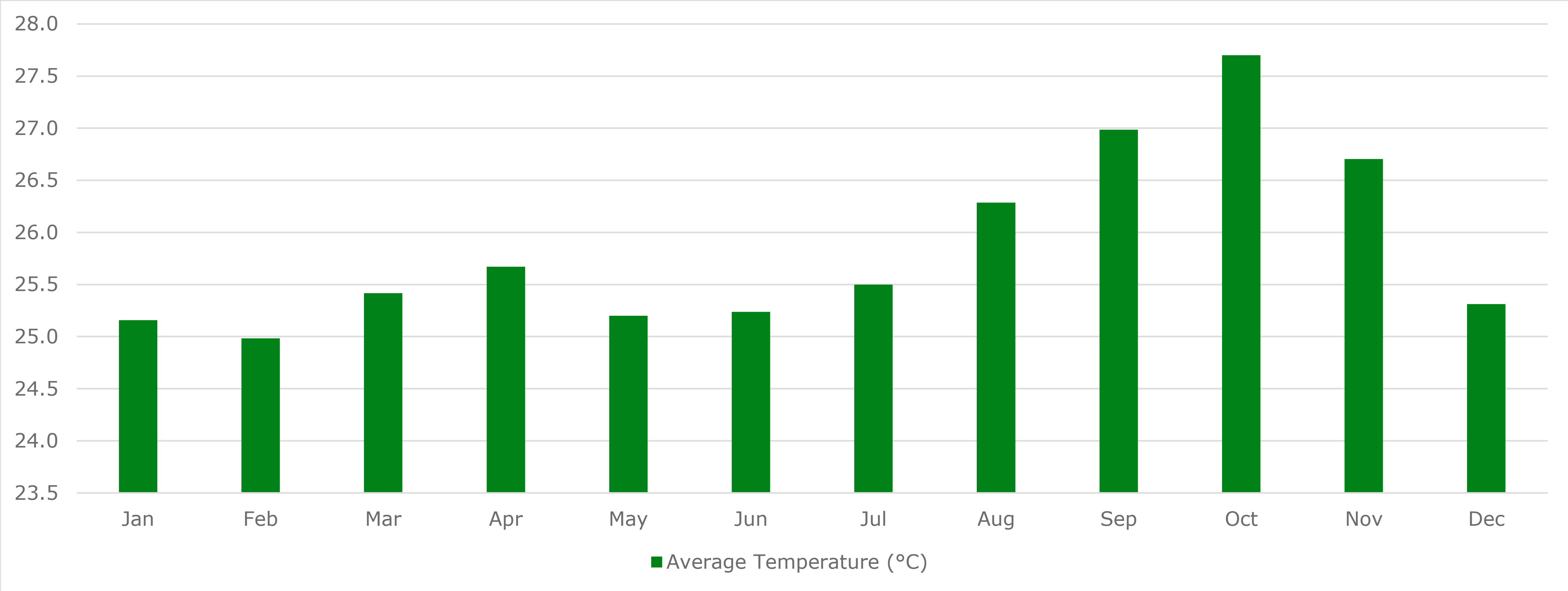


TABLE 4.3 MONTHLY TEMPERATURE AT EAGLE MOUNTAIN (°C)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	34.6	31.5	28.4
2011	27.2	27.5	27.0	27.5	24.7	24.6	25.9	25.5	25.1	23.8	25.33	26.3
2012	26.4	26.5	26.5	27.3	28	27.5	27.5	28.7	29.8	29.5	28.7	25.6
2013	26.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2015	ND	ND	ND	24.7	25.6	26.0	ND	ND	ND	ND	ND	ND
2021	ND	ND	ND	ND	23.9	24.5	24.4	25.0	25.9	26.2	24.9	24.0
2022	23.5	23.6	23.9	24.2	24.5	24.1	24.8	25.7	26.3	25.9	24.8	23.8
2023	23.4	23.1	24.5	25.2	25.1	25.3	25.5	27.0	27.5	27.9	26.8	25.6
2024	25.0	25.6	26.0	26.1	25.1	25.2	25.5	26.4	27.7	27.0	26.6	24.9
2025	24.4	23.6	24.6	24.7	24.7	24.7	24.9	25.7	26.6	26.7	25.0	23.9
Average	25.2	25.0	25.4	25.7	25.2	25.2	25.5	26.3	27.0	27.7	26.7	25.3

Note: ND = no data

FIGURE 4.4 AVERAGE MONTHLY TEMPERATURE AT EAGLE MOUNTAIN (°C)



4.2.2 CLIMATE CHANGE

The following sections provide details on climatic or natural events that could be exacerbated by climate change. Key risks in Guyana include coastal flooding and sea level rise, flooding due to excessive rainfall, drought, and wildfires (USAID 2021).

4.2.2.1 FLOODING

The probability of flooding events in Guyana is projected to increase significantly in the future (30-50 years) due to climate change, according to most regional and global climatic models, with climatic changes already being observed in Guyana. Mean annual precipitation has increased at an average rate of 4.8 mm per month (2.7% per decade) and observations since 1960s indicate that the mean annual temperature in the country has risen by 0.3°C. Increases in temperature and changes in precipitation trends have led to unpredictable floods and drought periods as well as sea level rise and increased saltwater intrusion, all directly affecting agriculture, an important economic sector in the country (Green Climate Fund 2017).

Guyana experiences frequent flooding during the rainy seasons, affecting both the inland regions and the coast. In January 2005, heavy rainfall coupled with drainage blockages and pump malfunctions caused severe flooding in several regions. These floods affected 274,774 individuals and resulted in economic losses of $465 million. In January 2006, severe flooding occurred once again and resulted in $30 million in damages (USAID 2021).

According to the Global Facility for Disaster Reduction and Recovery (GFDRR), river flood hazard in Potaro-Siparuni Region 8 is classified as high with potentially damaging and life-threatening river floods expected to occur at least once in the next ten years in lowland areas. Climate change impacts resulting in an increase in extreme precipitation and an increase in the number of extreme rainfall events may result in an increasing hazard level in the region (GFDRR n.d.).

4.2.2.2 WATER STRESS AND DROUGHT

Guyana is also at risk from drought and is expected to see an increase in consecutive dry days due to climate change. Droughts in 1998 and 2009 to 2010 resulted in water rationing and extensive crop and livestock losses. Climate change will threaten agriculture production through increased competition for water resources, loss of agricultural lands due to flooding, heat stress, and increased incidence of pests and disease (USAID 2021).

Water scarcity and drought are classified as very low or non-existent in the Potaro-Siparuni region according to the GFDRR, with droughts occurring less than once every 1000 years (GFDRR n.d.). However, future climate projections indicate that the mean annual temperatures are likely to increase by 0.4°C to 2°C in the 2030s, by 0.9°C to 3.3°C in the 2060s and by 1.4°C to 5.0°C in the 2090s. A decrease of annual rainfall is projected from the 2060s onwards, along with an increase in heavy precipitation events. Changes in precipitation patterns coupled with rising temperatures will result in an increase in the frequency and extent of drought (failure of rain will occur with more frequency and periods with no rain will last longer than currently). Temperatures are projected to increase across all seasons, with the warming most pronounced in the dry season of August, September, and October. In these months, temperature is projected to increase by a minimum of 0.9°C and a maximum of 2.5°C by the 2030s; 1.5°C and 5.1°C by the 2060s; and 2.6°C and 6.6°C by the 2090s (Green Climate Fund 2017).

4.2.2.3 WILDFIRE

Wildfire hazard is classified as high in the Potaro-Siparuni region meaning that there is greater than 50% chance of encountering weather that could support a significant wildfire that is likely to result in both life and property loss in any given year. Impacts on people and property can not only occur due to direct flame and radiation exposure but also due to ember storm and low-level surface fire. In extreme fire weather events, strong winds and wind-born debris may weaken the integrity of infrastructure (GFDRR n.d.).

Wildfires primarily occur along the coast and affect both rural and urban areas; however, information on this hazard in Guyana has not been extensively analysed (USAID 2021). Dry soil and vegetation, low precipitation, wind speed, and humidity significantly impact climate variability and change by creating conditions where a small spark can ignite a wildfire, which then spreads rapidly and intensely due to the lack of moisture (Climate Tracker Caribbean 2024). There is evidence from discussions with local communities conducted in October 2025, that wildfires are common around Mahdia and the region, due to rubbish burning and bush burning practices.

Guyana's Environmental Protection Agency (EPA) stated that a total of 91,128 fires were recorded in 2024 from January to May. May had the lowest count while March had the highest count of wildfires with a total of 5,045.45 square miles of land burned over the five months, representing 6% of the country's land mass of 83,000 square miles (Climate Tracker Caribbean, 2024). There is evidence from discussions with local communities conducted in October 2025, that wildfires are common around Mahdia and the region, due to rubbish burning and bush burning practices.

For two consecutive years, air quality sensors reported degraded air quality due to wildfires in Regions 2, 3, 4, 5, 6, 9, and 10. The EPA reported that Regions 2, 3, 5, and 6 experienced fires of large-scale magnitude as the fire engulfed agricultural plots and mangroves, while Regions 1 and 10 experienced wildfires in forested areas in close proximity to people and Shell Beach protected area (Climate Tracker Caribbean, 2024).

Modelled projections of future climate identify a likely increase in the frequency of fire weather occurrence in the Potaro-Siparuni region, including an increase in temperature and greater variance in rainfall. In areas already affected by wildfire hazard, the fire season is likely to increase in duration and include a greater number of days with weather that could support fire spread because of longer periods without rain during fire seasons. Climate projections indicate that there could also be an increase in the severity of fire. Areas of very low or low wildfire hazard could see an increase in hazard, as climate projections indicate an expansion of the wildfire hazard zone (GFDRR n.d.).

4.2.2.4 EXTREME HEAT

Climate projections indicate that Guyana is likely to experience an increase in the occurrence of extreme heat conditions. The percentage of hot days is projected to increase substantially from about 15% of all observed days on average in 1981–2010 (10% in 1961–1990). Under a high emissions scenario, almost 90% of days on average are defined as 'hot' by the end-of-century. If emissions decrease rapidly, about 55% of days on average are 'hot' (WHO; UN; PAHO 2020).

Extreme heat hazard is classified as medium in the Potaro-Siparuni region with more than a 25% chance that at least one period of prolonged exposure to extreme heat, resulting in heat stress, will occur in the next five years. Continued emissions of greenhouse gases will cause further warming, and it is projected that there will be more frequent hot temperature extremes over most land areas during the next fifty years. Warming will not be regionally uniform. The temperature increase in the region in the next fifty years will be slightly higher than the worldwide average (GFDRR n.d.).

4.2.2.5 LANDSLIDES

Landslide susceptibility in the Potaro-Siparuni region is classified as low according to the GFDRR, as rainfall patterns, terrain slope, geology, soil, land cover, and potentially earthquakes in the area make localised landslides an uncommon hazard phenomenon. Climate change is likely to alter slope and bedrock stability through changes in precipitation and/or temperature. Future locations and timing of large rock avalanches are difficult to determine as these depend on local geological conditions and other non-climatic factors (GFDRR n.d.).

However, the project area may potentially be prone to landslides due the steep topography of the area, and Stronghold Guyana mining activities that will occur along the slopes of Eagle Mountain. Alluvial artisanal and small-scale mining activities which have occurred along the valleys in the area, and associated deforestation activities is also a contributing factor to slope instability, increasing the potential for landslides in the area.

4.2.2.6 CYCLONES / HURRICANES

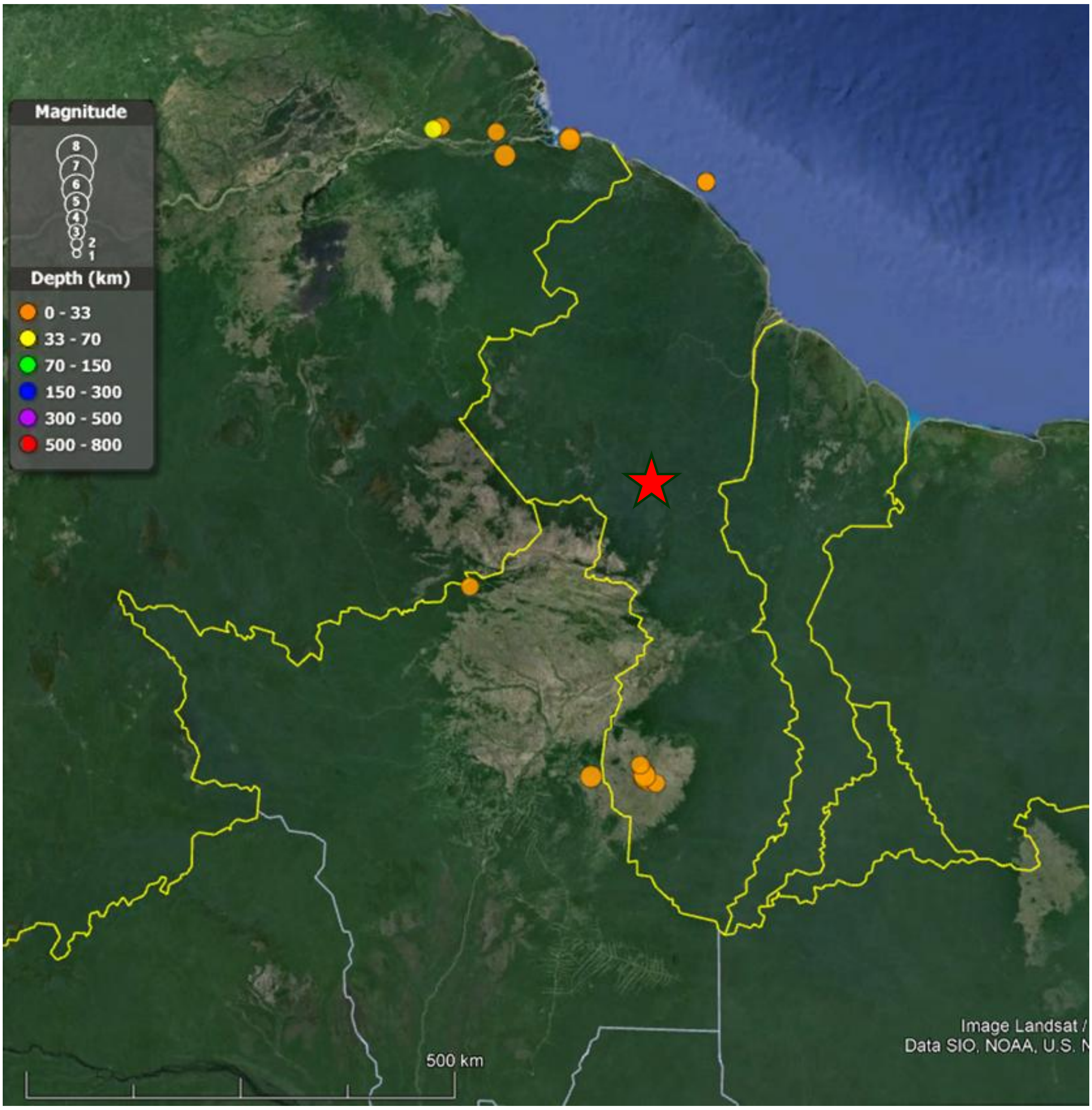
Due to its location, Guyana does not face the same risks as the island nations of the Caribbean. Guyana is not highly exposed to hurricanes and, while it is less vulnerable than its island neighbours, it is still an active member of the Caribbean Disaster Emergency Management Agency (CDEMA) (USAID 2021). The risk of hurricanes in the region is classified as very low, with less than a 1% chance of potentially damaging wind speeds in the Project area in the next ten years. Potential hazards can occur due to wind, heavy rainfall, and subsequent flooding.

4.2.2.7 EARTHQUAKES AND SEISMOLOGY

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.

Guyana is located within the South American tectonic plate. The Project area is located more than 300 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 2150 B.C (NGDC; WDS 2025). The results of that search are shown in Figure 4.5.

FIGURE 4.5 EARTHQUAKE LOCATIONS WITHIN AND AROUND GUYANA



Source: Google Earth, 2025; NGDC, WDS, 2024. Note: star shows Project location

Eight earthquake events have occurred in recorded history within 300 km of the Project area. The nearest and most recent event occurred near the Venezuelan border in northern Brazil, 28 km SW of Santa Elena de Uairén, Venezuela, in 2024, located at 4.40° north and 61.27° west at a depth of 11.1 km and a magnitude of 4.5 (IRIS 2025).

The other seven seismic events recorded to the south of the Eagle Mountain Project occurred in 2021 and include:

- Magnitude 4.1 earthquake located 70 km SSE of Lethem, Guyana at 2.8° north and 59.6° west at a depth of 15.5 km;
- Magnitude 4.1 earthquake located 79 km SSE of Lethem, Guyana at 2.8° north and 59.6° west at a depth of 12.9 km;

- Magnitude 4.8 earthquake located 80 km SSE of Lethem, Guyana at 2.8° north and 59.5° west at a depth of 10 km;
- Magnitude 5.5 earthquake located 82 km SSE of Lethem, Guyana at 2.7° north and 59.6° west at a depth of 5.4 km;
- Magnitude 4.4 earthquake located 86 km SSE of Lethem, Guyana at 2.6° north and 59.6° west at a depth of 10.7 km;
- Magnitude 4.3 earthquake located 89 km SSE of Lethem, Guyana at 2.6° north and 59.6° west at a depth of 10 km;
- Magnitude 4.1 earthquake located 93 km SSE of Lethem, Guyana at 2.6° north and 59.5° west at a depth of 10 km.

Other earthquake events that have occurred in Guyana are listed in Table 4.4.

TABLE 4.4 EARTHQUAKE EVENTS

Year	Month	Day	Lat	Lon	Depth (km)	Mag	Region
Earthquakes within 300km of the Project area							
2024	1	7	4.4022	-61.2719	11.1	4.5	28 km SW of Santa Elena de Uairén, Venezuela
2021	2	19	2.769	-59.631	15.5	4.1	70 km SSE of Lethem, Guyana
2021	3	24	2.7991	-59.6245	12.9	4.1	79 km SSE of Lethem, Guyana
2021	3	26	2.7945	-59.5842	10	4.8	80 km SSE of Lethem, Guyana
2021	1	31	2.6693	-59.5946	5.4	5.5	82 km SSE of Lethem, Guyana
2021	2	22	2.631	-59.591	10.7	4.4	86 km SSE of Lethem, Guyana
2021	2	7	2.6154	-59.5583	10	4.3	89 km SSE of Lethem, Guyana
2021	2	2	2.6015	-59.4799	10	4.1	93 km SSE of Lethem, Guyana
Earthquakes in Guyana							
2021	12	31	8.6345	-60.4069	15	4.6	83 km NW of Mabaruma, Guyana
2015	8	3	2.626	-59.57	0	3.2	Guyana
2008	11	11	8.2509	-59.0931	9.7	4.6	76 km E of Mabaruma, Guyana
1994	10	2	8.699	-58.745	35	4.3	Guyana
1981	11	18	6.7683	-58.8394	13	5.7	Guyana
1976	1	22	8.602	-60.411	33	5.3	Delta Amacuro, Venezuela (82 km WNW of Mabaruma, Guyana)

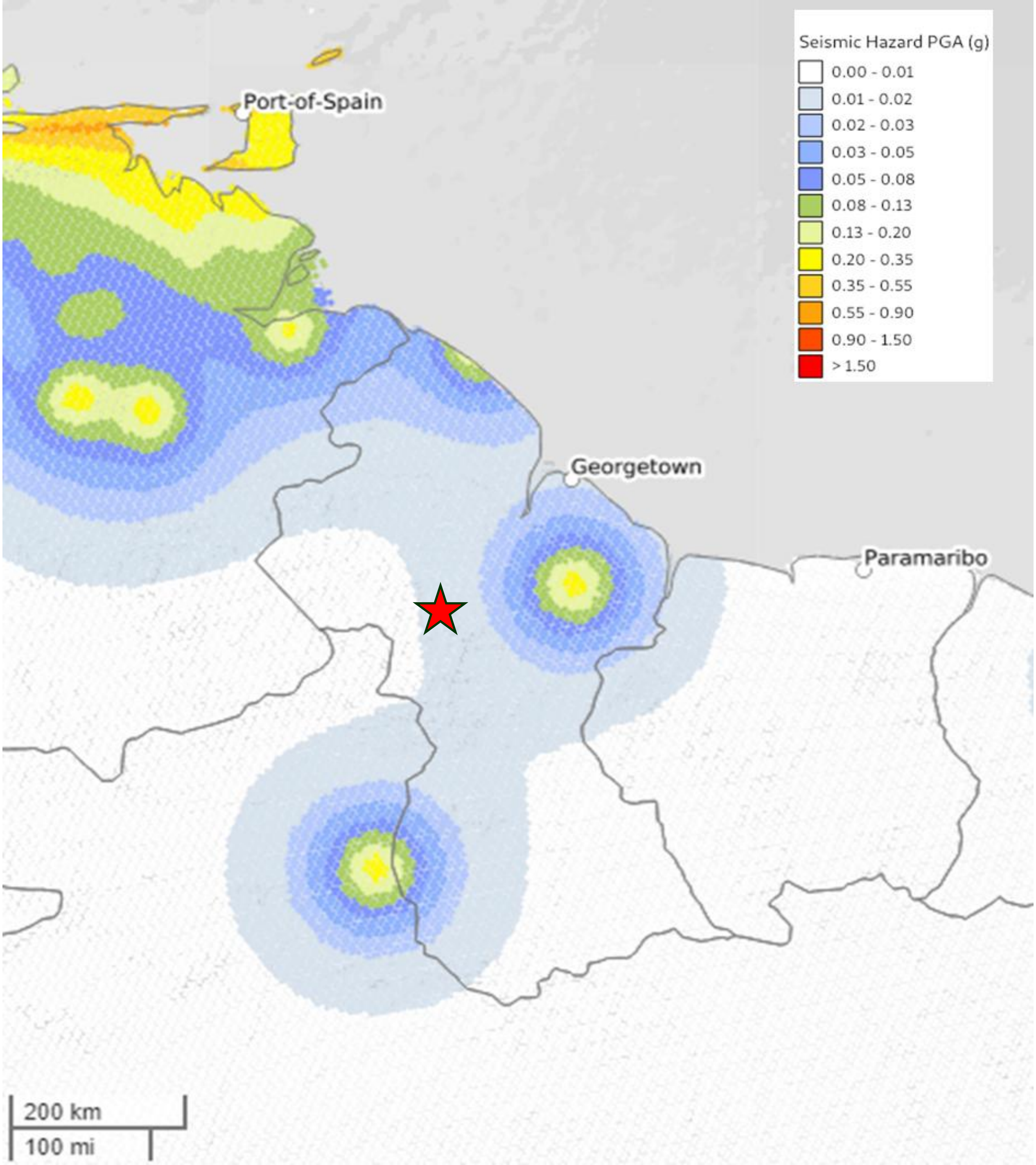
Year	Month	Day	Lat	Lon	Depth (km)	Mag	Region
1973	11	20	8.4217	-59.9048	0	4.1	Guyana
1968	2	26	5.1	-59.9	33	4.1	Guyana
1967	1	22	2.68	-59.1	33	4.1	Guyana
1965	8	15	2.648	-60.098	10	5.2	66 km ESE of Boa Vista, Brazil
1964	6	19	2.55	-59.3	75	4.2	Guyana

Source: IRIS Earthquake Browser (IRIS 2025).

The peak ground acceleration (PGA) defines the maximum acceleration of the ground that occurs in the event of an earthquake at a particular location (USGS 2019). This provides an indication of the seismic hazard to infrastructure from horizontal and vertical ground movement due to an earthquake.

Figure 4.6 depicts the geographic distribution of the PGA with a 10% probability of being exceeded in 50 years, computed for reference rock conditions (shear wave velocity, Vs30, of 760-800 m/s). Results of the Global Earthquake Model (GEM) Global Seismic Hazard Map (K. Johnson 2023) indicate that there is a low seismic hazard risk across Guyana which would result in earthquake loss of infrastructure, with a PGA on rock for a 475-year return period ranging between 0.01g to 0.02g for the project area.

FIGURE 4.6 PEAK GROUND ACCELERATION SEISMIC HAZARD MAP



Source: (K. Johnson 2023), Project location denoted by red star

5. PHYSIOGRAPHY, GEOLOGY, AND SOILS

5.1 INTRODUCTION

Investigative studies were conducted to characterise the physiographic, geology, and soils resources that could be impacted by the Project. This section describes the baseline conditions for these resources in the Project Area of Influence (AoI) and surrounding region. Specifically, this section does the following:

- Defines the general physiographic setting for the Project;
- Identifies and describes the regional and site geology and soil resources for the Project;
- Outlines the methodologies used for each of the baseline studies;
- Maps and characterises the soils resources in the Project AoI;
- Describes the physical and chemical characteristics of the soils; and
- Evaluates any potential environmental quality concerns in relation to the soils in the AoI based on the field investigations.

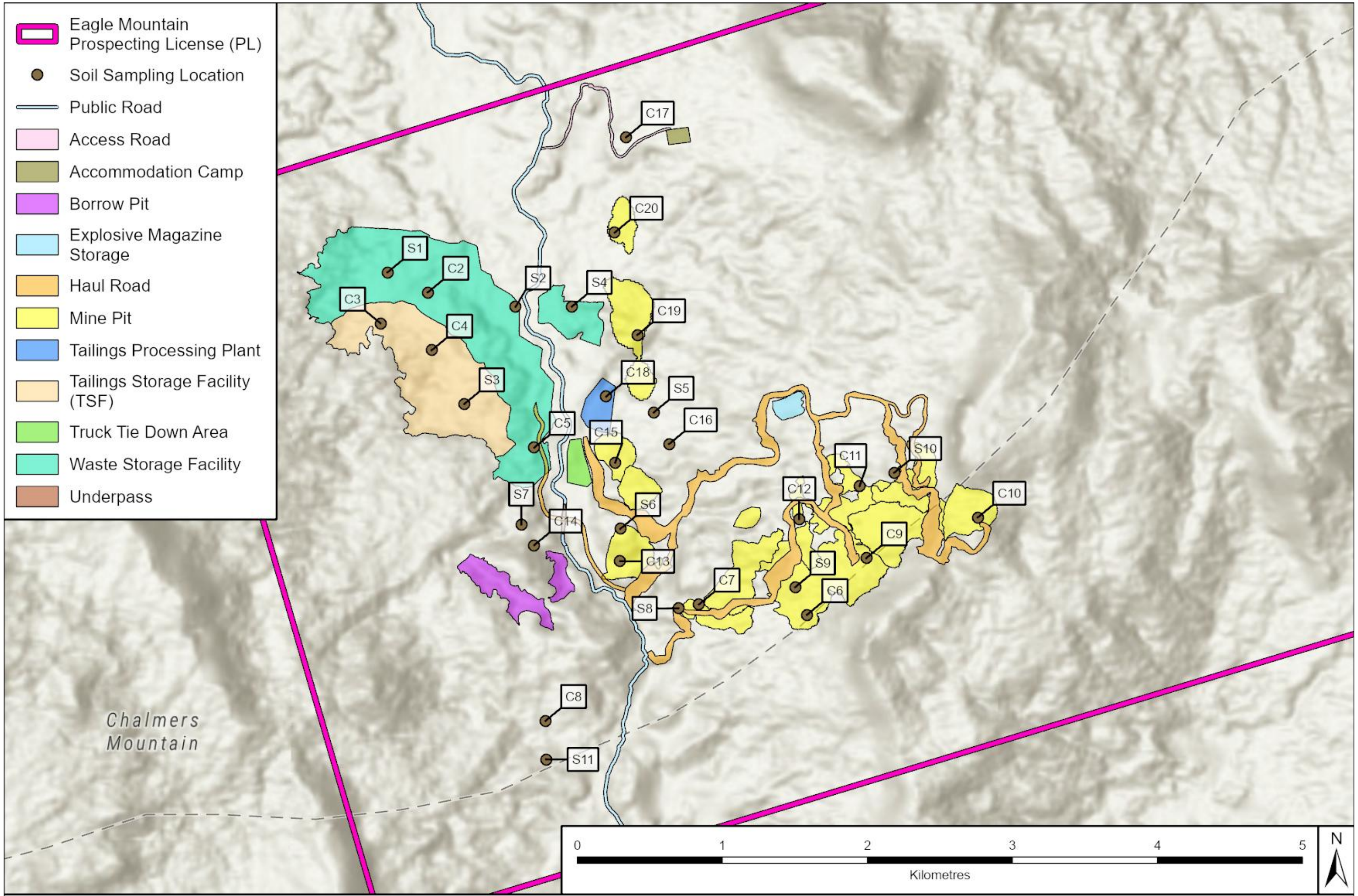
5.1.1 DATA COLLECTION AND METHODOLOGY

To characterise existing soil productivity and soil quality, 33 soil samples (designated S1 to S11 and C2 to C20, including three duplicate samples D1 to D3), were collected in October 2025.

The soil samples were collected from locations within or near the proposed Project ancillary facilities, within the proposed Project AoI (as shown in Figure 5.1). The sampling locations were selected to represent the range of landscapes and environments present within the study area, and the soils were described qualitatively based on their position in the landscape.

At each site, soil samples were collected from the topsoil from a depth of 10 to 30 centimetres (cm) using a soil bucket auger and/or appropriate hand tools. The samples were analysed for chemical and physical characterisation of soil productivity and potential contaminants of concern in accordance with the USEPA Soils Sampling and the Soil Science Society of America Methods of Soil Analyses protocols (USEPA 2023; SSSA 1986). Diagnostic tests were also conducted for each sample, including the identification of the soil type, the soil classification based on the Unified Soil Classification System, and the physical characteristics, which included the soil colour, soil structure, soil texture, and soil consistency and plasticity. The soil characterisation and chemical parameters are listed in Table 5.1 to Table 5.3, and results of the laboratory tests are provided in Appendix F-3.

FIGURE 5.1 SOIL SAMPLING LOCATIONS



Source: Esri, NASA, NGA, USGS, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

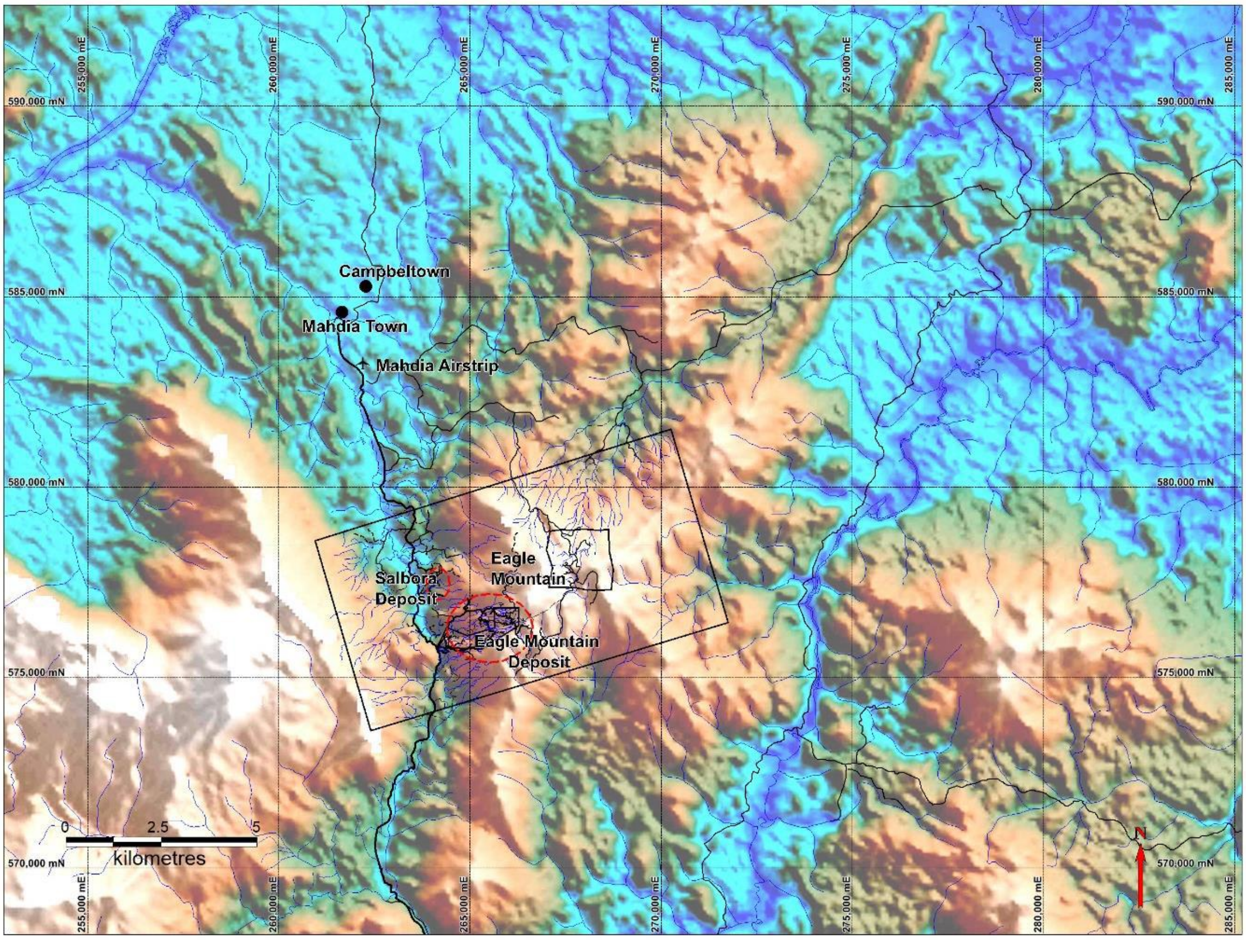
Path: \\vmukspgisfs01\Data\London\Projects\0763224 - Mako Mining EIA\Map\0763224 - Mako Mining EIA - V02C05 - SOI.aprx\0763224 - V02C05 - SOI - 05.01 - Soil Sampling Locations

5.2 BASELINE CONDITIONS

5.2.1 PHYSIOGRAPHY

The Property covers an area with elevations ranging from low-lying alluvial valleys (approximate elevation of 100 metres above mean sea level (amsl)) to the summit of Eagle Mountain (approximate elevation of 724.8 metres amsl). The majority of the Eagle Mountain deposit lies on the northwestern and southwestern slopes of Eagle Mountain and generally lies at elevations between 160 metres amsl and 500 metres amsl, extending over an area approximately 2.5 km x 1 km (Figure 5-1). The topography in the mineralised areas is characterised by steep sections separating less steep "benches".

FIGURE 5.2 PHYSIOGRAPHY OF THE PROJECT AREA



Source: PEA, 2024 (ERM)

5.2.2 GEOLOGY

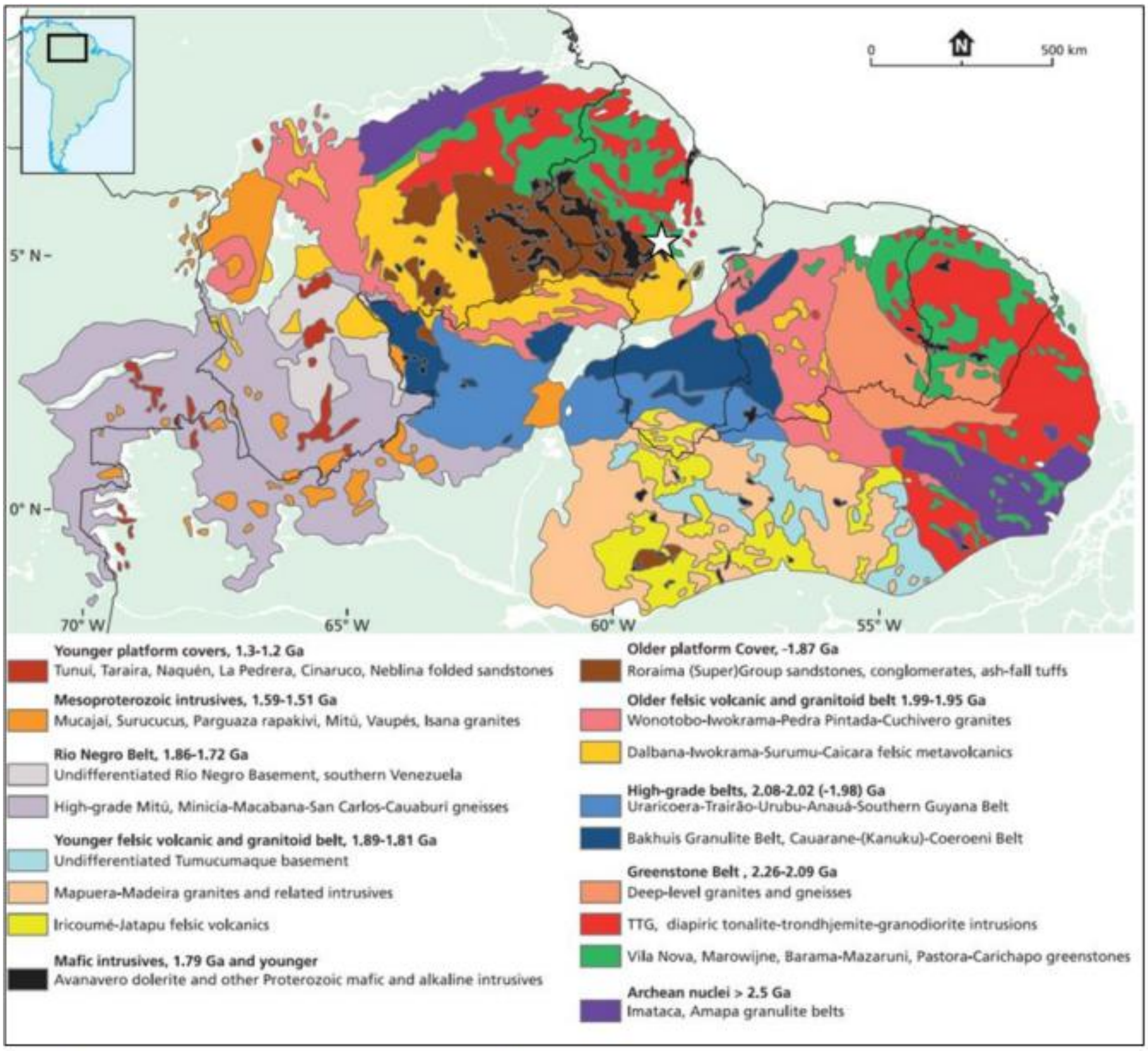
Information on geological characteristics have been obtained from the Project's Preliminary Economic Assessment Report (2024) and summarised in the sections below.

5.2.2.1 REGIONAL GEOLOGY

The Eagle Mountain Gold Mine Project is located approximately 200 kilometres (km) south-southwest of Georgetown, Guyana, in the northern part of the Trans-Amazonian province of the Guiana Shield (as shown in Figure 5.3).

Composed Primarily of Paleoproterozoic rocks accreted during the Trans-Amazonian Orogeny (2.2–2.0 billion years) and affected by tectonic, metamorphic, and intrusive events (Vanderhaeghe et al. 1998; Milési et al. 2003), the Guiana Shield forms an integral part of the Amazonian Craton. With a total area of 900,000 square kilometres (km^2), it covers Guyana, Suriname, French Guiana, eastern Venezuela, the northern end of Brazil, and easternmost Colombia (Daoust 2016; Tedeschi et al. 2020).

FIGURE 5.3 SIMPLIFIED GEOLOGICAL MAP OF THE GUYANA SHIELD



Note: The location of the Eagle Mountain Gold Project is shown by the white star.
Source: Preliminary Economic Assessment for the Eagle Mountain Project, 2024 (ERM)

The greenstone-TTG belts are generally attributed to the Trans-Amazonian Orogeny. The orogeny records the convergence and eventual collision between the Archean nuclei of the Amazonian Craton and the West African Craton to have occurred between 2.2 Ga and 1.9 Ga (Kroonenberg et al., 2016). The belts share close similarities with the more widely explored

Birimian of the West African Shield where numerous >2 Moz gold deposits are known in Senegal, Mali, Guinea, Ivory Coast, Ghana, and Burkina Faso.

Within the greenstone-TTG terrain, a series of major northwest-southeast striking, sinistral shear zones within a 75–100 kilometres wide belt developed during Trans-Amazonian orogenesis (Voicu et al., 2001). These structures are spatially associated with many known gold deposits in Guyana (e.g., Voicu et al., 1999; Bassoo and Murphy, 2018). The Eagle Mountain Gold Project lies between two of these structures, the Makapa-Kuribrong Shear Zone ("MKSZ") and Issano-Appaparu Shear Zone ("IASZ"). The northwest-southeast lineament bounding the northern part of the Pakaraima Mountains to the west of Eagle Mountain is interpreted to be an extension of the MKSZ, and it is possible that the Eagle Mountain deposit is associated with another of these regional structures.

5.2.2.2 SITE GEOLOGY

The Property is underlain by metavolcanic and metasedimentary rocks intruded by a composite granodiorite pluton that hosts the gold mineralisation at the Eagle Mountain deposit. At the Salbora deposit, mineralisation is within metavolcanic rocks adjacent to a northeast-trending monzonite dyke.

A large diabase to gabbro-norite sill, which is part of the Avanavero Suite, intrudes the granodiorite pluton and metavolcanic-sedimentary sequence and forms the ridge and cliffs at the top of Eagle Mountain. Associated dikes are oriented 120° and are estimated to be less than 10 metres thick.

The sequence has been deformed and folded in the Trans-Amazonian Orogeny and metamorphosed at greenschist facies. A system of low-angle, west-dipping thrust faults at the Eagle Mountain deposit and upright, north-south to northwest-southeast trending faults and breccias at the Salbora deposit are associated with this event and with gold mineralisation. Younger northwest to north-northwest trending faults crosscut and offset the shallow dipping structures at the Eagle Mountain deposit.

The shallow-dipping faults in granodiorite at the Eagle Mountain deposit range from narrow highly silicic altered zones to broader zones of pervasive deformation and fracturing. These fault zones are silicified and chlorite altered with disseminated pyrite and associated gold mineralisation.

The steep breccia zones at the Salbora deposit are also affected by chloritic alteration, silicification disseminated pyrite and associated gold mineralisation. At the Eagle Mountain deposit, the mineralised fault zones vary from 1 metre to 40 metres in thickness separated by 10 to 100 metres of unmineralised granite. At the Salbora deposit, gold mineralisation within steep breccia zones coalesces near surface into a broad, sub-horizontal zone of mineralisation. Gold mainly occurs as very fine disseminations of native gold within and associated with pyrite.

The Eagle Mountain deposit is modelled as a series of tabular, sub-horizontal to shallowly dipping zones. The variable thickness of each of the mineralised zones appears to be associated with deformation zones that split into several subparallel deformation zones, thereby broadening the zone of alteration and mineralisation.

At Salbora, gold mineralisation occurs within and adjacent to sub-vertical, north-south trending breccia zones that are generally a few centimetres to a few metres in thickness. Near the surface, these breccia zones appear to coalesce into broad, sub-horizontal zones of brecciation with mineralisation occurring over tens of metres. Breccias are developed in a tholeiitic mafic volcanic and altered granitoid adjacent to a monzonite intrusion. Mineralisation is associated with silicification, chloritic alteration and pyrite.

The Eagle Mountain and Salbora areas have been affected by tropical saprolite weathering to a depth of 10 to 50 metres. Gold mineralisation at the Eagle Mountain deposit (particularly Zones 1 and 2) have been heavily weathered and occurs largely within saprolite derived from granitoid-hosted deformation zone material, consisting of clay-rich material hosting very fine disseminated gold grains.

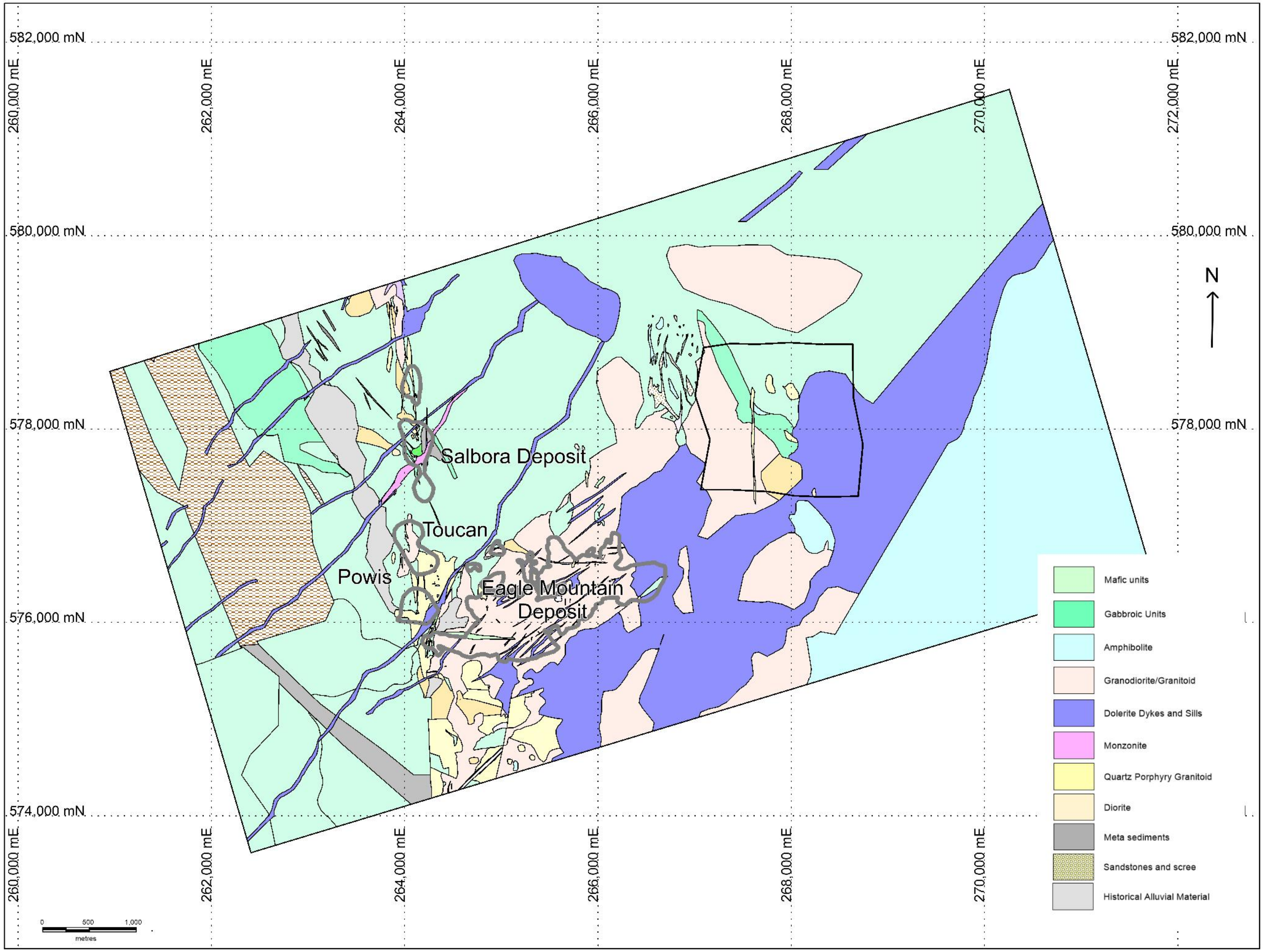
Saprolite is the chemical weathering product of the underlying bedrock that has decomposed in place and generally retains the rock's original structure and is especially characteristic of tropical lateritic weathering profile. The saprolite consists of soft clay to sandy particles, depending on the rock type being weathered and the amount of quartz present. Both the Eagle Mountain and Salbora deposits are affected by weathering that results in a typical saprolite depth of 10 to 30 metres and rarely to a maximum depth of 76 metres from surface. Saprolite transitions to fresh rock across a variable horizon is typically 1 to 3 metres thick.

The vertical and lateral variability within the laterite profile at Eagle Mountain has not been clearly defined. No ferruginous zone has been described, and the upper part of the laterite profile may have been removed by erosion.

Saprolite and transition material is both mineralised and un-mineralised. Gold mineralisation within the saprolite at the Eagle Mountain deposit occurs were mineralised zones reach shallow depths or outcrop. Mineralised saprolite is derived from mineralised granodiorite and consists of clay-rich material with very fine-grained disseminated gold. There is no evidence for gold remobilisation or enrichment in the supergene environment. Furthermore, there is no evidence of transportation or slope slip of saprolite.

At Salbora, the shallow mineralised zone has also been affected by weathering, resulting in a zone of mineralised saprolite near the surface.

FIGURE 5.4 SIMPLIFIED GEOLOGICAL MAP OF THE EAGLE MOUNTAIN AREA



Source: SGI (KMP), Derived from GRE, 2025.

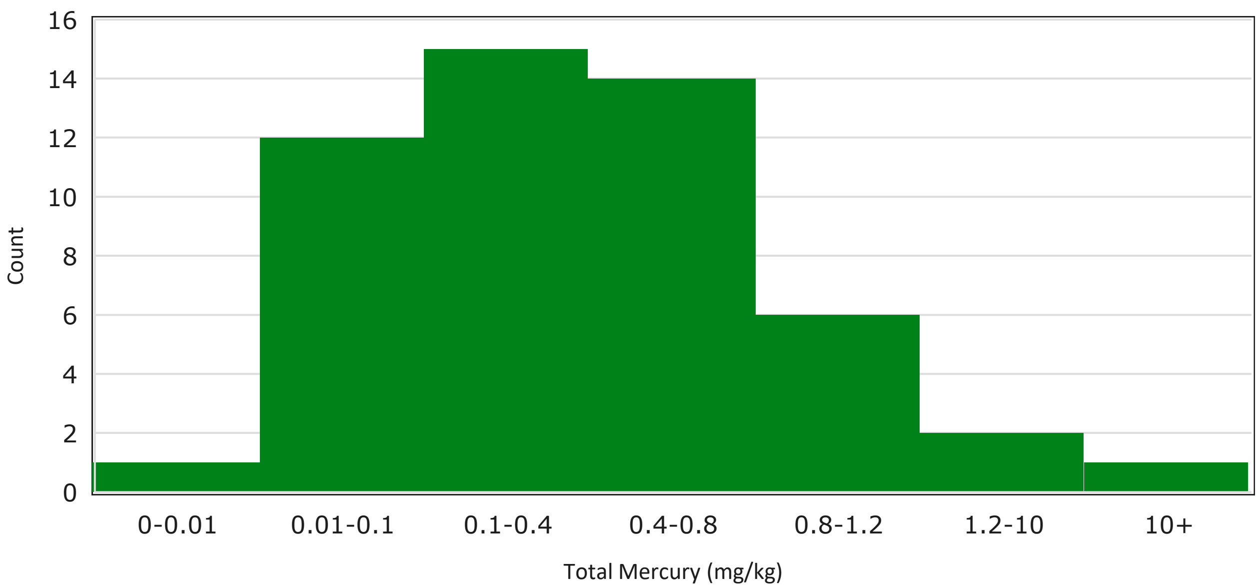
5.2.3 ARTISANAL MINING MERCURY CONTAMINATION

The Project area is located in an area with a history of small-scale artisanal mining, notably in the Mahdia and Minnehaha valleys, where mercury amalgamation was used for gold recovery. The baseline mercury contamination conditions within the Eagle Mountain Prospecting License (EMPL) were assessed by GRE in 2025 and involved mercury vapor scanning, soil, sediment, and water sampling and analysis to assess contamination severity and potential environmental liability.

Mercury contamination forms include elemental mercury, mercuric sulphide, organo-chelated mercury, acid-soluble salts, water-soluble salts, and organomercury compounds such as methyl mercury, the latter being the most toxic due to bioaccumulation in the food chain. Elemental mercury in soil can release mercury vapor detectable by a mercury vapor analyser, which guided GRE to select the sampling locations.

A total of 51 soil samples were collected in locations with higher mercury vapor readings to identify contamination hot spots. Total mercury content ranged from 0.0076 mg/kg to 18.4 mg/kg, with 39% exceeding five times the average crustal abundance (0.4 mg/kg) (Figure 5.5). Only one sample exceeded the USEPA Residential Soil Screening Level (7.1 mg/kg), and none exceeded the Industrial Soil Screening Level (30 mg/kg).

FIGURE 5.5 TOTAL MERCURY DISTRIBUTION IN SAMPLES



Source: Mercury Field Program Results: Technical Memorandum, GRE (2025)

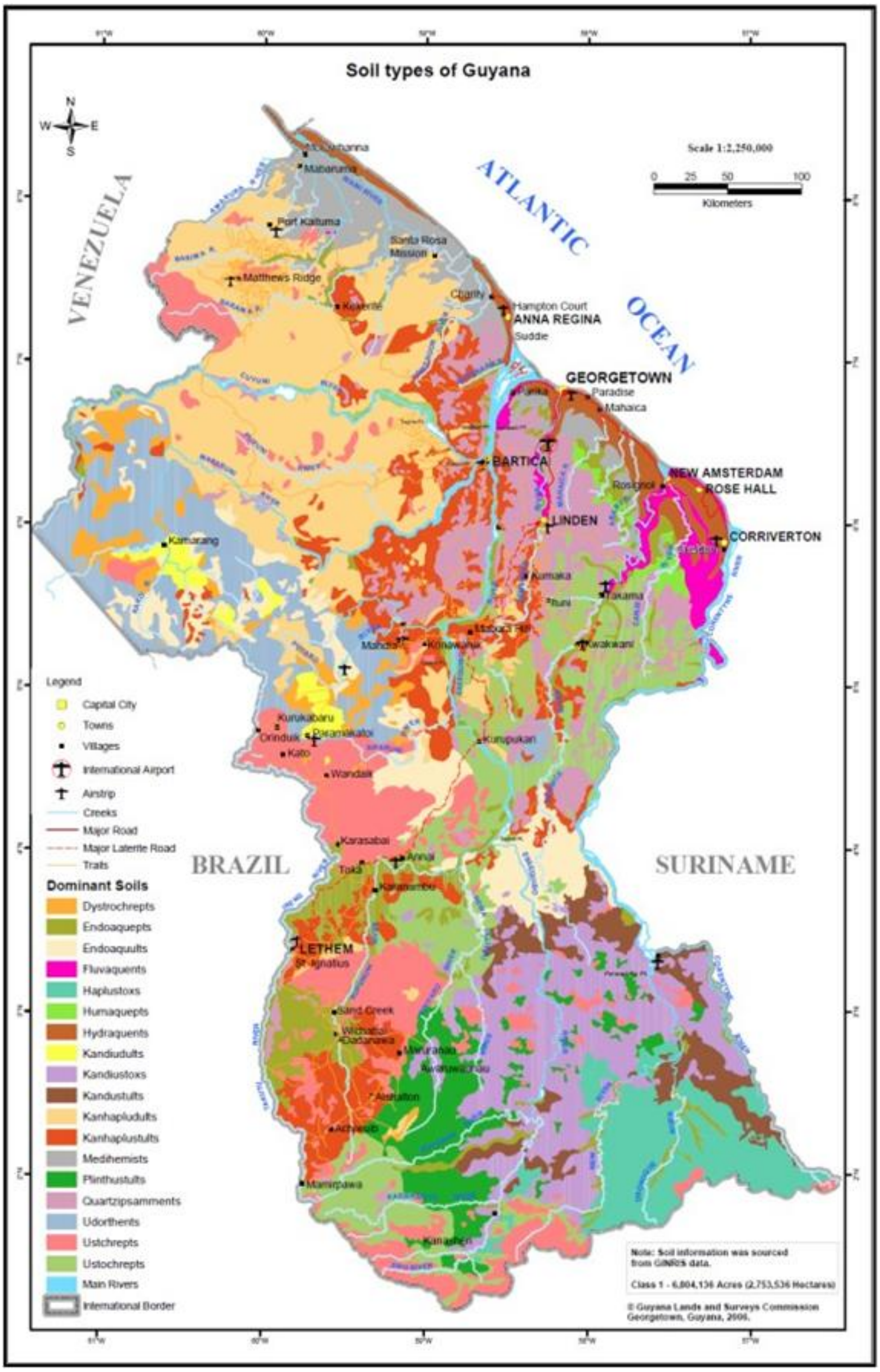
A medium correlation was found between total soil mercury and mercury vapor concentration, stronger at higher mercury levels. Methyl mercury ranged from below 0.05 µg/kg to 8.65 µg/kg and correlated positively with total mercury. Variations in mercury vapor readings were attributed to factors such as mercury species, recency of deposition, and temperature.

Mercury vapor analysis effectively located mercury-contaminated soils, with higher total mercury generally corresponding to higher vapor readings. Mercury contamination is heterogenous and localised to areas disturbed by artisanal mining. Approximately 10-15% of tested locations contained mercury above five times crustal abundance, while less than 1% exceeded USEPA soil screening levels. Methyl mercury levels were below USEPA thresholds.

5.2.4 SOILS

Information on the soil types found in the Project AoI was retrieved from the Guyana National Land Use Plan and The Preliminary Economic Assessment for the Eagle Mountain Gold Project (GLSC 2013; ERM 2024). Additionally, data were gathered from the above-referenced soil sampling locations.

FIGURE 5.6 SOIL MAP OF GUYANA



Source: GLSC 2013

5.2.4.1 SOIL PHYSICAL AND CHEMICAL CHARACTERISTICS

Existing soil information from Guyana's NAREI does not include detailed data on the physical characteristics, type, classification, and productivity and environmental quality of soils for the Project AoI (NAREI 2024). Therefore, to characterise existing soils, soils samples were collected from within the Project AoI and submitted for laboratory analysis (Figure 5.1). The results of the chemical characterisation are included in Appendix F-3.

In general, the soils found in the Project AoI and its vicinity have the following characteristics (as shown in Table 5.1):

- Well-drained, brown-red, reddish, or yellow-red, gravelly clays, silts, or laterite soils, are typical in hilly to steep hills and mountain landforms;
- Granular or blocky texture soils with low to medium plasticity and predominantly sand pr silt are typically associated with good to excessive drainage. These textures allow water to move through the soil profile relatively easily, preventing waterlogging.
- Clays soils are common in hilly to steep uplands landforms and can slow drainage, however the dominance of sand and silt textures suggests that, overall, the soils are not prone to waterlogging.

5.2.4.2 SOIL QUALITY

The soils sampled across the Project exhibit low soil fertility overall. The presence of a range of soil textures (from silty sand to clay) presented in Table 5.1 could provide reasonably favourable conditions, however laboratory results indicate low concentrations of key nutrients including total potassium, phosphorus, calcium, and magnesium relative to typical benchmark ranges. Despite this the soils indicate moderate moisture content (Table 5.2).

To assess for the presence of potential environmental quality concerns, the samples collected were analysed for a suite of parameters at all sampled locations. Analysis included testing for trace metals, polycyclic aromatic hydrocarbons (PAH), total petroleum hydrocarbons (TPHs), and benzene, toluene, ethylbenzene, and xylene (BTEX) at disturbed areas (e.g., artisanal and small-scale mining (ASM)). As listed in Table 5.3 the reported concentrations for all metals were below the USEPA screening levels for residential and industrial reference benchmarks or below the method detection limits. The report concentrations for PAHs, TPHs, and BTEX were below the method detection limits. In the few cases where parameters were detected, the reported concentrations were below the USEPA screening levels for residential and industrial reference benchmarks (USEPA 2021).

TABLE 5.1 PHYSICAL CHARACTERISTICS, TYPE, AND CLASSIFICATION OF THE SOILS

Location ID	Depth (centimetre)	Soil Colour	Soil Structure	Soil Texture	Soil Plasticity	Soil Type	Sampling Method	Unified Soil Classification System [a]
C2	30	Orange brown	Granular-blocky	Silt	Low plasticity	Sandy Clay	Composite sampling	SC
C3	20	Brown	Granular-blocky	Silty sands	Low plasticity	Silt	Composite sampling	CL
C4	30	Dark brown	Blocky	Clayey	Low plasticity	Clay	Composite sampling	CL
C5	15	Red brown	Granular	Sandy	Non-plastic	Sand/Silt	Composite sampling	SP
C6	20	Brown	Granular	Silty sand	Non-plastic	Silt	Composite sampling	SP
C7	20	Brown	Blocky-platey	Silty	Medium plasticity	Silt Clay	Composite sampling	OL
C8	15	Brown	Blocky	Clayey	Medium plasticity	Clay	Composite sampling	CL
C9	20	Reddish brown	Platey	Clayey	High plasticity	Clay	Composite sampling	CL
C10	15	Reddish brown	Blocky-granular	Silty	Low plasticity	Silt Clay	Composite sampling	OL
C11	10	Orange brown	Granular	Silty	Low plasticity	Silt	Composite sampling	SM
C12	10	Orange brown	Blocky	Fine silt with Gravel	Medium plasticity	Silt Clay	Composite sampling	CL
C13	10	Orange brown	Granular	Sandy Clay	Low plasticity	Silt	Composite sampling	CL

Location ID	Depth (centimetre)	Soil Colour	Soil Structure	Soil Texture	Soil Plasticity	Soil Type	Sampling Method	Unified Soil Classification System [a]
C14	15	Reddish brown	Blocky-platey	Clayey	Medium plasticity	Clay	Composite sampling	MH
C15	20	Orange to reddish brown	Granular	Silty	Low plasticity	Silt/ Clay	Composite sampling	CL
C16	10	Dark brown	Blocky	Clayey	Medium plasticity	Clay	Composite sampling	OL
C17	10	Dark reddish brown	Granular	Medium grain sand	No plasticity	Sand	Composite sampling	SP
C18	25	Yellow brown	Blocky	Clayey	Medium plasticity	Clay	Composite sampling	CL
C19	20	Dark reddish brown	Blocky-granular	Silty clay	Low plasticity	Clay	Composite sampling	OL
C20	Not provided	Reddish brown	Granular	Silty sand	Low plasticity	Silt	Composite sampling	SC
S1	20	Brown	Granular	Silt	No plasticity	Sandy silt	Composite sampling	SM
S2	20	Brown	Granular	Silt	No plasticity	Sandy silt	Composite sampling	SM
S3	20	Orange brown	Platey	Clayey	High plasticity	Clay	Composite sampling	CL
S4	15	Orange brown	Granular	Sandy	Low plasticity	Silt	Composite sampling	SC
S5	15	Yellow dark brown	Blocky	Silty	Low plasticity	Silt	Composite sampling	OL
S6	18	Orange brown	Blocky	Silty clayey	Low plasticity	Clay	Composite sampling	CL

Location ID	Depth (centimetre)	Soil Colour	Soil Structure	Soil Texture	Soil Plasticity	Soil Type	Sampling Method	Unified Soil Classification System [a]
S7	20	Reddish brown	Granular-blocky	Silty clay	Low plasticity	Silt	Composite sampling	SC
S8	20	Yellow brown	Granular	Fine loose silt	Low plasticity	Silt	Composite sampling	ML
S9	20	Red orange	Blocky	Silty	Medium plasticity	Clay silt	Composite sampling	CL
S10	20	Reddish brown	Granular-blocky	Clayey	Low plasticity	Clay	Composite sampling	CL
S11	20	Reddish brown	Blocky	Silty clay	Low plasticity	Silt	Composite sampling	CL

[a] CL=lean clay; SP=poorly graded sand; SC=clayey sand; SM=silty sand; MH=fine sandy silts; ML=silt; and OL=silty clays.

TABLE 5.2 SUMMARY OF SOIL PRODUCTIVITY CHARACTERISTICS AND COMPARISON TO BENCHMARK OR BACKGROUND VALUES

Parameter	Unit	Concentration in Background or Benchmark Criteria	Minimum	Mean	Maximum
Nutrients					
Total Potassium	%	0.1-3 [b]	0.04	0.49	2.22
Calcium	%	0.01-28 [c]	0.01	0.04	0.12
Magnesium	%	0.06-0.6 [a]	0.03	0.10	0.26
Other Soils Parameters					
Moisture	%	NA	10.3	17.28	25.3

mg/kg = milligrams per kilogram; NA = not available

[a] Common range in soils (Lindsay 1979)

[b] Range of optimal cation exchange capacity value for soils used for agricultural production (Bohn et al. 1979)

c Value is the observed range of the expected 95 percent range for the U.S. soils west of the 96th meridian (Shacklette and Boerngen 1984)

TABLE 5.3 CHEMICALS OF POTENTIAL CONCERN COMPARED TO CRITERIA

Parameter	Unit	USEPA Residential Soil Screening Level a	USEPA Industrial Soil Screening Level a	Minimum	Mean	Maximum
Metals (n=33)						
Total Lead (Pb)	mg/kg	400.00	800.00	4.50	13.08	29.20
Total Copper (Cu)	mg/kg	3,100.00	47,000.00	24.30	82.47	166.00
Total Arsenic (As)	mg/kg	0.68	3	3.20	8.46	37.00
Total Zinc (Zn)	mg/kg	23,000.00	350,000.00	20.60	52.76	82.30
Total Cadmium (Cd)	mg/kg	7.10	100.00	BDL	BDL	BDL
Total Chromium (Cr)	mg/kg	12,000.0 b	180,000.0 b	52.00	140.67	519.00
Total Mercury (Hg)	mg/kg	11.00	46.00	0.07	0.32	0.98
Organics (n=33)						
Polycyclic Aromatic Hydrocarbons (PAHs)						
Acenaphthene	mg/kg	3,600.00	45,000.00	BDL	BDL	BDL
Acenaphthylene	mg/kg	NA	NA	BDL	BDL	BDL
Anthracene	mg/kg	18,000.00	230,000.00	BDL	BDL	BDL
Benzo[a]anthracene	mg/kg	1.10	21.00	BDL	BDL	BDL
Benzo[a]pyrene	mg/kg	0.11	73.00	BDL	BDL	BDL
Benzo[b]fluoranthene	mg/kg	1.10	1.80	BDL	BDL	BDL

Parameter	Unit	USEPA Residential Soil Screening Level a	USEPA Industrial Soil Screening Level a	Minimum	Mean	Maximum
Benzo[g,h,i]perylene	mg/kg	NA	NA	BDL	BDL	0.013
Benzo[k]fluoranthene	mg/kg	11.00	210.00	BDL	BDL	BDL
Chrysene	mg/kg	110.00	2,100.00	BDL	BDL	BDL
Dibenzo(a,h)-anthracene	mg/kg	0.11	2.10	BDL	BDL	BDL
Fluoranthene	mg/kg	2,400.00	30,000.00	BDL	BDL	BDL
Fluorene	mg/kg	2,400.00	30,000.00	BDL	BDL	BDL
Indeno[1,2,3-cd]pyrene	mg/kg	1.10	21.00	BDL	BDL	BDL
Naphthalene	mg/kg	2.00	8.60	BDL	BDL	0.002
Phenanthrene	mg/kg	N/A	N/A	BDL	BDL	BDL
Pyrene	mg/kg	1,800.00	23,000.00	BDL	BDL	BDL
Total Petroleum Hydrocarbons (TPHs)	mg/kg	N/A	N/A	BDL	BDL	16.6
Benzene, Toluene, Ethylbenzene and Xylene (BTEX)						
Benzene	mg/kg	1.20	5.10	BDL	BDL	BDL
Xylenes, Total	mg/kg	550.00	2400.00	BDL	BDL	BDL
Ethylbenzene	mg/kg	5.80	25.00	BDL	BDL	BDL
Toluene	mg/kg	4,900.00	47,000.00	BDL	BDL	BDL

n = number of sampled locations;
BDL = below method detection limit (analysed but not detected above the method detection limit or sample detection limit);
mg/kg = milligrams per kilogram;
NA = not available;
USEPA = U.S. Environmental Protection Agency
[a] This includes the USEPA regional screening levels for residential and industrial soils (USEPA 2024).
[b] This includes Total Chromium III.

6. LANDSCAPE AND VISUAL

6.1 INTRODUCTION

This Chapter presents the landscape and visual baseline chapter for the Eagle Mountain Gold Project.

6.1.1 ASSUMPTIONS AND LIMITATIONS

Using a combination of desktop analysis and photographs taken during the April 2025 field campaign we were able to determine the local environmental setting and gain a general understanding of the site's landscape setting.

6.2 LANDSCAPE BASELINE CONDITIONS

The Landscape Study Area was defined as the area within a 3.5 km radius of the Projects' main works area/components ("Project Area") which the impacts are likely to occur. The size of the AoI will vary significantly depending on the type, scale, and location of the proposed development. For mine projects and processing plant infrastructure, a radius of between 1-5 km is generally used[1]. Due to the steep topography of the Eagle Mountain Prospecting License (EMPL), landscape and visual impacts are unlikely to occur over 1-2 km from the Project. As such, the 3.5 km radius is conservatively applied.

6.2.1 TOPOGRAPHY

As described in Chapter 11.9 – Land Use, Guyana covers 214,920 square kilometres (km^2) and is bordered by the Atlantic Ocean to the north, Brazil to the south, Suriname to the east, and Venezuela to the west. It can broadly be divided into four ecoregions:

- The low **coastal plain** stretches approximately 9,202 km^2, from the Corentyne River in the east to Waini Point in the west, and ranges from approximately 5 to 65 kilometres wide along the coast. It accounts for less than 8 percent of the country's land area and is approximately 1.4 meters below mean high tide level. The coastal plain is known for its silty clay, peat and sandy soils which are conducive to agriculture.
- The **hilly sand region** is a largely vegetated zone dominated by white, sandy soils and undulating terrain lying inland from the coastal zone. This zone is approximately 28,920 km^2, is largely forested, and contains most of the country's bauxite and stone mineral deposits.
- The **forested highlands** extend from the hilly sand region to the country's southern borders and are part of the pre-Cambrian Guiana Shield. This zone comprises about 73 percent of the country's land mass – approximately 156,450 km^2 – and is often divided into the western highlands and southern uplands. The highland region is known for its mountain ranges, dense forest, and gold and diamond mineral resources.
- The **interior savannas** consist of two main savanna complexes: the Rupununi Savannas and the Intermediate Savannas. The Rupununi Savannas cover 15,540 km^2 and lie in the

[1] GLVIA3 (3rd Edition, 2013). https://www.landscapeinstitute.org/technical-resource/landscape-visual-impact-assessment/

southwestern part of the country. The Intermediate Savannas cover 5,180 km^2 and are 97 kilometres from the mouth of the Berbice River.

The relief of the broader area is characterised by hills and valleys/ plains. The relief of the Landscape Study Area ranges from 100 m (valley floor) to 724.8 m above mean sea level (Figure 6.1).

The area of the Prospecting Licence covers an area with elevations ranging from low-lying alluvial valleys (approximate elevation of 100 metres above mean sea level (amsl)) to the summit of Eagle Mountain (approximate elevation of 724.8 metres amsl). The majority of the Eagle Mountain deposit lies on the northwestern and southwestern slopes of Eagle Mountain and generally lies at elevations between 70 metres amsl and 500 metres amsl, extending over an area approximately 2.5 km x 1 km (Figure 6.1). The topography in the mineralised areas is characterised by steep relief with steep sided gullies.

At higher elevations near the summit of Eagle Mountain, above the Project Area, dolerite sills and dikes form steep cliffs of up to 150 metres vertical relief. Unweathered dolerite boulders, up to 15 metres in diameter derived from erosion of the host hocks around the intrusions, are frequent at lower elevations on the western flank of Eagle Mountain.

Small deeply incised creeks widen quickly to form alluvial flats up to 2 kilometres wide that drain either to the Mahdia River and then to the Potaro River to the north, or south to the Minnehaha Creek and then to the Konawaruk River. The alluvial deposits within both watersheds have been historically worked by artisanal miners and are still worked today outside the Project area.

The area is covered by thick tropical jungle. Many areas of deforestation due to historical mining have since regrown into tropical jungle vegetation (refer to Figure 6.2).

FIGURE 6.1 TOPOGRAPHY OF LANDSCAPE STUDY AREA

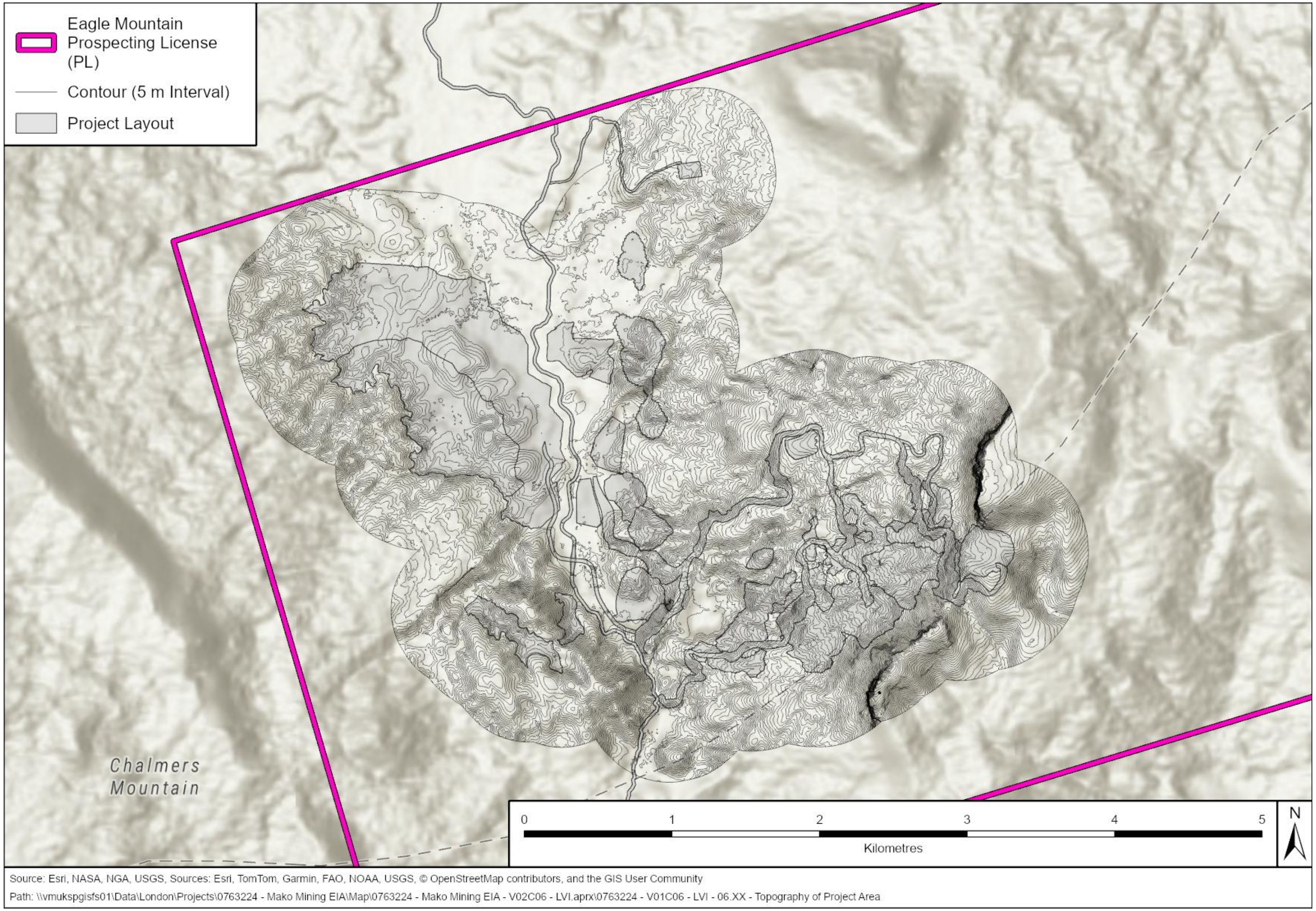


FIGURE 6.2 REMNANTS OF AN ARTISANAL OPERATION (OUTSIDE PROJECT AREA)

6.2.2 LANDSCAPE CHARACTERISTIC UNIT (LCU)

At a global level, landscape has been classified into "bioregions" by One Earth[2]. A bioregion is a geographical area defined by ecological systems and could contain one or more ecoregion. The bioregions 2023 framework is characterised by the world's major biogeographical realms, the broadest divisions of earth's land surface in which ecosystems and groupings of organisms share a common evolutionary history. These correspond approximately to the major continents of the earth but are further subdivided.

Each bioregion is characterised by distinct landscape characteristics and may consist of one or more ecoregions.

[2] Ecoregions were previously defined by the WWF (Terrestrial Ecoregions | Biome Categories | WWF (worldwildlife.org)) and are now managed by nonprofit organisation One Earth (https://www.oneearth.org/)

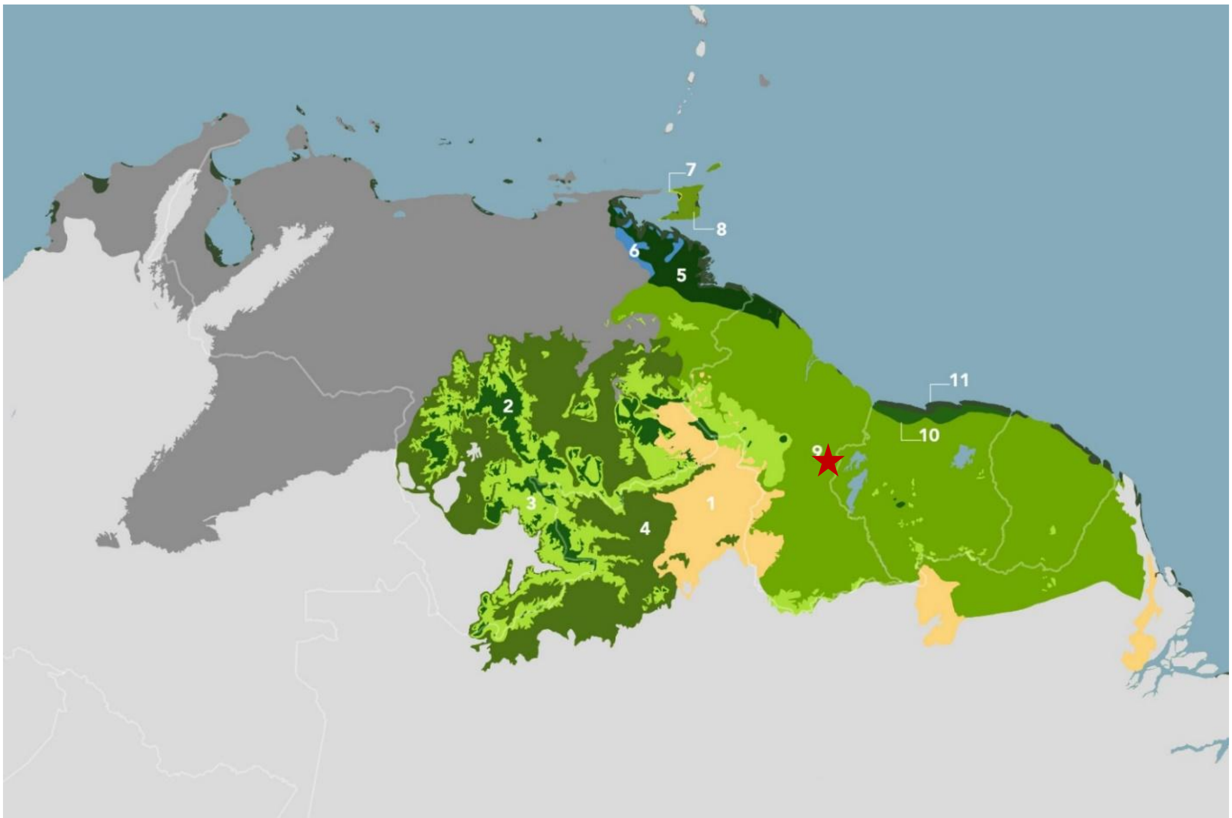
The Project is located fairly centrally within the large Guianan Lowland Moist Forests ecoregion (106,384 m²) which is one of the eleven[3] ecoregions of the Guianan Forests & Savanna (NT21) bioregion[4] (Figure 6.3).

Primarily situated in southeastern Venezuela in northern South America, the Guianan Highlands Moist Forests ecoregion is an elevational "island" surrounded by llanos and lowland forest. Portions of the ecoregion lie in the northernmost tip of Brazil, with small slivers in western Guyana and eastern Colombia. Most of this ecoregion lies within the eastern portion of the Orinoco Basin which drains into the Caribbean Sea from Venezuela. Another portion drains into the Amazon Basin.

The ecoregion sits upon the Guyana Shield which underlies the northern region of South America. It consists of a rock basement with a variety of igneous and metamorphic rocks. The soils are generally sandy and poor in nutrients. The region is perforated by a series of ancient uplands and highlands between 500–3,000 m in elevation.

It hosts vast expanses of tall primary rainforest and open, treeless, or nearly treeless savannas interrupted by gallery forests.

FIGURE 6.3 ECOREGIONS



Source: One Earth, 2023 Framework. Note: Star indicates Project location.

[3] Guianan Savanna, Pantepui Forests and Shrublands, Guianan Highlands Moist Forests, Guianan Piedmont Moist Forests, Orinoco Delta Swamp Forests, Orinoco Wetlands, Trinidad and Tobago Dry Forests, Trinidad and Tobago Moist Forest, Guianan Lowland Moist Forests, Guianan Freshwater Swamp Forests, and Amazon-Orinoco-Southern Caribbean Mangroves

[4] NT21 is a code to identify which is the ecoregion in One Earth. NT identifies that we are in the Neotropical realm one of the macro-regions into which the Earth is divided, with five major subrealms—Amazonia, Andes Mountains & Pacific Coast, South American Grasslands, Brazil Cerrado & Atlantic Coast, and Upper South America. 21 (of 23) is the number of the ecoregion in neotropics (https://www.oneearth.org/navigator/)

The Guianan Forests and Savanna bioregion is part of the Upper South America subrealm and is made up of 11 ecoregions: (1) Guianan Savanna (2) Pantepui Forests and Shrublands (3) Guianan Highlands Moist Forests (4) Guianan Piedmont Moist Forests (5) Orinoco Delta Swamp Forests (6) Orinoco Wetlands (7) Trinidad and Tobago Dry Forests (8) Trinidad and Tobago Moist Forest (9) Guianan Lowland Moist Forests (10) Guianan Freshwater Swamp Forests (11) Amazon-Orinoco-Southern Caribbean Mangroves.

The general landscape and terrain of the EMPL is rocky highlands characterised by large boulders, rocky outcrops, steep hills, ravines and swamps (natural and artificial). The land cover within the EMPL can be characterised as a natural and degraded tropical forest habitat as some areas mainly the lower latitudes showing evidence of historic artisanal mining activity (refer to Figure 6.4 and Figure 6.5) while the areas at higher elevations show mostly intact forest (Figure 6.6). The characteristics of the land cover enable the landscape to be classified into distinct areas sharing common features. Given the general homogeneity of the landscape in the vicinity of Project, with consistent physical, visual, and land-cover characteristics at the scale relevant to landscape and visual impact assessment, it is considered sufficiently uniform to be treated as a single Landscape Characteristic Unit (LCU). As the landscape sensitivity can be assessed by the ability of a particular landscape to absorb aesthetic alterations, this means the project surroundings are assumed to be of homogenous sensitivity.

There are no social receptors within the EMPL boundary, however, social receptors were identified around the EMPL though some distance away, they are “Minnehaha” landing, and the communities and town of Campbelltown, Princeville, and Mahdia respectively (Refer to Chapter 11 Social Baseline] for more information on these).

FIGURE 6.4 AERIAL PHOTO OF HISTORIC AND CURRENT ARTISANAL MINING (OUTSIDE THE PROJECT AREA BUT WITHIN THE BROADER STUDY AREA, NORTH OF MAHDIA)

FIGURE 6.5 AERIAL VIEW OF PROJECT CAMP (CURRENT)

FIGURE 6.6 CREEK NEAR GATE WITHIN THE PL SURROUNDED BY NATURAL VEGETATION AND ROCKS

6.2.3 PROTECTED AREAS AND CULTURAL VALUE

Protected areas are defined to safeguard valuable species and habitats. At the same time, they often also protect the character of the landscape, and the cultural values associated with it. To understand the perceived value of a particular landscape, areas are the starting point in understanding landscape value. There are no protected areas within the EMPL or within a 25 km range of the EMPL boundary in any direction, the closest protected area is the Kaieteur

National Park located approximately 40 km west of the EMPL. Additionally, while in the field, two rock shelters were identified in proximity to one of the pit areas. Evidence on the ground indicates that these shelters are being used by pork-knockers both historically and present day. No archaeological materials of any kind were present at the two locations (Figure 6.7). Refer to Chapter 11 [Cultural Heritage Baseline] for more information.

FIGURE 6.7 ROCK SHELTER, HISTORICALLY OCCUPIED BY PORK KNOCKERS

6.3 VISUAL BASELINE CONDITIONS

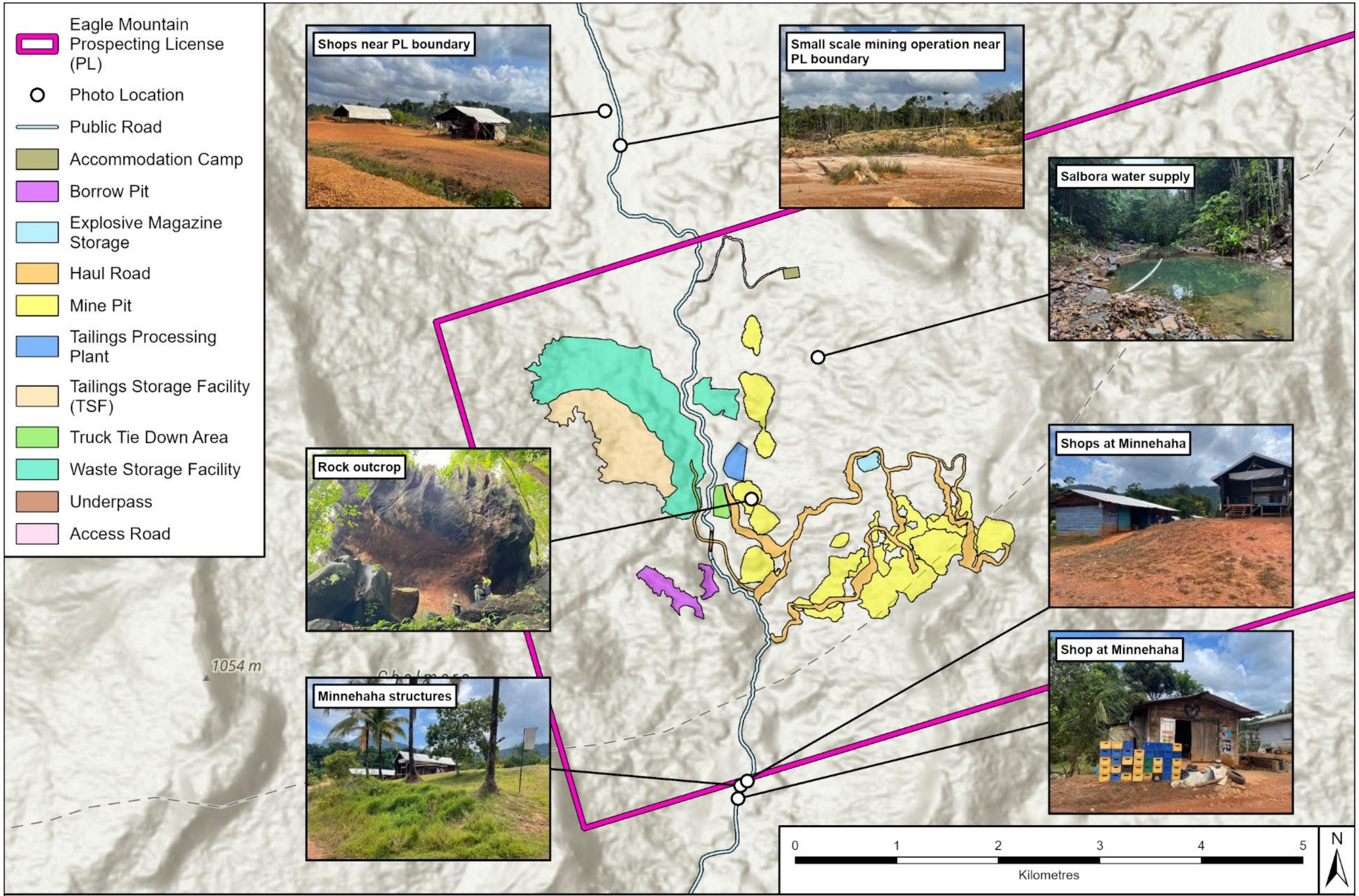
The visual study area is defined as the area within which the Project could be discernible by the human eye and could interfere with the main sensitivities identified in the local context.

Based on the project description, key elements of the projects with the potential to visually impact the surrounding areas include, the Processing Plant, the Waste Dump, Waste Storage Facility, Tailings Storage Facility (TSF) and Mine Pits. These areas are either restricted to not exceed the maximum height of the surrounding regional topography, or very remote from any potential visual sensitive receptors, to potentially impact surrounding areas.

An overview of some key locations within the EMPL and surrounding area is provided in

Figure 6.8. The figure identifies features relevant to the visual baseline, including the informal Minnehaha settlement, the pork-knocker rock outcrop, the Salbora water-supply abstraction point, and several small structures within the wider landscape. These locations help illustrate the spatial context of potential visual receptors and the relationship between the Project footprint and surrounding areas.

FIGURE 6.8 PHOTOMAP OF KEY LOCATIONS WITHIN AND SURROUNDING THE EMPL



Source: Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community, Esri, NASA, NGA, USGS

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7. HYDROLOGY AND SURFACE WATER

7.1 INTRODUCTION

This section presents baseline information drawn from hydrological study reports prepared by Global Resource Engineering Inc. (GRE). For water quality assessments, data from GRE and Stronghold Guyana's ongoing monitoring programme has been utilised. All information provided herein is directly sourced from these reports and datasets. The full GRE report is given in Appendix F.

7.1.1 DATA SOURCES

Data sources include:

- Studies carried out by Global Resource Engineering (GRE) Inc.
  - Hydrological monitoring records from the 2024–2025 baseline programme, including:
    - Stream stage and discharge measurements at designated stations
  - Sediment transport and total suspended solids (TSS) monitoring data, including:
    - Event based and routine TSS samples with associated field logs.
    - Paired TSS–discharge measurements and derived relationships.
  - Surface water quality sampling and analysis, including:
    - Sampling rounds completed in January, March, July, and September 2025 at georeferenced stations
    - QA/QC records (calibrations, duplicates, blanks).
    - Laboratory certificates of analysis.
- Historical site datasets from prior surface water surveys (2013).
  - Geospatial datasets supporting hydrology, including:
    - GPS coordinates for monitoring stations and access points.
    - Digital elevation models, catchment delineations, and river network layers for the drainage network within and surrounding the project area.
    - Project layout drawings and infrastructure plans used to contextualise monitoring locations.
- Mercury screening/testing programme design and associated water sampling results relevant to surface waters.
- Preliminary Economic Assessment (ERM, 2024).

7.1.2 ASSUMPTIONS AND LIMITATIONS

7.1.2.1 ASSUMPTIONS

The following assumptions were made to enable a baseline assessment to be completed:

- Field measurements and sampling follow established QA/QC practices (calibration checks, duplicates, blanks); calibration records are considered valid for the analysis period.
- Laboratory analyses are performed to accredited methods; detection limits and uncertainty are sufficient for parameter screening and trend evaluation.

- Rainfall inputs from site and regional gauges are representative for event interpretation and hydrograph response at monitored stations.
- Chain of custody and sample integrity were maintained; samples are assumed free of contamination or handling artifacts affecting results.
- The IFC comparison is intended for benchmarking purposes and to provide context on general water quality representative of pre-mining conditions. IFC EHS Guidelines for Mining effluent are referenced only for this comparative assessment and do not serve as compliance criteria.

7.1.2.2 LIMITATIONS

The following limitations are relevant to the hydrology baseline studies:

- Surface water information has been drawn primarily from GRE's monitoring programme and historical site surveys; ERM did not independently replicate measurements or reanalyse laboratory samples.
- Spatial coverage is constrained to accessible gauging and sampling stations; several tributaries and headwater reaches remain ungauged.
- Water quality sampling comprises discrete rounds (Jan, Mar, Jul, Sep 2025).
- Field parameter coverage is incomplete for certain rounds; where absent, laboratory pH/EC were used as proxies, which limits immediate QA/QC checks.
- No continuous turbidity or suspended sediment instrumentation was deployed; sediment flux estimates depend on discrete sampling.
- Earlier surface water quality studies were also conducted by EMC during the 2013 wet and dry season. Baseline water-quality data are typically considered valid for up to three years, however, given the pronounced seasonal variability and the influence of upstream small-scale mining activities, the 2013 baseline data may not fully represent current conditions.

7.1.1 DATA COLLECTION AND METHODOLOGY

The field programme was designed to acquire hydrological information required to characterise surface water conditions at the mine site and to provide data for assessing potential impacts on local surface water resources. Activities within the 2024–2025 monitoring programme are explained in the following sections, and are listed below:

- Stream discharge and total suspended solids (TSS) monitoring.
- Conceptual hydrological modelling
- Surface water quality assessment.

7.1.1.1 STREAM DISCHARGE AND TOTAL SUSPENDED SOLIDS MONITORING

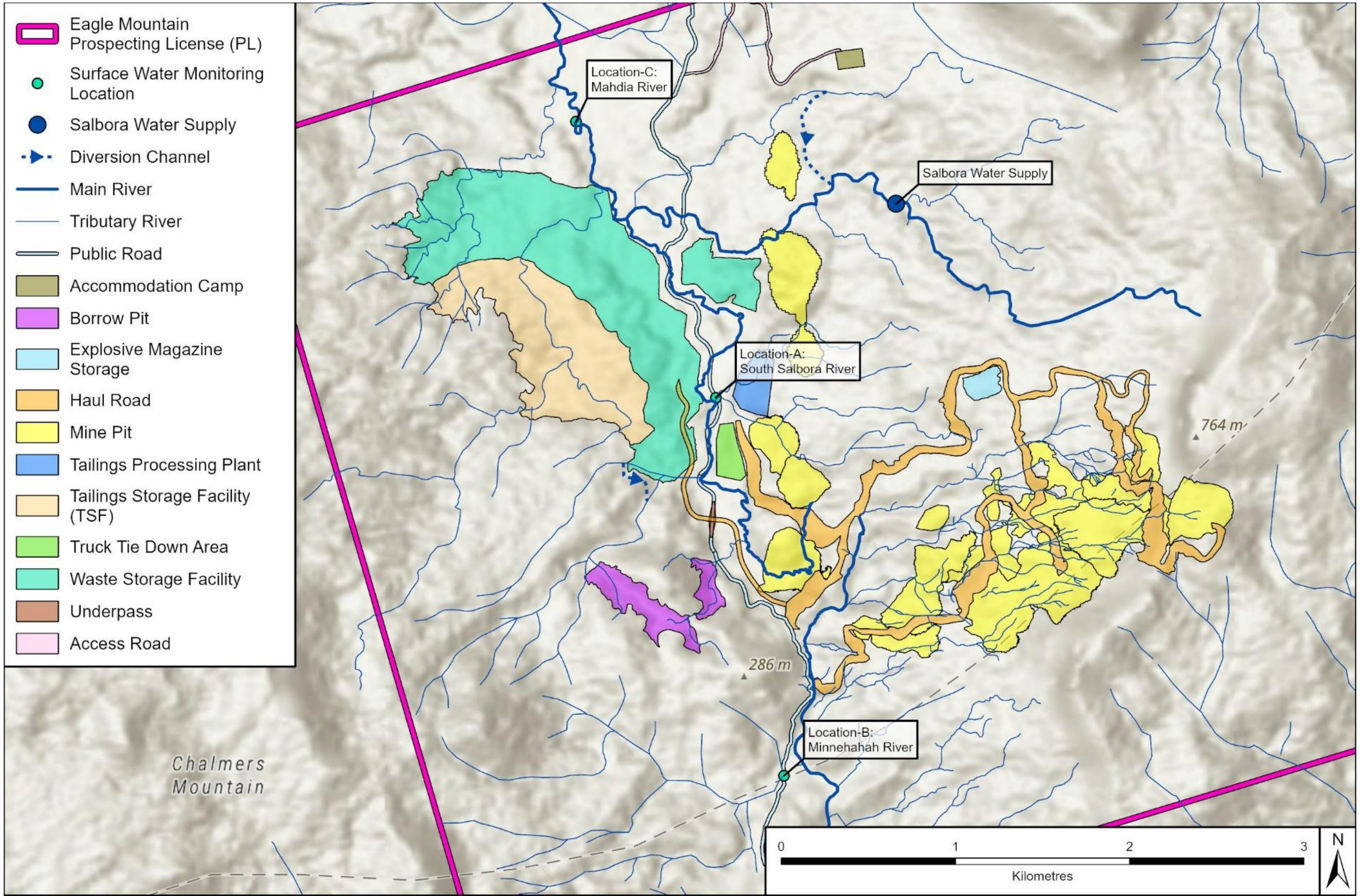
Since June 2024, GRE, working with site personnel, initiated a monitoring programme to describe how the Eagle Mountain drainage network conveys water and suspended material through its catchments. Accordingly, the programme combines stream discharge measurements with co-located TSS sampling at three locations across the study area - South Salbora River (Location A), Minnehaha River (Location B), and Mahdia River (Location C)

(Figure 7.1) - with an additional monitoring point established at Deer Creek (Location D) for TSS-only sampling.

Discharge observations define seasonal and event scale flow regimes, establishing the hydrographic context and low flow indices that govern dilution capacity, hydraulic connectivity, and downstream exposure. Paired TSS sampling characterises the sediment response - how erosion and transport differ between baseline conditions and storm pulses - serving as an indicator of water clarity and a proxy for particulate bound contaminants

Considered together, these datasets support stream discharge (Q) – TSS relationships, provide calibration and testing inputs for surface water modelling, and frame the sensitivity of downstream receptors.

FIGURE 7.1 SURFACE WATER FLOW RATE MONITORING LOCATIONS



Source: Esri, NASA, NGA, USGS, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

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Stream Discharge

Discharge was measured on a semi-monthly schedule at stream reaches identified to be hydraulically stable and free of backwater effects. A control line was set perpendicular to flow to define the wetted width and allow repeatable occupation through seasons and storms.

Measurements followed a velocity–area procedure using a calibrated SonTek FlowTracker2 handheld ADV. Approximately twenty verticals were occupied across the section, with evenly spaced stations throughout the main conveyance. At each vertical, depth was recorded and point velocity measured at 0.6 × depth (Figure 7.2). Instrument diagnostics were reviewed in the field; traverses were accepted when the largest single-station contribution to total discharge was ≤ 15%, a threshold adopted for uneven, sandy–muddy beds typical of the site. If exceeded, station spacing was adjusted and the traverse repeated.

FIGURE 7.2 RECORDING OF STREAM VELOCITY AT A MONITORING STATION

Total Suspended Solids Monitoring

TSS monitoring was co-located with the discharge programme and sampling was scheduled to capture baseline dry and wet season conditions and storm responses, providing a consistent record of suspended material under both quiescent and energetic flow states.

Field practice followed a simple, repeatable routine. Samples were taken mid-channel using pre-cleaned bottles, filled and capped below the water surface to minimise aeration and loss of fines. Each sample was labelled with the station ID, date, and time, which was then stored in iced coolers, and transferred under chain of custody to an accredited off-site laboratory (Kaizen) for TSS (mg/L) analysis using APHA Standard Methods. Where feasible, sampling coincided with discharge measurements to enable subsequent Q–TSS analysis.

7.1.1.2 SURFACE QUALITY SAMPLING AND ANALYSIS

Sample Collection

Surface-water quality sampling was conducted in January, March, July, and September 2025 to characterise ambient chemistry and its seasonal/event variability across the Eagle Mountain catchments. The programme was executed at six georeferenced stations - SWSA (South Salbora), SWSB (Minnehaha, guard hut), SWSC (Mahdia), SWSD (Deer Creek), SWSE (Mahdia water-supply reservoir), and SWSG (North Salbora, bridge after Marshal) (Table 7.1) - selected to bracket headwaters, mid-reaches, confluences, and a key reservoir within the study area (Figure 7.4).

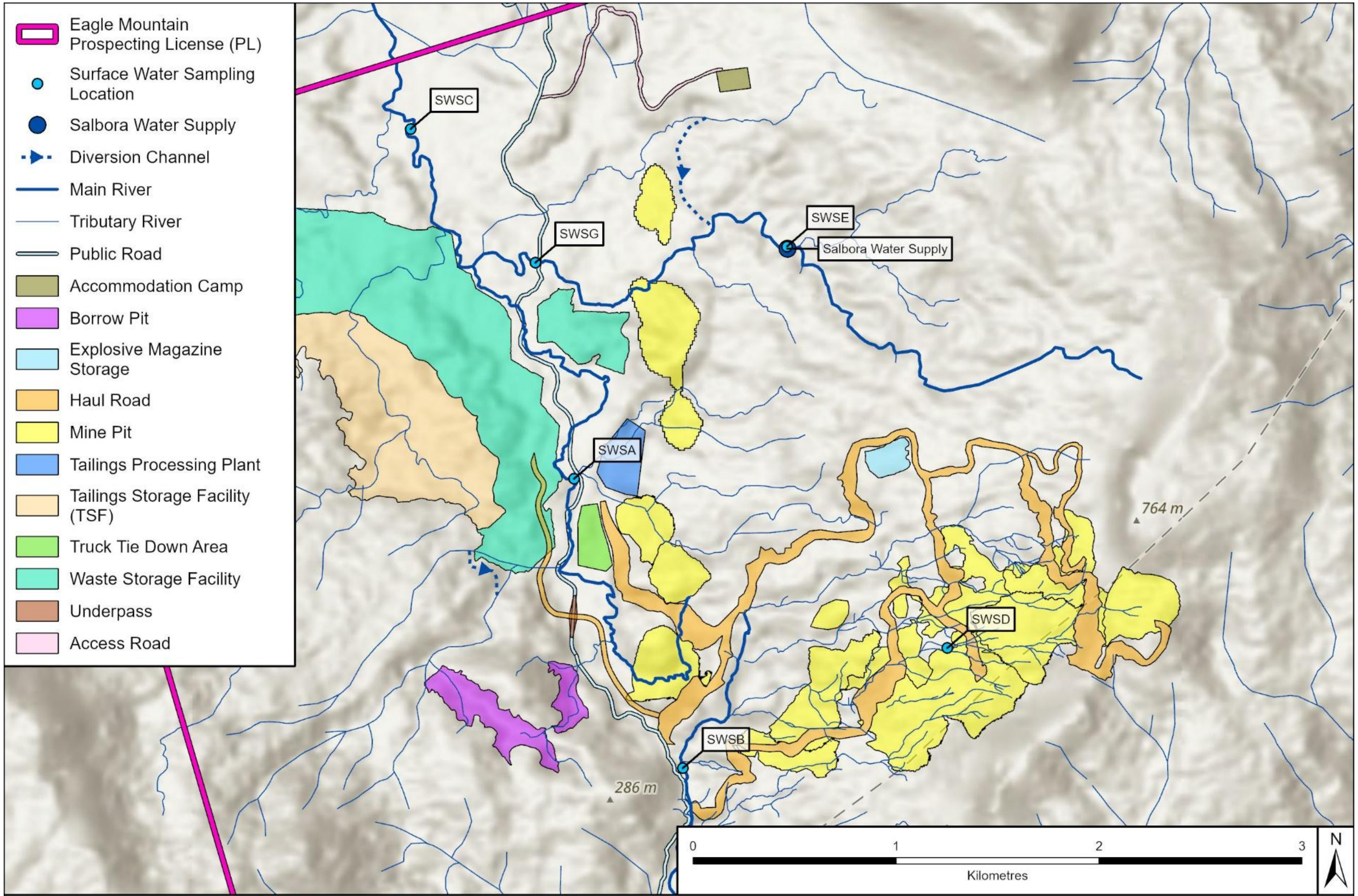
Sampling followed standard practice suitable for flowing rivers and impounded waters. At each station, bottles were filled mid-channel (or representative mid-reach for impoundments), capped underwater to minimise aeration, and labelled with station ID, date, and time.

Surface water sampling locations are summarised in Table 7.1 whereas their locations are shown in Figure 7.3.

TABLE 7.1 SURFACE WATER SAMPLING POINTS 2025

Location	Description of Location	UTM Coordinates	
		Easting	Northing
SWSA	South Salbora River	263670	577105
SWSB	Minnehaha River (Guard Hut)	264206	575680
SWSC	Mahdia River	262865	578828
SWSD	Deer Creek	265510	576272
SWSE	Salbora Water Supply	264720	578250
SWSG	North Salbora River (Bridge after Marshal)	263480	578170

FIGURE 7.3 SURFACE WATER SAMPLING LOCATIONS



Source: Esri, NASA, NGA, USGS, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

Path: \\vmukspgisfs01\Data\London\Projects\0763224 - Mako Mining EIA\Map\0763224 - Mako Mining EIA - V02C07 - HYD.aprx\0763224 - V02C07 - Hydrology - 07.01 - SW Sampling Locations

Laboratory Analyses

Surface water samples were collected in clean sample bottles and preserved according to laboratory directions. Sample bottles were provided by and submitted to IMEX Inc. located in Georgetown, Guyana and Kaizen Environmental Services Labs, an accredited laboratory located in Georgetown, Guyana. Onsite, sample bottles were initially stored in coolers with the ice packs or frozen water bottles changed twice daily. Samples were packed into separate coolers with ice packs and bubble wrap. Ice packs were frozen in the camp kitchen freezers throughout the program. Analysis parameters are provided in Table 7.2.

TABLE 7.2 WATER QUALITY ANALYSIS PARAMETERS

Physical Parameters	Major Ions and General Chemistry
pH	Residual Chlorine (Cl)
Electrical Conductivity	Sulphates (SO4)
Turbidity	Fluoride (F)
Total Suspended Solids	Total Alkalinity
Total Dissolved Solids	Bicarbonate Alkalinity
	Ammonia (NH3)
	Hardness
	Calcium (Ca)
	Magnesium (Mg)
	Potassium (K)
	Sodium (Na)
Metals and Trace Elements	
Aluminium (Al)	Molybdenum (Mo)
Antimony (Sb)	Nickel (Ni)
Arsenic (As)	Selenium (Se)
Cadmium (Cd)	Zinc (Zn)
Chromium (Cr)	Methyl Mercury (Hg)
Cobalt (Co)	
Copper (Cu)	
Iron (Fe)	
Lead (Pb)	
Manganese (Mn)	

Quality Assurance and Quality Control

Quality assurance and quality control (QAQC) samples were collected to verify that the sample collection and handling process has not compromised the quality of the surface water samples. All field quality control samples were prepared and collected in the same manner as regular investigation samples with respect to sample volume, containers, and preservation. Quality control samples included a field duplicate.

7.2 BASELINE CONDITIONS

7.2.1 HYDROLOGICAL SETTING

The Eagle Mountain Project is located within the Hinterland Forest region of central Guyana (Guyana Lands and Surveys Commission, n.d.), an area defined by a humid tropical climate and dense rainforest. Accordingly, the region experiences bi-modal wet seasons - from May to July and again from November to January - interspersed with distinct dry periods (GRE, 2025; Environmental Management Consultants (EMC), 2014).

The project area straddles a drainage divide between the Potaro and Konawaruk River basins, both of which ultimately form tributaries to the Essequibo River before it discharges into the Atlantic Ocean. Consequently, surface water drainage in the study area is dominated by two principal river systems: the Mahdia River, flowing northwards to the Potaro, and the Minnehaha River, which flows southwards to the Konawaruk. The Mahdia is fed by tributaries such as Kettledrum Creek and Elephant Creek, while the Minnehaha receives input from Deer Creek, Culvert Creek, Bacchus Creek, and Baboon Creek. These smaller streams are typically shallow and often ephemeral, reflecting strong seasonal variability in flow. Notably, several watercourses - including the Mahdia and Minnehaha Rivers - have been severely disturbed by historical and ongoing mining activities, resulting in localised contamination, increased sedimentation, and stream diversion (EMC, 2014). In contrast, streams at higher elevations tend to be less impacted and retain more natural characteristics (GRE, 2025). Overall, the regional hydrology is shaped by high rainfall, rugged topography, and a legacy of anthropogenic disturbance, with the Mahdia and Minnehaha rivers acting as key conduits linking the project area to the wider Essequibo basin.

7.2.2 STREAM DISCHARGE MEASUREMENTS

Between June 2024 and May 2025, 33 semi-monthly streamflow measurements were recorded at key sites across the project area, including the South Salbora River (Location A), Minnehaha River (Location B), and Mahdia River (Location C), with additional monitoring points established at Deer Creek (Location D), Mahdia Water Supply (Location E), Baboon Creek (Location H), and the North Salbora River (Location G). However, as of the latest reporting, comprehensive data and spatial coordinates were only available for Locations A, B, and C. Available stream discharge results and their coordinates are provided in Table 7.3.

TABLE 7.3 STREAM DISCHARGE RESULTS SUMMARY

Name	Location ID	Easting	Northing	No. of Readings	Discharge			
					Geometric Mean (m^3/s)	Average (m^3/s)	Maximum (m^3/s)	Minimum (m^3/s)
S Salbora River	A	263685.00	577127.00	15	0.072	0.169	0.511	0.027
Minnehaha River	B	264077.00	574956.00	13	0.353	0.445	1.223*	0.035
Mahdia River	C	262883.00	578711.00	4	0.295	0.295	0.313	0.278
Mahdia Water Supply	E	264720	578250	1	0.355	0.355	0.355	0.355

The results indicate that the South Salbora River exhibited a geometric mean discharge of 0.072 m^3/s (average 0.169 m^3/s), with values ranging from a minimum of 0.027 m^3/s to a maximum of 0.511 m^3/s over 15 readings. The Minnehaha River, monitored at 13 intervals, showed a higher geometric mean discharge of 0.353 m^3/s (average 0.445 m^3/s), with a maximum recorded value of 1.223 m^3/s - this peak corresponds to measurements recorded for the development of a storm hydrograph for the Minnehaha River and is considered an outlier relative to typical flow conditions. The Mahdia River, with four readings, demonstrated relatively stable flows (geometric mean and average both 0.295 m^3/s), with minimal variability between minimum and maximum values.

It is important to note that, due to the timing of the monitoring campaign, the majority of the flow rate data collected to date represents wet season conditions, in June, September and November 2024, as well as March 2025. Based on GRE's flow-rate measurement graphs, three measurements were collected during the dry season (March 2025), while the remaining measurements were collected during the wet season (June, September, and November 2024). As a result, the observed discharge values may not fully capture the range of seasonal variability expected in this humid tropical environment, where bi-modal wet seasons can drive significant fluctuations in streamflow. Furthermore, the absence of complete data for several monitoring locations, as well as the lack of mapped coordinates for some sites, introduces uncertainty regarding the spatial representativeness of the dataset. Additional data collection and continued monitoring would provide further confirmation across a broader range of hydrological conditions.

Despite these limitations, the available data suggest that streamflow in the main rivers is relatively consistent, with the South Salbora River displaying less variability than might be expected for a rainforest catchment. This may reflect the influence of catchment characteristics, antecedent conditions, or the limited temporal coverage of the current dataset.

7.2.3 TOTAL SUSPENDED SOLIDS MONITORING

The primary objective of the total suspended solids monitoring programme was to quantify changes in soil erosion and sediment load over time, both under baseline conditions and in response to storm events. TSS samples were collected periodically at the same key monitoring sites used for stream discharge—namely, the South Salbora River (Location A), Minnehaha River (Location B), and Mahdia River (Location C); with Deer Creek (Location D) also included in the monitoring network.

Similar to stream discharge, additional monitoring points were established at Mahdia Water Supply (Location E), Baboon Creek (Location H), and an unnamed location (Location G); however, these sites are excluded from the present summary due to insufficient data collected during sampling. As such, Table 7.4 below provides an overview of TSS concentrations observed between June 2024 and May 2025 at Locations A, B, C, and D.

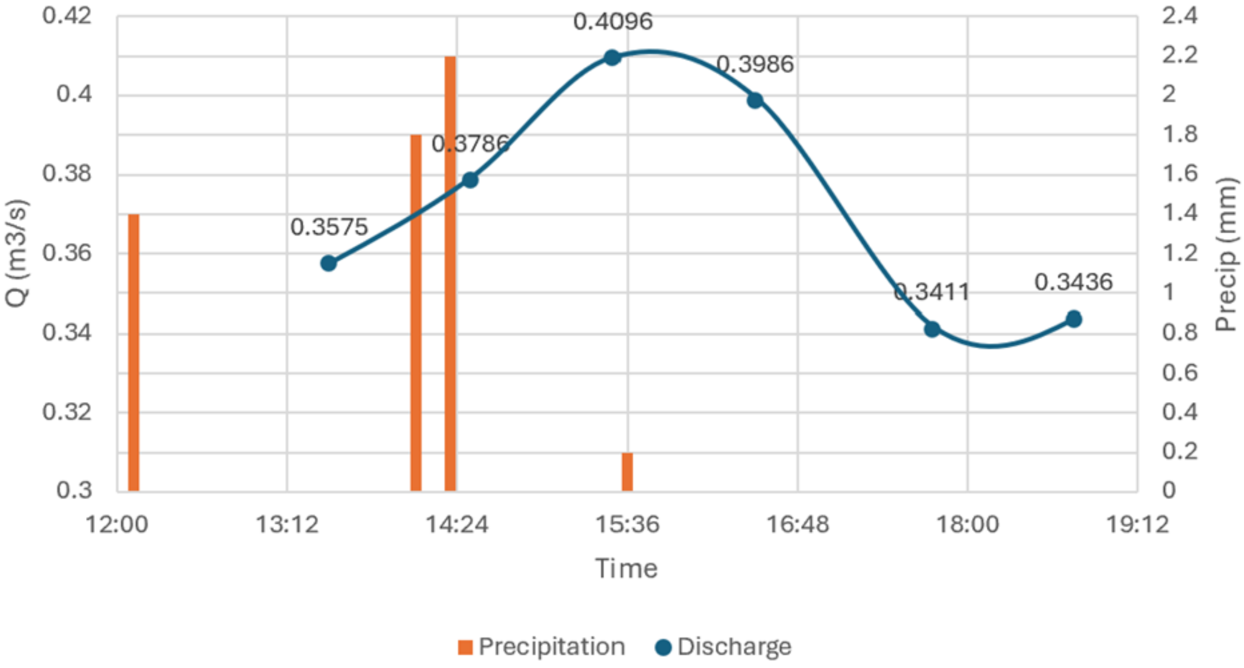
TABLE 7.4 SUMMARY OF TOTAL SUSPENDED SOLIDS (TSS) MEASUREMENTS AT KEY MONITORING LOCATIONS (JUNE 2024 – MAY 2025)

Name	**Location ID**	**Easting**	**Northing**	**No. of Readings**	**Discharge**			
					Geometric Mean	Average	Maximum	Minimum
S Salbora River	A	263685.00	577127.00	8	15.04	24.82	56.10	3.33
Minnehaha River	B	264077.00	574956.00	11	36.69	111.92	830.20	3.80
Mahdia River	C	262883.00	578711.00	5	27.47	33.18	61.30	13.30
Deer Creek	D	265510,00	576272.00	8	4.24	13.75	84.7	1.00

The results reveal pronounced variability in TSS concentrations across the monitored sites. The Minnehaha River (Location B) exhibited the largest dispersion, with a geometric mean TSS of 36.69 mg/L and a maximum value of 830.2 mg/L, the latter recorded during a significant rainfall event in June 2024. The South Salbora River (Location A), Mahdia River (Location C), and Deer Creek (Location D) showed geometric means of 15.04 mg/L, 27.47 mg/L, and 4.24 mg/L, respectively, with maximum values reaching 56.10 mg/L, 61.30 mg/L, and 84.7 mg/L. These results highlight the episodic nature of sediment mobilisation, with the majority of sediment transport occurring during high-flow or storm events.

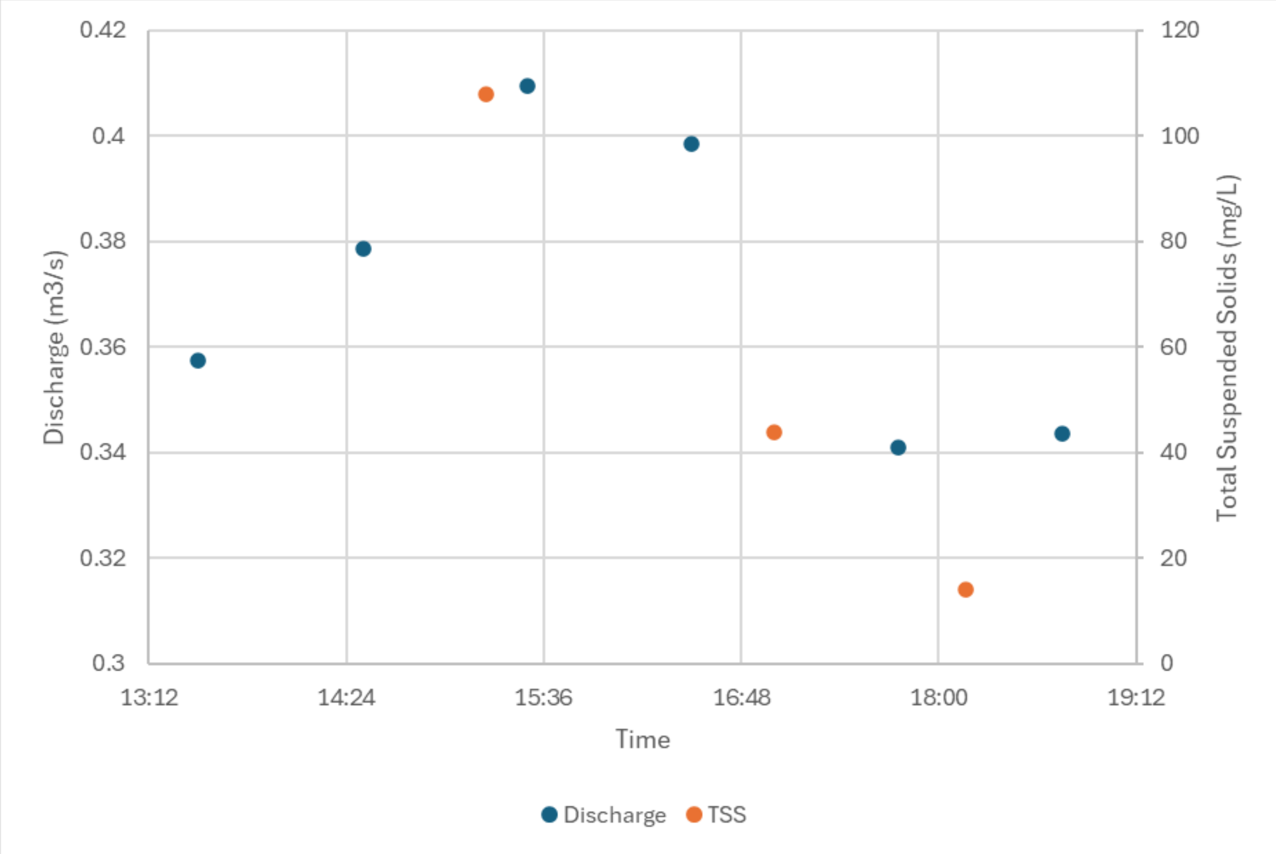
The event-driven nature of sediment transport is particularly evident in the Minnehaha River. During a storm event on 18 June 2024, intensive sampling captured the rapid hydrological response to rainfall, as illustrated in Figure 7.4. The storm hydrograph shows a clear increase in discharge (Q) following precipitation pulses, with peak flows occurring shortly after rainfall events. This temporal alignment between rainfall and streamflow highlights the catchment's sensitivity to intense precipitation.

FIGURE 7.4 STORM HYDROGRAPH FOR THE MINNEHAHA RIVER



Further analysis of the same event demonstrates a strong positive correlation between stream discharge and TSS concentrations. As shown in Figure 7.5, TSS values rise sharply in tandem with increasing discharge, peaking during the highest flows and subsequently declining as the hydrograph recedes. This relationship confirms that the largest sediment loads are mobilised during storm-driven high-flow periods, rather than under baseline conditions.

FIGURE 7.5 TSS VS DISCHARGE FOR THE MINNEHAHA RIVER



Overall, therefore; the pronounced variance between geometric mean and maximum TSS values across all sites emphasises the importance of episodic, high-intensity events in shaping sediment dynamics within the study area. While baseline concentrations remain moderate, extreme values recorded during storm events highlight the potential for significant, short-term erosion and downstream sediment delivery.

7.2.4 ARTISANAL MINING MERCURY CONTAMINATION

The Eagle Mountain Project is located in an historically active location for small-scale artisanal mining and the associated use of mercury amalgamation techniques for gold recovery (see Vol 2: Chapter 5). To determine the baseline mercury contamination in the Project area, GRE conducted a mercury field testing programme in 2025, collecting soil, sediment, and surface water samples.

A total of 30 sediment samples collected from rivers, streams, and ponds showed total mercury concentrations ranging from 0.0352 mg/kg to 4.22 mg/kg, with higher mercury in pond sediments and variable levels in streams. No consistent trend with depth was observed. Methyl mercury ranged up to 2.08 µg/kg and visible mercury droplets were found in some stream sediment samples.

A total of 12 water samples were collected at the locations of the sediment samples and analysed for total mercury with three samples also tested for methyl mercury. Results for all samples showed total mercury content below the quantification limit of 0.5 µg/L, and methyl mercury ranged from 0.000081 µg/L to 0.00054 µg/L, with the highest concentration found in pond water. No correlation was found between sediment and water mercury concentration. All water samples were below USEPA freshwater criteria for mercury and methyl mercury, indicating low aquatic risk.

Mercury contamination in sediments was higher in stagnant waters affected by mining but did not correlate with mercury levels in water. Water mercury concentrations were low and below regulatory criteria, indicating limited mobilisation of mercury from soils and sediments into water bodies.

Despite historic widespread mercury use, the program did not find evidence of water contamination or aquatic toxicity risk from artisanal mercury soil contamination within the Eagle Mountain concession.

7.2.5 CONCEPTUAL HYDROLOGICAL SYSTEM

The conceptual surface water flow model was developed to describe hydrological conditions at Eagle Mountain and to qualitatively represent catchment-scale water dynamics across three phases: pre-mining (baseline), operational (during mining), and post-mining.

7.2.5.1 PRE-MINING

Prior to mining, high rainfall and sustained shallow groundwater discharge produce predominantly gaining streams from headwaters to main streams, with large flows and occasional floodplain inundation at lower elevations and seasonal wetlands where backwater limits drainage. The drainage network within and surrounding the project area is largely perennial, with short ephemeral reaches at higher gradients where rocky beds reflect energetic flow. Vegetation generally suppresses erosion, though exposed saprolite is readily mobilised under intense storms.

7.2.5.2 DURING MINING

During operations, surface water is segregated and routed around facilities: pit dewatering becomes a managed source, and controlled releases from TSFs and WSFs (runoff/seepage) are handled within Guyanese regulatory discharge standards under a site-wide water balance.

7.2.5.3 POST-MINING

Post-closure, pits transition to pit lakes that act as stable storages and moderated outlets to downstream channels, likely increasing dry-season baseflow relative to pre-mining conditions.

7.2.6 SURFACE WATER QUALITY

Surface water quality was characterised at six georeferenced stations—SWSA (South Salbora), SWSB (Minnehaha, guard hut), SWSC (Mahdia), SWSD (Deer Creek), SWSE (Mahdia water supply- reservoir), and SWSG (North Salbora). Sampling was undertaken in January and March 2025, and again in July and September 2025, capturing the region’s bimodal hydrological regime (wet seasons in May–July and November–January) and the intervening drier months. To evaluate potential mining related effects and characterise baseline conditions, results from each campaign (Table 7.6 to

Table 7.9) are interpreted against the International Finance Corporation (IFC) mining effluent guidelines (IFC, 2007) (Table 7.5). Using the IFC thresholds provides a benchmark for the current water quality in the study area, and a practical reference point for future performance.

TABLE 7.5 GUIDELINES FOR MINE EFFLUENT MONITORING (IFC, 2007)

Parameter	Unit	IFC Guideline Limit
Total Suspended Solids	mg/L	50
pH	S.U.	6.0 – 9.0
COD	mg/L	150
BOD	mg/L	50
Oil and Grease	mg/L	10
Total Iron (Fe)	mg/L	2.0
Arsenic (As)	mg/L	0.10
Cadmium (Cd)	mg/L	0.05
Lead (Pb)	mg/L	0.02
Mercury (Hg)	mg/L	0.002
Copper (Cu)	mg/L	0.3
Cyanide (CN)	mg/L	1
Cyanide Free	mg/L	0.1
Cyanide WAD	mg/L	0.5
Chromium (VI)	mg/L	0.1
Zinc (Zn)	mg/L	0.5
Nickel	mg/L	0.5
Antimony (Sb)	mg/L	0.02 mg/L
Temperature	ºC	<3 degree differential
Phenols	mg/L	0.5
Note: Metals concentrations represent total metals		

TABLE 7.6 JANUARY 2025 SURFACE WATER QUALITY RESULTS SUMMARY

Parameter	Units	SWS A 25001	SWS B 25001	SWS C 25001	SWS D 25001	SWS E 25001	SWS G 25001	IFC Guideline Limit
Aluminium (Dissolved)	mg/L	< 0.368	< 0.368	< 0.368	< 0.368	< 0.368	< 0.368	No specific limit
Aluminium (Total)	mg/L	< 0.368	< 0.368	< 0.368	< 0.368	< 0.368	< 0.368	No specific limit
Arsenic (Dissolved)	µg/L	< 2.001	< 2.001	< 2.001	< 2.001	< 2.001	< 2.001	0.1
Arsenic (Total)	µg/L	< 2.001	< 2.001	< 2.001	< 2.001	< 2.001	< 2.001	0.1
Cadmium (Dissolved)	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	0.05
Cadmium (Total)	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	0.05
Chromium (Dissolved)	mg/L	< 0.07	< 0.07	< 0.07	< 0.07	< 0.07	< 0.07	0.1
Chromium (Total)	mg/L	< 0.07	< 0.07	< 0.07	< 0.07	< 0.07	< 0.07	0.1
Copper (Dissolved)	mg/L	< 0.021	< 0.021	< 0.021	< 0.021	< 0.021	< 0.021	0.3
Copper (Total)	mg/L	< 0.021	0.036	0.048	< 0.021	< 0.021	< 0.021	0.3
Iron (Dissolved)	mg/L	0.762	0.522	1.278	0.108	< 0.084	0.796	2.0
Iron (Total)	mg/L	12.297	0.794	3.012	0.154	0.461	3.149	2.0
Lead (Dissolved)	mg/L	< 0.015	< 0.015	< 0.015	< 0.015	< 0.015	< 0.015	0.02
Lead (Total)	mg/L	< 0.015	< 0.015	< 0.015	< 0.015	< 0.015	< 0.015	0.02
Mercury (Dissolved)	µg/L	< 1.094	< 1.094	< 1.094	< 1.094	< 1.094	< 1.094	0.002

Parameter	Units	SWS A 25001	SWS B 25001	SWS C 25001	SWS D 25001	SWS E 25001	SWS G 25001	IFC Guideline Limit
Mercury (Total)	µg/L	< 1.094	< 1.094	< 1.094	< 1.094	< 1.094	< 1.094	0.002
Nickel (Dissolved)	mg/L	< 0.061	< 0.061	< 0.061	< 0.061	< 0.061	< 0.061	0.5
Nickel (Total)	mg/L	< 0.061	< 0.061	< 0.061	< 0.061	< 0.061	< 0.061	0.5
Silver (Dissolved)	mg/L	< 0.038	< 0.038	< 0.038	< 0.038	< 0.038	< 0.038	No specific limit
Silver (Total)	mg/L	< 0.038	< 0.038	< 0.038	0.050	0.126	0.118	No specific limit
Zinc (Dissolved)	mg/L	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	0.5
Zinc (Total)	mg/L	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	0.5
Antimony	mg/L	0.00077	0.00110	0.00100	0.00120	0.00094	0.00078	No specific limit
Antimony (Dissolved)	mg/L	0.00140	0.00140	0.00083	0.00140	0.00150	0.00160	No specific limit
Selenium	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	No specific limit
Selenium (Dissolved)	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	No specific limit

Key Notes
Units: Most metals in mg/L; Arsenic and Mercury in µg/L.
Highlighted results indicate exceedances to the IFC guideline limit.

TABLE 7.7 MARCH 2025 SURFACE WATER QUALITY RESULTS

Parameter	Units	SWSA25-002	SWSB25-002	SWSC25-002	SWSD25-002	SWSE25-002	SWSG25-002	IFC Guideline Limit
pH	S.U.	8.67	8.24	7.79	7.36	6.94	6.78	6-9
Residual Chlorine	mg/L	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	No specific limit
Sulphates	mg/L	0.65	<0.50	0.64	0.8	0.62	0.92	No specific limit
Conductivity	µS/cm	438	416	419	395	390	403	No specific limit
Fluoride	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	No specific limit
Turbidity	FTU	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	No specific limit
Total Suspended Solids	mg/L	7	99	5	<2	3	<2	50
Total Dissolved Solids	mg/L	56	<25	<25	<25	32	<25	No specific limit
Total Alkalinity	mg/L	8.8	5.2	7	4.8	7.7	10.5	No specific limit
Bicarbonate Alkalinity	mg/L	10.7	6.4	8.6	5.9	9.4	12.8	No specific limit
Ammonia	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	No specific limit
Hardness	mg/L	18.7	6.7	20.8	4.3	12.2	25.5	No specific limit
Dissolved Calcium (Ca)	mg/L	4.6	1.6	5.8	0.9	2.5	6.4	No specific limit
Dissolved Magnesium (Mg)	mg/L	1.8	0.7	1.5	0.5	1.4	2.3	No specific limit
Dissolved Potassium (K)	mg/L	<0.5	0.5	<0.5	<0.5	<0.5	0.5	No specific limit
Dissolved Sodium (Na)	mg/L	2.9	2.3	3.3	2.3	2.3	2.5	No specific limit
Methyl Mercury (Hg)	µg/L	0.000434	0.000461	0.000183	0.000074	0.000081	0.000134	No specific limit
Total Aluminium (Al)	mg/L	0.354	2.15	0.326	0.212	0.227	0.156	No specific limit

Parameter	Units	SWSA25-002	SWSB25-002	SWSC25-002	SWSD25-002	SWSE25-002	SWSG25-002	IFC Guideline Limit
Total Antimony (Sb)	mg/L	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	No specific limit
Total Arsenic (As)	mg/L	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	0.1
Total Cadmium (Cd)	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.05
Total Chromium (Cr)	mg/L	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	No specific limit
Total Cobalt (Co)	mg/L	<0.0020	0.0021	<0.0020	<0.0020	<0.0020	<0.0020	No specific limit
Total Copper (Cu)	mg/L	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	0.3
Total Iron (Fe)	mg/L	1.7	4.2	1.4	<0.20	<0.20	0.81	2.0
Total Lead (Pb)	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.2
Total Manganese (Mn)	mg/L	0.197	0.087	0.1	<0.050	<0.050	0.112	No specific limit
Total Molybdenum (Mo)	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	No specific limit
Total Nickel (Ni)	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.5
Total Selenium (Se)	mg/L	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	No specific limit
Total Zinc (Zn)	mg/L	<0.070	<0.070	<0.070	<0.070	<0.070	<0.070	0.5
Oil and Grease	mg/L	<3	<3	<3	<3	<3	<3	10
Nitrates	mg/L	0.149	0.247	0.137	0.380	0.296	0.224	No specific limit
Nitrite	mg/L	<0.005	0.005	<0.005	<0.005	<0.005	<0.005	No specific limit
Total Kjeldahl Nitrogen	mg/L	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	No specific limit
Ammonia	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	No specific limit
Phenols in water	mg/L	0.002	<0.002	<0.002	0.002	<0.002	0.002	No specific limit
E. coli	MPN/100mL	NA	NA	NA	NA	8	NA	No specific limit

Parameter	Units	SWSA25-002	SWSB25-002	SWSC25-002	SWSD25-002	SWSE25-002	SWSG25-002	IFC Guideline Limit
Total Coliforms	CFU/100ml	NA	NA	NA	NA	894	NA	No specific limit

(ND = Not Detected; NA =Not Analysed)

Note: Highlighted results indicate exceedances to the IFC guideline limit.

TABLE 7.8 JULY 2025 SURFACE WATER QUALITY RESULTS

Parameter	Units	SWSA25-003	SWSB25-003	SWSC25-003	SWSD25-003	SWSE25-003	SWSG25-003	IFC Guideline Limit
pH	S.U.	8.51	8.25	7.8	7.71	6.31	7.28	6-9
Residual Chlorine	mg/L	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	No specific limit
Sulphates	mg/L	1	1	2	1	1	2	No specific limit
Conductivity	µS/cm	117	157	158	151	190	161	No specific limit
Fluoride	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	No specific limit
Turbidity	FTU	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	No specific limit
Total Suspended Solids	mg/L	2.8	20.8	7.68	25.6	0.83	3.76	50
Total Dissolved Solids	mg/L	14	6	22	36	10	38	No specific limit
Total Alkalinity	mg/L	12	8	10	6	11	14	No specific limit
Bicarbonate Alkalinity	mg/L	12	8	10	6	11	14	No specific limit
Ammonia	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	No specific limit
Hardness	mg/L	12	6.1	9.9	4.3	9.5	13.7	No specific limit
Dissolved Calcium (Ca)	mg/L	2	1.3	1.8	0.9	1.9	2.5	No specific limit
Dissolved Magnesium (Mg)	mg/L	1.5	0.6	1.2	0.5	1.2	1.6	No specific limit
Dissolved Potassium (K)	mg/L	<0.5	<0.5	<0.5	0.5	<0.5	<0.5	No specific limit
Dissolved Sodium (Na)	mg/L	1.9	2.3	1.8	2.6	1.8	2	No specific limit
Total Sodium (Na)	mg/L	1.6	2.15	1.58	2.28	1.75	1.8	No specific limit
Total Calcium (Ca)	mg/L	<2.50	<2.50	<2.50	<2.50	1.81	<2.50	No specific limit
Total Magnesium (Mg)	mg/L	<2.50	<2.50	<2.50	<2.50	1.1	<2.50	No specific limit

Parameter	Units	SWSA25-003	SWSB25-003	SWSC25-003	SWSD25-003	SWSE25-003	SWSG25-003	IFC Guideline Limit
Total Potassium (K)	mg/L	<2.50	<2.50	<2.50	<2.50	<0.50	<2.50	No specific limit
Methyl Mercury (Hg)	µg/L	0.000862	0.000276	0.000339	0.000131	0.000054	0.000295	No specific limit
Total Aluminium (Al)	mg/L	0.101	0.62	0.277	0.388	0.258	0.165	No specific limit
Total Antimony (Sb)	mg/L	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	No specific limit
Total Arsenic (As)	mg/L	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	0.1
Total Cadmium (Cd)	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	0.00111	<0.00040	0.05
Total Chromium (Cr)	mg/L	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	No specific limit
Total Cobalt (Co)	mg/L	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0021	No specific limit
Total Copper (Cu)	mg/L	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	0.3
Total Iron (Fe)	mg/L	1.6	1.7	1.8	0.65	0.33	1.5	2.0
Total Lead (Pb)	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.2
Total Manganese (Mn)	mg/L	0.227	0.062	0.134	<0.050	<0.050	0.251	No specific limit
Total Molybdenum (Mo)	mg/L	0.0074	<0.0050	<0.0050	<0.0050	0.0194	<0.0050	No specific limit
Total Nickel (Ni)	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.5
Total Selenium (Se)	mg/L	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	No specific limit
Total Zinc (Zn)	mg/L	<0.070	<0.070	<0.070	<0.070	<0.070	<0.070	0.5
Oil and Grease	mg/L	0.1	0.9	0.7	Not Detected	0.9	1.3	10
Nitrates	mg/L	1.4	2.5	0.9	1.5	0.7	0.8	No specific limit
Nitrite	mg/L	0.005	0.015	0.009	0.003	0.003	0.004	No specific limit
Total Kjeldahl Nitrogen	mg/L	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	No specific limit

Parameter	Units	SWSA25-003	SWSB25-003	SWSC25-003	SWSD25-003	SWSE25-003	SWSG25-003	IFC Guideline Limit
Phenols in water	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	No specific limit
Phosphate	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	No specific limit
E. coli	MPN/100mL	NA	NA	NA	NA	TNTC	NA	No specific limit
Total Coliforms	CFU/100ml	NA	NA	NA	NA	TNTC	NA	No specific limit

(ND = Not Detected; NA =Not Analysed)

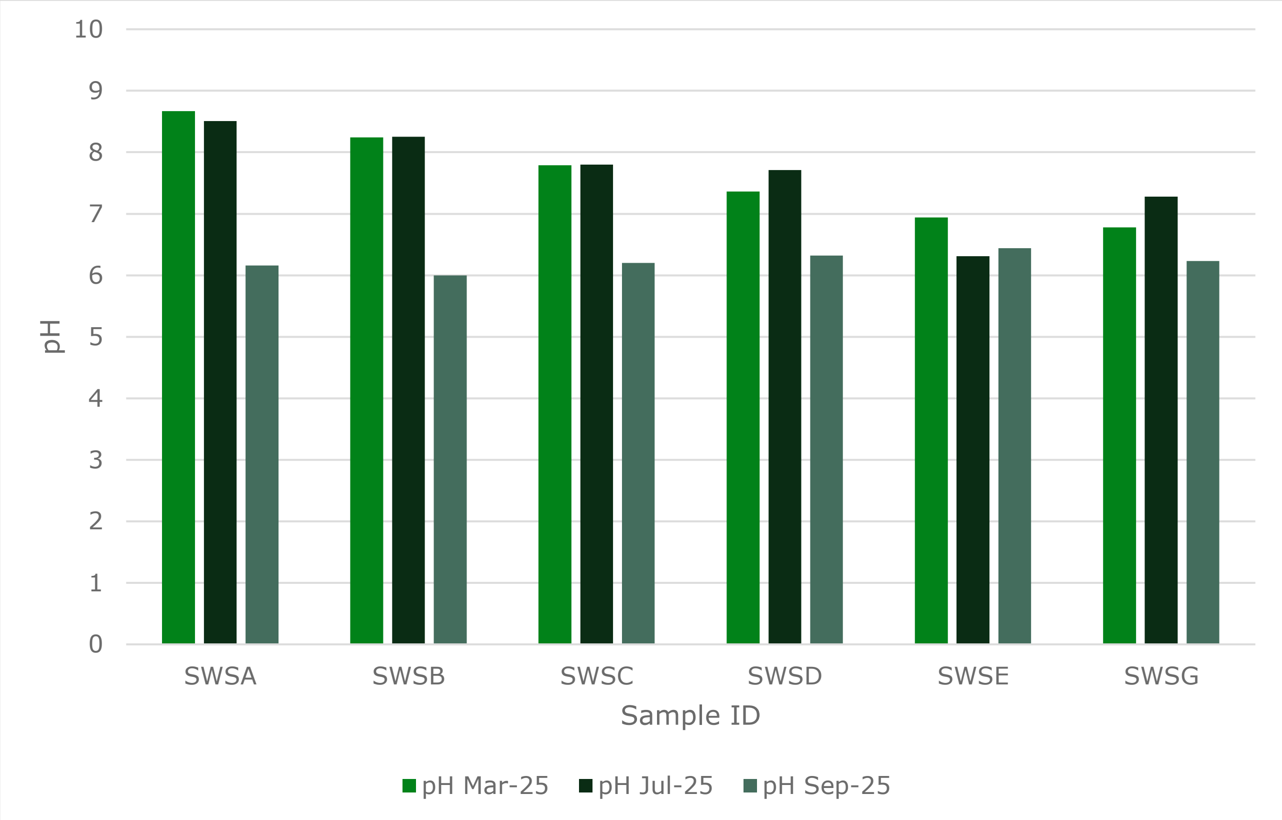
TABLE 7.9 SEPTEMBER 2025 SURFACE WATER QUALITY SAMPLING RESULTS

Parameter	Units	SWSA25-004	SWSB25-004	SWSC25-004	SWSD25-004	SWSE25-004	SWSG25-004	IFC Guideline Limit
pH	S.U.	6.16	6.00	6.2	6.32	6.44	6.23	6-9
Residual Chlorine	mg/L	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	No specific limit
Sulphates	mg/L	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	No specific limit
Conductivity	µS/cm	97.4	94	310	124	272	240	No specific limit
Fluoride	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	No specific limit
Turbidity	FTU	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	No specific limit
Total Suspended Solids	mg/L	3.4	5.72	4.62	1.54	1.64	3.7	50
Total Dissolved Solids	mg/L	52	58	50	66	28	4	No specific limit
Total Alkalinity	mg/L	16	6	20	20	10	16	No specific limit
Bicarbonate Alkalinity	mg/L	16	6	20	20	10	16	No specific limit
Ammonia	mg/L	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	No specific limit
Hardness	mg/L	13.6	6	11.1	4.3	11.4	14.7	No specific limit
Dissolved Calcium (Ca)	mg/L	2.6	1.5	2.4	1	2.4	3.1	No specific limit
Dissolved Magnesium (Mg)	mg/L	1.5	0.6	1.3	<0.5	1.3	1.6	No specific limit
Dissolved Potassium (K)	mg/L	<0.5	0.6	<0.5	0.7	<0.5	<0.5	No specific limit
Dissolved Sodium (Na)	mg/L	2.1	2.6	2	2.7	2.3	2.1	No specific limit
Total Calcium (Ca)	mg/L	2.62	<2.50	2.5	<2.50	<2.50	3.28	No specific limit
Total Magnesium (Mg)	mg/L	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	No specific limit
Total Potassium (K)	mg/L	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	No specific limit

Parameter	Units	SWSA25-004	SWSB25-004	SWSC25-004	SWSD25-004	SWSE25-004	SWSG25-004	IFC Guideline Limit
Total Sodium (Na)	mg/L	2.06	2.59	2.07	2.72	2.31	2.17	No specific limit
Methyl Mercury (Hg)	µg/L	0.00062	0.000234	0.000291	0.000069	0.000126	0.000274	No specific limit
Total Aluminium (Al)	mg/L	<0.050	0.199	0.139	0.084	0.056	0.072	No specific limit
Total Antimony (Sb)	mg/L	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	No specific limit
Total Arsenic (As)	mg/L	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	0.1
Total Cadmium (Cd)	mg/L	0.0008	0.00045	<0.00040	<0.00040	<0.00040	<0.00040	0.05
Total Chromium (Cr)	mg/L	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	No specific limit
Total Cobalt (Co)	mg/L	0.0021	<0.0020	<0.0020	<0.0020	<0.0020	0.002	No specific limit
Total Copper (Cu)	mg/L	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	0.3
Total Iron (Fe)	mg/L	1.3	0.88	1.7	<0.20	<0.20	1.5	2.0
Total Lead (Pb)	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.2
Total Manganese (Mn)	mg/L	0.266	0.071	0.159	<0.050	<0.050	0.246	No specific limit
Total Molybdenum (Mo)	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	No specific limit
Total Nickel (Ni)	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.5
Total Selenium (Se)	mg/L	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	No specific limit
Total Zinc (Zn)	mg/L	<0.070	<0.070	<0.070	<0.070	<0.070	<0.070	0.5
Oil and Grease	mg/L	9.6	6.2	1.4	2.7	0.5	1.33	10
Nitrates	mg/L	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	No specific limit
Nitrite	mg/L	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	No specific limit
Total Kjeldahl Nitrogen	mg/L	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	No specific limit

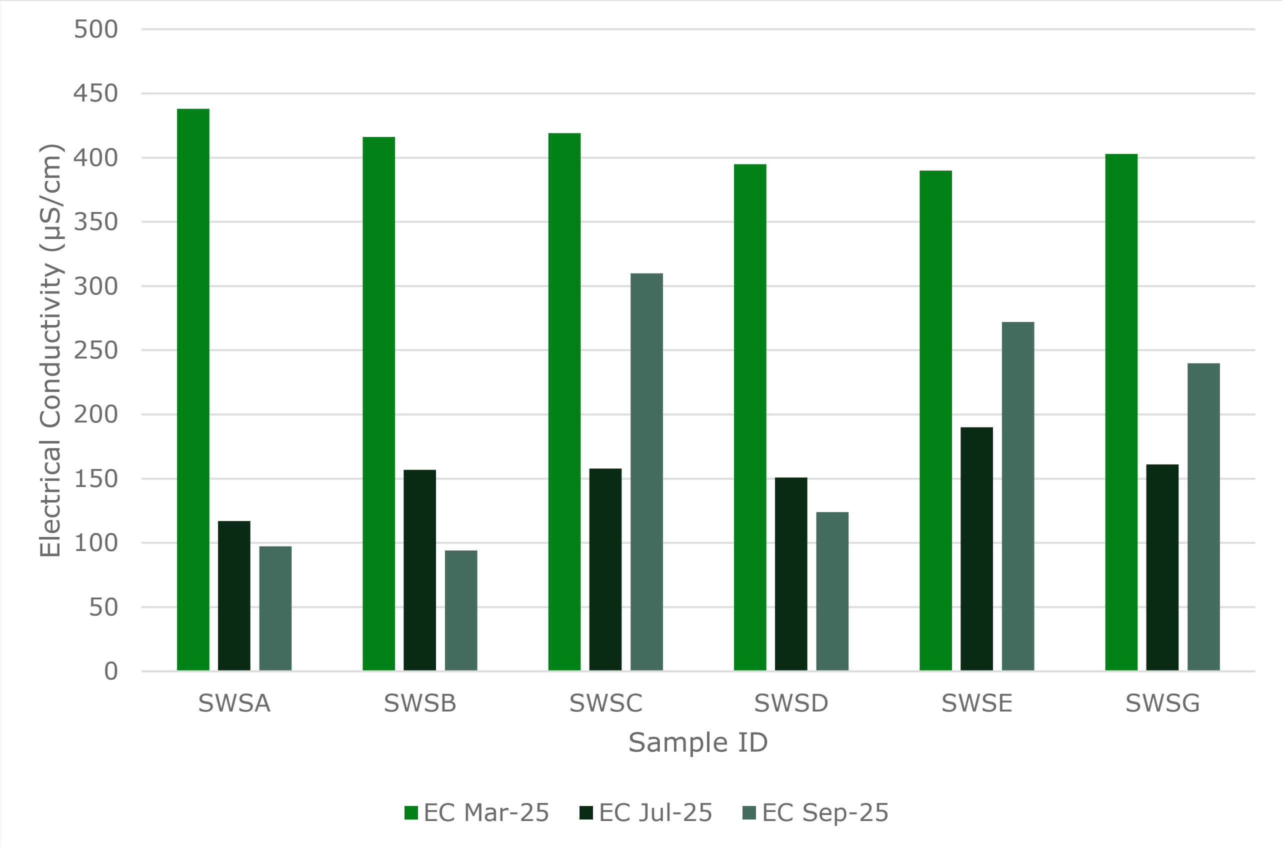
Parameter	Units	SWSA25-004	SWSB25-004	SWSC25-004	SWSD25-004	SWSE25-004	SWSG25-004	IFC Guideline Limit
Phenols in water	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	No specific limit
Phosphate	mg/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	No specific limit
E. coli	MPN/100mL	NA	NA	NA	NA	TNTC	NA	No specific limit
Total Coliforms	CFU/100ml	NA	NA	NA	NA	TNTC	NA	No specific limit

FIGURE 7.6 PH RESULTS FOR THE SURFACE WATER SAMPLING POINTS (MARCH - SEPTEMBER 2025)



Across the network, pH remained within the IFC range for all campaigns (Figure 7.6). In March, waters were mildly alkaline at SWSA–SWSC (8.67–7.79) and closer to neutral at SWSD–SWSG (7.36–6.78). In July, during the first wet season, pH moderated toward neutral (8.51–6.31), with SWSE at the lower end (6.31). By September, which falls in the drier shoulder preceding the second wet season, pH converged near neutral across sites (6.00–6.44); SWSB sat at the lower guideline bound (6.00). The temporal evolution - from slightly alkaline conditions in the dry months to near-neutral conditions during and following wet-season flows - may be indicative of increased runoff and organic acidity effects during higher discharge.

FIGURE 7.7 ELECTRICAL CONDUCTIVITY RESULTS FOR SURFACE WATER SAMPLES (MARCH - SEPTEMBER 2025)



Monitoring of Electrical Conductivity (EC) provides an indication of the dissolved ionic content of surface waters, helping to distinguish natural geochemical conditions from potential influences of upstream mining activities and supporting interpretation of metals, TSS, and broader water-quality patterns. Results of EC indicated that the highest values were exhibited in March (~390–438 µS/cm at SWSA–SWSG) (Figure 7.7). In July, EC decreased markedly (~117–190 µS/cm), potentially indicating wet-season influence across the catchments. In September, EC remained low to moderate at most sites (94–240 µS/cm) but was elevated at SWSC (310 µS/cm) and SWSE (272 µS/cm) relative to neighbouring stations.

Total Suspended Solids (TSS) were generally low, but a single IFC exceedance occurred in March at SWSB (99 mg/L), while co-sampled stations during that event were well below the guideline (typically < 2–7 mg/L). This intra-event contrast, coupled with SWSB's road-adjacent setting on the Minnehaha, may be attributed to localised sediment mobilisation such as bank erosion or road-derived fines. In July, during the wet season, TSS remained moderate (0.83–25.6 mg/L, highest at SWSD, a tributary upstream of SWSB), and by September, values were uniformly low (≈1.5–5.7 mg/L). Oil & Grease (O&G) was compliant throughout but approached the 10 mg/L limit at SWSA in September (9.6 mg/L) and was relatively elevated at SWSB (6.2 mg/L) compared with other stations.

Total iron (Fe) is the only metal that exceeded IFC limits. During January (within the November–January wet season), total Fe exceeded 2.0 mg/L at SWSA (12.297 mg/L), SWSC (3.012 mg/L), SWSF (2.680 mg/L), and SWSG (3.149 mg/L), while SWSB, SWSD, and SWSE remained compliant. Corresponding dissolved Fe was much lower (for example, SWSA 0.762 mg/L; SWSG 0.796 mg/L) along the Mahdia system and its tributaries. In March, a further exceedance occurred at SWSB (4.2 mg/L), with most other stations compliant or near-threshold (e.g., SWSA 1.7 mg/L). By July and September, all stations were compliant (≤ 1.8 mg/L), though SWSA and SWSC occasionally approached the upper end of the observed range (1.6–1.8 mg/L). Other IFC-listed metals were consistently compliant across campaigns. Lead remained well below 0.02 mg/L (typically < 0.003 mg/L). Mercury totals were < 1.094 µg/L (< 0.001094 mg/L), below the 0.002 mg/L limit. Arsenic was < 0.00080 mg/L from March onward (and < 2.001 µg/L in January), cadmium was non-detect except a low July detection at SWSE (0.00111 mg/L), below the 0.05 mg/L limit, and copper, chromium (VI), nickel, zinc, and antimony were non-detect or very low relative to their respective guidelines.

Major ions, nutrients, and general chemistry: Alkalinity and hardness were low to moderate, peaking in March (alkalinity ≈4.8–10.5 mg/L; hardness ≈4.3–25.5 mg/L) and contracting in July and September under wet-season and shoulder-season dilution (hardness typically 4.3–14.7 mg/L; bicarbonate usually ≤ 16 mg/L). Dissolved cations (Na, Ca, Mg, K) were uniformly low, with SWSC on the main Mahdia and SWSE (the reservoir) tending toward the upper end of the range. Nitrogen species were low throughout in March nitrate ranged 0.137–0.380 mg/L across sites; in July values rose at some stations (0.7–2.5 mg/L, highest at SWSB). Phenols were very low (< 0.002–0.002 mg/L), below the IFC guideline of 0.5 mg/L, indicating minimal phenolic hydrocarbon loading.

Microbiology was reported for SWSE, the community water-supply reservoir. March showed modest counts (E. coli 8 MPN/100 mL; Total Coliforms 894 CFU/100 mL), while July and September results were higher in count. There is no IFC effluent benchmark for these indicators; however, the pattern indicates high bacterial loads typical of surface-water storage under wet-season runoff and warmer conditions. According to discussions with Guyana Water Incorporated (GWI) during public consultations, the reservoir is chlorinated prior to distribution to the community. The sampling conducted for the Project was upstream of this chlorine treatment.

8. GROUNDWATER

This Section presents the groundwater baseline chapter for the Eagle Mountain Gold Mine Project.

8.1 INTRODUCTION

This section presents baseline information drawn from hydrogeological study reports prepared by Global Resource Engineering Inc. (GRE). For water quality assessments, data from Stronghold Guyana's ongoing monitoring programme has been utilised. All information provided herein is directly sourced from these reports and datasets. No primary data has been collected by ERM.

This baseline chapter provides a summary of GRE's hydrogeological studies as well as the results obtained from the water quality monitoring programme. The full GRE report is given in Appendix F.

8.1.1 DATA SOURCES

The following data sources have been utilised in the development of groundwater baseline:

- Studies carried out by GRE Inc.
  - ESIA Support Report (GRE, 2025)
  - Geological logs from the exploration drilling program, the geotechnical drilling program, as well as from the installation of the dedicated groundwater monitoring wells.
  - Aquifer transmissivity values.
  - Groundwater level data collected from the dedicated groundwater monitoring wells located on site.
- Preliminary Economic Assessment (ERM, 2024).
- Water quality analysis results provided by Stronghold Guyana Inc.

8.1.2 STUDY LIMITATIONS

8.1.2.1 ASSUMPTIONS

The following assumptions were made to enable a baseline assessment to be completed:

- Hydrogeological information (including monitoring well data, aquifer testing results, groundwater levels, etc.) has been obtained entirely from reports prepared by GRE.
- Data accuracy and completeness are subject to the methodologies and assumptions applied by GRE in their original studies.
- Any constraints or uncertainties inherent in GRE's reporting (e.g., data coverage, modelling assumptions) remain applicable to this section.
- ERM has not performed additional field investigations or analytical validation of the hydrogeological data.

8.1.2.2 LIMITATIONS:

The following limitations are relevant to the hydrogeology baseline studies:

- Hydrogeological information aquifer characterisation has been drawn primarily from GRE's studies; ERM did not independently replicate measurements or re-analyse aquifer testing data and laboratory samples.
- Field parameter coverage is incomplete for certain rounds; where absent, laboratory pH/EC were used as proxies, which limits immediate QA/QC checks.
- Laboratory detection limits and methods vary between datasets; censored values near detection limits reduce confidence in trend analyses for some analytes.

8.1.3 DATA COLLECTION AND METHODOLOGY

The field study was designed by GRE to acquire hydrogeological information required to complete the hydrogeological characterisation of the mine site and to produce data for assessing potential impacts on groundwater resources. Activities within the field program are summarised below:

- Installation of groundwater monitoring wells.
- Packer tests: a total of 21 packer tests were conducted in 14 boreholes.
- Performing pumping tests at eight existing wells in the project area.

8.1.3.1 INSTALLATION OF GROUNDWATER MONITORING WELLS

From September 2024, Stronghold Guyana installed ten (10) groundwater monitoring wells to ascertain the pre-development hydrogeologic conditions within the Project Area. Shallow and intermediate depth groundwater monitoring wells were installed to enable monitoring for groundwater levels and water quality throughout the project life cycle at key areas including waste storage facilities (WSF), the process plant, and the tailings storage facility (TSF). The goal of these programs was to install wells across the different stratigraphic units at the project site. Drilling has revealed that the site has three main stratigraphic units: saprolite, a transition zone and hard rock. Along the river channels, there are alluvial and colluvial deposits. Much of the alluvium has been re-worked by the local miners and has a different, and significantly less-dense texture than if it were material placed by standard alluvial/colluvial action.

GRE installed groundwater wells in saprolite or transition materials and conducted packer tests in the hard rock units. Groundwater level measurements and sampling have been carried out in the monitoring wells.

Well construction details are summarised in Table 8.1 whereas the locations of monitoring wells are shown in Figure 8.1.

TABLE 8.1 PROJECT WELL RECORD

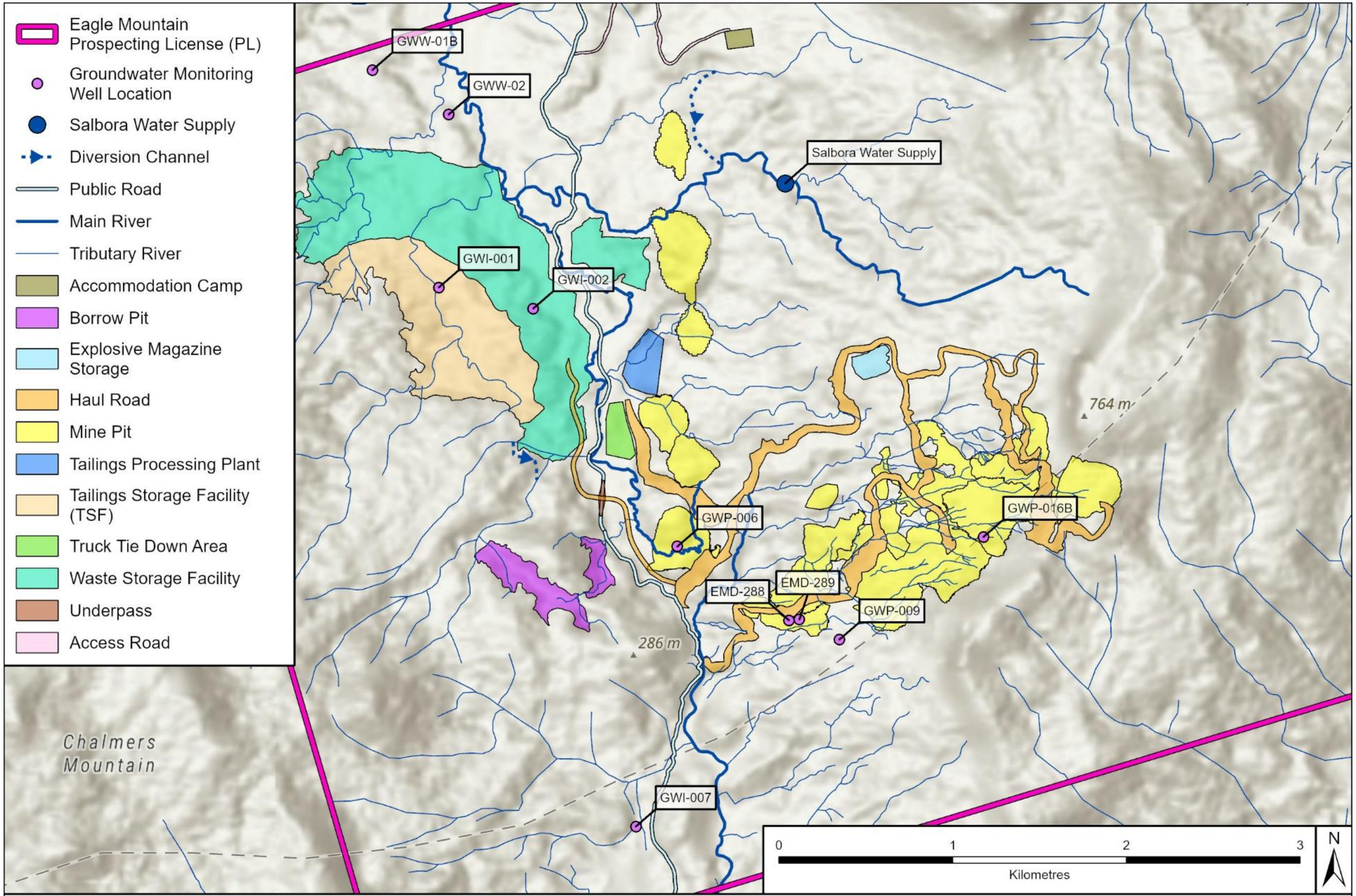
Well ID	Installation Date/Year (MM/DD/YYYY)	Well Diameter (mm)	Total Depth (m)	Screen Interval(s) (m)	WL[1] Max (mbgs[2].)	WL Min (mbgs.)
Pit Wells						
GWP-006	12/03/2024	38.10	27.10	9.10-21.10	0.79	1.86
GWP-009	03/08/2025	38.10	60.00	30.00-60.00	4.56	6.36
GWP-016B	11/11/2024	38.10	30.00	20.82-26.94	8.00	21.53
Standpipe Piezometers (Pit Area)						

Well ID	Installation Date/Year (MM/DD/YYYY)	Well Diameter (mm)	Total Depth (m)	Screen Interval(s) (m)	WL[1] Max (mbgs[2].)	WL Min (mbgs.)
EMD-288	06/21/2024	25.40	19.46	12.45-19.46	14.69	19.45
EMD-289	06/20/2024	25.40	28.60	24.03-28.60	19.11	22.60
TSF and WSF Infrastructure Wells						
GWI-001	01/18/2025	38.10	10.14	4.02-10.14	2.90	3.64
GWI-002	02/06/2025	38.10	27.67	6.20-27.67	0.63	1.28
GWI-007	02/12/2025	38.10	18.30	3.05-18.30	0.58	0.80
Monitoring Wells (Project Site Northern Boundary)						
GWW-01B	01/16/2025	38.10	19.60	7.60-13.60	0.78	1.99
GWW-02	01/20/2025	38.10	16.50	4.26-13.44	6.78	8.29

[1] WL: Water Level.

[2] mbgs: meters below ground surface

FIGURE 8.1 GROUNDWATER MONITORING WELL LOCATIONS



Source: Esri, NASA, NGA, USGS, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community
Path: \\vmukspgisfs01\Data\London\Projects\0763224 - Mako Mining EIA\Map\0763224 - Mako Mining EIA - V02C08 - HYG.aprx\0763224 - V02C08 - Hydrogeology - 08.01 - GW Monitoring Well Locations

8.1.3.2 GROUNDWATER QUALITY SAMPLING

Sample Collection

Groundwater samples were collected by Stronghold and GRE during four sampling runs, which form part of the groundwater monitoring program that is being implemented at the proposed Eagle Mountain Gold Mine. These sampling runs were conducted during January, March, July and September 2025.

Groundwater samples were collected using the low-flow sampling method. The well is pumped using a low flow pump at a low rate to minimise disturbance and turbulence in the well. Typically, the pumping rate is in the order of 5 to 9 L/hour. The abstracted groundwater is passed through a flow cell where a multi-probe is used to monitor various parameters, including pH, specific electrical conductivity, oxidation reduction potential (ORP), dissolved oxygen (DO), turbidity, and temperature is measured. Once the parameters stabilise within pre-set guidelines, the water sample is collected.

Laboratory Analyses

Groundwater samples were collected in clean sample bottles and preserved according to laboratory directions. Sample bottles were provided by and submitted to IMEX Inc. located in Georgetown, Guyana and Kaizen Environmental Services Labs, an accredited laboratory located in Georgetown, Guyana. Onsite, sample bottles were initially stored in coolers with the ice packs or frozen water bottles changed twice daily. Samples were packed into separate coolers with ice packs and bubble wrap. Ice packs were frozen in the camp kitchen freezers throughout the program.

TABLE 8.2 WATER QUALITY ANALYSIS PARAMETERS

Physical Parameters	Major Ions and General Chemistry
pH	Residual Chlorine (Cl)
Electrical Conductivity	Sulphates (SO4)
Turbidity	Fluoride (F)
Total Suspended Solids	Total Alkalinity
Total Dissolved Solids	Bicarbonate Alkalinity
	Ammonia (NH3)
	Hardness
	Calcium (Ca)
	Magnesium (Mg)
	Potassium (K)
	Sodium (Na)
Metals and Trace Elements	
Aluminium (Al)	Molybdenum (Mo)

Physical Parameters	Major Ions and General Chemistry
Antimony (Sb)	Nickel (Ni)
Arsenic (As)	Selenium (Se)
Cadmium (Cd)	Zinc (Zn)
Chromium (Cr)	Methyl Mercury (Hg)
Cobalt (Co)	
Copper (Cu)	
Iron (Fe)	
Lead (Pb)	
Manganese (Mn)	

Quality Assurance and Quality Control

Quality assurance and quality control (QAQC) samples were collected to verify that the sample collection and handling process has not compromised the quality of the groundwater samples. All field quality control samples were prepared and collected in the same manner as regular investigation samples with respect to sample volume, containers, and preservation. Quality control samples included a field duplicate.

Chemical analysis results from the most recent sampling runs (January, March, July and August 2025) are included in this report. Groundwater sample results are presented and compared to the relevant guidelines. Laboratory certificates of analysis are included in Appendix F.

8.1.3.3 EQUIPMENT

Groundwater sampling and monitoring equipment includes:

- Solinst Levelogger pressure transducers and associated accessories (USB field reader, laptop)
- Groundwater level meter (dip meter)
- Purge pump, tubing, batteries.
- Sample bottles, preservation fluids (acids), filtration equipment, ice packs.
- Multiparameter water quality meter (e.g. YSI ProDSS) and flow-through cell.

8.2 HYDROGEOLOGICAL SETTING

Information on the project area's hydrogeology has been obtained from the ESIA Support Report (GRE, 2025) and the PEA Report (ERM, 2024).

The project area is a high recharge environment with heavy rain, and soils which permit significant infiltration of rainwater into the groundwater system. The area has relatively impermeable bedrock (~1×10^{-5} cm/s). Occasional fractures exist that have higher conductivity; however, the bedrock can generally be considered an aquitard rather than an aquifer. Shallow groundwater is hosted in the saprolite formation, and in some cases, in a weathered rock zone at the top of the bedrock (i.e. transition zone). The transition zone of the Eagle Mountain deposit is often thin or absent altogether. It cannot be considered a uniform site-wide aquifer, but locally, it hosts groundwater and typically has a slightly higher conductivity than the saprolite above it. Groundwater reports on a short flow pathway to surface water. Over the entire project domain, streams are gaining with respect to groundwater. Generally, the lower elevation streams are perennial, and the higher elevation streams may be ephemeral.

8.2.1 HYDROSTRATIGRAPHIC UNITS

Drilling has revealed that the hydrogeological setting consists of three main units: saprolite, a transition zone at the top of the hard rock, and hard rock. Along the river channels, there are alluvial and colluvial deposits. Much of the alluvium has been re-worked by the local miners and has a different, and significantly less dense texture than if it were material placed by standard alluvial/colluvial action. The regional groundwater flow is assumed to follow the topography of the area.

8.2.1.1 SAPROLITE AQUIFER / AQUITARD

The topsoil is saprolite and varies in thickness and has a clayey nature. The saprolite forms due to the weathering and decomposition of the host geology (granite/granodiorite) and is especially characteristic of tropical lateritic weathering profiles. The thickness of this saprolite varies throughout the project area. The Eagle Mountain deposit is affected by weathering, resulting in a typical saprolite thickness of 10 to 30 metres and rarely reaching a maximum depth of 76 metres from the surface.

The vertical and lateral variability within the laterite profile at Eagle Mountain has not been clearly defined. No ferruginous zone has been described, and the upper part of the laterite profile may have been removed by erosion. The shallow mineralised zone has also been affected by weathering, resulting in a zone of mineralised saprolite near the surface (Figure 8.2).

The saprolite is classified as an aquitard rather than an aquifer based on the above. Aquifers underlying the saprolite are considered to be confined.

8.2.1.2 TRANSITION ZONE AQUIFER

The transition zone is associated with the zone where the degree of weathering of the host geology grades over from highly weathered or decomposed (saprolite) to no weathering (fresh granite/granodiorite). This zone typically consists of a combination of saprolite and smaller boulders of un-weathered or fractured granite. The upper portion of the competent granite is characterised by a higher degree of fracturing.

The transition zone is often thin, typically less than 30 centimetres in the Eagle Mountain deposit, and is generally <2m, or absent altogether. It cannot be considered a uniform site-wide aquifer, but locally, it hosts groundwater and typically has a slightly higher conductivity/permeability than the saprolite above it due to the higher degree of fracturing in the upper part of the granite/granodiorite. Groundwater flows in this aquifer are expected to be regional. Transition material is both mineralised and un-mineralised.

8.2.1.3 FRACTURED ROCK AQUIFER

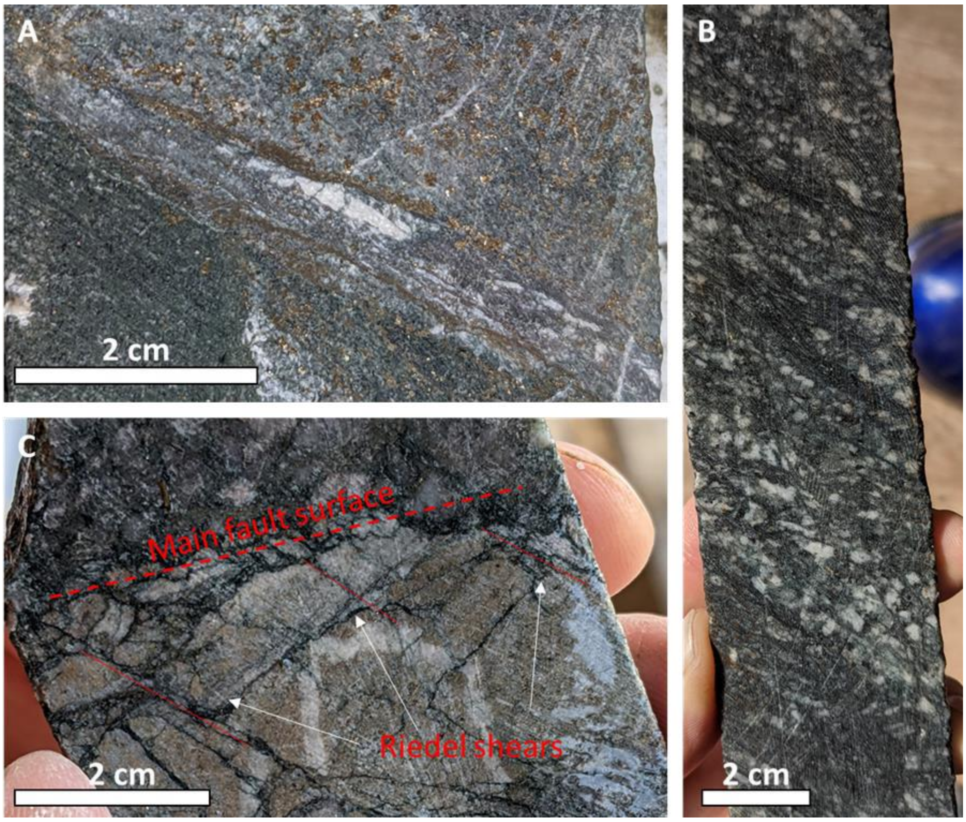
The fractured rock aquifer is associated with the fresh, un-weathered host geology. The area is underlain by an older package of metavolcanic rocks that have been affected by several intrusions of various ages and compositions. These metavolcanic rocks are typically dark coloured and fine-grained, contain minor disseminated pyrite and display a general cleavage trending 030°. The metavolcanics are generally mafic to intermediate in composition (tholeiitic basalts and andesites), although more felsic compositions are also recorded (dacite and rhyolite). These metavolcanic and minor metasedimentary rocks have been intruded by older mafic intrusions (dolerites). Both later intrusions and the host units have also undergone greenschist facies metamorphism, with porphyroblasts of actinolite/hornblende observed.

The area has relatively impermeable bedrock. Occasional conductive fractures exist in the hard rock that have higher conductivity, but in general, the bedrock can be considered an aquitard rather than an aquifer. These fractures can convey water and also can have hydrostatic pressure, which is higher than the surface of the ground. These range in character from single discrete, narrow deformation zones only a few cm wide (Figure 8.2) to broader zones of pervasive deformation and fracturing (Figure 8.3). In places, several fracture orientations occur, and Riedel shear fractures can be recognised.

Conceptualisation of pre-mining conditions is provided in Figure 8.4.

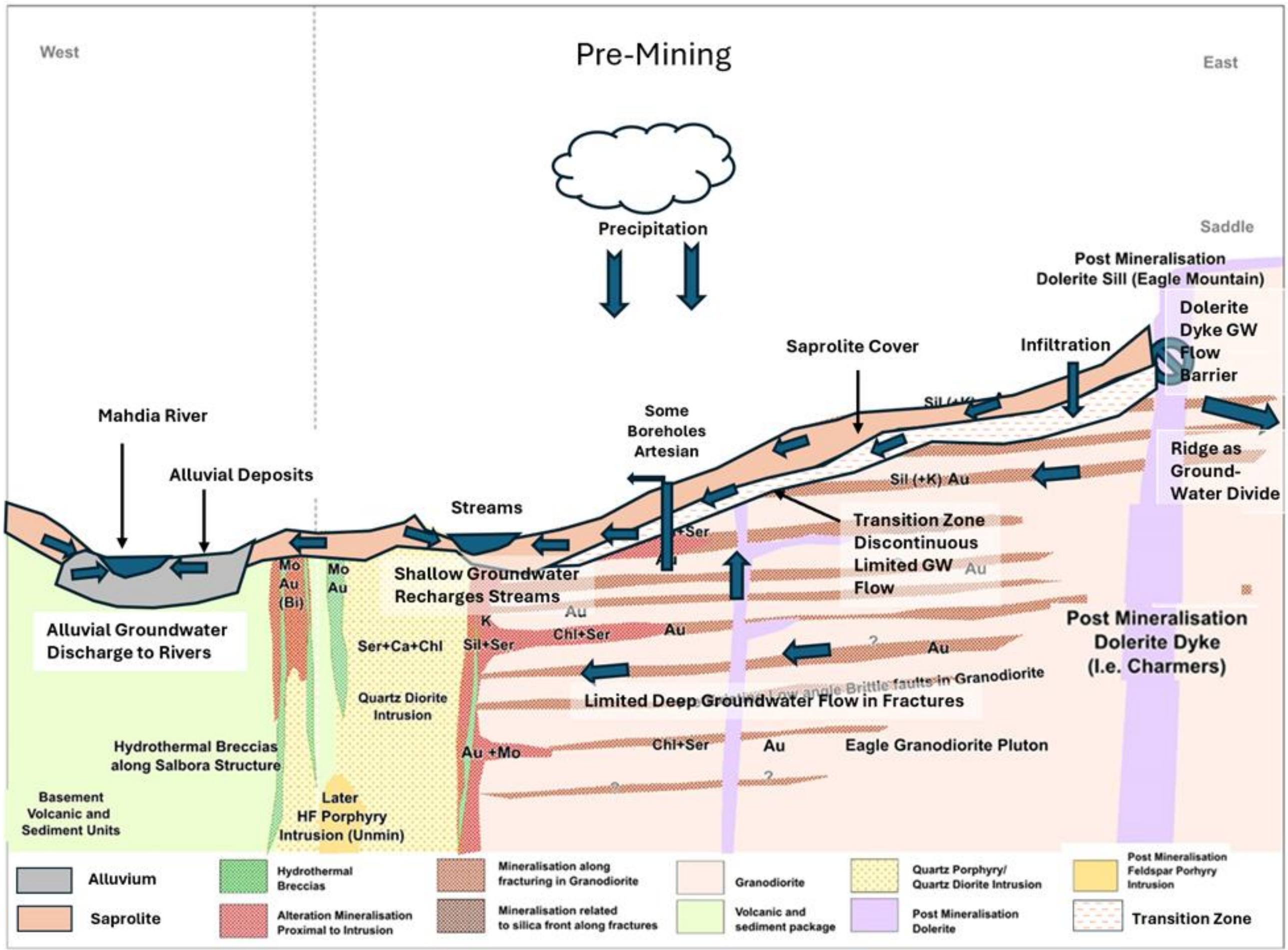
FIGURE 8.2 TYPICAL MINERALISED SAPROLITE CORE FROM THE SALBORA AREA IN DDH EME20-57

FIGURE 8.3 EXAMPLES OF DEFORMATION ASSOCIATED WITH SHALLOW FAULT ZONES



Note: A – Single discrete shear with associated pyrite. B – Broader zone of deformation. C – Discrete fractures displaying Riedel shears.

FIGURE 8.4 PRE-MINING CONCEPTUAL GROUNDWATER MODEL



8.2.2 AQUIFER CHARACTERISATION

Aquifer tests and the results obtained from the subsequent data analyses, as reported by GRE, are provided in the following sections.

8.2.2.1 PACKER TEST RESULTS

The following comparative conclusions have been drawn from the packer tests, while the results are shown in Table 8.3.

- In the next stages of project design, development, and characterisation, additional testing should be considered to optimise design parameters for pit wall stability and other areas throughout the Project that are to be considered for infrastructure;
- The overall rock mass exhibits a hydraulic conductivity with a geometric mean of 1.14 x 10^{-4} cm/s;
- This conclusion was made in spite of a field-testing protocol which preferentially selected fractured intervals with the greatest potential to report conductivity results above the accepted minimum (1.00 x 10^{-9} cm/s) of the packer device;
- The maximum measured hydraulic conductivity is 9.12 x 10^{-3} cm/s, which is the conductivity range typically associated with a uniform fine sand (A. Freeze, 1979).

TABLE 8.3 PROJECT PACKER TEST SUMMARY

	Number of Tests	Hydraulic Conductivity (cm/s)			
		Geometric Mean	Average	Maximum	Minimum
Qz Diorite	3	6.44×10^{-5}	3.43×10^{-4}	9.95×10^{-4}	1.10×10^{-5}
Granodiorite	4	1.02×10^{-5}	7.69×10^{-5}	1.92×10^{-4}	9.58×10^{-8}
Granite	2	7.33×10^{-5}	7.33×10^{-5}	7.55×10^{-5}	7.11×10^{-5}
Mafic Int.	1	2.38×10^{-6}	2.38×10^{-6}	2.38×10^{-6}	2.38×10^{-6}
Basalt	2	8.75×10^{-5}	1.12×10^{-4}	1.83×10^{-4}	4.18×10^{-5}
Mafic Vol.	4	2.36×10^{-4}	3.28×10^{-4}	5.84×10^{-4}	6.65×10^{-5}
Meta-Sed.	4	1.81×10^{-3}	4.11×10^{-3}	9.12×10^{-3}	2.25×10^{-4}
Gabbro	1	4.17×10^{-4}	4.17×10^{-4}	4.17×10^{-4}	4.17×10^{-4}
All tests	**21**	$\mathbf{1.14 \times 10^{-4}}$	$\mathbf{1.06 \times 10^{-3}}$	$\mathbf{9.12 \times 10^{-3}}$	$\mathbf{9.58 \times 10^{-8}}$

8.2.2.2 PUMPING TEST RESULTS

In analyses of the aquifer tests, due to the environment in which most of these tests were performed, unconfined aquifer type curves for the pump tests (Neuman type curves) and slug-out tests (Dagan type curves) were selected and adjusted to fit the drawdown and recovery data from each test.

USGS spreadsheets were used to analyse most of the recovery data obtained from the wells. Recovery analyses using the Cooper-Jacobs Recovery type curve were used for every well with observed recovery periods. Each recovery curve was properly adjusted to fit the late-time data in each analysis to ensure that the aquifer response to the drawdown was appropriately captured (as there was potential for water in the pump and discharge line to fill the well once the pump was turned off).

The results obtained from the pumping tests are summarised in the following bullets, while the hydraulic conductivity values for each test are presented in Table 8.4.

- Saprolite was found to be in the range of 1.00×10^{-5} cm/s to 1.00×10^{-6} cm/s. This is comparable to a silt or fine sand (Domenico & Schwartz, 1990). Since the Project saprolite is typically composed of fine-grained materials, these analyses support that observation. This observation is additionally supported by geotechnical classification, which has identified the saprolite as silt;
- The Transition Zone has a greater range of K-values than the saprolite, spanning 1.00×10^{-3} cm/s to 1.00×10^{-5} cm/s. Hydraulic conductivities of this magnitude are between coarse sand and fine sand (Domenico & Schwartz, 1990). This larger range is to be expected, as Transition Zone material is known to exhibit varying levels of fracturing and weathering that can differ significantly from one area to another. The transition zone

throughout the Project is also quite narrow, making it quite difficult to isolate this layer, which could be another cause for the range in K-values.

TABLE 8.4 PROJECT WELL TEST ANALYSES

Well ID	Date of Test (MM/DD/YYYY)	Material	Analysis Type	K (cm/s)	K, Geo. Mean (cm/s)
PIT WELLS					
GWP-006	01/12/2025	Transition Zone	Neuman	3.38×10^{-3}	2.53×10^{-3}
	01/13/2025		CJ	1.90×10^{-3}	
GWP-009	03/11/2025	Saprolite	Neuman	1.87×10^{-5}	2.52×10^{-5}
	03/12/2025		CJ	3.40×10^{-5}	
GWP-016B	01/14/2025	Saprolite	Neuman	4.03×10^{-6}	4.79×10^{-6}
	01/15/2025		CJ	5.70×10^{-6}	
TSF and WSF INFRASTRUCTURE WELLS					
GWI-001	01/23/2025	Transition Zone	Neuman	2.14×10^{-4}	9.02×10^{-5}
	01/24/2025		CJ	3.80×10^{-5}	
GWI-002	03/04/2025	Transition Zone	Neuman	3.00×10^{-4}	5.14×10^{-4}
	03/05/2024		CJ	8.80×10^{-4}	
GWI-007	02/28/2025	Transition Zone	Neuman	2.90×10^{-4}	3.88×10^{-4}
	03/01/2025		CJ	5.20×10^{-4}	
MONITORING WELLS					
GWW-01B	01/18/2025	Saprolite	Neuman	5.94×10^{-5}	3.85×10^{-5}
	01/19/2025		CJ	2.50×10^{-5}	
GWW-02	01/27/2025	Transition Zone	Dagan (1)	8.94×10^{-6}	1.25×10^{-5}
			Dagan (2)	1.46×10^{-5}	
			Dagan (3)	1.53×10^{-5}	

8.2.3 GROUNDWATER LEVELS

Groundwater levels fluctuate during the bi-modal wet and dry season cycles, with an average change being ~1-5 meters in elevation, depending on location. Higher elevation groundwater is more susceptible to changes in elevation.

There is a poorly developed alluvial deposit which follows the bed of the Mahdia and Minnehaha Rivers. This material is slightly more conductive than the saprolite (largely because it has been washed of fines by miners over the last 100 years). Both the Mahdia and Minnehaha Rivers are the ultimate discharge points for groundwater within the project area.

Occasional conductive fractures exist in hard rock, which can convey water and also have hydrostatic pressure, which is higher than the surface of the ground. This creates artesian well (or borehole) conditions. Artesian conditions are defined as a well which has flowing groundwater at the surface. Artesian conditions indicate that the hydrostatic pressure of future pit walls should be monitored and considered. There are no groundwater users in the project area. All water use is surface water use. There is no significant irrigated agriculture in the vicinity or in the region.

The depth to the groundwater level is recorded in the dedicated groundwater monitoring wells installed on site. These wells are located around the proposed pit area, infrastructure area and site-wide areas. Information on groundwater levels is presented in GRE (2025) which is provided in Appendix F.

8.2.3.1 VIBRATING WIRE PIEZOMETER (VWP) RESULTS

So far, VWPs have been able to capture the end of the 2024 wet season, as well as some of the 2025 season. The following conclusions have been drawn from the available data, while detailed measurements are documented in GRE (2025) and provided in Appendix F.

- Water elevation does not vary significantly throughout the limited timeframe, averaging 2.95 m among the wet and dry seasons;
- Six locations are equipped with nested VWPs (i.e. more than one sensor installed within a single borehole). At all six locations, a downward vertical hydraulic gradient is observed, indicated by piezometric heads that remain below the corresponding sensor depths.;
- Including the first reading after installation, VWP-3S has consistently observed negative water pressures. This indicates that the water level at this elevation in the borehole is below the VWP sensor's detection range. This VWP supports the null-hypothesis in that the water level has consistently trended below 7.90 meters below ground surface but above 66.00 meters below ground surface (VWP-4D).

Overall, the available VWP data indicate that the site is unlikely to encounter highly pressurised fracture zones, as most boreholes exhibit a downward vertical gradient.

8.3 AREA OF INFLUENCE

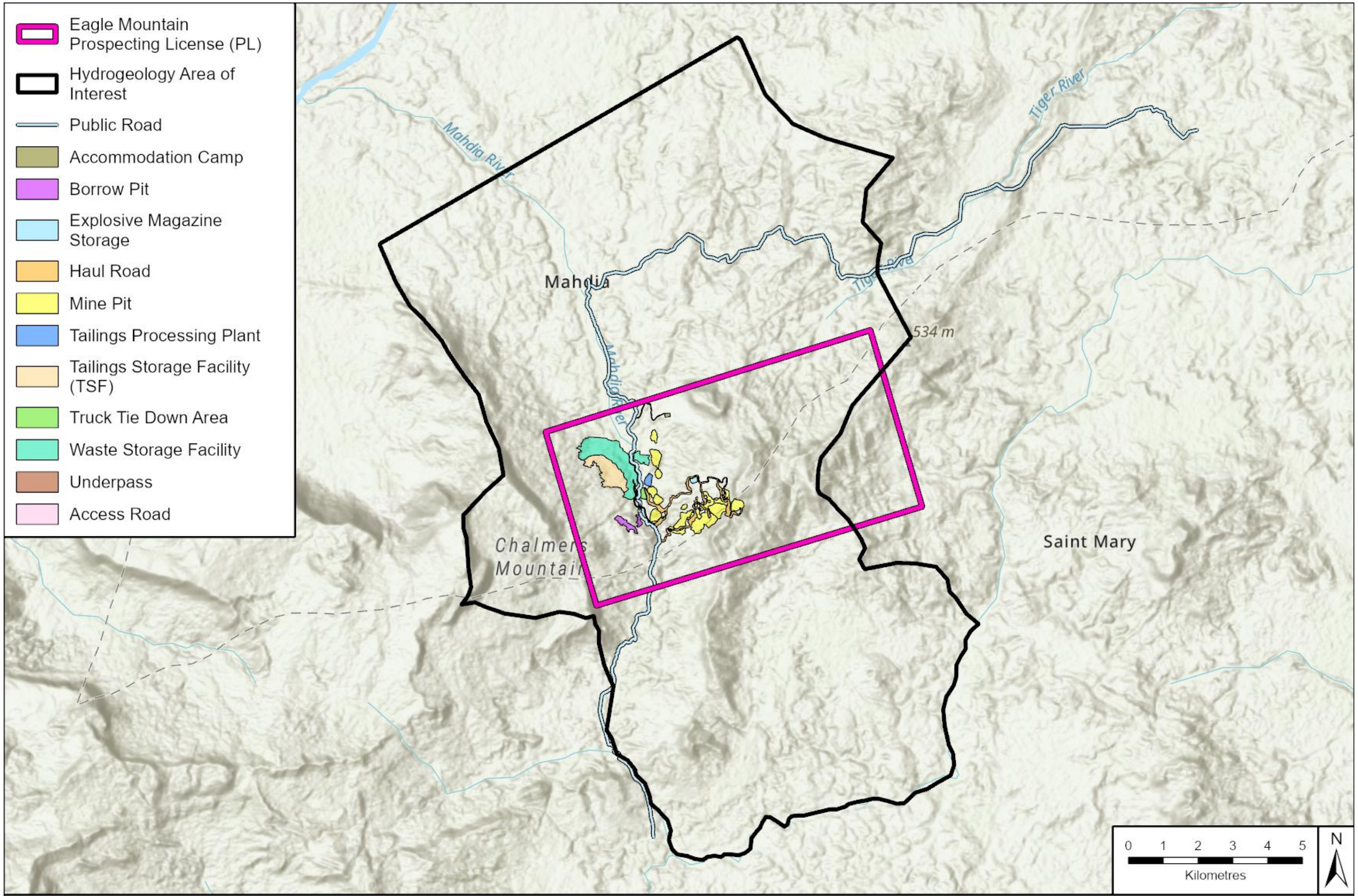
The area of influence is defined as the sub-catchments within which the operations will be located. The sub-catchments are defined based on natural groundwater flow boundaries, including topographical highs, which act as watersheds, and low-lying rivers or streams.

Information on the area of influence has been obtained from the ESIA Support Report by GRE (2025) and summarised in the sections below.

Figure 8.5 shows the Area of Influence for project’s potential impacts on groundwater. The project area is located in a valley and bordered by high landforms such as ridgetops. The boundary of the sub-catchment is defined along the existing ridgeline. To the east, the area is enclosed by a dolerite sill (Eagle Mountain), which functions as a hydraulic divide. To the west, the boundary is outlined by a combination of the Mahdia River and a prominent ridge. It is worth noting that east and west of the proposed Eagle Mountain mining operations, the topography is characterised by undulations with the most prominent high points on the eastern and western sides of the area of influence.

The northern boundary is primarily defined by the Mahdia River, which drains the area to the north and eventually flows into the Potaro River. To the south, the boundary of the area of interest is marked by the Minnehaha Creek, which drains the project area to the south and ultimately feeds into the Konawaruk River. Throughout the entire project domain, streams are gaining in relation to groundwater. The Mahdia River drains most of the area, whereas the Minnehaha Creek drains most of the Project's Mineral Resource area. The Mahdia River and Minnehaha Creek are the final discharge points for groundwater within the project area.

FIGURE 8.5 HYDROGEOLOGY AREA OF INFLUENCE



Source: Esri, NASA, NGA, USGS, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

Path: \\vmukspgisfs01\Data\London\Projects\0763224 - Mako Mining EIA\Map\0763224 - Mako Mining EIA - V02C08 - HYG.aprx\0763224 - V02C08 - Hydrogeology - 08.02 - Hydrogeology AoI

8.4 GROUNDWATER QUALITY

Groundwater quality within the project area was assessed through sampling campaigns conducted by GRE and Stronghold during both the dry and wet seasons. These sampling activities aimed to establish a preliminary understanding of baseline groundwater quality and to support future evaluations of potential project-related impacts.

The groundwater sampling points are listed in Table 8.5 while their locations are shown on a map in Figure 8.1. The results and interpretations of these evaluations are presented in the following sections.

TABLE 8.5 EAGLE MOUNTAIN PROJECT HYDROGEOLOGY MONITORING WELL NETWORK

Area	Station	UTM Coordinates[1]		Ground Elevation (mamsl)	Stickup Elevation (mamsl)	Depth (m)	Top of Screen (mbgl)	Bottom of Screen (mbgl)	Well Diameter (mm)	Water level logger	Target Layer
		Easting	Northing								
Pit well	GWP-006	264121	576100	74.90	No data	27.10	9.10	21.10	38.1	No	Transition zone
	GWP-009	265016	575613	234.96	No data	60.00	30.00	60.00	38.1	No	Saprolite
	GWP-016B	265862	576205	406.27	No data	30.00	20.82	26.94	38.1	No	Saprolite
Infrastructure area	GWI-001	262582	577629	64.37	No data	10.14	4.02	10.14	38.1	No	Transition zone
	GWI-002	263244	577522	65.85	No data	27.67	6.20	27.67	38.1	No	Transition zone
	GWI-007	263741	547335	67.17	No data	181.30	3.05	18.30	38.1	No	Transition zone
Site- wide area	GWW-01B	265862	576205	406.27	No data	19.60	7.60	13.60	38.1	No	Saprolite
	GWW-02	262784	578635	65.00	No data	16.50	4.26	13.44	38.1	No	Transition zone
Standpipe Piezometer	EMD-288	264803	575726	211.00	No data	19.46	12.45	19.16	25.40	Yes	Saprolite
	EMD-289	264743	575629	201.00	No data	28.60	24.03	28.60	25.40	Yes	Transition zone

Notes: 1: Survey coordinate system in UTM zone PSAD562 21N.
m – meters
mamsl – meters above mean sea level
mbgl – meters below ground level

8.5 FIELD PARAMETERS

Field parameters such as pH and electrical conductivity were obtained from laboratory analyses. As raw field data were unavailable, laboratory measurements were used for the assessment. Among the laboratory results, field parameters were available only for the March and July sampling campaigns.

Groundwater at most wells exhibited slightly acidic to neutral pH during the March 2025 sampling campaign. The pH values range from 5.92 to 6.59, indicating slightly acidic conditions whereas conductivity varies between 339–597 µS/cm, suggesting moderate mineral content. During the July 2025 sampling campaign, the field pH values generally tended to be acidic to neutral, ranging between 5.93 and 6.76.

8.6 GROUNDWATER QUALITY COMPARISONS

January 2025

The sample (Well) shows higher levels of Aluminium (Total) and Iron compared to others. Other metals such as Arsenic, Cadmium, Chromium, Mercury, and Nickel are all below detection limits. Aluminium levels were elevated in two samples (up to 3.310 mg/L), although IFC does not set a limit; the WHO drinking water guideline is 0.2 mg/L. All other metals (As, Cd, Pb, Hg, Ni, Zn, Sb, Se) were within IFC limits.

Microbiological contamination (Total Coliforms and *E. coli*) was detected in two samples (PWS-W 01B 25001 and PWSE 25001), making the water unsuitable for potable use.

March 2025

Total iron was detected in most samples (0.33–15.0 mg/L), with some concentrations below the detection limit. Microbiological contamination: total coliforms present in sample GWS25W1 (>2420), while *E. Coli* was in the same sample. Trace metal antimony, chromium and nickel were detected in very low concentrations, whereas cadmium remained below detection limits.

Metals: Most samples meet IFC standards, except Iron concentrations were elevated in some samples (GWS2502-002, GWS2507-002, GWS25W2-002 and GWS25D1-002), exceeding the IFC guideline. pH was elevated in one sample (GWS2516-002), exceeding the IFC guideline. Total Suspended Solids concentrations were elevated in one sample (GWS25W2-002), exceeding the IFC guideline. Microbiological: Total Coliforms and *E. coli* were detected in one sample (GWS25W1-002), which is non-compliant with potable water standards. General Chemistry: pH, TDS, and major ions are mostly within acceptable ranges. Conductivity: No set IFC limit, but values indicate moderate mineralisation.

July 2025

Metals: Most samples meet IFC standards; however, Iron concentrations were elevated in some samples (GWS25W1-003, GWS25W2-003, and GWS25D1-003), exceeding the IFC guideline. pH was observed to be slightly acidic in two samples (GWS2516-003 and GWS2501-003), showing results outside the IFC guideline range.

August 2025

Microbiological: Groundwater sample (GWS25W1003b) showed TNTC (Too Numerous To Count) for both Total Coliforms and *E. Coli*.

TABLE 8.6 JANUARY 2025 WATER ANALYSIS RESULTS SUMMARY

Parameter	Units	GWP 01 6B 25001	GWW 01B 25001	PWSE 25001	PWS-W 01B 25001	Well	IFC Guideline Limit
Aluminium (Dissolved)	mg/L	< 0.368	< 0.368	< 0.368	1.180	0.760	No specific limit
Aluminium (Total)	mg/L	< 0.368	< 0.368	< 0.368	2.850	3.310	No specific limit
Arsenic (Dissolved)	µg/L	< 2.001	< 2.001	< 2.001	< 2.001	< 2.001	0.1
Arsenic (Total)	µg/L	< 2.001	< 2.001	< 2.001	< 2.001	< 2.001	0.1
Cadmium (Dissolved)	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	0.05
Cadmium (Total)	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	0.05
Chromium (Dissolved)	mg/L	< 0.07	< 0.07	< 0.07	< 0.07	< 0.07	0.1
Chromium (Total)	mg/L	< 0.07	< 0.07	< 0.07	< 0.07	< 0.07	0.1
Copper (Dissolved)	mg/L	< 0.021	< 0.021	< 0.021	< 0.021	< 0.021	0.3
Copper (Total)	mg/L	< 0.021	< 0.021	0.024	< 0.021	0.035	0.3
Iron (Dissolved)	mg/L	< 0.084	0.126	< 0.084	0.090	< 0.084	2.0
Iron (Total)	mg/L	< 0.084	1.897	0.495	1.526	1.572	2.0
Lead (Dissolved)	mg/L	< 0.015	< 0.015	< 0.015	< 0.015	< 0.015	0.02
Lead (Total)	mg/L	< 0.015	< 0.015	< 0.015	< 0.015	< 0.015	0.02
Mercury (Dissolved)	µg/L	< 1.094	< 1.094	< 1.094	< 1.094	< 1.094	0.002
Mercury (Total)	µg/L	< 1.094	< 1.094	< 1.094	< 1.094	< 1.094	0.002
Nickel (Dissolved)	mg/L	< 0.061	< 0.061	< 0.061	< 0.061	< 0.061	0.5
Nickel (Total)	mg/L	< 0.061	< 0.061	< 0.061	< 0.061	< 0.061	0.5

Parameter	Units	GWP 01 6B 25001	GWW 01B 25001	PWSE 25001	PWS-W 01B 25001	Well	IFC Guideline Limit
Silver (Dissolved)	mg/L	< 0.038	< 0.038	< 0.038	< 0.038	< 0.038	No specific limit
Silver (Total)	mg/L	< 0.038	< 0.038	0.055	0.226	0.090	No specific limit
Zinc (Dissolved)	mg/L	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	0.5
Zinc (Total)	mg/L	< 0.006	0.025	< 0.006	0.034	0.012	0.5
Antimony	mg/L	0.00093	0.00094	0.00130	0.00110	0.00100	No specific limit
Antimony (Dissolved)	mg/L	0.00140	0.00140	0.00150	0.00130	0.00150	No specific limit
Selenium	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	No specific limit
Selenium (Dissolved)	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	No specific limit
Microbiology	CFU/100ml	–	–	Coliform: Present; E. coli: Present	Coliform: Present; E. coli: Present		No specific limit

Units: Most metals in mg/L; Arsenic and Mercury in µg/L.

TABLE 8.7 MARCH 2025 WATER ANALYSIS RESULTS SUMMARY

Parameter	Units	GWS2506-002	GWS2509-002	GWS2516-002	GWS2501-002	GWS2502-002	GWS2507-002	GWS25W1-002	GWS25W2-002	GWS25D1-002	IFC Guideline Limit
pH	S.U.	6.59	6.14	5.92	6.08	6.31	6.24	6.04	6.15	6.22	6-9
Residual Chlorine	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	No specific limit
Sulphates	mg/L	<0.50	0.88	0.53	14.89	0.91	0.73	0.53	2.95	0.68	No specific limit
Conductivity	µS/cm	401	449	394	469	343	450	339	597	582	No specific limit
Fluoride	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	No specific limit
Total Suspended Solids	mg/L	7	27	8	10	37	19	7	381	15	50
Total Dissolved Solids	mg/L	78	126	146	86	180	62	414	60	230	No specific limit
Total Alkalinity	mg/L	16.0	47.8	5.9	50.6	14.2	104.8	5.7	126.9	104.8	No specific limit
Bicarbonate Alkalinity	mg/L	19.6	58.3	7.2	61.8	17.3	127.8	6.9	154.8	127.8	No specific limit
Total Iron (Fe)	mg/L	0.83	0.98	0.33	0.83	4.6	2.8	1.1	15	3.3	2.0

Parameter	Units	GWS2506-002	GWS2509-002	GWS2516-002	GWS2501-002	GWS2502-002	GWS2507-002	GWS25W1-002	GWS25W2-002	GWS25D1-002	IFC Guideline Limit
Total Copper (Cu)	mg/L	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	0.0098	0.0249	0.3
Total Zinc (Zn)	mg/L	<0.070	<0.070	<0.070	<0.070	<0.070	<0.070	<0.070	<0.070	<0.070	0.5
Total Antimony (Sb)	mg/L	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	No specific limit
Total Arsenic (As)	mg/L	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	0.00097	<0.00080	0.1
Total Cadmium (Cd)	mg/L	0.00652	0.00584	0.00586	0.00585	<0.00040	<0.00040	0.00917	0.00501	0.00414	0.05
Total Chromium (Cr)	mg/L	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	0.0123	<0.0080	0.1
Total Nickel (Ni)	mg/L	<0.0050	<0.0050	<0.008	<0.0050	0.0116	<0.0050	<0.0050	0.0169	0.0068	0.5
E. coli	MPN/100mL	NA	NA	NA	NA	NA	NA	8	NA	NA	No specific limit
Total Coliforms	CFU/100ml	NA	NA	NA	NA	NA	NA	>2420	NA	NA	No specific limit

(ND = Not Detected; NA =Not Analysed)

Note: Highlighted results indicate exceedances to the IFC guideline limit.

TABLE 8.8 JULY 2025 WATER ANALYSIS RESULTS SUMMARY

Parameter	Units	GWS250 6-003	GWS250 9-003	GWS251 6-003	GWS250 1-003	GWS250 2-003	GWS250 7-003	GWS25 W1-003	GWS25 W2-003	GWS25D 1-003	IFC Guideline Limit
pH	pH units	6.76	6.25	5.64	5.93	6.16	6.53	6.25	6.13	6.26	6-9
Conductivity	(µS/cm)	166	271	185	206	166	363	363	147	199	No specific limit
Total Dissolved Solids	mg/L	20.0	112	32	14	58.0	170	6	44	32	No specific limit
Total Suspended Solids	mg/L	17.6	20.7	10.2	20.7	19.4	10.8	32.1	38.1	19.0	50
Total Alkalinity	mg/L	13	58.0	7	6	39.0	153	8.00	50.0	38.0	No specific limit
Bicarbonate Alkalinity	mg/L	13.0	58.8	7	6	39.0	153	8.00	50.0	38.0	No specific limit
Hardness	mg/L	11.7	56.5	5.8	3.6	33.6	126.5	1.7	33.9	33.9	No specific limit
Total Iron (Fe)	mg/L	0.87	0.91	<2.0	1.8	1.7	0.60	2.4	2.7	5.0	2.0
Total Copper (Cu)	mg/L	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	0.3

Parameter	Units	GWS2506-003	GWS2509-003	GWS2516-003	GWS2501-003	GWS2502-003	GWS2507-003	GWS25W1-003	GWS25W2-003	GWS25D1-003	IFC Guideline Limit
Total Chromium (Cr)	mg/L	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	0.1
Total Manganese (Mn)	mg/L	<0.050	0.127	0.085	0.052	0.514	0.189	0.322	0.610	0.553	No specific limit
Total Zinc (Zn)	mg/L	<0.070	<0.070	<0.070	<0.070	<0.070	<0.070	<0.070	<0.070	<0.070	0.5
Total Sodium (Na)	mg/L	1.80	10.08	2.4	5.54	4.34	8.38	4.64	5.82	4.29	No specific limit
Total Potassium (K)	mg/L	<2.50	<2.50	<2.50	<0.50	<0.50	<0.50	<0.50	0.85	0.56	No specific limit
Total Calcium (Ca)	mg/L	<2.50	<2.50	<2.50	0.97	6.12	30.80	0.82	8.00	6.62	No specific limit
Total Magnesium (Mg)	mg/L	<2.50	<2.50	<2.50	<0.50	4.0	9.21	<0.50	3.5	3.84	No specific limit
Total Nickel (Ni)	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.5
Total Selenium (Se)	mg/L	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	No specific limit
Total Lead (Pb)	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.2

Parameter	Units	GWS250 6-003	GWS250 9-003	GWS251 6-003	GWS250 1-003	GWS250 2-003	GWS250 7-003	GWS25 W1-003	GWS25 W2-003	GWS25D 1-003	IFC Guideline Limit
Total Cobalt (Co)	mg/L	<0.0020	<0.0020	<0.0020	<0.0020	0.0040	<0.0020	0.0025	0.0041	0.0045	No specific limit
Total Cadmium (Cd)	mg/L	<0.00040	<0.00040	<0.00040	0.00259	0.00278	0.00277	0.00313	0.00189	0.00285	0.005
Total Arsenic (As)	mg/L	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	0.1
Total Antimony (Sb)	mg/L	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	No specific limit
Total Aluminium (Al)	mg/L	0.431	0.402	0.110	0.910	0.299	0.293	1.44	0.817	1.800	No specific limit
Methyl Mercury (Hg)	µg/L	0.000199	0.000503	0.000184	0.000066	0.000675	0.000328	<0.000160	0.000944	0.000791	No specific limit

Note: Highlighted results indicate exceedances to the IFC guideline limit.

TABLE 8.9 AUGUST 2025 WATER ANALYSIS RESULTS SUMMARY

Parameter	GWS25W1003b	IFC Guideline Limit
Units	CFU/100ml	No specific limit
Total Coliforms	TNTC	No specific limit
E. Coli	TNTC	No specific limit

9. MINERAL WASTE

9.1 INTRODUCTION

This chapter describes the Project’s mineral waste baseline taken from the Geochemical Analysis of Waste Rock and Tailings (GRE 2025).

This section outlines the baseline conditions for the geochemical characteristics of the mined materials in order to identify risks of Acid Rock Drainage (ARD) and Metal Leaching (ML) associated with development and operations. ARD and ML can negatively impact local and regional water quality through the geochemical reactions that occur between rock and water.

9.2 DATA COLLECTION AND METHODOLOGY

9.2.1 WASTE ROCK

Two geochemical testing programs have been carried out: (1) Static testing in which samples are collected across the Project Area (July 2024) and sent to lab for analysis; and (2) Onsite kinetic testing commenced in January 2025 in which samples are exposed to ambient conditions to simulate field conditions.

For the static testing, a total of 50 waste rock samples of a variety of oxidation states and lithologies were collected from exploration and Geotech drilling core samples. Of the 50 samples, 32 were from the Eagle Mountain pit area, four were from Powis, 10 were from Salbora, and 4 were from Toucan. All samples were submitted for the following at the SGS Laboratory in Burnaby, Canada:

- Acid Base Accounting (ABA) by modified Sobek (Lawerence & Wang, 1996).
- Whole Rock Analysis
- Metals by *aqua regia* digestion and Inductively Coupled Plasma Mass Spectrometry (ICP-MS)
- Synthetic Precipitation Leaching Procedure (SPLP) (US EPA, 1994).

For the onsite kinetic tests, 10 waste rock samples representative of oxidation states and lithologies were collected separately in buckets and exposed to ambient conditions. Leachate was analysed weekly for pH, conductivity, and dissolved oxygen and sent to external labs monthly for multi-element analyses.

A full methodology is included in the “Geochemical Analysis of Waste Rock and Tailings, GRE, 2025” report as provided in Appendix F.

9.2.2 TAILINGS

In addition to the waste rock samples, four tailings samples, representative of Eagle Mountain fresh rock, Eagle Mountain saprolite, Salbora and Toucan fresh rock, and Salbora saprolite, were selected for environmental testing. The constituents of the composites (sample and proportion) were established based on contribution of the area to the overall resource and mine plan sequencing. All samples were tested at accredited laboratories.

9.3 RESULTS

9.3.1 WASTE ROCK

The following section presents the results of lab testing of the 50 waste rock samples, as well as the current status of the waste rock kinetic cell testing.

9.3.1.1 ACID-BASE ACCOUNTING

Acid Base Accounting (ABA) tests were performed to determine the acid generating potential (AP) and neutralisation potential (NP). Quantitative AP and NP values are used to predict the acid generation potential of the waste rock. Subtracting AP from NP (NP-AP), gives the Net Neutralisation Potential (NNP), while dividing NP by AP (NP/AP) gives the Neutralisation Potential Ratio (NPR). Based on the resulting values of NNP and NPR, the samples are classified as potentially acid-generating (PAG), potentially acid-consuming (PAC) or uncertain according to the criteria given by the GARD Guide, (INAP, 2009).

The NNP vs NPR results of the ABA testing are presented below in Figure 9.1 and Figure 9.2. ABA analysis shows that only one volcanic fresh rock sample out of 50 total is PAG. Two-fifths of the tested rock samples are non-acid-generating, and 19 samples are PAC due to high NP content. The remaining ten samples are uncertain or non-reactive, as the ratio of NP to AP is less than 2. Volcanic rock shows the most diverse span of potential acid generation, as it contains both the highest PAC samples and the only PAG sample of the sample set. Transition and oxidised rock have statistically significantly less NP than fresh rock, however, they also contain significantly less AP.

FIGURE 9.1 ABA PLOTS OF WASTE ROCK TEST RESULTS, BY OXIDATION

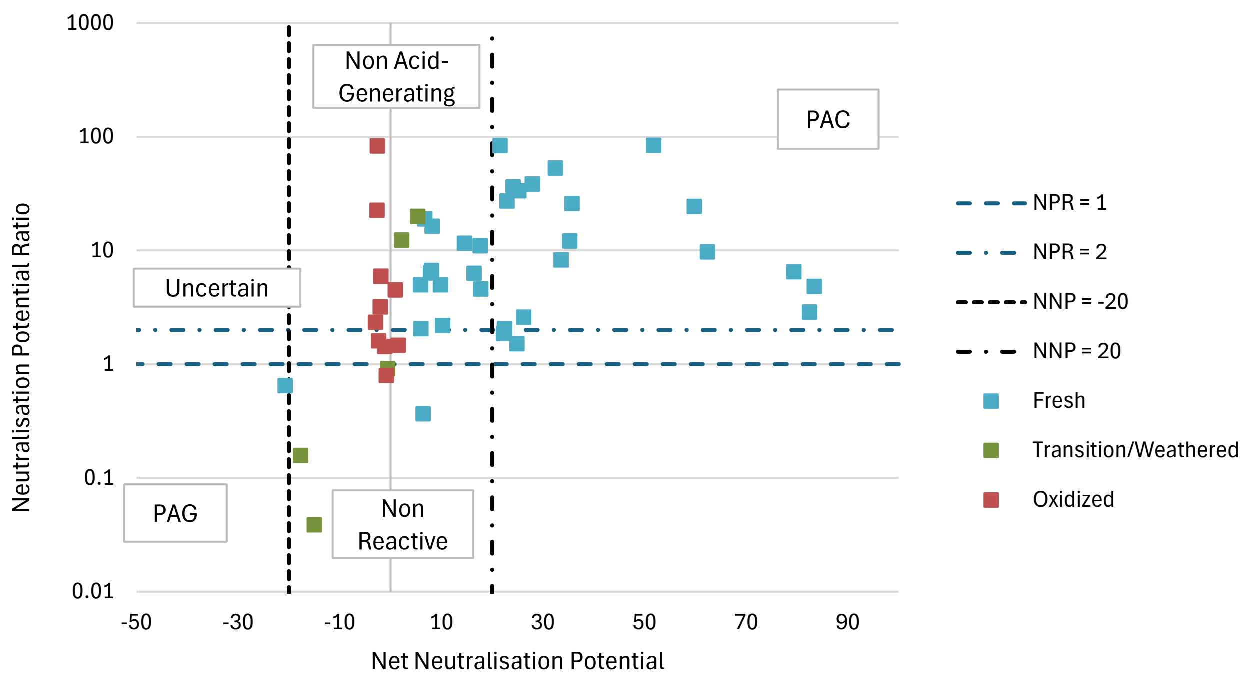
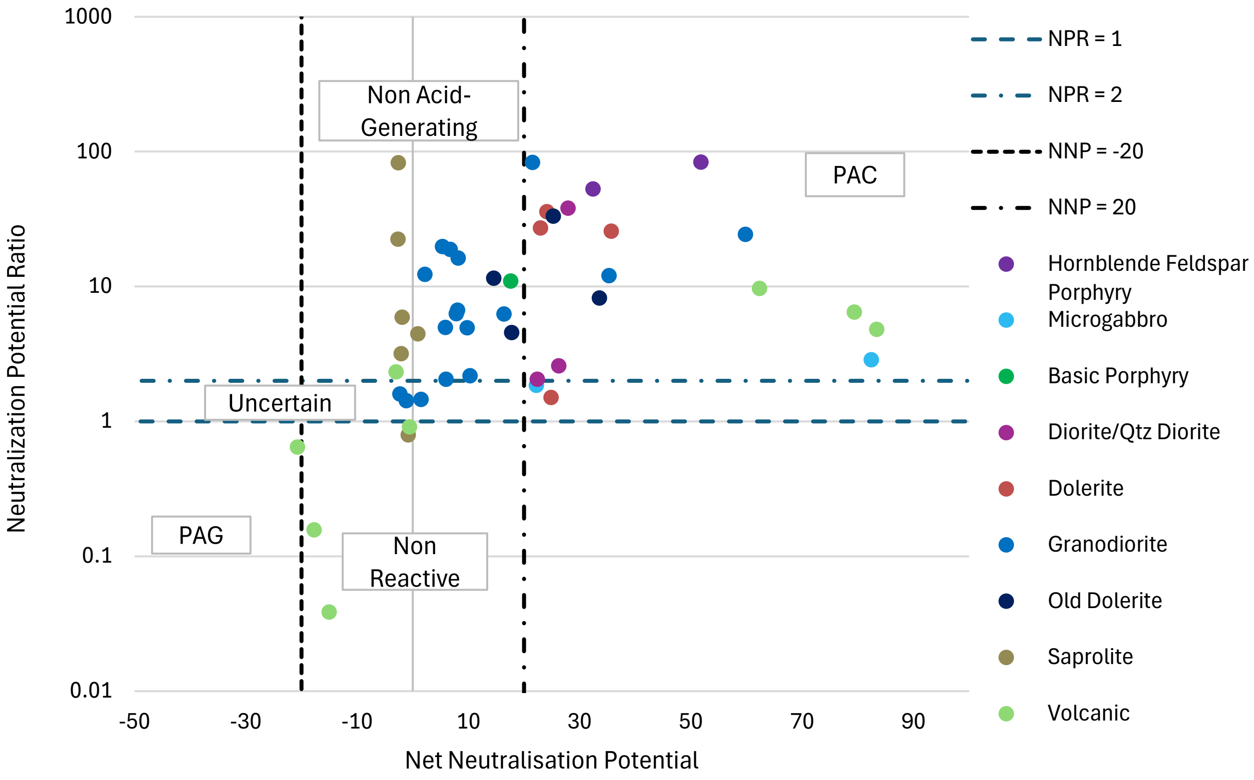


FIGURE 9.2 ABA PLOT OF WASTE ROCK TEST RESULTS, BY LITHOLOGY



9.3.1.2 WASTE ROCK METALS CONTENT BY ICP-MS

The concentration of elements in part-per-million (ppm) was compared to established crustal abundance values to determine relative elemental enrichment. An enriched element may be at higher risk for leaching under ML conditions. However, if rock has a metal concentration near or below crustal averages, it may have less risk of leaching in elevated quantities. The average metal content of waste rock of different oxidation state is in comparison to crustal averages is plotted in Figure 9.3.

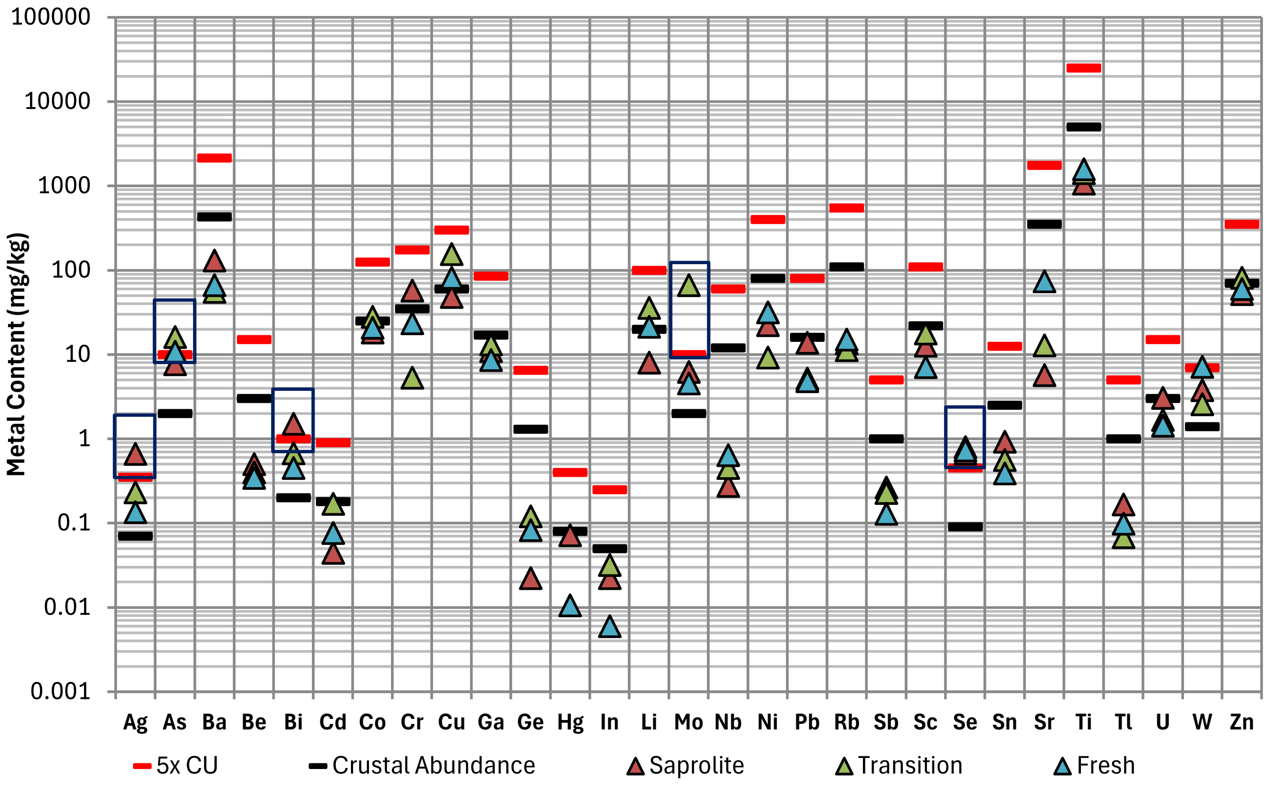
The analysis shows that the following metals may be Constituents of Concern (COCs) in future analysis of waste rock leachate water quality:

- Silver (in saprolite)
- Arsenic (in transition and fresh material)
- Bismuth (in saprolite)
- Molybdenum (in transition material)
- Selenium*

**Selenium concentrations were at the detection limit of 1 ppm for the majority of samples, although some samples had up to 3 ppm. However, selenium is often problematic in ML and must be considered a COC.*

Cobalt, chromium, copper, nickel, and zinc, other metals often problematic in ML, appear to be enriched at or below crustal abundance.

FIGURE 9.3 METAL CONCENTRATIONS IN TESTED WASTE ROCK, BY OXIDATION



9.3.1.3 WHOLE ROCK ANALYSIS

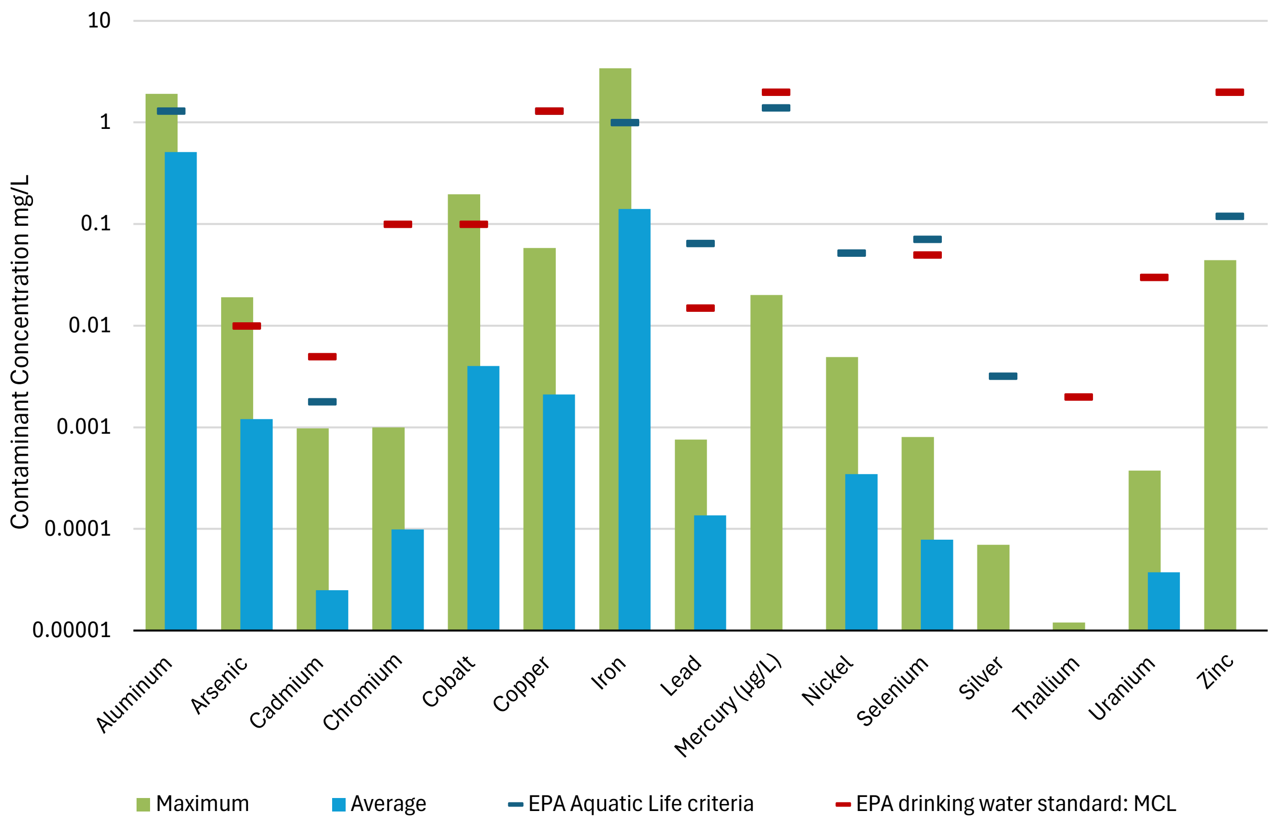
Whole rock analysis showed some compositional differences between waste rock of different oxidation. Transition rock is higher in iron oxide as compared to the saprolite and fresh rock samples. Saprolite is higher in aluminium oxides and loss on ignition (LOI) material. The transition and fresh rock material have considerably more calcium, sodium, and magnesium oxides than the saprolite. Saprolite has a higher aluminium oxide content than fresh rock, as well as a much higher percentage of material loss on ignition (LOI). These findings are consistent with expectations of oxidised and fresh rock as well as ABA results. Calcium and magnesium minerals are often responsible for the production of NP, which matches the ABA results which showed the greatest NP capacity in fresh rock, followed by transition rock.

9.3.1.4 SYNTHETIC PRECIPITATION LEACHING PROCEDURE (SPLP)

SPLP analysis shows minimal mobilisation of regulated metals and compounds from the waste rock into leachate. Post leaching, the leachate pH ranged between 5.1 – 9.5, with sulphate concentrations between 0.3 mg/L and 40 mg/L. Redox potential of the leachate was between 189 mV and 423 mV. Figure 9.4 shows the average concentration of regulated metals in SPLP leachate compared to U.S. EPA freshwater and drinking water standards. This comparison is for reference purposes only because the short-term leach results with a 20:1 water to rock ratio cannot be extended directly to the long-term composition of mine discharge associated with the waste rock dump. Only three of 50 total samples showed any exceedances of freshwater standards. Leachate from GC25-48 exceeded reference values with 0.019 mg/L arsenic, leachate from GL24-001 exceeded reference values with 0.196 mg/L cobalt and 3.41 mg/L iron, and leachate from GL24-011 exceeded reference values with 1.91 mg/L aluminium.

Molybdenum was also elevated in the leachate of GC25-26 up to 0.053 mg/L. When taken as an average, no samples exceed the U.S. EPA reference values.

FIGURE 9.4 MAXIMUM AND AVERAGE METALS CONCENTRATIONS IN SPLP LEACHATE



9.3.1.5 KINETIC CELLS

Kinetic Testing Overview

Ten on-site kinetic tests were initiated in January 2025 using material split from samples previously submitted to SGS. Table 9.1 summarises key descriptive information for the kinetic testing samples, including drill core intervals, lithology, and oxidation state.

TABLE 9.1 KEY DESCRIPTIVE INFORMATION FOR THE KINETIC TESTING SAMPLES

Sample ID	Hole ID	From (M)	To (M)	Lithology	Oxidation	Pit
GC25-18	Pit-Geotech-11	67	75.6	Volcanic	Fresh	Salbora
GC25-19	Pit-Geotech-12	36.21	41.52	Microgabbro	Fresh	Salbora
GC25-20	Pit-Geotech-12	25.5	30.76	Volcanic	Transition	Salbora
GC25-22	Pit-Geotech-04	50.65	56.24	Granodiorite	Fresh	Toucan
GC25-24	Pit-Geotech-15	28.13	30.75	Granodiorite	Fresh	Eagle
GC25-26	Pit-Geotech-05	26.1	30.6	Volcanic	Transition	Powis

Sample ID	Hole ID	From (M)	To (M)	Lithology	Oxidation	Pit
GC25-27	Pit-Geotech-05	36.6	38.69	Volcanic	Fresh	Toucan
GC25-28	Pit-Geotech-10	5.67	11.28	Saprolite	Saprolite	Eagle
GC25-31	Pit-Geotech-14	21.74	24.47	Old Dolerite	Fresh	Eagle
GC25-37	EMM21-20	30.76	36.44	Granodiorite	Fresh	Eagle

The on-site kinetic testing programme provides an integrated assessment of waste rock behaviour under natural climatic conditions and indicates that, overall, the tested materials exhibit predominantly benign geochemical characteristics. Across the test period, leachate pH values generally remained above rainwater, suggesting limited acid generation potential for the majority of materials. Where occasional lower pH values were observed, these were isolated and did not persist, indicating only mild and localised reactions rather than sustained acid rock drainage behaviour.

Leachate chemistry further supports this interpretation. Electrical conductivity values consistently exceeded those of rainwater, confirming some dissolution of soluble constituents, but concentrations remained low overall and showed strong sensitivity to seasonal variations in rainfall and leachate volumes. Dissolved oxygen levels were generally high, indicating that oxygen availability was not a limiting factor and that oxidation reactions were not occurring at rates sufficient to significantly deplete oxygen in solution.

Metal concentrations in kinetic cell leachate were typically low and, for most analytes, remained below applicable freshwater reference values. Where exceedances were recorded, these were generally episodic, often coinciding with early testing phases or dry periods when reduced leachate volumes can lead to temporary concentration effects. Sulphate concentrations were also low overall and below international guideline values, indicating limited sulphide oxidation at the scale represented by the kinetic tests. Evidence of neutralisation processes was observed in some materials, consistent with the presence of acid-neutralising minerals and further moderating potential acidity.

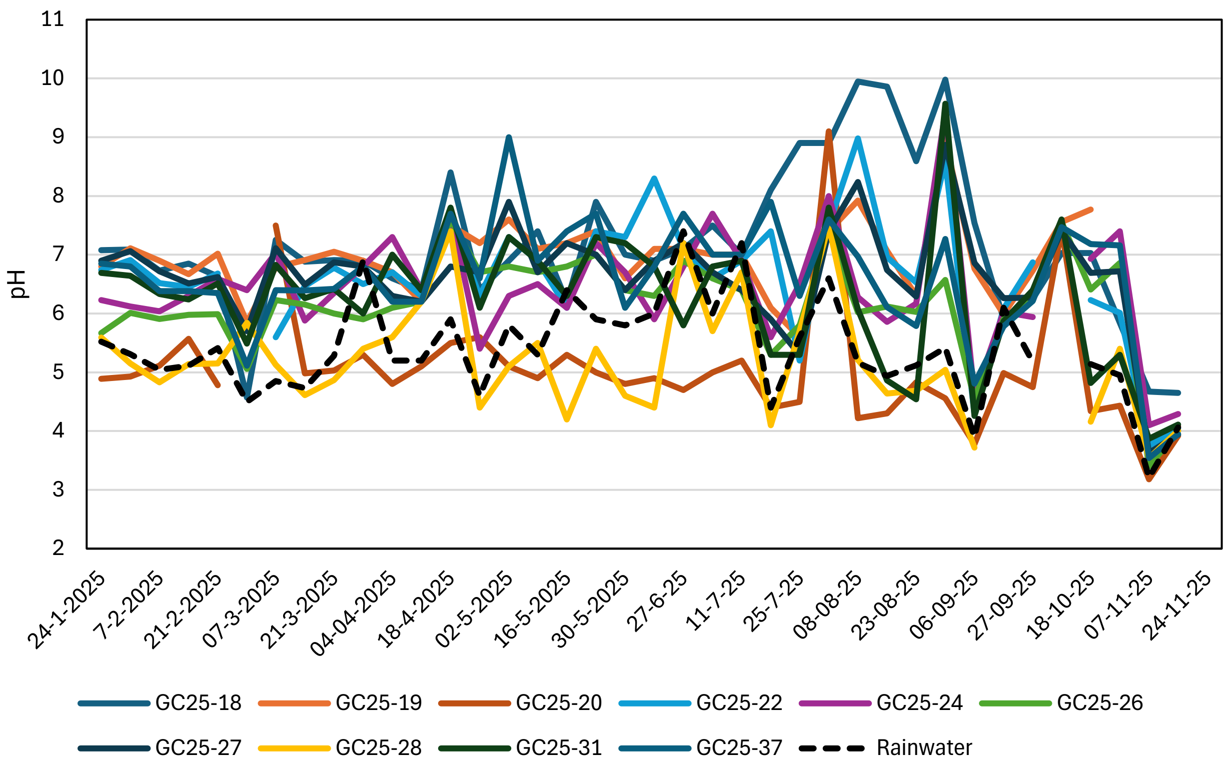
In combination, the kinetic test results indicate that most waste rock types at Eagle Mountain are unlikely to generate persistent acidity or significant metal leaching under expected site conditions. While continued monitoring is appropriate to confirm longer-term trends, the results to date are consistent with a generally low ARD and metal-leaching risk for waste rock

Weekly measurements and monthly laboratory leachate results are presented in detail in the following sections.

Weekly Measurements

Figure 9.5 presents the leachate pH results for the 50 weeks of measurements.

FIGURE 9.5 KINETIC CELL PH



Results from 28-2-2025 and 07-3-2025 are excluded from the graph due to measurement procedure and low water content affecting measurement accuracy.

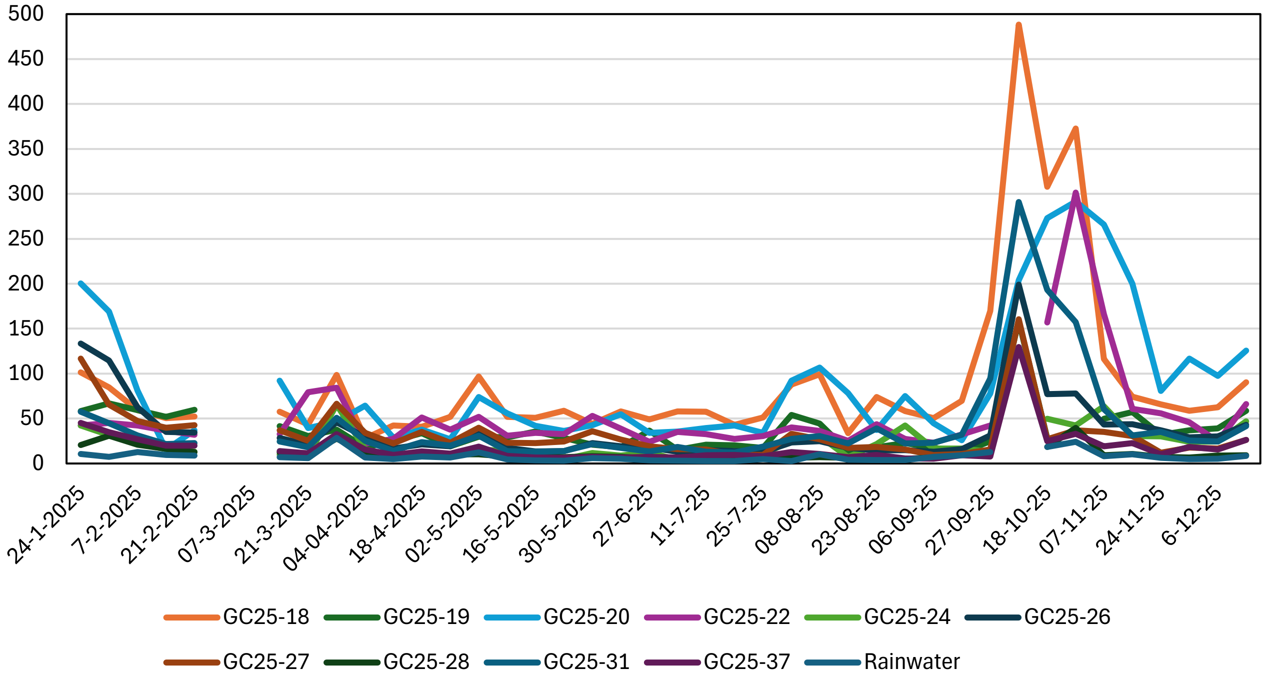
Most cells test consistently above rainwater pH. The exception is cell GC25-20 and GC25-28, (volcanic transition material from Salbora and saprolite from Eagle Mountain) which periodically test at or below rainwater pH. This is an indication that acid neutralising minerals are not readily dissolved into leachate upon contact with naturally acidic rainwater, not present, or that acid generation is occurring. GC25-20 has a sulphur content of 0.685%, an AP of 21.1, and an NP of 3.3, so it is likely that the low pHs seen are a result of sulphate mineral oxidation. On several instances, the leachate from GC25-20 was noted to be green, indicating the presence of ferrous sulphate, the product of sulphate mineral oxidation, in solution. However, this cell still shows mild ARD behaviour.

The pH results are better interpreted in the context of electrical conductivity, dissolved oxygen and measurements of litres of leachate collected, presented in Figure 9.6, Figure 9.7, and Figure 9.8.

The electrical conductivity measures the ability of a solution to conduct electricity, which is directly proportional to the concentration of dissolved ions present in solution. Electrical conductivity results show that all leachate is consistently above rainwater conductivity and releasing ions into solution. Lowest conductivity is seen in leachate from GC25-28 (saprolite from Eagle Mountain). This is consistent with what is expected of saprolite, as due to its oxidised nature, saprolite is typically barren of acid generating and acid neutralising minerals, as well as most dissolvable salts. GC25-20 and GC25-18 (transition material from Salbora and fresh rock from Salbora) have consistently higher conductivities than other cells. There is a notable spike in electrical conductivity of the leachate solutions from all the kinetic cells in October of 2025. This spike corresponds with the dry period where minimal, if any, leachate was collected from the cells (Figure 9.8). The observed increase in electrical conductivity of the solution during this dry period is attributed to the release of a comparable amount of ions being washed from the rock into a reduced volume of water. Electrical conductivity values return to near pre-dry period levels in November and early December corresponding with the continuation of rainfall at the site.

Dissolved oxygen measures the amount of oxygen present in the leachate. Less dissolved oxygen in solution indicates that oxygen is being used to oxidise other material in solution. Most dissolved oxygen readings are close to full saturation and show that all leachate is acceptable for supporting aquatic life. This implies that oxygen consumption due to mineral reactions is overtaken by the continuous replenishment of oxygen by the abundance of gaseous phase and the fast gaseous diffusion mechanisms. On several occasions, particularly in the dry season, leachate from kinetic cell GC25-22 (fresh granodiorite from Toucan) has shown particularly low (5.9 – 7 mg/L) dissolved oxygen measurements relative to other kinetic cells. However, even these lower levels of dissolved oxygen are above the minimum levels necessary for sustaining aquatic life (USEPA, 2021).

FIGURE 9.6 KINETIC CELL ELECTRICAL CONDUCTIVITY



Results from 28-2-2025 and 07-3-2025 are excluded from the graph due to measurement procedure and low water content affecting measurement accuracy.

FIGURE 9.7 KINETIC CELL DISSOLVED OXYGEN

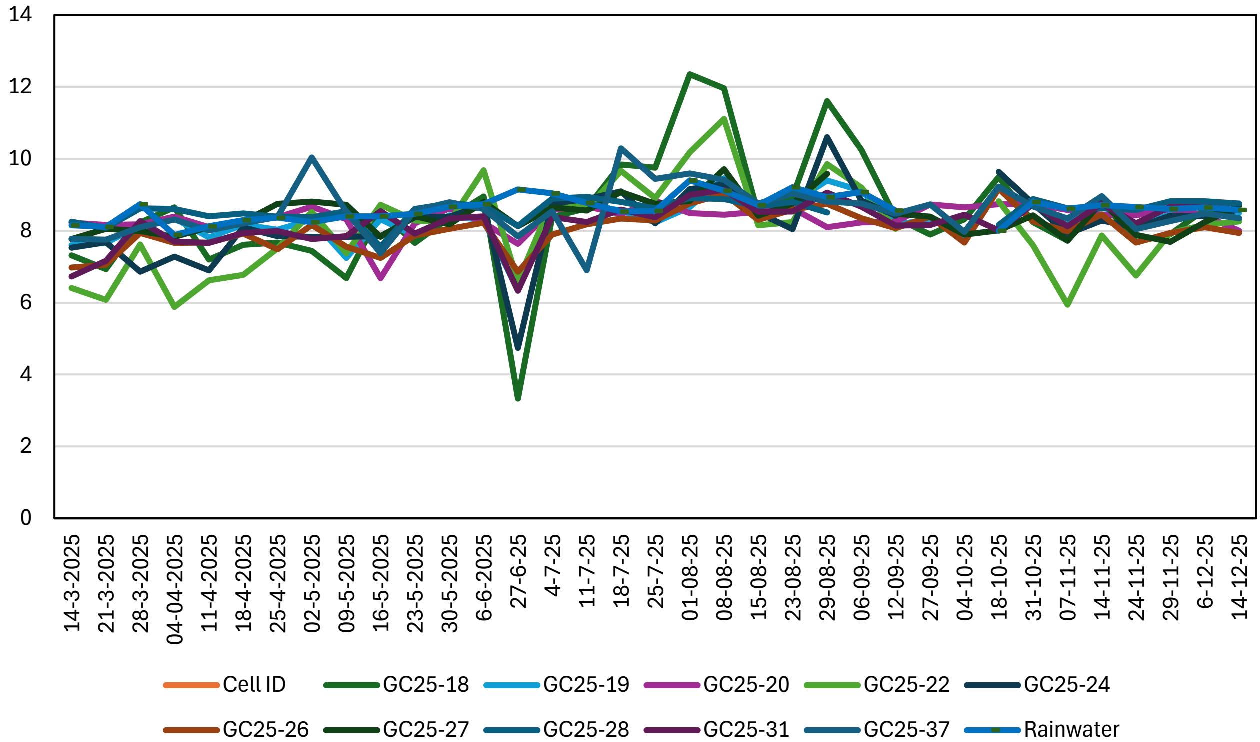
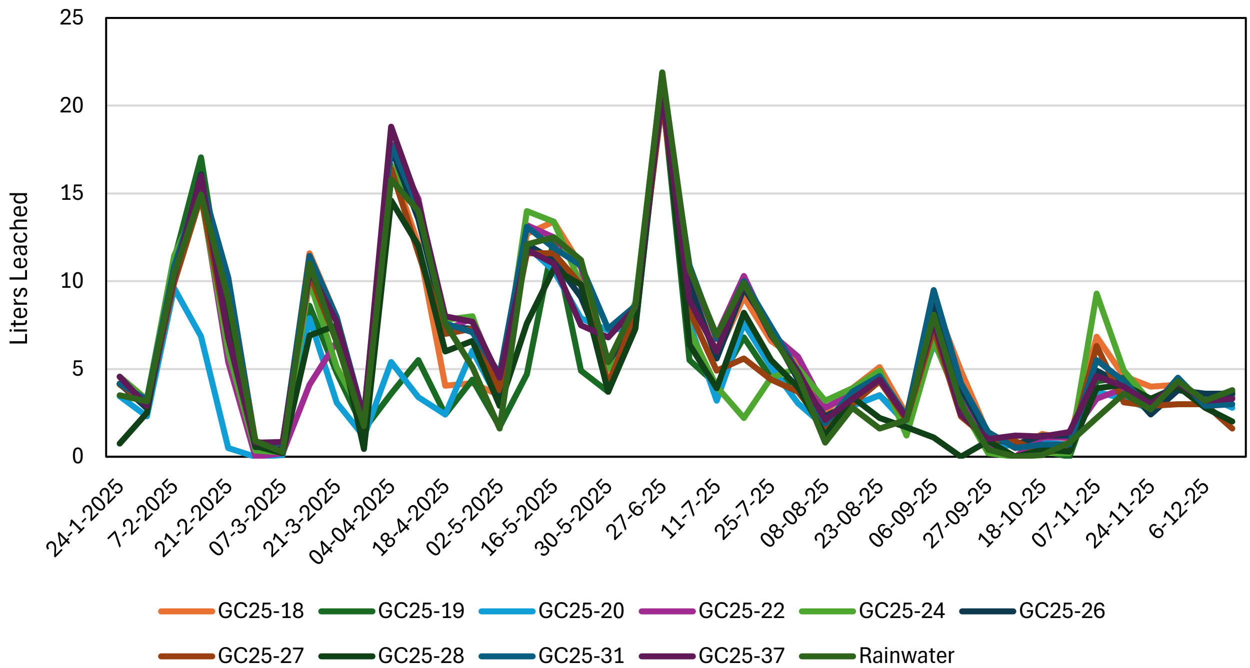


FIGURE 9.8 KINETIC CELL LITRES LEACHATE COLLECTED

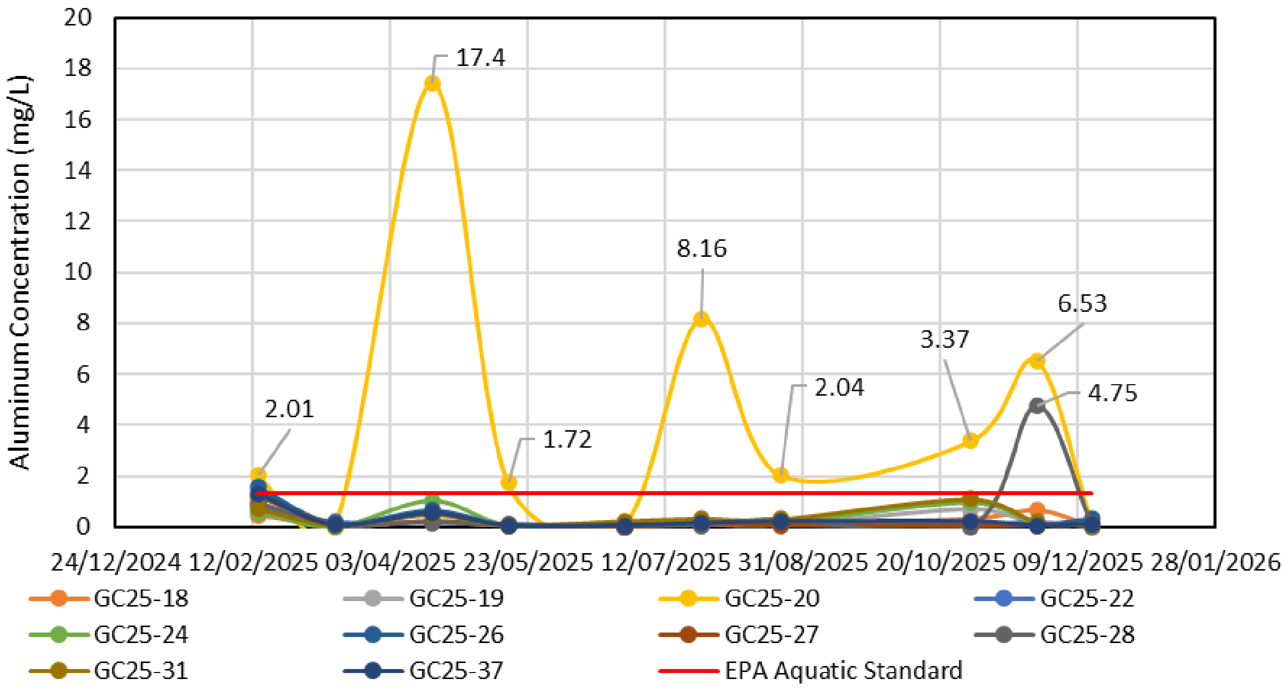


Monthly Laboratory Results

Ten months of leachate data have been received to date. Leachate samples were taken on 2/14/2025, 3/14/2025, 4/18/2025, 5/16/2025, 6/27/2025, 7/25/2025, 8/23/2025, 10/31/2025, 11/24,2025, 12/14,2025. All samples were sent for metals analysis to Kaizen Laboratory in East Bank Demerara, Guyana, except for the first sample (2/14/2025) which was analysed at IMEX Laboratory in East Coast Demera, Guyana. The concentration of metals in kinetic cell leachate was compared to U.S. EPA freshwater and drinking water standards (US EPA). The metal concentrations in leachate over time for notable metals are presented below. Exceedances of EPA freshwater standards are labelled in the graphs.

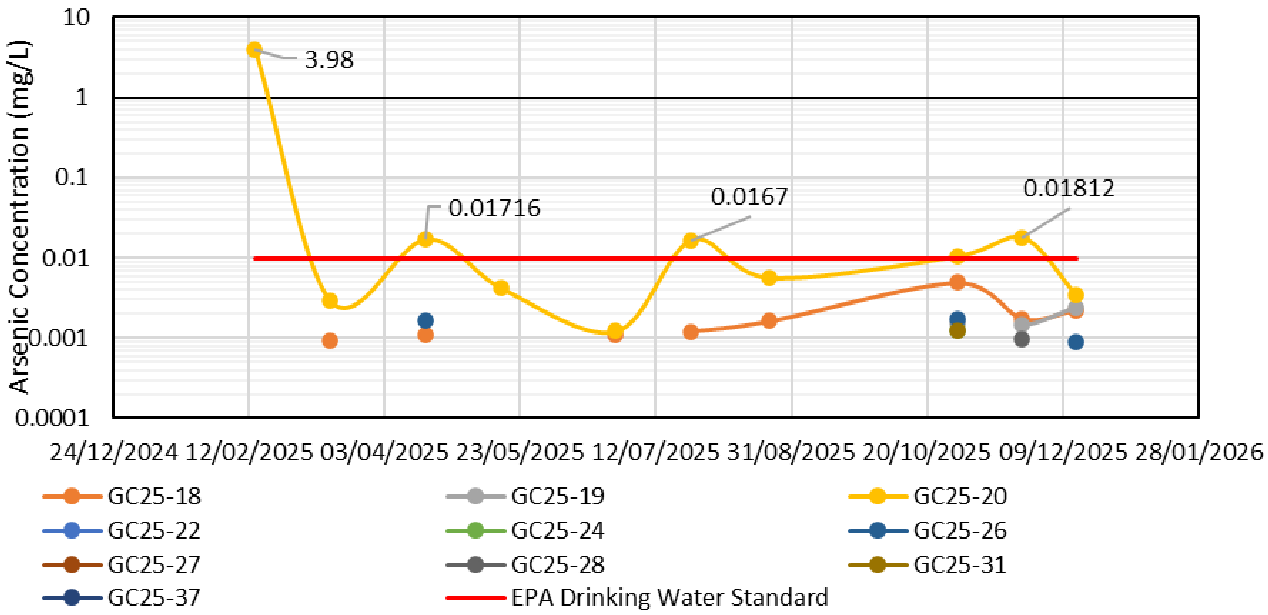
The aluminium concentration in kinetic cell leachate for most kinetic cells has remained below the EPA aquatic standard for aluminium (1.3 mg/L). However, leachate from GC25-20 showed periodic exceedances of the standard, both in the wet and dry seasons. The magnitude of the exceedance appears to increase in the dry seasons. Additionally, leachate from GC25-28 showed one instance of exceedance on 11/24/25. The results are presented in Figure 9.9.

FIGURE 9.9 ALUMINIUM CONCENTRATIONS IN KINETIC CELL LEACHATE



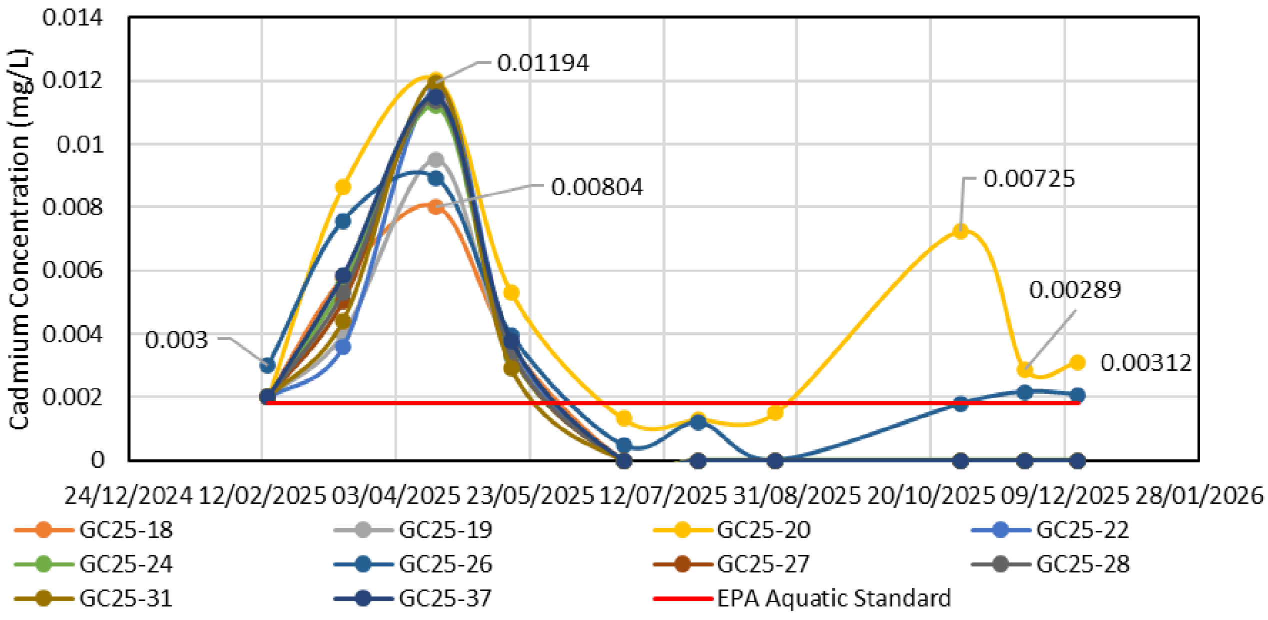
The arsenic concentration in kinetic cell leachate for most kinetic cells has remained below the EPA aquatic standard for arsenic (0.01 mg/L). However, leachate from GC25-20 showed periodic exceedances of the standard, particularly in the dry seasons. These results are presented in Figure 9.10.

FIGURE 9.10 ARSENIC CONCENTRATIONS IN KINETIC CELL LEACHATE



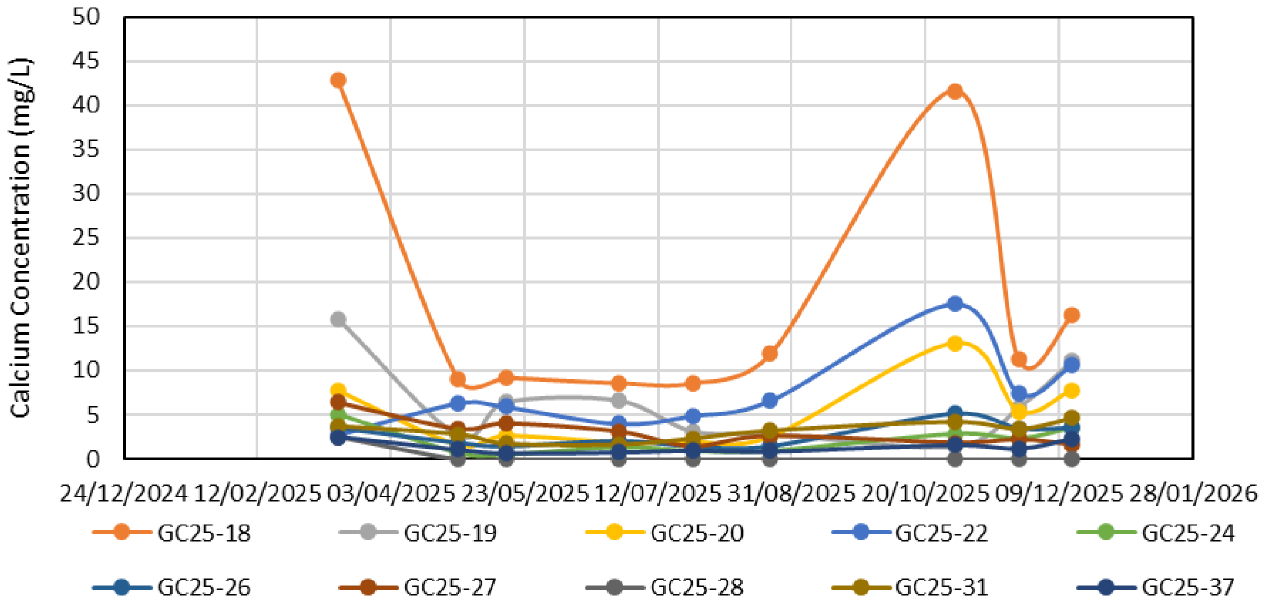
The cadmium concentration in kinetic cell leachate showed exceedance of the EPA aquatic standard for cadmium (0.002 mg/L) at the beginning of the kinetic cell life (February to June). However, the concentration of cadmium in most kinetic cells subsequently dropped to below the detection limit (0.0004 mg/L). Leachate from GC25-20 and from GC25-37 continues to show periodic exceedances of the standard, as shown in Figure 9.11.

FIGURE 9.11 CADMIUM CONCENTRATIONS IN KINETIC CELL LEACHATE



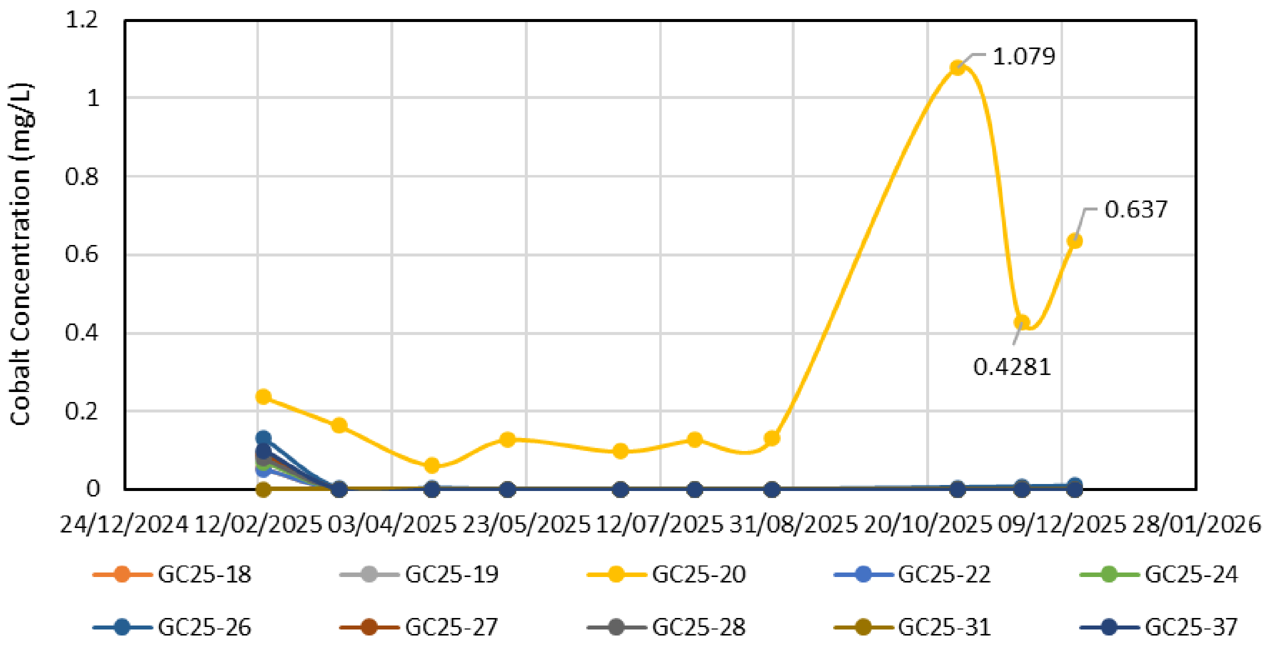
Calcium was not analysed in the first testing round (2/14/2025). Leachate from most kinetic cells indicate levels of calcium between 0 to 5 mg/L. The leachate from GC25-18 shows consistently elevated levels of calcium relative to the other kinetic cells in the range of 8 to 45 mg/L. This is consistent with the high neutralisation potential present in this sample, and likely indicates that the calcium-containing, acid-neutralising minerals in the rock of GC25-18 are dissolving into solution upon contact with rainwater. These results are presented in Figure 9.12.

FIGURE 9.12 CALCIUM CONCENTRATIONS IN KINETIC CELL LEACHATE



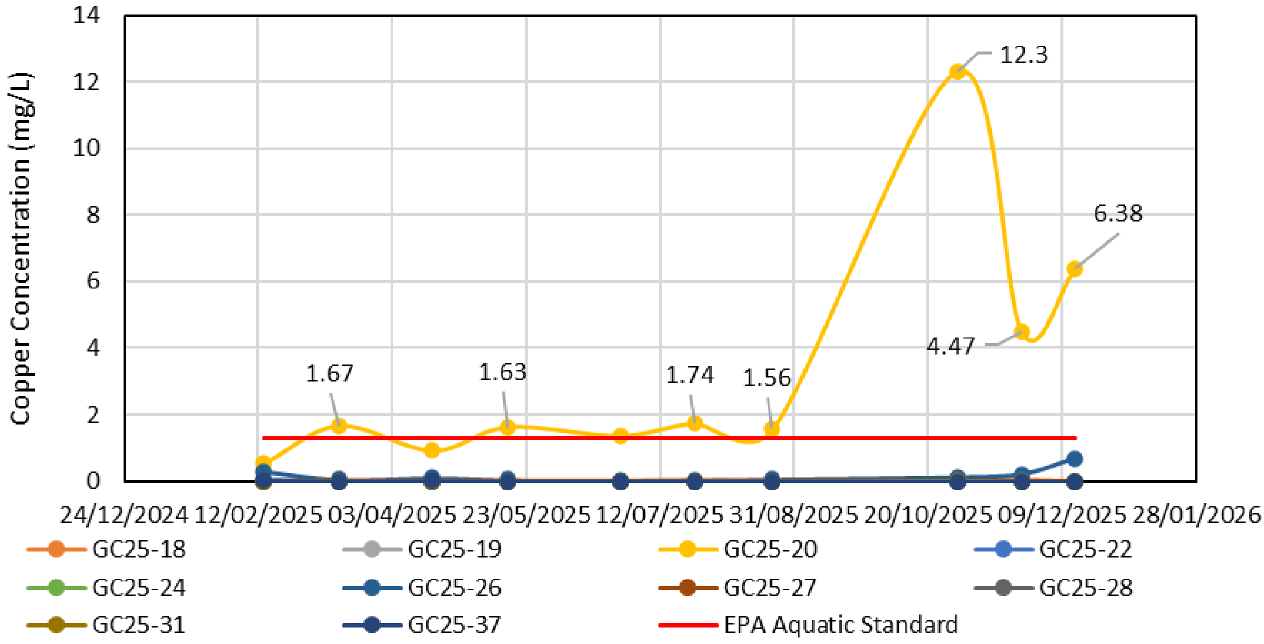
The cobalt concentration in kinetic cell leachate has, for most kinetic cells, remained below 0.1 mg/L. However, leachate from GC25-20 shows consistent cobalt leaching in the range of 0.1 to 0.2 mg/L, as well as periodic increases in cobalt, especially during the dry season, up to 1.079mg/L, as shown in Figure 9.13.

FIGURE 9.13 COBALT CONCENTRATIONS IN KINETIC CELL LEACHATE



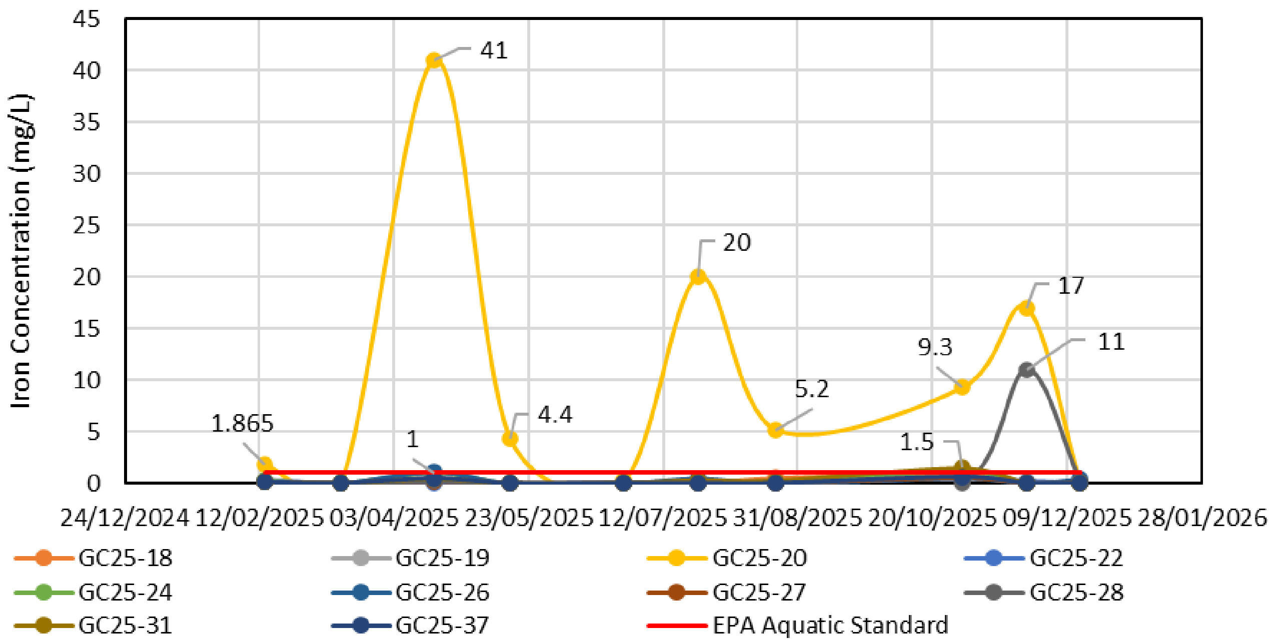
The copper concentration in kinetic cell leachate remained below the EPA aquatic standard for copper (1.3 mg/L) for most samples. However, leachate from GC25-20 showed periodic exceedances of the standard, up to a high of 12.3 mg/L on 10/31/2025.

FIGURE 9.14 COPPER CONCENTRATIONS IN KINETIC CELL LEACHATE



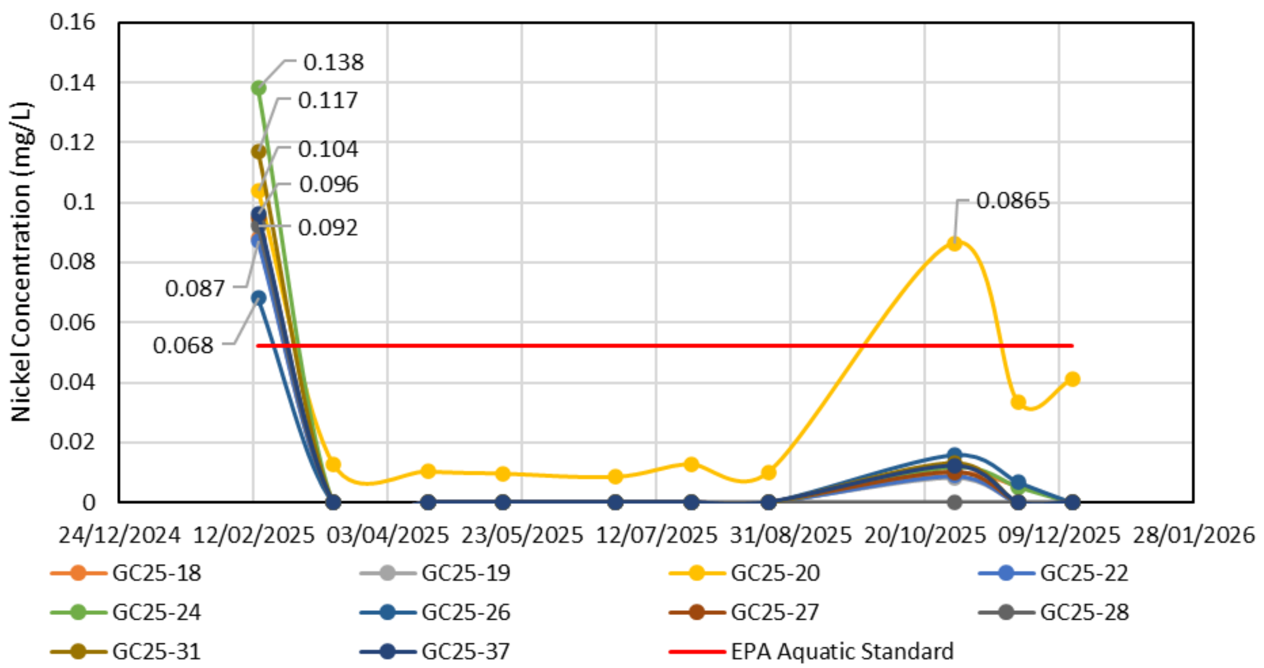
The iron concentration in kinetic cell leachate has remained below the EPA aquatic standard for iron (1 mg/L) for most kinetic cells. However, leachate from GC25-20 showed periodic exceedances of the standard, up to a high of 41 mg/L on 4/25/2025. The magnitude of the exceedance appears to increase in the dry seasons and closely follows the same exceedance pattern observed in GC25-20 aluminium concentrations (Figure 9.9). Additionally, cell GC25-27 shows an exceedance of the iron standard on 10/31/2025 and GC25-28 shows an exceedance of the iron standard on 11/24/2025. These results are presented in Figure 9.15.

FIGURE 9.15 IRON CONCENTRATIONS IN KINETIC CELL LEACHATE



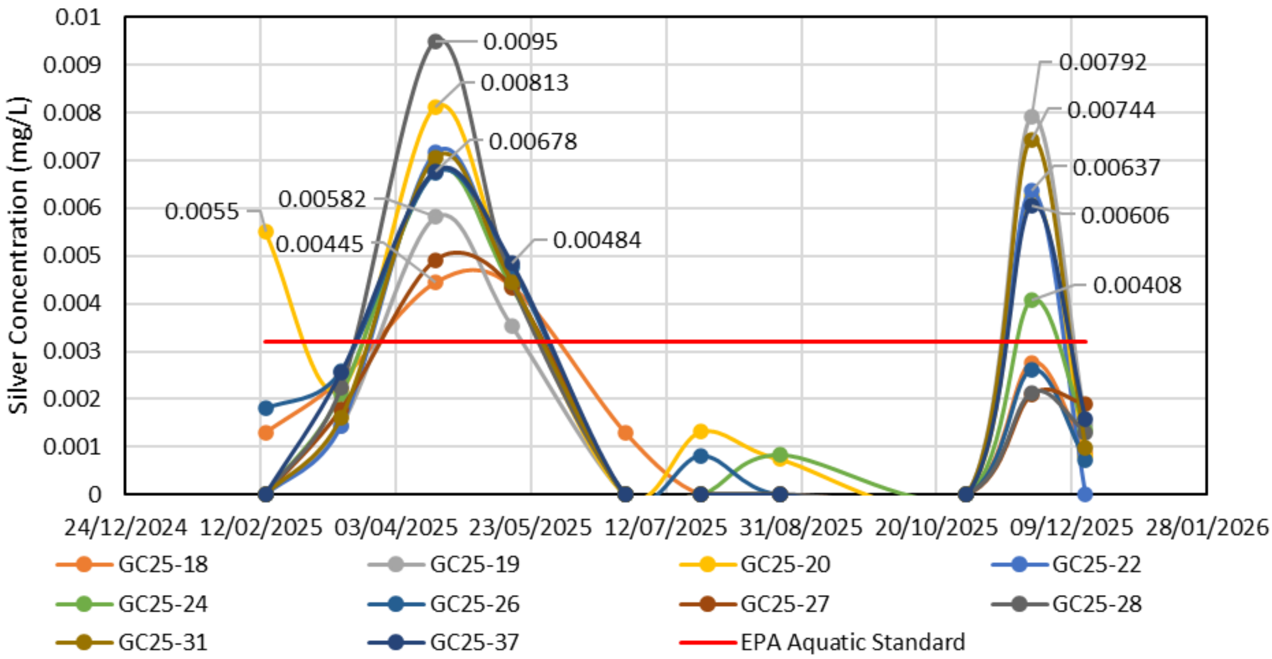
The nickel concentration in kinetic cell leachate showed exceedance of the EPA aquatic standard for nickel (0.052 mg/L) in the first testing cycle for all kinetic cells. However, the concentration of nickel in most kinetic cells subsequently dropped to below the detection limit (0.005 mg/L), with the exception of GC25-20, which has been testing below the EPA standard with the exception of 10/31/2025. These results are presented in Figure 9.16.

FIGURE 9.16 NICKEL CONCENTRATIONS IN KINETIC CELL LEACHATE



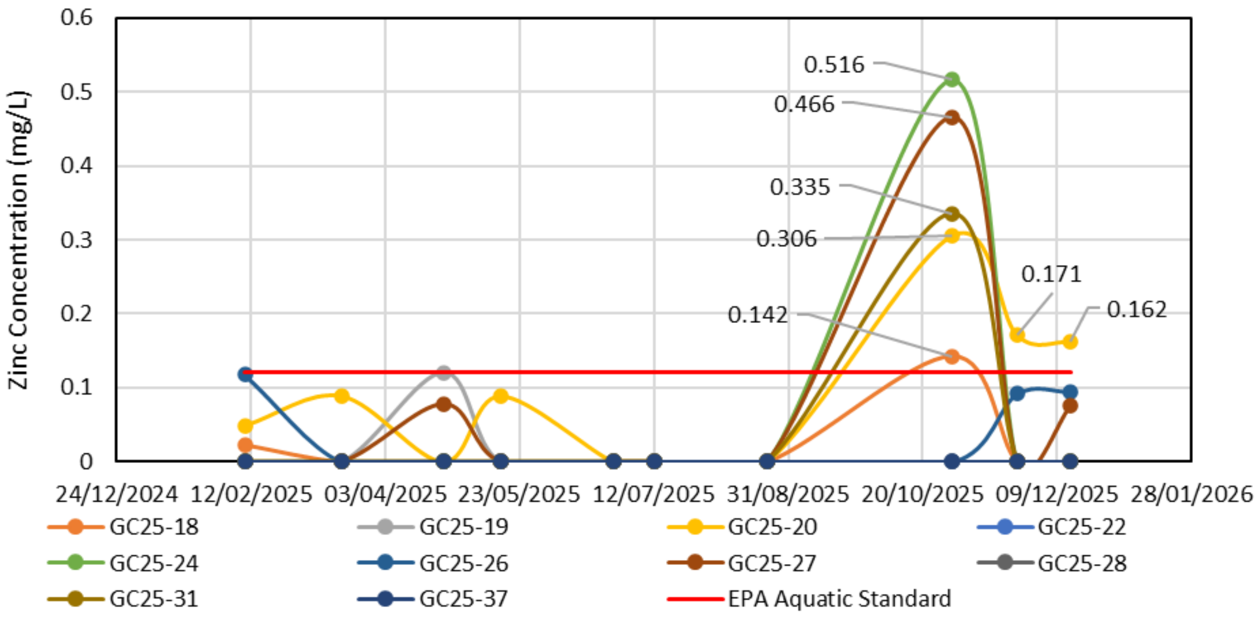
The silver concentration in kinetic cell leachate showed exceedance of the EPA aquatic standard for silver (0.0032 mg/L) for all cells at the beginning of the first wet season (April to June) up to 0.0095mg/L and again for five cells at the beginning of the second wet season (November) up to 0.0079mg/L. In the time before, between, and after the dry seasons, the concentration of silver in most kinetic cells was near or below detection limit (0.001 mg/L). These results are presented in Figure 9.17.

FIGURE 9.17 SILVER CONCENTRATIONS IN KINETIC CELL LEACHATE



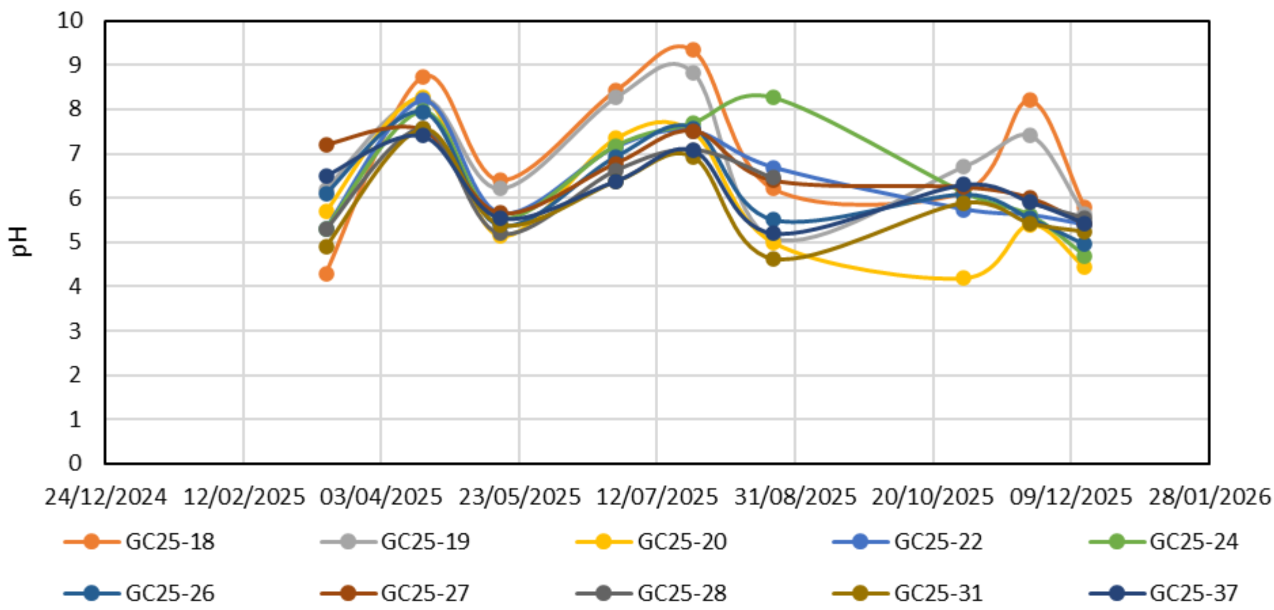
Zinc concentrations in the kinetic cell leachate have been below the EPA aquatic standard for zinc (0.12 mg/L) for the entirety of the testing period until 10/31/2025, when leachate from five cells (GC25-18, GC25-20, GC25-24, GC25-27, and GC25-31) tested above the standard at up to 0.516 mg/L. Although the zinc leachate concentration decreased to below standards for four of the cells in November, the leachate from GC25-20 continued to exhibit concentrations of zinc above the EPA standard in both November and December. These results are presented in Figure 9.18.

FIGURE 9.18 ZINC CONCENTRATIONS IN KINETIC CELL LEACHATE



The pH of the kinetic cell leachate, as measured by the lab (Figure 9.19), shows similar trends and fluctuations noted by onsite measurements (Figure 9.5). In general, the pH of the leachate remains between 5 and 9, with the exception of leachate from cell GC25-20 which periodically has a pH level of around 4.5, and leachate from cell GC25-18 which periodically has leachate with a pH above 9, due to the abundance of neutralising material present in the rock as presented for calcium concentrations in Figure 9.12.

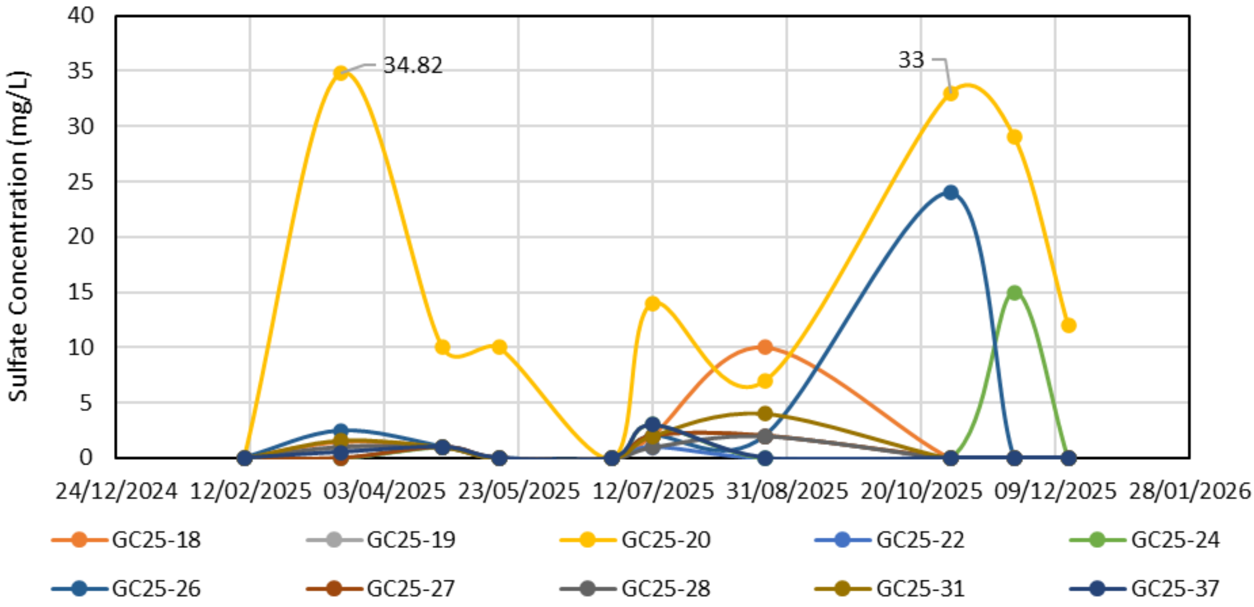
FIGURE 9.19 KINETIC CELL LEACHATE PH, LAB MEASURED



The majority of kinetic cells had sulfate concentrations in the range of 1-10 mg/L for the duration of the testing period. Sulfate levels were highest in the leachate of GC25-20, at 34.82

mg/L, however these are significantly below the IFC sulfate standards of 250 mg/L (International Finance Corporation (IFC), 2007). These results are presented in Figure 9.20.

FIGURE 9.20 SULFATE CONCENTRATIONS IN KINETIC CELL LEACHATE



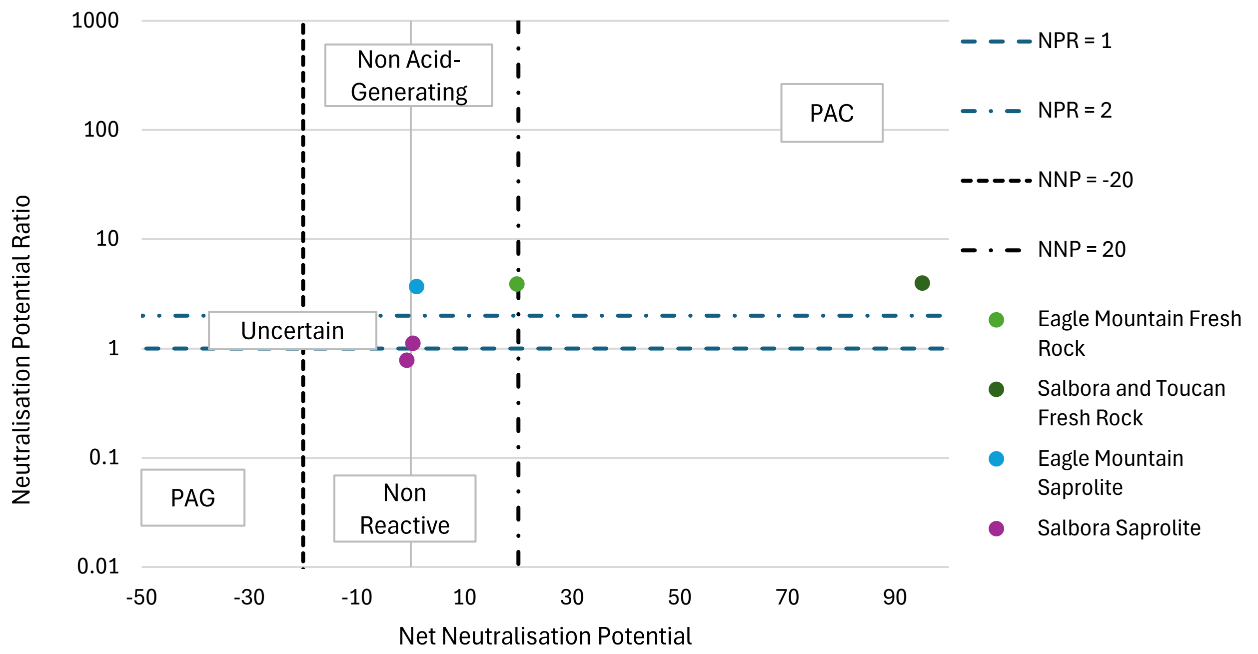
9.3.2 TAILINGS RESULTS

This section presents the results of environmental testing performed on representative tailings samples, including solids and supernatant, collected after gold extraction and cyanide detoxification of samples from the principal mineralised zones.

9.3.2.1 ACID-BASE ACCOUNTING

Acid base accounting (ABA) was performed by modified Sobek methods. The samples have a paste pH between 8.09 and 8.56, with a total sulphur content between 0.058% and 1.14%, and sulphide between 0.01% and 1.02%. The NNP vs NPR is plotted below in Figure 9.21.

FIGURE 9.21 ABA PLOT OF TAILINGS TEST RESULTS

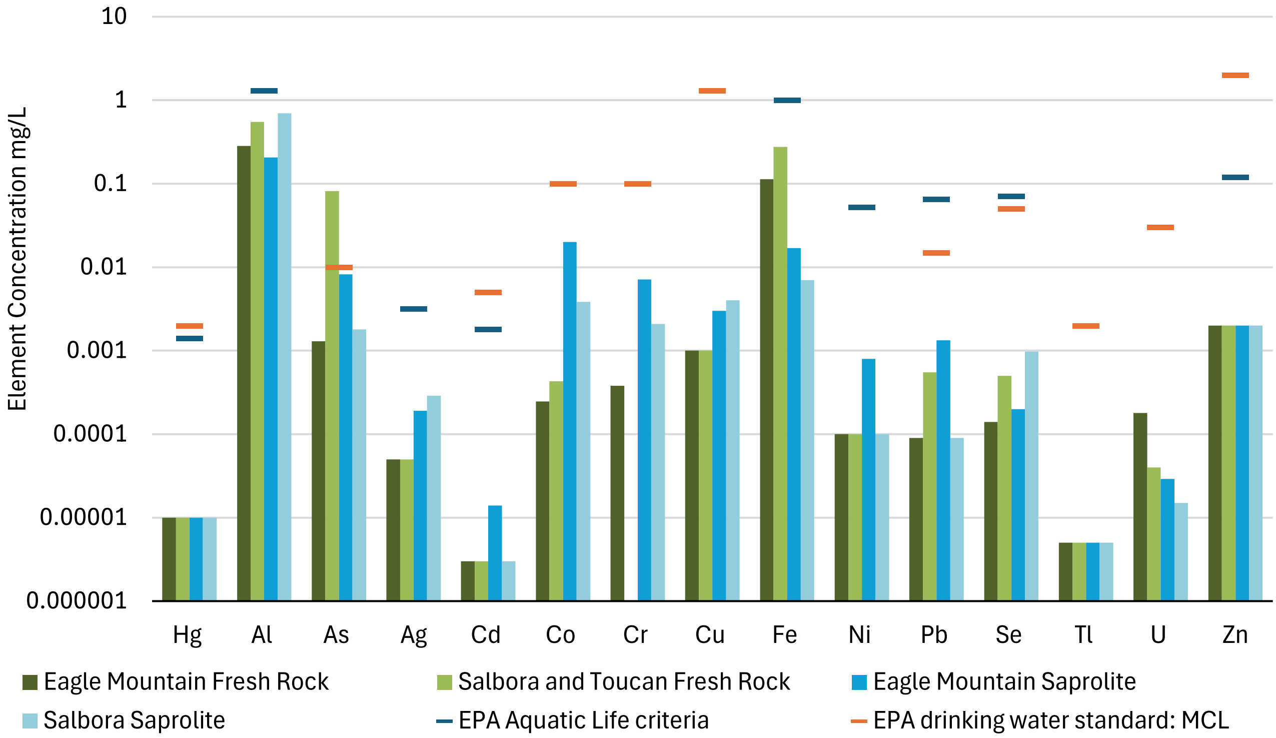


All saprolite tailings samples are barren of both acid generating and acid consuming material, testing as either non-acid-generating or uncertain. The fresh rock tailings sample from the Eagle Mountain area is on the border between non-acid-generating and potentially acid consuming, and the fresh rock tailings samples from the Salbora and Toucan areas tests as potentially acid consuming. This indicates that, although sulphides are present, there is sufficient neutralisation potential present in the fresh rock tailings samples to buffer the acid generated.

9.3.2.2 SPLP

The solids were leached with pH 5 water. The resulting leachate was analysed. All four sample SPLP results have been received, although chromium was not tested in the Salbora and Toucan fresh rock. Final SPLP leachate pH of the samples ranged from 9.13 to 9.83. Cyanide was minimal in the saprolite tailings samples from the Eagle Mountain and Salbora areas (<0.01 mg/L, and 0.05 mg/L, respectively) but found at 0.16 mg/L in the leachate from the Eagle Mountain area fresh rock and at 0.80 mg/L in the leachate from Salbora and Toucan fresh rock. WAD cyanide was uniformly <0.01 mg/L for all samples. The concentrations of elements that commonly impact water quality standards in comparison to U.S. EPA freshwater and drinking water standards are presented in Figure 9.22. This comparison is for reference purposes only. Unlike the waste rock SPLP tests, the tailings residue and supernatant were generated under conditions that reflect those used in the process plan, including the pulp density.

FIGURE 9.22 CONCENTRATIONS OF ELEMENTS IN TAILINGS SPLP LEACHATE



The SPLP leachate from Salbora and Toucan fresh rock tailings has an exceedance of U.S. EPA drinking water reference value for arsenic. All other SPLP leachate do not exceed reference values for any elements.

9.3.2.3 SUPERNATANT

Combined filtrate from each of the tailings samples was analysed. Solution pH was 7.71 in the filtrate from Eagle Mountain saprolite, 8.24 in the filtrate from Eagle Mountain fresh rock, 8.61 in the filtrate from Salbora and Toucan fresh rock and 8.9 in the filtrate from Salbora saprolite. Sulphate concentrations ranged from 2100 mg/L in the saprolite samples to 4000 mg/L in the filtrate from Eagle Mountain fresh rock. Nitrate was found in significant amounts in the filtrate from the Eagle Mountain saprolite and Salbora saprolite (3.24 mg/L and 1.14 mg/L, respectively). Ammonia species were found in the filtrate of all four samples in the 1-7 mg/L range. Figure 4-3 presents the filtrate concentrations of elements that commonly impact water quality standards in comparison to U.S. EPA freshwater and drinking water standards. This comparison is for reference purposes only and cannot be extended directly to the long-term composition of mine discharge associated with a tailings storage facility.

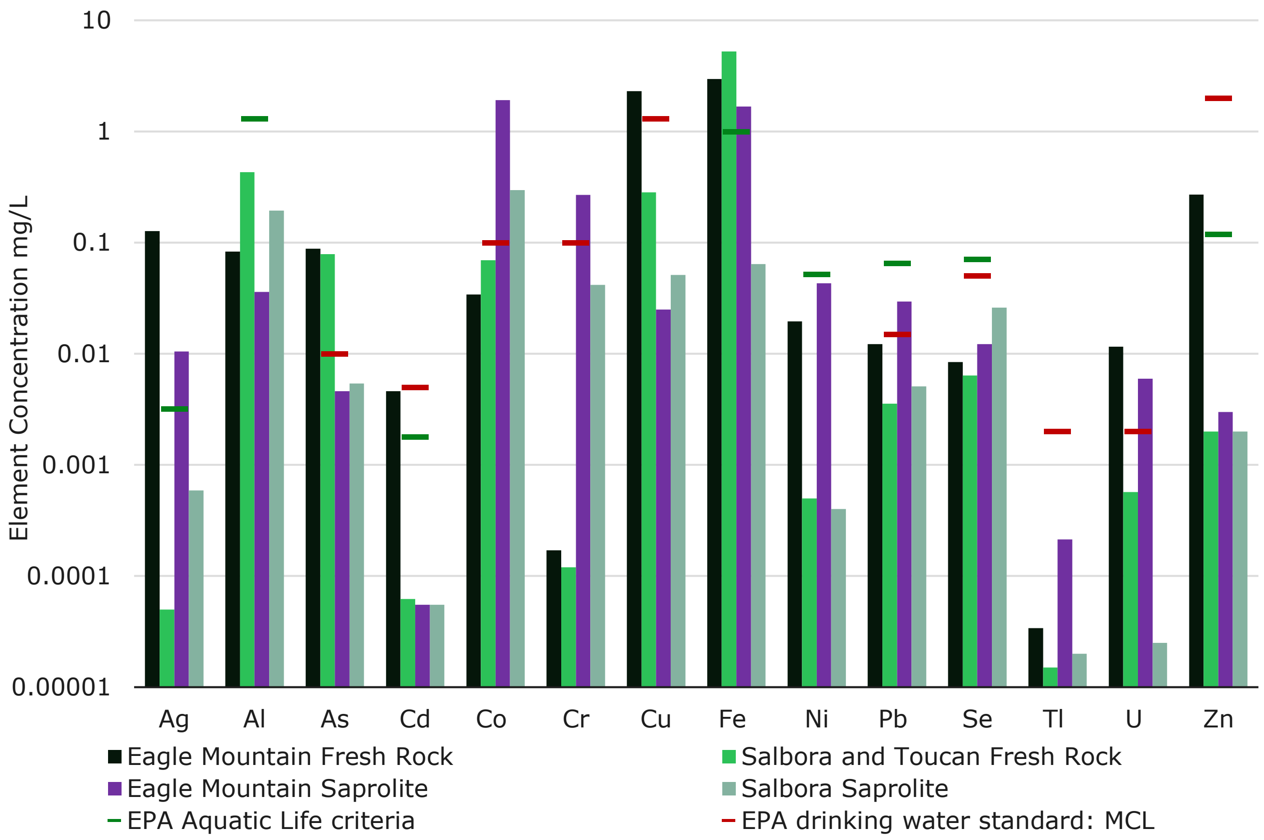
9.4 CONCLUSIONS

Tested rock shows minimal ARD risk, with only one of 50 samples displaying PAG. Two-fifths of the samples are non-acid-generating, and 19 samples are potentially acid consuming. Total sulfur in the rock ranges from 0.006% to 1.9%, with an average of 0.251%. Whole rock analysis shows considerable presence of NP-contributing calcium and magnesium minerals in fresh and transition rock that have the capability to buffer acid produced by sulfate mineral oxidation. The circum-neutral to basic SPLP leachate pH and maximum of 40 mg/L sulfate concentrations in leachate support the conclusion that minimal sulfides and abundant NP is present in most rock. Additionally, results from the kinetic cells through to the December 2025 show that most leachate pH is above rainwater pH and in the 6-8 range, with the exception of GC25-20 (transition material from Salbora which is relatively small in overall volume) which has leachate at or below rainwater pH in the 4.5-5.5 range, and shows some signs of mild sulfate mineral oxidation. Even in this cell, maximum sulfate levels are only around 35 mg/L, which indicates there is no realised ARD. Electrical conductivity appears to increase as the total volume of leachate decreases in the dry season due to less rainfall. Dissolved oxygen appears to be near or at full saturation capacity for most cells.

Tested waste rock is minimally enriched in metals, with average concentrations of 50 samples above 5x crustal abundance for six elements: silver, arsenic, bismuth, molybdenum, and selenium. SPLP results show some metal exceedances of U.S. EPA fresh water and drinking water guidelines for three samples, but when all results are taken as an average, the resulting leachate is below all reference values. Metal concentrations are of consistent concern in the leachate from cell GC25-20 (transition material from Salbora, which is a rare rock type on site). Aluminium, arsenic, cadmium, copper, cobalt, and iron are consistently found at levels exceeding EPA water quality reference values. Exceedances are especially magnified at the transitions between dry and wet seasons. Leachate from this cell also showed occasional exceedance of nickel, silver, and zinc water quality standards, usually at the transition between dry and wet seasons. Other cells show a similar pattern of increased metals in leachate at the transition between dry and wet season, particularly for silver and cadmium, where there are some exceedances of the U.S. EPA water quality reference values. However, unlike the leachate from cell GC25-20, the metals concentration in the leachate from the remaining cells reliably decreases to significantly below reference values during the wet months. This trend indicates that dilution plays an important role in maintaining low levels of metals in contact water. Onsite kinetic cells should continue to be monitored through 2026, particularly those with anomalous metals concentrations in leachate.

Tailings results indicate that saprolite tailings products are likely to be inert, while tailings from Eagle Mountain fresh rock are non-acid generating or potentially acid consuming. The received results indicate that some metals (including silver, arsenic, cobalt, chromium, copper, iron, lead, uranium, and zinc) in tailings filtrate are elevated above U.S. EPA fresh water and/or drinking water reference values (Figure 9.23). Sulphate in the filtrate is in the range of 2000-4000 mg/L, with WAD cyanide at 0.01 mg/L and total cyanide in the 2-6 mg/L range. Less elevated metals are seen in the SPLP test leachate than in the filtrate, with only one exceedance of reference values for arsenic in SPLP leachate from Salbora and Toucan fresh rock.

FIGURE 9.23 CONCENTRATIONS OF ELEMENTS IN TAILINGS FILTRATE



Metal concentrations in the filtrate are higher than in the SPLP tests. Filtrate samples from Eagle Mountain fresh rock tailings exceed U.S. EPA freshwater and drinking water reference values for silver, arsenic, copper, iron, uranium, and zinc. Filtrate from Eagle Mountain saprolite tailings exceeds reference values for silver, cobalt, chromium, iron, lead, and uranium. The filtrate from Salbora and Toucan saprolite tailings exceed reference values for arsenic and iron, and filtrate from Salbora saprolite exceeds reference values for cobalt.

10. BIOLOGICAL RESOURCES

The biological baseline evaluation conducted between 2013 and 2021 aimed to comprehensively assess the major taxonomic groups and habitats within the Study Area. These included vegetation, Lepidoptera (butterflies), and other invertebrates, fish, mammals, birds, amphibians, and reptiles. These biological resources were categorised into aquatic and terrestrial sub-groups.

One of the primary objectives of this study was to identify any critical habitat and sensitive species withing the Study Area. Critical habitats are a subset of modified and natural habitats with high biodiversity value including *"(i) habitat of significant importance to Critically Endangered and/or Endangered species; (ii) habitat of significant importance to endemic and/or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes"* as defined by the International Finance Corporation (IFC 2012)[1].

Sensitive species include:

- Threatened species – species categorised as critically endangered, endangered or vulnerable according to the International Union for Conservation of Nature (IUCN) Red List of Threatened Species (IUCN, 2021-3)[2]; this also includes species identified with varying levels of trade restrictions under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) Appendices.
- Rare species – endemic[3] and locally rare species, and species that may not be listed under IUCN Red List of Threatened Species but are threatened or likely to become threatened in the region; and
- Migratory species – defined by the United Nations (UN) Convention on the Conservation of Migratory Species of Wild Animals as "*the entire population or any geographically separate part of the population of any species or lower taxon of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries"* (IUCN SSC, 2021).

Guyana's biodiversity is of global significance, giving rise to ecological integrity, climate regulation, water purification, and sustainable livelihoods through such activities as ecotourism (WWF 2021, WWF 2012b). Situated in the Guiana Shield and belonging to the Amazon biome, Guyana possesses some of the greatest species diversity in the world, with 1,673 arthropods, 467 fishes, over 8,000 plants, 225 mammals, 814 birds, 130 amphibians, and 179 reptiles, with many more species yet to be found (EPA, 2014). The intricate waterbodies in Guyana, such as the Essequibo, Mazaruni, and Berbice rivers sustain diverse terrestrial and freshwater ecosystems (Netzer et al., 2014). These diverse flora and fauna species render crucial ecological services, particularly aquatic and terrestrial ecosystems.

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[1] IFC Performance Standards (2012). Available Online at: 2012-ifc-performance-standards-en.pdf

[2] IUCN (2021-3). Red List of Threatened Species. Available Online at: IUCN Red List of Threatened Species

[3] Species defined as restricted-range, which refers to a limited extent of occurrence (EOO) for a particular species by IFC (2019). PS6 GN6. Available Online at: International Finance Corporation's Guidance Note 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources

10.1 BASELINE METHODOLOGY

The biodiversity baseline for the Study Area was established through a combination of desktop research and four in-field surveys conducted between 2013 and 2021 by Environmental Management Consultants Inc. (EMC). This methodology aimed to comprehensively assess the presence and distribution of key species and habitats within the study area.

Field Survey dates are summarised below:

- 2013 wet season survey - May 29 to June 9
- 2013 dry season survey - September 3 to 14
- 2021 wet season survey - July 12 to 25
- 2021 dry season survey 2021 - October 4 to 16

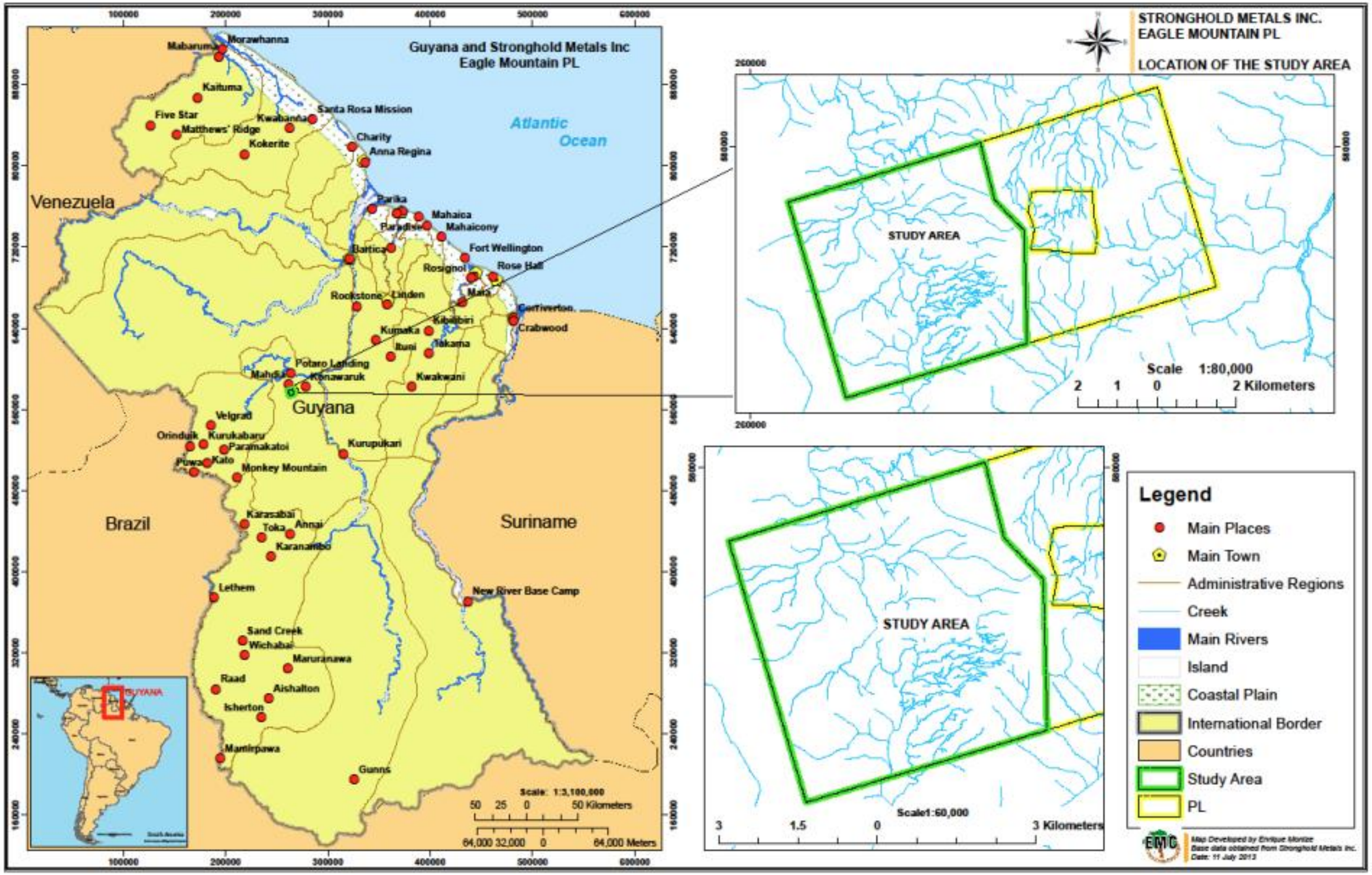
10.1.1 DESKTOP REVIEW AND SURVEY DESIGN

A comprehensive review of key information and documents, including the Integrated Biodiversity Assessment (IBAT) Performance Standards 6, Checklists of Fauna, International Union for Conservation of Nature (IUCN) Red List, and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), were used to assess potential species presence within the Study Area, and evaluate those that may be identified by their special status Faunal species checklists and resources such as the FAO Global Forest Resources Assessment, BirdLife International website, and Amphibians and Reptiles of Guyana aided in species verification. Insights from the Reunion Gold Oko West Project ESIA were also incorporated as a key reference and guidance document during the process of writing, ensuring that the methods and best practices outlined within the ESIA informed the development of this EIA (Oko West Gold Mine EIA, 2025). Guided by EPA guidelines and IFC PS 6, the survey was designed to assess spatial variations in biodiversity. Survey sampling locations for all taxa were established based on forest/vegetation types, hydrology, topography, and habitat disturbance levels within the Study Area.

10.1.2 DEFINING THE AREA OF INFLUENCE

The project area is located in the Potaro Mining District, eight kilometres south of Mahdia. As part of the Guiana Shield, it is known for its vast highland forests, abundant biodiversity, and important river systems, such as the Potaro and Siparuni Rivers, which are essential tributaries of the Essequibo. Stronghold Guyana have identified an area of focus within the Eagle Mountain Prospecting License (EMPL), which they plan to develop into a mine. The EMPL, depicted in Figure 10.1, covers approximately 5000 hectares within which a smaller focus area, designated as the study area, has been identified for mine development. Baseline studies completed in 2013 and 2021 were focused on the study area in the western EMPL, marked by the green border in Figure 10.1. The remaining area in the eastern location (yellow border) of the EMPL was assessed through a walkover assessment in 2025.

FIGURE 10.1 LOCATION OF EAGLE MOUNTAIN PROPERTY AND STUDY AREA



Source: EMC 2021

The figure also depicted several waterways including the Mahdia River and Minnehaha Creek, which serve as the main drainage for the study area, and crossed by several small, shallow, and sometimes seasonal streams. The area has been heavily disturbed, particularly along the Mahdia River and nearby roads, where small-scale gold mining has caused significant deforestation. Six transects within the area of influence were identified to be surveyed during the biodiversity assessment. The specific survey techniques employed at each transect and plot are described in Section 10.1.5. The location for the fauna transects and number of plots for the flora transects are highlighted in Figure 10.1 and Table 10.2.

TABLE 10.1 NUMBER OF PLOTS AND SUB-PLOTS PER TRANSECT IN 2013 AND 2021

2013			**2021**		
Transect	**Plots**	**Sub-plots**	**Transect**	**Plots**	**Sub-plots**
1	13	3	1	9	4
2	11	3	2	9	3
3	8	3	3	9	5
4	9	1	4	8	2
5	10	2	5	7	2
6	4	1	6	7	3

TABLE 10.2 LOCATION AND DESCRIPTION OF FAUNA TRANSECTS

Transect	GPS Coordinates and Elevation	Habitat Description
T1	21 N 0266126 0576719, Elev. 573m 21 N 0265638 0576147, Elev. 368m 21 N 0265496 0576226, Elev. 344m	Transects include areas of mixed forests (mostly undisturbed but with some disturbed forest) on rocky and brown sands/loam soils. Transect runs from access road at high elevations on Eagle Mountain to base of mountain. Crosses small access lines, drill pads, the creek at the main campsite, sections of Minnehaha Creek, and part of the main access road to Minnehaha.
T2	21 N 0263513 0574829, Elev. 350m 21 N 0264077 0574961, Elev. 352m 21 N 0264025 0574942, Elev. 352m	Includes areas of intact mixed forest and disturbed forest on rocky and brown sands/loam soils. Transects run from road behind campsite to main access road and includes areas of open shrub, grassland and creeks.
T3	21 N 0263500 0578083, Elev. 127m 21 N 0264195 0576176, Elev. 105m 21 N 0263589 0577567, Elev. 127m 21 N 0263476 0578018, Elev. 90m	Includes sections of mixed forests with primary and secondary growth. Runs from the end of T2 to the main road along forest trails through a small area of savannah-like habitat.
T4	21 N 0263812 0577232, Elev.97m	Includes approximately 1.2 km of secondary road characterised by mixed forest, drill pads, flooded pools, and a section of the main road with secondary forest bisected by several fast-flowing creeks. Sampling areas also included

Transect	GPS Coordinates and Elevation	Habitat Description
		Marshall's Farming area, with rocky, red loam and sandy soils
T5	21 N 0263497 0578240, Elev.100m 21 N 0264735 0578253, Elev.136m	Includes lower elevations of study area, a fast-flowing clearwater creek (the Mahdia Town water source), a forested trail running to the top of the creek's waterfall, and the access road to the water source. Transect is characterised by primary and secondary vegetation and an open reclaimed mined area.
T6	21 N 0262831 0578805, Elev.70m 21 N 0262948 0578848, Elev.74m 21 N 0263414 0578830, Elev.153m 21 N 0263201 0578891, Elev.104m	Includes a small access road with secondary vegetation leading to Mahdia Creek, reclaimed mining areas, active mining areas, and a section of main road running to end of property and continuing for about 800 m out of the property, with mixed lowland forests, on red loam, rocks, clay soils.

10.1.3 GROUND TRUTHING AND TERRESTRIAL WALKOVER SURVEY

In 2025, ERM conducted ground truthing and a wet season terrestrial walkover reconnaissance survey following the methodology of opportunistic, visual and acoustic observations and habitat assessment to validate the assessment conducted in 2021. This included a collection of eDNA samples and ground truthing to confirm that the previous analysis and the condition of the ecosystem on site is unchanged in the western portion of the EMPL. This aimed to validate if the baseline data collected in 2021 is still relevant and document any significant changes in the ecosystem and habitat conditions. A reconnaissance wet and dry season survey was conducted in the eastern portion of the EMPL to assess the ecosystem condition, habitats and biodiversity composition.

10.1.4 EDNA ANALYSIS

Environmental DNA (eDNA) was used alongside traditional biodiversity survey methods in the Project Area to assess vertebrate and invertebrate species diversity. This approach involved extracting genetic material from environmental samples, such as water. eDNA analysis is cost-effective and valuable for monitoring biodiversity and studying population dynamics, including elusive species (Sahu et al. 2023, Thomsen et al. 2012). Operational Taxonomic Units (OTUs) classify genetically similar individuals based on DNA sequencing (Blaxter et al. 2005, Mächler 2021), facilitating analysis and interpretation of collected eDNA. eDNA analysis was done in 2025 to supplement the data collected in 2021. In the western EMPL, 12 eDNA samples were collected at several surface water sampling points and an additional six (6) samples were collected for analysis in the eastern EMPL during the reconnaissance effort during both the wet and dry seasons.

10.1.5 FIELD METHODOLOGY

10.1.5.1 FLORA

A modified stratified-random sampling design was used, with six west-east transects laid out across the study area, aligned to existing drill lines (roughly following a 73° grid bearing) and avoiding zones of complete vegetation clearance, which were identified via satellite imagery. Along each transect, 100 metres × 20 metres plots were established every 300 metres, with additional 5 metres × 5 metres sub-plots set roughly every 650 metres. The transect lines were marked with numbered tape, and the spacing between transects was checked at 100-meter intervals, with the starting points documented. The same six transects surveyed in 2013 were revisited in 2021, although some plots and sub-plots had to be relocated due to inaccessibility.

In the main plots, all woody plants (dicot trees, palms, lianas) with a diameter at breast height (DBH) of at least 10 centimetres were counted and identified. Sub-plots included all smaller trees and lianas, as well as flowering plants (such as shrubs, heliconia, bromeliads, and aroids) and ferns. Woody plants were categorised by size (poles: 5-14 centimetres DBH, saplings: less than 5 cm DBH but taller than 1 meter, and seedlings: less than 1 meter tall), and disturbance and soil type were also recorded.

For the 2025 walkover survey, transects were walked systematically across the western and eastern EMPL to ensure adequate visual coverage of all habitat types. The team proceeded at a slow pace, making frequent stops to observe and document dominant plant species, habitat conditions, and any notable or protected flora. Target notes were taken for specific areas of interest, including ecologically significant features, signs of recent disturbance, and the condition of various vegetation zones. This sample plot taken during this survey can be shown in Table 10.3.

TABLE 10.3 FLORA SAMPLE PLOTS FOR THE 2025 TERRESTRIAL WALKOVER SURVEY

Terrestrial Sample Plot	GPS Location
T1	21 N 0262844 0578813 Western EMPL
T2	21 N 0264694 0578222 Western EMPL
T3	21 N 0262844 0578813 Western EMPL
T4	21 N 0263642 0577157 Western EMPL
T5	21 N 0267815 0578114 Eastern EMPL
T6	21 N 0267732 0577720 Eastern EMPL
T7	21 N 0267628 0578519 Eastern EMPL
T8	21 N 0266900 0579044 Eastern EMPL
T9	21 N 0267364 0576281 Eastern EMPL
T10	21 N 0267019 0576022 Eastern EMPL

10.1.5.2 MAMMALS

Non-Volant Mammals

The following methods were utilised to assess the non-volant mammal fauna at transects:

Visual encounter surveys (for animal presence/ or signs of presence) were conducted in the morning (approx. 07:00 hrs – 10:30 hrs) as well as at night (approx. 19:00 hrs – 23:00 hrs) to document diurnal and nocturnal mammals. Transects T2 through T6 were each surveyed over two days, while Transect one, which featured more diverse habitats, was surveyed for three days. Mammal presence was recorded through direct observations as well as indirect evidence such as tracks, droppings, prey remains, burrows, markings, and scent.

In 2021, additional methods were used: ten Sherman traps baited with sunflower seeds and sardines were placed for eight days near transect T1 at the main campsite, though traps were not used at all sites due to logistical constraints. Also, three camera traps were deployed—one at T2 and two at T1 (one at the forest edge and one at the campsite by the garbage pit)—each operating for six days.

Additionally, interviews were conducted with Stronghold staff who had at least two years of experience in the area to further document the mammal fauna of the study area. Interviews were conducted by showing persons photographs of mammals of Guyana and recording whether they have been seen within the study area. Interviews are regarded as extremely useful in rapid biodiversity assessments.

For the 2025 walkover survey, the methodology was conducted along walking trails in the eastern portion of the Project Area to observe most fauna species. Surveys were performed using Acoustic and Visual Encounter Survey methods, along with opportunistic sightings. Herpetofauna was surveyed across various habitats, including swamps and old mining pits, through both diurnal and nocturnal surveys.

Microchiropteran Bats

At each of the six transects, the team set up three 12 metres × 2.6 metres and three 6 metres × 3 metres ground-level mist nets (38 millimetres mesh size nets made by Avinet, Drysden, NY, USA) arranged perpendicularly to maximise the captures of bats. Mist-nets were opened before sunset for a total of two consecutive nights at each site, as bats quickly learn to avoid them. Rain and storms often delayed or shortened survey sessions on most nights. Nets remained open for up to seven hours after sunset, aligning with peak bat activity and capture rates.

Mist-nets were checked every 30 minutes. Captured bats were identified using the field key to the bat fauna of Guianan sub region provided by Lim and Engsrom (2001) and Lopez-Baucells et al. 57 (2016) Field Guide to Amazonian Bats and released immediately at the capture site. Capture effort was measured by the total hours of net surface area deployed. Because heavy rainfall reduced capture rates early in the survey as bats can detect the mist-nets in rain, opportunistic sampling was done in likely roosting areas.

10.1.5.3 BIRDS

Bird surveys were conducted along each fauna transect using both Visual and Auditory Encounter Surveys (Point Counts) to assess species presence, distribution, and relative abundance. Many cryptic and canopy-dwelling species were confirmed through playback of recorded bird calls.

Mist-netting was also performed at all transects in a variety of microhabitats including near streams, on well-drained ground, in swampy areas, on slopes, under closed canopy, and in tree-fall gaps to maximise species capture. Six nets were placed along trails at each site, with their orientation adjusted to the diverse terrain. Captured birds were photographed, identified using field guides (Braun et al. 2000; Hilty, 2003), marked on the fifth primary feather for recapture tracking, and then released at the capture site. Each transect was surveyed over two days: visual and auditory surveys on the first day, and mist-netting on the second.

With the exception of mist netting, this methodology was adapted for the 2025 walkover survey for the eastern section of the EMPL.

10.1.5.4 AMPHIBIANS AND REPTILES

Amphibian surveys were conducted across various habitats within the study area, including lowland and upland forests, savanna-like open spaces such as old mining sites, access roads, swamps, creeks, and other water bodies linked to the natural drainage system. These sites typically featured undulating terrain with mixed forest and secondary growth in previously disturbed mining areas.

At each of the six fauna transects, three sub-sites were designated for amphibian sampling:

(a) 3–5 transects of approximately 100 meters each in forested areas

(b) transects near or around swamps, creeks, and water bodies

(c) 3–5 transects of about 100 meters in open habitats such as savannas, roads, and abandoned mining zones.

Both diurnal and nocturnal visual encounter surveys (VES) and auditory encounter surveys (AES) were performed daily along these transects to document species presence, distribution, and relative abundance. Habitat patch sampling was also carried out. Surveys following heavy rainfall targeted explosive breeders that utilise runoff for breeding and egg-laying.

Additionally, three pitfall trap stations were installed at transects T1 and T2. Previously surveyed tunnels and caves found in the areas located around the EMPL were inaccessible due to debris and safety concerns during this period. Supplementary species data were gathered through interviews with company workers, local miners, and residents. Photographs were taken of most observed species to aid identification.

In the 2025 walkover survey, the eastern portion of the EMPL was traversed on foot throughout several trails to observe and document the herpetofauna species.

10.1.5.5 FISH

Ten sites were sampled during both seasons, selected based on their location, habitat type, and ease of access. To ensure that the sites were exhaustively sampled, different fishing gears were used depending on site conditions: gillnets and hook-and-line in larger channels, and dip nets and drag nets in shallow areas. Cast nets could not be used due to shallow, rocky, or crowded conditions at all sites. All the sites were either congested or too shallow and rocky to facilitate the used of cast nets.

The following are the different sampling gears used at the different sampling sites:

- FP1 - Hook and line, gillnet, visual observation and drag seine.
- FP2 - Gillnets, hook and line, drag seine and visual observation.
- FP3 - Gillnets, hook and line, visual observation, drag seine and dip net.
- FP4 - Hook and line and visual observation.
- FP5 - Visual observation, hook and line, gillnet and drag seine.
- FP6 - Hook and line, visual observation and interview(s) with locals.
- FP7 - Drag seine and dip net.
- FP8 - Hook and line, visual observation and drag seine.
- FP9 - Hook and line, gillnet and visual observation.
- FP10 - Drag net, visual observation and dip net.

Approximately 24 hours were spent at each of the sampling sites, including the evenings and early mornings (as per Table 10.4). The following methods were used:

- Gillnets were set out based on the depth, width and velocity of the water body. In areas where gillnets were used, these nets were checked every morning at 08:00 hrs and afternoon at 17:00 hrs. Gillnets were used to target nocturnal fishes. However, according to Kirk Winemiller (Personal Communication, February 2021) the usage of drag nets targets all aquatic species found in the water body.
- Dip nets and drag seine were used at most of the sampling sites. These methods were used to capture small fish species.
- Hook and line fishing was undertaken where possible depending on the velocity of the water and the depth. Hooks were baited either using earthworms dug from the sample areas or with small fish that had been captured with dip nets and/or gillnets.
- In areas where the stream has clear/brackish water, visual encounter surveys were used to record fish that are surface oriented or dwell in shallow waters.
- Interviews were conducted with miners and employees of Stronghold who live in the area to gather information on fish commonly caught within the study area.

All the different species collected were photographed and were classified following the taxonomic classification of Watkins et al. (2004).

TABLE 10.4 LOCATIONS AND HABITAT DESCRIPTIONS OF FISH SURVEYS

Fishing Points	GPS Coordinates	Habitat Description and Elevation (m)
FP1	Start: 21N 0263582 0578145 End: 21N 0236456 0578170	Elev. 102 m. Marshall clear water creek. The site is located along the access road of the Mahdia Town water supply reservoir. Channel depth approx. 0.3m and width approx. 3.3m. Human disturbance along the bank and channel estimated to be negligible. Channel estimated to be 40% woody debris, 15% sand, 30% leaf litter, 5% pebbles, and 10% clay; whereas the bank was estimated to be 50% shrubs, 25% trees and 25% grass. No human disturbance. The weather during the sampling was sunny with little rainfall.
FP2	Start: 21N 0264089 0574963 End: 21N 0264328 0574395	Elev. 118m. Minnehaha Creek. The site is located at the southern border of Eagle Mountain property. Channel depths 0.3m at shallowest and

Fishing Points	GPS Coordinates	Habitat Description and Elevation (m)
		1.5m at deepest. Channel width approx. 3m. Channel estimated to be 20% woody debris, 20% sand, 10% leaf litter, 15% pebbles, 15% gravel and 20% silt; whereas bank estimated to be 50% shrubs, 25% trees and 25% grass. Human disturbance was high, i.e., secondary growth, domestic garbage, and mining.
FP3	Start: 21 N 0265345 End 0576687	Pond at Friendly Hill. Fishing point at access road to the existing Camp. Water murky, channel depth approx. 1.8m deep and 30m wide. Channel estimated to be 50% clay, 20% woody debris, 20% leaf litter, 5% rocks and 5% sand; whereas bank estimated to be 25% trees, 55% shrubs and 15% grass. Canopy cover was 25% and human disturbance was relatively high due to presence of exploration drilling activities.
FP4	Start 21 N 0265467 End 0576451	Turtle Pond. Fishing point is located close to the existing Camp. Channel estimated to be 10% clay, 40% woody debris, 40% leaf litter, 10% pebbles; whereas the bank was 80% trees, 10% shrubs and 10% shrubs. Human disturbance was negligible. The pond was approximately 3m wide and 0.6m deep.
FP5	Start: 21N 0264139 0576138 End: 21N 0263875 0576125	Elephant Pond. The fishing point located in the shrub area. Channel estimated to be 40% clay, 15% woody debris, 20% leaf litter, 15% sand and 10% cobbles; whereas the bank was 40% trees, 30% shrubs and 20% shrubs. Human disturbance is negligible. Pond approx. 10m wide and 1.8m deep. Length of the area sampled was 50m. The water was clear. Pond drains into a fast-flowing stream.
FP6	Start 21 N 0263476 End 0578034	Mahdia Creek. Channel here is like a murky pond, about 10m wide and >4m deep. Channel estimated to be 30% clay, 30% woody debris, 20% leaf litter and 20% leaf litter; whereas the bank was 70% trees, 10% shrubs and 20% grass. Canopy cover estimated as 75%. Human disturbance at site low.
FP7	Start: 21N 0263685 0577368 End: 21N 0263654 0577336	Elev. 103m. Unnamed creek. The channel was considered as a clear water stream about 4 ft wide and not more than 2 ft deep. The channel was estimated to be 30% clay, 30% woody debris, 10% pebbles, 10% cobbles and 20% leaf litter, while the bank was 70% trees, 10% shrubs and 20% grass. The level of canopy cover was estimated to be 95% while the level of human disturbance was negligible.
FP8	Start: 21N 0264726 0578233 End: 21N 0264339 0578342	Elev. 178m. Mahdia water supply creek. Channel shallow, rocky, with clear water. Width approx. 5m and depth from 0.3-1.5m. The channel was estimated to be 5 % wood debris, 20% sand, 10% pebbles, 10% cobbles, 55% rocks; whereas the bank was 5 % grass, 90 % trees and 5% shrubs. Human disturbance was estimated to be low to

Fishing Points	GPS Coordinates	Habitat Description and Elevation (m)
		moderate due to the presence of the water reservoir.
FP9	Start: 21N 0263574 0577638 End: 21N 0263579 0577531	Elev. 90m. Unnamed creek. The fishing point was a murky pond approx. 5m wide and 0.3-1.5m deep. The channel was estimated to be 10% woody debris, 20% sand, 20% pebbles, 50% clay; whereas the banks were estimated to be 50 % grass, 10 % trees and 40% shrubs. Human disturbance was low.
FP10	Start: 21N 0264201 0575729 End: 21 N 0264217 0575625	Elev. 138m. Minnehaha Creek. Site at the entrance of the compound. The channel estimated to be 5% clay, 10% sand, 5% silt, 10% cobbles, 5% woody debris, 5% litter and 5% pebbles and 55% rocks; whereas the bank was 20% grass, 10% shrubs and 70% trees. Canopy cover was 100% and human disturbance was high due to access road passing across creek. Channel was fast flowing and murky at some points due to heavy rainfall.

10.1.5.6 LEPIDOPTERA AND OTHER MACRO-INVERTEBRATES

Lepidoptera were sampled using baited butterfly traps (with fermented banana, plantain, beer, mango and watermelon) and butterfly nets. Captured butterflies were placed in envelopes and photographed for identification.

Terrestrial macro-invertebrates were surveyed daily along six transects using Visual Encounter Surveys (VES) and, both flying and crawling insects were caught with a long-handled sweep net, which was used randomly when insects were observed. These insects were then removed, photographed, and identified. Night sampling (between 8:30 and 11:30h and 13:30 to 16:00h) involved a light trap (with UV and white light) hung from a tree branch 1–2 meters above the ground and a white sheet to attract and collect nocturnal insects such as moths and beetles, with the trap operating for three 10-minute intervals each night: 1 hour after sunset, 2 hours after sunset and 3 hours after sunset. The light trap was designed to avoid bias in insect sampling methods and consider variables like moonlight, wind, and temperature. A white sheet behind the light provided a safe landing for flying insects, reducing escape routes.

Pitfall traps were also set along a 200 m transect to capture ground-dwelling insects which consisted of an 8 cm deep hole with a plastic container filled with water and a bit of detergent, set flush with the ground to capture insects.

For aquatic macro-invertebrates, all fishing locations were surveyed using a D-net to collect both surface and bottom-dwelling species. The net was swept against various substrates, such as rocks and wood, and the area was agitated to dislodge hidden invertebrates. The collected specimens were placed in a tray for counting, identification, and photography.

10.1.6 EDNA ANALYSIS

The eDNA samples were collected from a total of 18 streams, 12 located in the western portion and 6 in the eastern portion of the project area, per season (Figure 10.2 and Figure 10.3). A total of 36 eDNA samples were collected across both the wet and dry season surveys. The sampling sites included a mix of rivers, streams, and tributaries, all situated within the boundaries of the project's permit area. Samples were properly filled, labelled, and prepared for shipment to NatureMetrics for laboratory analysis. The general field data collected from these sampling activities is presented Table 10.6. During the wet season walkover survey in July 2025, water samples were collected from targeted locations within wetlands, ponds, and streams using sterile syringes. These samples underwent DNA extraction, purification to remove PCR inhibitors, and metabarcoding via PCR amplification with specific primers. The resulting DNA sequences were sequenced and analysed to identify and quantify species present in the sampled environments. This method was replicated in September 2025 for the dry season.

DNA sequencing data was processed using a specialised bioinformatics pipeline tailored for quality filtering, OTU clustering, and taxonomic assignment. To ensure accuracy, quality control thresholds were implemented to minimise false results. Taxonomic classification of each DNA sequence was achieved by referencing multiple authoritative databases: NCBI nucleotide (GenBank), Barcode of Life Database (BOLD), SILVA, and the NatureMetrics Database of Life. Additionally, the Global Biodiversity Information Facility (GBIF) was consulted to maintain taxonomic consistency across databases. Taxonomic assignments were finalised at the lowest feasible taxonomic level based on consistent matches across all databases. GBIF occurrence records were cross-referenced to validate species presence specifically in Guyana. Any DNA sequences that could not be identified or were misidentified, including common contaminants such as human and livestock DNA, were systematically excluded from the analysis.

TABLE 10.5 EDNA SAMPLING LOCATIONS

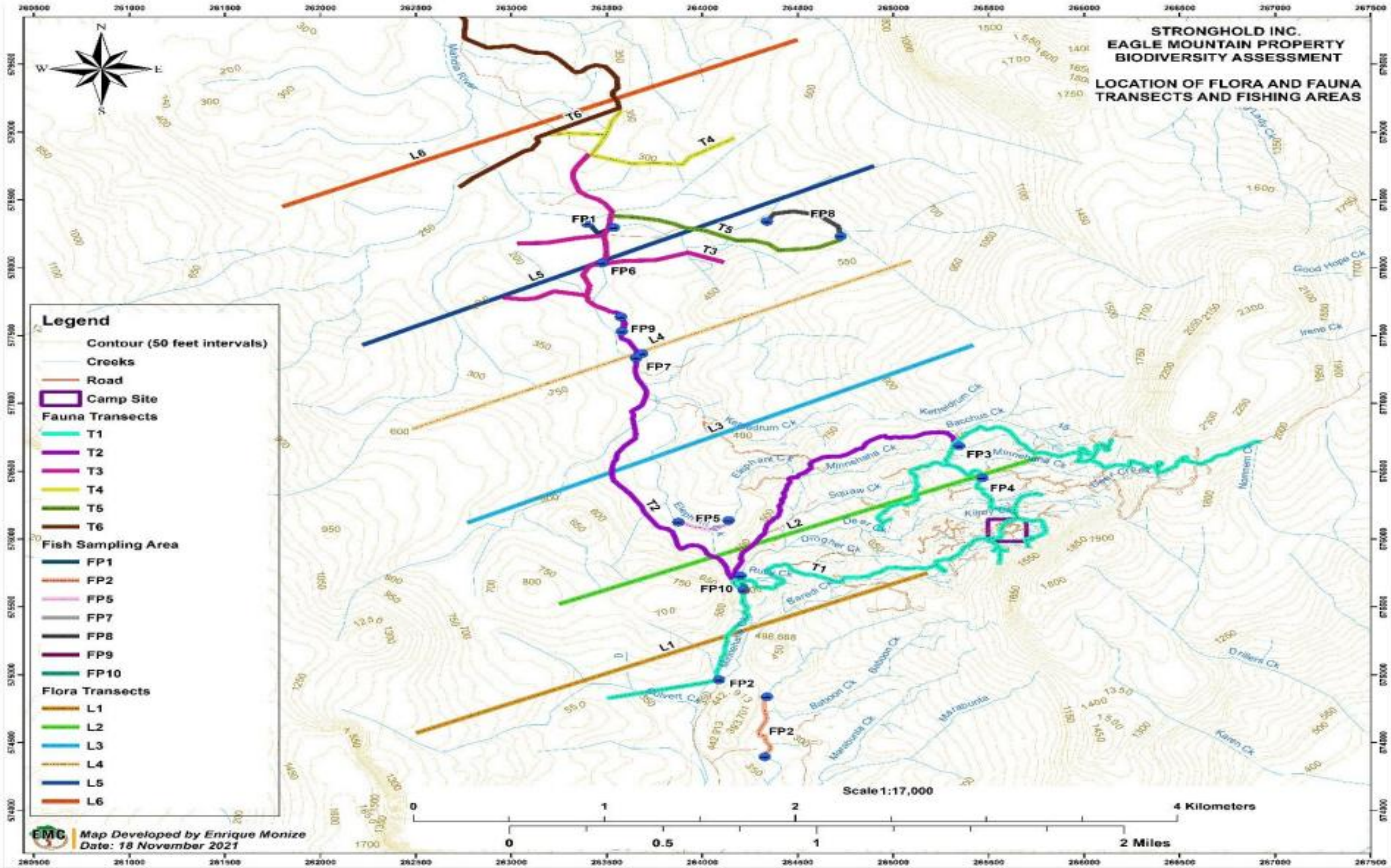
eDNA Barcodes	Sample ID	Sample Location Name	GPS Coordinates (Lat-Long)	General Location	Date Sampled
Wet Season 2025					
ASI-01-13154	Mako July 01	Deer Creek	5.208092ºN, 59.114816ºW	Western EMPL	07-07-2025
ASI-01-13155	Mako July 02	Minnehaha (guard hut)	5.201499ºN, 59.128596ºW	Western EMPL	07-07-2025
ASI-01-13156	Mako July 03	Mahdia river	5.229431ºN, 59.140930ºW	Western EMPL	08-07-2025
ASI-01-13157	Mako July 05	Mahdia water supply	5.224420ºN, 59.128596ºW	Western EMPL	08-07-2025
ASI-01-13158	Mako July 04	Waterfalls/ creek adjacent MWS	5.225860ºN, 59.127222ºW	Western EMPL	08-07-2025
ASI-01-13159	Mako July 06	North Salbora	5.222935ºN, 59.133869ºW	Western EMPL	08-07-2025
ASI-01-13160	Mako July 07	South Salbora	5.214303ºN, 59.133339ºW	Western EMPL	09-07-2025
ASI-01-13161	Mako July 08	Apollo area	5.218454ºN, 59.135701ºW	Western EMPL	09-07-2025

eDNA Barcodes	Sample ID	Sample Location Name	GPS Coordinates (Lat-Long)	General Location	Date Sampled
ASI-01-13162	Mako July 09	Minnehaha / Eldorado creek	5.194612ºN, 59.129919ºW	Western EMPL	09-07-2025
ASI-01-13163	Mako July 10	Camp creek	5.205585ºN, 59.115736ºW	Western EMPL	09-07-2025
ASI-01-13164	Mako July 11	South plot	5.202798ºN, 59.107572ºW	Eastern EMPL	09-07-2025
ASI-01-13165	Mako July 13	South plot – Bacchus Pit	5.214765ºN, 59.114092ºW	Western EMPL	10-07-2025
ASI-01-13166	Mako July 12	South Plot – Duck Pond	5.213312ºN, 59.117209ºW	Western EMPL	10-07-2025
ASI-01-13167	Mako July 14	Central plot	5.219821ºN, 59.096855ºW	Eastern EMPL	10-07-2025
ASI-01-13168	Mako July 15	Central plot	5.222060ºN, 59.099767ºW	Eastern EMPL	10-07-2025
ASI-01-13169	Mako July 16	North Plot	5.231871ºN, 59.104551ºW	Eastern EMPL	10-07-2025
ASI-01-13170	Mako July 17	South plot	5.206812ºN, 59.100057ºW	Eastern EMPL	10-07-2025
ASI-01-13171	Mako July 18	South Plot	5.204680ºN, 59.103173ºW	Eastern EMPL	10-07-2025
ASI-01-13172	Mako July Field Blank	N/A	N/A	N/A	15-07-2025
Dry Season 2025					
AMI-01-02336	Mako October 01	Deer Creek	5.208092ºN, 59.114816ºW	Western EMPL	10-10-2025
AMI-01-02345	Mako October 02	Minnehaha (guard hut)	5.201499°N, 59.128596°W	Western EMPL	11-10-2025
AMI-01-02337	Mako October 03	Mahdia river	5.229431°N, 59.140930°	Western EMPL	11-10-2025
AMI-01-02352	Mako October 04	Waterfalls/ creek adjacent MWS	5.225860°N, 59.127222°W	Western EMPL	11-10-2025
AMI-01-02348	Mako October 05	Mahdia water supply	5.224420°N, 59.128596°W	Western EMPL	11-10-2025
AMI-01-02354	Mako October 06	North Salbora	5.222935°N, 59.133869°W	Western EMPL	11-10-2025

eDNA Barcodes	Sample ID	Sample Location Name	GPS Coordinates (Lat-Long)	General Location	Date Sampled
AMI-01-02347	Mako October 07	South Salbora	5.214303°N, 59.133339°W	Western EMPL	11-10-2025
AMI-01-02350	Mako October 08	Apollo area	5.218454°N, 59.135701°W	Western EMPL	11-10-2025
AMI-01-02351	Mako October 09	Minnehaha / Eldorado creek	5.194612°N, 59.129919°W	Western EMPL	11-10-2025
AMI-01-02338	Mako October 10	Camp creek	5.205585°N, 59.115736°W	Western EMPL	10-10-2025
AMI-01-02335	Mako October 11	South plot	5.202798°N, 59.107572°W	Eastern EMPL	10-10-2025
AMI-01-02340	Mako October 12	South Plot – Duck Pond	5.213312°N, 59.117209°W	Western EMPL	10-10-2025
AMI-01-02341	Mako October 13	South plot – Bacchus Pit	5.214765°N, 59.114092°W	Western EMPL	10-10-2025
AMI-01-02346	Mako October 14	Central plot	5.219821°N, 59.096855°W	Eastern EMPL	10-10-2025
AMI-01-02349	Mako October 15	Central plot	5.222060°N, 59.099767°W	Eastern EMPL	10-10-2025
AMI-01-02343	Mako October 16	North Plot	5.231871°N, 59.104551°W	Eastern EMPL	10-10-2025
AMI-01-02353	Mako October 17	South plot	5.206812°N, 59.100057°W	Eastern EMPL	10-10-2025
AMI-01-02344	Mako October 18	South Plot	5.204680°N, 59.103173°W	Eastern EMPL	10-10-2025
AMI-01-02339	Mako October 19	N/A	N/A	N/A	13-10-2025

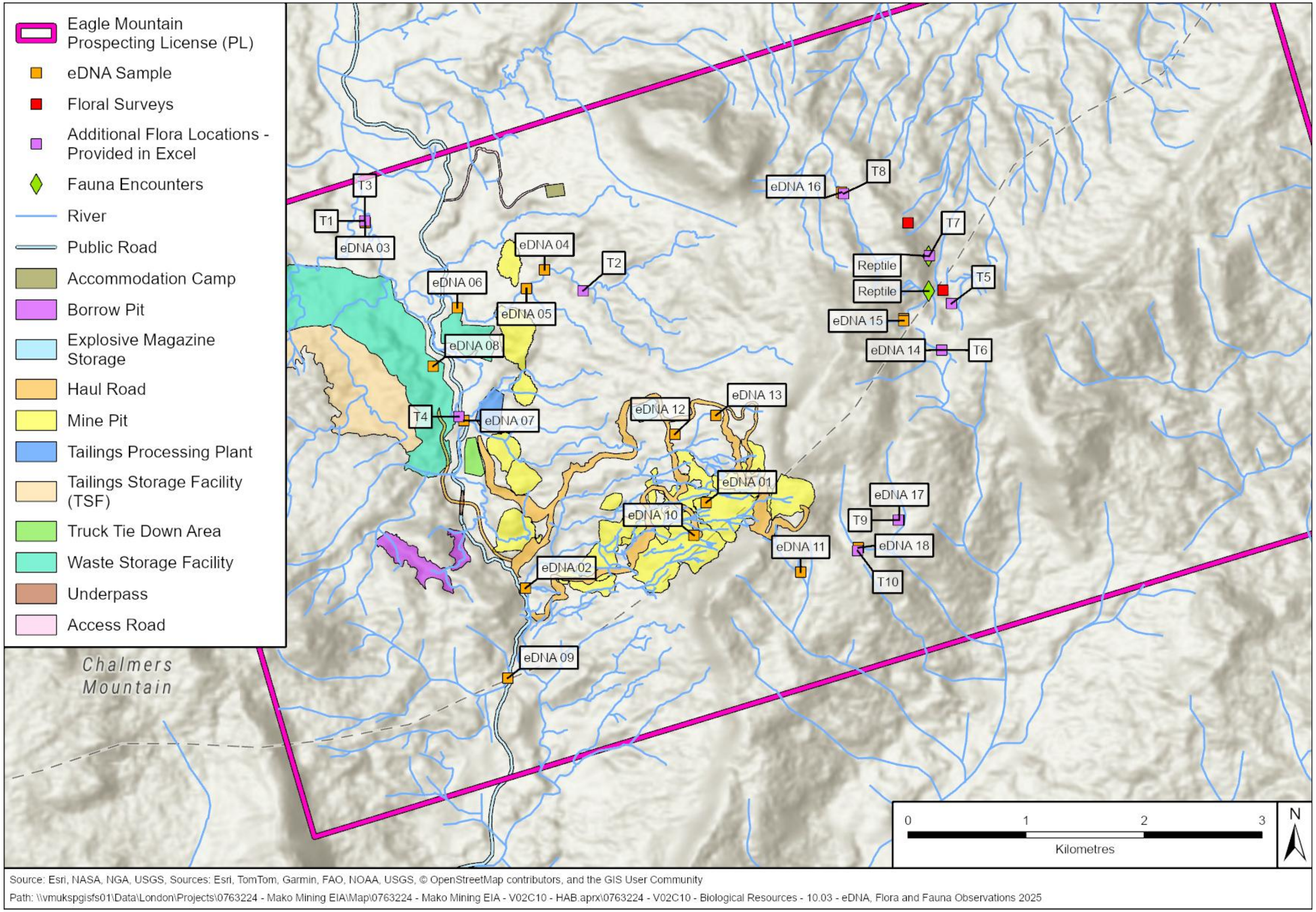
Note: General location of East and West within the EMPL is defined by the location of samples compared to the Eagle Mountain ridgeline.

FIGURE 10.2 LOCATION OF FLORA AND FAUNA SURVEY TRANSECTS AND FISHING POINTS



Source: EMC 2021

FIGURE 10.3 LOCATIONS OF EDNA SAMPLING POINTS AND 2025 FLORAL AND FAUNAL OBSERVATIONS



Source: ERM 2025

10.1.7 DATA ANALYSIS

The study assessed biodiversity across seasons and years by measuring terrestrial and aquatic species through metrics like total abundance, species richness, family richness, and Shannon's diversity index, revealing seasonal and temporal trends in species distribution. Conservation status and regional uniqueness of species were evaluated using the IUCN Red List, CITES, and checks for endemism (limited to Guyana or the Guianan Shield). Bird endemism and migration were defined according to Braun et al. (2007) and Cornell Lab of Ornithology (2023):

- **GUI birds**: Restricted to the Guianas and adjacent parts of Venezuela/Brazil.
- **TEP birds**: Found in tepui highlands across Venezuela, Brazil, and Guyana (including Guyana's Pakaraima and Merume Mountains).
- **AMN birds**: Exclusive to Amazonian and Guianan lowlands north of the Amazon River.

10.2 PROTECTED AREAS AND SPECIAL STATUS SPECIES

10.2.1 AREAS OF RECOGNISED GLOBAL, NATIONAL AND LOCAL IMPORTANCE TO BIODIVERSITY

Guyana's biodiversity is characterised by its diverse ecosystems, including tropical rainforests, savannas, wetlands, and mangroves. Located within the Guiana Shield, its stable geological structure contributes to the regions' high levels of endemism and species diversity. Guyana consists of extensive freshwater systems, such as the Essequibo and Demerara rivers, that support a wide array of aquatic life. Despite its ecological significance, only around 8.5 percent of Guyana's landmass is protected or conserved. Legally established protected areas, such as Iwokrama Forest and Kaieteur National Park, safeguard key biodiversity hotspots.

The Study Area, though not recognised as a conservation priority by the Government of Guyana as it does not fall within any designated Protected Areas of Guyana, is located within a region of high biodiversity and consists of special status species (IUCN Red Listed, CITES, and Guyana/Guiana Shield endemics). Despite the absence of designated protected areas nearby, the Study Area's ecological value highlights the importance of integrating conservation considerations into project planning and implementation. Understanding the spatial distribution of biodiversity and identifying critical habitats within the Study Area are crucial steps towards responsible environmental stewardship and sustainable development.

10.3 TERRESTRIAL ECOLOGY RESULTS

10.3.1 ECOSYSTEM STRUCTURE AND FUNCTION

Situated within the Guiana Shield in west-central Guyana, Eagle Mountain is part of a vital neotropical ecosystem characterised by extensive primary tropical forests and freshwater systems. The area lies within the Potaro Mining District #2, near Mahdia. This region contains intact highland forests which are important biological linkages between the Amazon Basin and the northern Guiana Shield watersheds. These forests support rich biodiversity, endemic species, and important river systems, including the Potaro and Siparuni Rivers. Despite surface disturbance from mining and logging, the region's ecosystems are able to sustain key ecological functions, supporting watershed health and species connectivity across the landscape.

10.3.1.1 GROUND TRUTHING

In the general areas where floral and faunal transects were conducted within the western portion of the EMPL, several positive environmental changes were observed since the surveys that were done in 2013 and 2021. These areas showed signs of reduced human disturbance, highlighting more favourable conditions for natural regeneration. One notable improvement was the quality of water bodies and rivers, which appeared cleaner and healthier, largely due to a decline in artisanal mining activities. Additionally, the vegetation has experienced substantial regrowth, indicating successful natural recovery in previously impacted zones. There was also a noticeable decrease in informal road tracks, suggesting reduced vehicular intrusion and overall human presence. Despite these encouraging developments, a decline in fauna populations was recorded between 2013 and 2021. This reduction in wildlife may be a delayed consequence of past habitat degradation, which likely forced many species to relocate. While the environment is showing strong signs of recovery, the long-term return of wildlife may depend on continued protection and ecosystem restoration efforts.

10.3.2 BIODIVERSITY

The rich biodiversity found throughout Guyana can also be found within the Study Area, which encompasses diverse habitats and ecosystems crucial for understanding the environmental impact and conservation considerations of mining operations in the region. Approximately more than 460 terrestrial wildlife species and 116 terrestrial families were identified in the Study Area, along with more than 130 aquatic species and 39 aquatic families[4]. Twenty-six orders of macro-invertebrates' species were documented in the survey area, with 17 of these species' orders identified in 2021. Sections 0 through 10.4.3 detail the findings derived from comprehensive terrestrial and aquatic biodiversity surveys conducted both within and around the boundaries of the Study Area. These surveys highlight the region's diverse species, including those of conservation concern or special status, and provide insights into their distribution and habitat preferences within the landscape.

Approximately more than 576 species were recorded across the four survey seasons.

The results of the terrestrial ecology surveys described below, including the total number of individuals, species, and special status species, are based on in-field surveys. These data provide a direct count of organisms observed during the survey period (Table 10.6).

TABLE 10.6 TOTAL NUMBER OF FLORA AND FAUNA FOUND IN THE STUDY AREA

	Terrestrial	Aquatic
Family	>116	>39
Species	>460	>130

10.3.3 FLORA

The study area contains mixed tropical forests, with vegetation types varying along slopes from hilltops to valleys. The small waterways and valleys are dominated by a distinct, low-diversity forest type primarily featuring Crabwood Crabwood (*Carapa guianensis*) and Trysil (*Pentaclethra macroloba*). Floral surveys from 2013 and 2021 identified 97 tree species (woody

[4] Reptiles and amphibians are included in aquatic numbers in this total

plants with diameters over 10 cm) from 38 families, averaging 224 trees per hectare. There were several species including *Eschweilera spp., Mora spp., Pentaclethra macroloba, Maburea trinervis, Dicymbe altsonii* which were dominant in each of the main plots by varying levels of altitudes (Table 10.7). The *Leguminosae* family had dominated the tree population, comprising 38.5% of the recorded individuals. Other significant families include *Lecythidaceae* (13.3%), *Chrysobalanaceae* (4.9%), and *Bombacaceae* (3.5%).

The species distribution had several changes with the altitudes as the lower elevations favoured Karallis (*Eschweilera spp*.) and Maburea (*Maburea trinervis*), while higher elevations have more Crabwood and Clump Wallaba species (*Dicymbe altsonii*). Trees were most abundant in mid-slope forests at elevations between 150 and 300 meters above sea level, and although tree diameter sizes show no consistent pattern by altitude, upper slopes and hilltops tend to have had larger trees.

TABLE 10.7 NUMBER OF INDIVIDUALS, MEAN DBH AND FIVE MOST ABUNDANT SPECIES IN MAIN PLOTS BY ALTITUDE CLASS

Altitude (m)	2013		2021		Most Abundant Species
	Individuals / ha	Mean dbh	Individuals / ha	Mean dbh	
<75	107	30.83	178	32.87	Trysil, Potaro Kakaralli, Warakairo, Maburia, Sarabebeballi, Black Kakarilli
75-150	201	35.82	972	23.81	Clump Wallaba, Black Kakaralli, Potaro Kakaralli, Smooth-leaf Kakaralli, Trysil
150-225	265	31.48	1400	20.62	Trysil, Sarabebeballi, Clump Wallaba, Smooth-leaf Kakaralli, Parakusan
225-300	255	34.74	233	18.66	Trysil, Clump Wallaba, Apaikara, Sarabebeballi, Crabwood
>300	222	39.78	193	27.44	Sarabebeballi, Trysil, Clump Wallaba, Apaikara, Crabwood

At higher elevations, the dense mixed forest canopy was primarily composed of species from families such as Caesalpiniaceae, Lecythidaceae, Rubiaceae, Chrysobalanaceae, Guttiferae, Olacaceae, and Papilionaceae. The sub-canopy layer included Burseraceae, Annonaceae, Sapotaceae, and Mimosaceae, while the forest floor was dominated by shrubs from Heliconiaceae and several Melastomataceae species. It was noted that a healthy juvenile forest layer, composed of seedlings, saplings, and poles, was dominated with multiple families including Meliaceae and Lecythidaceae.

The forest was noted to be intact at higher elevations but the vegetation at lower levels, including the area around the Mahdia River was most degraded due to artisanal mining activities done with the project area. However; there were successional pioneer species observed among the secondary forest growth. Additionally, fewer trees approximately 16 percent were recorded in the disturbed plots in comparison to undisturbed plots with several species such as *Dicymbe altsonii*, Eschweilera *sagotiana*, *Licania laxiflora*), were more abundant in undisturbed plots and *Tapirira marchandii* and *Pentaclethra macroloba* more abundant in disturbed plots (Table 10.8).

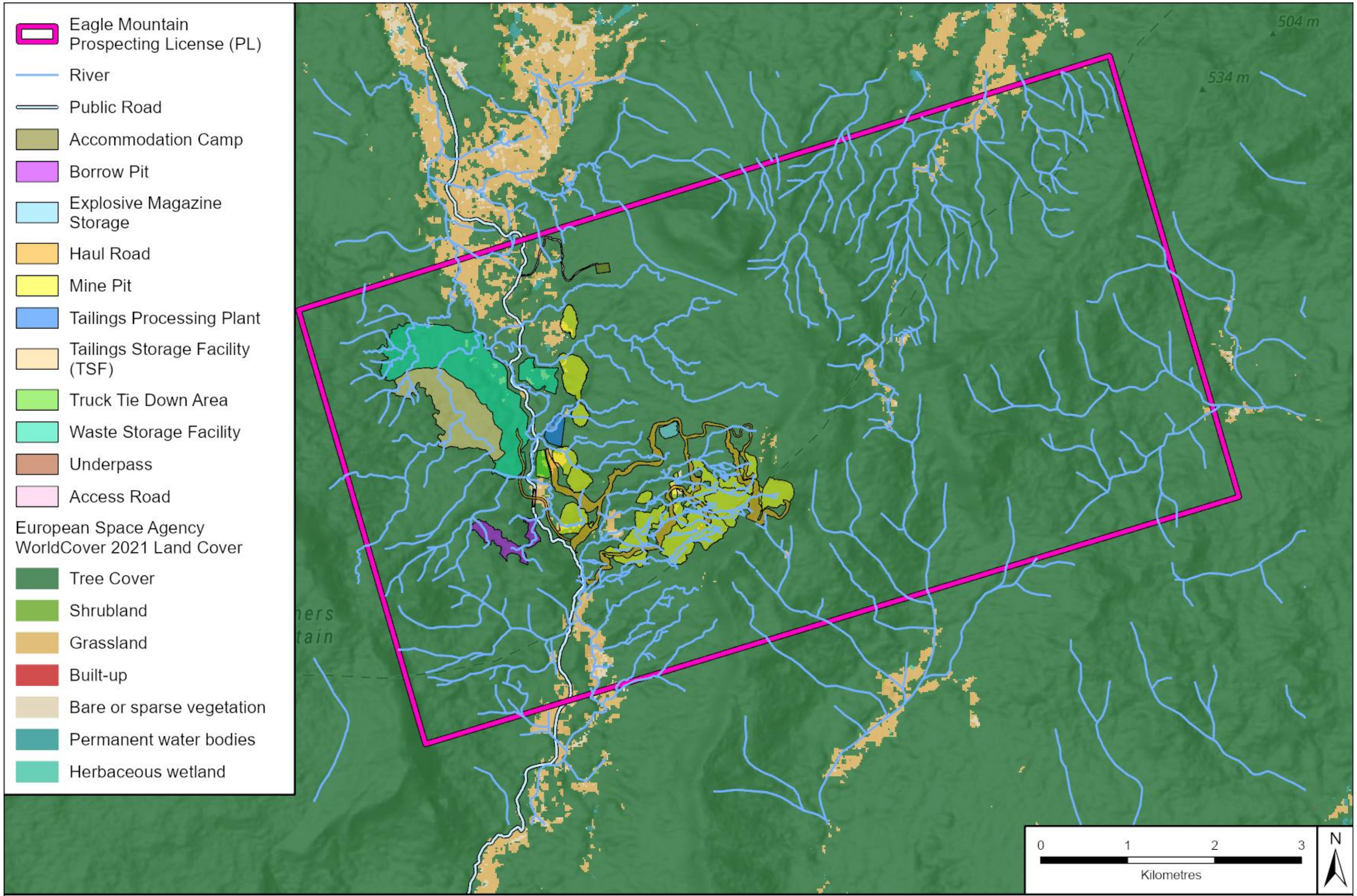
TABLE 10.8 COMPARISON OF WOODY SPECIES BETWEEN DISTURBED AND UNDISTURBED MAIN PLOTS

Disturbance State	2013		2021	
	Individuals / ha	Mean dbh	Individuals / ha	Mean dbh
Disturbed Plots	199	34.29	189	28.3
Undisturbed Plots	239	34.99	239	26.9

Guyana and the surrounding frontier forest of the Guiana Shield contain approximately 8,000 documented plant species of which some of the species are considered endemic to the region (Parker et al., 1993). There were few species identified in the study area which were found to be endemic to Guyana and the Guiana Shield which are further discussed in Section 9.5.1.3.

In 2025 terrestrial walkover survey, sample plots were taken in both western and eastern EMPL as part of ground truthing and reconnaissance exercises. A general description identified key observations and species that can be found within the study area. 58 species were recorded during this exercise in both sections of the EMPL belonging to 31 families with the most common belonging to *Poaceae, Arecaceae, Annonaceae,* and *Caesalpiniaceae*. The western and eastern EMPL generally exhibits a mix of landscape conditions shaped by past mining and human activity, with elevations ranging from low-lying riverbanks around 100 meters to hilly and mountainous terrain exceeding 500 meters. Artisanal Mining has been seen to cause significant forest loss, soil erosion, and open pits, particularly along riverbanks with the soil type being laterite or sandy. Despite this, many sites show strong signs of vegetative recovery and forest regeneration, including dense understories and secondary growth alongside remaining primary forest patches (Table 10.9). The forest cover and streams located within the Project area and surrounding the EMPL are shown in Figure 10.4. Photos of the site are shown in Photo 1 to Photo 3.

FIGURE 10.4 VEGETATION COVER AND STREAMS LOCATED WITHIN AND SURROUNDING THE PROJECT AREA



Source: Esri, NASA, NGA, USGS, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community
Path: \\vmukspgisfs01\Data\London\Projects\0763224 - Mako Mining EIA\Map\0763224 - Mako Mining EIA - V02C10 - HAB.aprx\0763224 - V02C10 - Biological Resources - 10.xx - Habitat Map

TABLE 10.9 SUMMARY OF VEGETATION SURVEY RESULTS ACROSS WET AND DRY SEASONS FROM 2013, 2021 AND 2025 TERRESTRIAL WALKOVER

Vegetation Survey	Collective Data - 2013 and 2021	2025 Terrestrial walkover
Species Richness	97	58
Family diversity	38	31
Average Individuals per hectare	224	>100
Sampling methods used	Vegetation main and sub-plots	Random sample plots
Number of endemic species	2	2
Number of IUCN Red List species (endangered, vulnerable or near threatened)	0	0
Number of CITES species	0	0

PHOTO 1 AREA PREVIOUSLY DISTURBED BY MINING

PHOTO 2 SECONDARY GROWTH FOREST IN AREA PREVIOUSLY DISTURBED BY SMALL-SCALE GOLD MINING

PHOTO 3 AREA OF FOREST DISTURBED BY ONGOING EXPLORATION DRILLING ACTIVITIES

10.3.4 MAMMALS

A total abundance of 59 species was identified during the 2013 and 2021 surveys. Of these, 35 were species of non-volant mammals and 24 species of microchiropteran bats. During the 2025 terrestrial walkover, no mammals were recorded. However, capybara (*Hydrochoerus hydrochaeris*) tracks were observed in the western EMPL.

10.3.4.1 NON-VOLANT MAMMALS

There is a diverse fauna of non-volant mammals in the Study Area, despite the disturbances at lower elevations of the mountain range due to artisanal mining, as the forests at higher elevations remain largely intact providing suitable habitats for many non-volant mammal species. The greatest diversity of mammal species was recorded at transect T1 (shown in Figure 10.2), as this area is generally undisturbed by human activity.

The total number of non-volant mammal species recorded in the Study Area is 35 species belonging to 21 families. Interviews with residents and Stronghold staff identified the presence of a further nine species of non-volant mammals.

The most common species identified include:

- Agouti (*Dasyprocta leporina*)
- Lowland Paca (Agouti paca)
- Brocket Deer (Mazama)
- Howler Monkey (*Alouatta macconnellii*)
- Guiana Spider Monkey (*Ateles paniscus*)

Primates were observed and heard foraging, at both higher and lower elevations, and this was recorded at various elevations and times of day, specifically in the mornings and evenings. All local primate species were detected in the study area except for the brown-bearded saki (*Chiropotes satanus*), which is not found in this region of Guyana. Groups of five Guiana spider monkeys were seen and heard throughout the study area.

Five out of Guyana's six cat species were documented within the Study Area, excluding oncilla (*Lepardus tigrinus*). Adult jaguar (*Panthera onca*) tracks and scats were detected in 2013 and 2021. Tayra (*Eira Barbara*) and lowland tapir (*Tapirus terrestris*) were detected by camera traps, and bicolored arboreal rice rat (*Oecomys bicolor*) were caught in a Sherman trap. Lowland tapirs were also observed in 2021, and tracks were detected in all surveys.

Some mammals were more difficult to observe, with many only identified by their tracks and scats. The giant anteater (*Myrmecophaga tridactyla*) and white-lipped peccary *(Tayassu pecari*) are among the species identified during interviews with local people.

In 2013 and 2021, the mammal surveys identified several species of conservation concern within the survey area. These include species such as the Lowland tapir, Guiana spider-monkey, giant anteater and white-lipped peccary, which are all listed as Critically Endangered on the IUCN Red List, due to habitat loss and hunting.

10.3.4.2 MICROCHIROPTERAN BATS

The total number of microchiropteran bat species recorded in the Study Area is 24 species belonging to 5 families. The microchiropteran bat species identified in the different survey seasons are summarised in Table 10.10. The 2021 wet season survey was disrupted by heavy rainfall and severe thunderstorms, leading to the detection of fewer bat species.

Most bat species captured were frugivores - *Carollinae* and *Stenodermatinae*. The short-tailed fruit bat (*Carollia perspicillata*) which feeds on the fruits of disturbance-associated plant species was the dominant bat species, indicating that the Study Area is high abundance of pioneer plants, such as those in the family *Cecropiaceae, Piperaceae*, and *Solanacea*. Very few

Phyllostomine bats were captured, also reflecting the Study Area's historical disturbance as these are gleaning animalivores and rarely captured in disturbed forest.

Molossid bats, such as *Eumops* and *Molossus*, were only found during searches for roosts, likely because their high-flying habits allow them to avoid ground-level mist nets. Davie's big-eared bat (*Micronycteris daviesi*) appears to be rare, though little is known about its ecology. The capture of *Thyroptera discolor* was notable, as this small, slow-flying species is seldom caught unless fine-mesh nets are used. The infrequent capture of certain bat groups and families, like *Thyropteridae*, *Emballonuridae*, and *Mormoopidae*, may reflect both past forest disturbance and sampling biases, especially *Molossidae*.

Guyana is home to at least 222 native non-marine mammal species, about half of which are bats, but none of the recorded species are unique to the country. There was no evidence of critical mammal habitats found during the study. Several species are also listed on the CITES appendices. Detailed information regarding all special status species can be found in Section 10.4.3.

Photo 4 through Photo 6 depict common non-volant mammal and bat species photographed during field surveys conducted in the Study Area.

TABLE 10.10 SUMMARY OF TOTAL MAMMAL SURVEY RESULTS ACROSS WET AND DRY SEASONS FROM 2013 AND 2021

Mammal Surveys	Wet Season 2013	Dry Season 2013	Wet Season 2021	Dry Season 2021	Interviews
Non-Volant Species	16	18	17	19	9
Microchiropteran Bats Species	15	12	7	13	-
Total Species Richness[1]	31	30	24	32	9
Family diversity	14	15	17	19	-
Sampling methods used	Transect survey, Interview	Transect survey, Interviews	Transect survey, Interview	Transect survey, Interview	-
Number of endemic species[2]	1	2	2	2	-
Number of IUCN Red List species (endangered, vulnerable or near threatened)	5	3	3	5	-
Number of CITES species	8	8	10	11	-

[1] Mammals that were identified to species level through survey methods or physical observations (scat and tracks) were included in this total. Mammals identified as a general species name (i.e., spp.) were not included in this count.
[2] Endemic species are native to Guyana or the Guiana Shield region.

PHOTO 4 RED HOWLER MONKEY (*ALOUATTA SENICULUS*)

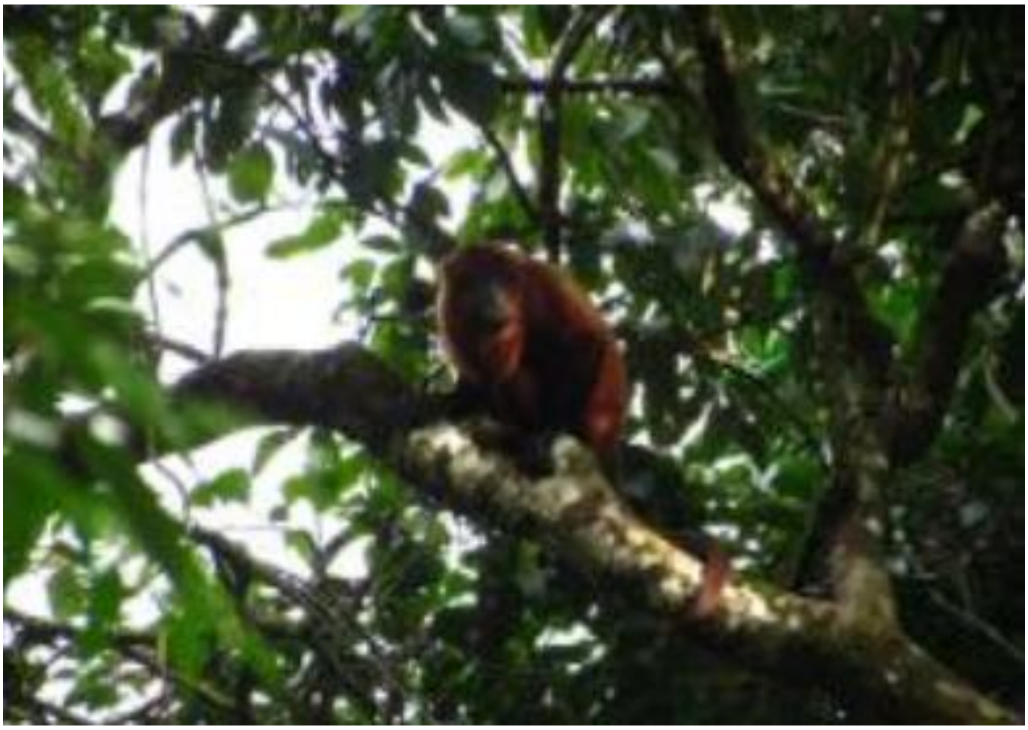


PHOTO 5 GREAT FRUIT-EATING BAT (*ARTIBEUS LITURATUS*)

PHOTO 6 BICOLOURED ARBOREAL RICE RAT (*OECOMYS BICOLOR*)

10.3.5 BIRDS

The total number of bird species recorded in the Study Area is 244 species belonging to 47 families. A summary of bird survey results across wet and dry seasons in 2013 and 2021 are summarised in Table 10.11.

TABLE 10.11 SUMMARY OF BIRD SURVEY RESULTS ACROSS WET AND DRY SEASONS IN 2013, 2021 AND 2025 TERRESTRIAL WALKOVER

Bird Surveys	**Wet Season 2013**	**Dry Season 2013**	**Wet Season 2021**	**Dry Season 2021**	**2025 Walkover survey**
Total abundance	1001	601	999	943	> 50
Species Richness[1]	161	141	145	82	13
Family diversity	39	40	40	25	10
Sampling methods used	Mist nets, transect survey	Mist nets, transect survey	Mist nets, transect survey	Mist nets, transect survey	Transect survey
Most abundant species	*Streptoprocne zonaris*	*Ramphocelus carbo*	*Psarocolius decumanus*	*Psarocolius viridis*	*Rhamphocelus carbo*
Number of endemic species[2]	GUI, AMN: 12	GUI, AMN: 11	GUI, AMN: 8	GUI, AMN: 5	GUI. AMN: 4
Number of IUCN Red List species (endangered, vulnerable or near threatened)	5	5	3	3	0

Bird Surveys	Wet Season 2013	Dry Season 2013	Wet Season 2021	Dry Season 2021	2025 Walkover survey
Number of CITES species	26	29	25	23	1

[1] Birds that were identified to species level were included in this total.
[2] Endemism and migration for each bird species were defined by Braun et al. 2007 and Cornell Lab of Ornithology. (2023). GUI - Restricted to the Guianas and adjacent Venezuela and Brazil, TEP - Restricted to the tepui highlands of Venezuela, Brazil and Guyana. In Guyana, these include the Pacaraima and Merume Mountains, and AMN - Restricted to Amazonian (and Guianan) lowlands north of the Amazon.

Despite mining in the area, there are many microhabitats for birds such as hilltops and ravines, open and dense forests, disturbed and intact forests, riverine forests and fruiting and flowering forests. There is therefore a large diversity of birds in the study area. The most diverse families observed during the surveys (in decreasing order of abundance) include:

- tyrant flycatchers (*Tyrannidae*, 24 species)
- antbirds (*Thamnophilidae*, 23 species)
- tanagers (*Thraupidae*, 21 species)
- hummingbirds (T*rochilidae*, 16 species)
- parrots (*Psittacidae*, 15 species)
- woodcreepers (*Furnariidae*, 11 species)
- hawks (*Accipiptridae*, 10 species)
- woodpeckers (*Picidae*, 9 species)

The most common species observed during the surveys include:

- swifts and swallows (*Chaetura cinereiventris, Streptoprocne zonaris, Hirundo rustica*);
- green oropendola (*Psarocolius viridis*);
- silver-beaked tanager (*Ramphocelus carbo*); and
- brown-throated parakeet (*Aratinga pertinax*).
- The most heard bird was the screaming piha (*Lipaugus vociferans*).

In all surveys identified numerous special status bird species. All psitticines and toucans surveyed were listed as CITES Appendix II species. Three species were listed as Vulnerable on the IUCN Red List: channel-billed toucans (*Ramphastos vitellinus*), white-throated toucans (*Ramphastos tucanus*) and Guianan streaked antwrens (*Myrmotherula surinamensis*). No migratory birds were recorded, and there was no evidence of Critical Habitat for bird species. A summary of the number of bird special status species during each survey is listed in Table 9.11. Detailed information regarding all special status species can be found in section 10.4.3.

In the 2025 terrestrial walkover, there were 13 species identified during the survey including Musician Wren (*Cyphorhinus arada),* Chestnut Woodpecker (*Celeus elegans),* Squirrel Cuckoo *(Piaya cayana),* Blue and Yellow Macaw *(Ara ararauna)* and white-throated toucan (*Ramphastos tucanus).* These species represent 10 families which were previously identified in the 2013 and 2021 surveys. These observations were primarily recorded through Acoustic and Visual Encounter Surveys, which facilitated both direct and indirect identification of species across varied habitats. Each species was identified by more than one individual.

Photo 7 to Photo 9 depict common bird species photographed during field surveys conducted in the Study Area.

PHOTO 7 GUIANAN WARBLING ANTBIRD (*HYPOCNEMIS CANTATOR*)

PHOTO 8 GUIANAN COCK-OF-THE-ROCK (*RUPICOLA RUPICOLA*)

PHOTO 9 SQUIRREL CUCKOO (*PIAYA CAYANA*)

10.3.6 REPTILES

The total number of reptile individuals recorded in the Study Area is greater than 1082. These are from 46 species belonging to 16 families of Squamata (lizards and snakes), Testudines (turtles and tortoises) and Crocodylia (caimans, alligators and crocodiles). During the 2025 terrestrial walkover, seven (7) species were recorded belonging to 6 families. These species were recorded in the 2013 and 2021 surveys (Table 10.12).

Interviews with Stronghold Guyana staff revealed a further four snake species: bushmaster (Lachesis muta), rainbow boa (Epicrates cenchria), boa constrictor (Boa constrictor), and green anaconda (Eunectes murinus).

Teiid lizards (*Ameiva ameiva* and *Kentropyx calcarata*) and the Amazonian skink (*Copeoglossum nigropunctatum*) were the most commonly surveyed reptiles, found basking on transects and around campsites. Nearly half of species detected within the study area were snakes, with 19 species from six families recorded. Four species of freshwater turtles were recorded within the creeks of the Study area, along with three out of four of the species of Guyanan Caiman (*Caiman crocodilus, Paleosuchus trigonatus, and Paleosuchus palpebrosus*).

The 2021 wet season survey recorded one yellow-footed tortoise (*Chelonoidis denticulata*, VU) was recorded which is listed as Vulnerable on the IUCN Red List due to being unsustainably harvested for meat. However, yellow-footed tortoise is still frequently encountered in Guyana. CITES Appendix II reptile species recorded include spectacled caiman (*Caiman crocodilus*), Cuvier's dwarf caiman (Paleosuchus palpebrosus), Schneider's dwarf caiman (*Paleosuchus trigonatus*), Amazon tree boa (*Corallus hortulanus*), green anaconda (*Eunectes murinus*), boa constrictor (*Boa constrictor*), and rainbow boa (*Epicrates cenchria*). There was no evidence of Critical Habitat for reptile species.

Photo 10 to Photo 11 depict common species photographed during field surveys conducted in the Study Area.

TABLE 10.12 SUMMARY OF REPTILE SURVEY RESULTS ACROSS WET AND DRY SEASONS FROM 2022 TO 2024

Reptile Surveys	**Wet Season 2013**	**Dry Season 2013**	**Wet Season 2021**	**Dry Season 2021**	**2025 Terrestrial Walkover**
Total abundance	225	360	187	310	<10
Species Richness	30	34	20	25	7
Family diversity	13	14	13	13	6
Sampling methods used	Pitfall traps, transect survey	Pitfall traps, transect survey	Pitfall traps, transect survey	Pitfall traps, transect survey	Transect survey
Most abundant species	*Ameiva ameiva*	*Ameiva ameiva*	*Kentropyx calcarata*	*Kentropyx calcarata*	*Ameiva ameiva*
Number of endemic species	Guiana Shield endemics: *3*	Guiana Shield endemics: *2*	Guiana Shield endemics: *2*	Guiana Shield endemics: *3*	Guiana Shield endemics: 1
Number of IUCN Red List species (endangered, vulnerable or near threatened)	0	0	1	0	0
Number of CITES species	5	7	4	9	1

PHOTO 12 *ERYTHROLAMPRUS BREVICEPS*

PHOTO 13 *PALEOSUCHUS TRIGONATUS*

PHOTO 14 *AMEIVA AMEIVA*

10.3.7 AMPHIBIANS

The total number of amphibian individuals recorded in the Study Area is more than 1492. These are from 36 species belonging to six families of anurans – frogs and toads. These results are inclusive of the 2025 terrestrial walkover survey. The amphibian species identified in the different survey seasons are summarised below (Table 10.13).

Across the 2013 and 2021 survey years, more individuals and species were recorded in the wet season compared to the dry season, as amphibians are typically more active and breed during the rainy season.

During the 2013 and 2021 wet season, the highest abundance of amphibians – 32 individuals - was recorded at transect T5a (forest transect close to Marshall Creek) and the greatest species diversity – 16 species - at T5b (road transect leading into the creek acting as the primary water source for Mahdia). The lowest abundance - three individuals – and second lowest species diversity – three species – were recorded during the wet season along T1c, a road transects which crosses various active and abandoned gold mines. T1c and T6a had the lowest species diversity – two species.

During the dry season, the highest abundance of amphibians – 11 and ten species – was recorded at transect T2a and T2b respectively, which had water pools and overhanging vegetation favourable to species at reproduction stage such as *Hypsiboas boans*. Similarly to the wet season, the greatest species diversity in the dry season – 12 species - was also recorded at T5a, and the lowest species diversity – six species - was also at T1b and T1c, as well as at T6c (all heavily disturbed areas). The lowest species abundance – two species – was at transect T1b.

In the 2025 terrestrial walkover survey, 13 species were recorded including two endemic species - *Anomaloglossus sp*. and *Stefania woodleyi* – found in both the western and eastern EMPL. Other notable species include Knudsen's Thin-Toed Frog *(Leptodactylus knudseni)* and Arrabal's Suriname toad *(Pipa arrabali).*

Hylidae (treefrogs) were the most abundant family overall, with 16 species, observed vocalising in areas with large amounts of vegetation overhanging water, such as pools, ponds, and creeks at the forest edge. *Boana boans* and *Scinax ruber* were the most recorded treefrogs. The second most represented family was Bufonidae (toads) with seven species, of which *Rhinella marina* was the most common species. Adult toads and their juveniles were most recorded at transects nearby to creeks in swampy areas, and alongside the access roads where there is high surface water runoff from the surrounding inclined forests e.g. transects next to Marshall Creek and Culvert Creek.

Three amphibian species recorded in the Study Area and documented between Western and West Central Guyana and are therefore endemic to Guyana: Kaie Rocket Frog (*Anomaloglossus kaie*i), Evan's Stefania (*Stefania evansi*), Woodley's Stefania (*Stefania woodleyi*). The survey effort also recorded *Atelopus hoogmoedii*, which is listed as a CITES Appendix II species due to its prevalence in pet trade. No endangered, rare or threatened amphibian species were recorded.

Photo 15 through Photo 16 depict common species photographed during field surveys conducted in the Study Area.

TABLE 10.13 SUMMARY OF AMPHIBIAN SURVEY RESULTS ACROSS WET AND DRY SEASONS FROM 2013, 2021 AND 2025 TERRESTRIAL WALKOVER

Amphibian Surveys	Wet Season 2013	Dry Season 2013	Wet Season 2021	Dry Season 2021	2025 Terrestrial walkover
Total abundance	260	325	548	359	>10
Species Richness[1]	28	21	21	20	13
Family diversity	6	6	5	4	6
Sampling methods used	Transect survey	Transect survey	Pitfall traps, transect survey	Pitfall traps, transect survey	Transect survey
Most abundant species	*Scinax boesemani*	*Hypsiboas boans*	*Rhinella marina*	*Scinax ruber*	*Rhinella marina*
Number of endemic species	*2*	*2*	*2*	*1*	*2*
Number of IUCN Red List species (endangered, vulnerable or near threatened)	1	1	1	0	0
Number of CITES species	0	0	0	0	0

[1]Amphibians that were identified to species level were included in this total. Amphibians identified as a general species name (i.e., spp.) were not included in this count.

PHOTO 17 *STEFANIA EVANSI*

PHOTO 18 *ANOMOLOGLOSSUS KAIEI*

PHOTO 19 *STEFANIA WOODLEYI WITH OFFSPRING*

PHOTO 20 *ARRABAL'S SURINAME TOAD (PIPA ARRABALI)*

10.3.8 LEPIDOPTERA (BUTTERFLIES) AND OTHER TERRESTRIAL MACRO-INVERTEBRATES

10.3.8.1 LEPIDOPTERA (BUTTERFLIES)

The total number of butterfly species recorded in the Study Area is 60 species belonging to five families and 15 sub-families. The butterfly species identified in the different survey seasons are summarised below:

- 2013 wet season survey exercise - 31 butterfly species belonging to three families and ten sub-families;
- 2013 dry season survey - 32 species belonging to four families and ten sub-families;
- 2021 wet season survey – 29 species belonging to six families and 12 sub-families; and
- 2021 dry season survey – 26 species belonging to five families and 12 sub-families.

Most species recorded in the survey area belong to the family Nymphalidae, which is the largest family of butterflies both globally and within forest habitats in Guyana. The families Pieridae and Riodinidae were also fairly abundant, and a few individuals from the Lycaenidae, Hesperiidae, and Papilionidae families were surveyed.

Butterflies and moths are good indicators of ecosystem health. There was greater species abundance and diversity in undisturbed areas than disturbed areas, with habitat-specialists (e.g. *Thyridia psidii aedesia, Siproeta stelenes, Eurema albula*) the main species recorded in undisturbed areas and generalists (e.g. *Aphrissa statira, Heliconius erato*) in disturbed areas. The distribution of butterfly species also changed with elevation, for example with *Siproeta stelenes, Paraeuptychia metaleuca* and *Morpho menelaus* only observed at high elevations.

Guyana has 1,100 documented butterfly species[5], none of which are listed in the IUCN Red List of Threatened Species as endangered, rare or threatened.

10.3.8.2 TERRESTRIAL MACRO-INVERTEBRATES

The total number of terrestrial macro-invertebrates recorded in the Study Area is 26 orders. The terrestrial macro-invertebrate orders identified in the different survey seasons are summarised below:

- 2013 wet season survey exercise – 15 macro-invertebrate orders;
- 2013 dry season survey – 25 macro-invertebrate orders;
- 2021 wet season survey – 6 macro-invertebrate orders; and
- 2021 dry season survey – 16 macro-invertebrate orders.

Note: terrestrial macro-invertebrates were recorded in terms of their order rather than species and families due to difficulty in identifying them to lower taxa.

10.3.9 TERRESTRIAL FAUNA EDNA

The eDNA analyses conducted during both the wet and dry seasons of 2025 revealed the presence of several terrestrial fauna species that were not detected during the standard walkover surveys. The additional detections encompass representatives from all previously mentioned taxonomic groups, except for Lepidoptera and other macroinvertebrates. In total, the eDNA results identified 94 mammal species, including various microchiropteran taxa, 40

[5] Gillman and Teeuw (1996)

bird species which includes 23 unidentified species, eight (8) reptiles, and 40 amphibians. This addition has substantially enhanced the overall species inventory and indicated a higher level of terrestrial biodiversity than initially observed through conventional survey methods. eDNA analysis also identified eight species of conservation concern according to the IUCN Red List: the Red-faced Black Spider Monkey, South American Tapir, Giant Anteater, White-lipped Peccary, *Allobates amissibilis,* and Yellow-Footed Tortoise, all categorised as Vulnerable (VU), along with the Neotropical Otter, and Spot-legged Turtle listed as Near Threatened (NT). Three amphibian species (*Allobates amissibilis*, *Stefania evansi*, and *Stefania woodleyi*), endemic to Guyana were also detected through eDNA analysis.

TABLE 10.14 TERRESTRIAL FAUNA DETECTED BY EDNA ANALYSIS

Family	Genus	Species	Common Name
Mammals			
Atelidae	*Alouatta*	-	-
Atelidae	*Ateles*	*Ateles paniscus*	Red-faced Black Spider Monkey
Caviidae	*Hydrochoerus*	-	-
Caviidae	*Hydrochoerus*	*Hydrochoerus hydrochaeris*	Capybara
Cebidae	*Cebus*	-	-
Cebidae	*Sapajus*	*Sapajus apella*	Black-capped Capuchin
Cervidae	-	-	-
Cervidae	*Mazama*	*Mazama americana*	Red Brocket Deer
Cricetidae	-	-	-
Cricetidae	*Nectomys*	-	-
Cricetidae	*Oecomys*	*Oecomys auyantepui*	Guianan Oecomys
Cricetidae	*Oecomys*	*Oecomys bicolor*	White-Bellied Oecomys
Cricetidae	*Oecomys*	*Oecomys rex*	Regal Oecomys
Cricetidae	*Oecomys*	*Oecomys rutilus*	Reddish Oecomys
Cricetidae	*Rhipidomys*	-	-
Dasypodidae	*Cabassous*	*Cabassous unicinctus*	Southern Naked-Tailed Armadillo
Dasypodidae	*Dasypus*	*Dasypus kappleri*	Greater Long-Nosed Armadillo
Dasypodidae	*Dasypus*	*Dasypus novemcinctus*	Nine-Banded Armadillo
Didelphidae	*Caluromys*	*Caluromys philander*	Bare-Tailed Woolly Opossum
Didelphidae	*Chironectes*	*Chironectes minimus*	Water Opossum
Didelphidae	*Marmosa*	-	-
Didelphidae	*Marmosa*	*Marmosa lepida*	Rufous Mouse Opossum

Family	Genus	Species	Common Name
Didelphidae	*Marmosa*	*Marmosa murina*	Linnaeus's Mouse Opossum
Didelphidae	*Micoureus*	-	-
Didelphidae	*Gracilinanus*	*Gracilinanus emiliae*	Emilia's Gracile Opossum
Didelphidae	*Philander*	*Philander opossum*	Gray Four-Eyed Opossum
Didelphidae	*Philander*	*Philander opossum*	Gray Four-Eyed Opossum
Echimyidae	-	-	-
Echimyidae	*Echimys*	-	-
Echimyidae	*Makalata*	-	-
Echimyidae	*Makalata*	*Makalata didelphoides*	Brazilian Spiny Tree Rat
Echimyidae	*Proechimys*	-	-
Emballonuridae	-	-	-
Emballonuridae	*Cormura*	*Cormura brevirostris*	Chestnut Sac-Winged Bat
Emballonuridae	*Rhynchonycteris*	*Rhynchonycteris naso*	Proboscis Bat
Emballonuridae	*Saccopteryx*	-	-
Emballonuridae	*Saccopteryx*	*Saccopteryx bilineata*	Greater Sac-Winged Bat
Emballonuridae	*Saccopteryx*	*Saccopteryx leptura*	Lesser Sac-Winged Bat
Felidae	*Leopardus*	-	-
Felidae	*Leopardus*	*Leopardus pardalis*	Ocelot
Furipteridae	*Furipterus*	-	-
Furipteridae	*Furipterus*	*Furipterus horrens*	Thumbless Bat
Megalonychidae	*Choloepus*	*Choloepus didactylus*	Southern Two-Toed Sloth
Molossidae	*Eumops*	*Eumops auripendulus*	Black Bonneted Bat
Molossidae	*Molossus*	-	-
Molossidae	*Nyctinomops*	*Nyctinomops macrotis*	Big Free-Tailed Bat
Mormoopidae	*Pteronotus*	-	-
Mormoopidae	*Pteronotus*	*Pteronotus gymnonotus*	Big Naked-Backed Bat
Mustelidae	-	-	-
Mustelidae	*Galictis*	*Galictis vittata*	Greater Grison
Mustelidae	*Eira*	*Eira barbara*	Tayra

Family	Genus	Species	Common Name
Mustelidae	*Lontra*	*Lontra longicaudis*	Neotropical Otter
Myrmecophagidae	*Myrmecophaga*	*Myrmecophaga tridactyla*	Giant Anteater
Myrmecophagidae	*Tamandua*	*Tamandua tetradactyla*	Southern Tamandua
Noctilionidae	*Noctilio*	*Noctilio leporinus*	Greater Bulldog Bat
Pitheciidae	*Pithecia*	*Pithecia pithecia*	White-Faced Saki
Phyllostomidae	-	-	-
Phyllostomidae	*Artibeus*	-	-
Phyllostomidae	*Artibeus*	*Artibeus jamaicensis*	Jamaican Fruit Bat
Phyllostomidae	*Artibeus*	*Artibeus lituratus*	Great Fruit-Eating Bat
Phyllostomidae	*Carollia*	-	-
Phyllostomidae	*Chiroderma*	-	-
Phyllostomidae	*Lionycteris*	-	-
Phyllostomidae	*Lionycteris*	*Lionycteris spurrelli*	Chestnut Long-Tongued Bat
Phyllostomidae	*Lonchorhina*	-	-
Phyllostomidae	*Lophostoma*	-	-
Phyllostomidae	*Micronycteris*	*Micronycteris hirsuta*	Hairy Big-Eared Bat
Phyllostomidae	*Micronycteris*	*Micronycteris megalotis*	Little Big-Eared Bat
Phyllostomidae	*Platyrrhinus*	-	-
Phyllostomidae	*Phyllostomus*	*Phyllostomus latifolius*	Guianan Spear-Nosed Bat
Phyllostomidae	*Rhinophylla*	*Rhinophylla pumilio*	Dwarf Little Fruit Bat
Phyllostomidae	*Sturnira*	-	-
Phyllostomidae	*Sturnira*	*Sturnira tildae*	Tilda's Yellow-Shouldered Bat
Phyllostomidae	*Tonatia*	-	-
Phyllostomidae	*Trinycteris*	*Trinycteris nicefori*	Niceforo's Big-Eared Bat
Phyllostomidae	*Uroderma*	*Uroderma bilobatum*	Tent-Making Bat
Phyllostomidae	*Vampyriscus*	*Vampyriscus bidens*	Bidentate Yellow-Eared Bat
Procyonidae	-	-	-
Procyonidae	*Bassaricyon*	-	-
Procyonidae	*Nasua*	*Nasua nasua*	South American Coati
Procyonidae	*Potos*	-	-
Procyonidae	*Potos*	*Potos flavus*	Kinkajou

Family	Genus	Species	Common Name
Sciuridae	-	-	-
Sciuridae	*Sciurus*	*Sciurus aestuans*	Brazilian Squirrel
Tapiridae	-	-	-
Tapiridae	*Tapirus*	*Tapirus terrestris*	South American Tapir
Tayassuidae	-	-	-
Tayassuidae	*Tayassu*	*Tayassu pecari*	White-Lipped Peccary
Thyropteridae	*Thyroptera*	*Thyroptera tricolor*	Spix's Disk-Winged Bat
Vespertilionidae	-	-	-
Vespertilionidae	*Eptesicus*	-	-
Vespertilionidae	*Lasiurus*	-	-
Vespertilionidae	*Myotis*	-	-
Vespertilionidae	*Myotis*	*Myotis albescens*	Silver-Tipped Myotis
Vespertilionidae	*Myotis*	*Myotis nigricans*	Black Myotis
Birds			
Accipitridae	*Accipitridae*	-	-
Accipitridae	*Leucopternis*	*Leucopternis albicollis*	White Hawk
Accipitridae	*Spizaetus*	*Spizaetus tyrannus*	Black Hawk-Eagle
Alcedinidae	*Chloroceryle*	-	-
Alcedinidae	*Chloroceryle*	*Chloroceryle aenea*	American Pygmy Kingfisher
Apodidae	*Apodidae*	-	-
Bucconidae	-	-	-
Cathartidae	*Cathartes*	*Cathartes aura*	Turkey Vulture
Columbidae	*Columba*	*Columba livia*	Rock Dove
Columbidae	*Geotrygon*	*Geotrygon montana*	Ruddy Quail-Dove
Columbidae	*Leptotila*	*Leptotila rufaxilla*	Grey-Fronted Dove
Cracidae	-	-	-
Cracidae	*Ortalis*	-	-
Cuculidae	*Piaya*	*Piaya cayana*	Squirrel Cuckoo
Furnariidae	-	-	-
Furnariidae	*Cranioleuca*	-	-
Grallariidae	-	-	-
Momotidae	*Momotus*	-	-
Momotidae	*Momotus*	*Momotus momota*	Amazonian Motmot
Odontophoridae	*Odontophorus*	*Odontophorus gujanensis*	Marbled Wood Quail

Family	Genus	Species	Common Name
Parulidae	-	-	-
Phalacrocoracidae	*Phalacrocorax*	*Phalacrocorax brasilianus*	Neotropic Cormorant
Picidae	*Campephilus*	*Campephilus melanoleucos*	Crimson-Crested Woodpecker
Picidae	*Celeus*	*Celeus elegans*	Chestnut Woodpecker
Pipridae	*Lepidothrix*	-	-
Pipridae	*Manacus*	-	-
Psittacidae	*Ara*	-	-
Psittacidae	*Pionus*	*Pionus menstruus*	Blue-Headed Parrot
Psophiidae	*Psophia*	-	-
Psophiidae	*Psophia*	*Psophia crepitans*	Grey-Winged Trumpeter
Rallidae	*Aramides*	-	-
Ramphastidae	-	-	-
Thamnophilidae	-	-	-
Thamnophilidae	*Sakesphorus*	-	-
Trochilidae	-	-	-
Trogonidae	-	-	-
Trogonidae	*Trogon*	-	-
Tyrannidae	-	-	-
Threskiornithidae	*Mesembrinibis*	*Mesembrinibis cayennensis*	Green Ibis
Tinamidae	*Tinamus*	*Tinamus major*	Great Tinamou
Reptiles			
Alligatoridae	*Paleosuchus*	-	-
Gymnophthalmidae	*Loxopholis*	*Loxopholis percarinatum*	Müller's Tegu
Gymnophthalmidae	*Neusticurus*	*Neusticurus bicarinatus*	Two-Faced Neusticurus
Gymnophthalmidae	*Neusticurus*	*Neusticurus rudis*	Red Neusticurus
Gymnophthalmidae	*Neusticurus*	-	-
Geoemydidae	*Rhinoclemmys*	*Rhinoclemmys punctularia*	Spot-legged Turtle
Leptotyphlopidae	*Siagonodon*	-	-
Testudinidae	*Chelonoidis*	*Chelonoidis denticulatus*	Yellow-Footed Tortoise
Amphibian			

Family	Genus	Species	Common Name
Aromobatidae	*Allobates*	-	-
Aromobatidae	*Allobates*	*Allobates amissibilis*	-
Bufonidae	-	-	-
Bufonidae	*Atelopus*	-	-
Bufonidae	*Atelopus*	*Atelopus hoogmoedi*	Hoogmoed's Harlequinfrog
Bufonidae	*Rhaebo*	*Rhaebo guttatus*	Smooth-Sided Toad
Bufonidae	*Rhinella*	-	-
Bufonidae	*Rhinella*	*Rhinella marina*	Cane Toad
Caeciliidae	*Caecilia*	*Caecilia tentaculata*	Bearded Caecilia
Centrolenidae	*Hyalinobatrachium*	*Hyalinobatrachium mondolfii*	-
Centrolenidae	*Vitreorana*	*Vitreorana gorzulae*	Bolivar Giant Glass Frog
Hemiphractidae	*Stefania*	*Stefania evansi*	Groete Creek Treefrog / Evans' Stefania
Hemiphractidae	*Stefania*	*Stefania woodleyi*	Woodley's Frog
Hylidae	-	-	-
Hylidae	*Dendropsophus*	-	-
Hylidae	*Dendropsophus*	*Dendropsophus leucophyllatus*	Bereis' Treefrog
Hylidae	*Nesorohyla*	-	-
Hylidae	*Scinax*	-	-
Hylidae	*Scinax*	*Scinax boesemani*	Boeseman's Snouted Treefrog
Hylidae	*Scinax*	*Scinax ruber*	Red Snouted Treefrog
Hylidae	*Trachycephalus*	-	-
Leptodactylidae	-	-	-
Leptodactylidae	*Leptodactylus*	*Leptodactylus bolivianus*	Bolivian White-Lipped Frog
Leptodactylidae	*Leptodactylus*	*Leptodactylus knudseni*	Knudsen's Frog
Leptodactylidae	*Leptodactylus*	*Leptodactylus petersii*	Peters' Thin-Toed Frog
Leptodactylidae	*Lithodytes*	*Lithodytes lineatus*	Gold-Striped Frog
Leptodactylidae	*Pleurodema*		
Microhylidae	*Otophryne*	*Otophryne robusta*	Pancake Frog
Phyllomedusidae	-	-	-
Phyllomedusidae	*Phyllomedusa*	-	-

Family	Genus	Species	Common Name
Phyllomedusidae	*Callimedusa*	*Callimedusa tomopterna*	Tiger-Striped Tree Frog
Phyllomedusidae	*Phyllomedusa*	*Phyllomedusa vaillantii*	White-Lined Leaf Frog
Phyllomedusidae	*Phyllomedusa*	*Phyllomedusa bicolor*	Two-Colored Leaf Frog
Phyllomedusidae	*Pithecopus*	*Pithecopus hypochondrialis*	Northern Orange-Legged Leaf Frog
Pipidae	*Pipa*	-	-
Pipidae	*Pipa*	*Pipa arrabali*	Arrabal's Surinam Toad
Ranidae	*Lithobates*	*Lithobates palmipes*	Amazon River Frog
Rhinatrematidae	*Rhinatrema*	-	-
Rhinatrematidae	*Rhinatrema*	*Rhinatrema bivittatum*	Two-Lined Caecilian

10.4 AQUATIC ECOLOGY RESULTS

The results of the aquatic ecology surveys described below, including the total number of individuals, species, families, and special status species, are based on in-field surveys, providing a direct count of organisms observed during the survey period.

10.4.1 AQUATIC MACROINVERTEBRATES

For stream sampling, mostly mayflies of the order Odonata and freshwater shrimps (Decapoda) were recorded. Overall, there was a poor assemblage of aquatic macro-invertebrates. In the mined-out areas sampled, only generalist insects were observed such as from the orders of Hymenoptera and Diptera (Table 10.15).

TABLE 10.15 LIST OF MACRO-INVERTEBRATE ORDERS RECORDED IN 2013 AND 2021 (INCLUDING TERRESTRIAL MACRO-INVERTEBRATES)

Macroinvertebrate Order	2013	2021
Diptera	Present	Present
Hymenoptera	Present	Present
Odonata	Present	Present
Lepidoptera (moths)	Present	Present
Isoptera	Present	
Blattaria	Present	Present
Coleoptera	Present	Present
Hemiptera	Present	Present
Orthoptera	Present	Present
Aranaeae	Present	Present
Haplotaxid	Present	Present
Diplopoda	Present	Present

Macroinvertebrate Order	2013	2021
Zygentoma	Present	
Scorpiones	Present	
Decapoda	Present	Present
Dermaptera	Present	
Ephemeroptera	Present	Present
Plecoptera	Present	
Nematoda	Present	
Chilopoda	Present	
Amblypygi	Present	
Mantodea	Present	Present
Phasmida	Present	Present
Isopoda	Present	
Pulmonata	Present	Present
Homoptera	Present	Present

10.4.2 FISH

The total number of fish recorded in the Study Area in 2013 and 2021 are 48 species belonging to 17 families. In 2021, 903 and 1110 individuals were recorded in the wet and dry seasons respectively (Table 10.16). A greater number of individuals were surveyed during the dry season survey effort than in the wet season due to fish being trapped in small ponds during the dry season. The species diversity and abundance were highest at Marshal Clearwater Creek and the site at the Culvert at Minnehaha Creeks Confluence, and lowest at the Creek at Friendly Hill and Turtle Pond. Most species surveyed were small species typically found in headwaters.

The dominant fish families surveyed were the Characidae and Cichlidae across both seasons and years, and *Bryconops affinis* and *Moehkhausia oligolepis* (Characidae) and *Hoplias malabaricus* (Erythrinidae) and *Rhamdia quelen* (Heptapteridae) were recorded in all surveys. These species are common throughout the Eagle Mountain region. The feeding patterns of Characidae likely explain their abundance in the Study Area, as they feed upon a wide range of plants, animals and other materials including planktonic, crustaceans, insects, some higher plant material, detritus and even fish scales.

Many species surveyed are important to local people, for example in commercial or recreational fisheries, in aquaculture, as subsistence or as aquarium fish. Himara (*Hoplias macropthalmus*) are economically important across Guyana as they are considered a delicacy, however this "bush fish" is not consumed in the Eagle Mountain area due to the mining activities.

No migratory fish were recorded, and no fish species detected within the survey efforts are listed as Endangered or Threatened on the IUCN Red List. There was no evidence of Critical Habitat for fish. Fish species endemic to Guyana include *Aequidens potaroensis, Crenicichla* *wallacii*, Anablepsoides (*Rivulus) holmiae*, and *Anablepsoides (Rivulus) waimacui.* The *Lebiasina* species may be restricted range but more research is needed.

TABLE 10.16 SUMMARY OF FISH SURVEY RESULTS ACROSS WET AND DRY SEASONS FROM 2013 AND 2021

Fish Surveys	Wet Season 2013	Dry Season 2013	Wet Season 2021	Dry Season 2021
Species Richness	17	25	24	27
Family diversity	8	12	11	13
Sampling methods used	hook and line, drag seines, gillnets, visual observations	hook and line, drag seines, gillnets, visual observations	hook and line, drag seines, gillnets, visual observations	hook and line, drag seines, gillnets, visual observations
Most abundant species	*Moenkhausia lepidura*	*Moenkhausia lepidura*	*Jupiaba spp*	*Moenkhausia browni*
Number of endemic species	*2*	*2*	3	*2*
Number of IUCN Red List species (endangered, vulnerable or near threatened)	0	0	0	0
Number of CITES species	0	0	0	0

Photo 21 to Photo 23 depict common species photographed during field surveys conducted in the Study Area.

PHOTO 21 ANABLEPSOIDES (*RIVULUS*) WAIMACUI

PHOTO 22 FLAME TAIL TETRA (*APHYOCHARAX ERTHYRURUS*)

PHOTO 23 DEUTERODON POTAROENSIS

10.4.3 AQUATIC FAUNA EDNA

The eDNA results for both seasons of the 2025 survey detected several aquatic fauna species which accounts for 57 fish species. The eDNA analysis identified no aquatic species of conservation concern according to the IUCN Red List. One fish species (*Ancistrus leucostictus*) which is endemic to Guyana was detected through eDNA analysis.

TABLE 10.17 AQUATIC FAUNA SPECIES DETECTED BY EDNA ANALYSIS

Family	Genus	Species	Common Name
Fishes			
Acestrorhynchidae	*Acestrorhynchus*	*Acestrorhynchus falcatus*	Red-Tailed Freshwater Barracuda
Acestrorhynchidae	*Acestrorhynchus*	-	-
Anostomidae	-	-	-
Anostomidae	*Leporinus*	-	-
Apteronotidae	*Apteronotus*	-	-
Apteronotidae	*Apteronotus*	*Apteronotus albifrons*	Black Ghost Knifefish
Callichthyidae	*Callichthys*	-	-
Callichthyidae	*Callichthys*	*Callichthys callichthys*	Cascarudo
Callichthyidae	*Corydoras*	-	-
Characidae	-	-	-
Characidae	*Astyanax*	-	-
Characidae	*Moenkhausia*	-	-
Characidae	*Hemigrammus*	-	-
Characidae	*Tetragonopterus*	-	-
Characidae	*Tetragonopterus*	*Tetragonopterus argenteus*	Dollar Tetra
Crenuchidae	*Characidium*	-	-
Cichlidae	*Aequidens*	-	-

Family	Genus	Species	Common Name
Cichlidae	*Crenicichla*	-	-
Cichlidae	*Guianacara*	-	-
Curimatidae	-	-	-
Erythrinidae	-	-	-
Erythrinidae	*Erythrinus*	-	-
Erythrinidae	*Hoplerythrinus*	-	-
Erythrinidae	*Hoplias*	-	-
Erythrinidae	*Hoplias*	*Hoplias malabaricus*	Wolf Fish
Gymnotidae	*Electrophorus*	-	-
Gymnotidae	*Gymnotus*	-	-
Gymnotidae	*Gymnotus*	*Gymnotus carapo*	Banded Knifefish
Heptapteridae	-	-	-
Heptapteridae	*Rhamdia*	-	-
Iguanodectidae		-	-
Iguanodectidae	*Bryconops*	-	-
Iguanodectidae	*Bryconops*	*Bryconops melanurus*	Tail-Light Tetra
Lebiasinidae	-	-	-
Lebiasinidae	*Pyrrhulina*	-	-
Loricariidae	-	-	-
Loricariidae	*Ancistrus*	-	-
Loricariidae	*Ancistrus*	*Ancistrus leucostictus*	-
Loricariidae	*Hypostomus*	-	-
Loricariidae	*Lithoxus*	-	-
Parodontidae	-	-	-
Pimelodidae	-	-	-
Pimelodidae	*Pseudoplatystoma*	-	-
Pimelodidae	*Pimelodus*	*Pimelodus ornatus*	Ornate Pimelodus
Prochilodontidae	*Prochilodus*	-	-
Prochilodontidae	*Prochilodus*	*Prochilodus nigricans*	Black Prochilodus
Sciaenidae	-	-	-
Sciaenidae	*Micropogonias*	-	-
Sternopygidae	-	-	-
Sternopygidae	*Eigenmannia*	-	-
Sternopygidae	*Eigenmannia*	*Eigenmannia virescens*	Glass Knifefish
Sternopygidae	*Sternopygus*	-	-

Family	Genus	Species	Common Name
Sternopygidae	*Sternopygus*	*Sternopygus macrurus*	Longtail Knifefish
Synbranchidae	-	-	-
Trichomycteridae	-	-	-
Trichomycteridae	*Ituglanis*	-	-
Trichomycteridae	*Trichomycterus*	-	-

10.5 SPECIAL STATUS SPECIES

Freshwater and aquatic special status species in the Study Area encompass a diverse range of organisms that meet specific conservation criteria. These species are primarily defined as those listed as NT, VU, EN, or CR on the IUCN Red List (Table 10.18). Species that are endemic to Guyana, the Guiana Shield or specific locations within the country are also considered special status. This includes species that have restricted distributions within Guyana, highlighting their significance for local biodiversity conservation efforts. Species listed under CITES are also identified, emphasising their international conservation importance and the need for protection measures. Identifying and understanding these species is crucial for effective conservation planning and management strategies, ensuring the preservation of Guyana's unique freshwater and aquatic ecosystems and the biodiversity they support.

TABLE 10.18 SUMMARY OF FLORA AND FAUNA SPECIES OF SPECIAL STATUS DOCUMENTED WITHIN THE STUDY AREA

Classification	IUCN				IUCN Total	CITES			Endemic
Taxa	CR	EN	VU	NT		Appendix I	Appendix II	Appendix III	
Flora	0	0	3	0	0	0	0	0	2
Mammals	0	0	4	1	5	2	8	3	2
Birds	0	0	3	3	6	0	39	1	15
Amphibians and Reptiles	0	2	1	0	3	0	10	0	4
Fish	0	0	0	0	0	0	0	0	0
Aquatic Macroinvertebrates	0	0	0	0	0	0	0	0	0
Grand Total	**0**	**2**	**11**	**4**	**14**	**2**	**57**	**4**	**23**

[1] Endemics listed are those that are true Guyana endemics and/or endemic to the Guiana Shield.

IUCN Red List of Threatened Species Version 2024-1 (IUCN 2024) criteria used globally categorise species based on their risk of extinction, ranging from Extinct to Least Concern (Table 10.19). Species categorised as CR, EN, and VU are collectively regarded as internationally "threatened."

TABLE 10.19 DEFINITIONS OF IUCN RED LIST THREATENED CATEGORIES

IUCN Red List Status	Definition [1]
Critically Endangered (CR)	A taxon is Critically Endangered when the best available evidence (severe population decline, very small population, very small geographic area occupied, or a calculated probability of extinction during the next 10 years of >50%) indicates that it is facing an extremely high risk of extinction in the wild.
Endangered (EN)	A taxon is Endangered when the best available evidence (large population decline, small population, small geographic area occupied, or a calculated probability of extinction during the next 20 years of >20%) indicates that it is considered to be facing a very high risk of extinction in the wild.
Vulnerable (VU)	A taxon is Vulnerable when the best available evidence (substantial population decline, small population, fairly small geographic area occupied, or a calculated probability of extinction during the next 100 years is >10%) indicates that it is considered to be facing a high risk of extinction in the wild.
Near Threatened (NT)	A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered, or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.

[1] IUCN Standards and Petitions Committee. 2024.

10.5.1 IUCN

No threatened flora species were detected in surveys. Several birds and mammalian species recorded from the study area can be considered Rare and are listed on the IUCN Red List as Near Threatened: jaguar (*Panthera onca*), caica parrot (*Pyrilia (Gypopsitta*), mealy parrot *(Amazona farinosa*), blue-cheeked parrot (*Amazona dufresniana*), and orange-breasted falcon (*Falco deiroleucus*). Three (3) species of frogs recorded from the study area are Threatened. Two (2) Threatened species of reptile was recorded from the study area. No aquatic macroinvertebrates or fish species identified were listed on the IUCN Red List. This absence of listed species indicates that the sampled aquatic communities did not include any taxa officially recognised as threatened or endangered according to global conservation assessments. The findings suggest that the local populations of macroinvertebrates and fish in the surveyed area are not currently under significant conservation concern based on global criteria.

10.5.1.1 MAMMALS

Six mammal species recorded from the study area are classified as Threatened. The IUCN Red List lists the lowland tapir (*Tapirus terrestris*), Guiana spider-monkey (*Ateles paniscus*), giant anteater (*Myrmecophaga tridactyla*), and white-lipped peccary (*Tayassu pecari*) as Vulnerable (Miranda et al., 2014, Varela et al., 2019; Mittermeir et al. 2021; Keuroghlian et al., 2013). The jaguar (*Panthera onca*) and the Neotropical Otter (*Lontra longicaudis*) is listed by IUCN as Near Threatened (Quigley et al., 2017).

The Tapir is found in lowland regions of northern and central South America, from Argentina, Bolivia, Brazil, Colombia, Ecuador, French Guiana, Guyana, Paraguay, Peru, Suriname, and Venezuela. *Tapirus terrestris* is considered to be Vulnerable due to habitat loss, illegal hunting, roadkill, and competition with livestock. In Guyana this species appears to be widely distributed and inhabits 39 swamp forests, dry and moist shrublands and grasslands and a wide variety of wetlands (Montambault and Missa, 2002; Lim and Engstrom, 2004; Rapid

Assessment Program, 2008). The tapir, listed since July 1, 1975, also faces no current quotas but has experienced trade restrictions in Argentina and Paraguay, focusing on controlling trade to protect the species.

The Giant Anteater (*Myrmecophaga tridactyla*) is native to most countries in South America, Honduras, Nicaragua, and Panama. Its specialised diet, low reproductive rate, large body size, and widespread habitat loss are major factors contributing to its population decline. Due to constant habitat degradation, this species is listed as Vulnerable (Miranda *et al.*, 2014).

The Guiana spider monkey (*Ateles paniscus*) is found in parts of Brazil, French Guiana, Guyana, and Suriname and is listed as Vulnerable due to habitat loss driven by expanding agriculture, ranching, mining, hydroelectric projects, and road construction, which also increase hunting pressure. This monkey mainly inhabits primary, mature forests and is rarely seen in forest edges or degraded areas. In Guyana, it is known to occur in the far south and east of the Essequibo River (Mittermeier *et al*., 2021).

The white-lipped peccary (*Tayassu pecari*) can be found in Central and South America and is listed as Vulnerable due to threats like habitat loss, illegal hunting, livestock competition, and disease. In Guyana, the species is widespread and occupies diverse habitats such as evergreen and seasonal forests, savannahs, swamp forests, and coastal mangroves (Montambault and Missa, 2002; Lim and Engstrom, 2004).

The jaguar (*Panthera onca*) has an extensive range spanning from the tropical Americas up to the southern United States and down to Argentina. It primarily lives in tropical lowland forests with dense vegetation, especially in areas near water and abundant prey. The size of jaguar territories varies depending on location, season, and resource availability. Classified as Near Threatened, the species has experienced an estimated 20–25% decline in its habitat and population over the past 21 years, largely due to habitat loss and illegal hunting by humans (Quigley et al, 2017).

The Neotropical otter *(Lontra longicaudis*) is a widely distributed species in Central and South America, measuring 1.2 to 1.7 m in length. Weighing between 5 to 15 kg, it has morphological and physiological adaptations for both aquatic and terrestrial habitats, though it relies heavily on waterbodies for feeding. This species is typically found near rivers, lakes, coastal areas, and are opportunistic predators, primarily consuming fish and crustaceans (Rheingantz, *et al.*, 2017).

10.5.1.2 BIRDS

Several birds recorded from the study area are listed on the IUCN Red List as Threatened. The channel-billed toucan (*Ramphastos vitellinus)*, white-throated toucan (*Ramphastos tucanus*), and Guianan streaked antwren (*Myrmotherula surinamensis*), are listed by the IUCN as Vulnerable; whereas the mealy parrot (*Amazona farinosa*), blue-cheeked parrot (*Amazona dufresniana*), and orange-breasted falcon (*Falco deiroleucus)* are listed as Near Threatened (NT) (BirdLife International, 2016).

The channel-billed toucan (*Ramphastos vitellinus*) is found in Brazil, Colombia, Venezuela, Trinidad and Tobago, and across the Guianas. It is relatively common and lives in a variety of habitats, including lowland forests near water, forest edges, swamps, riverine areas, clearings, and savanna patches, though it is less frequent in secondary or selectively logged forests. Despite its wide range, the species faces growing threats. Deforestation in the Amazon and hunting pressure have been noted as the main causes of concern for its population (BirdLife International, 2016a).

The White-throated toucan (*Ramphastos tucanus*) is found in Brazil, Venezuela, and across the Guianas and is currently listed as Vulnerable. It is considered fairly common and is usually seen in lowland tropical forests, especially along old riverbeds, mature forests near water, and late-stage successional forests. It also uses secondary forests, clearings, edges, plantations, gardens, mangroves (in Guyana), and even isolated pasture trees for foraging (BirdLife International, 2016b).

The Caica parrot (*Pyrilia caica*) is found across Venezuela, Brazil, Guyana, Suriname, and French Guiana, though it is not very common in any part of its range. It inhabits tall, primary "terra firme" forests, up to elevations of 1,100 meters. Its population is believed to be declining due to ongoing deforestation for cattle ranching and agriculture, along with hunting pressures. Because of these threats, the species has been classified as Near Threatened, with an estimated population decline of 25-30% over the next three generations (BirdLife International, 2016d).

The Mealy parrot (*Amazona farinosa*) is found throughout tropical regions of Central and South America. It lives mainly in large areas of lowland evergreen forest but can also be seen in palm stands, deciduous and gallery forests, and secondary growth near forests. Due to ongoing deforestation in the Amazon and pressure from hunting and trapping, its numbers are expected to decline steadily over time. As a result, the species is classified as Near Threatened (BirdLife International, 2016e).

The Blue-cheeked parrot (*Amazona dufresniana*) is found in parts of Venezuela, Guyana, Suriname, French Guiana, and northern Brazil. It typically lives in humid forests, especially gallery forests, up to about 560 meters in elevation in Guyana. The species has a relatively small population that appears to be slowly declining. Because of ongoing habitat loss and trapping for trade, it is classified as Near Threatened (BirdLife International, 2016f).

The Orange-breasted Falcon (*Falco deiroleucus*) ranges across much of Latin America but is uncommon in some areas, such as Guyana. It relies on mature forests and often nests on cliffs near water, though it can adapt somewhat to human-altered landscapes. This falcon is a skilled hunter, specialising in catching other birds while in flight. Due to deforestation and declines across its range, its population is shrinking by an estimated 25–30% over three generations, leading to its current status as Near Threatened (BirdLife International, 2016g).

The Guianan streaked antwren (*Myrmotherula surinamensis*) inhabits the understorey and middle layers of Amazonian lowland forests, including seasonally and permanently flooded forests, as well as shrubby secondary growth, up to 550 meters in elevation. It is found across the Guyana Shield region, including Brazil, French Guiana, Guyana, Suriname, and Venezuela. The main threat to this species is rapid deforestation driven by cattle ranching, soy farming, and expanding road networks in the Amazon basin. Despite these threats, it can tolerate some secondary growth and is considered less sensitive to habitat disturbance than many other forest birds.

10.5.1.3 AMPHIBIANS AND REPTILES

Three (3) frog species recorded from the study area, the Kaei rocket frog (*Anomaloglossus kaiei*) and *Anomaloglossus praderioi*, are both classified as Endangered on the IUCN Red List, and the *Allobates amissibilis* classified as Vulnerable, indicating they face a very high risk of extinction in the wild. The genus *Anomaloglossus* remains poorly studied, and both species face ongoing threats from habitat degradation such as mining and other human activities, necessitating further research and DNA studies to confirm their presence in the area and better understand their conservation status.

Anomaloglossus kaiei is a terrestrial frog active during the day, primarily living in both primary undisturbed forest and disturbed forest areas, although it is not closely tied to water bodies. This species has been documented from Kaieteur National Park extending to the slopes of Maringma Tepui in Guyana, as well as the slopes of Mt. Wokomung, and possibly into adjacent areas of Brazil (Kok et al. 2006; Kok, 2010). It occupies a range of elevations between 150 and 1,060 meters above sea level and is considered locally abundant within this range. Despite this, *Anomaloglossus kaiei* has ongoing declines in both the extent of occurrence and quality of its forest habitat caused by human activities (IUCN SSC Amphibian Specialist Group, 2018).

Anomaloglossus praderioi is also a terrestrial, diurnal species but is restricted to undisturbed montane forests with medium canopy cover, characterised by abundant epiphytes, mosses, and dense undergrowth. It is known from just a few isolated sites within its range, making its population particularly vulnerable (IUCN SSC Amphibian Specialist Group, 2021). This species occurs at higher elevations, ranging between 1,310 and 1,950 meters above sea level, and has been recorded from two localities in eastern Venezuela: slopes of Mt. Roraima and Sierra de Lema, and two localities in Guyana: the slopes of Mt. Roraima and Maringma Tepui. The habitat of *Anomaloglossus praderioi* continues to decline due to mining activities and other human pressures, prompting its Endangered status.

Allobates amissibilis is a small, cryptically coloured nurse frog from the Aromobatidae family. This species is endemic to Guyana and inhabits open mixed lowland and premontane forests at elevations of 160 to 950 meters and areas with a low canopy within the Iwokrama Mountains in Guyana, specifically noted at Turu Falls and on a high unnamed peak in the Iwokrama Forest Reserve. It is primarily diurnal, with individuals active during the day and males calling sporadically, particularly in response to rain, reflecting the typical diurnal behaviour of its family. (Kok *et al*, 2013).

Two (2) Threatened species of reptile was recorded from the study area. The yellow-footed tortoise (Chelonoidis denticulata) is listed by IUCN Red List as Vulnerable (Tortoise & Freshwater Turtle Specialist Group, 1996). It occurs in Brazil, Colombia, Ecuador, French Guiana, Guyana, Peru, Suriname, Trinidad & Tobago, Venezuela, and Bolivia. The yellow-footed tortoise is a food source for the local people and indigenous communities in the region. It is still commonly encountered in Guyana (Smithsonian Institute, 2000; Donnelly et al., 1998); whereas elsewhere in the region they have been unsustainably harvested for their meat and are less frequently encountered. The Spot-legged Turtle (*Rhinoclemmys punctularia*) is classified as Near Threatened on the IUCN Red List and inhabits freshwater environments such as rivers, marshes, and lakes, as well as various terrestrial regions in Suriname, Guyana, French Guiana, Trinidad and Tobago, and Brazil. It is a generalist omnivore, feeding water lilies, seeds, fruits, and invertebrates. While they typically travel alone, they can also be found in small groups, indicating communal behaviour.

10.5.2 CITES

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) regulates international trade in specific wildlife species to ensure their protection. As an international agreement, CITES requires member countries to adhere to its regulations. If a project or activity impacts a species listed in the CITES Appendices, it must comply with legal requirements for managing and mitigating these impacts. Non-compliance can result in significant legal penalties, fines, or even the suspension of operations (CITES 2024).

Species covered by CITES are categorised into three Appendices based on their level of protection:

- Appendix I includes species that are critically endangered, with trade restricted to exceptional circumstances. For these species, you need an import permit from the country receiving the specimen and an export permit from the country sending it. Special care is required for live specimens to ensure their well-being.
- Appendix II contains species that may become endangered if trade is not controlled. An export or re-export permit is necessary but import permits are usually not required unless specified by national laws. Live specimens must also be handled carefully to prevent harm.
- Appendix III lists species protected in at least one country, which seeks international help to manage trade. For trade involving these species, an export permit from the listing country is required, while other countries need to provide a certificate of origin. Re-exporting also requires a re-export certificate.

The following sections detail the flora and fauna observed in the Study Area that are listed under CITES:

10.5.2.1 MAMMALS

Several mammal species in the study area are protected under the CITES Appendices due to conservation concerns. All primates are listed in Appendix II, while the jaguar is in Appendix I, reflecting its critical status. The ocelot is also in Appendix I, after being reclassified from Appendix II in 1990 due to increased threats. Appendix II species, such as the red howler monkey, Guianan weeper capuchin, jaguarundi, and Guianan white-faced saki, face risks from trade and habitat loss. These primates have been listed since 1977, with some quotas in place, such as 242 live Guianan weeper capuchins annually from Guyana. The tayra, red brocket deer, and white-lipped peccary are Appendix III to facilitate international trade monitoring. Recent trade suspensions and quota adjustments highlight ongoing threats and the need for enhanced conservation measures.

10.5.2.2 BIRDS

All psittacines (parrots) and toucans recorded in this study are listed under CITES Appendix II due to threats from habitat loss and the pet trade. Several bird families in the study area, including Accipitridae (hawks, kites), Falconidae (falcons, caracaras), Psittacidae (macaws, parrots), Ramphastidae (toucans, aracaris), Strigidae (owls), and Trochilidae (hummingbirds), face significant risks from deforestation, agriculture, urbanisation, and illegal trade. CITES Appendix II regulates international trade in these species to promote sustainable population management and prevent further declines. The King Vulture, listed in Appendix III, is also declining due to habitat loss and disturbance, with trade monitored to ensure sustainability. Conservation measures focus on habitat protection and the regulation of trade to address ongoing threats, support population recovery, and ensure the long-term survival of these vulnerable bird species across Central and South America.

10.5.2.3 REPTILES

Species documented from the survey area in the following species are listed under CITES Appendix II: Alligatoridae (caimans), Teiidae (tegus), Geoemydidae (turtles), Testudinidae (tortoises), and Boidae (boas). These reptiles face threats from habitat loss and overexploitation for skins and meat.

10.5.2.4 NOT LISTED

Flora or fauna species - amphibians, bats, butterflies, aquatic species, and macro-invertebrates - documented in the study area are listed in the CITES Appendices (Table 10.20). This suggests that these communities are not currently considered threatened or endangered according to global conservation standards.

TABLE 10.20 SUMMARY OF ALL FAUNA IDENTIFIED IN THE STUDY AREA LISTED IN CITES

Family Name	Scientific Name	Common Name	CITES Appendix
Felidae	*Leopardus pardalis*	Ocelot	Appendix I
Felidae	*Panthera onca*	Jaguar	Appendix I
Atelidae	*Alouatta macconnellii / Alouatta seniculus*	Guiana howler monkey / Red Howler Monkey	Appendix II
Cebidae	*Cebus olivaceus*	Guianan Weeper Capuchin	Appendix II
Cebidae	*Saimiri sciureus*	Squirrel Monkey	Appendix II
Atelidae	*Ateles paniscus*	Guiana spider monkey	Appendix II
Callitrichidae	*Saguinus midas*	Golden-handed Tamarin	Appendix II
Felidae	*Herpailurus yagouaroundi*	Jaguarundi	Appendix II
Pitheciidae	*Pithecia pithecia*	Guianan White-faced Saki	Appendix II
Tapiridae	*Tapirus terrestris*	Lowland Tapir	Appendix II
Falconidae	*Falco rufigularis*	Bat Falcon	Appendix II
Falconidae	*Falco deiroleucus*	Orange-breasted Falcon	Appendix II
Falconidae	*Herpetotheres cachinnans*	Laughing falcon	Appendix II
Falconidae	*Micrastur mirandollei*	Slaty-backed Forest-Falcon	Appendix II
Falconidae	*Ibycter americanus*	Red-throated Caracara	Appendix II
Falconidae	*Daptrius ater*	Black Caracara	Appendix II
Falconidae	*Ictinia plumbea*	Plumbeous Kite	Appendix II
Falconidae	*Elanoides forficatus*	Swallow-tailed Kite	Appendix II
Psittacidae	*Ara ararauna*	Red-and-Green Macaw	Appendix II

Family Name	Scientific Name	Common Name	CITES Appendix
Psittacidae	*Amazona amazonica*	Orange-winged Parrot	Appendix II
Psittacidae	*Amazona farinosa*	Mealy Parrot	Appendix II
Psittacidae	*Deroptyus accipitrinus*	Red-Fan Parrot	Appendix II
Psittacidae	*Pionus menstruus*	Blue-headed Parrot	Appendix II
Psittacidae	*Pionites melanocephalus*	Black-headed Parrot	Appendix II
Psittacidae	*Pionopsitta caica*	Caica Parrot	Appendix II
Psittacidae	*Pionus fuscus*	Dusky Parrot	Appendix II
Psittacidae	*Touit batavica*	Lilac-tailed Parrotlet	Appendix II
Psittacidae	*Aratinga pertinax*	Brown-throated Parakeet	Appendix II
Trochilidae	*Phaethornis ruber*	Reddish Hermit	Appendix II
Trochilidae	*Phaethornis superciliosus*	Eastern Long-tailed Hermit	Appendix II
Trochilidae	*Heliothryx auritus*	Black-eared Fairy	Appendix II
Trochilidae	*Thalurania furcata*	Fork-tailed Woodnymph	Appendix II
Trochilidae	*Phaethornis bourcieri*	Straight-billed Hermit	Appendix II
Trochilidae	*Chlorostilbon mellisugus*	Blue-tailed Emerald	Appendix II
Trochilidae	*Campylopterus largipennis*	Grey-breasted Sabrewing	Appendix II
Trochilidae	*Anthracothorax nigricollis*	Black-throated Mango	Appendix II
Ramphastidae	*Ramphastos tucanus*	White-throated Toucan	Appendix II
Ramphastidae	*Ramphastos vitellinus*	Channel-billed Toucan	Appendix II
Ramphastidae	*Pteroglossus aracari*	Black-necked Aracari	Appendix II
Ramphastidae	*Pteroglossus viridis*	Green Aracari	Appendix II
Trochilidae	*Glaucis hirsutus*	Rufous-breasted Hermit	Appendix II
Trochilidae	*Threnetes leucurus*	Pale-tailed Barb throat	Appendix II
Accipitridae	*Rupornis magnirostris*	Roadside Hawk	Appendix II
Psittacidae	*Amazona dufresniana*	Blue-cheeked Parrot	Appendix II
Trochilidae	*Phaethornis ruber*	Reddish Hermit	Appendix II
Strigidae	*Pulsatrix perspicillata*	Spectacled owl	Appendix II
Accipitridae	*Leucopternis albicollis*	White Hawk	Appendix II
Accipitridae	*Buteogallus urubitinga*	Great Black Hawk	Appendix II
Accipitridae	*Buteo brachyurus*	Short-tailed Hawk	Appendix II

Family Name	Scientific Name	Common Name	CITES Appendix
Alligatoridae	*Paleosuchus trigonatus*	Schneider's Dwarf Caiman	Appendix II
Alligatoridae	*Caiman crocodilus*	Spectacled Caiman	Appendix II
Alligatoridae	*Paleosuchus palpebrosus*	Cuvier's Dwarf Caiman	Appendix II
Teiidae	*Tupinambis teguixin*	Gold tegu	Appendix II
Geoemydidae	*Rhinoclemmys punctularia*	Spot-legged wood turtle	Appendix II
Testudinidae	*Chelonoidis denticulata*	Yellow-footed tortoise	Appendix II
Boidae	*Corallus hortulanus*	Amazon tree boa	Appendix II
Boidae	*Eunectes murinus*	Green Anaconda	Appendix II
Boidae	*Epicrates cenchria*	Rainbow Boa	Appendix II
Boidae	*Boa constrictor*	Boa constrictor	Appendix II
Cathartidae	*Sarcoramphus papa*	King Vulture	Appendix III
Mustelidae	*Eira barbara*	Tayra	Appendix III
Cervidae	*Mazama americana*	Red Brocket Deer	Appendix III
Tayassuidae	*Tayassu pecari*	White-lipped Peccary	Appendix III

10.5.3 ENDEMICS

Species that are true endemics to Guyana or the Guiana Shield have conservation concerns due to their limited geographic ranges, which make them highly vulnerable to habitat loss and environmental changes. Endemism to Guyana means a species is found only within the country and has adapted specifically to its local conditions. Species endemic to the Guiana Shield, which includes Guyana, Suriname, French Guiana, and southeastern Venezuela, have evolved in the region's stable environment, characterised by mineral-rich soils and diverse ecosystems. This isolation in the Guiana Shield has led to a rich diversity of specialised flora and fauna found nowhere else, highlighting the need for targeted conservation efforts to protect these species and their habitats.

The biodiversity and endemism of Guyana’s flora and fauna reflect its position within the broader Guiana Shield region, rather than as a distinct phytogeographic area. Plant endemism is not well defined, but certain species like *Dicymbe altsonii* are unique to Guyana, particularly in the lowland and montane forests of the Pakaraima Mountains and central uplands. Another notable plant, *Catostemma commune*, is endemic to the Guiana Shield and thrives in various forest types, especially within the Essequibo and Cuyuni River Basins and the Northwest District.

In terms of macro-invertebrates, no endemic species were identified in the study area, though overall knowledge of invertebrate diversity and endemism in Guyana is limited. However, certain groups such as ants (Formicidae), butterflies (Lepidoptera), and earthworms (Opisthopora) are believed to have high endemism within the Guiana Shield.

Several fish species recorded are endemic to Guyana's rivers, including *Aequidens potaroensis*, *Crenicichla wallacii*, *Ancistrus leucostictus,* and two Anablepsoides species. The genus *Lebiasina* also appears to have species with restricted distributions, though further taxonomic study is needed.

Amphibian endemism is more pronounced, with species such as Woodley's stefania (*Stefania woodleyi*), Evan's stefania (*Stefania evansi*), the Kaie rocket frog (*Anomaloglossus kaiei*), and the *Allobates amissibilis* being unique to Guyana. Another frog, *Anomaloglossus praderioi*, has a limited range, found only in two locations each in Venezuela and Guyana. Most endemic amphibians are associated with the highland Tepui formations of the Guiana Shield.

No reptiles or mammals recorded in the study area are endemic to Guyana itself, although some, like the Guianan saki monkey and Guiana spider monkey, are endemic to the wider Guiana Shield. Similarly, while no birds from the study area are strictly endemic to Guyana, several are restricted to the Guiana Shield region or areas north of the Amazon. Notable examples include the Guianan toucanet (*Selenidera piperivora*), Cayenne jay (*Cyanocorax cayanus*), Guianan puffbird (*Notharchus macrorhynchos*), and Guianan cock-of-the-rock (*Rupicola rupicola*). Some species also have ranges extending into adjacent parts of Venezuela and Brazil.

Overall, Guyana's biodiversity is characterised by a mix of local and regional endemics, particularly among plants, fish, amphibians, and birds, with the Guiana Shield serving as a critical centre of endemism and species diversity.

10.5.4 MIGRATORY SPECIES

No migratory species were observed in the study area, as the interior lowlands of Guyana are not considered critical habitats for migratory animals. However, the forests and rivers around Eagle Mountain are connected to the larger Amazon Basin, acting as important biological corridors that facilitate animal movement. The Mahdia and Potaro Rivers, which drain the Eagle Mountain landscape, are part of the river system linked to the Essequibo River Basin, a key aquatic corridor connecting to the Amazon, especially during seasonal floods when the Rupununi savannas create continuous waterways between tributaries of the Rio Branco and Rupununi Rivers (Watkins et al., 2004). The forested landscape of Eagle Mountain represents lowland and lower montane forest ecosystems typical of the broader Guyana Shield and Amazon Basin regions, further contributing to ecological connectivity.

11. SOCIOECONOMIC BASELINE

11.1 INTRODUCTION

This section describes the socioeconomic baseline conditions for the Project, sets out the relevant criteria, describes the methodology for the baseline survey, and summarises the socio-economic survey data.

This chapter includes information related to governance, demographics, education, employment, livelihoods, community health, land use, Indigenous (Amerindian) peoples, and ecosystems services, as well as other related topics, at both the country level and in the Social Area of Influence (Social AoI).

The Chapter summarises the Social AoI baseline, for the full socio-economic report, including the wider regional and national context, refer to Volume 4: Appendix F.7 – Social Baseline Report.

11.1.1 SOCIAL AREA OF INFLUENCE (AOI)

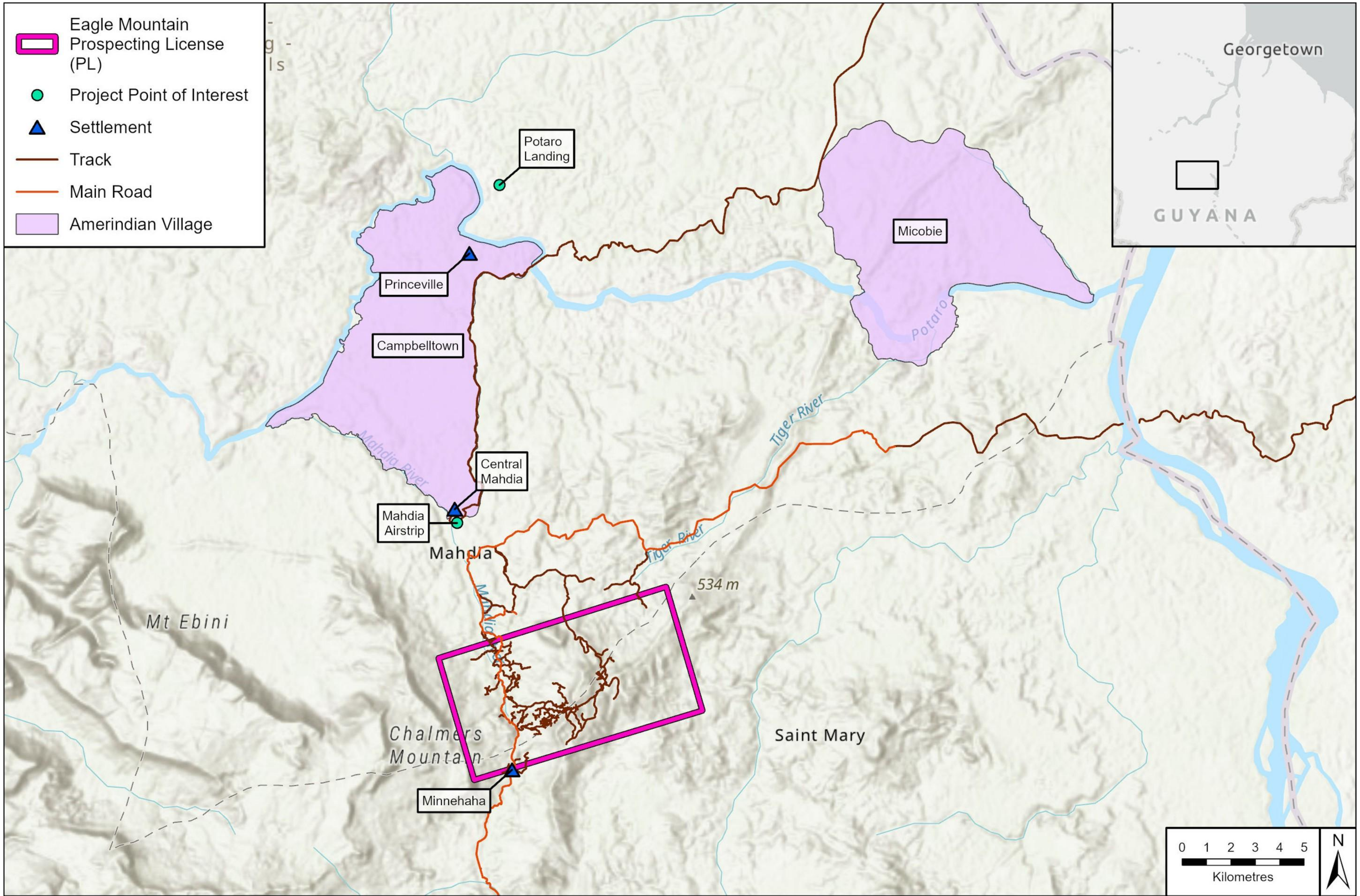
The study areas referenced in the discussion of socioeconomic resources comprise the Social Area of Influence (Social AoI) and are described below (see also Figure 11.1):

- **Direct AoI:** This area includes the population centres surrounding the Eagle Mountain Prospecting License (EMPL) area and the road network extending from Georgetown via Linden and Mabura, to Mahdia. The EMPL is within an area approximately 200km-southwest of Georgetown the capital of Guyana, between latitudes of 573,600°N and 581,500°N and longitudes of 261,000°E and 271,800°E.

  The Direct Area of Influence includes:

  - Mahdia, the regional centre, located 8 km from the EMPL, serving as a central hub to the Region.
  - Campbelltown, an Indigenous community located adjacent to Mahdia and 8 km from the EMPL.
  - Princeville, a satellite community of Campbelltown, located within the titled boundaries of Campbelltown.
- **Indirect AoI:** This area includes the population centres located further from the EMPL, in proximity to potential ancillary facilities, and/or that have direct socioeconomic connection with proposed Project activities. This includes:
  - Micobie, an Indigenous community located over 20 km from the EMPL.
  - Linden, over 50km from the EMPL, from where some workers may be sourced.
  - Georgetown, the capital and port city to and from which Project supplies will be shipped and where government offices are headquartered.

FIGURE 11.1 SOCIAL AOI



Source: Esri, NASA, NGA, USGS, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

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11.1.2 DATA SOURCES

Data sources include a combination of primary data collected through fieldwork in 2025 and secondary data, including census data, recent media sources, and published academic and/or research data where available.

11.1.3 ASSUMPTIONS AND LIMITATIONS

- Secondary data are based on the most up-to-date and publicly accessible information available. Preliminary results for the 2022 Guyana Population and Housing Census are now available, however full and final datasets have not yet been released. As such, this report uses 2022 data where possible, and in cases where detailed information is not yet published, the 2012 census figures are used as substitutes and may therefore be considered outdated. Primary data collected through fieldwork supplement significant gaps in available secondary and/or census data.
- Although the Social AoI includes some areas within Regions 4 and 10, information on existing socioeconomic resources conditions is focused on national level and on Region 8, where the proposed Project is located.
- Although all possible efforts were made to organise interviews ahead of time, fieldwork data collection was opportunistic, based on the availability and willingness of respondents to share information, size of population centre, and fieldwork time constraints. Representative sampling ranges from approximately 20 percent to less than 5 percent among communities and population centres in the Social AoI. Sampling is therefore not necessarily statistically representative due to practical field constraints, but data does, however, give sufficient detail on the baseline conditions relevant to the nature and scale of the potential impacts on these communities.

11.2 DATA COLLECTION AND METHODOLOGY

Primary data collection was based on semi-structured socioeconomic interviews and focus groups within communities and households in the Social AoI. An informal scoping visit was conducted in January 2025 to establish context with a preliminary Social AoI, that was followed up with a longer field visit in October 2025. Consultants with expertise in ESIAs, international standards, community-based fieldwork, and local knowledge and experience developed the interview guide. Interviews included questions pertaining to the following categories:

- Socioeconomics, including:
  - Indigenous peoples;
  - Demographics;
  - Infrastructure;
  - Employment, income, skills, and education;
  - Public health; and
  - Ecosystem services.
- Land use, including all existing and proposed land use.

In addition to the above categories, interviews also addressed topics related to the following themes:

- Community health and wellbeing, including traditional or cultural medicine;

- Safety and security;
- Intangible cultural heritage[1];
- Land governance and management;
- Natural resource use and informal livelihood activities;
- Access to water and water use;
- Presence of vulnerable peoples.

The socioeconomic interviews were conducted by teams comprised of international and Guyanese Subject Matter Experts (SMEs), including a Spanish and Portuguese speaker.[2] The interviews were semi-structured with open-ended questions. Findings were recorded as handwritten notes and using a tablet, to record geospatial location and/or corresponding images (using a tailored electronic data collection form developed for the study). The interviews lasted between 30 and 60 minutes. Interview locations, numbers, and respondents are summarised in Table 11.1.

TABLE 11.1 TOTAL SOCIOECONOMIC INTERVIEWS CONDUCTED IN APRIL 2025 FOR BASELINE DATA COLLECTION

Location	Number of Interviews	Respondents
Mahdia	26	Government representatives, hospital workers, police officers, teachers, resident households, shop owners, NGOs
Campbelltown	7	Toshao and Village Councillors, resident households, school headteacher, school students, school cooks, community health worker, elder
Princeville	2	Village Councillors, resident households, schoolteachers, community health worker, elder, women's group
Micobie	3	Toshao and Village Councillors, resident households, schoolteachers, school students, community health worker, nurses, elder, women's group
Minnehaha	6	Shop owners, miners, resident households
Total	44	

Selection of interview respondents was based on a mix of targeted and opportunistic sampling. Interviews were organised with individuals in leadership positions in each community and population centre (e.g., Toshao and council members), as well as individuals from schools, health posts and hospitals, police and/or community security groups, and relevant government ministries and organisations (e.g., Guyana Geology and Mines Commission (GGMC), Guyana Forestry Commission (GFC)). Interviews with other residents were typically opportunistic, based on door-to-door visits and snowball sampling (i.e., asking interviewees who else to interview). The data obtained from the interviews and focus groups have been used and referenced throughout this section.

[1] This topic is covered in Section 12 (Cultural Heritage).
[2] The ERM team did not identify any potential interview participants who did not speak at least one of the languages spoken by team members. Any individuals identified as speaking Amerindian languages also spoke English as a native language.

11.3 EXISTING SOCIOECONOMIC CONDITIONS

11.3.1 GOVERNANCE

The Social AoI is primarily located in Region 8, Potaro-Siparuni, and the road network extending from Georgetown to Mahdia via Linden and Mabura[3] (Table 11.2).

TABLE 11.2 GOVERNANCE STRUCTURES WITHIN THE SOCIAL AOI

Type of Settlement	Settlement Name	Governance Structure
Towns	Mahdia	Elected Regional Chairperson and Mayor
Titled Amerindian Community	Campbelltown and Micobie	Elected Village Council and Toshao
Community Development Council	Princeville	Elected community Council and Chairperson
Informal Mining Settlement	Minnehaha	There is no formal governance structure in these settlements. Landowners will lease land or buildings to individuals, and the GGMC and local rangers issue and inspect contacts and licenses.

Governance in the Social AoI is managed as various levels:

- Governance within the region is managed by the Regional Democratic Council (RDC), whose function is to provide essential services to the region on behalf of the national government. The RDC's responsibilities include but are not limited to administration and finance, agriculture, education and health delivery. The RDC is supported by other administrative bodies and government agencies to support the effective management of the region. These councils, in turn, are accountable to the central government. Regional Executive Officers (REOs) manage these programs and report to the Ministers of the relevant Ministries.
- The Mahdia Town Council is responsible for overseeing the day-to-day operation of the town. Mahdia was declared a town in August 2018 (previously referred to only as a community), and has since been formally managed by the Mayor, Deputy Mayor, Councillors and Town Clerk/Administrators. The Council's responsibilities include solid waste collection and disposal, maintenance of infrastructure services (roads, bridges, etc.), market facilities, and child welfare services among others, in accordance with budgetary allocations approved by Parliament to execute developmental works and the collection of rates and taxes.
- The Indigenous communities also have their own governance structure which usually includes management by the village council of approximately 8 members, headed by the Toshao, Chairperson or Senior Councillor. The designation of village leaders is contingent upon whether the community is titled, untitled, or classified as a community development council (CDC).

[3] The information presented will focus on the existing conditions within Region 8, where the proposed project is located.

11.3.2 POPULATION AND EDUCATION

11.3.2.1 REGION 8

The population of Region 8 increased to 13,598 in 2022, up from 11,077 recorded in the 2012 census (BSG, 2026; BSG, 2012). Although rising, the region's population density remains low, averaging 0.68 people per square kilometre in 2022, compared to 0.51 people per square kilometre in 2012. The most recently available population numbers for formal settlements in the Social AoI are provided in Table 11.3. Fieldwork observations and discussions with community authorities indicate some growth since the 2012 census.

TABLE 11.3 POPULATION ESTIMATES FOR FORMAL SETTLEMENTS WITHIN THE SOCIAL AOI

Settlement Type	Settlement Name	Population from 2022 Census Preliminary Results/ 2019 *Amerindian Peoples Association Census*	Population Estimate from 2025 Fieldwork
City/Town	Georgetown	125,683[1]	Estimate not feasible
	Linden	33,183[1]	Estimate not feasible
	Mahdia	2,575[1]	3,000[3]
Indigenous Communities	Campbelltown	1,000[2]	1,504[3]
	Princeville	196[2]	300[3]
	Micobie	512[2]	691[3]
	Minnehaha		50 to 80[3]

[1] 2022 National Population and Housing Census Preliminary Results (Bureau of Statistics, 2022)
[2] Our Land, Our Life (Amerindian Peoples Association, Forest Peoples Programme, & Rainforest Foundation US, 2018)
[3] Population numbers provided by *Toshaos* and/or community leadership, and residents' estimates, these are not independently verified for this report.

59.3 percent of the school age population were reported to be attending school in 2012 (BSG, 2012). Education in Region 8 faces challenges due to the region's remoteness, mountainous terrains, dispersed settlements, and limited transportation links. Many communities are only accessible by trails, boat or costly air travel, which restricts regular delivery of educational resources and mobility of teachers and students (News Room, 2022). These geographic barriers combined with limited infrastructure, intermittent communication networks, and socioeconomic constraints further hinders consistent school attendance and contribute to educational disparities within the region.

The region has high primary school attendance but faces challenges in secondary education access and retention. Overall, the region has three secondary schools, thirty primary schools (including one primary top), and twenty-six nursery schools (Ministry of Education, 2024). This situation contributes to a substantial drop in attendance at the upper secondary level, with only 21.8 percent of youths aged 15–17 attending school (BSG, 2012).

Efforts are underway to strengthen educational infrastructure, with a focus on expanding educational access and quality, and addressing disparities in hinterland regions. In 2024, the

Ministry of Education officially approved the construction of three new secondary schools in Region 8, including one in Micobie. Initiatives are also underway to address the shortage of trained teachers within the region, as the government is working towards ensuring that all teachers are trained by 2025 and is exploring incentives to attract and retain educators to the region. The Guyana Online Academy for Learning (GOAL) program has been instrumental in providing scholarship opportunities for residents to pursue online education, with over 200 residents within the region benefitting from the initiative thus far (Stabroek News, 2023).

Beyond formal education, residents also benefit from vocational training programs which provide an opportunity for people to develop profitable skills. For example, in 2023, 23 residents of Mahdia graduated from a garment construction program, equipping them with skills to start their own businesses and meet the local demand for school uniforms (DPI, 2023). Further plans are in place to train and employ youth within the expanding of the health sector (DPI, 2024).

11.3.2.2 MAHDIA

Mahdia (Figure 11.2), located in central Guyana, currently serves as a town and regional administrative centre of Region 8 after officially gaining its township status in 2018.

FIGURE 11.2 CENTRE OF MAHDIA

Source: ERM 2025

The settlement was established in 1884 by Afro-Guyanese following Emancipation, who migrated from coastal areas in pursuit of gold. The town was then expanded by the British Consolidated Mining Company into a mining exploration and Colonial Administrative Offices were established (Things Guyana 2019). The settlement has since been a hub for gold, diamond and forestry activities. The town has a diverse population predominantly consisting of Afro-Guyanese, Indigenous peoples (predominantly from the Patamona people[4] – often spelled Patamuna), Islanders[5] , Brazilians, and Venezuelans.

Mahdia has one public nursery, one public primary, one public secondary school, and a private institution known as the School of Excellence (ERM Fieldwork, 2025). The nursery and primary schools serve predominantly the residents of Mahdia, whereas the Mahdia Secondary School (Figure 11.3) serves as the principal secondary education institution in the town of Mahdia and wider region. Students at the Secondary School come from a range of regional communities, including Mahdia, Princeville, Campbelltown, Minnehaha, and several remote areas. Notably, students from these remote areas often attend school seasonally, depending on the work schedules of their parents, many of whom are engaged in mining and other transient occupations (ERM Fieldwork, 2025). From engagement, it was noted that some parents travel to the bakdams with their entire families for work (including children of school age). In such instances, the children are temporarily enrolled in the nearest school and commute from the backdam to attend classes (ERM Fieldwork, 2025).

Historically, the school also serviced students from the communities of Chenapou, Micobie, El Paso, and Karisparu, who utilise the dormitory due to long distances from residence. However, since the dormitory fire in 2023 that claimed the lives of 20 female students, females are no longer hosted, and the remaining female students were transferred to Georgetown to attend school. While the male dormitories remain operational, there have been behavioural and mental health challenges among the male students as a result of witnessing the dormitory fire, leading the Ministry of Education to consider relocating them back to their home communities for schooling (ERM Fieldwork, 2025).

[4] Patamona people are one of nine main ethnic groups (or “tribes”) of Amerindian or Indigenous peoples in Guyana.
[5] Islanders represent immigrants and their descendants from the Caribbean Islands, such as St. Lucia and Dominica.

FIGURE 11.3 MAHDIA SECONDARY SCHOOL

Source: ERM Fieldwork, 2025

Over the past five years, secondary school completion rates have risen to 90 percent, a substantial improvement from previous years. This positive trend is attributed to several factors, including the Government of Guyana's cash grant program, which incentivises school attendance, and a growing awareness among students and families that employment in remote areas is not the only viable option for economic advancement (ERM Fieldwork, 2025).

Mahdia secondary school currently employs 23 teachers, although staffing remains a challenge. At the time of interviews, two teachers were reportedly on secondment, one attending Cyril Potter College of Education (CPCE), and two more expected to leave for CPCE soon. Despite these constraints, the school has implemented systems to manage classes effectively. However, a recurring issue was noted that some teachers who leave for training do not return to Mahdia, contributing to ongoing staffing shortages.

Mahdia Secondary School also provides several essential services to support student well-being and engagement. These include a school feeding program and a football coach to promote physical activity and teamwork.

11.3.2.3 CAMPBELLTOWN

The titled Amerindian village, Campbelltown (Figure 11.4), located adjacent to the mining town of Mahdia and about 8 km from the EMPL, is home to approximately 1,500 residents, predominantly Patamona people, as well as Wapishana people. The main livelihood activities include mining, logging, farming, and occasional hunting.

FIGURE 11.4 CAMPBELLTOWN

Source: ERM Fieldwork, 2025

Campbelltown has a nursery school, and a recently commissioned primary school (Figure 11.5) which serves grade one and two (High Commission Guyana, 2024). Due the proximity of Campbelltown to the regional capital, students attend the remaining grades of primary education and secondary education at the Mahdia Primary and Secondary schools.

FIGURE 11.5 CAMPBELLTOWN PRIMARY SCHOOL

Source: ERM Fieldwork, 2025

11.3.2.4 PRINCEVILLE

Princeville (Figure 11.6) is a satellite community of Campbelltown, located within Campbelltown's titled lands, northeast of the main boundary. It has an estimated population of about 300 people and was formerly known as Kangaruma Junction. The community is predominantly inhabited by Patamona and Wapishana peoples. Although it falls under the administration of Campbelltown's village council, independent services in the community include a health post and a nursery/primary school (Figure 11.7), while secondary education is accessed in Mahdia. The local economy is centred on farming and mining.

In 2022, the community was provided with a school bus, through financial aid from the Government of Guyana, to transport students daily to school in Mahdia. Parents pay a monthly fee (approximately GYD $1,500 or USD $6.88) per child which provides a stipend for the driver (ERM Fieldwork, 2025).

FIGURE 11.6 PRINCEVILLE

Source: ERM Fieldwork, 2025

FIGURE 11.7 PRINCEVILLE PRIMARY SCHOOL COMPOUND

Source: ERM Fieldwork, 2025

11.3.2.5 MICOBIE

Micobie (Figure 11.8) is a titled indigenous village situated approximately 60 km east of the EMPL and approximately 57 km from central Mahdia with an estimated population of 700 inhabitants. The community is primarily composed of indigenous peoples, including Patamona, Macushi – often spelled Makushi, and those of Carib ancestry, who have preserved much of their cultural heritage, such as use of traditional medicines and oral histories (ERM Fieldwork, 2025). Micobie is situated along the Potaro River near Tumatumari and the people who live there largely practice subsistence activities often considered part of 'traditional' Amerindian livelihoods, such as small-scale farming and mining.

FIGURE 11.8 MICOBIE

Source: ERM Fieldwork, 2025

Micobie has a nursery and primary school (Figure 11.9), and a secondary school that is currently under construction. Interviews with the community indicated that the school will feature specialised classrooms and labs. The nursery school currently serves 48 pupils and is staffed by three teachers. The primary school accommodates over 150 pupils and is supported by 10 teachers. These teachers receive training at CPCE in Georgetown and return to serve the Micobie community.

Following the Mahdia dormitory fire, a decision was made to construct a secondary school in Micobie to reduce the risks associated with students traveling long distances for education. While construction is ongoing, approximately 70 secondary students from Micobie and El Paso are temporarily housed at the primary school and the community's craft centre. Four teachers are dedicated to these students, with additional support from 2-3 teachers from Mahdia who assist several times a week. Secondary students currently study up to six subjects: Mathematics, English, Information and Communication Technology (ICT), Electronic Document Preparation and Management (EDPM), Integrated Science, and Social Studies.

The school has a feeding program, implemented by the Ministry of Education, which provides daily breakfast and lunch to students. Additional activities offered to students include Physical

Education programmes. Teachers interviewed have expressed interest in expanding extracurricular offerings to include drama and singing classes, because of the potential positive impact on student engagement and behaviour (ERM Fieldwork, 2025).

FIGURE 11.9 MICOBIE NURSERY AND PRIMARY SCHOOLS

Source: ERM Fieldwork, 2025

11.3.2.6 MINNEHAHA

Minnehaha (Figure 11.10) is an informal mining settlement located less than 1 km from the EMPL southern boundary. Interviews with inhabitants suggested a population of approximately 50 to 80 persons (*this figure is provided by local residents*). The settlement was developed to support small scale mining within the vicinity. The population fluctuates depending on the rush for gold within the nearby mining areas, reportedly reaching as many as 100 occupants (ERM Fieldwork, 2025). There are no educational facilities in Minnehaha.

FIGURE 11.10 MINNEHAHA

11.3.3 ECONOMIC AND LAND USE

11.3.3.1 REGION 8 CONTEXTUAL OVERVIEW

In 2012, the number of adults (those > 15 years old) in Region 8 who were considered economically active totalled 3,305 (or 84.2 percent) (BSG, 2012), with fewer women (79.4 percent) considered economically active than men (85.7 percent). Those considered economically inactive or unemployed included students, homemakers, retirees, and those physically unable to work.

Household incomes in Region 8, particularly in smaller communities in the Social AoI, are variable; with high levels of informal and ad hoc income-generating activities, the boom-bust dynamics of mining, and reliance to varying degrees on subsistence activities. As such, average incomes are difficult to estimate. Region 8’s economy is primarily driven by gold and diamond mining, which serves as the main source of employment and income.

While agriculture and forestry are present, they play a secondary role in the region's economy. The southern sub-region (Sub-District 2) engages more in subsistence farming and small-scale crop production and livestock. Government initiatives aim to boost agricultural productivity and self-sufficiency, including programs for poultry and non-traditional crops.

According to Guyana’s National Land Use Plan, most of the available land in hinterland regions, including Region 8, remains forest-covered, and is subject to multiple competing land use claims (LCDS, 2013). Therefore, land use in the region is characterised by:

- Indigenous customary lands (titled and non-titled);
- Forestry leases and state forest management areas;
- Mining and associated ancillary uses; and

- Small scale agriculture (often in support of hinterland communities)

Mahdia

Mahdia, the regional administrative capital, functions as a central hub for mining operations, attracting both local and transient workers. The town's commercial sector includes hotels, guesthouses, businesses, and food vendors which are the mainstream sources of income within the town. People from surrounding communities and interior settlements rely on the services in Mahdia to fulfil their daily and business activities. Interviews with Mahdia government leadership underlined that attempts to diversify livelihood activities in Mahdia include a focus on the promotion and development of the tourism and agriculture sectors to decrease dependence on mining (ERM Fieldwork, 2025).

The main economic activity is gold mining, with more than half of the population actively involved in the sector. Agricultural activities are perceived by those engaged to be underdeveloped, with the town relying on imports for its produce and livestock (ERM Fieldwork, 2025). Currently, most residents that farm operate at a subsistence level, while some surplus is sold locally. There are ongoing collaborations with the town and the government to improve food security, with recent initiatives like distributing agricultural supplies (ERM Fieldwork, 2025). Some residents also practice livestock rearing for household use or consumption.

Indigenous Communities

Indigenous communities in Region 8 engage in a diverse mix of livelihood activities, including small-scale mining, subsistence farming, fishing, hunting, and logging. Among these, mining is the primary economic activity. Both Micobie and Campbelltown have mining concessions, issued by the Guyana Geology and Mines Commission (GGMC), within their titled community. within their boundaries. Residents participate in mining within these concessions as well as in other interior locations. The sector is male dominated; however, during community engagement, interviews were conducted with one female resident involved in mining. After transitioning from cooking in a mining camp, she now operates a small dredge with a team of four, a role she has maintained for over four years (ERM Fieldwork, 2025).

Farming is another traditional livelihood, which is primarily practiced by women and elderly men. In Campbelltown, designated farming lands are located approximately two km from the main settlement, requiring residents to walk or rely on transportation for access. Additionally, residents interviewed noted that poor soil quality restricts crop diversity, further constraining agricultural productivity (ERM Fieldwork, 2025).

Fishing and hunting are long-standing cultural activities. Factors such as water contamination, seasonal water shortages, and wildlife migrating farther away due to increased human activity, have reduced the scale of these activities. Despite these challenges, fishing and hunting continue to play a role in indigenous community life (ERM Fieldwork, 2025).

Other sources of livelihood include small retail businesses such as shops and snackettes[6], as well as employment in public service roles like teachers, nurses, and community service officers (ERM Fieldwork, 2025). Community "hubs" in indigenous communities provide a space

[6] quick-service eateries serving traditional, local snacks, pastries, and other lunch items

for residents to sell produce, crafts and other items in a centralised location (refer Figure 11.11 and Figure 11.12 respectively for photos of shops and hubs).

FIGURE 11.11 MICOBIE VILLAGE SHOP

Source: ERM Fieldwork, 2025

FIGURE 11.12 CAMPBELLTOWN VILLAGE HUB

Source: ERM Fieldwork, 2025

Within the wider Social AoI, Micobie and Campbelltown are titled communities, and Princeville, a satellite community of Campbelltown. None of these indigenous communities' title boundaries overlap with the Project's EMPL.

11.3.3.2 ARTISANAL AND SMALL-SCALE MINING

Region 8 currently has a high level of artisanal and small-scale mining (ASM) and medium-scale mining activity, especially within the wider Social AoI. ASM is widespread, along with associated land clearing, river dredging, and sediment deposition altering local ecosystems. The National Land Use Plan notes that former mining lands are often left degraded, though they hold the potential for conversion to alternative uses such as forested areas, pasture, or aquaculture (LCDS, 2013). Artisanal mining impacts as seen from the flight into Mahdia are shown in Figure 11.13.

FIGURE 11.13 ARTISANAL MINING ALONG THE POTARO RIVER NEAR MAHDIA

Source: ERM Fieldwork, 2025

A main access road runs through the EMPL, leading to active small and artisanal mining activities, just outside the EMPL boundaries. Small-scale mining operations are common in the area, with occupants granted land usage and extraction rights by legal owners who receive a percentage of the revenue. Miners reported a preference for independent mining using a small gold pan (locally referred to as "punting"), as much of the gold in the area is fine powdered or conversely chip (Coarse) gold and can be recovered with a pan (ERM Fieldwork, 2025).

Workers indicated fluctuations in gold prices reflect periods of 'highs' and 'lows' in gold production profits. At the time of surveys, one gram of gold was sold for approximately GYD $31,000 (or approximately $155 USD). Refer to Figure 11.14 for examples of artisanal mining activity in the Social AoI (ERM Fieldwork, 2025).

FIGURE 11.14 ARTISANAL MINING ACTIVITY IN THE SOCIAL AOI

Source: ERM Fieldwork, 2025

To conduct mining activities within communities' designated concessions, individuals are required to obtain a valid work permit through the GGMC. This permit must be submitted to the Village Council (VC), which holds the authority to grant permission for mining operations. Once approved, miners are obligated to pay a royalty to the VC, typically amounting to 10 percent of the earnings or the equivalent of two pennyweights[7] per ounce of gold extracted. The permit requires renewal every three months, with a renewal fee of GYD 12,000

[7] A pennyweight is a unit of mass in the troy weight system, equal to 24 grains, 1/20 of a troy ounce, or approximately 1.555 grams

(approximately USD 57.35). Wardens from the GGMC routinely conduct inspections to verify the validity of permits and monitor mining activities within the concessions (ERM Fieldwork, 2025). Meanwhile, in the more informal mining camps, miners either work for a mining claim or do “punting” - individual panning and gold detector work - independently, paying a royalty to the claim holder (when authorised) (ERM Fieldwork, 2025).

Although GGMC officers regularly visit mine sites across Region 8, including within the Social AoI to oversee and enforce mining regulations, informalities persist, including improper use and/or management of mercury and tailings and mining without the permission of the license owner (as observed in the EMPL), which results in concerns about land disturbances and more significantly, water quality throughout communities (ERM Fieldwork 2025).

11.3.3.3 NATURAL RESOURCE USE

In addition to mining and forestry, natural resource use-based livelihood activities in the EMPL include opportunistic hunting.

Hunting and Fishing

Other land and natural resource use-based livelihood activities in the Social AoI include opportunistic hunting and fishing. Wild cow/bush cow/tapir, aguti, labba, powis, deer, and wild pig/peccary are the most common species caught. The most caught fish species include haimara (*Hoplias macrophthalmus*), patwa (*Cichlasoma bimaculatum*), and huri (*Hoplias marabalicus*). Fishing and hunting activity is limited and reportedly occurs only occasionally due to concerns about water contamination and knock-on effects for consumption. Commercial hunting and fishing are typically more common in the Amerindian communities than in the informal mining settlements and other population centres (ERM Fieldwork, 2025). Hunting among residents has reportedly become time consuming, as hunters must venture further distances. Likewise, fishing mainly occurs in the Potaro River and surrounding area, with concerns about water contamination and knock-on effects for consumption hindering consumption of locally caught fish. Social AoI residents also indicated a general decline in hunting and fishing activities due to increasing human activity, specifically mining (ERM Fieldwork, 2025). Despite the decline, hunting and fishing are still regarded as important traditional Indigenous practices in Amerindian communities, with residents indicating that they go outside their community boundaries in order to practice their way-of-life (ERM Fieldwork, 2025).

Agriculture

Farming is primarily for subsistence in local communities and informal settlements throughout the Social AoI (Figure 11.15 and Figure 11.16), with small kitchen gardens and subsistence farms yielding cassava, banana, cane, coconut, pineapple, peppers, ground provisions, and plantain. Vegetables are scarcely cultivated due to the unsuitable soil type; therefore, residents tend to purchase produce from supermarkets in Mahdia or vehicles coming into communities weekly selling produce (ERM Fieldwork, 2025). Some residents in the Social AoI also cultivate “bush medicine”[8] in their farms or kitchen gardens or harvest from the

[8] Bush medicine refers to the traditional healing practices that utilises plants, herbs, roots, and fruits to prevent, manage or cure various illnesses.

surrounding environment, for the traditional treatment of minor ailments (ERM Fieldwork, 2025).

FIGURE 11.15 SUBSISTENCE FARMING WITHIN THE SOCIAL AOI

Source: ERM Fieldwork, 2025

FIGURE 11.16 SUBSISTENCE FARMING WITHIN THE SOCIAL AOI

Source: ERM Fieldwork, 2025

Forestry and conservation

Region 8 is characterised by dense forests which are rich in biodiversity and valuable timber species. A significant portion of the region is covered by pristine rainforest, which plays a crucial role in biodiversity conservation and climate regulation. The Iwokrama Rainforest and the Kaieteur National Park, two globally recognised conservation areas, lie within this region. These areas are managed under a sustainable use model that balances conservation with research and limited resource extraction. The forested lands are also used for community forestry initiatives, particularly in Indigenous villages, where traditional practices are integrated with modern sustainable forestry techniques, providing timber, non-timber forest products, and ecosystem services.

Logging, primarily done by small and medium scale operators, is a common activity regulated by the Guyana Forestry Commission (GFC). Community members throughout the Social AoI also participate in logging for use in local housing construction. These areas are surrounded by dense forests rich in hardwood species like greenheart, purpleheart, and wallaba. In Mahdia and surrounding communities, logging is often linked to mining operations, as timber is used for construction in residential/commercial use and in gold mining camps. Indigenous communities, rely on logging for both commercial purposes and subsistence needs, including building homes and community structures. Forestry activities have been noted to contribute to local livelihoods.

11.3.3.4 LAND OWNERSHIP IN THE EMPL

As discussed in the Project Description, the EMPL covers approximately 4,787 hectares of mineral rights. The EMPL was issued on September 30, 2024, by the Geology and Mines Commission Guyana. The Property also includes a 254-acre medium-scale permit held by Kilroy Mining Inc. on which Stronghold has a long-term lease with a 2% NSR royalty, and a 24.4-acre Small Scale Mining Claim (known as SSMC) under option and purchase agreement. Both permits are locally owned and are currently registered to the respective local parties.

11.4 COMMUNITY HEALTH, SAFETY, AND WELLBEING IN THE SOCIAL AREA OF INFLUENCE

This section relies primarily on data collected during ERM fieldwork carried out in 2025 within the Social AoI. Regional data is used where available for context.

11.4.1 HEALTHCARE INFRASTRUCTURE

In Region 8, there are nineteen health posts, four health centres, and two district hospitals (Bureau of Statistics, 2024; Ministry of Health, 2024)). Of the 25 health institutions, one district hospital, one health centre and one health posts are located within the Social AoI (see Table 11.4).

While the Ministry of Health in Guyana in recent years has expanded funding for smaller health posts (for example, the health posts in Amerindian communities), access to biomedical health care remains sparse, particularly within hinterland communities such as Region 8. Patients in need of emergency care travel to the nearest hospital to access emergency care services. This poses challenges in access to healthcare, particularly for workers and community members in remote areas, including those working in the artisanal and medium scale mining sector (ERM Fieldwork, 2025).

TABLE 11.4 HEALTHCARE AND MEDICAL SERVICES AVAILABLE IN THE SOCIAL AOI

Healthcare Service	Location in the Social AoI
District Hospital	Mahdia
Health Centre	Campbelltown
Health Posts	Micobie, Princeville

Source: ERM Fieldwork, 2025

11.4.1.1 MAHDIA DISTRICT HOSPITAL

The Mahdia District Hospital (Figure 11.17) is one of two district hospitals servicing Region 8. Located in Mahdia, approximately 8 km from the Project site, the hospital provides comprehensive medical services to the region's population, including remote, hinterland, and mining communities within Region 8, Sub District 1. The facility plays a critical role in delivering primary, secondary, and emergency healthcare, and also functions as the regional distribution centre for essential medications and supplies (ERM Fieldwork, 2025).

FIGURE 11.17 MAHDIA DISTRICT HOSPITAL

Source: ERM Fieldwork, 2025

11.4.1.2 CAMPBELLTOWN HEALTH CENTRE

The Campbelltown Health Centre serves as a critical primary healthcare facility for the community and surrounding areas (Figure 11.18). The health centre operates from Monday to Friday and provides a range of essential services. These include chronic disease management, child health, antenatal care, family planning, outpatient consultations, and malaria testing. Referrals to Mahdia Hospital are made for cases that exceed the health centre's capacity, such as childbirth, abdominal pain or other complex conditions. The local population is generally well-informed about the services offered at Campbelltown and understands when to seek care there versus at Mahdia (ERM Fieldwork, 2025).

FIGURE 11.18 CAMPBELLTOWN HEALTH CENTRE

Source: ERM Fieldwork, 2025

11.4.1.3 MICOBIE HEALTH POST

The Micobie Health Post serves as the primary healthcare facility for the village of Micobie and surrounding mining communities of El Paso, Mango Landing, Mowasie, and Konawaruk. The centre is staffed by a team comprising one registered midwife, three nursing assistants, one medical personnel, and one auxiliary staff. Most of the staff are residents of Micobie, which enhances community trust and facilitates communication, especially as some staff members speak indigenous languages. Notably, there is a shortage of staff to meet the demand at the health post. Prospective healthcare workers must travel to Mahdia for training, which poses logistical and financial barriers. This has contributed to understaffing and limits the health post's capacity to expand services.

The health post consists of one dressing bed and one examination bed, and often limited resources to meet the patients' demand. On average, the health post receives approximately 25 patients daily, many of whom walk from nearby villages and mining areas. Healthcare services are structured throughout the week: post-natal clinics are held on Tuesdays, focusing on childcare, vaccinations, and maternal follow-up; and Fridays are dedicated to family planning services. High-risk pregnancies are referred to Mahdia and subsequently, Georgetown Public Hospital, given the lack of advanced obstetric care locally. There are no permanent dental and optical services available, and these services are only provided intermittently by visiting teams. The health post does not have a pharmacy, and medications are dispensed directly by the healthcare staff. Supplies are provided approximately every six months from Mahdia Hospital, which can lead to shortages if demand fluctuates unexpectedly. Additionally, there is no medivac service in Micobie, and emergency cases must be transported by road to Mahdia Hospital, which can delay critical care.

11.4.2 HEALTH AND WELLBEING STATUS

11.4.2.1 PRIMARY HEALTH CONCERNS

The Mahdia District hospital frequently treats cases of diabetes, hypertension, pregnancy-related complications, low haemoglobin, dengue fever and malaria. Other serious cases occasionally treated include injuries from assault such as stabbing and shooting, and obstetric emergencies, particularly among workers in the mining sector.

The health issues most commonly reported by residents within the Social AoI include malaria, dengue fever, and common cold/flu. Seasonal trends show a decrease in malaria during the dry season and a rise in dengue fever, while the wet season sees the opposite pattern. Fumigation efforts are in place to control mosquito populations, though they only eliminate adult mosquitoes, leaving larvae unaffected.

Indigenous members reported teenage pregnancies as a major concern within the communities. This trend is often attributed to limited access to reproductive health education. The health centre attempts to address this through its family planning services, though broader community engagement and support are needed to mitigate the issue. Common sexually transmitted infections (STIs) include HIV and syphilis, which are monitored and managed locally. Among older residents, chronic conditions such as diabetes, hypertension, and high blood pressure are frequently reported.

Traditional medicine, or "bush medicine," is commonly used by patients of Indigenous communities as a first response to illness. While medical professionals often advise against combining bush remedies with prescribed medications, some patients continue to do so. There have been serious incidents resulting from improper use of bush medicine and prescribed medications, including one reported case during the survey where a patient’s condition worsened after using both simultaneously, requiring saline treatment. Another case involved a family consuming a poisonous herb known as "hairy" in an attempt to prevent COVID-19, resulting in severe illness and one fatality (ERM Fieldwork, 2025). Despite these risks, bush remedies such as sweet broom for colds and other herbs for kidney stones remain popular.

11.4.2.2 MATERNAL AND CHILD HEALTH

Women in Sub-District 1, Region 8, including those living in Indigenous communities, travel to the Mahdia District Hospital to receive antenatal and post-natal care (ERM Fieldwork, 2025).

Table 11.5 summarises the healthcare indicators for Region 8 compared to the national level, highlighting differences in antenatal and postnatal care, contraceptive use, neonatal mortality, early childbearing, and child immunisation rates. Child immunisation rates are consistently lower than the national averages based on the MICS 2019-2020 data. Although Region 8 shows moderate coverage for most vaccines, it trails behind the national levels, especially for yellow fever, where coverage is less than half the national rate (UNICEF, 2023). This suggests difficulties in vaccine delivery and accessibility in remote areas, which could increase vulnerability to preventable diseases.

TABLE 11.5 HEALTH INDICATORS BETWEEN REGION 8 AND NATIONAL AVERAGES

Indicator	Region 8	National
Antenatal Care Coverage (Women 15-49)[9]	90.7	89.1%
Postnatal Health Checks (Newborns)[10]	92.3%	94.6%
Contraceptive Prevalence Rate (Women 15-49)[11]	32.7%	29.9%
Neonatal Mortality Rate[12]	9.0%	16.1%
Early Childbearing (Women 20-24)[13]	29.2%	13.5%
Immunisation Coverage		
Polio	82.0%	89.9%
Tuberculosis	93.0%	94.6%
DPT	84.0%	89.2%
Measles	88.0%	90.3%
Yellow Fever	37.7%	71.5%

Source: UNICEF, 2023

11.4.2.3 SUBSTANCE ABUSE

Reports from the Guyana Drug Information Network (GUYDIN) and the Ministry of Health indicate that alcohol, marijuana, and, increasingly, cocaine are the most abused substances in hinterland communities (GUYDIN, 2023; Ministry of Health, 2024), including Region 8. Nonetheless, alcohol consumption remains the most abused substance, deeply entrenched in social life and is often normalised within communities, mining camps and remote settlements. According to the MICS 2019-2020 data, the use of alcohol was reported higher among men[14] (54.0 percent) than women[15] (24.0 percent) in Region 8, than the national level (UNICEF, 2023). Marijuana use is also widespread, with law enforcement reporting frequent seizures, including recent operations involving the seizure of over 1,600 grams of marijuana and smaller quantities of cocaine at Konawaruk Junction and Mahdia Arcade (Guyana Times, 2024). These findings suggest that illicit drug trade and consumption are not isolated incidents, but part of a

[9] Percentage of women aged 15-49 years who had a live birth in the last two years that meet the following criteria: (a) were attended at least once by a skilled health personnel and/or (b) were seen at least four times by any provider.
[10] Percentage of women age 15-49 years with a live birth in the last 2 years whose most recent live-born child received health checks while in facility or at home following birth, percent distribution who received post-natal care (PNC) visits from any health provider after birth, by timing of visit, and percentage who received post-natal health checks.
[11] Percentage of women aged 15-49 years currently married or in union who are using (or whose partner is using a (modern or traditional) contraceptive method.
[12] Percentage per 1000 birth rates with the probability of dying within the first month of life.
[13] Number of women aged 20-24 years who had at least one live birth before age 18.
[14] Percentage of men age 15-49 years who have had at least one alcoholic drink at any time during the last one month.
[15] Percentage of women age 15-49 years who have had at least one alcoholic drink at any time during the last one month.

broader pattern linked to economic activities in the region. Emerging trends include the introduction of synthetic drugs and recreational substances among younger populations. A National Survey highlighted that youth in Guyana, including those in hinterland regions, are increasingly experimenting with substances such as ecstasy (Guyana Times International, 2019).

This aligns with findings across the Social AoI, where drug and alcohol use was identified as a major concern, particularly among youth in Indigenous communities (ERM Fieldwork, 2025). Alcohol consumption is widespread and practiced by both men and women, with youth drinking often linked to increased violence in homes and schools. Substance abuse has been attributed to the absence of positive role models, limited recreational spaces, and a lack of meaningful after-school activities for children. Residents also reported that young people are increasingly exposed to “foreign” substances such as pills, vaping products, and other drugs. These trends highlight the urgent need for rehabilitation services, which are currently unavailable in these communities (ERM Fieldwork, 2025). Communities rely heavily on outreach programs and awareness campaigns, but these efforts are sporadic and under-resourced.

11.4.3 QUALITY OF LIFE

Like food insecurity at the national level, food insecurity and nutritional issues are common within the Social AoI. The limited variety of foods available locally affects both nutritional intake and overall quality of life. Food insecurity in Mahdia and the surrounding communities is closely tied to the availability of local agriculture, access to diverse food sources, and the affordability of fresh produce (ERM Fieldwork, 2025). While interviewees indicated that the land in Mahdia was once used for farming, much of it is now occupied, limiting opportunities for community-based cultivation. As a result, residents rely heavily on food transported from Georgetown, which introduces logistical challenges and contributes to higher prices, especially for fresh fruits and vegetables.

In Indigenous communities, farming is practiced on small to medium scales and often maintained by women. However, the range of produce is generally limited to root crops such as cassava and a few types of fruits like watermelon, and pumpkin. Growing cash crops and a wider variety of fruits is reported to be challenging due to poor soil conditions, which are not well-suited for these types of cultivation. Farming consistently poses additional challenges such as access to farms (for example, in Campbelltown where the farms are located a reasonable distance from the homes), the shortage of water during the dry season, aging women unable to spend long hours cultivating, and the reluctance among younger residents to engage in farming (ERM Fieldwork, 2025). Combined with the lack of structured support systems and agricultural education, these factors contribute to weakened food security in the region, limiting both the availability and diversity of locally grown food.

11.4.4 SAFETY AND SECURITY

Mahdia Police Station provides service to Region 8, Sub-District 1, acting as the district police headquarters. Region 8, particularly the Mahdia area, is generally considered a quiet and safe community, with no reported robberies. However, community members noted instances of assault and theft.

According to insights from the Mahdia Police Station, the primary safety concerns in the region are traffic accidents and sexual assault (ERM Fieldwork, 2025). In 2025, there were two traffic-related incidents, both involving all-terrain vehicles (ATVs). Additionally, there were twelve reported cases of sexual assult, with cases predominantly occurring in indigenous communities and often involving underage girls, with perpetrators frequently being known to the victims. The region benefits from active community policing groups that patrol daily, both during the day and night, supported by over 50 police officers. While the workload is considered manageable, there is a recognised need for additional personnel to adequately cover the expansive area. Other issues such as domestic abuse are addressed through fines and imprisonment, and while noise nuisance exists, it is not a major concern among residents. The local prison can accommodate up to 50 individuals, and police presence is heightened between November 5th and January 15th to ensure safety during the festive season.

Residents noted that Mahdia is a small, close-knit town with relatively low levels of crime, contributing to a general sense of safety among residents despite the presence of sexual assault which is mainly domestic in setting. During the ERM Survey, the most commonly reported incidents are shoplifting and petty theft, which are typically opportunistic and often committed by individuals from outside the community. Due to the town’s size and familiarity among residents, perpetrators are usually identified and apprehended quickly. Interviewees noted that the police are generally responsive and effective in handling such incidents.

In contrast, Indigenous communities within the Social AoI (Micobie, Campbelltown, and Princeville) expressed more nuanced safety concerns. While residents generally feel safe, issues such as unauthorised access by outsiders, robberies, and interpersonal violence were raised.

In Princeville, safety concerns are primarily linked to drug and alcohol abuse, which often leads to fighting and violence among residents, particularly around shops and bars. Community Policing Groups (CPGs) exist within communities, but their effectiveness is limited due to the voluntary nature of the role, lack of consistency, and absence of arms. CPGs are tasked with reporting crimes rather than intervening directly, which restricts their impact on maintaining safety. Domestic crimes are reported to the Village Councils, and more serious criminal activities are reported to the police station.

Micobie residents reported feeling unsafe due to miners accessing the village through non-community-owned concessions, resulting in uncontrolled movement.

11.5 SOCIAL INFRASTRUCTURE AND SERVICES IN THE SOCIAL AREA OF INFLUENCE

11.5.1 SOCIAL INFRASTRUCTURE IN THE SOCIAL AOI

11.5.1.1 HOUSING

Housing in Potaro-Siparuni (Region 8) reflects the region’s diverse geography and economic activities, ranging from more developed urban areas to rural communities and industrial camps dependent on natural resource extraction. Infrastructure challenges such as limited road access and basic amenities can also impact the quality of housing (ERM Fieldwork, 2025).

In Mahdia, the regional capital, housing are generally of a higher standard when compared to the rest of the region, however, less developed than typical urban centres in Guyana. There is a mixture of commercial buildings like hotels, apartments, and other businesses, alongside residential structures, ranging from modest to more substantial structures. Currently, there is a new housing development underway at Tracks A and B Four Miles Mahdia, with the construction of a 95-acre housing scheme which will offer over three hundred residential house lots (DPI, 2025).

Housing in the Indigenous communities varies from traditional wooden houses to concrete houses. Given that most of the communities are remote, access to resources is challenging and expensive for residents. Residents explained that the wood used to build their homes is mostly locally harvested from regional forests. The traditional materials used to build benabs (typically community meeting centres) have been replaced with improvised alternatives. Instead of using traditional wood and palm branches/truli, the communities of Campbelltown, Princeville, and Micobie now construct benabs using concrete and wooden frames with zinc roofs (Figure 11.19). This change was made because traditional materials are expensive and require frequent maintenance. Additionally, these materials are not readily available in the region and were previously sourced from as far as Region 1 (ERM Fieldwork, 2025). Figure 11.20 shows typical dwelling unit in the Social AoI.

Within the mining areas of Region 8, housing consists of semi-permanent structures such as makeshift camps or barracks to accommodate workers (Figure 11.21). It is common for informal settlements to develop on the outskirts of mining camps to provide easy access to resources necessary to support mining operations. These informal settlements consist of shops, general stores, restaurants, and other amenities. Refer to Figure 11.22 for an example of housing in an informal settlement in the Social AoI.

FIGURE 11.19 COMMUNITY BENAB MADE WITH IMPROVISED ALTERNATIVES

FIGURE 11.20 TYPICAL DWELLING TYPE IN INDIGENOUS COMMUNITIES IN THE SOCIAL AOI

FIGURE 11.21 TYPICAL DWELLING TYPE IN AN ARTISANAL AND SMALL-SCALE MINING CAMP

FIGURE 11.22 TYPICAL DWELLING SETTLEMENT IN AN INFORMAL MINING SETTLEMENT

11.5.1.2 POWER

Mahdia has a power plant managed by the government of Guyana. Mahdia Power and Light Inc. (MPL Inc.) are responsible for the generation and distribution of electricity in Mahdia and Campbelltown.

With efforts to integrate a solar-diesel hybrid system, in December 2024, a photovoltaic (PV) farm was commissioned in Mahdia, providing an additional 0.65 megawatts of electricity to be integrated into the current mini grid for a more stable and reliable power supply (Guyana Energy Agency, 2024). This project was funded by the Inter-American Development Bank (IDB) under its Energy Mix Diversification and Strengthening of the Department of Energy (EMISDE) programme. The solar farm is expected to offset approximately 30 percent of the annual electricity demand in Mahdia and would be able to supply up to two hours of electricity daily without the use of diesel generators, hence reducing fuel consumption and carbon emissions (Guyana Times 2024). During socioeconomic surveys, residents reported a general improvement in electricity supply, mainly due to the integration of solar energy. However, occasional blackouts and low voltage still occur, as the solar system is currently undergoing testing. This results in businesses and some residents having back-up generators. When the MPL switches to solar power, it often results in low voltage. Despite this, residents noted that blackouts are less frequent than before. With the integration of solar power, a 30 percent reduction in electricity tariffs for residents became effective in July 2025 (DPI, 2025a). On the downside, electricity costs for businesses remain significantly high (ERM Fieldwork, 2025).

Although Princeville is close to Mahdia, the community is not on the electricity grid, therefore has no power supply from MPL. Residents of Princeville and Micobie rely on individually owned generators to supply power. The schools, health posts, and ICT Hubs in both communities are equipped with solar panels for power generation, which was provided through the Government of Guyana.

11.5.1.3 TELECOMMUNICATIONS

Telecommunications infrastructure in Region 8 has long lagged when compared to more developed areas in Guyana, such as the coastal belt, due to the region's geographic isolation. Hinterland communities have benefited from the ICT Access and e-Services for Hinterland Poor and Remote Communities (HPRC) Project, which is spearheaded by the Office of the Prime Minister through the National Data Management Authority (NDMA) (DPI, 2024). This project has introduced high-speed internet connectivity to over 240 remote communities, using Low Earth Orbit (LEO) satellite technology, which offers faster, and more stable internet compared to traditional satellite systems. The WiFi-GY Programme, another key initiative, has expanded free public internet access across hinterland areas, enabling residents to engage in online education, telemedicine, and e-government services.

Internet access in Mahdia has significantly improved due to these targeted government initiatives aimed at bridging the digital divide between coastal and hinterland regions, and Mahdia is part of a broader infrastructural development plan that includes ICT hubs powered by solar energy, ensuring sustainable connectivity even in areas with limited access to the national grid. Residents and businesses in Mahdia also rely on private satellite e-services for enhanced internet access.

Internet access is less dependable and slower in more remote communities given the underdeveloped and rugged terrains. Other remote communities outside of Mahdia have no internet service providers (ERM Fieldwork 2025). Communities beyond Mahdia rely on mobile phones for communication and daily, weekly, or monthly data plans for internet connection. The Indigenous communities also benefit from the ICT Access and e-Services for the HPRC Project and the Wi-Fi GY Programme.

11.5.1.4 SOCIAL WELFARE

The Ministry of Amerindian Affairs (MoAA), Ministry of Human Services and Social Security, and Non-Governmental Organisations (NGOs) all support vulnerable communities throughout Region 8. Social support services within the region are extremely limited, with no dedicated facilities available locally. This leads to significant social challenges, including high rates of teenage pregnancy, drug and alcohol abuse, and school dropout.

During fieldwork interviews, it was reported by a resident of Campbelltown that there is a representation of ChildLink's Child Advocacy Centre (CAC) in Mahdia. The branch was established in Mahdia in 2022, and is comprised of a team of two staff who coordinate child protection efforts. The CAC provides counselling for children, conducts forensic interviews, and delivers awareness sessions in schools (ERM Fieldwork, 2025). It collaborates closely with the police, health, and education sectors, reporting cases directly to the Mahdia Police Station and handling matters from across the entire region. Ten cases were recorded in 2024 and thirteen so far in 2025. These numbers are believed to be vastly unreported (ERM Fieldwork, 2025). To improve coverage, ChildLink has designated point persons in Kato, Paramakatoi, and Chenapou, but gaps in access and trust remain significant barriers.

Additional social services within the Social AoI includes outreach by the Ministry of Health which conducts educational talks and health outreaches, such as providing malaria and dengue awareness and treatment Organisations such as the Guyana Responsible Parenthood Association (GRPA) hosts biannual visits offering screenings for STDs, cervical cancer, and HPV; and Blossom Inc. occasionally organises health outreach programs. These visits are deemed effective as women often prefer to disclose health concerns to visiting teams from outside the region due to confidentiality concerns (ERM Fieldwork, 2025).

Following the Mahdia dormitory fire in 2023, the Ministry of Health launched a multi-phase mental health program offering crisis intervention and psychosocial support across the Social AoI. This initiative included telemedicine services and training for teachers and community leaders to strengthen resilience and access to care (Ministry of Health, 2023). Additionally, cash grant programs implemented by the government of Guyana aids in alleviating economic hardship faced by households in these areas (Government of Guyana, 2023).

11.5.1.5 WATER AND SANITATION

Region 8 has historically faced challenges in accessing clean and reliable water, particularly in remote and mountainous hinterland communities. According to the 2012 census, 65 percent of households in Region 8 used waterways ("river/stream/creek/pond/spring") as their primary source of water, with rainwater catchments providing the second most common water source (Bureau of Statistics, 2012). According to a UNICEF report, as of 2017, approximately 65.2 percent of the Region's population has access to improved drinking water sources, and 22.2 percent of the Region's population undertake some form of water treatment (UNICEF, 2017). Nonetheless, approximately 10.8 percent of people in Region 8 rely on rainwater collection as their primary source of drinking water, and 21.0 percent rely on surface water (considered an 'unimproved source') (MICS, 2023).

In recent years, substantial government investments have reportedly led to marked improvements in water infrastructure across the region, with hopes of achieving 100 percent coverage by 2025, aligning with Guyana's commitment to the Sustainable Development Goals (Guyana Standard, 2024). Several key projects have been implemented to support this goal, which consist of the construction of water supply and distribution systems, which includes a deep well, extensive piping, storage tanks, and a photovoltaic pumping system in communities. Despite these advancements, water supply is still intermittent in some areas, and concerns about water quality, such as discoloration and potential contamination persist among community members interviewed (ERM Fieldwork, 2025).

Mahdia's water supply system is primarily dependent on the Salbora Creek (Figure 11.23) located in the EMPL, which serves as the main source of water for domestic use across the town. Water is distributed in sections, typically every two to three days, due to limitations in infrastructure and supply capacity. During the dry season, when the Salbora Creek experiences reduced flow or dries up entirely, water shortages can be experienced (Stabroek News, 2024; ERM Fieldwork, 2025). In response to these seasonal challenges, residents purchase water by the drum, with prices reaching approximately GYD $1,200 (approximately USD $5.75) per drum.

FIGURE 11.23 SALBORA WATER SUPPLY (WEIR AND INTAKE PIPE FOR MAHDIA WATER SUPPLY), MAHDIA

Source: ERM Fieldwork, 2025

To alleviate pressure on the Salbora source, the Guyana Water Incorporated (GWI Inc.) has installed four groundwater wells (Figure 11.24), with a fifth currently under construction to supply water to Mahdia and a section of Campbelltown community (Stabroek News, 2024). These wells are intended to supplement the creek supply and improve overall water access. However, during interviews, some residents noted that the government-installed wells have not been fully integrated into the distribution network, as pipeline connections remain incomplete though this was not able to be independently verified (ERM Fieldwork, 2025).

The primary source of water in Campbelltown are the community wells; however, water scarcity remains an issue, especially where existing well water is deemed to be unsuitable for consumption. Residents rely on rainfall for drinking and cooking, while water from creeks and streams is used for bathing and washing. During the dry season, when rainfall is minimal and nearby creeks/streams run dry, residents rely on the Village Council to supply water from the Salbora creek or a creek in Princeville. This is distributed via a village tractor to residents free of charge. The Village Council is actively working to improve long-term water access by drilling a new well. There are also ongoing discussions about sourcing water from nearby mountainous areas, including Ebini Mountain, Tucan Mountain, and as far as the Potaro River, to diversify and stabilise the community's water supply.

Both Micobie and Princeville communities have one well each, which was noted by community members to not adequately service the entire community and that it is not considered safe for drinking (ERM Fieldwork, 2025). Residents frequently use water sourced from creeks for domestic purposes, boiling it to cook or drink. The creeks can run dry during the dry season, exacerbating water scarcity and increasing reliance on other sources such as rainwater collection and purchasing water drums. Similarly, in Micobie, residents primarily rely on Tiger Creek and the Potaro River for water for domestic purposes. There is also a natural spring located approximately 2.5 km away from the community's centre that is preferred for cooking/drinking due to the water quality. This natural spring is also affected by the dry season, limiting access and supply.

Water and sanitation were also reported by community members to be a concern. In Micobie, some interviewees noted water supply to schools is insufficient, and the well, typically a reliable source, was out of order at the time of fieldwork. This has, at times, led to school closures and reliance on well water for drinking (Ministry of Education, 2025).

FIGURE 11.24 GROUNDWATER WELL IN PRINCEVILLE COMMUNITY

Source: ERM Fieldwork, 2025

In the Minnehaha informal mining settlement, water is sourced from nearby creeks for domestic purposes and farming. Water is drawn from a ravine located in the Ebini Mountain area on the western side of the EMPL, which is reported to be clean and potable. Although the water from the ravine is consumed by some occupants, others rely solely on bottled water for drinking and cooking.

Throughout the Social AoI, concerns persist regarding mercury contamination, muddy well water, and inconsistent supply of water from both the wells and the creeks. While the water is generally considered clean for washing and other domestic purposes, it is not considered safe for drinking by those interviewed (ERM Fieldwork, 2025). As a result, residents rely heavily on bottled water for drinking and cooking. Rainwater is also stored in buckets and tanks, though this method is unreliable during dry periods.

11.5.2 WASTE MANAGEMENT IN THE SOCIAL AOI

11.5.2.1 SOLID WASTE MANAGEMENT

Mahdia Town Council is responsible for solid waste collection and disposal. Currently, garbage is disposed of in a landfill close to Mahdia airstrip. Due to concerns about sanitary and presentation, a new area was identified for a dumpsite outside the airstrip zone (ERM Fieldwork, 2025).

In the Indigenous communities and informal mining settlements, waste disposal primarily consists of burning garbage or disposing of it directly into small pits and piles.

11.5.2.2 DOMESTIC EFFLUENT

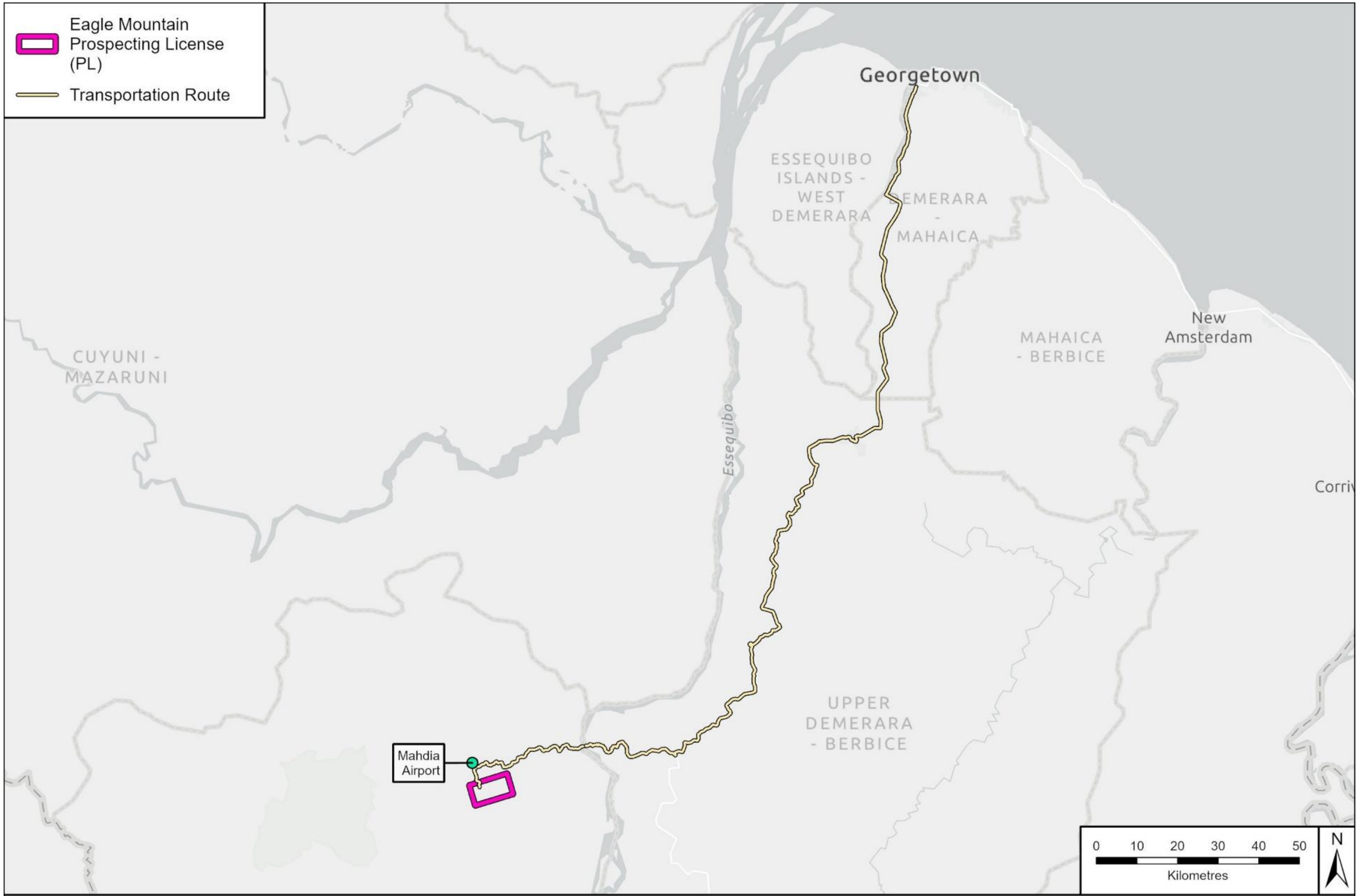
Most households in Mahdia have flush toilets, supported by septic tanks systems. In the indigenous communities, while it is common for schools and health posts to have flush toilets, most of the households have slab latrines without ventilation, while some have pit latrines, only a few have flush toilets. In informal mining communities, slab latrines are predominantly used. (ERM Fieldwork, 2025).

11.5.3 TRANSPORTATION IN THE SOCIAL AOI

Roads, access routes, and efficient means of transportation are critical considerations in Guyana’s interior. Access to Mahdia and the Project site is currently possible through a combination of road-based and/or air-based transport. See Figure 11.25 for the anticipated Project road and air transportation routes.

Equipment and supplies will be brought in by air and road from Georgetown. Workers are to be substantially sourced from the local communities in the Socia AoI and more broadly in Guyana.

FIGURE 11.25 ANTICIPATED PROJECT ROAD AND AIR TRANSPORTATION ROUTES



Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community; GuyNode

Path: \\vmukspgisfs01\Data\London\Projects\0763224 - Mako Mining EIA\Map\0763224 - Mako Mining EIA - V01C06 - Stakeholder Engagement.aprx\0763224 - V01C06 - Stakeholder Engagement - 06.XX - Anticipated Transportation Routes

11.5.3.1 ROAD NETWORK

The road access route from Georgetown to Mahdia in Guyana spans approximately 310 kilometres and typically takes around 6 to 8 hours by vehicle, depending on weather and road conditions. Access is via the Linden–Soesdyke Highway, passing through Linden and continuing via the Linden–Lethem Road toward Mabura Hill. The Essequibo River is crossed at Mango Landing. From there, a laterite road is used to access Mahdia and the Project Area. The route beyond Linden is currently undergoing maintenance and being paved, however some sections can become muddy and challenging during the rainy season. Recent developments to sections of the Linden-Mabura road route has improved commute on sections of the access route. The upgrades are part of a transformative US$190 million project aimed at converting the 121 km stretch into an all-weather, asphalt-paved highway. The initiative, co-financed by the Caribbean Development Bank (CDB), the UK Caribbean Infrastructure Partnership Fund (CIPF), and the Government of Guyana, includes a 7.2-metre-wide carriageway, a two-metre pedestrian and cycle lane, and 10 bus stops with accessibility ramps (Guyana Times, 2025). The project also involves replacing deteriorated timber bridges and culverts, installing 123 roadway lights, and adding climate-resilient features to withstand heavy rainfall and flooding. As of January 2026, the upgrade project has reached 62 percent completion and is expected to complete works by September 2026 with delays from its initial deadline of December 2025 (Stabroek News, 2026). Within the Social AoI, Mahdia and Campbelltown have a developed road network with a combination of paved concrete and laterite roads connecting various areas (Figure 11.26), while Micobie and Princeville have predominantly laterite roads connecting areas within the communities (Figure 11.27).

FIGURE 11.26 VIEW OF ROAD CONNECTING MAHDIA TO CAMPBELLTOWN

Source: ERM Fieldwork, 2025

FIGURE 11.27 TYPICAL LATERITE ROADS WITHIN COMMUNITIES IN THE SOCIAL AOI (ROAD SHOWN IN MICOBIE)

Source: ERM Fieldwork, 2025

Within the Social AoI, commute is common via vehicles, however, forms of off-road vehicles, such as 4x4 pickups and All-Terrain Vehicles (ATVs) are used to access some remote locations, especially those with harsh terrain. Historically, Mahdia's internal roads were primarily laterite surfaces, which deteriorated quickly under heavy rainfall, creating accessibility issues for residents and mining operators. To address this, the Government of Guyana has invested in infrastructure upgrades, and continues to exert efforts on upgrading access routes. In 2024, approximately GYD $600 million (approximately USD $3 million) was allocated for rehabilitating key roads, including the Mahdia Main Access Road, Church Street, Campbelltown Main Road, and the Airstrip Housing Scheme Road. These works use rigid concrete pavement for durability and include phased upgrades of major connectors within communities in Mahdia and Campbelltown (DPI, 2024). Paved asphalt/concrete road access in the other communities Micobie and Princeville is not yet available, as roads are currently paved with laterite (ERM Fieldwork, 2025).

Residents within these communities rely on a combination of transportation methods shaped by terrain and infrastructure limitations. In Mahdia and Campbelltown, movement within the town is primarily by minibuses, motorcycles, and off-road vehicles, which navigate the concrete and laterite roads connecting nearby communities. Small taxi services and private vehicles are also common, while walking remains practical for short distances since most essential services are centrally located. In other communities, residents mostly walk or ride to their destinations. Campbelltown and Princeville both have a community bus, predominantly used for transporting children to school, and occasionally used to transport residents. In contrast, Micobie's connectivity is far more challenging. Some residents rely on river transport along the Potaro River (Figure 11.28), using boats and canoes to access the central community. When traveling by land, residents rely on 4x4 pickups, tractors, and ATV's to navigate the terrain with primarily walking to destinations within the village. Micobie community has a village vehicle (4x4 pickup) which was bought using the village's royalties earned through miners operating within the village's concessions, and which is used to conduct village affairs within and outside the village (ERM Fieldwork, 2025).

FIGURE 11.28 SECTION OF THE POTARO RIVER AT MICOBIE

Source: ERM Fieldwork, 2025

11.5.3.2 AIR TRANSPORTATION

Domestic flights are a critical aspect of transportation within Region 8 as air travel significantly reduces travel time. Despite high costs and occasional weather-related disruptions, air travel remains an essential part of Region's 8 transportation network, especially for delivering goods, healthcare access, emergency services, educational access, and administrative outreach to the remote communities of Region 8. Currently, there are three airstrips in the Region located in the communities of Mahdia, Kato, and Paramakatoi.

Within the Social AoI, the Mahdia airstrip (Figure 11.29) services the town and serves as a transit to surrounding communities within Region 8. The route for local air travel to the town includes a fifty-minute journey from the Ogle International Airport in Georgetown, Region 4 to the Mahdia Airstrip, Region 8. Therefore, for travel to Georgetown, some residents often use the Mahdia Airstrip, as flights are faster and more reliable than the lengthy road journey. However, road travel remains the predominant option as it is deemed more cost effective, especially when transporting goods (ERM Fieldwork, 2025).

FIGURE 11.29 MAHDIA AIRSTRIP

Source: ERM Fieldwork, 2025

11.5.3.3 MAIN ACCESS ROAD

Robust traffic data was collected for the Project from April 2024 to July 2025, using an automatic traffic counter located at the junction of the Camp Access Road and the Main Access Road (‘old Potaro-Konawaruk Road’). This data was collected at different months, days, and times of day throughout this period, recording traffic from both directions, and qualitative analysis has been conducted on the number of vehicles using the access road. Figure 11.30 shows that the average number of cars per hour using the road is between 3.5 and 6.6 vehicles per hour between 7am and 9pm. This included Stronghold Guyana vehicles. February was the month with the highest average number of vehicles per day; however, this may be an artifact of sampling intensity differences. The busiest times of the day where around 1pm and 6pm, with less traffic between 10pm and 6pm (Figure 11.31).

FIGURE 11.30 AVERAGE NUMBER OF VEHICLES PER DAY PER MONTH

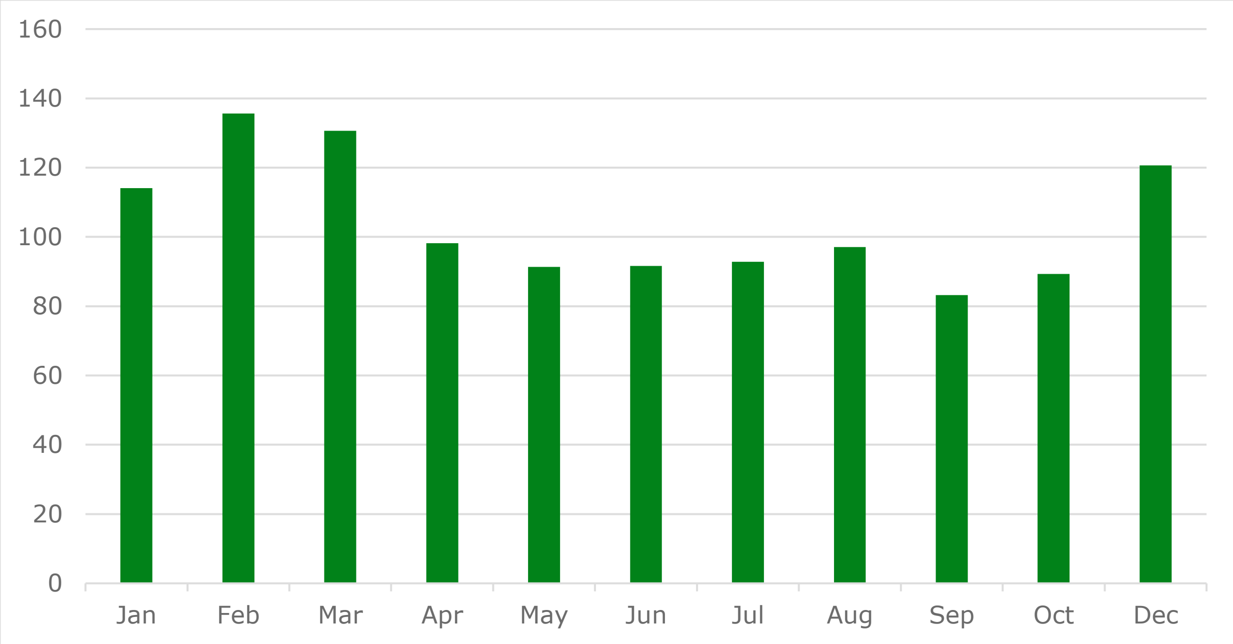
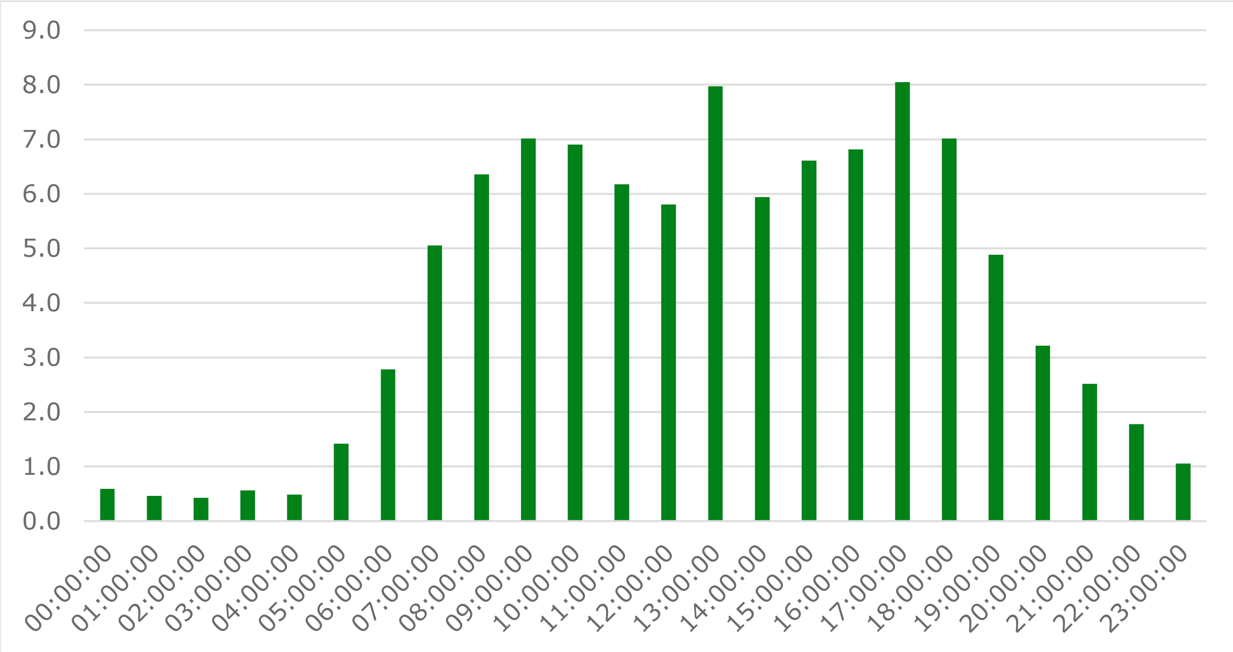


FIGURE 11.31 AVERAGE NUMBER OF VEHICLES PER HOUR OF THE DAY



As the main assess road will be utilised by local communities and the Project, the Project will construct an overpass to reduce impacts from local vehicles interacting with heavy plant and trucks on the access road. This is discussed in Volume 1: Chapter 2 - Project Description.

11.6 ECOSYSTEM SERVICES

Ecosystem Services (ES) are defined as the benefits people derive from the natural environment, encompassing natural resources that support fundamental human needs for health and survival, bolster economic activities, and contribute to cultural satisfaction (World Resources Institute, 2013).

There are four (4) standard categories of ES:

- **Provisioning Services:** These include goods or products obtained from ecosystems, such as food, water, wood, fibres, and other natural resources.
- **Regulating Services:** These are the benefits gained from the ecosystem's control over processes like climate regulation, water flow regulation, disease control, pollination, and protection against natural hazards.
- **Cultural Services:** These encompass non-material benefits derived from the ecosystem, such as recreational opportunities, spiritual values, and aesthetic enjoyment.
- **Support Services:** These natural processes maintain other services, such as erosion control, soil formation, nutrient cycling, and primary productivity.

ES are crucial for sustaining life and human activities, providing the foundation for economic activities, and overall health and well-being. Recognising and valuing these services is essential for promoting sustainable development and environmental conservation.

11.6.1 METHODOLOGY

The methodology employed to identify and assess ES is based on the "Guide for the Integration of Ecosystem Services in the Impact Assessment" by the World Resources Institute (World Resources Institute, 2013). In addition, ERM incorporated the International Finance Corporation (IFC) Performance Standards (PS) from 2012, with a particular focus on IFC PS 4 and 6. These standards outline key requirements, including:

- Conducting a systematic review to identify priority ES.
- Engaging Affected Communities in accordance with the stakeholder engagement process defined in PS 1.

Moreover, according to the (IFC, 2012), the determination of priority ecosystem services is described as follows:

> “Priority ecosystem services are two-fold: (i) those services on which project operations are most likely to have an impact and, therefore, which result in adverse impacts to Affected Communities; and/or (ii) those services on which the project is directly dependent for its operations (e.g., water). When Affected Communities are likely to be impacted, they should participate in the determination of priority ecosystem services in accordance with the stakeholder engagement process as defined in Performance Standard 1”

11.6.1.1 IDENTIFICATION

Two (2) steps are performed to identify relevant ES. First, a list is created of ES likely present in the Social Area of Influence (AoI) that meets two (2) criteria:

- Habitats or ecosystems present in the Social AoI that are believed to provide this service or are similar to habitats elsewhere that provide this service.
- People are believed to benefit from the service, whether locally, nationally, or globally, and/or the Project is expected to benefit from this service.

Second, a scoping exercise is conducted to evaluate the list of ES, considering only those services that will potentially be affected by or that the Project will depend on. ES are included in the scope of the assessment if:

- One or more potentially significant sources of direct or indirect impact have been identified that would affect the value and functionality of the ES; and/or
- The Project will be potentially dependent on the ES (e.g., freshwater requirements during operations, erosion control measures that protect and maintain access to Project facilities).

11.6.2 EXISTING ECOSYSTEMS IN THE SOCIAL AREA OF INFLUENCE

A number of ES were identified in the Social AoI through ERM fieldwork and supplementary research (Table 11.6). Unless otherwise noted, sources for the remaining information in this section are ERM Fieldwork 2025.

TABLE 11.6 ES IDENTIFIED IN FIELDWORK AND SUPPLEMENTARY RESEARCH

	Ecosystem Service	Category	Beneficiaries
1	Freshwater	Provisioning Service	Town, Indigenous Communities and Informal Settlements within the Social AoI and the Eagle Mountain Project
2	Wild foods and hunting	Provisioning Service	Informal settlements and Indigenous communities within the Social AoI
3	Agricultural crops	Provisioning Service	Towns, Informal Settlements and Indigenous communities within the Social AoI
4	Artisanal fishing	Provisioning Service	Indigenous communities within the Social AoI
5	Biomass fuel	Provisioning Service	All communities within the Social AoI
6	Timber and other wood products	Provisioning Service	All communities within the Social AoI
7	Biochemical, natural medicines, pharmaceuticals	Provisioning Service	Town, Informal Settlements and Indigenous communities within the Social AoI
8	Air quality regulation	Regulating Service	All communities within the Social AoI
9	Climate change regulation	Regulating Service	All communities within the Social AoI
10	Erosion control	Regulating Service	All communities within the Social AoI
11	Regulation of soil quality	Regulating Service	All communities within the Social AoI
12	Regulation of pests	Regulating Service	All communities within the Social AoI
13	Pollination	Regulating Service	All communities within the Social AoI
14	Natural disaster risk reduction	Regulating Service	All communities within the Social AoI
15	Fire regulation	Regulating Service	All communities within the Social AoI

	Ecosystem Service	Category	Beneficiaries
16	Habitat provision	Supporting Services	All communities within the Social AoI
17	Nutrient cycling	Supporting Services	All communities within the Social AoI
18	Primary production	Supporting Services	All communities within the Social AoI
20	Water cycling	Supporting Services	All communities within the Social AoI
21	Recreation and ecotourism	Cultural Services	Town and Indigenous Communities within the Social AoI
22	Educational and cultural values	Cultural Services	Towns and Indigenous Communities within the Social AoI

Reference: ERM, 2025

11.6.2.1 PROVISIONING SERVICES

Provisioning services are the most frequently identified ecosystem service throughout the settlements in the Social AoI. Key provisioning services include fresh water, timber, foods and natural (or "bush") medicines. Provisioning services are listed in Table 11.9.

TABLE 11.7 ES PROVISIONING SERVICES

Service	Description
Fresh water	• The inhabitants of the Social AoI depend on the water resources provided by surface and groundwater to carry out some of their domestic activities. Among the main functions of this resource for the communities are cleaning, personal hygiene, washing clothes, and human and animal consumption. • The Potaro River is the main river flowing through the Social AoI, and along its course are several major waterfalls, including the Kaieteur Falls, Tumatumari, Amatuk, and Waratuk Falls. It originates in the Pakaraima Mountains near Mount Ayanganna and flows eastward for about 255 km before joining the Essequibo River. The Essequibo River, originating in the Acarai Mountains and stretching for 1,014 km, is a vital drainage conduit for over half of Guyana, and subsequently flows into the Atlantic Ocean. Within the Social AoI, evidence of past and ongoing mining activities is prevalent, with numerous mined-out ponds and old mining sites surrounded by secondary forests. This indicates a history of significant anthropogenic impact. • People living in Indigenous communities and informal mining settlements within the Social AOI are mostly dependent on these freshwater sources for many domestic uses including bathing, drinking, washing, and cooking. However, doubts about contamination of the water bodies limits its usage for human consumption. Given the mountainous terrain within the region, smaller waterways such as ravines and springs are also prevalent and provide vital sources of freshwater to communities and settlements, especially for cooking and consumption. • Rainwater also serves as an important source of water used for the same purposes. During the dry season, high temperatures, low water levels, and dry conditions were frequently raised as a subject of concern by residents throughout the Social AoI, particularly those living in rural and isolated settlements, who were concerned about access to clean, potable water and key transport routes. • The nearby creeks, streams and rivers are particularly important during the dry seasons as it may be harder to collect water due to lack of rain. The

Service	Description
	landing communities have mostly depended on man-made wells for their domestic water supply as there are limited rivers and streams near the communities. Additionally, residents at all settlements and in all Amerindian communities consistently expressed concerns about freshwater contamination from mining activities, and the potential effects it may have on people and on aquatic biodiversity.
Agricultural crops	• Most people in the Social AoI, especially Indigenous community members and landings residents, also indicated that they produce at least some foods in backyard or kitchen gardens, emphasising that small-scale or household-level agricultural production is a key provisioning service. These include crops such as pumpkin (*Cucurbita pepo*), ground provisions (predominantly cassava (*Manihot esculenta*) and plantain (*Musa* paradisiaca), and fruits like bananas (*Musa sapientum*), pineapples (*Ananas comosus*), and mangoes (*Mangifera indica*). • Many households in Indigenous communities depend to varying extents on grown crops for consumption and daily income. These crops are sold to residents, and within the nearby town of Mahdia. Green vegetables are mostly bought due to the soil type not being suitable for production. The use of cultivated goods (such as cassava) is particularly important in Indigenous communities during community events, such as Amerindian Heritage Month.
Fishing	• In some of the areas in the Social AoI, people fish in the creeks and rivers, mostly for consumption, but also for recreation or part-time income. Some common species caught include Patwa (*Cichlasoma bimaculatum*) and Banga (*Macrodon ancylodon*). • The significance of these species extends beyond their ecological roles, as fish farming and traditional fishing methods, including the use of bows and arrows, are actively promoted within the Indigenous communities. These practices not only sustain the local economy but also preserve a way of life deeply rooted in the community's connection to its aquatic resources. The reliance on and reverence for these species underscore their importance, blending tradition with sustainable practices to protect both the community and its surrounding ecosystems.
Wild foods and hunting	• All communities within the Social AoI have indicated different levels of hunting for wild meat which is done as recreation activities, sale and consumption purposes. Notably, the Tapir or Bush cow (*Tapirus terrestris*) are recognised across the Social AoI. In the Amerindian communities of Campbelltown, Micobie and Princeville, a variety of wildlife is hunted – each species valued for its contribution to local diets and culture. Some animals hunted by residents include deer (family Cervidae), labba, agouti (*Dasyprocta leporine*), armadillo (family Dasypodidae), powis (*Crax alector*), tapir (*Tapirus terrestris)*, the white-lipped peccary (*Tayassu pecari),* and Watrash or Capybara (*Hydrochoerus hydrochaeris*). The informal mining settlement, Minnehaha has also reported occasional hunting in the nearby forests. Labba (*Cuniculus paca*) and Deer (family Cervidae), and Armadillos (family Dasypodidae) are commonly sought, given their widespread presence in these areas. • Nevertheless, wildlife hunting has decreased as the wildlife population has declined in these forested areas, forcing the residents to go farther distances to pursue hunting activities. Although most people living in the Social AoI reported some regular consumption of a range of fish and bushmeat, fishing and hunting are not a primary source of subsistence or livelihood activity, partly because of reported declines in fish and wildlife abundance, or concerns about freshwater contamination from mining activities and the potential effects of eating animals that ingest or live in the water.
Timber and other wood products	• Timber harvesting for household and community use, as well as commercial production, are key in the Social AoI, with valuable species exported to international markets, and low-value hardwoods used in local housing construction.

Service	Description
	• Commercial logging activities are recognised for their role in supplying wood to both local and international markets. This supply chain supports various economic activities, contributing to the livelihoods of community members and residents of the Social AoI who are employed in the logging industry. Additionally, the harvesting of wood for personal or community use plays a pivotal role in local development and self-sufficiency. Timber is utilised in constructing essential infrastructure such as houses, schools, and boats, directly impacting community welfare and development. The types of wood logged for commercial and residential purposes including Greenheart (Chlorocardium rodiei), Purpleheart (Peltogyne purpurea), Washiba (Handroanthus spp), and Silverballi (Aniba spp), not only reflect the biodiversity of the forest resources but also their value to humans. • Silverballi and Red Cedar are often used for structural components and finishes in housing due to their workability and aesthetic appeal. Wallaba, known for its resistance to termites and decay, is frequently used in building piers and other structures exposed to water. Greenheart and Purpleheart are valued for their hardness and resistance to rot, making them ideal for fishing boats and heavy-duty construction.
Biomass fuel	• Timber and other biological material derived from living organisms (more commonly plants) also serves as a source of energy. Communities within the Social AoI use firewood and charcoal[16] for domestic purposes, including cooking, heating, and sometimes even lighting. Firewood is a vital resource, especially in rural areas where access to electricity or alternative fuels may be limited. It plays a role in daily household activities and is often gathered from local forests.
Biochemicals, natural medicines, pharmaceuticals	• A variety of plants, each with their unique medicinal properties, serve as natural remedies for a range of ailments in the Social AoI, particularly in the Amerindian communities where the use of natural remedies or bush medicine is preferred over complementary medicine, and landing settlements where access to healthcare and pharmaceuticals is limited. For instance, Leaf of Life (*Bryophyllum pinnatum*) is utilised in teas to combat colds, bronchitis, diabetes, and kidney stones, demonstrating the plant's broad medicinal applications. Similarly, Fever Grass (*Cymbopogon citratus*) offers relief from fevers, headaches, and insomnia, while Daisy (*Bellis perennis*) addresses coughs, liver and kidney issues, and inflammation. • Zeb Grass (*Commelina cayennensis*) and Moran Bush (*Pittyrogramma calomelanos*) are known for their blood-cleansing and antibiotic properties, respectively. Other plants like Guava Leaf (*Psidium guajava*), Papaya Leaf (*Carica papaya*), and Pear Leaves (*Persea americana*) are utilised for their benefits in treating gastrointestinal issues, lowering blood pressure, and alleviating pain. • Ginger (*Zingiber officinale*) and Ginger Grass (*Cymbopogon martinii*) are used for their anti-inflammatory and rejuvenating effects. Additionally, Mango Leaves (*Mangifera indica*) and Soursop Leaves (Annona muricata) contribute to heart health and blood pressure regulation. Plants such as the Bird Vine (*Stachytarpheta jamaicensis*), Broad Leaf Thyme (*Coleus amboinicus*), and others offer solutions to modern health challenges, including COVID-19. • Additional natural medicines include Tulsi (*or toolsie*) (*Ocimum sanctum*) plant to clean kidneys; Lemongrass/Fevergrass (*Cymbopogon citratus*) to treat cold symptoms; Rose of the Mountain (*Brownea latifolia*) to treat pre-diabetes symptoms; Mocha Mocha (*Hyptis verticillata Jacq*) to treat snake and scorpion bites; Squash Bitters (*Momordica charantia*) to regulate blood sugar; Capadulla (*or kapadula)* (*Doliocarpus dentatus*) and Sarsaparilla (*Smilax ornata*) are known for their aphrodisiac benefits; Locust Bark (*Hymenaea courbaril L.*) helps to relieve back pain; Wansimai (*Martinella obovata*) helps with sore eyes; Crapo pepper (scientific name unknown) is used to treat prostate cancer; Quashie bitters (*Quassia amara L.*) and granny

[16] Charcoal is produced by strongly heating wood in a low oxygenated environment.

Service	Description
	back bone (*Lygodium sp*.) used to treat kidney stones; and Kanga palm (*Cecropia spp.*) to treat kidney issues.
Cultural Services	• Cultural services are the second most prevalent ecosystem service. The most common cultural services include: • Use of natural spaces and resources for local tourism or local recreation, such as riverbanks for recreational fishing and natural terrain, forests and scenery for relaxing. An occasional site for recreation is the Salbora Creek; • Other sites include the Tumatumari Falls, Amatuk Falls, and Waratuk Falls, located near the Social AoI; • Values placed on Indigenous land tenure and connections to land and place, both for titled and non-titled Indigenous communities; and • Values placed on the aesthetics provided by landscapes and riverscapes, including the potential development of nature-based ecotourism; • The Denham Suspension Bridge, also known as the Garraway Stream Bridge, a historic single-lane suspension bridge is also of cultural significance within the Social AoI. • Throughout the Social AoI, the high recreational and aesthetic values related to natural spaces are often framed as vulnerable or in the process of being degraded by increased mining and logging activity. Although there is some enthusiasm for ecotourism development, tourism had significantly reduced across the country and supporting infrastructure for tourism in the Social AoI is currently limited.

11.6.2.2 REGULATING SERVICES

Regulating services represents the third most prevalent ecosystem service identified in the Social AoI, including erosion protection and the role of vegetation in regulating erosion on slopes, and climate regulation provided by forests that capture and store carbon and impact rainfall levels. Concern about the unusually hot and dry conditions characterising the Social AoI in October correlated with concerns about potential forest fires. Regulating services are listed in Table 11.9.

TABLE 11.8 ES REGULATING SERVICES

Service	Description
Air Quality regulation	• Air quality regulation is an essential ecosystem service where natural ecosystems influence air quality by either removing pollutants from the air (acting as a "sink") or releasing chemicals into the atmosphere (acting as a "source"). • The surrounding rainforest and wetland ecosystems in the Social AoI play a pivotal role in maintaining air quality. Vegetation around the communities, such as trees and other plants, captures dust, particulates, and various pollutants from the air, thereby reducing their concentration in the atmosphere. These plants act as natural air purifiers, absorbing pollutants like nitrogen dioxide, sulfuric dioxide, and ozone. This process not only improves the air quality but also provides significant health benefits to the local human population and wildlife.
Climate change regulation	• Rainforests and wetlands regulate the microclimate for the benefit of people in the Social AoI, including temperature, humidity, and air quality. The dense canopy of rainforests provides shade, reducing direct sunlight and maintaining cooler temperatures. Wetlands release water vapor through transpiration, stabilising humidity levels. Both ecosystems act as natural air filters, absorbing pollutants and capturing dust, thereby improving air quality. Additionally, these ecosystems sequester significant amounts of carbon dioxide, mitigating climate change effects.

Service	Description
Erosion control	• Water and wind are considered the main erosive elements in removing the fertile layer of the soil. However, human activities, including recreational, extractive, agriculture and livestock activities, also contribute to this process of soil degradation, accelerating the rate of soil loss. • The dense vegetation in rainforests plays a vital role in stabilising soil and preventing erosion. Plant roots help bind the soil, reducing its susceptibility to being washed or blown away. Additionally, the canopy layer in rainforests reduces the impact of heavy rainfall on the soil, while wetlands act as buffers, slowing down water flow and trapping sediments.
Regulation of soil quality	• Soil retention helps maintain healthy ecosystem conditions (including ecosystem structures and processes), functions and for the delivery of many other ES. Regular plant growth and harvest cycles lead to constantly changing land cover conditions, including temporally bare soils that are exposed to soil erosion by water. These impacts can lead to further direct and indirect effects such as changes in soil structures and functions as well as biodiversity shifts. Soil retention is therefore a major regulator on which multiple human activities and related ecosystem services depend (Burkhard, 2019).
Regulation of pests	• Some species that live in ecosystems that are relatively less impacted or modified than agro ecosystems tend to move or settle in crops used by human communities. These species include bats, birds, and even microscopic pathogens (Tscharntke et al. 2005). The increase in global temperatures influences the incidence and abundance of human pathogens. Predators to insects, or in forests, pasture areas, etc. can control pests that damage crops and livestock.
Pollination	• The pollination process is essential for economic activities, since most of the crops used both for human consumption and forage depend on pollination to reproduce and maintain genetic variability, which provides resistance to crops against diseases and pests. A secondary product of pollination is obtaining honey, which is a valuable secondary product contributing to the local economy. • Guyana's rich biodiversity, including its rainforests and wetlands, provides an ideal environment for a variety of pollinators such as bees, bats, butterflies, and birds. These pollinators are essential for the successful cultivation of crops like fruits, vegetables, and other essential food sources.
Natural disaster risk reduction	• Ecosystems can reduce the damage caused by natural disasters such as hurricanes and tsunamis, while maintaining natural fire frequency and intensity. • Healthy ecosystems and good agricultural practices benefit humans in many ways, including helping to mitigate some of the effects of these natural hazards. Vegetated land cover, particularly in rainforests, stabilises soil and prevents erosion, which is essential during heavy rainfall and storm events. The dense root systems of trees and plants in these areas help to anchor the soil, reducing the likelihood of landslides and sediment runoff that can exacerbate flooding (EPA, 2023). Wetlands act as natural sponges, absorbing excess water during storms and releasing it slowly, which helps to mitigate the impact of flooding on downstream communities.
Fire regulation	• Wildfires or fires play a vital role in the dynamics of most forest ecosystems. They promote the growth of some plant species, encourage the development of some fauna communities, and create new habitat conditions for several species. This happens only when these fires are not devastating and are part of the natural dynamics (Kendra K. McLauchlan, 2020).

11.6.2.3 SUPPORTING SERVICES

Supporting services are ecological outcomes that are not directly used but support other ecosystem services and may be under-identified because other services may be better understood or identified by participants or stakeholders. During ERM fieldwork, participants often valued forests and waterways (and the interconnections between them) for their maintenance of biodiversity, a supporting service, while also valuing their contribution to climate regulation and rainfall (a regulating service). Supporting services are listed in Table 11.9.

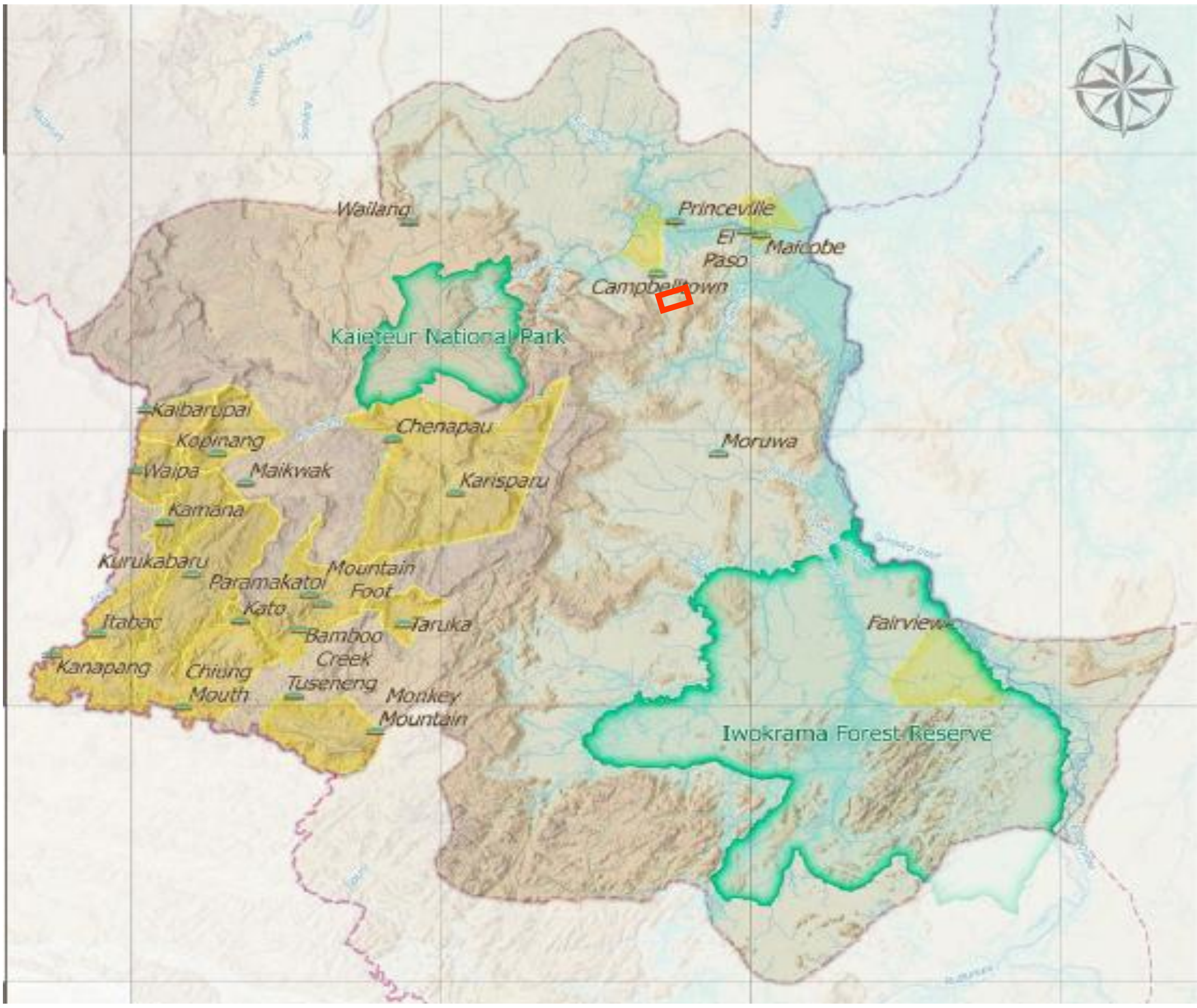
TABLE 11.9 ES SUPPORTING SERVICES

Service	Description
Habitat provision	• The interdependence of species and habitats within an ecosystem fosters resilience against environmental stresses, promotes genetic diversity, and supports the lifecycle needs of plants and animals. It regulates and supports the capacity of the ecosystem to provide other services that derive from the healthy interactions and processes of biodiversity and its habitats. Various services such as water purification, air quality regulation, soil fertility, and pollination are ensured. • Different natural habitats were identified in the Social AoI. The tropical rainforest is rich in biodiversity and includes towering trees like Greenheart, Purpleheart, and Wallaba. These trees form a canopy that regulates the local microclimate and supports a wide range of species.
Nutrient cycling	• These are processes that move and regulate matter between the geosphere, the atmosphere, the terrestrial biosphere, and the oceans. Carbon, phosphorus, and nitrogen cycles are particularly important as their availability underpins all other ecosystem processes (and services). The rates of these element cycles in all their forms, such as nutrients, are regulated by physical, chemical, and biotic factors. • All nutrients eventually dissolve (from the atmosphere) or run-off (from terrestrial ecosystems) into the ocean. Some nutrients remain as a reservoir of dissolved nutrients in the surface layer of the water, and marine life food chains uptake the nutrients that are available. Eventually, when these organisms die or discharge some nutrients, these sink onto the seabed and can be re-cycled to the surface by upwelling currents.
Primary Production	• Primary production is the organic matter formed by photosynthetic organisms such as algae and phytoplankton (Qian, 2020). It is closely linked to mass flow regulation, atmospheric regulation, pest regulation, water purification and flow regulation (Padisák, 2023). • This foundational process is essential for the stability of ecosystems, as it drives the flow of energy through the food web and supports higher trophic levels, including herbivores and predators. Primary production contributes to atmospheric regulation by capturing carbon dioxide during photosynthesis, thereby mitigating climate change and regulating the global carbon cycle.
Water cycling	• The flow of water through ecosystems in its solid, liquid, or gaseous forms is influenced by the surrounding ecosystems, both on the timing and magnitude of runoff, flooding, and aquifer recharge, as well as the mitigation of extreme weather events. • Vegetation influences the hydrological balance by allowing evapotranspiration and infiltration into the soil, thus regulating surface runoff. This helps regulate flood events and erosion, as well as river flows and the availability of water in the aquifer. • The relief and the vegetation also form a barrier effect that absorbs strong winds and extreme rains. Consequently, it reduces the probability of droughts, stabilises slopes, prevents landslides, and retains and generates organic soil suitable for agriculture, livestock, and forestry.

11.7 INDIGENOUS PEOPLES IN THE SOCIAL AREA OF INFLUENCE

Region 8 had a population of 8,009 indigenous peoples as of the 2012 census (72.3 percent of the total population in the region), and it is anticipated to have grown since (BSG, 2012). Figure 11.32 shows the Amerindian settlements in Region 8 in relationship to the EMPL. Within the Social AoI, the Indigenous communities Campbelltown, Princeville and Micobie have been considered as part of the baseline.

FIGURE 11.32 AMERINDIAN SETTLEMENTS IN REGION 8



Source: Amerindian Peoples Association, et al, 2018; ERM, 2025
Note: Red rectangle represents approximate location of EMPL.

11.7.1 CAMPBELLTOWN

Campbelltown (Figure 11.33) is located adjacent to Mahdia and approximately 8 km from the EMPL. The Indigenous community that was founded in the 1900s and formally received its land title in 2006 with boundaries demarcated as follows:

> " *The area commencing at the Southern end of the Denham Bridge, Garraway Stream and its boundary extends southwards along the Potaro/Kangaruma road for approximately 5 ½ miles to the source of an unnamed creek, thence in an approximate South-Southwest direction for approximately 2 ½ miles to the foot of the upper Mahdia*

> *Falls, thence along the Right Bank of the Mahdia River to its mouth, thence along the Right Bank of the Potaro River back to the point of commencement. Save and except all privately owned lands legally held."*

Many residents believe that the village should be extended beyond the current boundaries to the northeast (i.e., in the opposite direction of the EMPL, as a significant portion of fishing and hunting grounds are not currently included within the village boundaries. The village has not formally applied for an extension of land title but has held internal discussions to formulate a description of the extension (Amerindian Peoples Association, et al, 2018).

FIGURE 11.33 CAMPBELLTOWN

Source: ERM Fieldwork, 2025

The village is primarily inhabited by members of the Patamona tribe, along with descendants of the Arawak and Carib peoples. Established in the 1940s under the leadership of Captain Cecil Thomas, the settlement began when Thomas moved from Wakapoa to Campbelltown, at a time when the area was covered by dense forest and Mahdia had only one mining company. During his tenure, officials advised residents to relocate, citing concerns that the village's proximity to Mahdia could pose risks to the indigenous population. However, most villagers chose to remain (Amerindian Peoples Association, Forest Peoples Programme, & Rainforest Foundation US, 2019). The village governance is managed by a council including a Toshao, a deputy Toshao, a secretary, a treasurer, and five additional councillors.

The local economy is primarily based on mining and logging, with the community possessing both mining and logging concessions within and near the titled boundaries. Some mining activities occur without the Village Council's permission, creating access to resource conflicts, with some residents reporting having been stopped from entering the concession of miners, preventing them from accessing fishing and hunting grounds are also lost due to mining (Situational Analysis of Region 8, 2020).

Other economic activities include hunting and subsistence farming which is mainly practiced by the community elders. Farming is conducted mainly within the village title lands, however, residents indicated that many hunting areas are located outside the community boundaries (ERM Fieldwork, 2025). Similarly, fishing spots can be found outside the village boundaries, and residents visit a few times a week. Residents raised concerns regarding poor soil quality for farming, and destruction of their hunting grounds (ERM Fieldwork, 2025).

11.7.2 PRINCEVILLE

Princeville is a satellite community of Campbelltown, located within the Campbelltown's titled boundaries. The history of Princeville dates back to the 1960s, where people lived at Kangaruma (known as Three Mile junction). Around 1970, Allan Prince (Akawaio from Bartica) started to clear the area around today's Princeville, which is named after him. Some years later, the people living at Kangaruma moved to Princeville (Amerindian Peoples Association, Forest Peoples Programme, et al, 2018).

Princeville is managed collectively by a senior councillor and three other councillors, under the umbrella of the Campbelltown Village Council, where the councillors represent the community. The population is predominantly of the Patamona peoples.

Most residents in Princeville depend on a mix of farming, hunting, fishing, gathering and mining. The Village Council office is shown in Figure 11.34.

FIGURE 11.34 PRINCEVILLE VILLAGE COUNCIL OFFICE

Source: ERM Fieldwork, 2025

11.7.3 MICOBIE

Micobie (Figure 11.35) is a village located approximately 58 km (36 miles) northeast of Mahdia township. The Amerindian settlement was first located on the left bank of the Potaro River, immediately after the Tumatumari Falls and was called Tumatumari. In 1967, the District Commissioner visited Tumatumari and requested residents to identify a suitable area to relocate, with land for permanent crops and development. The relocation has been attributed to either he fact the village was in an area prone to flooding or that the establishment of the Youth Core at Tumatumari was a contributing factor for the request. Villagers first referred to it as 'Cassava Hill', then 'New-Foundout', and later it was referred to as 'Mogobi', which means lizard in Patamona (Amerindian Peoples Association, et al, 2018). Interviews with the community members and Toshao confirmed the preferred spelling of 'Micobie' (ERM Fieldwork, 2025).

The village obtained its title in the 2000s, with boundaries described as follows:

> "*The tract commences approximately 1 ½ mile from the mouth of the Potaro River, thence along the Left Bank of the Potaro River for approx. 4 ½ miles to a point opposite of the mouth of Tiger River, thence across the Potaro River to the Left Bank of the Tiger River, thence up the Left Bank of the Tiger River to the intersection with the Tumatumari branch road, thence north along the Bartica/Potaro road for approximately 4 ½ miles, thence in a north eastern direction for approximately half of a mile to the source of an unnamed creek passing through the Tumatumari Ridge, its mouth being approx. 1 ½ miles from the mouth of the Potaro River, thence along the said unnamed*

creek to the point of commencement. Save and except all privately owned lands legally held".

The Village Council has not formally applied for an extension of village boundaries but intends to apply soon (ERM Fieldwork, 2025). The council is composed of a Toshao, deputy Toshao, a secretary, a treasurer, and five additional councillors.

FIGURE 11.35 MICOBIE

Source: ERM Fieldwork, 2025

Micobie is home to indigenous groups such as the Patamona, Wapichan, Makushi, Akawaio, Arawak, Carib, and Warrau, with a small number of people from other ethnic backgrounds found across Guyana.

The village's economy relies on traditional practices, including subsistence farming, hunting, fishing, gathering, and small-scale mining (Amerindian Peoples Association et al., 2018). While farming remains a key activity, the most productive agricultural lands lie outside the titled area to the east. Within the titled lands, farming plots tend to be less fertile or impacted by mining operations, particularly in areas like Sagula Palu and Sugar Hill. Residents cultivate crops such as cassava, eddoe, plantain, pumpkin, and pepper (Amerindian Peoples Association et al., 2018).

Hunting grounds beyond the titled area include lands north of the Potaro River and areas east along Mahdia Road and Sarane Creek, with some residents traveling down the Essequibo River to locations such as Mupha, Kanaima, and Madre Creeks (Amerindian Peoples Association et al., 2018). Fishing occurs along the Potaro and Essequibo Rivers, from Siparuni Mouth down to Arasaro Mouth, while gathering activities take place along Tiger Creek, the Potaro River, and Kulunai River, both within and outside titled lands (Amerindian Peoples Association et al., 2018).

Mining also plays a role in Micobie's economy. Historically, villagers engaged in mining on a small scale, and today some operate small dredges under village council approval. Residents have expressed concerns about river mining, which they consider to cause pollution of waterways, erode riverbanks, and disrupt fishing. Mining along the Potaro River has degraded water quality and affected farming areas like Sugar Hill, as well as access to game and clean drinking water. Operations using hydraulic "land" dredges, excavators, and river "draggers" occur on both titled and untitled lands, and in some cases have altered the course of creeks such as Tiger Creek (Situational Analysis of Region 8, 2020; ERM Fieldwork, 2025).

12. CULTURAL HERITAGE

12.1 INTRODUCTION

This chapter presents the baseline for cultural heritage and assesses the nature, distribution, and value (significance) of identified cultural heritage resources for the Eagle Mountain Gold Project.

12.1.1 LEGISLATIVE FRAMEWORK

This baseline has been prepared taking the following into consideration:

- National legislation and regulations of Guyana for the protection of cultural heritage.
- International treaties signed by the government of Guyana for the protection of cultural heritage.
- International environmental standards for cultural heritage:
  - International Finance Corporation Performance Standards for Cultural Heritage (IFC PS8).
- Good International Industry Practice (GIIP).

12.1.1.1 NATIONAL LEGISLATION

National legislation relating to the protection of cultural heritage in Guyana is summarised in Table 12.1.

TABLE 12.1 NATIONAL LEGISLATION IN RELATION TO THE PROTECTION OF CULTURAL HERITAGE IN GUYANA

Law	Brief Description
Guyana Constitution Article 149	Stipulates that Indigenous peoples shall have the right to the protection, preservation and promulgation of their languages, cultural heritage and way of life.[1]
The Draft National Cultural Policy of Guyana (2013)	Established the framework through which the Government can support the conservation and management of cultural resources.
Guyana Constitution Article 212S 2010	Establishes the Indigenous Peoples Act (IPC). IPC's mandate includes offering recommendations on economic and educational policies to advance the interest of indigenous people and the promulgation of the cultural heritage and language of indigenous peoples, especially with regard to their participation in national decision making and other decisions that affect their lives.[2]

[1] Cultural Survival (2015) Convention on Economic, Social, and Cultural Rights Shadow Report Submission: Indigenous Rights Violations in Guyana. Available at: Guyana 1980 (rev. 2016) Constitution - Constitute (constituteproject.org). Accessed 22/05/2025
Submitted for the 56th Session, Geneva 21 September - 9 October 2015

[2] Government of Guyana. (2012) Government of Guyana Response to the United Nations Expert Mechanism on the Rights of Indigenous Peoples: Consultation on the Role of Languages and Culture in the Promotion and Protection of the Rights and Identity of Indigenous Peoples and Questionnaire on Best Practices in relation the Declaration on the Rights of Indigenous Peoples. Available at: https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.ohchr.org%2Fsites%2Fdefault%2Ffiles%2FDocuments%2FIssues%2FIPeoples%2FEMRIP%2FDeclaration%2FGuyana.doc%23%3A~%3Atext%3D(b)%2520Indigenous%2520Peoples%2520Commission%26text%3DThis%2520body%2520was%2520appointed%2520in%2CArt%2520212%2520S%2520(c)).&wdOrigin=BROWSELINK Accessed: 22/05/2025.

Law	Brief Description
Amerindian Act (2006)	Supports the conservation of indigenous cultural heritage and patrimony. Under the Act, the management, conservation and protection of cultural lands, artefacts and natural resources are within the remit of the Village Council and provides collective decision making with regard to research and development. Also provides for the protection of material and moral interests relating to the cultural heritage of the Amerindians. And the laws governing mining also include protection of their heritage.[3]
The Environmental Protection Act (1996)	One of the responsibilities of the EPA is to work with the National Trust of Guyana to identify and evaluate the direct and indirect impact of material assets, cultural heritage and landscape.
National Trust Act, No. 7 of 1972	Governs the management of any building, structure, object, or other manmade or natural feature that is of historic or national cultural significance that could be impacted by the Project. Includes shipwrecks and other marine features. Would only apply to the Project in the event of a chance find, in which case the Act would require Stronghold Guyana Inc. to work cooperatively with the National Trust to manage any resources discovered

12.1.1.2 INTERNATIONAL TREATIES

International Treaties relating to the protection of cultural heritage in Guyana are summarised in Table 12.2.[4]

TABLE 12.2 INTERNATIONAL TREATIES FOR THE PROTECTION OF CULTURAL HERITAGE

Title	Ratification/Acceptance Date
United Nations Educational, Scientific and Cultural Organisation Convention Concerning the Protection of the World Cultural and Natural Heritage (1972)	Ratified by Guyana on 20/06/1977. Presents definitions for cultural heritage and natural heritage which may apply to the project locations. The Convention applies to the project only if the Government identifies site within the development areas for consideration as a World Heritage Site.
United Nations Educational, Scientific and Cultural Organisation Convention on the Protection of the Underwater Cultural Heritage (2001)	Ratified by Guyana on 28/04/2014. Would apply to any submerged cultural heritage in the Project AOI.

12.1.1.3 INTERNATIONAL LENDER ENVIRONMENTAL STANDARDS

There are a number of international lender banks and finance institutions who insist on a minimum level of environmental and social standards from the projects that they finance. The

[3] Cultural Survival (2015) Convention on Economic, Social, and Cultural Rights Shadow Report Submission: Indigenous Rights Violations in Guyana, Submitted for the 56th Session, Geneva 21 September - 9 October 2015. Available at: https://tbinternet.ohchr.org/_layouts/15/TreatyBodyExternal/DownloadDraft.aspx?key=pyyvUAkWue6jD7t02QQWIM4uiIE0S7+R8FmH/8cwQLZnv9NVFaiICORAG+/yTH8zWtidZKlIPvWzMTwbGBJjeA==. Accessed 22/05/2025

[4] UNESCO, World Heritage Convention. Guyana. Available at: https://whc.unesco.org/en/statesparties/gy/. Accessed 22/05/2025

International Finance Corporation (IFC) has developed eight environmental and social Performance Standards (PS) to manage the social and environmental risks and impacts of IFC-financed projects (most recent version from 2012). While the IFC PS's and the accompanying Guidance Notes are not mandatory for the Project, these standards have been used as a guide in completion of this EIA.

IFC Performance Standards state that the party responsible for implementing and operating the project must comply with the applicable national laws, including those laws implementing host country obligations under international law. The project operator is also required to meet the requirements of the standards throughout the life of an investment by IFC or other relevant financial institution.

IFC PS 8 recognises the importance of cultural heritage for the current and future generations.[5] Consistent with the Convention Concerning the Protection of the Worlds Cultural and Natural Heritage, this PS sets out minimum requirements for the protection of cultural heritage resources in development projects financially supported by the IFC.

The objectives of the PS8 standard are to:

- protect cultural heritage from the adverse impacts of Project activities and support its preservation; and
- promote the equitable sharing of benefits from the use of cultural heritage.

Key sections within PS8 include the following:

In paragraph 6 it calls for the implementation of international treaties and national laws relating to heritage protection, stating that clients:

> '*Will identify and protect Cultural Heritage by ensuring that internationally recognised practices for the protection, field-based study, and documentation of Cultural Heritage are implemented'*.

In paragraph 7 it adds that:

> '*Where the risk and identification process determines that there is a chance of impacts to Cultural Heritage, the client will retain competent professionals to assist in the identification and protection of Cultural Heritage'*.

In paragraph 9 it also states that:

> '*The client is responsible for siting and designing a project to avoid significant adverse impacts to Cultural Heritage. The environmental and social risks and impacts identification process should determine whether the proposed location of a project is in areas where Cultural Heritage is expected to be found, either during construction or operations*'.

The standard goes on to specify that Affected Communities and relevant national regulatory agencies should be consulted. It favours the retention of cultural heritage in situ (paragraph 12), only permitting exceptions where there is no feasible alternative, and the removal of the resource is carried out 'using the best available technique'.

[5] International Finance Corporation, performance Standard 8: Cultural Heritage. Available at: https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/performance-standards/ps8. Accessed 22/05/2025

In paragraphs 13-15, the standard addresses impact on 'critical Cultural Heritage' defined as:

> *'Recognised heritage of communities who use or have used within living memory the Cultural Heritage for long-standing cultural purposes; or (ii) legally protected Cultural Heritage areas, including those proposed by host governments for such designation.'*

The standard states that critical heritage should not be removed unless in exceptional circumstances where impacts are unavoidable. In such cases, external experts should be retained to assist in its protection and assessment. Where there are legally protected sites, the client is required to comply with legal requirements related to their protection, consult stakeholders, and implement additional programs to promote and enhance their conservation.

12.1.1.4 GOOD INTERNATIONAL INDUSTRY PRACTICE (GIIP)

Safeguarding and protecting cultural heritage with the use of innovative approaches, in cooperation with stakeholders, is key to appropriate management and promotion of cultural heritage for the benefit of the country and communities and social cohesion, wellbeing and environmental sustainability.[6] This baseline for the Project has taken into consideration the following approaches in line with GIIP.

Precautionary Approach

GIIP requires developers to take a precautionary approach to cultural heritage identification, protection, and safeguarding. Where there is uncertainty about the impact of a development on cultural heritage (such as through an insufficient level of information) Good International Industry Practice requires an assumption that a significant adverse impact will occur and require appropriate mitigation for the assumed impact until such a time as further information is available to allow a robust assessment of potential impact. This precautionary approach is relevant to managing risk and impacts to cultural heritage and has been applied to this Project.

Mitigation Hierarchy

The implementation of the mitigation hierarchy is one of the fundamental objectives of PS 8 and is recognised GIIP. The project developer should always in the first instance look to avoid any impacts on cultural heritage through Project redesign. Where avoidance is not feasible, the developer will apply a mitigation hierarchy that minimises as much as possible any adverse impacts on cultural heritage. This concept has been applied to the selection of mitigation measures for this Project.

12.2 SCOPE

The AoI for this baseline chapter includes areas of direct impacts, indirect impacts, and cumulative impacts during the construction, operation, and decommissioning stage within the proposed Project footprint and study area. This baseline study considers the extent and value (significance) of all identified tangible and intangible cultural heritage resources within the defined Project AoI with the potential to be directly or indirectly impacted.

[6] UNESCO. Cultural heritage: 7 successes of UNESCO's preservation work. Available at: https://www.unesco.org/en/cultural-heritage-7-successes-unescos-preservation-work. Accessed: 22/05/2025.

The following Project-related activities and associated infrastructure with the potential to impact cultural heritage resources are considered:

- The proposed Project footprint, including all associated infrastructure[7];
- 500-meter study area surrounding the boundary of the Eagle Mountain Prospecting License (EMPL) Area (LiDAR and desk-based study); and
- Field surveys and clearance of the Project construction boundary.

12.3 METHODOLOGY

12.3.1 BASELINE METHODOLOGY AND APPROACH

This baseline report is prepared using the draft guidance on Heritage Impact Assessments for Cultural World Heritage Sites (International Council on Monuments and Sites, ICOMOS)[8] and international guidance (ICOMOS and IFC PS8).[9] For the purposes of this baseline, environmental impact assessment guidelines rely on the Environmental Protection Agency, Guyana (EPA) Vol. 3 for Mining August 2000.

Cultural heritage resources were identified through the following:

- Desk-based research, including remote sensing and lidar; and
- Field survey including walkover, targeted 3D digital surveys, surface collection and test excavations, as appropriate.

12.3.1.1 DESK-BASED RESEARCH

The following information and sources were consulted during desk-based research of cultural heritage:

- Published and available academic research of the region;
- Cartographic materials and publicly available remote sensing data including satellite imagery and historic mapping;
- Project captured LiDAR data; and
- ERM CRM Baseline Report from the 2025 field walkover describing known and potential cultural heritage sites within the Project License Area, conducted by the University of Guyana[10].

12.3.1.2 FIELD SURVEY FOR TANGIBLE AND INTANGIBLE CULTURAL HERITAGE

One round of cultural heritage surveys has been carried out within the EMPL and is described as follows:

[7] It should be noted that at the time of writing this report, cultural heritage surveys have not yet been conducted for the port area.
[8] ICOMOS, 49-51 rue de la Fédération 75015 Paris, France in collaboration with the World Heritage Centre. 2011. Guidance on Heritage Impact Assessments for Cultural Heritage Properties. A publication of the International Council on Monuments and Sites. Available at: iccrom.org. Accessed on: 31/03/2022.
[9] https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/performance-standards/ps8
[10] Daggers, L. B. (2025). ERM CRM Baseline Report - Stronghold Guyana Mining. Guyana: University of Guyana.

April 2025

An intuitive and pedestrian survey was conducted within the vicinity of Stronghold Guyana's concession during the period of April 5th to 12th 2025. The survey included indicative project areas identified as: Plant site, Proposed Quarry (Borrow Pit) and Waste dump, Waste Dump 1 and TSF, and the Mine Pit. The general terrain is rocky highlands, which includes large outcrops, steep hills, ravines, and swamps. The site vegetation includes dense shrubs, marsh vegetation including primary and secondary forest. The Ground Surface Visibility (GSV) of the site ranged from 0 percent to 100 percent. Site activities present in the survey area ranged as follows: disturbance relating to previous 'artisanal' mining activities and/or disturbance resulting from ongoing infrastructural development (the construction of roads, and other land clearing activities), to previously undisturbed ground.

12.3.2 LIMITATIONS

The following limitations are noted from the study:

- When secondary sources such as databases or historical mapping are used, errors in the initial parties' data will be transmitted across into the current study;
- Field survey is limited to areas where it is safe to traverse, any areas with too steep of an incline or if vegetation is too dense to allow for entry are therefore not surveyed, or surveyed at distance.
- In addition to the challenging field conditions, time constraints necessitated that a representative sample of the AoI and project development locations within the AoI be surveyed;

12.4 CULTURAL HERITAGE STUDIES TO DATE IN REGION 8, GUYANA

Little is known archaeologically of the Potaro-Siparuni region within which the Project is located, as limited archaeological work has been conducted previously within the Project area and region at large. The most notable exception is by Meggers and Evans (1960) in the Pakaraimas and William's (2004:371-372) work at Mazaruni, Potaro and Essequibo Rivers (Williams, n.d.) and later the archaeology of Iwokrama by Plew (2002, 2005).

One of the most notable categories of archaeological sites within the region is ground stone features, which occurs in numerous locations along major rivers. In some cases, surveys described vessels recessed into rock shelter floors and burial urns in shaft burials on hills. Sites dating into the Horticultural Period have been found on the Essequibo (n=7) and Siparuni (n=1). Test excavations have been conducted at four locations on the Essequibo: near Kurukupari Falls at Errol's Landing, Alexis Marcel's Island, Makari Falls (Williams, 1996a), and at the Reserve Base Camp (Field Station) by Plew (2002). Notably, Errol's Landing yielded a particularly dense concentration of ceramic sherds (Plew & Pereira, 2008). Radiocarbon dates obtained produced dates ranging between 2,080 ± 70 B.P. (Beta-76246) at 45–60 cm and 2,910 ± 80 B.P. (Beta-76247) from deeper deposits firmly placing the lower levels of the site within the early Horticultural Period.

Petroglyphs at Kurukupari on the Essequibo River include stylistic elements characteristic of the so-called *Enumerative* and *Fish-Trap* petroglyph styles which Williams (1985a) believes to be associated with different time periods, different cultural traditions and different subsistence strategies are present at Kurukupari on the Essequibo. Williams (1985a) has argued that these styles correspond to distinct chronological phases, cultural traditions, and subsistence strategies. Their presence underscores the diversity of symbolic expression and the potential linkage between rock art, social identity, and resource exploitation within the landscape. The archaeological evidence from the broader region, including sites within the Iwokrama Reserve, dates to the Archaic Period. The material record suggests a pattern of broad-spectrum foraging, with communities exploiting a wide range of ecological niches. This adaptive strategy is reflected in the varied site types documented in the reserve, which collectively illustrate the dynamic interaction between cultural practices and the riverine environment.

12.5 ARCHAEOLOGICAL AND HISTORIC BACKGROUND OF CULTURAL HERITAGE IN GUYANA

This section provides a period-by-period overview of the archaeology and history of the national, regional and Project-level areas of interest.

There are three main landscapes that have had a strong influence on the pre-Colombian populations: grassy savannas, rainforest and coastal plain. The chronology of Guyana can be divided up into several impressed eras indicatively representing food procurement methodology, technological and material developments, nomadic, semi-sedentary and permanent hunter-gather-fisher communities, farmers utilising slash and burn agriculture and later permanent agriculture, and the euro-interactive changes seen during the 1500's CE.

12.5.1 PREHISTORY

12.5.1.1 PALEOINDIAN PRE- 7,000 BP (CA. 5000 BCE)

The earliest known archaeological sites in South America are in northeastern Brazil, south of Guyana.[11] While no archaeological sites relating to this period have been confirmed within Guyana, projectile points dating to the period have been identified along the Cuyuni and Mazaruni rivers in the Region. The small shape and low weights of the projectile points suggest that the diets of those who were using the points were more reliant on smaller game rather than megafauna.

This may be indicative of a hunter-gatherer subsistence strategy that was reliant on foraging and supplemented with wide variety of smaller game adapted to the cooler, dryer, less forested climate that existed during the period in what is now Brazil and Guyana[12].

12.5.1.2 ARCHAIC 7000-3500 BP (5000 TO 1500 BCE)

Near the littoral zone of northwest Guyana, shell midden sites have been excavated that date to the Early to Middle Holocene[13]. These excavations used isotopic analysis that identified a trend towards an increasing reliance on plants in local diets across the period. Indicative of an expanding reliance upon 'garden-style' seasonal cultivation/exploitation of wild plants, prior to the structured domestic agricultural practices of later periods. They also found that during the

[11] Plew Mark, G. (2016). The Early Peopling of Guyana: The Evidence for Paleo-Indian Hunters. In The Archaeology of Guyana. BAR Publishing, Oxford.
[12] Meggars, Betty, J. (2007) Mid-Holocene Climate and cultural dynamics in Brazil and the Guianas. In Climate Change and Cultural Dynamics: A Global Perspective on Mid-Holocene Transitions. Editors David G. Anderson, Kirk A Munich and Daniel H. Sandweiss. Elevier Inc.
[13] Daggers, Louisa, Mark Plew, Alex Edwards, Samantha Evans, Robin Trayler (2018) Assessing the Early Holocene Environment of Northwestern Guyana: An Isotopic Analysis of Human and Faunal Remains. In Latin American Antiquity 29(2) 2018pp.279-292

Early Archaic this plant reliance was correlated with dry spells known though the broader Amazonian area during the period, likely including the site area.

Peoples during this period likely experienced fluctuating climatic conditions and an overall general warming of the environment. As a result, people may have been mobilised to exploit a range of seasonal food sources including starchy plants, and not yet engaged with sedentism and agri-settlements.

There is also a wider range of material culture known archaeologically from this period in Guyana beyond the simple projectile points of the previous Paleo-Indian period. These remains relate to innovation in technology and processing, for instance of percussion-made stone tools, split water-worn cobbles, and line-sinkers often made of quartz or shist. At this time peoples have been associated with the production of petroglyph and pictograph rock art, as well as practicing preferential treatment of their dead.[14] At various sites human remains have been found interred in flexed positions, urns or cairns.

12.5.2 HORTICULTURAL PERIOD 3500 BP – PRESENT (1500 BCE TO 2024 CE)

As the name suggests, the beginning of the Horticultural period is defined by the introduction of domestic horticultural practices to the region, primarily the cultivation of manioca.[15] However, within this period pottery types and radio carbon dates have been used to identify the following cultural phases to indicate different cultures of peoples within this broad period that did not have traditions of written history, these phases are briefly outlined below with their key archaeological characteristics which may be found within the AoI:

12.5.2.1 ALAKA (2000-1680 BP [0 TO 320 CE])

Shell midden sites containing lithic debitage, stemmed and rounded base projectile points are commonly located in the landscape near mangrove swamps and indicative of this period. Though not identified in Suriname and French Guiana, Alaka shell middens are widespread in the southern Caribbean, providing insights into the diet of shell mound inhabitants and a guide to burials during the occupation of shell midden mounds[16]. A well-known type-site is the Siriki shell mound, located on Siriki Creek 6 km inland of the Pomeroon River estuary.

12.5.2.2 MABARUMA (1500 TO 400 BP [500 TO 1600 CE])

This period is represented by plain and decorated pottery types including zoomorphic designs[17], with multiple temper types such as sand and steatite. Lithic artifacts include items such as celts, choppers, hammerstones and flake blades. During this period there is an increased reliance on horticulture and plants, and we begin to see more permanent settlements. Settlements tended to be located on more elevated areas to avoid inundation, and elaborate burials with flexed internments and burial goods were commonly selected uphill of these settlements.

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[14] Plew Mark, G. (2016). The Early Peopling of Guyana: The Evidence for Paleo-Indian Hunters. In The Archaeology of Guyana. BAR Publishing, Oxford.
[15] Plew Mark, G. (2016). The Early Peopling of Guyana: The Evidence for Paleo-Indian Hunters. In The Archaeology of Guyana. BAR Publishing, Oxford.
[16] Daggers, Louisa & Plew, Mark. (2015). Recent Excavations at the Siriki Shell mound north-western Guyana. Antiquity Journal.
[17] Evans, Clifford and Meggers, Betty J. 1960. "Archaeological investigations in British Guiana, South America." Bureau of American Ethnology Bulletin. 177:1–418.

Research suggests that this period may have lasted until contact with Europeans and is contemporary with the Abary (750-450 BP [1250 to 1550 CE]) and Koriabo (600 to 650 BP [1400 to 1350 CE]) periods.

12.5.2.3 TARUMA PHASE (300 TO 200 BP [1700 TO 1900 CE])

This period is characterised by established villages surrounded by gardens, built on elevations in the landscape with the occasional expedient seasonal site still being utilised. Three plain pottery types and five decorated types characterise this period. Rock art sites indicate use of fishing traps[18], though similar material culture to prior phases indicates significant continuation of practice. These include the use of percussion stone tools and grinding stones. In this period European goods are present, but not in high numbers, as forests are the main source of food and subsistence.

Mortuary tradition is primarily cremation or inhumation, though the poor preservation of burials in tropical soils is evident. During Eurocentric upheavals associated with the period, previously dominant indigenous cultural practices are maligned in the record and severely impacted by the introduction of euro-disease, killing off the majority of the existing population[19]. Large swathes of territory became infilled by the Wai Wai Phase communities from Brazil.

12.5.2.4 WAI WAI (100 BP TO PRESENT [1900 CE TO PRESENT])

Archaeological and ethnographic accounts of the Carib speaking Wai Wai people indicate that villages were laid out in roughly circular patterns and moved every 3 to 6 years, which result in predominantly shallow refuse deposits. Abandonment of lithics is common throughout this period, as they were replaced by metal tools. Pottery appears to have been relied upon consistently in everyday use in the form of plainwares and decorated types[20].

12.5.3 COLONIALISM (420 TO 30 BP [1580 TO 1970 CE])

Colonising forces often leave their archaeological remains in the form of refuse pits of imported goods, buildings, military infrastructure, agricultural infrastructure and town planning[21]. The Dutch were the first European country to establish a colony in Guyana in about 1580[22] and later British explorers investigated the Cuyuni River area[23]. European control of Guyana was contentious from 1654 to 1831 which controlled oscillating between the Dutch, English, and French government's trading companies.[24]

The established trade routes brought with them the preferred colonial traditions and methods for ceramics and architecture, and primarily settling along the coast where it was preferable to

[18] Plew Mark, G. (2016). The Early Peopling of Guyana: The Evidence for Paleo-Indian Hunters. In The Archaeology of Guyana. BAR Publishing, Oxford.
[19] Meggars, Betty, J. (2007) Mid-Holocene Climate and cultural dynamics in Brazil and the Guianas. In Climate Change and Cultural Dynamics: A Global Perspective on Mid-Holocene Transitions. Editors David G. Anderson, Kirk A Munich and Daniel H. Sandweiss. Elevier Inc.
[20] ibid
[21] National Trust of Guyana (2023) Guidelines for Preserving Heritage Buildings, Sites and Areas of National Heritage Significance. Available at Guidelines for Preserving Heritage Buildings, Sites, and Areas of National Heritage Significance – National Trust (ntg.gov.gy). Accessed on 26/06/2024
[22] Menke, Jack (2024) History of Guyana. Britannica. Available at; Guyana - Colonialism, Independence, Culture | Britannica. Accessed on 24/06/2024.
[23] Daggers, Louisa (2024). ERM CRM Baseline Report – (Re Union Gold)
[24] Thompson, A. O. (2006). SYMBOLIC LEGACIES OF SLAVERY IN GUYANA. NWIG: New West Indian Guide / Nieuwe West-Indische Gids, 80(3/4), 191–220. http://www.jstor.org/stable/41850454

cultivate and transport cash crops such as sugar compared to the densely forested interior of Guyana.

From 1831 until Guyanese independence in 1970, the region was under British rule. Following initial colonisation by the British, in 1838, large numbers of indentured Indian peoples were migrated to Guyana, settling and establishing their own identifying characteristics on the regions again including trade items and cultural identifiers such as ceramics, personal adornment items, and architectural styles that would differ from European or Indigenous populations.

12.5.4 INDEPENDENCE (30 BP TO PRESENT [1970 CE - PRESENT])

12.5.4.1 RECORDED SITES OF ADMINISTRATIVE REGION EIGHT (POTARO SIPARUNI)

To date there are approximately 66 identified and or reported archaeological sites ranging from Site Number: VIII-1:1 -VIII-1:4 to VIII-2:1 to VIII-1:62. Within both subregion one and two, below are the known sites in subregion one.

12.5.4.2 ARTIFACTS, FEATURES AND SITES EXPECTED WITHIN STRONGHOLD GUYANA'S PROJECT AREA (SUB-REGION 2)

The general world-wide definition of archaeological significance is the potential of an item/artifact, feature, or site whether prehistoric or historic to potentially inform regarding the prehistory or history of a region. As such, all prehistoric and historic materials should be considered significant. This said, task and time specific items that include stone tools, pottery, historic glass and ceramic wares, and metal tools are perhaps, along with features and sites "most significant". It is important to remember that many prehistoric and historic items may be considered 'refuse'; material byproducts of past activities whether purposely discarded or lost. Typically, historic era materials from the 18th, 19th and early 20th century will occur in greater quantities with site areas being substantially larger. Early mining activities, for example, may consist of a variety of features and utilisation/processing/refuse distributions.

Known archaeology in Region 8 is summarised in Table 12.3.

TABLE 12.3 KNOWN ARCHAEOLOGY IN REGION 8

	Table of known sited in Region No. 8, Subregion No.2				
Ceramic Sites	Petroglyphs/Pictographs	Chipping Station	Grinding Surface	Terra Preta	Historic
20	21	1	17	1	2

The following site types might be expected within the project area:

- Sherd scatters: These are light surface scatters of ceramic sherds (<5 sheds per sq. meter). Sherds may be undecorated or may exhibit decoration in the form of incisions.
- Quarry sites/Lithic workshops: These are areas characterised by dense scatters of flakes and cores (>20 flakes per sq. metre).
- Habitation sites: Large open areas (characterised by dense scatters of lithic and ceramic remains >100 sq. meters).

- Caves and rock shelters: These locations served as habitation and burial locations. Ceramic scatters and burial urns have been found in caves and rock shelters.
- Petroglyphs or pictographs: Pecked and painted geometric, zoomorphic and anthropomorphic elements are known from both northern Guyana and the Rupununi.
- Grinding surfaces (pollisoirs): These surfaces may be circular or trough-like. Isolated pottery sherds, cores, picks (pointed triangular items made from andesite), shaft straighteners/polishers (small sandstone slabs having one or more grooves), stone projectile points and ground stone axes.
- Historic sites: Consisting of but not limited to old, minded sites, including equipment, historic pottery (blue and white, metals, bottles, pipes) and housing structures
- Terra Preta: These locations served as habitation and Horticultural area indicative to anthropogenically manipulated environments and associated with pottery scatters. Found in close proximity to flowing permanent rivers and creeks.

12.5.4.3 AREAS LIKELY TO PRODUCE EVIDENCE OF PREHISTORIC OR HISTORIC ARTIFACTS/SITES/FEATURES WITH PROBABILITY NOTED

For purposes of this study, levels of probability reflect the common/specific association of a site/feature type with a particular topographic location as they are known within a locale or in this instance the project area.

High probability areas are those known always to be more or less associated with a particular landscape and geological features (caves/rock-shelters). Obviously, the latter varies by local terrains. Medium probability reflects situations where site/features are known to occur with some regularity in association with certain geological features. Any area where drainage occurs (prominences, ridgelines) or where water may collect (natural ponds, seeps, springs) are likely locations.

Medium-probability areas denote locations where sites and features are known to occur with some regularity, often in relation to specific geomorphological or hydrological characteristics. Such settings include areas of natural drainage (e.g., prominences, ridgelines) as well as locations where water naturally accumulates (e.g., ponds, seeps, and springs). These areas frequently supported both habitation and specialised activities, making them favourable for site discovery.

Low-probability areas are those where archaeological materials are less frequently encountered or are unlikely to be preserved due to environmental or geomorphological conditions. Nevertheless, given the variability of human land use strategies, even these settings cannot be entirely excluded from consideration.

The following are site types/features that are more likely to be encountered by high to low probability.

- Sherd and Lithic Scatters: Most likely located on /along primary and secondary river/ stream benches or terraces. May be found at falls and riffles where fishing was a co-occurring activity. Since there are no significant fluvial benches, terraces, falls, or riffles within the EMPL, there is a low to medium probability that ceramic and lithic materials could potentially be found.
- Caves and rock shelters: Generally found in areas of greater topographic relief. Areas where large boulders are exposed on steep slopes. Within the project area, the

geomorphology suggests a medium to high probability of encountering caves and rock shelters suitable for habitation, burial, or other cultural activities. Such locations are often productive archaeological contexts given their role in both daily use and ritual practices.

- Habitation sites: Habitation sites are most likely to be found along major river/stream benches or terraces. These sites are locations where Amerindians lived and conducted a variety of tasks within a delineated area. As is the case for sherd and lithic scatters, there are no significant fluvial benches, terraces, falls, or riffles. In the present project area, however, there are no significant fluvial benches, terraces, falls, or riffles that would ordinarily support the occurrence of these site types. Consequently, the probability of encountering habitation sites is assessed as low to medium. Forest clearance areas may nonetheless represent potential locations where such sites could be identified.
- Grinding surfaces/features: Typically found near or above water levels along major river/streams. Features are located on exposed and typically water-worn granites. Presence varies by season. Most commonly seen during dry periods. Within the project area, there is a medium probability of encountering grinding surfaces in association with rocky, annually flowing waterways. These features may occur in isolation or in conjunction with other site types, reflecting their role in food processing and tool production activities.
- Quarry Sites/Lithic workshops/chipping stations: Most likely located in and around rock outcrops or eroded areas exposing raw materials, particularly quartz. There is a low probability of encountering quarry/lithic workshops within the project area. Nevertheless, localised exposures of suitable stone may still yield evidence of small-scale chipping stations or opportunistic tool production.
- Petroglyphs/pictographs: Typically found in areas where caves and rock shelters occur. Rock art is often found on the rock faces of shelters or open-air granite boulders. Within the project area, there is a medium probability of encountering petroglyphs/pictographs, particularly in settings with exposed granite or sheltered rock surfaces conducive to preservation.
- Historic Sites: Historic remains are most often encountered in association with abandoned mining camps, old mine pits, and waterways that facilitated transport and settlement. Typical materials include bottles, historic ceramics, metal tools, and structural remnants such as housing foundations or equipment scatters. There is a high probability of encountering bottles, historic pottery and abandoned mining camp sites, most likely located in and around the project area, old mine pits and along water ways.
- Terra Preta sites: Terra Preta sites are anthropogenically enriched soils typically located in close proximity to permanent rivers and creeks. They are often associated with flooded landscapes, raised fields, and habitation zones, reflecting long-term human occupation and landscape modification. The geomorphological conditions suggest a low probability of encountering Terra Preta deposits. This is due to the limited presence of the fluvial and floodplain settings in which such soils are most commonly found.

12.5.5 INTANGIBLE TRADITIONS

Intangible cultural heritage consists of resources or sites of traditional, religious, or cultural significance, as well as traditional and spiritual beliefs, stories, knowledge, and practices. Under the umbrella of intangible heritage is living cultural heritage, or the aspects of cultural heritage that are inherited and continuous in nature. Descendants often inherit living heritage from previous generations including oral traditions, performing arts, social practices, rituals, and festivals. Living heritage can also be associated with physical locations like archaeological resources, sacred sites, sacred structures, and prominent topographical features essential for the preservation of traditional cultures.

During the cultural heritage stakeholder interviews in 2025, respondents were asked about intangible cultural heritage and associated sites in the region. Many of the beliefs shared revolved around traditional beliefs and oral stories.

Within the Indigenous communities, several participants referred to accounts involving spirits known as "Kanaimas". According to accounts from residents in Campbelltown, Micobie and Princeville, Kanaimas are believed to be spiritual beings that can influence individuals, sometimes described as taking the form of an animal such as a jaguar. These accounts interpret Kanaimas as manifestations linked to negative emotions and are said to be identified at night by distinct whistling sounds.

Other participants referred to beliefs involving gods of the mountains, noting that indigenous peoples would visit the surrounding mountains to pray for good fortune. However, with the widespread adoption of Christianity in the region, these traditional practices and beliefs have become less commonly observed.

Many respondents indicated that it is mainly the older generations who possess deeper spiritual beliefs, share traditional stories, and experience supernatural encounters. Nevertheless, some younger residents did acknowledge their own encounters or stories of Kanaimas, indicating a degree of acceptance of these cultural beliefs.

These intangible beliefs are not thought to be tied to specific location. As such, no specific resources such as spiritually significant natural features (e.g. trees, rocks), spaces (e.g. landscapes), or other physical sites were identified as being linked to these intangible values.

12.5.5.1 INDIGENOUS TRADITIONAL LANDS

While the closest indigenous community may be several kilometres from the Project, the indigenous land use and linkages to ancestral spaces remain largely undocumented. This can only become clearer with the undertaking of community engagements and land use mapping of the area. Several International Charters and Conventions including the UNDRIP and the Indigenous Peoples Act (2006) of Guyana, reinforces the importance of Indigenous traditional lands and resources which they have traditionally owned and or exploited, occupied or acquire overtime. It is important to bear in mind that Indigenous ancestral lands are areas considered to be under use for a prolonged period of time as a seasonal passage, spiritual landscape or resource exploitation for a population. This also includes areas utilised for fishing, hunting and gathering.

The Kaieteur National Park, a protected area and indigenous sacred site, is approximately 42 km from the project area. Given its prehistoric and historic significance and known land use there is a probability that sites of significance, seasonal or otherwise, may be within this vicinity.

However, surface traces of such land use may be obscured or distorted by historic mining activities and environmental processes, including sedimentation and erosion. This underscores the importance of integrating archaeological survey with Indigenous knowledge systems to fully document and respect cultural landscapes.

12.6 KEY BASELINE FINDINGS

The current baseline study identified a total of three cultural heritage resources within the Project AoI. Of these three identified resources, none are Designated (listed as having legal protection).

Presented below, are the results of desk-based investigation and the intuitive and pedestrian survey conducted within vicinity of Stronghold Guyana concession during the period of April 5th to 12th, 2025.

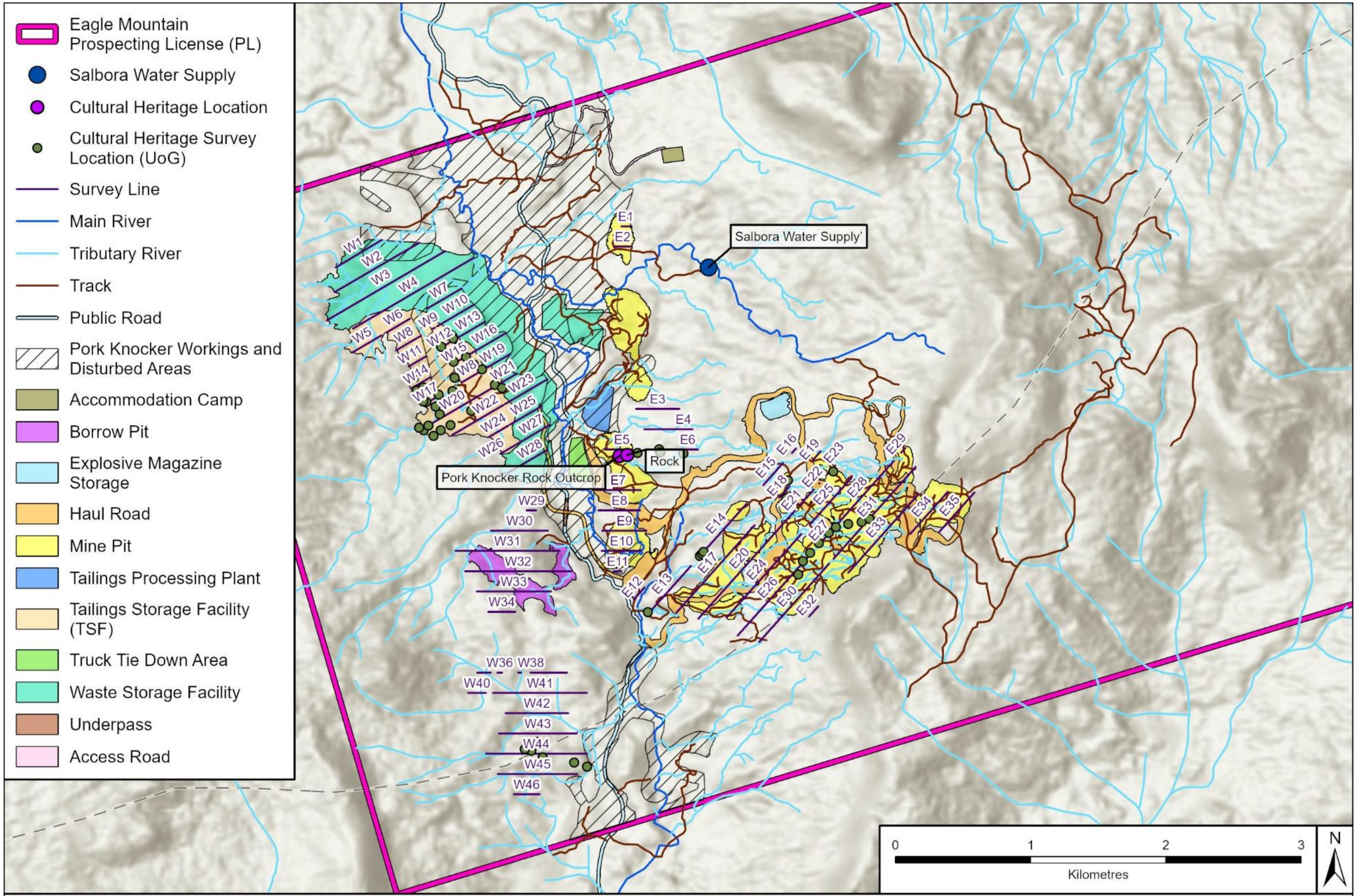
12.6.1 DESIGNATED CULTURAL HERITAGE RESOURCES

No designated cultural heritage resources were identified within the Project AoI.

12.6.2 NON-DESIGNATED CULTURAL HERITAGE RESOURCES

Evidence of cultural heritage resources that were identified within the Project AoI and are presented in Figure 12.1 and an overview of the resources per project footprint is provided in Table 12.4.

FIGURE 12.1 MAP OF PROJECT AREA HIGHLIGHTING PROPOSED SURVEY TRANSECT WITHIN THE EMPL



Source: Esri, NASA, NGA, USGS, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

Path: \\vmukspgisfs01\Data\London\Projects\0763224 - Mako Mining EIA\Map\0763224 - Mako Mining EIA - V02C12 - HIS.aprx\0763224 - V02C12 - Cultural Heritage - 12.01 - Cultural Heritage Resources

TABLE 12.4 CULTURAL HERITAGE RESOURCES PER PROJECT FACILITY

Site/Location	Current State
Tailings Storage Facility	Partly disturbed due to previous mining activities
Mine Pit	Partly disturbed due to land clearing, road development and historic mining
Waste Storage Facility	Disturbed, largely inaccessible
Tailings Processing Plant	Disturbed –mine site

Consideration should be noted that fixed terrain transects were utilised where possible, while in other cases, the ground-truthing exercise within the survey area was conducted in a more *ad hoc* manner, with the use of irregular transects as governed by the terrain. Further, guided individual inspection of exposed services, along with a requirement for localised removal of vegetation and leaf litter permitted the appropriate survey of certain areas. These adaptive strategies were implemented in response to a range of limitations, including dense vegetation cover, uneven topography, and prior disturbances to the landscape.

Considerable disturbance was observed throughout the EMPL. These impacts stem primarily from historic medium- and small-scale artisanal mining, which generated extensive waste rock piles and tailing ponds. In addition, large portions of the concession consist of swampy terrain, further constraining the effectiveness of site survey and ground visibility.

Although the survey design intended to establish and record multiple transects within the project area, the terrain did not permit placement of transects in close proximity. Owing to the difficulty of establishing systematic transects in suitable terrain, an intuitive survey approach was adopted instead.

Plant site

The site of the historical surface mining operation and pilot plant facility, which operated from 2016 to early 2017, includes shallow open pits, processing equipment, and a tailings impoundment (Figure 12.2). The mining area is now completely clear of vegetation and exhibits surface disturbance typical of an alluvial or saprolite operation. As a result, in this area the potential for intact archaeological deposits is considered minimal.

FIGURE 12.2 CONVEYOR AND SCRUBBER PLANT USED IN THE STRONGHOLD GUYANA PILOT PLANT OPERATION (2016-17)

The Mine Pit

Within the vicinity of the Mine Pit, specifically along the survey transect line E14, two historic English bottles were noted. The bottles were exposed and above the dense leaf litter within the area (Figure 12.3) and were left *in situ*. Disturbance within the area is evident and may be associated with past mining, spanning more than 100 years of activity in this site. Both bottles were photographed and geo-referenced, with two GPS points recorded (5.205272N 59.124378W and 5.205409N 59.124272W). The artifacts were left *in situ* in accordance with survey protocols.

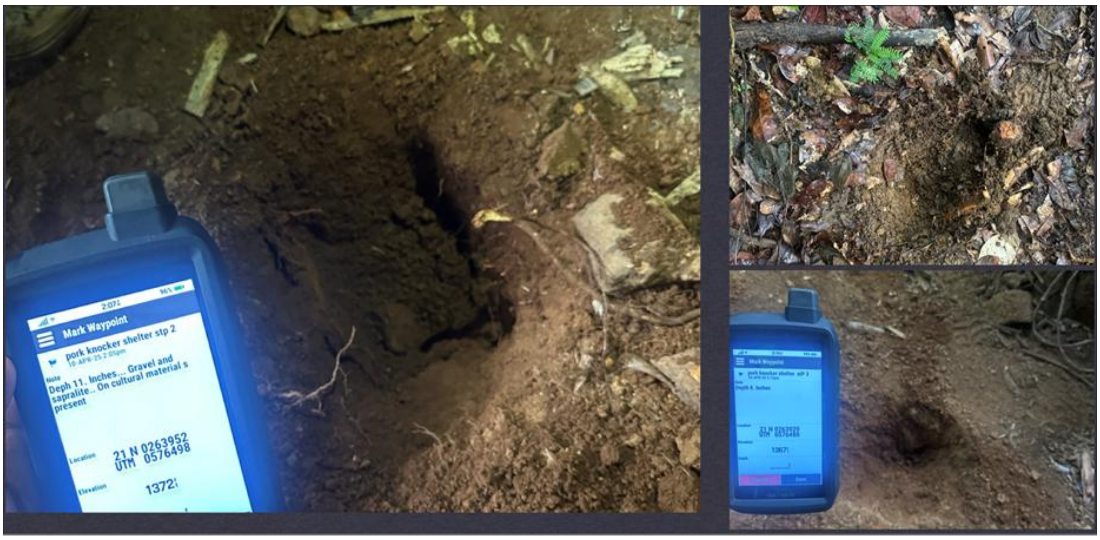
FIGURE 12.3 IMAGES OF HISTORIC BOTTLES WITH THE VICINITY OF THE MINING PIT

Rock Shelters (Area of Influence – Mine Pits)

Two Rock shelters were identified within the vicinity of the area outlined as the pit. Both shelters produced evidence of past mining and modern settlement by 'pork-knockers' (Figure 12.5). One of the shelters referred to as (Pork knocker rock outcrop) is situated on a gentle slope of a small hill, approximately 60 meters south of a small rocky tributary. Less than 15 percent consisted of loose sediments were the result of the decomposition of the shelter rock. The second shelter at the time of the survey, referred to as Rock Shelter (2), was temporarily occupied by illegal pork knockers and as a result access to the area and surveys were limited. Refer to the Social Baseline Chapter (Volume 2: Chapter 11) for more information on artisanal mining.

Shovel Test Pits (STPs) were dug approximately 1 meter apart at the base and entrance of the shelter and provided no evidence of archaeological materials (Figure 12.4 and Figure 12.5).

FIGURE 12.4 STPS WITHIN ROCK SHELTER 1



Four STP at depths of 16, 25, 20 and 27cm respectively were dug within the vicinity of the shelter one (1), however the location did not produce archaeological materials of any kind (Table 12.5). All STPs were spaced approximately one meter apart at the base and entrance of the shelter. Despite systematic testing, no archaeological materials were recovered from these contexts.

The absence of cultural material, coupled with the high proportion of exposed bedrock and environmental disturbance, suggests limited potential for intact archaeological deposits at this location. However, environmental and biodiversity disturbances were also noted, these disturbances range from, impacts of rainwater runoffs, including sedimentation, small borrows and materials left behind by small mammals, further affecting site integrity.

TABLE 12.5 LOCATION FOR DIGS IN CAVE SITE

STP. Pork Knocker Cave	
1-25 cm	21N 0265403 0575680
2-27 cm	21N 0263952 0576498
3-20 cm	21N 0263939 0576480
4-16 cm (entrance)	21N 0263955 0576482

FIGURE 12.5 ROCK SHELTER, HISTORICAL AND INTERMITTENT OCCUPATION BY PORT KNOCKERS (4 STPS WERE DUG IN THE SITE)

Waste Storage Facility 1 Site

Disturbance within this area is particularly notable, largely the result of medium- and small-scale mining activities (Figure 12.6). Due to the poor condition of the terrain, a systematic transect survey was not feasible. As a result, survey coverage was restricted to the ridge lines of the hill, which remained comparatively intact. The survey did not identify any evidence of archaeological significance within the site.

FIGURE 12.6 IMAGE OF THE TAILING POND WITHIN THE VICINITY OF WASTE DUMP 1

Tailings Storage Facility

This area presented challenging terrain characterised by extensive outcrops, steep rocky hills, and seasonally flowing streams. Vegetation consists of dense shrubs interspersed with secondary forests (Figure 12.7). Ground Surface Visibility (GSV) ranged from 0 to 20 percent. Survey efforts were necessarily restricted to locations not interrupted by flowing water or dominated by large outcrop hills.

No archaeological materials were identified during the survey. The survey did not identify any evidence of archaeological significance within the site.

FIGURE 12.7 IMAGE OF TSF 1, TERRAIN WITHIN THIS PROJECT AREA

Potential areas of interest

Areas with the highest potential for archaeological site discovery and documentation within the EMPL include TSF and the Mahdia main water tributary. These areas warrant additional survey and continued monitoring throughout the course of project development activities.

Conclusion

The survey results indicate that while much of the concession has been heavily disturbed, select areas retain potential for archaeological and heritage features, particularly historic mining sites and natural shelters. This report establishes a baseline record for the area and emphasises the importance of continued monitoring, community engagement, and targeted investigation in less-disturbed zones.

12.7 SENSITIVITY/VALUE OF RECEPTOR

Each identified tangible and intangible cultural heritage resource has been assigned a sensitivity/value. There are many factors to consider when assigning value to cultural heritage resources and key baseline findings are utilised to describe a "sensitivity" rating to a tangible or intangible cultural heritage resource.

Values are typically expressed as low, medium, high (and sometimes very high) and these can be equated to local, national, and international values.

The sensitivity/value of receptor for the cultural heritage resources identified in the baseline has been assigned based on ERM's internal Impact Assessment Standard criteria for Cultural Heritage Impact Significance, professional judgement, desk-based research, and the field survey on tangible and intangible cultural heritage.

ERM's internal impact assessment standard criteria for cultural heritage impact significance is aligned with the IFC PS8 guidance, and assigns a 'Low', 'Medium' and 'High' value to cultural heritage resources as set out in Table 12.6.

TABLE 12.6 CRITERIA FOR CULTURAL HERITAGE SENSITIVITY OF RECEPTOR (A GUIDE)[1]

Cultural Heritage Resource Sensitivity		
Low	Medium	High
• Defining Characteristics: • Site is not specifically protected under local, national or international laws or treaties; • Site can be moved to another location or replaced by a similar site, or is a type of site that is common in the surrounding region; • Site has limited or no cultural value to local, national or international stakeholders; and/or • Site has limited scientific value, or similar information can be obtained at numerous sites • (Replicable Cultural Heritage)	• Defining Characteristics: • Site is specifically or generally protected by local or national laws, but laws allow for mitigated impacts; • Site can be moved or replaced, or data and artefacts recovered in consultation with stakeholders; • Site has considerable cultural value for the local and/or national stakeholders; and/or • Site has substantial scientific value, but similar information can be obtained at a limited number of other sites. • (Non-replicable Cultural Heritage)	• Defining Characteristics: • Site is protected by local, national and international laws or treaties; • Site cannot be moved or replaced without a major loss of cultural value; • Legal status specifically prohibits direct impacts or encroachment on site and/or protection zone; • Site has substantial value to local, national and international stakeholders; and/or • Site has exceptional scientific value and similar site types are rare or non-existent • (Critical Cultural Heritage)

Each of the three cultural heritage resources are presented with a sensitivity in line with the ERM Impact Assessment Methodology[2]. Table 12.7 presents the 'types' and quantities of identified cultural heritage resources in relation to their sensitivity of receptor.

12.7.1 HIGH SENSITIVITY

No cultural heritage resources were attributed a high sensitivity.

12.7.2 MEDIUM SENSITIVITY

No cultural heritage resources were attributed a medium sensitivity.

12.7.3 LOW SENSITIVITY

The following three cultural heritage resources can be attributed a low sensitivity:

- MAK_CH_001 (Two English bottle cluster)
- MAK_CH_002 (Possible rock shelter)
- MAK_CH_003 (Pork-knocking activity – varied – Mine Site area)

TABLE 12.7 QUANTITIES OF HIGH, MEDIUM, AND LOW SENSITIVITY RECEPTORS

Type of Cultural Heritage resource	High Sensitivity	Medium Sensitivity	Low Sensitivity
Bottle cluster	0	0	1
Cave/ rock shelter	0	0	1
'Pork-knocking' activity	0	0	1
Total	0	0	3

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ERM Guyana
Lot 201 New Market Street
Georgetown
Guyana

T +592 501 0625

www.erm.com