

PROJECT SUMMARY
ANTHONY VIEIRA SAND QUARRY
DEMERARA RIVER

ANTHONY VIEIRA

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June 2023

1. INTRODUCTION

Mr. Anthony Vieira, a Guyanese Broadcaster and Developer, has a number of business interests and has been active in the broadcasting industry in Guyana for decades. The developer is proposing to invest and develop a sand quarry (the Project), within the Dora, Demerara River area. The Project will consist of a number of heavy-duty equipment, a sand washing and screening plant, conveyor system and support equipment. The Project Summary is prepared as part requirement of the EPA's environmental authorization application process. The summary contains the following information as required by the EPA Act:

- a non-technical explanation of the Project;
- the location, design and size of the project;
- the duration of the project;
- the possible effects on the environment.

2. PROJECT LOCATION

The Anthony Vieira sand quarry is located on the Right Bank of the Demerara River, approximately 70 KM south west of Georgetown and 37 Km North of Linden, through rivers. The sand quarry is accessible by the Demerara River and the Linden Soesdyke Highway, then secondary roads to the project area. Transport is possible by ships for export, barges and trucks.

The Anthony Vieira sand quarry project is centered on N 6.286721⁰ W 58.263759⁰ in the Demerara area central northern Guyana. The area is approximately 70 Km south west of the capital city of Georgetown and 70 Km north of Linden, all distances along riverain routes. All grid references used for the remainder of this report are following those on Figure 1.5, which is adapted from the 1:50, 000 sheet 28NW and 28 NE published by the Guyana Geology and Mines Commission (GGMC).

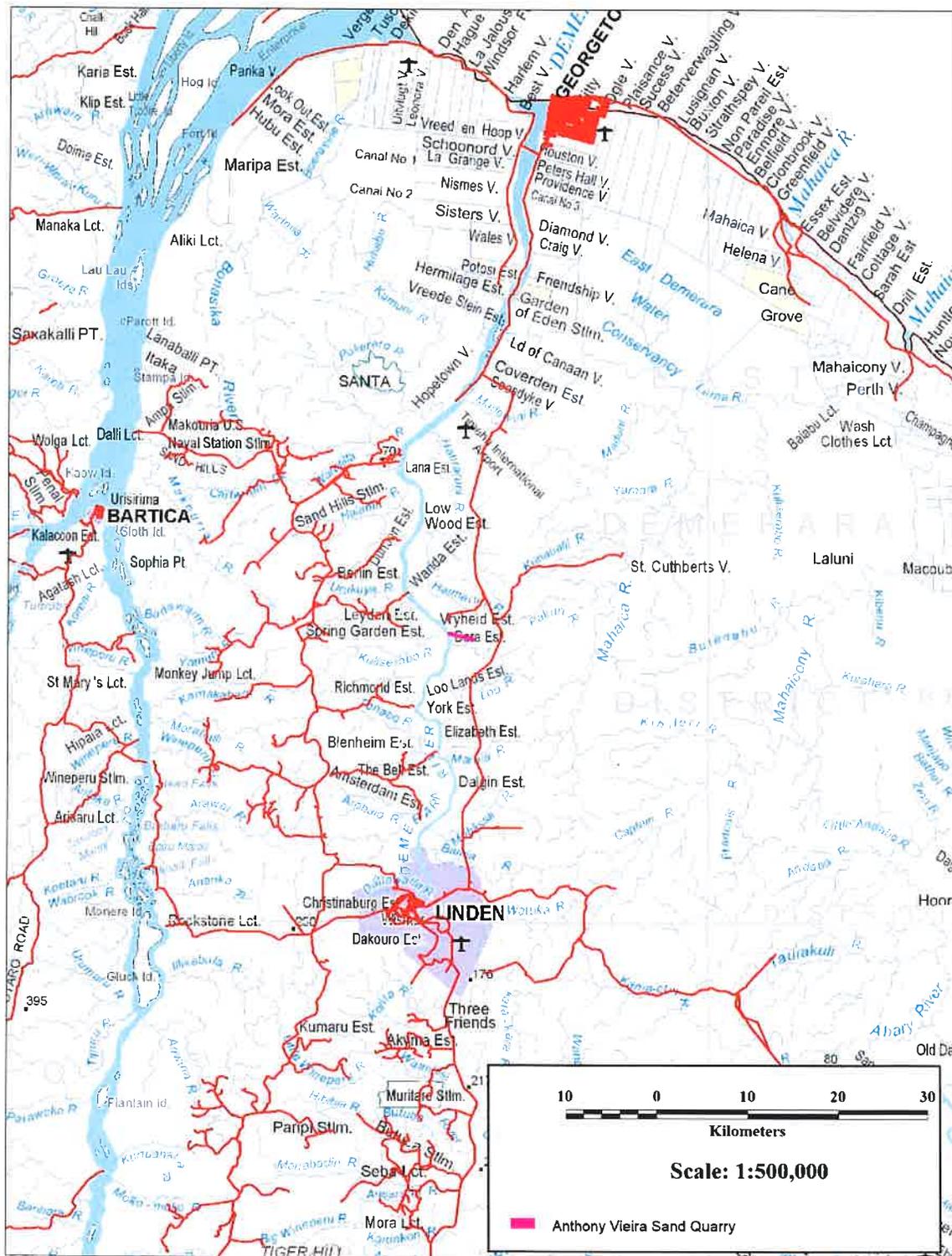


Figure 1: Map showing the location of Anthony Vieira Quarry

The formal description of the property is as follow:

Tract of state land located In the Coastal Area - No Mining as shown on Terra Surveys Topographic Map 28NW, at scale 1:50,000 with reference point 'X' located at the confluence of Lukubuna Creek and Hauraruni River with geographical coordinates of Longitude 58°13'23.196"W and Latitude 6°22'40.526"N

Thence at a true bearing of 204.84°, for a distance of 6 miles 1649.87 yards, to the point of commencement

Point A, located at geographical coordinates of longitude 58°15'55.973"W and latitude 6°17'12.502", thence at true bearing of 357.38°, for a distance of approximately 92.516 yards, to Point B, located at geographical coordinates of longitude 58°15'56.099"W and latitude 6°17'15.238". thence at true bearing of 103.78°, for a distance of approximately 549.343 yards, to Point C, located at geographical coordinates of longitude 58°15'40.208"W and latitude 6°17'11.364", thence at true bearing of 193.75°, for a distance of approximately 33.5521 yards, to Point D, located at geographical coordinates of longitude 58°15'40.446"W and latitude 6°17'10.399", thence at true bearing of 103.79°, for a distance of approximately 738.413 yards, to Point E, located at geographical coordinates of longitude 58°15'19.087"W and latitude 6°17'5.19". thence at true bearing of 14.45°, for a distance of approximately 6.78117 yards, to Point F, located at geographical coordinates of longitude 58°15'19.037"W and latitude 6°17'5.384", thence at true bearing of 103.79°, for a distance of approximately 1236.88 yards, to Point G, located at geographical coordinates of longitude 58°14'43.26"W and latitude 6°16'56.658". thence at true bearing of 13.66°, for a distance of approximately 74.7119 yards, to Point H, located at geographical coordinates of longitude 58°14'42.734"W and latitude 6°16'58.807", thence at true bearing of 103.79°, for a distance of approximately 499.961 yards, to Point I, located at geographical coordinates of longitude 58°14'28.273"W and latitude 6°16'55.279", thence at true bearing of 182.94°, for a distance of approximately 139.055 yards, to Point J, located at geographical coordinates of longitude 58°14'28.486"W and latitude 6°16'51.168", thence at true bearing of 283.78°, for a distance of approximately 1 mile 1264.56 yards, to the point of commencement at Point A

Thus enclosing an area of approximately 49 acres, save and except all lands lawfully held or occupied.

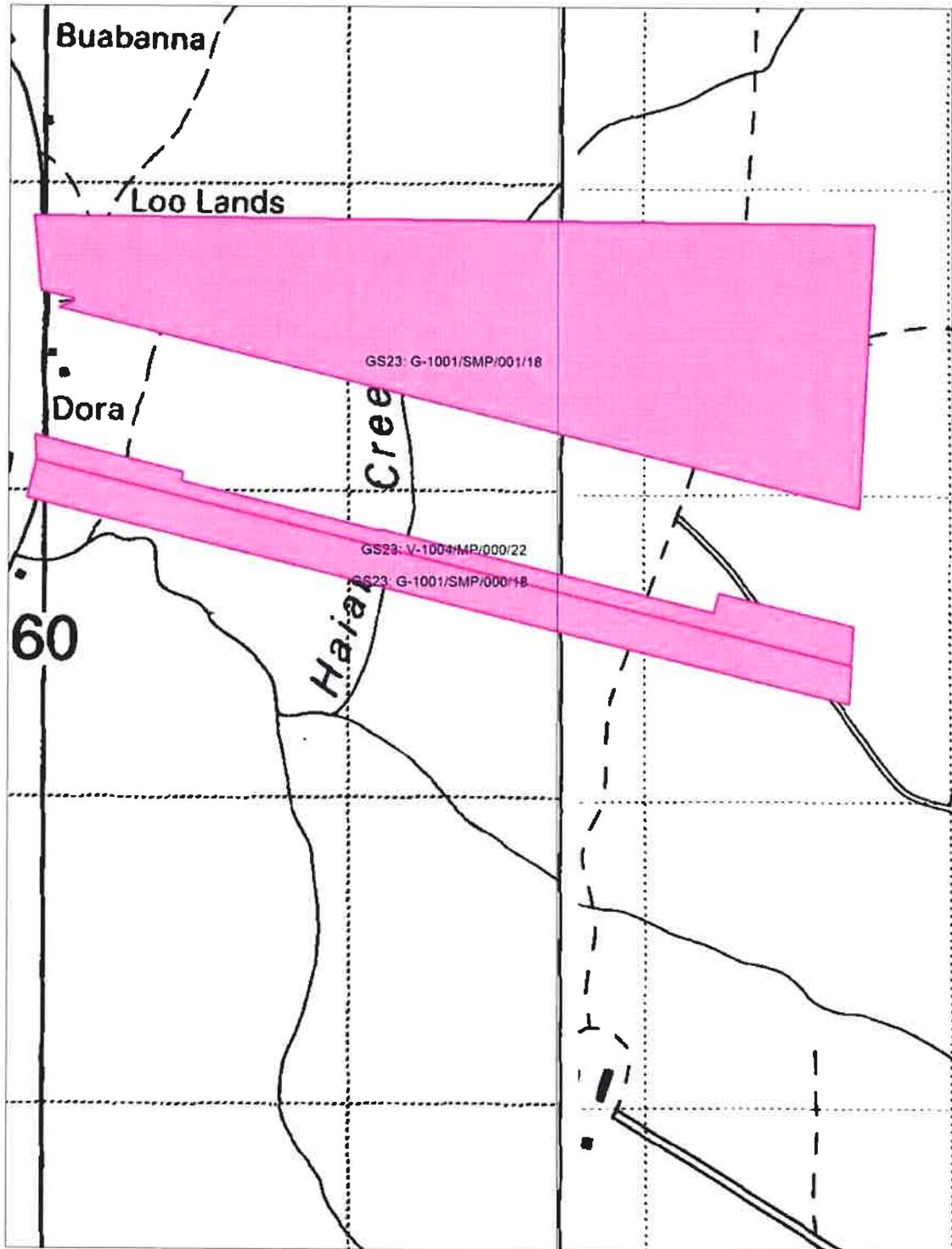


Figure 2: Map showing the location of Anthony Vieira Quarry

Anthony Vieira Quarry will focus on 'Site A' which has an estimated resource of 1,500,000 metric tonnes of sand. Mapping was done by C. Sparman, MSc, BMEng, which identified the resources by suitable topography and rock exposure. No other significant exploration has been carried out within the proposed Project area. The resource information is based on the geological information available along with the topography. No drilling is needed to further define the resource.

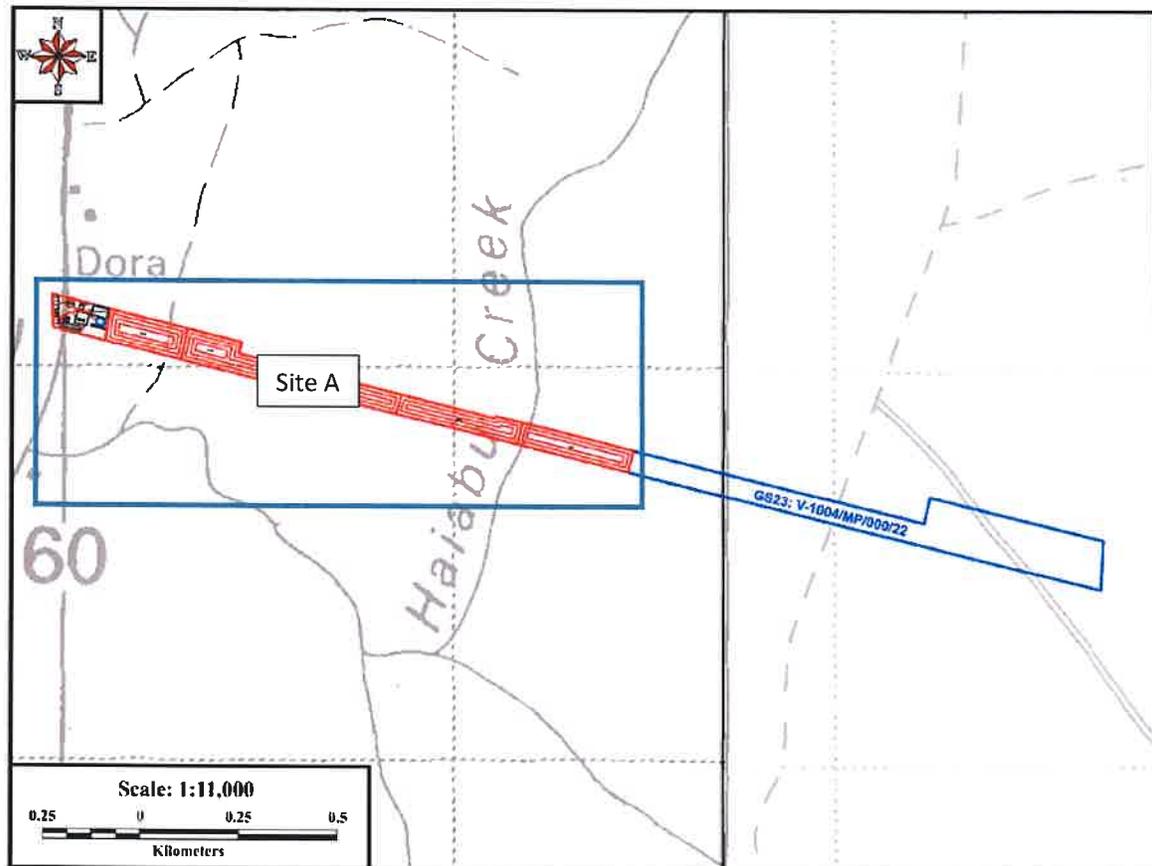


Figure 3: Site A proposed area for first phase extraction

The white sands of Guyana lie south of the coastal zone in an area referred to as the Hilly Sand and Clay Region. This natural region of the country obtained its name from the alternating sequence of unconsolidated sands and un-compacted clays that make up the soil structure of the area. These sands are said to be of fluvial origin and can be found on the outskirts of the Guiana Shield where a "sand belt" exists.

It is approximated that over 5, 000 square miles of Guyana are covered with deposits of loose white and brown sands of variable thicknesses. The white sands account for more than quarter of the area and represent the uppermost member in the sequence of unconsolidated sands known as the White Sand Series or Berbice Formation. Below the White Sands can be found the Intermediate Clays followed by the Lower Sands which lie on the Alternating Sands and Clays.

Large quantities of high purity silica rich sand of the Tertiary or Pleistocene White Sand Formation can be found. These sands are rich in silicon dioxide but small intrusion of brown sands and accumulated impurities can be found at random locations. These Brown Sands have been stained by brown ferruginous water. Other impurities may be found in the sand such as heavy metals whose contents rarely exceed 0.1%, and include ilmenite, magnetite, limonite, leucoxene, minor zircon, tourmaline, rutile, staurolite and andalusite.

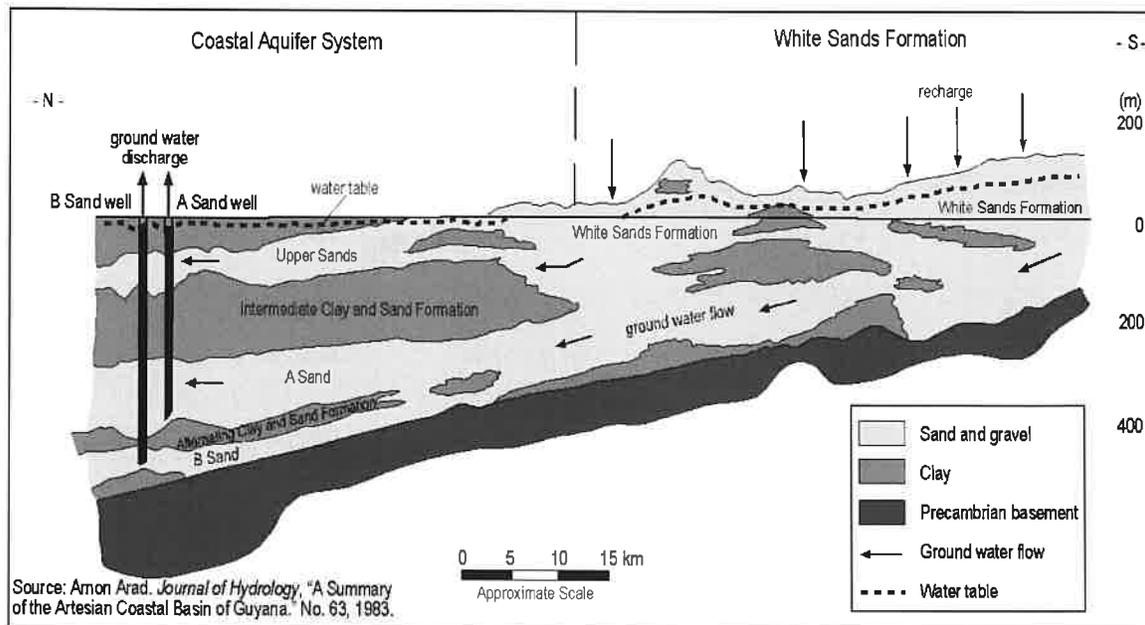


Figure 4: Geology Map of the Project Area, showing the sand belt

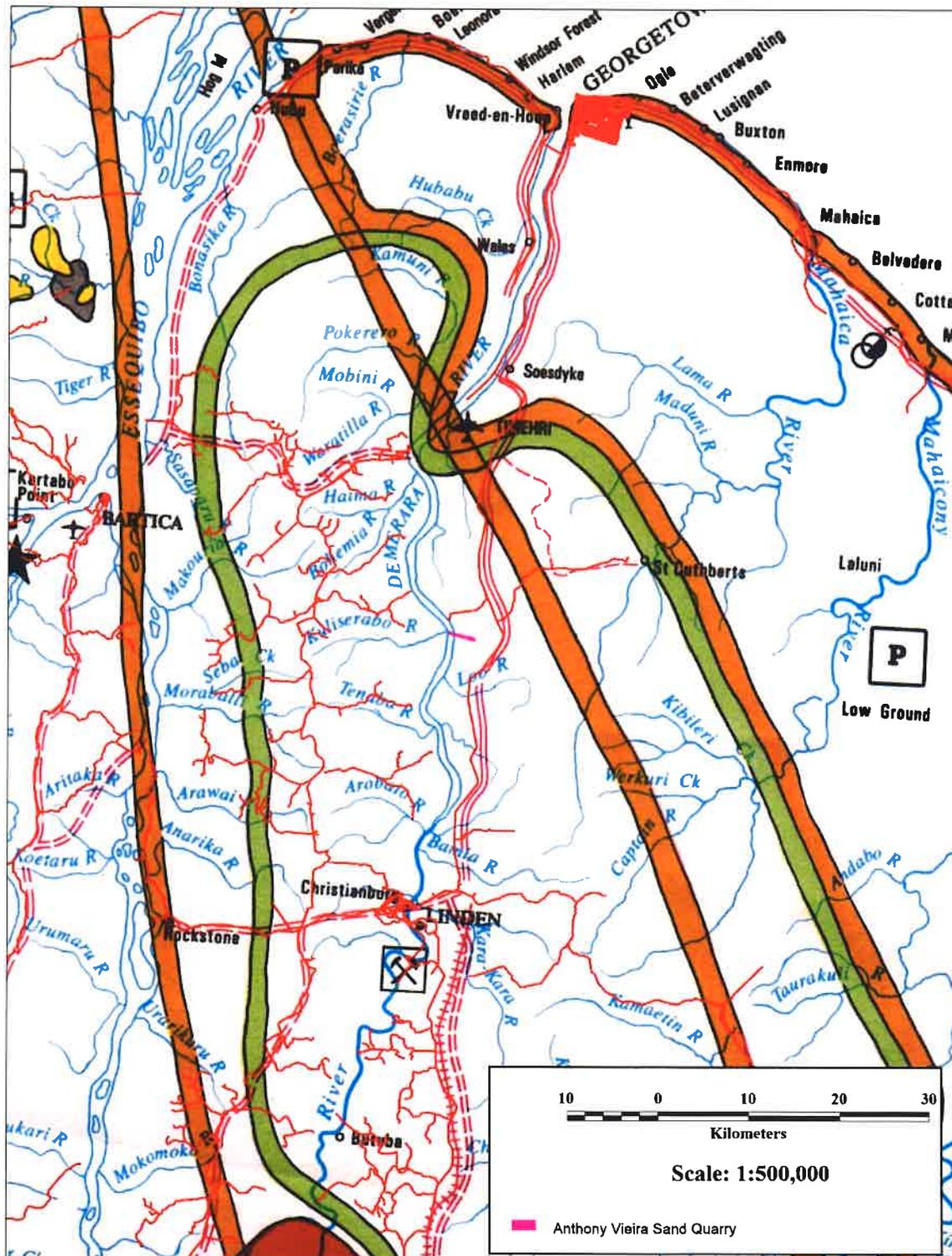


Figure 5: Geology Map of the Project Area, showing the sand belt

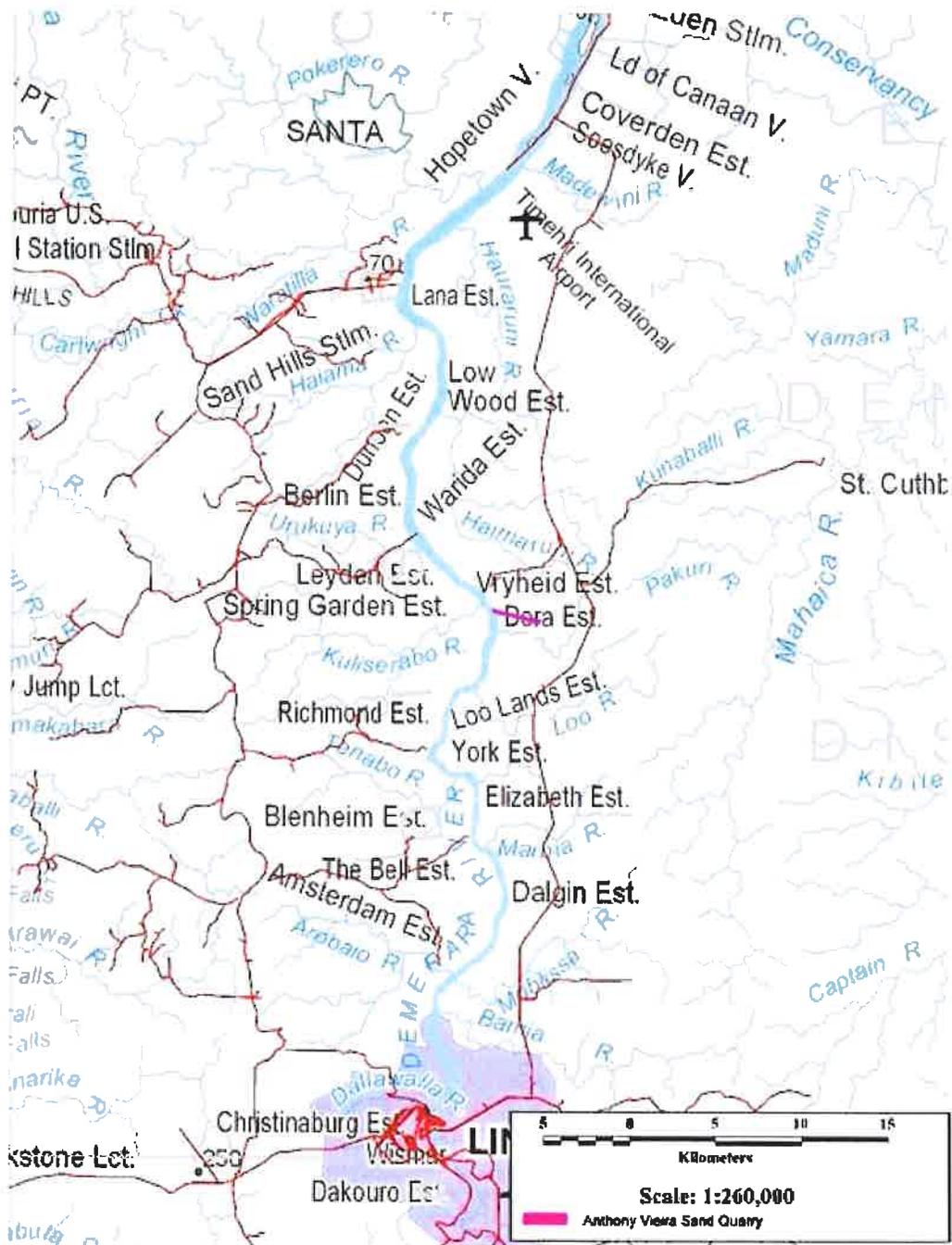


Figure 6: Map showing the major water courses and known places in Demerara River Area

3. PROJECT DESCRIPTION

The project will see 300,000 metric tonnes of sand being mined and produced annually from the Anthony Vieira Sand Quarry over a mine life of five (5) years. The extensions from Site A will be based on market analysis and demand. Quarrying operations are expected to commence in second quarter 2023 once all regulatory approvals are obtained.

The capital investment in the project is USD \$1.4 million but initial investment will be USD 0.6 million or GUY \$ 130,800,000. Through the Project's capital investment and the initial life of five years, the estimated annual turnover pre- tax is USD 536,068 (GUY \$ 116,862,824.). The Project will see about 25 employees for the life.

The production objective for the quarry is to produce regular sand for the local market, and washed and screened sand for the international market.

The development stages of the Project will consist of:

- **Construction Phase** – which will include land clearing, over burden stripping and stockpiling, construction of sand quarry access roads, on-loading facility, office and camp facilities, and the procurement of the sand washing and screening plant;
- **Operation Phase** – which will include sand excavation, sand stockpiling, sand washing and screening, on-loading, and barge transport;
- **Closure Phase** - based on extensions and future development of resources and reserves, once exploited, the buildings will be decommissioned, site clean-up, and rehabilitation.

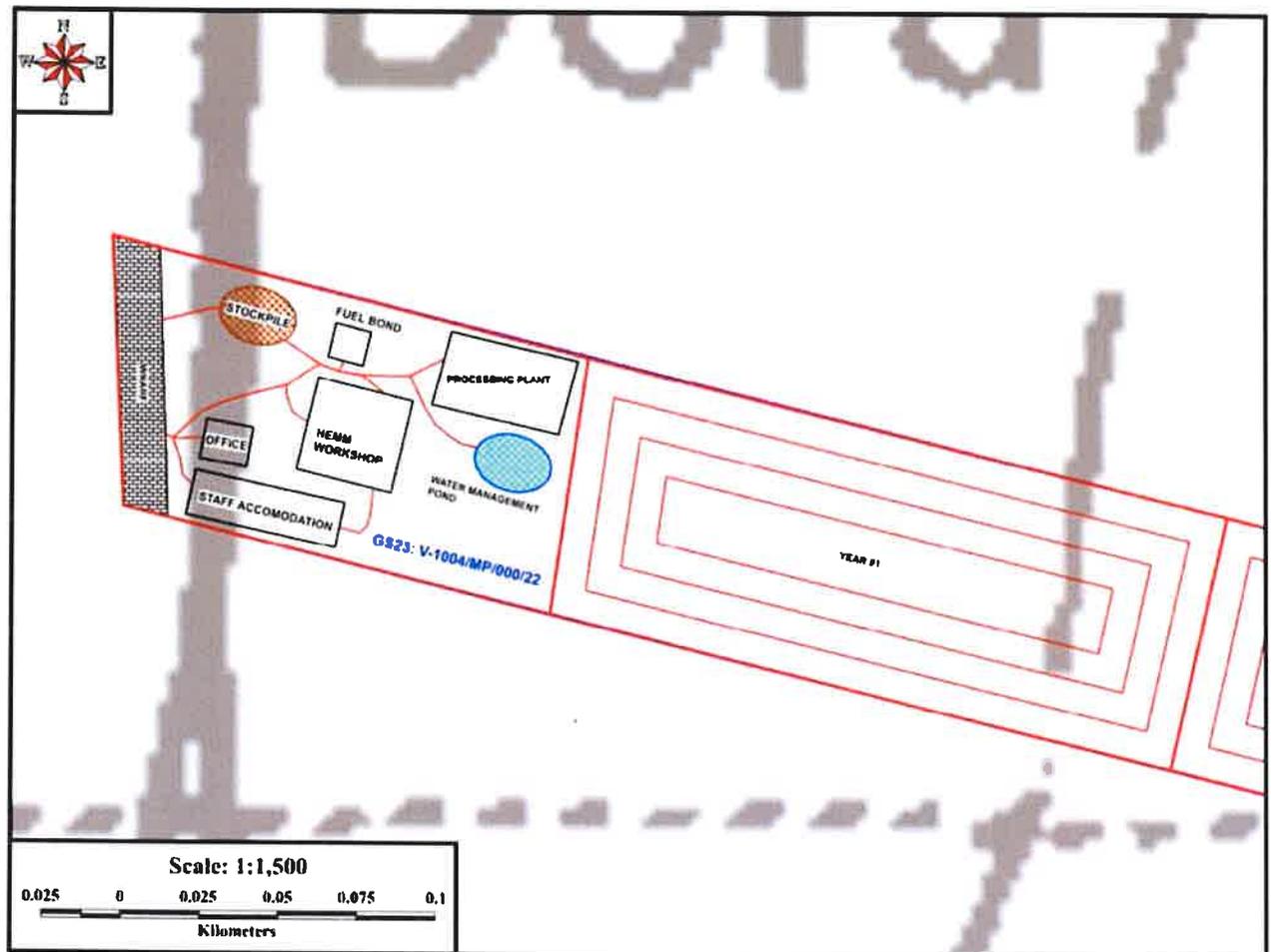


Figure 7: Anthony Vieira Proposed Sand Quarry Layout

3.1 MINING AND ORE PROCESSING

Sand quarrying will be conducted in accordance with industry best practices.

Mining at the Anthony Vieira Quarry will progress as follows:

- De- bushing- Trees and shrubs will be cleared 30.48 m from the advancing mine face, marketable timber will be stored in a log pond, and the Guyana Forestry Commission contacted to determine the best end use for the timber stored. Small trees and shrubs will be stockpiled for the rehabilitation phase, since this can be utilized as fertilizer/mulch and may contain seed to restart vegetation.

- Stripping- The volume of overburden to be stripped per year is estimated at 19,861 m³, which is equivalent to 31,778 tons. Overburden will be stripped to a depth of 0.762 m. Topsoil stripped during this phase will be stored for rehabilitation process. Stripping will be accomplished by using a CAT 320 D Excavator.
- Excavation of sand- The volume of sand to be mined per year is estimated at 300,000 tons. Sand will be excavated in levels of 4 m each, unless the market requires different size fractions, then the sand quarry will progress in a series of 4- benches, 0-4 m, 4-8 m, 8-12 m and 12- 12.762 m. Excavation of sand will be done utilizing a CAT 950 H loader.
- Loading and Haulage- Sand will be loaded in 30 ton trucks by CAT 950 H wheel loaders and hauled to the processing plant and dumped in the raw sand stockpile. Sand will then be loaded into the processing plant by the CAT 320 D excavator. Stockpiled, washed and processed sand will then be loaded into 30 ton trucks and transported to a wharf on the left bank Demerara River and stockpiled for international shipping. Sand will be loaded onto ships by a conveyor system or by CAT 950 H wheel loaders.
- Sand Washing and Processing- Sand will be washed and screened into different size fractions by the processing plant, which will produce stockpiles of varying size fractions.
- Rehabilitation and Closure- The sand quarry face will be levelled utilizing the CAT 320 D excavator and the CAT 950 H wheel loaders to a suitable gradient to minimize erosion. Portions of the Mining lease will be re- vegetated to return the land to a natural state, whilst the operator will apply for an agricultural lease for other portions of the Mining Lease, as such some water management ponds will be retained for irrigation. All road networks and trails that were encountered, before sand quarrying of the property will be re-established or retained if they were untouched.

The overall pit configuration will reflect local geological conditions and stability.

The initial pit layout at the end of one year will extend 206 m x 85 m, with a final pit depth of 12.762 m.

The final pit layout at the end of five (5) year is shown in fig. 3.15 below. The pit floor will be rehabilitated with 0.762 m of top soil. The sides of the pit will be contoured at least to 30 degrees, or to correlate with the surrounding topography.

The essential sand quarrying equipment for loading and hauling sand is proposed based on the required production capacity and on local conditions.

The quarrying phase with single shift operations, 1-8-hour shift, with the exception of haulage equipment which will work 2-8-hour shift, producing up to 0.3 million tons of sand per annum i.e. 25,000 tons sand per month:

There will be a necessity for qualified equipment operators and servicing (fuel and repairs, etc.). The amount and intensity of the applied machinery shall depend on the required capacity of the sand quarry.

The following sand quarry technology will be used for the assumed initial production capacity of 300,000 metric tons per annum;

- Clearing land/stripping- CAT 320D Excavator
- Loading- CAT 950 H Loader
- Haul Truck- 30 Tons

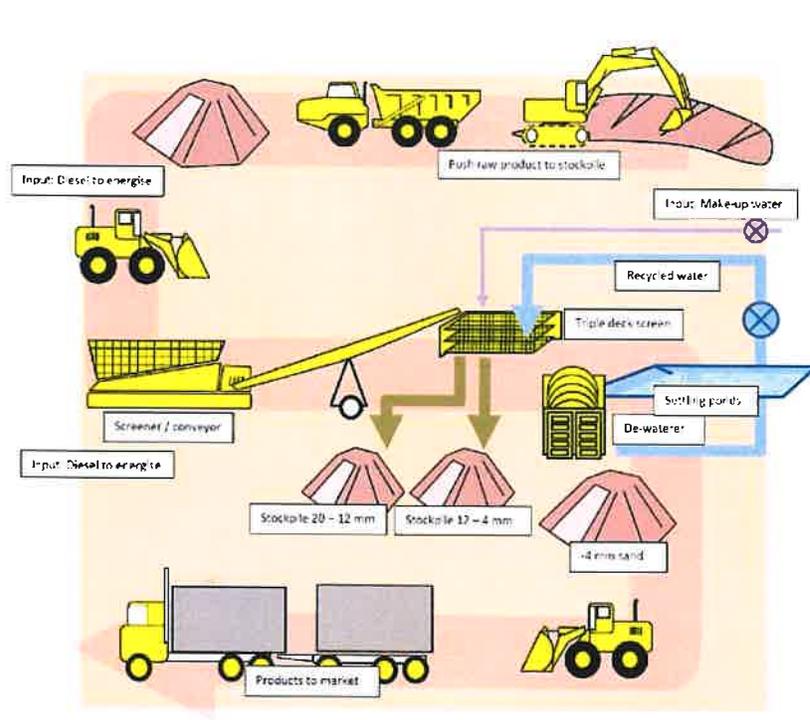


Figure 8: Schematic Stage 1 process flow

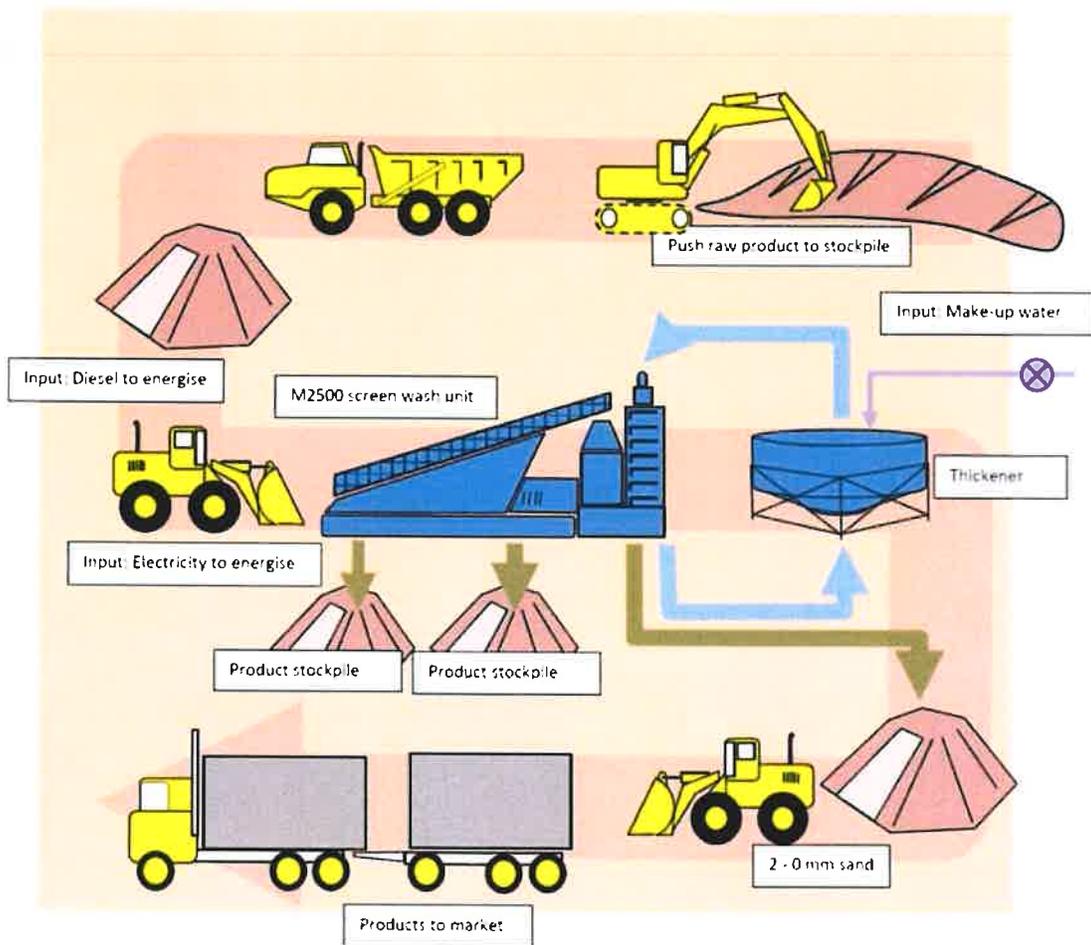


Figure 9: Schematic Stage 2 process flow

The processing plant will wash, screen and attrition sand and remove heavy minerals to create a final product for delivery to customers. There are no chemicals required for the process, which includes a thickener that will allow for 95 per cent of process water to be recycled.

The process flow for the plant will be as follows:

1. An upstream process, which will provide a slurry feed product with solids of a maximum 2mm size. The product is classified by a series of screens that will create a coarse product (<2mm - +0.6mm) and a fine product (-0.6mm).
2. The coarse product is washed, dewatered and stockpiled.
3. The finer product moves to an attrition scrubbing and washing process.

4. Finer product then moves on to a spiral bank separating the feed into heavies and lights.
5. The light product passes through a magnetic separation process.
6. Non-magnetic product moves to a counter flow classification unit (CFCU) which produces two products:
 - (a) A glass sand product ($<0.6\text{mm} + 0.212\text{mm}$).
 - (b) A fines product ($<0.212\text{mm} + 0.06\text{mm}$) that will be sent to the coarse sand stockpile.
7. Slimes less than $75\mu\text{m}$ produced by the plant will be treated through an AquaCycle thickener for process water recovery.

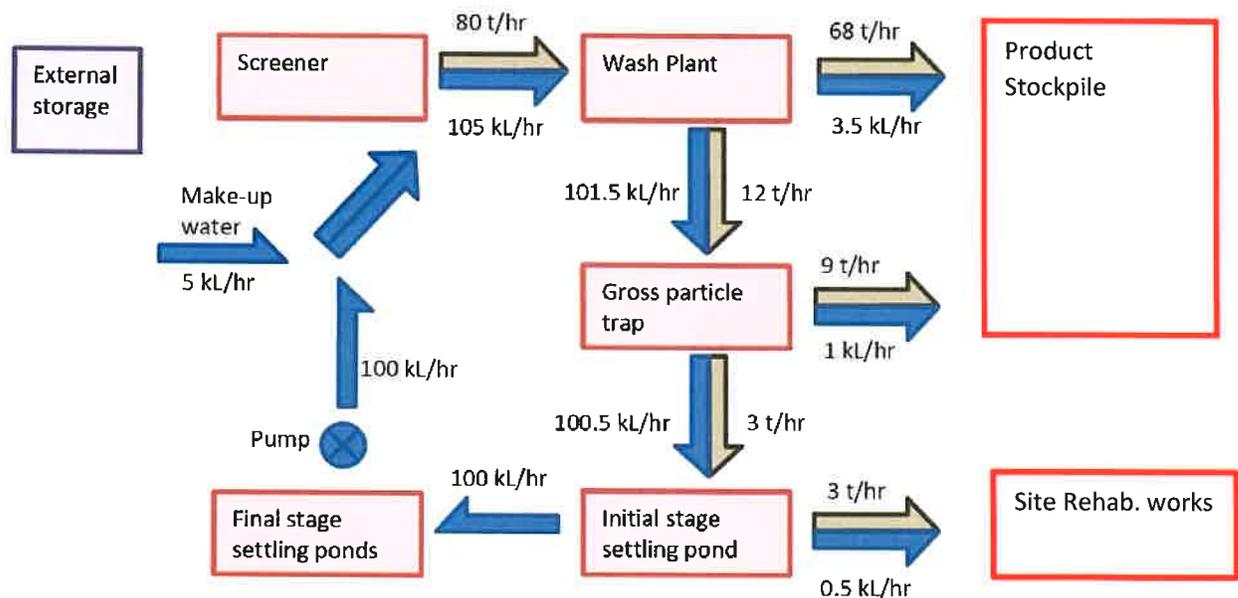


Figure 10: Water balance diagram processing circuit (Stage 1) Portafill Tec

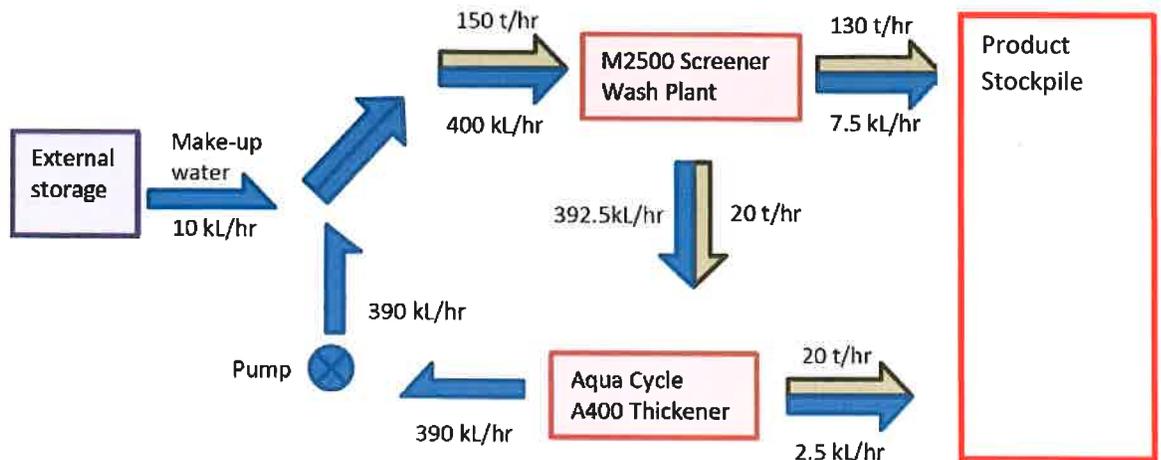


Figure 11: Water balance diagram processing circuit (Stage 2) M2500E4x

Out-loading will be done using with one (1) 2000 Hp tug and two (2) 1,500 tons barges. The estimated barge turn-around is 49 hours (21 hours on the river, 13 hours at the sand quarry, and 15 hours for off-loading). There is clear river access for tugs and barges using the Demerara River.

Offloading sites are available at Parika and Georgetown, with road access available to transport the product to the market. If international markets become available, transport from the Demerara River is suitable.

Power supply for the plant will be via a 250 KVA generator and camp, a 5 KVA generator. Potable water for domestic use will be sourced from a well or the Haiabu Creek and collected (and treated) rain water. Process water is required for the sand quarry and will be obtained from the Haiabu Creek. Water obtained from the proposed quarry water ponds will be routinely sprayed from a water tanker onto all access roads and the stockpiles.

Topsoil will be stockpiled for rehabilitation, while overburden will be stored in a spoilpile and used for road maintenance, or progressive backfilling. Logs obtained from clearing will be used for camps and other facilities and for erosion-control structures.

Domestic wastewater will be directed to a soak away filter treatment system prior to discharge to the Demerara River. Discharge into the river will be in accordance with EPA domestic wastewater

discharge limits. All sewage will be directed to septic tanks with filter bed treatment installed. Hazardous materials and waste will be managed in accordance with the EPA's hazardous waste management regulations/requirements. A laydown yard with an impervious base will be constructed onsite.

The following equipment in table 1, 2 and 3, are proposed to be used in the sand quarrying and processing of materials at the Anthony Vieira Sand Quarry:

Type of Equipment	Make/Model	Quantity
<i>Land Clearing, Stripping and Rehabilitation</i>		
Excavator	CAT 320 D	1
<i>Loading Equipment</i>		
Loaders	CAT 950 H	3
<i>Haulage Equipment</i>		
Haul Trucks	30 Ton Type	3
<i>Support Equipment</i>		
Transportation	Toyota Hilux 4X4	1
Power Admin	Miller 4KW Generator	1
Water Supply	Perkins Engine & Pressure Pump	1
Power processing Plant	CAT 400 KW Generator	1
Maintenance	Lincoln Air 500 Welding Plant	1
<i>Shipping</i>		
Tugboat	6000 Hp	1
Barge	3000 Tons	1

Table 1: Excavating, loading, haulage and support equipment

Item 1 Powerscreen Chieftan 1400 Rinser (C1565)			
Equipment	Model- Size	Power	Rating
Motor	Duetz BF4M2012	Diesel	73 KW
Tipping Grid	Radio controlled		
Integrated belt feeder	Variable feed		
Rinser box	2 deck		
Spray bars	5 per deck		
Item 2 Portafill Dewaterer System (DW80)			
Equipment	Model- Size	Power	Rating

Driven hydraulically by Chieftan			
Bucket wheel	2360 mm dia.		
Item 3 Water Pump Unit			
Equipment	Model- Size	Power	Rating
Motor	Duetz D20011L04	Diesel	40 KW
Water Supply	105 KL/hr.		

Table 2: Processing circuit (Stage 1)

Item 1 M2500 (E4X)			
Equipment	Model- Size	Power	Rating
1 Integrated hopper	6 m3	Electric direct drive	20 KW
2 Integrated feed conveyor	1000 mm	Electric direct coupled	20 KW
3 Triple- Deck Screen ProGrade	P3-75 (1.5x1.5)	WEG motor	22 KW
4 Integrated CDE EvoWash			
Dewatering screen	B- Series screen	2 x vibrating motors	2 x 3.6 KW
Hydro-Cyclone	1 x 625 mm dia.		
	1 x 325 mm dia. dual pass		
Sump	Mild steel slurry sump		
Sand slurry pump	1 x 8/6 Warman	Electric motor & drive	75 KW
5 Integrated stockpile conveyors	3 x aggregate, 1 x sand	Motorized drive pulleys	
6 Walkway and stairs	30 x 3 Galv. Flowforge to AS		
7 Electrics	Wired to central front panel		
Item 2 Counter Flow Classification Unit (CFCU 200) fed from M2500 Cyclones			
Equipment	Model- Size	Power	Rating
CFCU tank	3.2 x 2.3 m		
Item 3 Evowash (71)			
Equipment	Model- Size	Power	Rating
Dewatering Screen	C-Series screen	2 x vibrating motors	2 x 3.6 KW
Hydro-Cyclone	1 x 500 mm dia.		
Sump	Mild steel		
Sand slurry pump	1 x 6/4 Warman	Motor and drive	30 KW
Item 4 Aqua Cycle Thickener Tank (A400)			
Equipment	Model- Size	Power	Rating

Active raked thickener tank	400 m ³ /hr.	Motorized rake	3 KW
Sludge pump	Warman 4/3	Motor and drive	15 KW
Item 5 Stockpile Conveyor (C1565)			
Equipment	Model- Size	Power	Rating
EP multi-ply fabric-rubber	650 mm wide	Motorized head drum	2 x 3.6 KW

Table 3: Processing circuit (Stage 2)

4. POTENTIAL EFFECTS ON THE ENVIRONMENT

Anthony Vieira desires to conduct its Sand Quarry operations in an environmentally responsible manner and is committed to address all issues to ensure proper stewardship of public lands, preservation of wildlife and flora. Details of environmental mitigation measures are outlined in the Environmental Management Plan (EMP) prepared for Anthony Vieira. The EMP will address the potential impacts of the construction, operation and closure phases of the quarry.

POTENTIAL IMPACTS TO LAND AND SOIL

Soil erosion and sedimentation, top-soil mixing, compaction during construction and operation of the quarry. Soil contamination could also occur as a result of accidental release of fuels, waste oils and lubricants.

Mitigation Measures:

Erosion control management plans will be used to minimize soil erosion and sedimentation. Storm water will be appropriately drained and collected in a designated pond. Fuel oils, lubricants and waste oils will be stored in an area with an impervious base and a bund.

POTENTIAL IMPACTS TO AIR QUALITY

Fugitive dust from access roads, the pit excavations and the washplant along with diesel engines emissions are the main elements of air quality concerns at the sand quarry.

Mitigation Measures:

Fugitive dust will be managed by routine wet suppression on roadways, process areas and accessible working faces. Speed limits will be sternly enforced within the quarry to limit fugitive dust. Spray bars will be installed at strategic points on the washplant equipment to limit dust generation and escape.

Vehicles will be maintained based on a schedule and kept in good working order.

NOISE AND VIBRATIONS

Noise and vibrations will be produced from the operation of heavy equipment, the generator, and pit excavation

Mitigation Measures

Noise emissions will be mitigated by installing sound suppression equipment on vehicles, e.g. mufflers. Vehicles will be maintained according to the manufacturer's specifications and routinely serviced to maintain good working order. Vegetative buffer will be used between the quarry pit and the accommodation areas which will serve as a noise buffer.

IMPACTS TO WATER (SURFACE AND GROUND)

Vegetation clearing for construction, access roads and quarrying activities will reduce interception of surface water with the forest floor cover and may result in increased discharge into the Haiabu Creek and Seweya Creek, Unknown Tributaries Seweya Creek and eventually the Demerara River. Erosion may affect the water quality of the receiving bodies of water.

Ground water may be affected by infiltration and leaching of chemicals from exposed minerals, spoilpiles and spills of oils and grease.

Mitigation Measures

Surface and ground water impacts will be mitigated through the implementation of storm water and sediment control structures. Erosion control management plan will be used from construction to closure of the quarry.