ENVIRONMENTAL IMPACT ASSESSMENT

FOR THE PROPOSED CEMENT PLANT AND QUARRY OPERATION
BY CEMENT JAMAICA LIMITED AT PORT ESQUIVEL
INDUSTRIALCOMPLEX, ST CATHERINE AND
ROSE HALL DISTRICT CLARENDON,
JAMAICA

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EXECUTIVE SUMMARY

Introduction

The Environmental Impact Assessment (EIA) has been prepared in accordance with Terms of Reference (TOR) approved by Jamaica's National Environment and Planning Agency (NEPA) found in Section 4.0 of this report.

Cement Jamaica Limited (CJL) plans to build and operate a cement plant on the lands of the Port Esquivel Industrial Complex, St. Catherine, near the existing JB Feed Mill. The parcels of land (170 acres for the main plant and 500 acres for the limestone quarry) are strategically located within a region rich with limestone and zoned for mining with easy access to major roads, rail, and the port facility at Port Esquivel.

The plant is expected to produce 900,000 tons of cement clinker in its first year of production (2013). The nominal design capacity of the cement plant is planned for 1,500,000 tons of cement clinker by the year 2015. Deep water access for the export of cement to neighboring Caribbean Islands, such as Haiti, is readily available via an existing sea port at Port Esquivel. In this regard, a cooperative agreement exists between CJL and the West Indies Aluminum Company (WINDALCO) to increase the utilization of the existing port facility which is currently used only 40-60% of the available time at Port Esquivel.

The plant is planned to be constructed by an EPC Contractor, one of the world's leading designers and constructors of modern cement plants. The EPC Contractor will utilize modern technology to allow CJL to maintain low operating costs, while minimizing fugitive dust emissions, and meeting the following guidelines established by the Inter-American Development Bank (IDB):

- Cement Plant Environmental Emissions: **less than 820 kg CO_2/ton of clinker**
- Cement Plant Specific Fuel Consumption: **less than 3200 MJ /ton of clinker**

Limestone is the main raw material in the cement manufacturing process. Therefore, as part of this project, CJL also proposes to greatly expand the existing quarrying operations at Rose Hall Clarendon, near the border of St. Catherine which is located only 1.5 kilometers from the cement plant. The limestone will be transported to the plant via an enclosed overland conveyor system that will run across Government of Jamaica Land (i.e. Bodles Agricultural Complex) and over Highway 2000 into the Port Esquivel Industrial Complex.

Jamaica is also rich in clay and abundant reserves are located in relatively close proximity to the proposed location of the cement plant. This is important because clay is a raw material (typically used in the cement manufacturing process). Contracts will be established with existing clay quarry operating within a radius of 20 kilometers from the proposed location of the cement plant.

From here, the clay will be transported to the limestone quarry at Rose Hall utilizing 20-ton trucks via the existing roads to a new 1.5 kilometers haul road which will run from the Old Harbour Main Road to the Limestone Quarry at Rose Hall.

The final raw mix component to be used by CJL is a waste product, red mud, from Jamaica's bauxite industry. Here, again, large quantities of this waste material are available in Jamaica since it is the tailings from the principal industrial means of refining bauxite into alumina. It is planned to use the waste material from WINDALCO's existing industrial facilities located at Ewarton and/or Mandeville and to take advantage of regular rail or truck service from these facilities to WINDALCO's port at the Port Esquivel Industrial Complex, St. Catherine.

A 54 MW coal-fired/co-generation facility will be designed by the EPC Contractor to utilize waste heat from the cement manufacturing operations. In addition, it is foreseen for the EPC Contractor to supply and install a captive coal-fired power plant for the additional power required for power and utilities. Here, again, the EPC Contractor will utilize modern technology to meet the energy efficiency guidelines established by the Inter-American Development Bank (IDB):

- Coal Fired Power Plant**: greater than 36% for Net Plant HHV Efficiency (%)**
- Coal Fired Power Plant: **less than 890 kg Net CO_2 Emissions Intensity (kg CO_2/net MWh)**

This modern, 54 MW Circulating Fluidized Bed Combustion (CFBC) power plant will utilize imported coal to reduce Jamaica's demand for oil and eliminate a need for CJL's dependence on Jamaica Public Service (JPS) for power supply. In addition to coal, biomass or other carbon-neutral fuel will be added as needed to reach the maximum of 890 kg CO_2/MWh (net).

Project Rationale

Jamaica is an island nation with a population of 2,700,000 people with an economy that, since 1990, has grown marginally above its population growth rate. This rate of economic growth is inadequate given Jamaica's debt-to-GDP ratio of 135%, which is the fourth highest per capita globally. In this respect, Jamaica's economy is largely dependent on the Service Industry (primarily Tourism). In fact, the Service Industry accounts for more than 60% of Jamaica's GDP.

However, Jamaica's economy is also aided by Mining and Agricultural exports and, in this respect; Jamaica is estimated to have 150 billion tons of recoverable limestone which is the primary raw material in the production of cement. In fact, the abundance of limestone and other raw/waste materials, such as clay and red mud, makes Jamaica an ideal landscape for the production and export of cement.

It is somewhat ironic, therefore, that Caribbean Cement Company Limited (CCCL) is the sole manufacturer of cement in Jamaica and, until 1999, was also the sole supplier of cement to Jamaica. For this and other reasons (such as cement shortages), the Government of Jamaica (GOJ) has encouraged investments in the expansion of cement production, to meet local demand and the earning of foreign exchange from export.

Within the Caribbean Common Market (CARICOM), Jamaica, Trinidad, and Barbados are the major cement producing countries. Each of the three (3) cement plants in these countries are owned by the Trinidad Cement Limited (TCL) Group, which has benefited from protection under the Common External Tariff (CET) because, for many years, the application of the CET made cement imports uneconomical. In recent years, supply shortages, quality issues, and rising cement prices have forced many CARICOM countries to seek CET waivers to pre-determined quotas to enable the importation of cheaper cement. The import of cement by CARICOM member states from non-TCL sources are more recently significant and highlight the degree to which distributors are seeking cheaper alternatives to the TCL Group.

Jamaica is one of the largest economies in the Caribbean and it should be able to reverse the flat to moderate economic performances of prior years and start to achieve significant economic growth. The project described below will have a favorable impact on all sectors of the economy, particularly the construction sector which tends to experience a boom during the periods to economic growth. Moreover, the ability of the GOJ to improve tax revenue collections will impact on the Government's ability to address Jamaica's growing debt and provide additional resources for investment in public infrastructure. As a result of this project, it is expected that tax revenues from GCT (General Consumption Tax) and Income Tax will generate approximately $75 million USD annually for the GOJ.

The Project

Cement Jamaica Limited (CJL) plans a state-of-the-art, cost-effective, and environmentally-friendly cement plant for Jamaica's south coast with easy access to the sea port, limestone, clay, and red mud reserves that are required to produce and export portland cement. It is foreseen by CJL to design the cement plant to nominally produce 1.5 million tons of cement clinker per annum, of which three-quarters (3/4) would be exported and one-quarter (1/4) would be utilized by the local construction industry. Cemcorp Canada, the parent company of CJL, is a group that includes the largest condominium builder in Canada and major construction company. The group, itself, uses 70,000 tons of cement per annum.

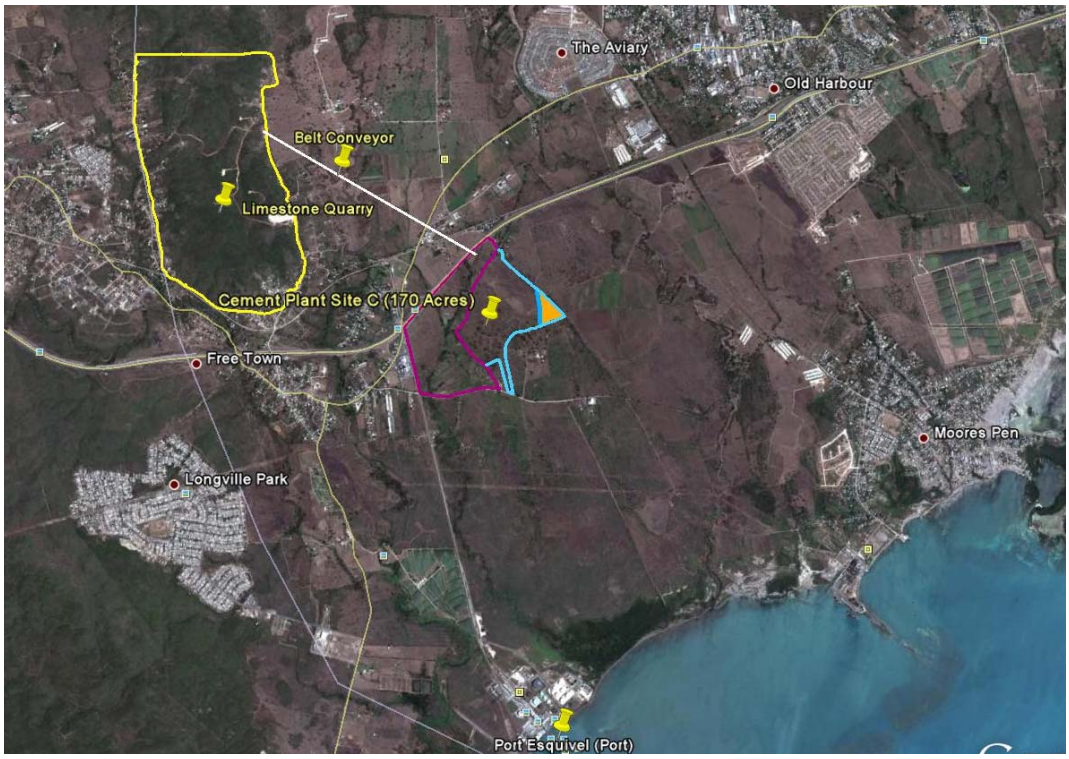


Figure 1.0 Project Location

Specifically, CJL proposes to erect and operate a new cement plant at the existing Port Esquivel Industrial Complex and limestone quarry at Rose Hall, part of Old Harbour Hill in St Catherine. The project is estimated to cost $340 million USD and to use less than 310 million tons of limestone over the next 50 years (this is less than 1% of Jamaica's available limestone reserves). A 30-month construction/commissioning schedule is anticipated, followed by 50-years of plant operations, and ultimately a 24-month decommissioning period which includes the re-vegetation of the limestone quarry.

The cement production process involves the following activities:

- Quarry & Raw Materials Preparation
- Clinker Production
- Cement Grinding & Distribution

The successful implementation of this project should provide high quality cement at affordable prices to major distributors within the Caribbean region. CJL's mission is to implement positive change in the Jamaican cement industry. In fact, CJL has already concluded significant take or pay contracts with strong and reputable users and distributors of cement to cover a significant portion of its proposed production which will serve to effectively manage the new company's profitability.

The plant will make optimum use of the existing deep water access at the Port of Esquivel for the cost-effective export of cement products to the wider Caribbean, USA and Canada. The plant, itself, will be located 3.5 kilometers from Port Esquivel at the intersection of the Port Esquivel access road and Highway 2000 which will provide easy access for the transport of product to the local construction industry. An existing rail road runs parallel to Windalco Road, adjacent to the proposed location of the new cement plant. Windalco's port facilities will also provide convenient access for the importation of clean, high quality coal for use by CJL's state-of-the-art, coal-fired/co-generation power generating plant. The power plant is needed to reduce Jamaica's need for oil and to eliminate CJL's dependence on JPS for power supply. Importantly, the fly ash (which is a waste material associated with coal burning power plants) will be 100% utilized by CJL as a cement additive. Moreover, a cogeneration facility will utilize waste heat from the cement manufacturing operations. Finally, gypsum which is added in small quantities (5%) to cement clinker (because it controls the setting time of concrete) will be transported to the cement plant by truck or barge from an existing gypsum facility owned by the TCL Group 65 kilometers away in Rockfort.

Applicable Policies and Legislation

Pollution control will be a main priority as it is the duty of CJL to be the steward of environmental protection at the cement plant, limestone quarry, and sea port. As such, pollution control measures and safeguards were selected with respect to the applicable policies and legislation requirements of Jamaica as well the International Guidelines, including those of the International Finance Corporation (IFC) and Inter-American Development Bank (IDB):

- International Finance Corporation (IFC, World Bank Group) Environmental, Health, and Safety Guidelines for Cement and Lime Manufacturing
- Document of the Inter-American Development Bank - Cement Manufacturing Plants Guidelines (An Approach to Reconciling the Financing of Cement Manufacturing Plants with Climate Change Objectives, March 10, 2010)
- Document of the Inter-American Development Bank - Coal Fired Power Plants Guidelines (An Approach to Reconciling the Financing of Coal-Fired Power Plants with Climate Change Objectives, July 10, 2010)
- Natural Resources Conservation Authority Act (1991)
- Environmental Review and Permitting Process (1997)
- Wildlife Protection Act (1945)
- The Endangered Species (Protection, Conservation and Regulation of Trade) Act (2000)
- The Natural Resources (Prescribed Areas)(Prohibition of Categories of Enterprise, Construction and Development) Order (1996)
- Water Resources Act (1995)
- Country Fires Act (1942)

- Quarries Control Act (1983)
- The Pesticides (Amendment) Act (1996)
- Clean Air Act (1964)
- The Natural Resources Conservation Authority (Air Quality) Regulations, 2002
- Trade Effluent and Sewage Regulations (1996) (Draft)
- Watershed Protection Act (1963)
- Town and Country Planning Act (1958)
- Land Development and Utilization Act (1966)
- Public Health Act (1976)
- The National Solid Waste Management Authority Act (2001)
- Jamaica National Heritage Trust Act (1985)
- Registration of Titles Act (1989)
- The Factories Act (1973)
- Jamaica's Energy Policy
- The Town and Country Planning (St. Catherine Coast) Provisional Development Order, 1964
- South Coast Sustainable Development Master Plan
- Cartagena Convention (Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region) (1983)
- Convention on Biological Diversity
- Portland Bright Protected Area (PBPA)

The project site consists of two (2) parcels of land in close proximity (2.0 kilometers) to each other and strategically located within a region rich with limestone and zoned for mining with easy access to major roads and the rail network as well as the existing West Indies Aluminum Company (WINDALCO) facilities at Port Esquivel. The water needed for plant operations will be provided by Windalco's deep water well through CJL's agreement with Windalco/ Jamaica Broilers. The limestone quarry, located at Rose Hall, is outside and to the north of the Portland Bright Protected Area (PBPA), while the plant site itself is located at an existing industrial complex, just on the edge of the PBPA, that is specifically zoned for industrial development by the Government of Jamaica.

Impact Identification

Environmental and Social Impacts were identified for each of the three (3) phases of the project:

1. Construction Phase;
2. Operational Phase;
3. Decommissioning Phase.

The main activities to be undertaken for each phase of this project include:

- Construction Phase:
  - Land clearing
  - Construction (plant, conveyor and road)
  - Transportation of heavy equipment and construction materials
  - Operation of heavy equipment
  - Fuel storage and dispensing for heavy equipment
- Operational Phase:
  - Access and opening of the quarries
  - Mining and Crushing Operations
  - Cement Plant Operation
  - Transport and Stockpiling of raw materials
  - Transport of bag and bulk cement local and export.
  - Power Plant Operation
  - Fuel storage and dispensing
- Decommissioning Phase:
  - Dismantling and removal of equipment
  - Re-vegetation of land and quarries

The potential negative impacts associated with this project are presented in the Table below:

POTENTIALLY NEGATIVE (SIGNIFICANT AND INSIGNIFICANT) IMPACTS

	ASPECT	POTENTIAL NEGATIVE IMPACTS
CONTRUCTION PHASE		
1.	Noise	• Nuisance to persons • Habitat disturbance • Hearing impairment (temporary, permanent)
2.	Fugitive dust emissions	• Air pollution • Respiratory problems • Increased sediment loads and degradation of natural aquatic receptors
3.	Vehicular emissions	• Air pollution • Respiratory problems
4.	Solid waste (top soil, vegetation, construction debris, garbage)	• Land and water pollution • Decreased availability of land fill
5.	Human waste	• Land and water pollution
6.	Use of fuel	• Depletion of (oil) resources
7.	Removal of vegetation	• Habitat destruction • Disruption of ecosystems
8.	Soil erosion	• Movement of sediment and pollutants into water courses • On-site impact is the reduction in soil quality which results from the loss of the nutrient-rich upper layers of the soil
9.	Increased traffic movement	• Traffic congestion • Motor vehicle accidents

10.	Use of water	• Depletion of water resources • Effluent
11.	Spills	• Land and water pollution
12.	Construction work	• Accidents causing death or injury
13.	Land use	• Displacement of about twenty (20) small farmers • Construction worker's camp
14.	Foreign work force	• Temporary population increase • Foreign worker health problems • Foreign/Local interactions • Camp disturbance • Local community disturbance • Transmitted diseases

POTENTIALLY NEGATIVE (SIGNIFICANT AND INSIGNIFICANT) IMPACTS

OPERATION PHASE		
	ASPECT	**POTENTIAL NEGATIVE IMPACTS**
1.	Noise	• Nuisance to persons • Habitat disturbance • Hearing impairment (temporary,permanent)
2.	Fugitive dust emissions	• Air pollution • Respiratory problems • Foliage growth impedance • Increased sediment loads and degradation of natural aquatic receptors
3.	Vehicular emissions	• Air pollution • Respiratory problems
4.	Solid waste (top soil, vegetation, operating debris, garbage)	• Land and water pollution
5.	Human waste	• Land and water pollution
6.	Use of Fuels & Lubricants	• Depletion of (coal and oil) resources • Greenhouse gas emissions (CO_2) • Air emissions (NO_X, SO_X, CO, Particulate)
7.	Removal of vegetation at Limestone Quarry	• Habitat destruction • Disruption of ecosystems • Displacement of a handful of families informally dwelling in this area
8.	Soil Erosion	• Movement of sediment and pollutants into water courses
9.	Increased traffic movement	• Traffic congestion • Motor vehicle accidents
10.	Use of water	• Depletion of water resources • Effluent
11.	Spills/Fuels & Lubricants (Oil spills/leaks)	• Land and water pollution
12.	Operation and Maintenance	• Accidents causing death or injury
13.	Land use	• Development of land for other purposes
14.	Aesthetics	• Visually unattractive
15.	Vibration	• Nuisance to persons • Habitat disturbance
16.	Increase utilization of existing port facilities	• Loss of marine habitat • Increased water pollution

POTENTIALLY NEGATIVE (SIGNIFICANT AND INSIGNIFICANT) IMPACTS

DECOMMISSIONING PHASE		
	ASPECT	**POTENTIAL NEGATIVE IMPACTS**
1.	Noise	• Nuisance to persons • Habitat disturbance • Hearing impairment (temporary,permanent)
2.	Fugitive dust emissions	• Air pollution • Respiratory problems
3.	Vehicular emissions	• Air pollution • Respiratory problems
4.	Solid waste (decommissioning debris, garbage)	• Land and water pollution • Decreased availability of land fill
5.	Human waste	• Land and water pollution
6.	Use of Fuels & Lubricants	• Depletion of (oil) resources
7.	Spills/Fuels & Lubricants (Oil spills/leaks)	• Land and water pollution
8.	Decommissioning	• Accidents causing death or injury

Potentially beneficial impacts associated with the Project are presented in the following Table:

POTENTIALLY POSITIVE (SIGNIFICANT AND INSIGNIFICANT) IMPACTS

	ACTIVITY	**POTENTIAL POSITIVE IMPACTS**
CONSTRUCTION PHASE		
1.	Creation of construction jobs	• Employment for locals • Increased commercial activities in the area
2.	Excavation	• May reveal a heritage site
3.	Improved infrastructure	• Accident prevention
4.	Increased Standard of Living	• Increased commercial activities in the area
5.	Foreign work force	• Skills transfer • Technology transfer • Cultural diversity
6.	Increase utilization of existing port facilities	• More jobs, increased earnings, government revenue
OPERATING PHASE		
1.	Creation of jobs	• Employment for locals • Increased commercial activities in the area • New skills development • Technology transfer
2.	Increased Standard of Living	• Increased commercial activities in the area
3.	Cement plant and quarry operation	• Potential for supplying excess power to National Grid • Promotion of the use of cogeneration and alternative fuels • Utilization of waste materials from other industries (Red Mud) • Possible lower cement prices in Jamaica • Improve Jamaica's trade balance (increased exports)
4.	Foreign work force	• Skills transfer • Technology transfer • Cultural diversity
5.	Increased Tax Revenue	• All categories (corporate, personal, consumption, etc.)

6.	Increase utilization of existing port facilities	• More jobs, increased earnings, government revenue
DECOMMISSIONING PHASE		
1.	Creation of decommissioning jobs	• Employment for locals (job loss for others) • Increased commercial activities in the area
2.	Land use	• Development of land for other purposes (ecological, social and commercial)

The following Table presents a summary of the significant aspects for the construction, operation, and decommissioning phases of the project. Most of the significant impacts identified are associated with the construction and operating phases. In all cases the significant negative impacts can be mitigated.

Negative environmental impacts can be mitigated by implementing measures during the construction, operating, maintenance and decommissioning phases to eliminate or significantly reduce them. Mitigation measures to address the potential negative impacts, significant or not, associated with this project are presented in the following Table.

	ASPECT / POTENTIAL SIGNIFICANT IMPACTS	**MITIGATION MEASURES**
CONSTRUCTION PHASE		
1.	Noise • Nuisance to persons • Habitat disturbance • Hearing impairment (temporary, permanent)	• Advise institutions and residents in the surrounding communities of construction date and times when high noise activity will occur • Good site management; Appropriate choice of machinery; Methods of working; Hours of working; Efficient material handling. • Define access routes to the site with the smallest number of properties in proximity to it. Goods will be imported through Port Esquivel to keep vehicle movements to a minimum. Once link roads are completed, all construction traffic to/from the quarry site should only use the link roads to avoid the Parochial Road/Foothill Community. • Construction workers to wear Personal Protective Equipment
2.	Fugitive dust emissions & vehicular emissions • Air pollution • Respiratory problems • Increased sediment loads and degradation of natural aquatic receptors	• Cover haulage vehicles transporting aggregate, soil and cement • Cover onsite stockpiles of aggregate, cement, soil, etc. • Ensure proper stock piling/storage and disposal of solid waste • Wetting of cleared land areas regularly and enforcement of speed limits • Provide workers with the necessary Personal Protective Equipment (PPE) e.g. dust masks and ensure that they are worn • Operate well maintained vehicles and equipment
4.	Solid waste (top soil, vegetation, construction	• Contain garbage and construction debris and dispose

	debris, garbage) • Land and water pollution	of at the approved municipal disposal site • Landscape project sites with top soil excavated
5.	Human waste • Land and water pollution	• EPC Contractor to prioritize installation of sewage treatment facility as one of the first activities • Use a reputable company to provide portable toilets for workers at quarry site
7.	Removal of Vegetation • Habitat destruction • Disruption of ecosystems	• Employment of project appointed ecologist • Translocation of fauna and some vegetation (trees) • Implement Habitat Restoration Program
8.	Soil Erosion • Movement of sediment and pollutants into water courses	• Implementation of proper drainage plans • Implementation of proper mining plans • Only clear top soil from areas to be used • Place berms around stockpiles of top soil
9.	Increased traffic movement • Traffic congestion • Motor vehicle accidents	• Advise schools and residents in the surrounding communities of construction dates and times • Good site management; Appropriate choice of machinery; Methods of working; Hours of working; Efficient material handling. • Define access routes • Goods will be imported through Port Esquivel to keep vehicle movements to a minimum. • Once link roads are completed, all construction traffic to/from the quarry site should only use the link roads to avoid the Parochial Road/Foothill Community. • Construction workers to wear seat belts • Erect signs along main transportation routes and in sensitive areas such as schools • Transport heavy equipment during off-peak traffic hours (between 2:00 to 4:00 a.m.) with police outriders • Trucks transporting construction material should be advised to comply with the speed limits • Use traffic signals or flagmen to manage traffic flows where road improvement works are being undertaken
11.	Spills • Land and water pollution	• Store fuel with secondary spill containment infrastructure • Utilize proper dispensing equipment • Have spill containment and cleanup equipment on site and dispose of waste in accordance with best practices
12.	Construction work • Accidents causing death or injury	• Implementation of Emergency Preparedness and Response Program (See APPENDIX 12) • Implementation of the Environmental Health & Safety Program (See APPENDIX 11) • Implementation of Prearranged quality curative treatment in May Pen Hospital for all emergencies • Erect signs during construction activities • Provide workers with the necessary Personal Protective Equipment (PPE) • Train construction personnel in good safety practices and emergency preparedness and response measures

13.	Land Use • Displacement of about twenty (20) small farmers • Construction worker's camp	• Agreement reached with farmers for their relocation adjacent to plant boundary. • Financial and employment assistance • Erection of security fence • Planned re-use of construction camp facilities for future cement storage
14.	Foreign work force • Temporary population increase • Foreign worker health problems • Foreign/Local interactions • Camp disturbance • Local community disturbance • Transmitted diseases	• In-camp codes of conduct and enforcement of key behaviors and reasonable use of alcohol shall be required • Establishment of "Liaison Committee" • Provision of employment and opportunities to local population • Employ security personnel

OPERATION PHASE		
	ASPECT / POTENTIAL SIGNIFICANT IMPACTS	**MITIGATION MEASURES**
1.	Noise • Nuisance to persons • Habitat disturbance • Hearing impairment (temporary, permanent)	• Industrial workers to wear Personal Protective Equipment, e.g. ear plugs and ensure they are worn • Equipment designed to conform to IFC EHS Guidelines • Controlled and informed blasting activities and times
2.	Fugitive dust emissions • Air pollution • Respiratory problems • Increased sediment loads and degradation of natural aquatic receptors	• Cover haulage vehicles transporting raw materials and cement • Covered onsite stockpiles of raw materials • Wetting of quarry haul road and unpaved areas and enforcement of speed limits • Provide workers with the necessary Personal Protective Equipment (PPE) e.g. dust masks and ensure that they are worn • Operate well maintained vehicles and equipment • Planting of trees to serve as windbreaks
3.	Vehicular emissions • Air pollution • Respiratory problems	• Use of low-emission vehicles and proper maintenance procedures
4.	Solid waste (operating debris, garbage) • Land and water pollution	• Recycling of solid waste • Use of fuel for the cement rotary kiln • Use as composting material for green spaces
5.	Human waste • Land and water pollution	• Proper design and maintenance of sewage treatment facility at both plant and quarry sites • Compliance with NEPA standards
6.	Use of Fuels & Lubricants • Depletion of (coal and oil) resources • Greenhouse gas emissions (CO_2) • Air emissions (NO_X, SO_X, CO, Particulate)	• Compliance with IDB Guidelines and NEPA Requirements • Use of latest advances in technology • Use of 30mg/Nm^3 IFC standard • Regular wetting of unpaved roads
7.	Removal of Vegetation (Quarry Only) • Habitat destruction • Disruption of ecosystems	• Employment of project appointed ecologist • Re-vegetation as you go by implementing Habitat Restoration Program
8.	Soil Erosion (Quarry Only)	• Implementation of proper drainage plans

	• Movement of sediment and pollutants into water courses	• Implementation of proper mining plans • Only clear top soil from areas to be used • Place berms around stockpiles of top soil
9.	Increased traffic movement • Traffic congestion • Motor vehicle accidents	• Hours of working; Efficient material handling. • Define access routes • Truck drivers and plant personnel to wear seat belts while in vehicles • Training and accident prevention classes • Erect signs along main transportation routes and in sensitive areas such as schools • Transport heavy equipment during off-peak traffic hours • Trucks transporting raw materials and cement should be advised to comply with the speed limits • Use traffic signals or flagmen to manage traffic flows where road improvement works are being undertaken
10.	Use of water • Depletion of water resources • Effluent	• Use of modern technology (co-generation and Waste Heat Recover Boilers) • Use of closed-loop recirculation technology • Treatment of effluent in compliance with NEPA guidelines
11.	Spills • Land and water pollution	• Store fuel with secondary spill containment infrastructure • Utilize proper dispensing equipment • Have spill containment and cleanup equipment on site and dispose of waste in accordance with best practices • Training of personnel in proper handling of hazardous materials
12.	Operation and maintenance work • Accidents causing death or injury	• Implementation of Emergency Preparedness and Response Program (See APPENDIX 10) • Implementation of the Environmental Health & Safety Program (See APPENDIX 11) • Implementation of Prearranged quality curative treatment in May Pen Hospital for all emergencies • Erect safety reminder signs and comply with local regulations • Provide workers with the necessary Personal Protective Equipment (PPE) • Train operation and maintenance personnel in good safety practices and emergency preparedness and response measures
14.	Aesthetics • Visually unattractive	• Reserve green areas • Use aesthetically pleasing paints and colors • Opacity monitoring of industrial stacks • Execute mining plan which is focused on visual appeal, especially from Highway 2000
16.	Increase utilization of existing port facilities • Loss of marine habitat • Increased water pollution	• Optimum use of ocean transport • Follow rules and regulations of Windalco and Jamaica Port Authority

DECOMMISSIONING PHASE		
	ASPECT / POTENTIAL NEGATIVE IMPACTS	**MITIGATION MEASURES**
4.	Solid waste (decommissioning debris, garbage) • Land and water pollution • Decreased availability of land fill	• Maximizing recycling, e.g. scrap metal
7.	Spills/Fuels & Lubricants (Oil spills/leaks) • Land and water pollution	• Comply with regulations and follow procedures and protocols related to hazardous materials, if any.
8.	Decommissioning • Accidents causing death or injury	• Implementation of Emergency Preparedness and Response Program (See APPENDIX 10) • Implementation of the Environmental Health & Safety Program (See APPENDIX 11) • Implementation of Prearranged quality curative treatment in May Pen Hospital for all emergencies • Erect safety reminder signs and comply with local regulations • Provide workers with the necessary Personal Protective Equipment (PPE) • Train demolition personnel in good safety practices and emergency preparedness and response measures

The detailed summary of these effects, the mitigation measures, and the environmental monitoring plans are found in Table 8.4 found in Section 8.0 (Impact Summary and Monitoring Plan).

Conclusion

This project is recommended for implementation because the positive impacts far outweigh the negative impacts. Jamaica will benefit from increase employment, increased earnings, increased tax revenue, increased foreign investment, and increased exports while the use of modern technology and other measures are taken to mitigate all of the potentially negative impacts.

All of the potential negative impacts identified can be effectively mitigated to reduce the risks and to meet the required environmental and social standards. The following is a summary of cumulative impacts:

Cumulative Impact on Air Quality:

A determination of the impact of the existing sources on the ambient air quality was made, as well as the cumulative impact with the addition of the air pollutant sources associated with the proposed cement manufacturing facility. ***TABLE 1*** shows the model results for (i) existing sources and (ii) all sources. The results for the existing sources reveal predicted high concentrations that exceed the respective Jamaican National Ambient Air Quality Standards (NAAQS) air quality standards for PM_{10} (24-hour

averaging period), NO_2 (1-hour averaging period), and all averaging periods for SO_2. In addition, the predicted annual average concentration for PM_{10} is exceeded once the background concentration is added as shown in ***TABLE 1***.

TABLE 1: *CUMULATIVE AIR IMPACTS*

Pollutant	Average Period	Background (µg/m^3)	NAAQS (µg/m^3)	Existing Sources Maximum Concentration (µg/m^3)	All Sources Maximum Concentration (µg/m^3)
PM_{10}	24-hr	9	150	**164**	**182**
	Annual	20	60	41	49
NO_2	1-h	0	400	**3021**	**3021**
	Annual	0	100	95	96
SO_2	1-hr	0	700	**7968**	**7968**
	24-hr	0	280	**652**	**652**
	Annual	0	60	**185**	**185**
CO	1-hr	0	40000	2236	2236
	8-hr	0	10000	470	470

However, ***TABLE 2*** demonstrates that the addition of the cement manufacturing facility will actually contribute insignificantly to the cumulative impact of the overall air quality. This is because by adding the other nearby sources (specifically, the existing power plants at Old Harbour Bay - Jamaica Public Service Company (JPS) and Jamaica Energy Partners (JEP) together with the Jamaica Broiler, Hipro Feed Mill facility and the Jamaica Broilers Ethanol facility), it is demonstrated that the proposed cement manufacturing facility has a negligible impact to the cumulative air quality impact of all sources within the project area. In fact, ***TABLE 2*** shows that the specific contribution of the existing Feed Mill overwhelmingly contributes to the peak modeled concentrations within the air shed. This can be easily rectified and CJL has expressed a willingness to design a new exhaust gas system for the Feed Mill according to "Good Engineering Practice" (GEP) so that its stack height is adequate to ensure that its point source emissions do not result in excessive pollutant concentrations in the immediate vicinity of its source.

TABLE 2: *CUMULATIVE IMPACT OF SOURCE CONTRIBUTIONS TO PEAK MODELED SHORT-TERM CONCENTRATIONS*

Facilities	Concentrations, µg/m^3						
	PM_{10} – 24h	NO_2 – 1h	NO_2 – 24h	SO_2 – 1h	SO_2 – 24h	CO – 1h	CO – 8h
Cement Jamaica Limited	17.996	0	0.245	0.01	0.3	0.0002	0.006
Jamaica Public Service	1.3	0	0.028	6911.63	567.2	2128.4	0.052
Jamaica Energy Partners	0.4	0.0004	0.093	1056.36	84.5	107.5	0.003
Hipro Feed Mill	162.3	2904.74	679.157	0	0.0003	0	470.066

Jamaica Broilers Ethanol	0.004	0.0236	0.02	0	0.0007	0	0.006
Totals	**182**	**2905**	**680**	**7968**	**652**	**2236**	**470**

Cumulative Impact on Noise Quality:

There will be a cumulative increase in noise.

The plant, however, will be fully compliant with International Standards (IFC's EHS Guidelines) so with the aid of personal protective equipment, the cement plant workers are unlikely to be impacted. Moreover, the plant is located within an existing industrial complex and will be designed for a maximum background noise of 60 dBA at any point from outside the plant fence so there will not be a significant increase in background noise from the proposed plant itself.

Of greater concern is the noise resulting from increased traffic outside of the plant. In fact, the baseline noise study identified an existing noise level ranging from 41.0 dBA to 83.3 dBA at a unique location some 0.3 kilometers away from the industrial complex itself. This suggests that the existing noise levels – having nothing to do with industrial activities - are already cause for concern and, if there is any incremental increase in the background noise then this will make it worse. However, the location of this noise receptor is, in fact, in a low population area and there is nothing present there (apart from Highway 2000) that generates noise in a sustained way so (for the purposes of this EIA Report and the cumulative impact resulting from the proposed cement plant), the source of this noise was considered to be isolated and coincidental to the time of monitoring.

Cumulative Impact on Traffic:

There will be a cumulative increase in automobile and truck traffic in the vicinity of the Port Esquivel Industrial Complex as a result of the estimated employment of 300 cement factory workers plus an associated 400 daily truck movements. Based on the highlighted information presented in ***TABLE 3***, the expected result is a maximum 20% increase to the base-line number of vehicles (3,378) reported at the intersection of Highway 2000 and Old Harbour main road during the hours of 8:00AM to 5:00PM. This is actually seen as a positive impact because this section of Highway 2000 is a toll road with low utilization, built to international safety standards consisting of four (4) traffic lanes with soft shoulders on either side. Toll revenues can be expected to increase by a minimum of 10%.

Traffic on Old Harbour Main Road will also increase as a result of the proposed project, but the primary area of concern (i.e. the parochial road leading to the limestone quarry) will be avoided by CJL constructing a new 1.5 kilometer haul road.

Traffic on the Old Harbour Road in the vicinity of the development will be also increased as a result of the transportation of clay, this increase in vehicular traffic was included as part of the 20% increase in traffic onto Highway 2000 identified above.

The other significant increase in traffic will be on the Port Esquivel Road, but this is a private road with very low usage (88 between the hours of 8:00 am – 5:00 pm). This impact will therefore not be of concern. One of the significant benefits of the proposed project is to increase the utilization of the existing port facility which have been negatively impacted by the economic downturn and its severe impact on Jamaica's bauxite industry as well as Jamaica's unemployment rate of more than 20%.

In summary, an overall 20% increase in traffic will occur. However, based on the low utilization rates, the existing infrastructure is more than adequate to handle the increased number of vehicles and, therefore, the cumulative impact in terms of "congestion" is negligible.

TABLE 3: *CUMULATIVE TRAFFIC IMPACTS*

Transported Material	Transport Method	Frequency of Round Trips	Distance (km)	Name of Roads Impacted	Type
Clay	20-ton Trucks	85 Trips Daily	12	Salt River Road	Existing Local Public Road
			1	Old Harbour Main Road	Existing Local Public Road
			2	CJL Limestone Quarry Road	New Private Road
Red Mud	Rail 27-ton Cars	Avoid 19 Trips Daily by Trucks	40	No Traffic Impact if Rail is Used	Existing Private Rail
Gypsum	20-ton Trucks	17 Trips Daily	11	Eleven Mile Town Road	St. Thomas Parrish Road
			11	Bustamante Highway	Existing City Public Roads
			7	Kingston City Roads	Existing National Public Road
			30	Highway 2000	Existing National Toll Road
			0.2	Old Harbour Main Road	Existing Local Public Road
			0.2	Windalco Access Road	Existing Private Road
Coal 31,000-ton Ships	40-ton Trucks	775 Trips Monthly	3.5	Windalco Access Road	Existing Private Road
Pozzolana 35,000-ton Ships	40-ton Trucks	875 Trips Monthly	3.5	Windalco Access Road	Existing Private Road
Cement 18,000-ton Ships	Trucks for Local Market	100 Trips Daily	30	Highway 2000	Existing National Toll Road
	Trucks for	200 Trips Daily	3.5	Windalco Access Road	Existing Private Road

	Export Market				

Cumulative Impact on Water Resources:

There will be a negligible cumulative impact on water usage within the Port Esquivel Industrial Complex because, here again, the current utilization rates are currently less than 50% as a result of the economic downturn. The water demand of the proposed project will increase the water usage of the industrial complex, principally as a result of the new power plant that is required to operate the cement plant. The cement plant, itself, including its sewage treatment plant will consume a maximum of only 30,000 gallons of water per day for domestic and industrial purposes combined. This is because of the water-conserving features of the cement plant (i.e. the Waste Heat Recovery Boiler and closed-loop water recirculation systems). The technology employed is therefore designed for low water usage.

There is existing deep water well on the property that is designed for 14,700 m^3/ hr that is not currently in use. The cement plant with captive power plant is estimated to require 500 m^3/hr of water to result in a maximum increase of 5% in water demand for the Port Esquivel Industrial Complex will occur. However, based on the current low utilization rates, the existing infrastructure is more than adequate to handle the increased demand and, therefore, the cumulative impact in terms of "availability" is not of concern.

Cumulative Impact on Waste Disposal:

The cumulative effect of waste disposal is limited to the construction phase of the project. It is negligible because of the EPC Contractor's Recycling Program (Segregation and recycling of construction waste by EPC Contractor into metal components, plastics, and glass separately elaborated in Section X) and because it is for such a brief period of time (less than 30 months) compared to the operational phase of the project (50 years). The waste generated during the operational phase of the project will either be burned as an alternative fuel in the cement rotary kiln or composted for use as organic fertilizer. The plant will be built with modern sewage treatment facilities and any effluent will comply with NEPA's requirements as elaborated in Section 5.2.14 of this EIA Report.

Cumulative Impact on Energy Consumption:

The cumulative effect of the proposed project on Jamaica's energy consumption will be positive. This is because while the cement plant will be connected to the national power grid, the integrated/cogeneration/captive coal-fired power plant will be fully capable of

meeting 100% of the cement plant's needs, and it will be capable of doing so at much lower costs than Jamaica Public Service (JPS). In fact, the plant will be capable of exporting lower-cost power to the National Grid which would help to improve the current power generation shortage situation in Jamaica. It is therefore likely that the proposed project will have a very positive cumulative impact on energy consumption – given that the vast majority of Jamaica's power is produced using some combination of diesel oil/heavy oil which must be imported from other countries.

Presently, there are two (2) generating power stations at Old Harbour Bay and both regular and high-tension power service is available at the proposed plant site. The negative impact of the proposed project on energy consumption is only during the construction phase of the project because only during this period of time will the cement plant will be dependent on Jamaica's National Power Grid. However, the negative impact is negligible because the power demand to support construction activities will be a maximum of 4000 kWh/day and will last for a maximum of 30 months before the captive power plant becomes operational. This demand will also be offset by utilizing power for a Standby Generator for emergency power which will be installed at the start of construction and therefore for used during construction.

Cumulative Social Impact:

According to the 2001 National Census of Jamaica, St. Catherine had an unemployment rate of 17%. A new census is scheduled for 2011, but it seems obvious, based on what has happened to Jamaica's bauxite and sugar industries over the last decade, together with the current global recession that the local unemployment rate is currently in excess of 20%. Therefore, the cumulative effect of the proposed project on Jamaica's social environment will be very positive. This is because the proposed project will be a significant source of employment:

- Approximately 300 local workers will be employed in short-term construction jobs;
- Approximately 450 local workers will be employed in long-term industrial jobs;
- Indirectly, it is estimated that 1,000 people will be employed in cement-related industries as a result of this project.

This is a positive not only for the immediate project area but the entire country as the major source of employment in the surrounding communities, until recently, has been from the bauxite and sugar industries as well as the port facilities at Old Harbour Bay and three (3) major housing communities being planned and built. The proposed project will go a long way towards alleviating unemployment in the communities and therefore increase the standard of living in this area and to the country by extension.

The negative social impacts will be very minor because the cement plant will have its own first aid, security, fire-and prevention facilities so the net impact on local area hospitals, fire departments, and police stations will be minor. Moreover, the EPC Contractor has a sound health and safety management plan so the cumulative impact on the social infrastructure as the May Pen Hospital, for example, is not expected to increase in any significant way. Similarly, apart from increase local patrols, no significant increase on the local police is expected. Finally, the plant will be designed with fire-prevention and a fire prevention management system (sprinklers and hydrants) so the increased demand to local fire departments is expected to be minimal.

1.0 INTRODUCTION

Cement Jamaica Limited (CJL) proposes the construction of a cement production facility at the Port Esquivel Industrial Complex and Rose Hall District St. Catherine/Clarendon, to be built and operated using the most modern design and technological standards. The facility, having a proposed location as shown in ***FIGURE 1.0***, will be nominally capable of producing 1.5 million ton per annum of clinker (the main component of cement) and will also incorporate the development of a limestone quarry. Limestone, itself, represents 75% of the raw material input to the clinker production. 20% of the raw material component for cement clinker is clay which will be acquired from existing clay mining operation. Waste components, red mud and coal ash; make up the final 5% of the mix design for producing cement clinker. Gypsum is blended into the clinker at a rate of about 2% and will be obtained from Carib Cement at Rockfort. This document provides a detail description of the project, applicable laws, the existing environment and describes the key impacts of the proposed development on the environment and local people through the construction, operation, and decommissioning phases of the project.

This document presents the findings of an Environmental Impact Assessment (EIA) of the proposed ***Cement Plant and Quarry Operation by Cement Jamaica Limited at Port Esquivel Industrial Complex and Rose Hall District St Catherine/Clarendon.*** The National Environmental and Planning Agency (NEPA), as a part of its permitting process require that projects of this nature conduct an EIA of the proposed development. EnviroPlanners Limited was contracted to conduct the study in accordance with the terms of reference approved by NEPA.

1.1 Purpose

An application was submitted for a development permit to the NEPA. The application was accompanied by Project Information Form (PIF) and supporting documentation. NEPA responded to that application with a request that an Environmental Impact Assessment (EIA) be conducted on the proposed development, based on their review of the permit application. NEPA supplied Generic Terms of Reference and requested modification of these Terms of Reference to be specific to the project. The modified Terms of Reference were submitted to NEPA for their approval and a response obtained.

The TOR is outlined in Section 4.0 and the completed document as approved by NEPA is presented in Appendix 4.

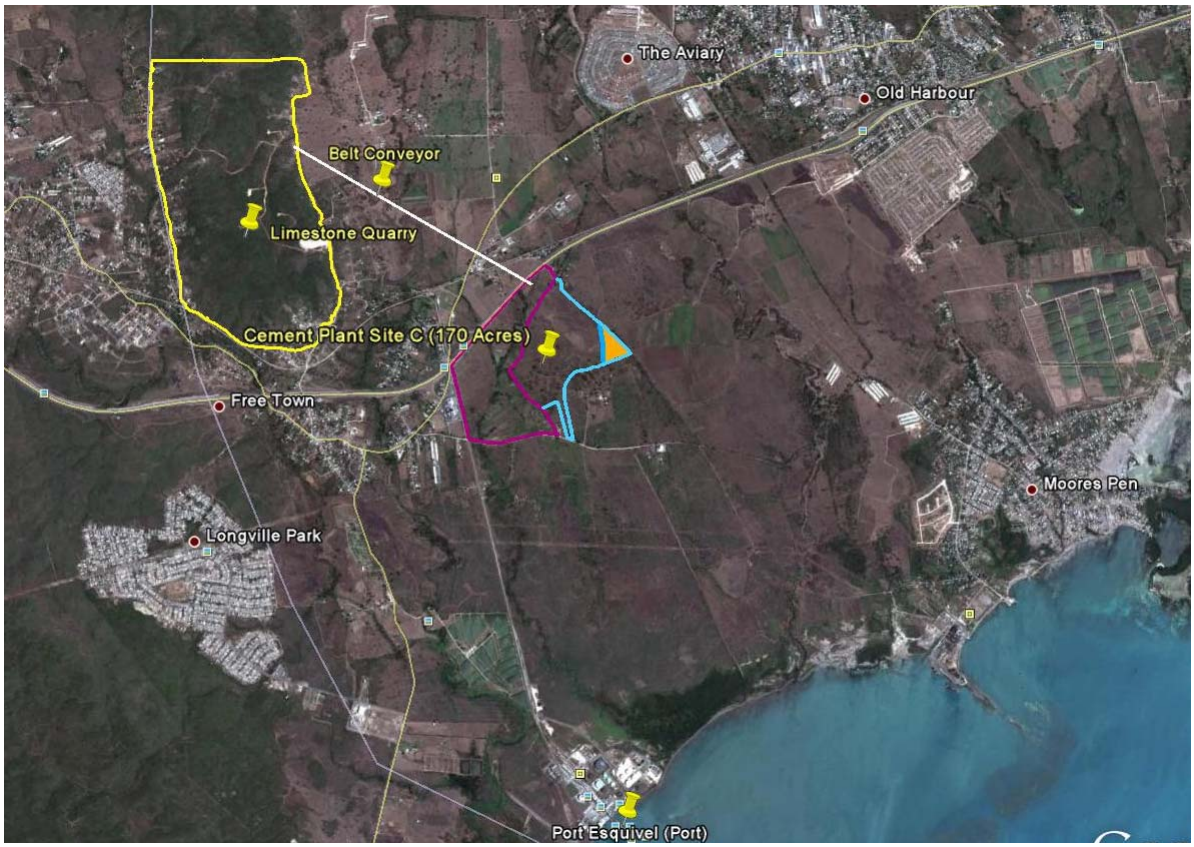


***FIGURE 1.0**: CEMENT JAMAICA LIMITED's PROPOSED PLANT & QUARRY LOCATIONS*

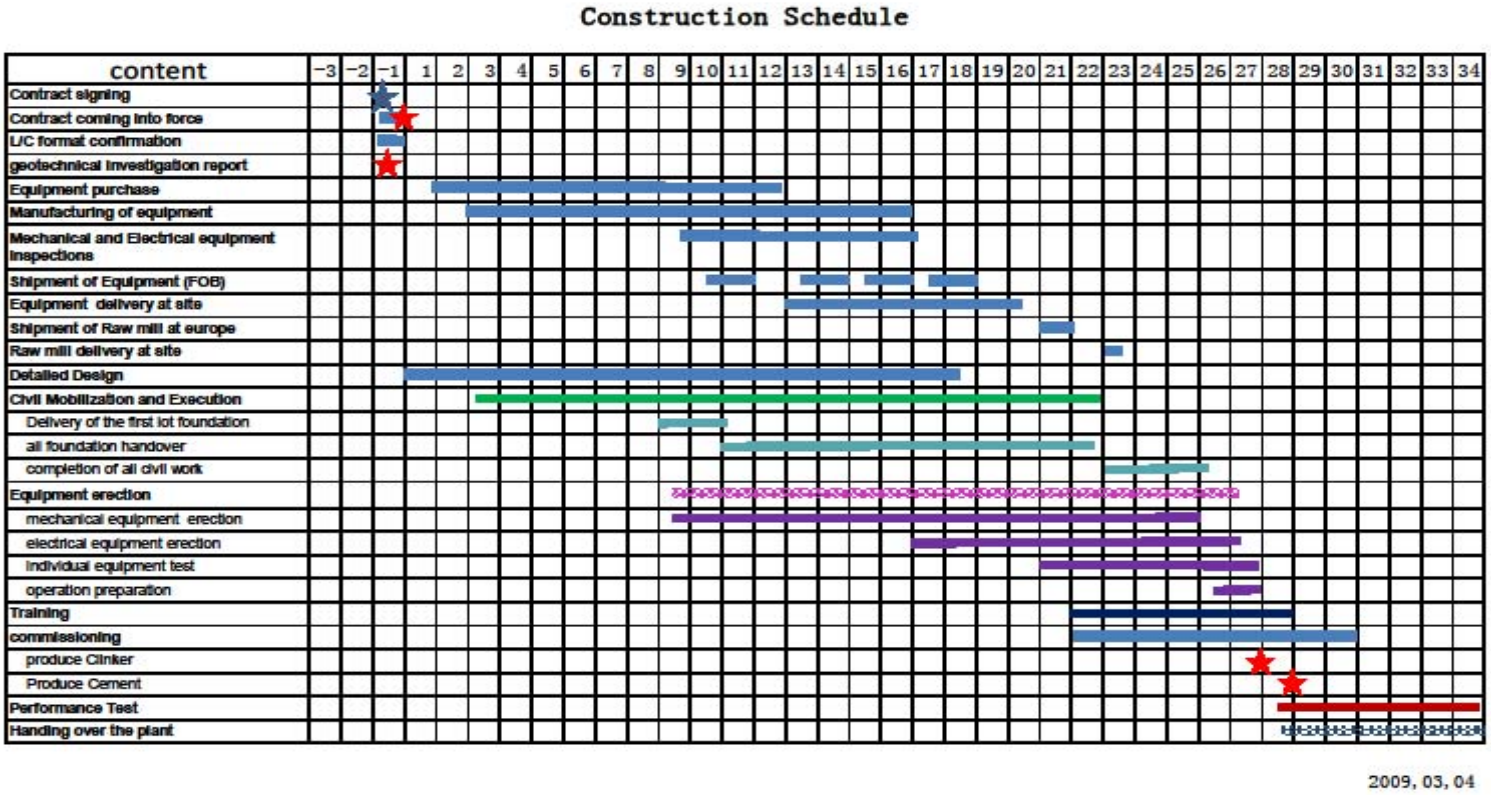


***FIGURE 2.0**: CEMENT JAMAICA LIMITED's PROPOSED 30-MONTH PROJECT SCHEDULE*

2.0 PROJECT DESCRIPTION

Cement Jamaica Limited (CJL) proposes to erect and operate a new cement plant at the existing Port Esquivel Industrial Complex. The project is estimated to cost $340 million USD. As shown in ***FIGURE 2.0***, a 30-month schedule is anticipated for construction after which the serviceable lifetime of the plant is expected to be 50 years. Ultimately, a 24-month decommissioning period is expected which will include re-vegetation of the limestone and clay quarries.

The main characteristics of the project are:

- Constructions of a nominal 5,000 ton per day cement manufacturing plant. Construction and commissioning is expected to be completed by 2013 (30 months) and will be undertaken by one of the world's leading cement equipment suppliers in an EPC (Engineer, Procure, Construct) contract model. The cement plant will be designed with the following modern technology to ensure environmental responsibility and sustainability in compliance with Guidelines for CO_2 Emissions and Specific Fuel Consumption issued by the Inter-American Development Bank:
  - 5-Stage Preheater with Low Pressure Cyclones
  - Modern Low NO_X Calciner
  - Modern High-Efficiency Grate Cooler
  - Modern Low NO_X Kiln Burner with capability to burn alternative fuels for lower CO_2 emissions
  - Vertical Roller Mill Technology for Cement Grinding for significantly lower power consumption
- Associated with the development of the cement plant will be the construction of a 9 MW cogeneration power plant. The cogeneration power plant will use waste heat from the cement plant's pyro-processing system to generate power. The plant's remaining power and utility requirements will be provided by a new 45 MW coal-fired power plant. This captive power plant will leverage the technological developments that have led to cleaner coal technologies that are able to increase their efficiency plant (i.e. to increase the amount of energy gained from each ton of coal) and to significantly decrease its air emissions (specifically sulfur dioxide, particulate matter, and nitrogen oxides). Coal will be imported to reduce Jamaica's demand for oil and to eliminate CJL's dependence on Jamaica Public Service (JPS) for power supply. Again, the work will be undertaken mainly by a specialist equipment supplier from China in an EPC contract model.
- The development of a limestone quarry and the sourcing and transportation of clay for existing clay quarries to supply the major raw materials for the production process.
- Transport of large volumes of raw and finished materials as follows:
  - Clay will be transported from within a radius of 20 kilometers to the limestone quarry at Rose Hall at *a rate of 1,700 tons per day*.

- Construction of a new 1.5 kilometer haul road from the Old Harbour Main Road in the vicinity of Bodles Crescent to the limestone quarry at Rose Hall primarily for use by 20-ton trucks hauling clay to the limestone quarry. Crushed Limestone and Clay (combined) will be transported via a 2.0 kilometer overland belt conveyor from the limestone quarry at Rose Hall to the cement plant at the Port Esquivel Industrial Complex *at a rate of 8,000 tons per day*.
- Raw Coal from the existing Port Esquivel to the new cement plant via a 3.5 kilometer existing road (Port Esquivel Road) *at a rate of 30,000 tons per month*.
- Red Mud will be transported via existing rail facilities to the cement plant at the Port Esquivel Industrial Complex from Mandeville and/or Ewarton *at a rate of 375 tons per day*.
- Gypsum will be transported 40 kilometers to the cement plant by truck or barge from an existing gypsum quarry located near Rockfort, *at a rate of 340 tons per day*.
- Pozzolana will be transported from the existing Port Esquivel to the new cement plant via a 3.5 kilometer existing road (Windalco Road) at *a rate of 35,000 tons per month.*
- Cement will be transported from the new cement plant via truck or rail via the existing 3.5 kilometer Windalco Road *at a rate of 4,300 tons per day.*
- Cement will be exported from Jamaica (using Windalco's existing port facilities at Port Esquivel) to the Caribbean Region, United States, and Canada *at a rate of 140,000 tons per month.*
- Cement will be supplied to Jamaica's construction industry (using the Old Harbour Main Road to Highway 2000 interchange) *at a rate of 1,600 tons per day.*

- Transport of large volumes of materials along these routes as well as using the established transport infrastructure. Transport will be along roads, using heavy goods vehicles.
- Finally, also associated with the development will be the construction of a power line (0.8 kilometer in length) to connect the cement plant to the existing national power grid. Note: the plant will be connected to the national power grid, however, the cogeneration/captive coal-fired power plant will be fully capable of meeting 100% of the cement plant's needs. This will help to improve the power generation shortage situation in Jamaica.

2.1 Location of the Proposed Development

The cement plant and limestone quarry will be situated on two (2) parcels of land in relatively close proximity (2 kilometers) to each other. The parcels of land are strategically located within a region rich with limestone and zoned for mining with easy access to major roads, rail, and the Windalco port facility at Port Esquivel.

2.1.1 Proposed Plant Site Location

The proposed plant site is located approximately 3 kilometers east of Freetown and 5 kilometers south-southeast of Old Harbour, Clarendon, Jamaica. As shown ***FIGURE 2.1.1*** , the site is bordered to the north Highway 2000 and bordered to the west by the Port Esquivel Road.

FIGURE 2.1.1*: MAP OF CEMENT JAMAICA LIMITED's PROPOSED LAND DEVELOPMENT*

2.1.2 Proposed Limestone Quarry Location

The proposed site of the limestone quarry is on lands located at Rose Hall in Clarendon near the border of St. Catherine adjacent to Freetown and the Bodles Agricultural facilities. Please see ***FIGURE 2.1.2 (***Valuation Reference No. 20702007003).

The project area for the limestone quarry straddles the eastern border of the parishes of Clarendon with that of St. Catherine approximately 5 kilometers west of the town of Old Harbour (GR 237 921.72E; 142 941.73N). It is centered at the false grid reference (GR) of 234 000E; 142 000N on the 1:50,000 metric topographic Sheet 17 (JD69 Series) (Fig 1).

All grid references used for the remainder of this report are following those on Map 1 which is adapted from the 1:50,000 Sheet 17 topographic JD69 series published by the Jamaican Survey Department. The project area is rectangular approximately 2.88 km2 in area.

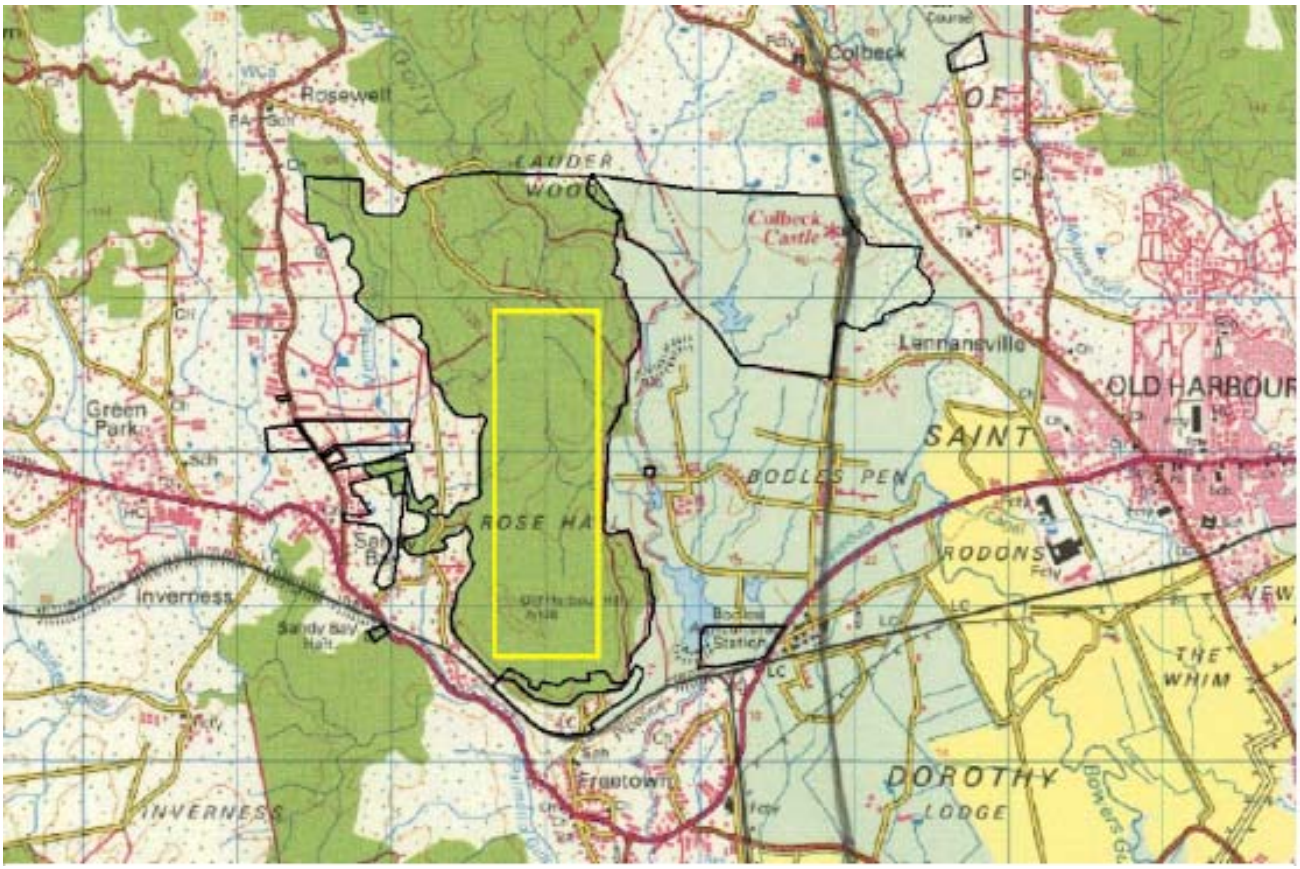


***FIGURE 2.1.2**: MAP OF CEMENT JAMAICA LIMITED's PROPOSED LIMESTONE QUARRY DEVELOPMENT*

Limestone is Jamaica's most abundant mineral. Limestone deposits account for 65% of the island by weight, and 85% of its surface coverage. High quality deposits exist – 98% $CaCO_3$ high purity grade – however, 80% of existing limestone quarries in Jamaica are producing less than 100,000 metric tons per year. Currently, only 250,000 metric tons of limestone is exported annually because most of the limestone quarries are landlocked. Nevertheless, Jamaica is arguably the easiest location in the Latin American and the Caribbean region to access a wide variety of consistent quality limestone aggregate. Moreover, many of Jamaica's limestone deposits exist at or close to the surface which makes for easy extraction.

The preliminary mining permit for the Limestone Quarry at Rose Hall is presented in ***APPENDIX 2***.

2.2 Overview of Cement Production

The proposed plant will produce cement from solid raw materials; limestone, clay and red mud which is a by-product of the bauxite bayer process. The raw materials are heated to a very high temperature (1450 °C) in the pyro-processing system via rotary kiln, causing thermal reactions which produce cement clinker. This clinker is then cooled and pulverized to produce the fine power (cement) for sale. A Process Flow Diagram illustrating the cement manufacturing process is presented in Figure 2.2. A brief summary of each stage of the production process is as follows:

2.2.1 Raw Material Extraction:

Extraction of the raw materials is from local quarries. The main raw materials are limestone, clay, and red mud (red mud is a bauxite tailing). The limestone and clay will be crushed together within the boundary of the Limestone Quarry and then transported approximately 2.0 kilometers, as a mix, to the cement plant by overland conveyor. In order to prevent dust emissions during the transport of extracted materials, the following techniques will be employed: The overland conveyor will be covered; a simple, linear layout will be applied to minimize the number of transfer points; cleaning of return belts in the conveyor belt systems; storage of crushed and pre-blended raw materials in covered or closed bays.

2.2.2 Raw Material Preparation:

Once the raw materials have arrived at the cement plant they will be stored separately from the other additives inside a covered storage building. Crushed materials, such as coal, will be stored in large covered stock piles. The process of crushing, stacking, and reclaiming for the purpose of feeding into the next stage of the process also achieves raw material 'pre-blending'. The raw materials are then fed in to separate feed bins. Red mud is a waste product which will be used to make cement clinker and this component will be delivered to site from external sources by rail and then stored in covered stock piles. This raw material will be added to the limestone/clay mix in relatively small quantities (<5%). From the feed bins, the raw materials are fed to the raw mill, where they are ground into a fine powder. Before entering the raw mill, each material is weighed and adjusted according to the chemistry of the raw mix. The finely ground raw material (raw meal) is transported to the homogenization silo, where it is blended (homogenized), by following a gravity-based extraction sequence as the material leaves the silo. At all stages of raw material preparation, appropriate methods will be used to prevent the escape of air-born dust emissions. These include the use of enclosed conveyors and storage, minimization of material drops, numerous nuisance dust collectors, and the use of a primary bag filter for the kiln/raw mill exhaust gases which are used for drying of the raw materials. All bag filters will be designed and operated to

ensure particulate emissions below 30 mg/Nm^3 including all other point sources, such as the clinker cooling, cement grinding, and coal grinding, in accordance with industry standards.

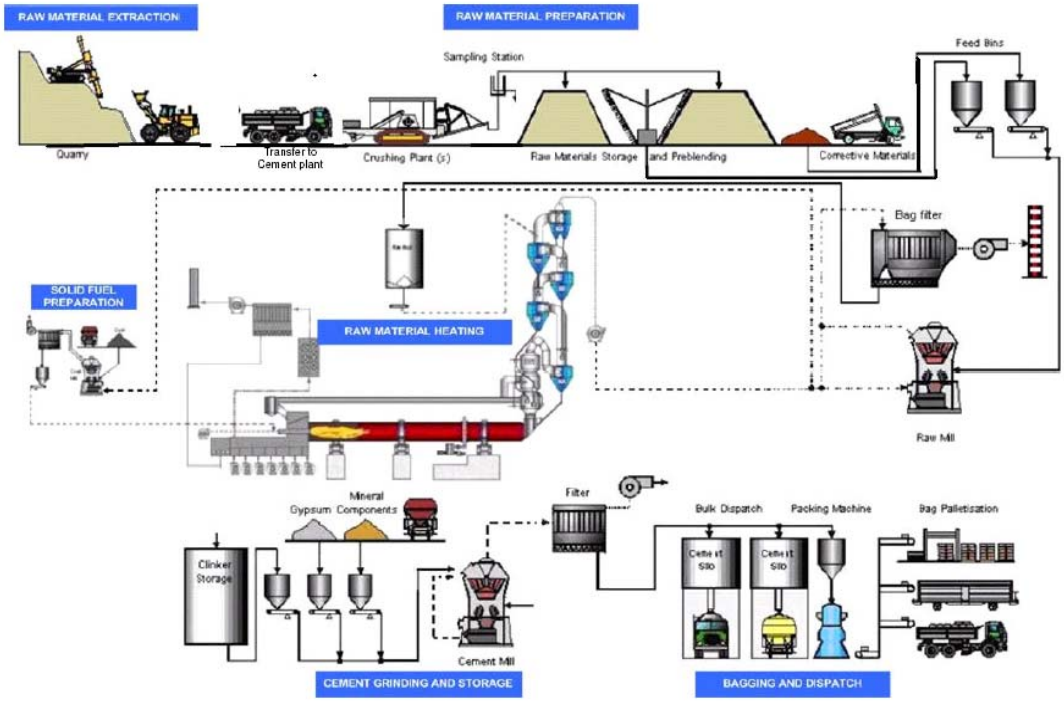


***FIGURE 2.2**: OVERVIEW OF THE CEMENT MANUFACTURING PROCESS*

2.2.3 Solid Fuel Preparation:

The production of cement requires the use of a significant amount of energy. In order to provide this energy, conventional solid fuels, such as coal, are burned in the pyro-processing system described above. It is also foreseen to burn waste oil and other by-product from oil refining process, petroleum coke, and possibly other sources of alternative fuels as well. The conventional fuels (coal) will be transported to the cement plant by truck from Port Esquivel. Before firing in the pyro-processing system, the fuels, just like the raw materials, have to be pulverized into a fine powder prior to feeding into the cement manufacturing process.

2.2.3 Pyro-process (Kiln System):

The raw materials are added and then heated to high temperatures; the cement "clinker" is formed as a result of thermal reaction. The cement plant will use the most modern and efficient design for undertaking this process. The raw materials are first preheated by 5-cyclone stages using the heat from the exhaust gases from the rotary kiln. From the 5-stage pre-heater/pre-calciner, the pre-calcined raw meal material mix enters the large,

rotary kiln where the remaining fuel is burned and the final high temperature chemical reactions take place. The produced clinker is then cooled and heat is recuperated. All of the waste heat is used to generate power by the cogeneration system. The clinker is dispatched by deep bucket pan conveyor to the clinker silos prior to the clinker grinding operations.

2.2.3 Cement Grinding and Storage:

The clinker is ground with additives (e.g. gypsum, limestone, pozzolana, including flyash from the coal power plant) to meet the quality requirements of the final cement. In the cement mill, grinding is carried out in a closed circuit arrangement. The system consists of one roller mill for significant power savings in comparison to three tube mills (ball mills). The finished product (cement) is collected by bag filters and then transported to cement storage silos prior to bulk loading, bagging and dispatch.

2.2.4 Bagging and Dispatch:

Part of the cement will be sold in bulk and will be transported in specialized bulk transporters. The rest will be bagged on site at a bagging plant, before being dispatched and sold to customers. Approximately 75% cement produced will be exported, and the remainder will be sold to customers in the local construction industry.

2.2.5 Process Controls:

The cement plant will be controlled by a Distributed Control System (DCS) from the Central Control Room. Process variables in all manufacturing departments will be continuously monitored in order to regulate and optimize cement production, i.e. from raw material storage to cement storage, packing and loading. However, manual intervention is warranted during process upsets, equipment malfunction or emergency conditions. Process temperatures and pressures are continuously monitored for any abnormal conditions to ensure that any abnormalities can be detected and rectified. Operation of the pyro-processing system receives close attention since product quality will be largely determined in the kiln. At every stage of the cement manufacturing, the raw and intermediate materials as well as the end products will be analyzed at the plant's laboratory to ensure that they conform to set quality standards on a consistent basis. The laboratory is equipped for testing of major process related materials, sample preparation, chemical analysis and physical testing.

2.2.6 Pollution Controls:

Pollution control measures and safeguards are key features in the operation of any industrial plant. The pollution control measures for the project were selected after identifying emissions of various pollutants, particularly air pollutants from the different stages of cement manufacturing.

2.2.6.1 Air Pollution Controls: Air pollutants generated during the operation of the Project consist primarily of particulates from quarrying, raw, and finished materials as well as fuel combustion by-products. Pulse jet type bag filters and bag houses will be employed as de-dusting equipment to control major emissions in the Kiln, Raw Mill, Grate Cooler, Coal Mill and the Cement Mill. For other emissions, a sufficient number of standardized bag filters will be installed at all transfer points at hopper, bins or silos as well as dust producing machinery (crushers, loading equipment, conveyors etc.) for de-dusting purposes. Modern technology burners, dosing systems for fuel and kiln feed, and kiln control systems are used for the plant processes to control emissions (NOx, SOx, CO). Cyclones will also be installed to capture materials entrained in airflows, which are routed through principal process units (e.g. milling and pyro-processing stages). They are considered as pre-treatment recovery and recycling device, and assists in enhancing the efficiency of both bag house and bag filter systems.

2.2.6.2 Water Pollution Controls: The Project adopts a modern, dry process of manufacturing cement. The principal effluent released from the clinker production and cement manufacturing process is equipment cooling water, which is innocuous. Moreover, apart from the cooling water used during the raw mill down condition to protect the bag filter, the process water will be completely reused via recirculation through water treatment systems. Domestic wastewater generated from toilets and the canteen is estimated to be at 225 m^3/d. All wastewater is routed to the wastewater treatment plant prior to disposal. The treated effluent will comply with NEPA Standard for sewage effluent. Overflow cooling waters, tanker washings and floor washings will be collected and conveyed by open drains. These process wastewaters will be channeled into a solids 'gravity' separator then to the wastewater treatment plant prior to discharge. During the peak of construction activities (i.e. the maximum demand), the fresh water requirement will be 1,200 persons x 100 kg water/person/day =120 tons of fresh water.

2.2.6.3 Noise Controls: Most cement projects generate significant, intermittent noise levels during blasting of the limestone within the quarry. A unique feature of the limestone found at Rose Hall, however, is that much of the limestone may be quarried by “ripping” techniques which will significantly decrease the frequency of blasting. Therefore, the principal noise emission sources will be associated with motors, fans, blowers, crushers, air compressor, and tube mills in the coal-fired power plant. In-plant shielding of noise emissions will be adopted to ensure that noise levels at the boundaries are within the regulatory limits (See TABLE 5.2 which demonstrates that the cement plant will be fully compliant with both IFC and NEPA

Standards for noise emissions). All equipment to be employed for the plant will be designed to operate with low noise levels, and will not exceed the maximum allowable noise level for the surrounding receiving land use.

2.2.6.4 Drainage from Quarry to Avert Flooding: Drainage will be provided to take storm water into nearby river courses to avert flooding arising from changes to the topography of areas being quarried.

2.2.6.5 Access to the Plant and Quarry: Access will be sought along the local road from the most western end of the Bodles facilities. This access point will prevent any disruption of the adjoining local residential communities, while providing easy access to the public, and large traversing from either ends of the country along the Highway 2000.

2.3 Manpower

The Project will require manpower in both of its project components: the quarry component and the cement plant component during both the construction and operational phases. Apart from the workers provided by the EPC Contractor, approximately 300 local workers will be involved in the construction phase of the project. During the operation phase of the project, the total manpower requirement is estimated to be 450 people. Indirectly, it is estimated that 1,000 people will be employed in cement-related industries as a result of this project. All recruited staff will be given appropriate training in order to educate them on the specific job tasks to be performed; safety procedures; and the concepts of quarrying and cement manufacturing.

2.4 Project Economics

The total project value is estimated at $340 million USD. Development of the project is planned to be completed within 30 months. Employment emanating from the operations will be in three phases, namely:

2.4.1 Construction phase: Over 300 persons will be employed over a 24 month period.

2.4.2 Operations phase: Approximately 450 persons comprising administrative, technical, and non-technical persons will be employed permanently and immediately after completion of the plant. These include engineers, chemists, computer operators, accountants, administrative assistances, secretaries, etc. The value of the project to the economy excludes the spin-off benefits affixed to the Project for related downstream and upstream industries as well as supporting sectors during the construction and operation phases of the project.

2.5 Proposed Community Development Plan to benefit Socio- Economic Environment

Several positive Community Development initiatives will be implemented in conjunction with the establishment of the Cement Plant.

2.5.1 Creation of a school for Jamaican children with Autism

During the construction phase of the cement plant an advanced education school, focusing on the treatment and education of children with autism, will be created to promote awareness and equal opportunity for Jamaican residents that is not currently available. This educational center will be built and funded by CJL and run in partnership with the University of the West Indies in Jamaica and George Brown College in Canada (see ***APPENDIX 11A*** for Draft MOU with partners). This educational center will provide a full day, twelve-month program for students starting at the age of three. The said school will have an early intervention class for young students aged 3-5, primary classes with students aged 5-12, and secondary classes with students aged 13-18. These classes will provide intensive 1:1 Applied Behavior Analysis (ABA) training, which is known to be the best way of treating and educating children with autism.

The program and school will draw upon the world-renowned programs taught at New Haven Learning Center in Toronto, Canada. New Haven has become the prototype for how to best understand the disorder and treat children who are affected. Children's health professionals consider the New Haven Learning Centre to be the "gold standard in autistic treatment and education". Employment opportunities and training will be created for the supply of local teachers and support staff, which is expected to be indefinite. *Further information on the school for Jamaican children with autism can be found in* ***APPENDIX 11B***

2.5.2 Establishment of a Behavioral Science Technology Programme at the University of the West Indies

A Behavioral Science Technology program will be set-up at the University of the West Indies to support regional development through education by facilitating the training of students in applied behavior analysis and behavioral intervention. Graduates of the program are typically employed in a variety of settings with diverse clinical populations of all ages who frequently present challenging behaviors, including but not limited to individuals with autism. Graduates may work to develop and implement behavioral interventions designed to manage challenging behaviors and/or teach a variety of skills. Graduates may find employment in schools, hospitals, residential and treatment facilities and rehabilitation and vocational agencies. This program helps to support regional development through education.

2.5.2 Creation of a Hybrid-Learning Platform at the University of the West Indies (specifically for the Behavioral Science Technology program)

The University of the West Indies will employ a hybrid approach to instructor led classroom based education, which will provide a competitive educational advantage in the global marketplace. The platform will provide both in-class instructor led education along with parallel online learning paths. As part of the online education students will have access to classroom videos, presentations, MP3 Audio of the lectures, classroom presentations, quizzes and a community forum including blogs dedicated to Applied Behavior Analysis (ABA) training that connects students throughout the world - (all online tools are specifically designed to maximize the Internet connection and speed in the students' geographical region).

The course work will be secure and compliant with Sharable Content Object Reference Model (SCORM) standards. SCORM is a collection of standards and specifications for web-based e-learning. This unique platform will establish the University of the West Indies as a leader in integrated education throughout the global arena. *Further information on hybrid learning platform can be found in* ***APPENDIX 11C.***

2.5.3 Creation of a Holiday Resort for Children and Families of Children with Autism

A holiday resort will be established in Jamaica that caters to families of children with autism from Jamaica, North America and around the world. The resort will promote regional integration by forging links among countries with autistic citizens – *preliminary research shows that there are no holiday resorts of this structure in existence.* The resort will include the same amenities a typical all-inclusive resort has with the added feature of 1:1 care for children with autism. This initiative creates an entire new tourist market for resort providers and local Jamaican businesses, as families of children with autism find it difficult to take proper holidays. Additional employment opportunities will be created for the supply of local support staff and teachers, which is expected to last indefinitely.

2.6 Reasons Why the Cement Plant is Needed

During the period 2000 to 2007, the global demand for cement increased at a pace that resulted in increased capacity utilization, product shortages, and rising prices. The increase in the demand for cement in China and the rest of the far-east was most significant and driven by massive investments in the public and private sector. In the USA, cement consumption reached unprecedented levels in 2005 and 2006, with demand surpassing 127 million metric tons in each of those years and with imports accounting for over 25% of total consumption. Within the Caribbean Community, the demand for cement between 2005 and 2007 was also at elevated levels due to heightened preparation for the Cricket World Cup (CWC) in 2007 as well as continued investments in the Tourism and Housing Sectors.

In the Caribbean Common Market (CARICOM), Jamaica, Trinidad and Barbados are the major cement producing countries, with the latter two having significant levels of exports. All three cement plants in these countries are owned and operated by the TCL Group which, for years, has benefited from the protection of the Common External Tariff (CET). In all three countries, the CET applicable is higher than the standard 15%, but capped by the World Trade Organization's bound rate of 60%. The application of the CET has made cement imports uneconomical in most instances and has resulted in virtual monopolistic conditions on the island of Jamaica. In recent years, supply shortages and rising cement prices have forced many CARICOM countries to seek CET waivers up to pre-determined quotas to enable the importation of cheaper cement, particularly from China, Colombia, Venezuela and the Dominican Republic. These imports are currently estimated at 1.1 million metric tons per annum. The import of cement by CARICOM member states from non-TCL sources are significant and highlight the degree to which distributors are seeking better and cheaper alternatives.

Cement Jamaica Limited (CJL) visualizes that the Caribbean market (including the reconstruction of Haiti as well as the potential for exports to the United States and Canada) has great opportunities. Therefore, CJL is proposing the establishment of a 1.5 million ton clinker per annum, state of the art, cost effective, environmentally-friendly cement plant to be located in the southern coast of Jamaica that will have full access to water, limestone, gypsum and other natural deposits required to produce Portland Cement. CJL has already concluded significant take or pay contracts with strong and reputable users and distributors of cement to cover a significant portion of its proposed production. This will serve to minimize CJL's production risks and effectively manage the company's profitability.

Jamaica is estimated to have 150 billion metric tons of recoverable limestone, the primary raw material in producing cement. In fact, limestone is Jamaica's most abundant mineral. Limestone deposits in Jamaica account for 65% of the island by weight, and 85% of its surface coverage. High quality deposits exist – 98% $CaCO_3$ high purity grade – however, 80% of existing limestone quarries in Jamaica are producing less than 100,000 metric tons per year. In fact, only 250,000 metric tons of limestone is currently being exported. Nevertheless, Jamaica is arguably the easiest location in the Latin American and the Caribbean region to access a wide variety of consistent, quality limestone aggregate. Moreover, many of Jamaica's limestone deposits exist at or close to the surface which makes for easy extraction. The abundance of limestone and other raw materials, including waste materials such as red mud, makes Jamaica an ideal landscape for the location of cement plants. The Government of Jamaica (GOJ) has encouraged investments in establishing a competing cement plant to Jamaica's current, sole cement manufacturer.

In a key policy decision, the GOJ applied for and obtained approval for the suspension of the 40% CET in May 2006 for duty free cement imports. The waiver of the CET has recently been in effect for a quota of up to 240,000 metric tons. Since 2005, cement imports into Jamaica have been significant and although Jamaica's current, sole cement manufacturing company recently expanded its cement capacity, there remain several importers. Developers believe a competing cement factory is important and necessary given the need to adequately supply the market with high quality and price competitive cement in order to avoid any recurrences of the cement supply shortages that damaged Jamaica's Construction Sector in 2005 and 2006.

There are a number of significant developments planned for Jamaica, specifically in the Tourism Sector, which include Harmony Cove, Palmyra Condominiums, the Negril Peninsula project, Celebrations Jamaica, and other hotel investments from Spanish Companies. In total, over 30,000 rooms were planned to be built during the period 2005-2015, with over 20,000 of these rooms slated for development during the period 2009-2015.

Jamaica's abundant natural resources, especially high quality and easily extractable limestone, make the island arguably the best location in Caribbean region for cement plants. Jamaica is one of the largest economies in the Caribbean and it is therefore somewhat ironic that the island currently boasts only one (1) cement manufacturing plant and exports only 250,000 tons of limestone annually. The project described within will help Jamaica to reverse the flat to moderate economic performances of prior years and start to achieve significant economic growth because it will have a favorable impact on all sectors of the economy. The ability of the GOJ to improve tax revenue collections as a result of this project will help the GOJ to address Jamaica's growing debt and to provide additional resources for investment in public infrastructure. As a result of this project, it is expected that tax revenues from GCT (General Consumption Tax) and Income Tax will generate approximately $75 million USD annually for the GOJ.

3.0 ANALYSIS OF ALTERNATIVE

A description of how the proposed project relates to the overall strategy/policy for the applicable technical area (i.e. the basis and rationale for the project) has been presented in **Section 2.0 (Project Description and Technical Basis), Section 2.1 (Location), 2.4 (Project Economics), and 2.5 (Why the Cement Plant is Needed)**. In comparison, Section 3.0 presents a systematic comparison of feasible project alternatives, both in terms of both the project (i.e., technology, design, operation, etc.) and site selection. The assessment of project alternatives and site selection must specifically include environmental and social factors and include a no action (i.e., without the project) scenario.

The alternative assessment should be quantitative and expressed in economical terms, as feasible. The assessment must clearly state and justify the selected alternative. This report also compares various alternatives by which the project could be realized and seeks to identify the one which represents the best combination of economic and environmental costs and benefits. Alternatives include location as well as approach to design, process, and construction technology as well as the country chosen.

Alternative Actions:
The main alternatives to the development of the new cement plant can be summarized as follows:

3.1 Do Nothing Alternative:

The 'do nothing' alternative means that Jamaica will continue to have only one (1) cement manufacturing plant on the island in spite of Jamaica's abundant natural resources and especially high quality and easily extractable limestone reserves which make the island arguably the best location in Caribbean region for cement plants. This single-source alternative not only fails to address Jamaica's needs to increase exports of natural resources, but could also very easily result in the cement supply shortages and cement quality issues that previously damaged Jamaica's Construction Sector. As a minimum, the virtual monopoly will cause cement prices to be higher than what they would be otherwise. Increased prices for the basic building materials (cement and fuel) incrementally increase other costs such as power and food prices.

The ease of availability to basic building materials is needed to further develop Jamaica's economy. Otherwise, it becomes increasingly difficult for developing nations to withstand the rising costs of basic necessities such as fuel. The 'do nothing' alternative does not seem plausible given the legitimacy of the proposed project rationale and the benefits to be derived. For example, 'doing nothing' would mean that the local environment would remain in its present condition, degraded by local land pressures. Choosing this option would mean that none of the aforementioned economic benefits

would be realized by Jamaica. In sum, there will be no economic growth as a result of the cement plant development, Jamaica's trade deficit would not improve, and Jamaica would remain susceptible to high cement prices and possible lapses in cement quality.

3.2 Project Implementation Options

Several options were considered for the implementation of the project including country selection, location selection, site selection and technology selection and these are all discussed below.

3.2.1 Increase Availability of Low Cost Imports: A waiver of the CET on cement imports is really a 'band-aid' approach because it does not help Jamaica with its trade deficit. This is a particular injustice because Jamaica is rich in all of the raw materials (limestone, clay, and red mud) needed to manufacture cement and to actually become a exporter of cement and limestone.

3.2.2 Project Site Options: Given that limestone typically represents 80% of the raw materials from which cement is manufactured, the availability of limestone is the primary criterion for determining potential sites for a new cement plant. Numerous site options were considered over many years to identify the most suitable location of the new cement plant. Therefore, other key factors such as the proximity of the limestone reserves to the tourist industry were deemed to be nearly as important as the proximity of the cement plant to the limestone reserves. These include accessibility (to the site), human population density, housing density, ecological community, and the extent of works required to make such sites fully functional. The main alternatives to the location of the new cement plant can be summarized as follows:

3.2.2.1 Locate the Limestone Quarry at Crescent Park Pen: A location of limestone quarry in the area known as the Crescent Park Pen, which has sufficient reserves of limestone, was considered. This location was ultimately rejected due to issues associated with local infrastructure, equipment, and materials transport.

3.2.2.2 Locate the Cement Plant Adjacent to Crescent Park Pen: The most ideal location for the location of the cement plant near the limestone quarry of Crescent Park Pen is the old bauxite plant. This location was determined to be the most convenient location in close proximity to the limestone reserves and the availability of an existing loading site for a belt conveyer that runs to the terminal located at Ocho Rios Port. However, this location, while very convenient, was rejected because of its potential impact and close proximity to the Tourism Industry of Ocho Rios. It

would require the rebuilding of the 7 kilometer long belt conveyor belt and it would represent an encroachment into the Tourist Area. Given the economic importance of the Tourism Industry to Jamaica's economy, the main alternatives for the location of the cement plant were confined to the industrial areas along the southern coast of Jamaica which have been specifically targeted for development by the Government of Jamaica and the Port of Kingston.

3.2.2.3 Locate the Cement Plant Adjacent to Longville Park: The so-called "Plant Site A" adjacent to the Longville Park was thoroughly investigated. However, it was ultimately rejected due to its environmental and social impacts on the existing fish ponds, farms, and the newly developed residential area. It was clearly identified that this location would have greater negative impacts as a result of more significant industrial development in the quieter residential and agricultural areas.

3.2.2.4 In addition, it is estimated that more extensive and expensive piling would be required for any heavy equipment located in close proximity to the existing fish ponds. Finally, it was ultimately rejected by CJL because the irregular shape of the available land made it impossible for the EPC Contractor to layout the equipment on the available land area of 101 acres in such a way to allow for the future possibility of the installation of a second kiln line.

3.2.3 Technology Options: Any discussion of the technology included as part of this project is considered to be 'state of the art' in terms of energy efficiency and its design makes use of a waste product (red mud) that is transformed into a usable product. Several alternative raw materials were considered as follows:

3.2.3.1 Shale: Shale was considered for use as one of the raw materials for cement production. The shale quarry is in Cambridge Hill area, which is about 80 kilometers away to cement plant site via Highway 2000 and crossing several big residential communities and towns, like Kingston City, Harbour View, Old Harbor, etc. In addition, the shale chemical analysis revealed that the available shale was high in alkali content. In order to produce the low alkali cement, a by-pass design would have been required. The result of the bypass would have been a reduction in fuel efficiency and an increase in CO_2 emissions. The shale was rejected due to the issues associated with high alkali and long transport.

3.2.3.2 Iron Ore: Iron ore was also considered during our initial feasibility studies. However, iron ore would have to be imported from abroad since Jamaica has no significant iron resources. In addition, in our discussions with Windalco, they were concerned with the potential contamination to Bauxite during the "import operations". Therefore, the possibility to import iron ore via Kingston port was evaluated. Ultimately, the design of using iron ore was dismissed due to issues related with material transports and the resultant environmental impact. Moreover, one of the key objectives of this project is to increase Jamaica's exports and to make Jamaica less dependent upon imports such as iron ore.

3.2.3.3 Red Mud: Ultimately, the iron ore was substituted with red mud to address the need for iron input to the cement manufacturing process. This was environmentally attractive because red mud is widely available in Jamaica because it is a waste produce (tailings) from the alumina manufacturing process. Site visits and discussions have taken place with Windalco as a source for this waste material. Positive discussions have been had with Windalco which confirm the viability of transporting red mud from the alumina plants at Mandeville and Ewarton via rail. The use of red mud will improve the environmental impact by using the tailings of bauxite industry.

3.2.3.4 Fly Ash: 100% of the coal burning ash collected from coal power plant will be used as a part of raw materials for cement production in the project design. This will eliminate the ash disposal as waste material and avoid the installation of holding ponds which could have negative impacts on the environment.

3.2.3.5 Effluent: In the plant design, the waste water in the cement production process, such as cooling water for machinery, will be fully recycled. There will be no effluent discharge from the production process.

3.2.3.6 Power Distribution: In the original design, Jamaica Public Service (JPS) was to supply power to the cement plant operation. However, there is a shortage of power generation capacity in Jamaica so this would have further aggravated a tense situation in the local power supply. Therefore, the power distribution system has been redesigned to make CJL self-sufficient. The proposed design now considers the planned installation of a 9 MW Waste Heat Recovery (WHR) power plant and 45 MW coal-fired power plant which meet the recommended guidelines of the Inter-

American Development Bank for fuel efficiency and CO2 emissions. A key design feature of the proposed system is to utilize the waste hot gas from the cement production facility to generate power via cogeneration.

3.2.4 Process Options:

3.2.4.1 Design of Grinding Mill(s): The grinding efficiency of a ball mill is only half as efficient as a vertical roller mill, therefore, for this project, CJL has chosen vertical roller mills for the following process options:

3.2.4.1.1 Finish Grinding: Three (3) ball mills for finish grinding were originally chosen based on the simplicity of design and operation, with consideration given to the skill level for local operators. However, ball mills result in significantly higher specific power consumption (minimum power savings 10 kWh/ton of cement). In addition, the noise level of a vertical roller mill is significantly lower than that of a ball mill. Therefore, the three (3) ball mills have been replaced with one (1) roller mill for an efficient operation and lower environment impact.

3.2.4.1.2 Raw Grinding: Modern raw grinding systems employ vertical roller mills almost exclusively over ball mill systems nowadays. This is because is because of the ability of a vertical roller mill to grind, dry, and classify - all in one compact machine for simplicity of layout and construction cost savings. Jamaica has a tropical climate with periods of high rainfall; therefore, the raw materials will likely have high moisture content during these periods of time. Not only will this create problems for being able to dry the raw materials in a ball mill system, but here again, a minimum power savings of 3 kWh/ton raw meal can be realized by choosing one (1) vertical roller mill over one or more ball mills. Another consideration is the use of a high pressure roller press for raw grinding for improved power savings over ball mill systems and similar power consumption to vertical roller mills. However, the use of a high pressure roller press is only possible when the raw materials are very dry. This will not be the case because Jamaica is a tropical environment. Therefore, the use of high pressure roller press for this project was dismissed early.

3.2.4.1.3 Solid Fuel Grinding: The solid fuel grinding system sometimes lends itself to favor ball mills over vertical roller mills in spite of the power savings (about 5 kWh/ton solid fuel). This is because capacity (tons per hour) is very small for the fuels in comparison to the finished cement. However, often times, solid fuels are also high in moisture content (>10% moisture) which favors the use of a vertical roller mills, again, because of the ability to grind, dry, and classify the product – all in one compact machine. Nevertheless, ball mills may be preferred in cases where the solid fuel has to be ground very fine. This is most common when the use of alternative fuels such as petroleum coke are considered because the volatile content of the fuel is very low and, therefore, the petroleum coke has to be ground very fine in order to promote complete combustion. Ultimately, vertical roller mill technology was chosen for the cement plant and ball mills were chosen for the power plant for this project.

3.2.5 Construction Technology Options: The proposed project site is exposed to three of the main natural hazards that affect Jamaica as elaborated below. The highest structure in the cement plant is the pre-heater tower at approximately 120 meters in height. In this respect, concrete construction will be applied in the foundation and lower level of the pre-heater tower. The middle and top levels of the pre-heater tower are expected to use structural steel. Alternatives, such as the use of fewer pre-heater stages, to lower the height of the structure would compromise, unfortunately, negatively impact the fuel efficiency of the plant and therefore the increase environmental emissions. Therefore, good engineering practices need to be implemented within the context of the preferred technology.

A thorough investigation of construction technology options will therefore depend on sound engineering design as well as field investigations (such as weather, climate, soil bearing capacity, the availability of construction materials locally and price, the availability of local lifting/crane equipment, and local labor skills). During the design phase, the EPC Contractor will choose the construction technology which best meets CJL's project schedule, safety, and quality as well as the economic benefit to the local community with due consideration to the following natural hazards:

3.2.5.1 Seismic Activity: Earthquake hazard zones for Jamaica were determined over the period from 1692 to the present time and shows that the Kingston area lies within the zone of highest probability of high intensity of earthquakes in Jamaica. Data from the Earthquake Unit at the University of the West Indies indicates that the Kingston area has an average exposure rate of 7 occurrences per century. With proper design, the threshold for damage can be increased for well-built structures. Alluvium and engineered soils that exist at the project site are highly susceptible to ground shaking and tend to amplify the effects of ground motion through earthquakes. To reduce the earthquake hazard, CJL's facility will be designed to withstand the ground motions expected. This will involve detailed site investigations and modeling.

3.2.5.2 Hurricanes: Hurricanes produce heavy rainfall, high winds, and storm surge, all of which have the potential to cause damage and dislocation at the Carib Cement plant. The high velocity winds can cause structural damage. This will be addressed by proper engineering design and implementation of a maintenance program by CJL.

3.2.5.3 Coastal Flooding: The site is susceptible to storm surge produced by hurricanes that have the potential to cause severe coastal erosion and inundation. Therefore, the engineering design of the drainage systems for the plant site and quarries is particularly important.

3.2.6 Country Options: CJL has concluded that Jamaica is the best available location in the Caribbean region for the presence of a new cement plant for the following reasons:

3.2.6.1 Jamaica's abundant natural resources, especially high quality and easily extractable limestone, make the island arguably the best location in Caribbean region for cement plants.

3.2.6.2 Jamaica currently only has one other cement manufacturing plant on the island.

3.2.6.3 Jamaica has good infrastructure conditions: there are good transport infrastructure facilities, such as, rail system, national highways, deep water sea ports, etc. It is, therefore, ideal for cement distribution.

3.2.6.4 As a former British colony, Jamaica is an English speaking country for ease of communications for CJL's Canadian parent company. In fact, owners of the Canadian parent company already have interests in Jamaica's cement wholesale business. Jamaica also has good legal systems, municipal administration systems, and a stable and healthy democratic government. Jamaica is home to the largest university in Caribbean area – West Indies University - which provides a good education and scientific research base for leveraging the required human resources to design, construct, and operate a modern cement plant.

3.2.6.5 Jamaica's government has an open mind to encourage foreign investment and has recently implemented economic policies to attract overseas capital for local economic development.

3.2.6.6 Jamaica is an island country and the third largest island in the West Indies.

3.2.6.7 Jamaica has a stable government, economy, and banking system.

3.2.6.8 Jamaica has a population of nearly 3 million persons.

3.2.6.9 Jamaica has good diplomatic and economic relationships with Caribbean countries and plays a leading role within the Caribbean Community.

3.2.6.10 Jamaica has a good industrial foundation as a result of the bauxite and alumina industries. Therefore, there are skillful technicians or workers trained in the mining and manufacturing industries who should be able to work in the cement manufacturing industry with adequate training.

4.0 TERMS OF REFERENCE

The National Environmental and Planning Agency (NEPA), as a part of its permitting process, requires that projects of this nature conduct an EIA of the proposed development. EnviroPlanners Limited was contracted by Cement Jamaica Limited to conduct the study in accordance with the terms of reference approved by NEPA. An application was submitted for a development permit to the NEPA. The application was accompanied by Project Information Form (PIF) and supporting documentation. NEPA responded to that application with a request that an Environmental Impact Assessment (EIA) be conducted on the proposed development, based on their review of the permit application. NEPA supplied Generic Terms of Reference and requested modification of these Terms of Reference (TOR) to be specific to the project. The modified Terms of Reference was submitted to NEPA for their approval and a successful response was received on January 7, 2010 as shown in ***APPENDIX 4***.

The Environmental Impact Assessment will provide a comprehensive evaluation of the site, in terms of predicted environmental impacts, needed mitigation strategies, potentially viable alternatives to the development proposed and all related legislation.

The following issues related to the specific project site will be identified and given special consideration:

4.1 Sites located within, adjacent to or in the vicinity of areas listed as protected (e.g. under the Wild Life Protection, Forest, Natural Resources Conservation Authority, Fishing Industry or Jamaica National Heritage Trust Acts or designated Ramsar Sites) or having protected species.

4.2 The main issue(s) to be considered are determined by the statutes of the legislation or convention in question and what the convention speaks to.

4.3 The impact of the development on the specific sensitivities of the protected area will be identified and be highlighted as is applicable (e.g. diversion of water flows, extraction of water, pollution).

4.4 The Environmental Impact Assessment will include but not limited to the following:

4.4.1 Provide a comprehensive description of the existing site proposed for mining operations and for the establishment of the Cement Plant. Detail the elements of the project, highlighting areas to be mined and the areas which are to be preserved in their existing state.

4.4.2 Identify the major environmental issues of concern through the presentation of baseline data which should include social and cultural considerations. Assess public perception of the proposed development.

4.4.3 Outline the Legislations and Regulations relevant to the project.

4.4.4 Predict the likely impacts of the development on the environment, including direct, indirect and cumulative impacts, and indicate their relative importance to the design of the development's facilities.

4.4.5 Identify mitigation action to be taken to minimize adverse impacts and quantify associated costs.

4.4.6 Design a Monitoring Plan which should ensure that the mitigation plan is adhered to.

4.4.7 Describe the alternatives to the project that could be considered at that site.

4.5 EnviroPlanners Limited will ensure that a thorough and comprehensive environmental impact is carried out by executing the following tasks:

4.5.1 Task #1: Description of the Project:

4.5.1.1 Provide a comprehensive description of the project, noting areas proposed for mining operations, mineral processing and construction of the Cement Plant. Detail the elements of the project, highlighting areas to be reserved for construction, areas to be preserved in their existing state as well as activities and features which will introduce risks or generate impact (negative and positive) on the environment. This will involve the use of maps, site plans, aerial photographs and other graphic aids and images, as appropriate, and include information on location, general layout and size, as well as pre-construction, construction, and post construction plans. All phases be clearly defined, the relevant time schedules provided and phased maps, diagrams and appropriate visual aids. A review of the impacts caused by operation will be done.

4.5.2 Task #2: Description of the Environment:

4.5.2.1 This task involves the generation of baseline data which is used to describe the study area as follows:

4.5.2.1.1 Physical environment;

4.5.2.1.2 Biological environment;
4.5.2.1.3 Socio-economic and cultural constraints.

4.5.2.2 The methodologies employed to obtain baseline and other data will be clearly detailed.

4.5.2.3 Baseline data will include:

4.5.2.3.1 Physical:

4.5.2.3.1.1 A detailed description of the existing geology, geomorphology, topography and hydrology of the quarry and cement plant sites. Special emphasis will be placed on storm water run-off, drainage patterns, effect on groundwater and availability of potable water. Any slope stability issues that could arise will be thoroughly explored and mitigation measures identified;

4.5.2.3.1.2 Water quality of any existing wells, rivers, ponds, streams or coastal waters in the vicinity of mining activities and the proposed cement plant. Quality Indicators will include but not necessarily be limited to nitrates, phosphates, faecal coliform, and suspended solids;

4.5.2.3.1.3 Climatic and Airshed conditions (air quality studies) in the area of influence, including particulate emissions from stationary or mobile sources, NOx, SOx, wind speed and direction, precipitation, relative humidity and ambient temperatures;

4.5.2.3.1.4 Noise levels of undeveloped site and the ambient noise in the area of influence;

4.5.2.3.1.5 Obvious sources of pollution existing and extent of contamination.

4.5.2.3.1.6 Availability of solid waste management facilities.

4.5.2.3.2 Biological:

4.5.2.3.1.1 Present a detailed description of the flora and fauna (terrestrial and aquatic) of the areas, with special emphasis on rare, endemic, protected or endangered species.

4.5.2.3.1.2 Migratory species will also be considered.

4.5.2.3.1.3 There may be the need to incorporate micro-organisms and the existence of micro-habitats to obtain an accurate baseline assessment.

4.5.2.3.1.4 Species dependence, niche specificity, community structure, population dynamics, carrying capacity, species richness and evenness (a measure of diversity) will to be evaluated.

4.5.2.3.3 Socio-economic & cultural:

4.5.2.3.3.1 Present and projected population; present and proposed land use; planned development activities, issues relating to squatting and relocation, community structure, employment, distribution of income, goods and services, recreation, public health and safety; cultural peculiarities, aspirations and attitudes will be explored. The historical importance of the area will also be examined. While this analysis is being conducted, an assessment of public perception of the proposed development will be conducted. This assessment may vary with community structure and may take multiple forms such as public meetings or questionnaires.

4.5.3 Task #3: Legislative & Regulatory Considerations:

4.5.3.1 Outline the pertinent regulations, policies and standards governing environmental quality, safety and health, protection of sensitive areas, protection of endangered species, siting and land use control at the national and local levels.

4.5.3.1 The examination of the legislation will include at minimum, legislation such as the NRCA Act, the Wildlife Protection Act, The Mining Act, legislation from the Solid Waste Management Authority (SWMA), and the appropriate international convention/protocol/treaty where applicable.

4.5.4 Task #4: Identification of Potential Impacts:

4.5.4.1 Identify the major environmental and public health issues of concern and indicate their relative importance to the design of the project and the intended activities.

4.5.4.2 Identify potential impacts as they relate to, (but are not restricted by) the following:

4.5.4.2.1 Change in drainage pattern;
4.5.4.2.2 Flooding potential;
4.5.4.2.3 Landscape impacts of excavation and construction
4.5.4.2.4 Loss of natural features, habitats, niches and species by construction and operation;
4.5.4.2.5 Pollution of potable, coastal, surface and ground water;
4.5.4.2.6 Air pollution;
4.5.4.2.7 Socio-economic and cultural impacts;
4.5.4.2.8 Risk assessment;
4.5.4.2.9 Noise
4.5.4.2.10 Change in soil pH;
4.5.4.2.11 Waste disposal;
4.5.4.2.12 Possible improper or accidental waste disposal via discharge into sewers and water bodies, creation of mud lakes;
4.5.4.2.13 Capacity and design parameters of waste treatment facility;
4.5.4.2.14 Impact of leachate.

4.5.4.3 Distinguish between significant positive and negative impacts, direct and indirect, long term and immediate impacts.

4.5.4.4 Identify avoidable as well as irreversible impacts.

4.5.4.5 Characterize the extent and quality of the available data, explaining significant information deficiencies and any uncertainties associated with the predictions of impacts.

4.5.4.6 A major environmental issue is determined after examining the impact (positive and negative) on the environment and having the negative impact significantly outweigh the positive.

4.5.4.7 It is also determined by the number and magnitude of mitigation strategies which need to be employed to reduce the risk(s) introduced to the environment.

4.5.4.8 Project activities and impacts will be represented in matrix form with separate matrices for pre and post mitigation scenarios.

4.5.5 Task #5: Mitigation Measures:

4.3.5.1 Prepare guidelines for avoiding, as far as possible, any adverse impacts due to proposed usage of the site and utilizing of existing environmental attributes for optimum development.

4.3.5.2 Quantify and assign financial and economic values to mitigating methods.

4.5.6 Task #6 Monitoring:

4.5.6.1 Design a plan to monitor implementation of mitigatory or compensatory measures and project impacts during construction and operation.

4.5.6.2 An Environmental Management Plan for the long term operations of the site will also be prepared.

4.5.6.3 An outline monitoring program should be included in the EIA, and a detailed version submitted to NEPA for approval after the granting of the permit and prior to the commencement of the development. At the minimum the monitoring program and report will include:

4.5.6.3.1 Introduction outlining the need for a monitoring programme and the relevant specific provisions of the permit license(s) granted.

4.5.6.3.2 The activity being monitored and the parameters chosen to effectively carry out the exercise.

4.5.6.3.3 The methodology to be employed and the frequency of monitoring.

4.5.6.3.4 The sites being monitored. These may, in instances, be pre-determined by the local authority and should incorporate a control site where no impact from the development is expected.

4.5.6.3.5 Frequency of reporting to NEPA:
The Monitoring report will also include, at minimum:

4.5.6.3.5.1 Raw data collected. Tables and graphs are to be used where appropriate.
4.5.6.3.5.2 Discussion of results with respect to the development in progress, highlighting any parameter(s) which exceeds the expected standard(s).
4.5.6.3.5.3 Recommendations/
4.5.6.3.5.4 Appendices of data and photographs if necessary.

4.5.7 Task #7 Project Alternatives:

4.5.7.1 Examine alternatives to the project including the no-action alternative.

4.5.7.2 This examination of project alternatives will incorporate the use history of the overall area in which the site is located and previous uses of the site itself. Refer to NEPA guidelines for EIA preparation.

4.5.7.3 All Findings will be presented in the EIA report and will reflect the headings in the body of the TORs, as well as references. Eight hard copies and an electronic copy of the report will be submitted. The report will include an appendix with items such as maps, site plans, the study team, photographs, and other relevant information.

4.6 Other pertinent and specific information to be covered/included in the EIA:
In addition to the above the following information will be included in the Environmental Impact Assessment Study:

4.6.1 Revised maps showing the areas proposed for quarry operation and the construction of the cement plant with the relevant setback from adjoining proposed residential and residential areas.

4.6.2 A Species Management Plan to reflect the temporary handling of any endangered or endemic species identified during the study.

4.6.3 An Archaeological study/assessment of the Rose Hall Quarry site.

4.6.4 Public Health and safety concerns for the quarry and cement plant- (Health Impact Study) facilities on the adjoining communities.

4.6.5 Preparation of a cumulative impact report of the new developments on the existing environment.

4.6.6 Provision of a conceptual reclamation and restoration plan for both facilities especially for the new quarry.

4.6.7 Development of a closure plan for both facilities.

4.6.8 Statements on Energy Conservation should be incorporated.

4.6.9 Quarry Restoration and After Care Analysis.

4.6.10 Outline of the transportation corridor for the conveyor belt and any other means of transportation of aggregates and finish products.

4.6.11 Traffic Studies for both facilities.

4.6.12 The disposal and management of solid, liquid and any hazardous waste during the construction and operational phases.

5.0 INSTITUTIONAL AND LEGAL FRAMEWORK (REGULATORY REQUIREMENTS)

The parent company of Cement Jamaica Limited (CJL) is committed to design and operate the proposed development to the same standard as its industrial developments in other parts of the world, such as North America. CJL is also committed to comply with all applicable legal and regulatory requirements that obtain in Jamaica. This commitment also applies to the EPC Contractor. The design and operational criteria for the facility have been based upon guidance provided by various Jamaican authorities, legislative and regulatory considerations identified below, and the Inter-American Development Bank.

The following legislation and regulations are pertinent to the proposed construction, operation, and decommissioning of the cement plant and its associated quarries. In each case, comments are made with respect to the project.

5.1 **IDB/IFC/World Bank Guidelines**:

5.1.1 International Finance Corporation (IFC, World Bank Group) Environmental, Health, and Safety Guidelines for Cement and Lime Manufacturing

The Environmental, Health, and Safety (EHS) Guidelines issued by IFC are technical reference documents with general and industry-specific examples of "Good International Industry Practice" (GIIP). When one or more members of the World Bank Group are involved in a project, these EHS Guidelines are applied.

As shown in ***TABLE 5.1.1 and TABLE 5.1.2,*** Cement Jamaica Limited (CJL) has voluntarily agreed to apply IFC Guidelines to *particulate emissions and noise emissions* for this project – even though they are not specifically required by NEPA. In fact, CJL agrees to apply either the IFC or NEPA Guidelines, whichever is more stringent.

TABLE 5.1.1*: CEMENT JAMAICA LIMITED's PROPOSED PLANT PARTICULATE EMISSIONS COMPARED TO IFC GUIDELINES*

Dust Collector	IFC Guideline	Supplier's Value
Main Dust Collector	<30 mg/Nm^3, dry basis	<30 mg/Nm^3, dry basis
• (m^3/min)/m^2		• 1.1 m^3/min/m^2
• Design inlet temperature, °C		• 90 – 110 °C
• Peak (5 minute) inlet temperature limit, °C		• 220 °C
Clinker Cooler Dust Collector	<30 mg/Nm^3, dry basis	<30 mg/Nm^3, dry basis
Cement Mill Dust Collector	<30 mg/Nm^3, dry basis	<30 mg/Nm^3, dry basis
Coal Mill Dust Collector	<30 mg/Nm^3, dry basis	<30 mg/Nm^3, dry basis
All Nuisance/Fugitive Dust Collectors	<30 mg/Nm^3, dry basis	<30 mg/Nm^3, dry basis

TABLE 5.1.2: *IFC STANDARDS FOR NOISE EMISSIONS*
(NEPA's guidelines for daytime perimeter noise are 75 decibels and 70 decibels for nighttime noise):

IFC Guideline	Supplier's Value
Maximum 60 dBA at any point from Outside Plant Fence	Maximum 60 dBA at any point from Outside Plant Fence
Maximum 85 dBA from Distance of 1.0 m from any mechanical equipment, except blower	Maximum 85 dBA from Distance of 1.0 m from any mechanical equipment, except blower and ball mill
Maximum 90 dBA from Distance of 1.0 m for Blowers	Maximum 90 dBA from Distance of 1.0 m for Blowers and ball mill
Maximum 90 dBA from Distance of 1.0 m for all Motors > 150 Kw	Maximum 90 dBA from Distance of 1.0 m for all Motors > 150 kW

5.1.2 Document of the Inter-American Development Bank - Cement Manufacturing Plants Guidelines

(An Approach to Reconciling the Financing of Cement Manufacturing Plants with Climate Change Objectives, March 10, 2010)

As shown in ***TABLE 5.1.3***, Cement Jamaica Limited (CJL) has also voluntarily agreed to apply IFC Guidelines to *gaseous emissions* for this project – even though they are not specifically required by NEPA. Cement plants are a significant source of CO_2 emissions, both due to fuel combustion and the decarbonization of limestone. The primary technique to be used by the EPC Contractor for prevention and control of CO_2 emissions is process selection and operation to promote energy efficiency (i.e. 5-stage pre-heater with calciner and high-efficiency clinker cooler). In addition, the EPC Contractor will give due consideration to meet IFC Guidelines for nitrogen oxide (NOx) emissions which are generated in the high temperature combustion processes of the cement kiln and calciner.

TABLE 5.1.3*: CEMENT JAMAICA LIMITED's PROPOSED PLANT GASEOUS EMISSIONS COMPARED TO IFC GUIDELINES*

Pollutant	IFC Guidelines (mg/Nm^3, dry at 10% O_2)	Supplier's Value (mg/Nm^3, dry at 10% O_2)
NOx	<500	<500
SO_2	<400	<400
THC	<10	<10
Hg	<0.05	<0.05
HCl	<10	<10
HF	<1	<1
CO_2	**<820 kg/ton clinker**	**<820 kg/ton clinker**
Dioxin/Furan	<0.1 TEQ	<0.1 TEQ
Cadmium + Thallium	<0.05	<0.05
Total Metals (Total of Arsenic, Lead, Cobalt, Chromium, Copper, Manganese, Nickel, Vanadium, and Antimony)	<0.5	<0.5

5.1.3 Document of the Inter-American Development Bank – Coal Fired Power Plants Guidelines

(An Approach to Reconciling the Financing of Coal-Fired Power Plants with Climate Change Objectives, July 10, 2009)

Coal is the least expensive, most abundant fossil fuel source for electric generation. However, coal-fired power plants produce a series of pollutants and other environmental impacts derived from the combustion of the coal. Based on technological developments over the last decades (which have led to cleaner coal technologies), IDB has agreed to support those coal-fired power plants in Latin America and the Caribbean (LAC) Region that are designed to meet minimum performance criteria in terms of efficiency and GHG emissions intensity, provided they also use the best appropriate available technology (e.g. the use of supercritical as opposed to subcritical technologies). Therefore, CJL and the EPC Contractor have agreed to use Super-Critical Technology for this project and to meet the minimum performance criteria shown presented in ***TABLE 5.1.4***:

TABLE 5.1.4*: CEMENT JAMAICA LIMITED's PROPOSED COAL-FIRED POWER PLANT MINIMUM PERFORMANCE CRITERIA*

Technology	IFC Guidelines Super-Critical Technology	Supplier's Value Super-Critical Technology
Net Plant Higher Heat Value (HHV) Efficiency (%) (Bituminous coal)	>38.3	>38.3
Net CO_2 Emissions Intensity (kg CO_2/net MWh)	<832	<832

5.2 National Legislation of Jamaica – Physical Environment

5.2.1 National resources Conservation Authority Act (1991)

The Natural Resources Conservation Authority Act was passed in the Jamaican Parliament in 1991 and provided the basis for the establishment of the Natural Resources Conservation Authority (NRCA) with primary responsibility for ensuring sustainable development in Jamaica through the protection and management of Jamaica's natural resources and control of pollution. Sections 9 and 10 of the NRCA Act stipulate that an Environmental Impact Assessment (EIA) is required for new projects and existing projects undergoing expansion. The body is also responsible for investigating the effect on the environment of any activity that may cause pollution or which involves waste management. Sections of the Act that relate specifically to pollution control state that:

5.2.1.1 No person shall discharge on or cause or permit the entry into waters, on the ground or into the ground, of any sewage or trade effluent or any poisonous noxious or polluting matter.

5.2.1.2 No person is allowed to construct or reconstruct or alter any works designed for the discharge of any effluent.

5.2.2 The Act also empowers the authority to require of any owner or operator of pollution control facility information on the performance of the facility, the quantity and condition of effluent discharged, and the area affected by the discharge of such effluent. The Authority has the right to consult with any agency or department of Government having functions in relation to water or water resources to carry out operations to:

5.2.2.1 Prevent pollutants from reaching water bodies.

5.2.2.2 Remove and dispose of any polluting matter or remedy or mitigate any polluted water body in order to restore it.

5.2.2 Environment Review and Permitting Process (1997)

The Environmental Permit and License System (P&L), introduced in 1997, is a mechanism to ensure that all developments in Jamaica meet required standards in order to minimize negative environmental impacts. The P&L System is administered by NEPA, through the Applications Section (formerly the Permit and License Secretariat). Permits are required by persons undertaking new development which fall within a prescribed category. Under the NRCA Act of 1991, the NRCA is authorized to issue, suspend and revoke permits and licences if facilities are not in compliance with the environmental standards and conditions of approval stipulated. An applicant for a Permit or License must complete an application form as well as a Project Information Form (PIF) for submission to the NRCA.

5.2.3 Wildlife Protection Act (1945)

The Wildlife Protection Act of 1945 prohibits removal, sale or possession of protected animals, use of dynamite, poisons or other noxious material to kill or injure fish, prohibits discharge of trade effluent or industrial waste into harbors, lagoons, estuaries and streams, and authorizes the establishment of Game Sanctuaries and Reserves. Protected under the Wildlife Protection Act are six species of sea turtle, one land mammal, one

butterfly, three reptiles and several species of birds including rare and endangered species and game birds.

5.2.4The Endangered Species (Protection, Conservation and Regulation of Trade) Act (2000)

This Act deals with restriction on trade in endangered species, regulation of trade in species specified in the schedule, suspension and revocation of permits or certificates, offences and penalties, and enforcement. Many species of reptile, amphibian and birds that are endemic to Jamaica but not previously listed under national protective legislation, or under international legislation, are listed in the Appendices of this Act.

5.2.5 The National Resources (Prescribed Areas) Prohibition of Categories of Enterprise, Construction and Development) Order (1996)

The island of Jamaica and the Territorial Sea of Jamaica have been declared a Prescribed Area. No person can undertake any enterprise, construction or development of a prescribed description or category except under and in accordance with a permit. The Natural Resources Conservation (Permits and Licenses) Regulations (1996) give effect to the provisions of the Prescribed Areas Order.

5.2.6 Water Resources Act (1995)

The Water Resources Act of 1995 established the Water Resources Authority (WRA). This Authority is authorized to regulate, allocate, conserve and manage the water resources of the island. The Authority is also responsible for water quality control and is required under Section 4 of the Act to provide upon request to any department or agency of Government, technical assistance for any projects, programmes or activities relating to development, conservation and the use of water resources.

It is the responsibility of the WRA as outlined in Section 16 to prepare, for the approval of the Minister, a draft National Water Resources Master Plan for Jamaica. Areas to be covered in this Draft Master Plan of 1990 included objectives for the development, conservation and use of water resources in Jamaica with consideration being given to the protection and encouragement of economic activity, and the protection of the environment and the enhancement of environmental values.

Section 25 advises that the proposed user will still have to obtain planning permission, if this is a requirement, under the Town and Country Planning Act. In addition, Section 21 of the Act stipulates that if the water to be used will result in the discharge of effluents, an application for a license to discharge effluents will have to be made to the Natural Resources Conservation Authority or any other relevant body as indicated by the Minister.

With regard to underground water, Section 37 states that it is unlawful to allow this water to go to waste. However, if the underground water "interferes or threatens to interfere with the execution or operation of any underground works", it will not be unlawful to allow the water to go to waste in order to carry out the required works provided that there is no other reasonable method of disposing of the water. The Authority also has the power to determine the safe yield of aquifers (Section 38).

5.2.7 Country Fires Act (1942)

Section 4 of the Country Fires Act of 1942 prohibits the setting of fire to trash without prior notice being given to the nearest police station and the occupiers of all adjoining lands. In addition, a space of at least fifteen feet in width must be cleared around all trash to be burnt and all inflammable material removed from the area. Section 6 of the Act empowers the Minister to prohibit, as may be necessary, the setting of fire to trash without a permit.

5.2.7.1 Offences against this Act include:

5.2.7.1.1 Setting fire to trash between the hours of 6.00 p.m. and 6.00 a.m. (Section 5a);

5.2.7.1.2 Leaving open-air fires unattended before they have been completely extinguished (Section 5b);

5.2.7.1.3 Setting fires without a permit and contrary to the provisions outlined in Section 6 (Section 8);

5.2.7.1.4 Negligent use or management of a fire which could result in damage to property (Section 13a);

5.2.7.1.5 Smoking a pipe, cigar or cigarette on the grounds of a plantation which could result in damage to property (Section 13b).

5.2.7.2 Vegetation clearance will be required but no burning is anticipated to facilitate this; however, the Developer should note the legal requirements for burning of vegetation.

5.2.8 Quarries Contract Act (1983)

The Quarries Control Act of 1983 established the Quarries Advisory Committee, which advises the Minister on general policy relating to quarries as well as on applications for licenses. The Act provides for the establishment of quarry zones, and controls licensing and operations of all quarries. The Minister may on the recommendation of the Quarries Advisory Committee declare as a specified area any area, in which quarry zones are to be established and establish quarry zones within any such specified area.

Section 5 of the Act states that a license is required for establishing or operating a quarry though this requirement may be waived by the Minister if the mineral to be extracted is less than 100 cubic metres. Application procedures are outlined in Section 8. The prescribed form is to be filed with the Minister along with the prescribed fee and relevant particulars. The applicant is also required to place a notice in a prominent place at the proposed site for a period of at least 21 days starting from the date on which it was filed.

CJL will apply for and obtain the necessary permits and/or licenses for any and all quarries used to provide material for this project.

5.2.9 The Pesticides (Amendment) Act (1996)

The Pesticides (Amendment) Act of 1996 amended sections of the principal act, which came into effect in 1975 and established the Pesticides Control Authority. This Act gives the Authority the responsibility of controlling the importation, manufacture, packaging, sale, use and disposal of pesticides. Section 11 states that the Authority is required to keep a register or record of all relevant information such as registered pesticides, restricted pesticides, pest control operators and persons licensed to import or manufacture pesticides. Under Section 16 of the Act, the Authority may also, with the approval of the Minister, make regulations which relate to areas such as:

5.2.9.1 Aerial application of pesticides;
5.2.9.2 Supervision required for the use of pesticides, the prescribed protective clothing to be worn and other precautionary measures;
5.2.9.3 The permissible levels of pesticides to be used;

5.2.9.4 The periods during which particular pesticides may or may not be used on certain agricultural crops;
5.2.9.5 The disposal of pesticides and packages.

5.2.10 Clean Air Act (1964)

This act refers to premises on which there are industrial works, the operation of which is in the opinion of an inspector likely to result in the discharge of smoke or fumes or gases or dust in the air. An inspector may enter any affected premise to examine, make enquiries, make tests and take samples of any substance, smoke, fumes, gas or dust as he considers necessary or proper for the performance of his duties.

CJL will ensure that all exhaust and emissions meet both the National Standards and IDB Standards.

Environmental issues: Environmental issues in cement manufacturing projects primarily include the following:

5.1.1.1 Air Emissions
5.1.1.2 Energy consumption and fuels
5.1.1.3 Wastewater
5.1.1.4 Solid waste generation
5.1.1.5 Noise

5.2.11 The Natural Resources Conservation Authority (Air Quality) Regulations, 2002

Part I of this Act stipulates license requirements and states that every owner of a major facility or a significant facility shall apply for an air pollutant discharge license. Part II speaks to the stack emission targets, standards and guidelines.

The Act states that no person shall emit or cause to be emitted from any air pollutant source at a new facility, any visible air pollutants the opacity or pollutant amount of which exceeds the standards.

Every owner of a facility with one or more air pollutant source or activity shall employ such control measures and operating procedures as are necessary to minimize fugitive emissions into the atmosphere and such owner shall use available practical methods which are technologically feasible and economically reasonable and which reduce, prevent or control fugitive emissions so as to facilitate the achievement of the maximum practical degree of air purity.

Under this Act, a "major facility" is described as any facility having an air pollutant source with the potential to emit:

5.211.1 One hundred or more metric tons/year of any one of total suspended particulate matter (TSP);

5.2.11.2 Particulate matter with a diameter less than ten micrometres (PM10);

5.2.11.3 Sulphur oxides measured as sulphur dioxide (SO_2);

5.2.11.4 Carbon monoxide (CO);

5.2.11.5 Nitrogen oxides (NOx) measured as equivalent nitrogen dioxide;

5.2.11.6 Five or more tons/year lead;

5.2.11.7 Ten or more tons per year of any single priority air pollutant; or

5.2.11.8 Twenty-five or more metric tons per year of any combination of priority air pollutants;

The stack emission standards specified in the Twelfth Schedule shall apply to all new facilities with air pollutant sources.

Emissions from the Cement Plant will have the potential to influence ambient air quality. The accumulated impact of emissions from the Cement Plant and the other major contributors to the airshed may impact air quality in the airshed. These impacts will be influenced by meteorological conditions (precipitation, wind direction and speed, etc). The regulations define primary and secondary ambient air quality standards. The standards for those pollutants of particular relevance to the operations at the Cement Plant are shown in ***TABLE 5.2****.*

TABLE 5.2*: NEPA STANDARDS FOR AIR POLLUTANTS*

Pollutant	**Averaging Time**	**NEPA Standards** ($\mu g/m^3$)	
Total Suspended Particulates	Annual	60	
	24 Hour	150	
PM10: diameter <10 micrometer	Annual	50	
	24 Hour	150	
Sulfur Dioxide	Type	Primary	Secondary
	Annual	80	60
	24 Hour	365	280
	1 Hour	700	-
Carbon Monoxide	8 Hour	10,000	
	1 Hour	40,000	
Nitrogen Dioxide	Annual	100	

5.2.12 Noise Standards

Jamaica has no national legislation for noise, but World Bank guidelines have been adopted by the National Environment and Planning Agency (NEPA), and are used for benchmarking purposes along with the draft National Noise Standard that is being prepared. The guidelines for daytime perimeter noise are 75 decibels and 70 decibels for nighttime noise.

5.2.13 Trade Effluent and Sewage Regulations (1996) (Draft)

Jamaica has draft regulations governing the quality of the effluent discharged from facilities to public sewers and surface water systems. These draft regulations were gazetted sometime in 2006. The draft guidelines require the facility to meet certain basic water quality standards for trade effluent including sewage. The requisite permits and licenses are required to install and operate sewage treatment facilities.

5.2.13.1 The project site contains several streams and is adjacent to a gully. During the construction and operation phases the integrity of the water quality in these systems should not be compromised.

5.2.13.2 **Cement *Jamaica Ltd. will apply for a permit to construct a sewage treatment facility and a license to discharge sewage effluent. The proposed sewage treatment facility will be designed to meet NEPA standards for effluent discharge.***

TABLE 14**:** *NEPA GUIDELINESS FOR EFFLUENT STANDARDS*

TABLE 14-A: *Immediate Technology Based Effluent Standards - Existing Plants*

Parameter	Effluent Standard
BOD5	20 mg/l
TSS	30 mg/l
Nitrates (as Nitrogen)	30 mg/l
Phosphates	10 mg/l
COD	100 mg/l
Ph	6-9
Fecal Coliform	1000 MPN/100 ml
Residual Chlorine	1.5 mg/l

TABLE 14-B: *Proposed Sewage Effluent Standards - New Plants*

Parameter	Effluent Standard
Biochemical Oxygen Demand (BOD)	20 mg/l
TSS	20 mg/l
Nitrates (as Nitrogen)	10 mg/l
Phosphates	4 mg/l
Chemical Oxygen Demand (COD)	100 mg/l
pH	6-9
Fecal Coliform	1000 MPN/100 ml
Residual Chlorine	1.5 mg/l

5.2.14 Watershed Protection Act (1963)

This Act provides for the protection of watersheds and areas adjoining watersheds and promotes the conservation of water resources. The entire island however is considered to be one watershed, but for management purposes is divided into smaller units. There are 26 watershed management units declared under the Act. The Act makes provision for conservation of watersheds through the implementation of provisional improvement schemes whereby soil conservation practices are carried out on land. No regulations have ever been prepared under this Act and therefore voluntary compliance and training have been the only measures available to ensure appropriate management practices in watersheds in Jamaica.

5.3 National Legislation of Jamaica – Social Environment

5.3.1 Town and Country Planning Act (1958)

Section 5 of the Town and Country Planning Act authorizes the Town and Country Planning Authority to prepare, after consultation with any local authority, the provisional development orders required for any land in the urban or rural areas, so as to control the development of land in the prescribed area. In this manner, the Authority will be able to coordinate the development of roads and public services and conserve and develop the resources in the area. Any person may, under Section 6 of the Act, object to any development order on the grounds that it is:

5.3.1.1 Impractical and unnecessary;

5.3.1.2 Against the interests of the economic welfare of the locality.

However, if the Minister is satisfied that the implementation of the provisional development order is likely to be in the public interest, he may, under Section 7 (2) of the Act, confirm it with or without

modification by publishing a notice in the Gazette. Section 8 of the Act also gives the Minister the authority to amend a confirmed development order. Section 10 of the Act states that a development order must include:

5.3.1.3 Clearly defined details of the area to be developed;

5.3.1.4 Regulations regarding the development of the land in the area specified;

5.3.1.5 Formal granting of permission for the development of land in the area.

If the provisions of section 9A of the Natural Resources Conservation Authority (NRCA) Act apply to the development, the application can only be approved by the Planning Authority after the NRCA has granted a permit for the development (Section 11 (1A)). The Authority may impose a "tree preservation order" under Section 25 of the Act if it considers it important to make provision for the preservation of trees and woodlands in the area of the development.

This order may:

5.3.1.6 Prohibit the cutting down, topping, lopping or willful destruction of trees;

5.3.1.7 Secure the replanting of any section of the woodland area in which trees were felled during the forestry operations permitted under the order.

The tree preservation order is not applicable to the cutting down of trees which were already dead, dying or had become dangerous and the order can take effect only after it has been confirmed by the Minister.

The Minister can, under Section 26 of the Act, make regulations to restrict and regulate the display of advertisements in any area to be developed if he considers this to be in the interest of public safety. Section 28 of the Act empowers the local authority to require the owner or occupier of land in the development area to take the steps necessary to ensure its proper maintenance.

5.3.2 Land Development and utilization Act (1996)

Under Section 3 of the Land Development and Utilization Act (1966), the Land Development and Utilization Commission is authorized to designate as agricultural land, any land which because of its "situation, character and other relevant circumstances" should be brought into use for agriculture. However, this order is not applicable to land, which has been approved

under the Town and Country Planning Act for development purposes other than that of agriculture. Among the duties of the Commission outlined in Section 14 of the Act is its responsibility to ensure that agricultural land is "as far as possible, properly developed and utilized".

The proposed cement plant site is zoned for industrial development.

5.3.3 Public Health Act (1976)

The Public Health (Air, Soil and Water Pollution) Regulations 1976, aim at controlling, reducing, removing or preventing air, soil and water pollution in all possible forms. Under the regulations given:

5.3.3.1 No individual or corporation is allowed to emit, deposit, issue or discharge into the environment from any source.

5.3.3.2 Whoever is responsible for the accidental presence in the environment of a contaminant must advise the Environmental Control Division of the Ministry of Health and Environmental Control, without delay.

5.3.3.3 Any person or organization that conducts activities which release air contaminants such as dust and other particulates is required to institute measures to reduce or eliminate the presence of such contaminants.

5.3.3.4 No industrial waste should be discharged into any water body which will result in the deterioration of the quality of the water.

5.3.4 The National Solid Waste Management Authority Act (2001)

The National Solid Waste Management Authority Act (2001) is “an act to provide for the regulation and management of solid waste; to establish a body to be called the National Solid Waste Management Authority and for matters connected therewith or incidental thereto”. The Solid Waste Management Authority (SWMA) is to take all steps as necessary for the effective management of solid waste in Jamaica in order to safeguard public health, ensure that waste is collected, sorted, transported, recycled, reused or disposed of, in an environmentally sound manner and to promote safety standards in relation to such waste. The SWMA also has responsibility for the promotion of public awareness of the importance of efficient solid waste management, to advise the Minister on matters of general policy and to perform other functions pertaining to solid waste management.

Solid waste management will be generated during both the construction and operation phases of the cement plant and will require the removal and

proper disposal of vegetative matter, which is cleared for construction, construction rubble and operational wastes.

5.3.5 Jamaica National Heritage Trust Act (1985)

The Jamaica National Heritage Trust Act of 1985 established the Jamaica National Heritage Trust (JNHT). The Trust's functions outlined in Section 4 include the following responsibilities:

5.3.5.1 To promote the preservation of national monuments and anything designated as protected national heritage for the benefit of the Island;

5.3.5.2 To carry out such development as it considers necessary for the preservation of any national monument or anything designated as protected national heritage;

5.3.5.3 To record any precious objects or works of art to be preserved and to identify and record any species of botanical or animal life to be protected.

Section 17 further states that it is an offence for any individual to:

5.3.5.4 Willfully deface, damage or destroy any national monument or protected national heritage or to deface, damage, destroy, conceal or remove any mark affixed to a national monument or protected national heritage;

5.3.5.5 Alter any national monument or mark without the written permission of the Trust;

5.3.5.6 Remove or cause to be removed any national monument or protected national heritage to a place outside of Jamaica.

The JNHT has been written to advising them of the project and to determine if there are any known heritages or archaeological sites of interest within the project area. No written response was received, up to the time of the submission of this report.

5.3.6 Registration of Titles Act (1989)

The Registration of Titles Act of 1989 is the legal basis for land registration in Jamaica, which is carried out using a modified Torrens System (Centre for Property Studies, 1998). Under this system, land registration is not compulsory, although once a property is entered in the registry system the title is continued through any transfer of ownership.

5.3.7 The Factories Act (1973)

Under Section 4 of the Factories Act, the Minister may make regulations generally for giving effect to the purposes of this Act, and for the purposes of ensuring the safety, health and welfare of persons who are employed in any factory or in connection with machinery, and in particular, and without prejudice to the generality of the foregoing provisions, any such regulations may provide for:

5.3.7.1 The safe means of approach or access to, and exit from, any factory, or machinery;

5.3.7.2 The fencing and covering of all dangerous places or machines;

5.3.7.3 Life-saving and first aid appliances;

5.3.7.4 Securing safety in connection with all operations carried on in a factory;

5.3.7.5 Securing safety in connection with the use of all engines, machinery, and mechanical;

5.3.7.6 The proper ventilation of any factory, having regard to the nature of the process carried on therein;

5.3.7.7 The sanitation, including the provision of lavatory accommodation (having regard to the number of workers employed) at any factory;

5.3.7.8 The provision and maintenance of appropriate facilities for the welfare of persons employed at any factory.

In Section 5 of the Act the Chief Factory Inspector may enter upon the premises and inspect the factory and machinery, at *all* reasonable times by day and night, and take materials used or samples of the products *of* such factory.

Where any accident occurs in a factory which:

5.3.7.9 Causes loss of life to a person employed in that factory; or

5.3.7.10 Disables any such person for more than two days from earning full wages at the work at which he was employed, the manager of the factory or person having control of the machinery in such factory shall forthwith report the occurrence of such accident to the Chief Factory Inspector and in connection therewith he shall furnish such particulars as the Chief Factory Inspector in any case from time to time may require.

The provisions as laid out under the Factories Act will be relevant to the Cement Jamaica Ltd. and the establishment of the Cement Plant.

5.3.8 Jamaica's Energy Policy

The Jamaican economy is not well endowed with petroleum based energy resources and therefore, depends heavily on imports. The policy seeks to diversify Jamaica's energy base with the aim of ensuring adequate and secure energy supply for Jamaica. The Energy Policy addresses issues relating to energy sources such as petroleum, renewable and other fuels. In keeping with the Government of Jamaica's commitment to deregulate and liberalize the Jamaican economy, the involvement of the private sector on a competitive basis is chosen as the best way to modernize and expand the energy sector, so as to achieve the required growth in energy supplies and to improve efficiencies in energy production.

There are several objectives of the Energy Policy a few of which are to:

5.3.8.1 Diversify the energy base;

5.3.8.2 Encourage efficiency in energy production, conversion and use with the overall objectives of reducing the energy intensity of the economy;

5.3.8.3 Complement the country's Industrial Policy recognizing the importance of energy as a critical input to industrial growth and stability;

5.3.8.4 Minimize the adverse environmental effects and pollution caused by the production, storage, transport and use of energy, and minimize environmental degradation as a result of the use of fuel wood; and

5.3.8.5 Establish an appropriate regulatory framework to protect consumers, investors and the environment.

These objectives will be achieved by creating and enabling the environment to:

5.3.8.6 Encourage private sector participation and investments through a policy of divestment and an appropriate regulatory framework conducive to new investment;

5.3.8.7 Encourage energy conservation/efficiency on the supply side as well as demand side management;

5.3.8.8 Fully protect the environment while ensuring that adequate energy supplies are available to the country and to sustain the desired rate of economic growth.

The protection of the environment is a primary objective of this Energy Policy and therefore, the environmental guidelines of the Natural Resources Conservation Authority (NRCA) relating to the energy sector will be strictly enforced.

With the establishment of the Cement Plant, Cement Jamaica Ltd. will act in keeping with the provisions under the Energy Policy and will sell their excess power to JPS. The objectives under the policy including the encouragement of the private sector to participate in the provision of energy sources, the diversification of Jamaica's energy base and the protection of the environment are all applicable to this proposed project.

5.3.9 The Town and Country Planning (St. Catherine Coast) Provisional development Order, 1964

This order is to make provision for the orderly and progressive development of the southern part of the parish of St. Catherine excluding Spanish Town but including the areas to the east, south and southeast. This will also include the whole parish coast from the Kingston and St. Andrew Corporate Area Boundary on the east to the parish of Clarendon boundary on the west. No development will be permitted which would conflict with the proposals outlined in the Order. Land use proposals are not made for the whole of the area contained within the boundary of the Order. The areas are zoned for: urban development, roads, commercial areas, beaches, seaside parks, roadside parks, areas of natural beauty and historic interest, industrial area, amenity, zoning related to use classes, public services and miscellaneous.

5.3.10 South Coast Sustainable Development Master Plan

The Portland Bright Protection Area is a massive area, but the Government of Jamaica has zoned the edge for industrial development. The limestone quarry is outside the Portland Bight Protected Area. Jamalco Bauxite Plant, Old Harbour Bay Power Station, Port Esquivel Bauxite Port, JB Ethanol, JB Feed Mill, Windalco Port, and recent approval granted for LNG Facility (cooperative with Venezuela).

The South Coast Development Master Plan (SCSDMP), 1999 was developed to facilitate a planned approach to the expected growth in the tourism industry and to explore environmentally sustainable pathways to economic growth. The plan area

runs from the east of Hellshire in St Catherine to Little London in Westmoreland, extending approximately 11 kilometers inland and offshore to a depth of 20m.

The Plan aims to provide a framework for the management of the natural and man-made environment and to achieve orderly and sustainable development of the South Coast. It includes land use designation to promote: best use and sustainable development of natural resources; protection and conservation of the terrestrial and marine environment; conservation of the cultural heritage; community development and improved health conditions; and diversification of economic activities.

The SCSDMP identified projects and programs in each of the key development sectors for the South Coast. The projects aim to address critical infrastructure and human resources constraints, as well as to secure the environmental assets of the region and promote economic growth. The projects were evaluated taking into consideration economic, social and environmental criteria, as well as consistency with the concept of sustainable development and stakeholder support. Appropriate development of infrastructure is a prerequisite for economic growth and diversification.

The Plan envisages sustained development based on adding value to the natural and human resources of the region through the growth of community-based services. The high quality of coastal and upland landscapes; the rivers and groundwater resources; the prime agricultural land; extensive forests and wetlands; the beaches, reefs and fish nursery areas; and the distinctive cultural heritage of the region are the key environmental assets which will support sustainable growth. Building on these resources, strong protection and management of critical natural resources is at the core of the Plan's vision.

The project is consistent with the aims and objectives of bringing development to the Southern Region of Jamaica.

5.4 International Legislative and Regulatory Considerations

5.4.1 Cartagena Convention (Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region) (1983)

Adopted in March 1983 in Cartagena, Colombia, the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region, also known as the Cartagena Convention, is the only

legally binding environmental treaty for the Wider Caribbean. The Convention came into force in October 1996 as a legal instrument for the implementation of the Caribbean Action Plan and represents a commitment by the participating governments to protect, develop and manage their common waters individually and jointly.

Ratified by twenty countries, the Cartagena Convention is a framework agreement which sets out the political and legal foundations for actions to be developed. The operational Protocols, which direct these actions, are designed to address special issues and to initiate concrete actions. The Convention is currently supported by three Protocols.

These are:

5.4.1.1 *The Protocol Concerning Co-operation in Combating Oil Spills in the Wider Caribbean Region* (The Oil Spills Protocol), which was adopted and entered into force at the same time as the Cartagena Convention;

5.4.1.2 *The Protocol Concerning Specially Protected Areas and Wildlife in the Wider Caribbean Region* (The SPAW Protocol), which was adopted in two stages, the text in January, 1990 and its Annexes in June, 1991. The Protocol entered into force in 2000;

5.4.1.3 The *Protocol Concerning Pollution from Land-based Sources and Activities in the Wider Caribbean Region* (LBS Protocol), which was adopted in October, 1999.

5.4.2 Convention on Biological Diversity

The objectives of the Convention on Biological Diversity are "the conservation of biological diversity, sustainable use of its components and the fair equitable sharing of the benefits arising out of the utilization of genetic resources". This is the first global, comprehensive agreement which has as its focus all aspects of biological diversity: genetic resources, species and ecosystems. The Convention acknowledges that the "conservation of biological diversity is a common concern of humankind and an integral part of the development process". In order to achieve its goals, the signatories are required to:

5.4.2.1 Develop plans for protecting habitat and species.

5.4.2.2 Provide funds and technology to help developing countries provide protection.

5.4.2.3 Ensure commercial access to biological resources for development.

5.4.2.4 Share revenues fairly among source countries and developers.

5.4.2.5 Establish safe regulations and liability for risks associated with biotechnology development.

Jamaica's Green Paper Number 3/01, entitled *Towards a National Strategy and Action Plan on Biological Diversity in Jamaica*, speaks to Jamaica's continuing commitment to its obligations as a signatory to the Convention.

6.0 METHODOLOGY AND APPROACH

6.1 General Approach

A multi-disciplinary team of experienced scientists and environmental professionals was assembled to carry out the required resource assessment, generation and analysis of baseline data, determination of potential impacts and recommendation of mitigation measures. The members of the EIA Professional Team are given in ***APPENDIX 6***. An interactive approach among the environmental team members and other project professionals was adopted and was facilitated by team meetings as required. In cases where specific expertise was not available amount the team those activities were sub-contracted to identified experts, as was the case for the airshed modeling.

Baseline data for the study area was generated using a combination of Field studies; Analysis of maps, plans, aerial photos; Review of engineer's reports and drawings; Review of background project documents; Structured interviews; Social surveys; Internet searches; Agency requests and document searches. Written environmental searches were undertaken through the Water Resources Authority (WRA), National Water Commission (NWC) and the Office of Disaster Preparedness and Emergency Management (ODPEM). In addition website searches of the National Environment and Planning Agency (NEPA), Meteorological Service of Jamaica, and NWC were undertaken to obtain any further relevant information.

6.2 Physical Environment

6.2.1 Site and Situation

A definition of the study area was determined based on the drainage pattern into and out of the site, the area to be traversed by the conveyor and reconnaissance of the communities within a sphere of influence – two (5) kilometer radius. Baseline data collection on the study area was conducted and included climate, hydrology, geology, noise, air quality, traffic, topography, socioeconomic, flora and fauna.

All issues material to the site, such as rainfall, groundwater pollution incidents, flooding incidents, and other critical facilities were reviewed within a three (3) kilometer radius of the site. The available data that was referenced for this study is listed below:

6.2.1.1.1 Satellite Photographs taken from Google Earth's website;

6.3.1.1.2 The 1:12,500 topographic sheet published by the Jamaica Survey Department;

6.3.1.1.3 Water Resources Authority (WRA) Data Request – Old Harbour;

6.3.1.1.4 Hydro-stratigraphic Map of Old Harbour;

6.3.1.1.5 Office of the Disaster Preparedness and Emergency Management (ODPEM);

6.3.1.1.6 National Works Agency;

6.3.1.1.7 Jamaica Meteorological Office;

6.3.1.1.8 Internet searches of NEPA and other websites.

6.3.1.1.9 Previous environmental impact studies for projects within the general area.

Data was garnered from field, aerial photographs other relevant reports held within various governmental and non-governmental organizations. Implementation of the Terms of Reference (TOR) of this study involved execution of the following tasks:

6.3.1.1.10 Review of the Project Description to understand the nature and components of the structures and activities of the proposed development, as well as examination of the Terms of Reference (TOR) with a view to identifying those aspects of the Terms of Reference that were to be addressed by the Hydrology Component of the EIA;6.3.1.3.1.11 Collation of available maps, plans, reports and data of relevance to the project and their review by desk study to understand the hydrological framework and to guide field investigation of the development site and its environs;

6.3.1.3.1.12 Field reconnaissance of the development site and its environs to confirm the desk study interpretation and collect such additional data as was possible, including on-site discussions with the Project Engineer.

6.2.2 Climate

The climate information such as rainfall was obtained from the National Meteorological Services.

6.2.3 Hydrology

The hydrological assessment was made using a combination of data source and calculation models such as the WinTR-55; which is a single-event, rainfall-runoff small watershed hydrologic model. The model

generates hydrographs from both urban and agricultural areas and at selected points along the stream system. Rainfall Intensity values were obtained from the Jamaica Meteorological Office.

6.2.4 Geology, Topography

Data was generated from published geological information as well as assessment of the site through field visits, previous site reports and intrusive site reports done and is current public domain reports held within various governmental and non-governmental organizations.

6.2.5 Drainage

Data was collected, reviewed and analyzed to provide analysis of the change in drainage patterns, issues related to potential for ponding, and any history of flooding on the sites. This included:

6.2.5.1 Drainage for the sites during construction to include mitigation for sedimentation to the aquatic environment;

6.2.5.2 Drainage for the site during operation, to include mitigation for sedimentation to the aquatic environment and flooding incidences.

6.2.6 Storm Water Runoff

Data was collected, reviewed and analyzed to effect discussion of the proposed development's impact on runoff and the consequential flooding potential. Potential increases to flows and channel shifting as well as to the coastal environment were identified subject to the available data. Other effects of storm water, such as soil erosion especially during the quarrying activities will be discussed along with mitigation measures to reduce same.

6.2.7 Coastal and Marine Ecosystem

An assessment of the construction and operation activities as to their influence on the existing marine environment was made. Also based on prediction of increased runoff, the effects on the marine environment were examined.

6.2.8 Noise & Air Quality

The approach taken in determining existing condition on the site as it relates noise and air was to conduct a search for available historic data.

The search came up with no available data for that site. Therefore, measurements were made on site using standard calibrated instruments.

6.2.9 Solid Waste

The availability of appropriate and approved solid waste facilities was examined.

6.3 Biological Environment

The approach taken for the study was to do a detailed walk through of the project site to ensure a proper coverage of all possible Fauna. The proposed site for the cement plant is highly disturbed and would not likely support any significant fauna. The quarry site exhibit clear signs of significant disturbance, but for the most part has been re-colonized by secondary forest. Detailed notes and photographs were taken during the surveys, summarized as follows:

6.3.1 Terrestrial Flora

The proposed plant site is highly disturbed and does not exhibit a great deal of biodiversity. The sparse vegetation indicates that the site was cleared in the past and is only partially re-colonized by a few naturally occurring species. The southeastern section is currently used by small farmers for cash crop. A detailed walk through the site was done to determine the presence of any flora of significance.

The proposed quarry site comprises predominantly of dry limestone forest the majority of which has been exposed to major disturbance.

6.3.2 Terrestrial Fauna

A detailed walk through the sites was done to determine the presence of any fauna of significance. The non-existence of any significant fauna on the plant site was as expected given the absence of any significant vegetation makes the site undesirable as an habitat for fauna. The quarry site had reasonable amounts of reptiles, butterflies and birds.

6.4 Socio-Economic & Cultural Environment

To determine the cultural and social factors associated with the construction and operation of the proposed limestone quarry and cement plant, members of the communities in the general vicinity of the project were interviewed and a review of economic and social literature was conducted. These were undertaken to ascertain information to satisfy the following factors as outlined in the approved terms of reference provided by NEPA:

6.4.1 Present and projected population;
6.4.2 Present and proposed land use;
6.4.3 Planned developmental activities;
6.4.4 Issues relating to squatting and relocation;
6.4.5 Community structure, employment and imcome;
6.4.6 Aspiration and attitude;
6. 4.7 Access to, and delivery of health, education and social services;
6.4.8 Recreation;
6.4.9 Public health and safety;
6.4.10 Historical importance of the area;
6.4.11 Public Perception;
6.4.12 Project awareness and acceptance

6.5 Manmade & Other Hazards

A review of all historical data available relating to hazards associated with projects of this nature, both locally and abroad was made. Incidences that may be peculiar to the project site were also researched. Consideration was given to possible occurrences both during the construction and the operation phases.

6.6 Traffic Assessment

The physical situation associated with the movement of traffic in the vicinity of the project site was observed and noted, along with the road conditions in the area. The volume and type of vehicular traffic traversing the roads adjacent to the site was measured. The data gathered was used to estimate the impacts together with any issues associated with the traffic locations.

7.0 CONDITION OF THE EXISTING ENVIRONMENT

Cement Jamaica Limited (CJL) has proposed the construction of nominal 5,000 tons per day of cement clinker manufacturing plant at the Port Esquivel Industrial Complex with a limestone quarrying less than 2 kilometers away in the Rose Hall area of Clarendon.

Baseline data collection on the study area was conducted and included climate, hydrology, geology, noise, air quality, traffic, topography, socioeconomic, flora and fauna. All issues material to the site, such as rainfall, groundwater pollution incidents, flooding incidents, and other critical facilities were reviewed within a 3 km radius of the site. The available data that was referenced for this study is listed below:

- Satellite Photographs taken from Google Earth's website.
- The 1:12,500 topographic sheet published by the Jamaica Survey Department.
- Water Resources Authority (WRA) Data Request – Old Harbour.
- Hydro-stratigraphic Map of Old Harbour.
- Office of the Disaster Preparedness and Emergency Management (ODPEM).
- National Works Agency.
- Jamaica Meteorological Office.
- Internet searches of NEPA and other websites.

Data was garnered from field, aerial photographs other relevant reports held within various governmental and non-governmental organizations.

Implementation of the terms of reference of this study involved execution of the following tasks:

(i) Review of the Project Description to understand the nature and components of the structures and activities of the proposed development, as well as examination of the Terms of Reference with a view to identifying those aspects of the Terms of Reference that were to be in the EIA;

(ii) Collation of available maps, plans, reports and data of relevance to the project and their review by desk study to understand the overall framework and to guide field investigation of the development site and its environs;

(iii) Field reconnaissance of the development site and its environs to confirm the desk study interpretation and collect such additional data as was possible.

7.1 The Physical Environment

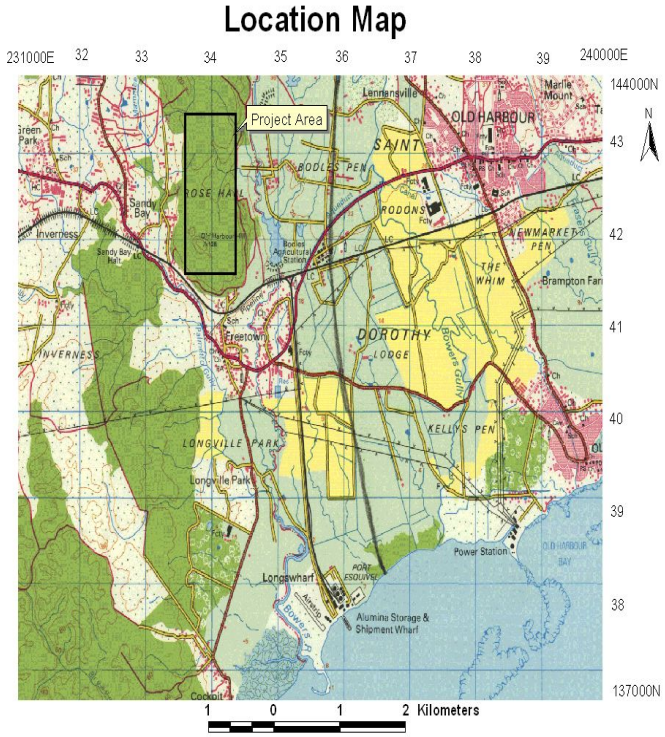
The relative location of the Limestone Quarries to the Cement Plant Site shown in ***FIGURE 2.1.4*** are within 2 kilometers of one another.

7.1.1 Limestone Quarry Site (See ***APPENDIX 7*** **-** Preliminary Limestone Mining Plan Report)

The limestone quarry project area straddles the eastern border of the parishes of Clarendon with that of St. Catherine approximately 4 km west of the town of Old Harbour (GR 237 921.72E; 142 941.73N). It is centered at the false grid reference (GR) of 234 000E; 142 000N on the 1:50,000 metric topographic Sheet 17 (JD69 Series). The project area is rectangular approximately 2.88 km^2 in area and can be defined by the following grid references based on the 1:50,000 topographic map Sheet 17

Northwestern corner – 233 616E 143 394N
Northeastern corner – 234 423E 143 394N
Southeastern corner – 234 423E 141 514N
Southwestern corner – 233 616E 141 514N

Figure 7.1: Limestone Quarry Location Map



7.1.1.1 Geology and Geomorphology

The geology and composition of the limestone deposit is based on information from *Geddes (2009) Evaluation of limestone Old Harbour Hill - Phase 1* (the composition of the raw material was evaluated based on surface samples).

The main structural elements in the project area are bedding and fractures. In general bedding is rare in the area however where seen and their orientation analyzed a distinct pattern emerge. Firstly most bedding in the eastern section of

the project area dips between 9 and 30 degrees in an easterly direction while those on the western side dip between 11 and 24 degrees in a southwesterly direction. These orientations suggest that the hill may represent an antiform with a vertical fold axis striking in a NNW-SSE direction along the main ridge of the hill.

Alternatively the present orientation of the bedding in the area may be due to localized drag folding in the vicinity of faults. However the shallow dips observed suggest that faulting did not have a great effect on bedding, since beds dragged by faulting usually show much steeper dips.

The project area is dominated by a major NE- SW trending fault that runs to the western section. There are several other minor faults/lineaments distributed throughout the area some of which has been widened to form gullies.

The main effect of these faults is that movements along them in the past have caused the limestone to be highly fractured and brecciated. The rocks affected in this way are broken up into angular fragments from 1mm – 45cm (5cm average). Thus horizons are frequently unconsolidated and lend themselves to easy ripping. In places however, the brecciated material has been partially to completely recemented by the deposition of a calcium carbonate cement, to form a hard consolidated limestone up to 2 metres thick.

Much of the eastern and western sides of the hill and its interior sections are marked by N-S faults which have resulted in steep cliffs along which brecciation is intense. The orientation of these major N –S faults, which are sub-parallel to the suggested NNW –SSE trend of the fold axis, strongly suggest that similar E –W compression forces created both the faults and folds.

The other major structural features in the area are joints. These are ubiquitous in the project area. There are several different joint sets in the area with the major ones being vertical and trending NE –SW and NW – SE. These tend to intersect with the faults to create blocks of limestone varying in size from a few centimeters to hundreds of metres.

Both faults and joints act as conduits allowing the percolation of water and soil. The cement holding the fault breccia together is often red from the lateritic soil being transported by seeping water.

Several fractures are however not filled and are at different stages of being widened by erosion and solution to create fissures and gullies. A particularly

prominent gully, the Clarendon Gully drains the area immediately north and east of project area.

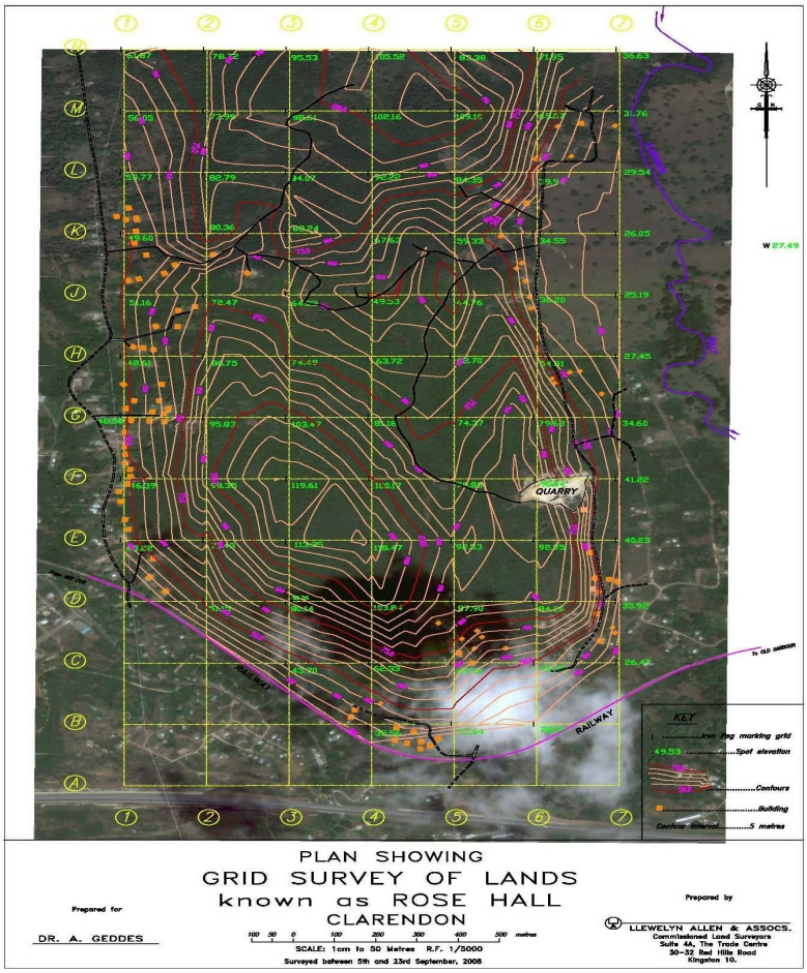
Regional assessment – The geological unit known as the Newport Limestone Formation is of Miocene age and includes the entire area investigated, which stratigraphically probably corresponds to the central and upper sections of the unit. The limestones are biogenic with numerous fossils, solid, massive to thickly bedded, predominantly very pure with a high $CaCO_3$ content. Superficial as well as deeper karstification of the limestone may be assumed. The limestones are sporadically lightly brecciated and slightly tectonically fractured. The limestones in the form of thick benches dip 9-30° in the eastern part and 11-24° in the western and southwestern part of the area. Thus, they form an apparently flat anticline with an axis in a NNW-SSE direction. The less frequent fault tectonics apparently has a predominantly N-S direction limiting the deposit, as well as a NE-SW and NW-SE direction.

The results of the chemical analysis prove that the limestones from surface outcrops have a high $CaCO_3$ content. A heightened to high MgO content was detected in only isolated samples. The contents of other contaminants are very low and favourable to cement grade limestone. The evaluation from the report by Geddes states: “Calcium Carbonate content ranging from 84.47 t0 98.78 %; Magnesium Carbonate content from 0.22 to 13.64 and Silica content from less than 0.2 to 5.78%. High silica and high magnesium carbonate values are found in only a few samples and are highly restricted in space and thus should have no effect on the quarrying activity to provide OPC raw material.

7.1.1.2 Topography and Hydrology

Contour data for the proposed sites was obtained from topographic surveys conducted by a commissioned land surveyor. The contour data revealed that the topography of the area is mountainous with moderate slopes. The proposed site is a headland with elevations varying from 118m to 34m above mean sea level. Figure 7.2 shows the contour data obtained when superimposed in a satellite image of the site.

Figure 7.2: Proposed Quarry Site Topography Map



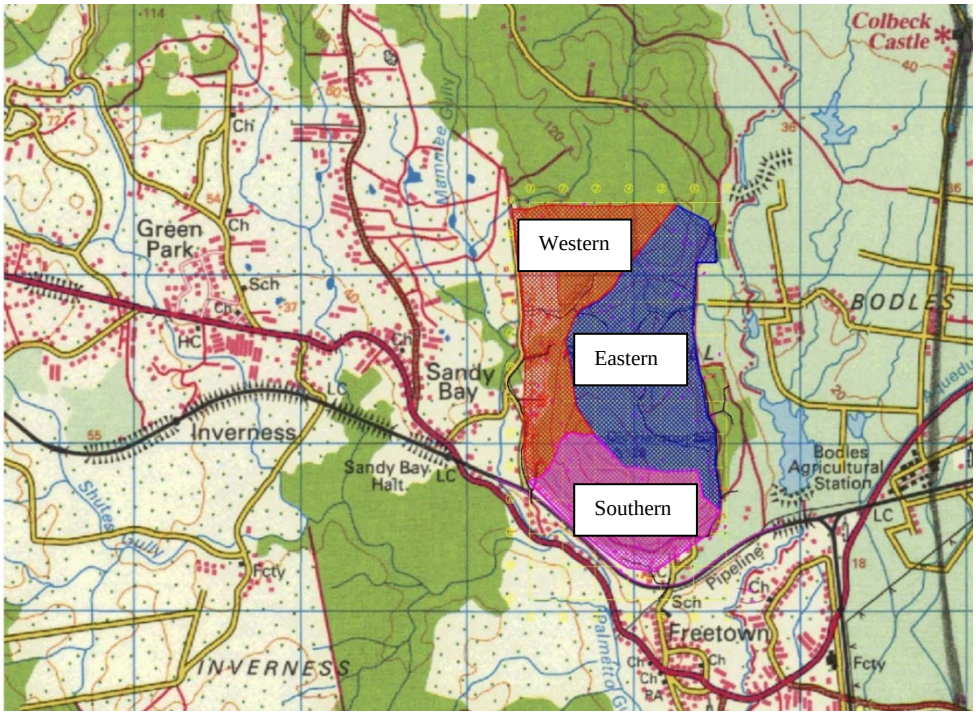
The site can be divided into three major catchments, eastern catchment, western catchment and southern catchment. Figure 7.3 shows the three major catchment areas.

The eastern catchment encompasses an area of approximately 99.7 hectares (996 938 m^2) and ultimately drains via overland flow to the Clarendon gully located east of the quarry site. See Figure 7.3

The western catchment has an area of approximately 71.8 hectares (718,336 m^2) and drains through three earth swales to the Mammee gully which runs parallel to the western boundary of the property before crossing the Old Harbour main road and discharging into the Palmetto Gully.

The Southern catchment has an area of 53.8 hectares (538,660 m^2) drained in a southerly direction via overland sheet flow. There was no noticeable drainage features draining this catchment which suggests that the land is drained by the existing roads an overland sheet flows to the Palmetto Gully.

Figure 7.3 Catchments associated with the proposed quarry site



The following could be concluded from the Hydrology and drainage analysis conducted to date:

Ø The Catchments for site are primarily bounded by the natural topography in the area. The estimated 50 year peak flows from these catchments are expected to increase during the operation of the quarry.

Ø The increases in flows are not expected to significantly affect the flows in the Clarendon and Mammee Gullies.

Ø There is no historical flood events on the site excepting at a box culvert 3 which channels the Mammee Gully flow under an existing local road? This however is said to be a rare occurrence.

7.1.1.3 Water Quality

There are three main watercourses within the region of influence of the proposed limestone quarry site; these are the Clarendon Gully, the Mammee Gully and the Palmetto Gully. None of these gullies maintain permanent flow, which takes place during and for short periods after rainfall/storm events. Although small pools of water were seen in depressions along the Mammee Gully during initial visit, at the time of sampling the gullies were all dry, therefore no water sample was collected for analysis.

Figure 7.3: The Mammee Gully to the west of the quarry site

7.1.2 Cement Plant Site

The proposed site for the development of the cement plant is located within the Port Esquivel Industrial Complex, on approximately 170 acres of land bordered to the north by Highway 2000 and to the west by the Port Esquivel main road. See Figure 7.4 below.

Figure 7.5: Proposed cement plant site

7.1.2.1 Geology and Geomorphology

The dominant superficial geological feature of the proposed cement plant site is alluvial deposits comprising of coarse gravels, sand and clay originating from the Rio Cobre Basin. The soil map of St. Catherine identifies the soil types for the areas as being the Lodge Clay Loam variety.

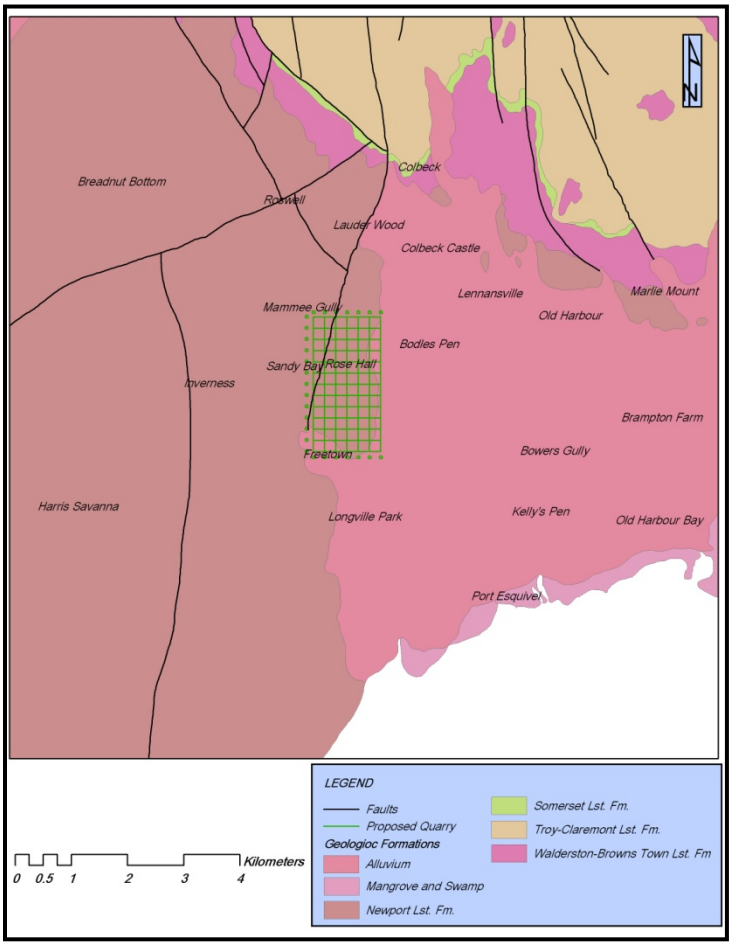
Quaternary alluvium covers the Coastal Plains in the southern half of the Rio Cobre Basins. The Alluvium Aquifer in the Project Area is represented by Quaternary Alluviums. The alluvium unit is often characterized by much variability in litho logy (both laterally and vertically) and has implications on its hydrologic character. Although predominantly a clayey unit, a well developed surficial aquifer may be found in the upper 20 to 30 metres, comprising fluvio-alluvial sands and silt, gravel, clays and marine sediment. The alluvial aquifer is unconfined and lies atop the karstic White Limestone Aquifer.

There appears to be restricted hydraulic continuity between the alluvium and underlying limestone, each functioning as an independent aquifer. This is largely the result of a confining marine clay layer that separates the two. The confining unit allows the underlying White Limestone to become pressurized above atmospheric pressure levels and therefore has a higher hydraulic head than water

levels in the alluvium aquifer. (Details are presented in Appendix 7.2 – Hydro-geological Study Report)

The general geology and geomorphology of the site suggest that it should be able to accommodate the structures associated with the cement plant; however a detail geotechnical study is required before final design is done.

Figure 7.6: Geological Formation of the plant site and wider environs

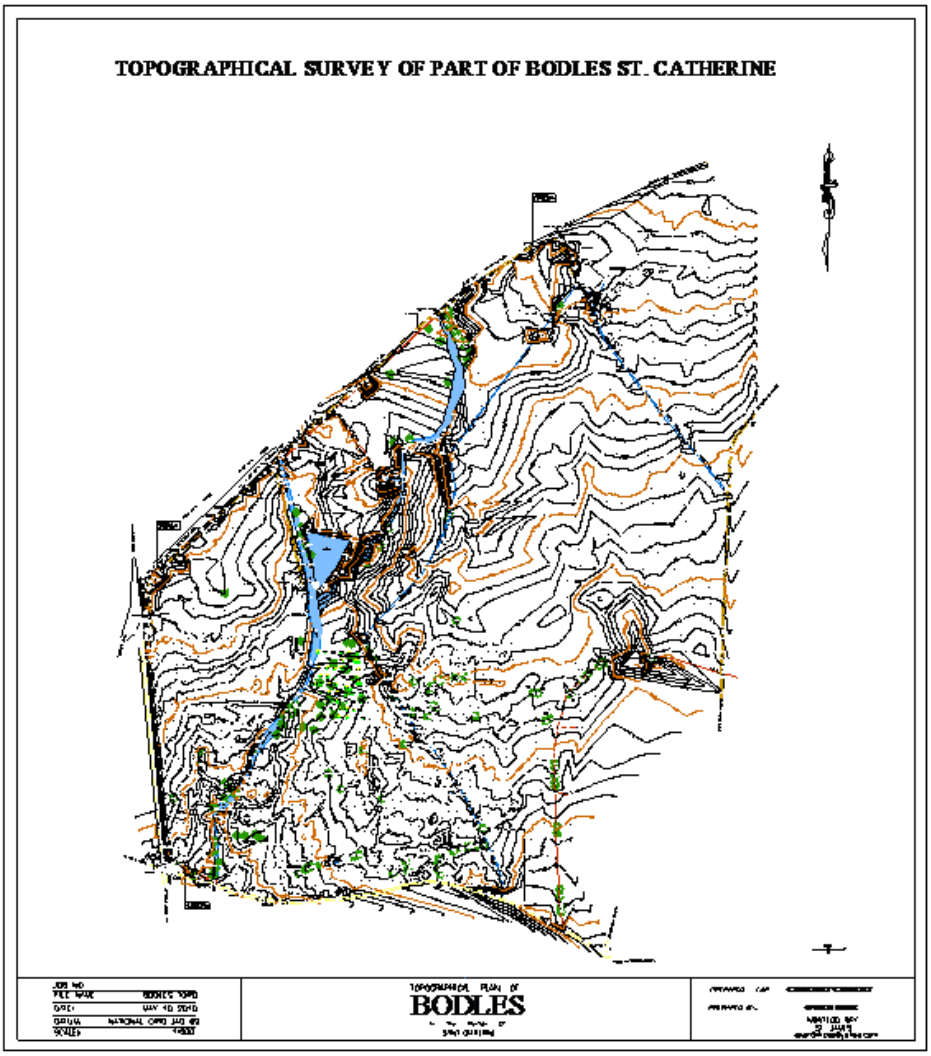


7.1.2.2 Topography and Hydrology

The site at present is has a gentle slope from north to south with the site elevation ranging from 23.5 m to 14m. The site receives an earth drain at the north end approximately 2m wide and 2.7 m deep which runs through the centre of the proposed site with a manmade pond, triangular in shape, having equal side of about 10 metres in length. The northeastern section of the site also has a constructed concrete canal that pulls water from the Bowers River, for use to irrigate the farming activities that takes place on that section of the site.

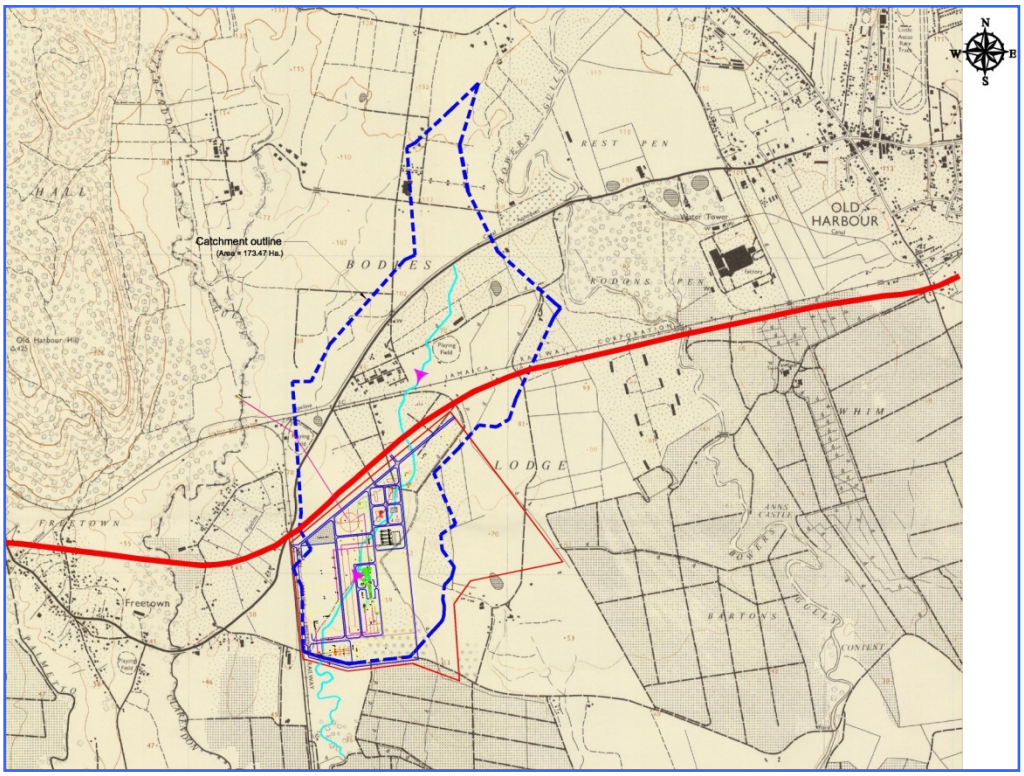
Investigations of the site topography as well as anecdotal information revealed that the main drain referred to earlier is unable to contain the storm water which is expected from even the 2 year return period and so ponding in several low spots occurs on the site. (See Figure 7.7 - topography survey diagram below)

Figure7.7: Topographical survey of proposed plant site



The area of concern has several catchments which are generally bounded by the natural topography. From the site visit it was evident that in its existing form, the land is drained via overland sheet flow to the earth drain travelling through the site as well as the low spots. The catchments associated with the site have an overall area of 223 HA. The catchments associated with subdivision one have moderate slopes reaching a summit of 39 m above mean sea level north of the site. (Figure 7.8 shows the catchments associated with the site)

Figure 7.8: Catchment associated with the proposed plant site



Meteorological data was supplemented by information regarding historical rainfall events that was obtained by conducting interviews with present residents in the area. From the information obtained, it was concluded that the proposed sites had no historical flooding events even during severe weather systems such as Hurricane Ivan in 2004 and Hurricane Dean in 2007. It was the general consensus that all the rainfall runoff tended to travel over land and on the existing roads to the existing earth drain. It should be noted however that there are no residents directly adjacent to the site and so they could not speak for what happens on the property.

A preliminary hydrologic analysis was conducted to conclude whether the existing drain could handle the expected flows from catchment. The analysis revealed that the existing drain could not handle the expected flows for even the 2 year event however the closest residents interviewed (less than 1km from site) had no recollection of flooding in past storm events.

The proposed plan is to redirect the route of the existing earth drain to a proposed open U-drain which will run along the northern boundary in a westerly direction to the western boundary of the site. The drain will then continue south along the

western boundary to the southwest corner of the site before discharge into an existing culvert which will have to be upgraded. The site will then be graded to drain via overland sheet flow to internal drainage to be designed once the construction of the plant begins, and ultimately discharged to the Open U-drain being proposed along the western boundary.

The proposed catchment is expected to generate a flow of 79.22 cubic metres per second for the 1 in 50 year event. The proposed U-drain will therefore be 8.6 m wide and 1.9m deep with a slope of 0.67% in order to handle the expected flow.

The following could be concluded from the analysis conducted to date:

- The Catchments associated with the site are primarily bounded by the natural topography in the area.
- Presently the site is drained by overland sheet flow to the existing earth drain which runs through the site.
- Anecdotal information retrieved on the site showed that there are no historical flood events on the site.
- A detailed topographic survey of the proposed site and the earth drain upstream should be conducted to confirm the expected flows reaching the site.
- A flood plain analysis should be conducted before internal drainage infrastructure as well as design floor levels are concluded.
- Use the proposed drainage infrastructure to conduct the flow out of the site
- Site should be graded to encourage runoff to proposed drainage infrastructure.

Further details on the hydrology of the proposed cement plant site may be obtained from; Appendix 7.3 – “Drainage Plan for Proposed Cement Plant”

7.1.2.3 Water Quality

The Bowers River which enters the site in the northeastern section and flows through the central region (see Figure 7.7) was the only water course that contained water during the time of the assessment. Samples for the analysis of water quality were collected in the vicinity of the pond and results are presented in ***TABLE 7.1.3.2.***

TABLE 7.3.1.2: *WATER QUALITY DATA ANALYSES FOR BOWERS GULLY CURRENTLY ON THE PROPOSED FUTURE PLANT SITE*

PARAMETER	TEST METHOD	RESULTS	NRCA AMBIENT FRESH WATER STANDARD	NRCA SEWAGE EFFLUENT STANDARD
Salinity (ppt)	OS	10.6	-	-
BOD_5 (mg/L)	H-10099	3.6	< 1.7	20
Oil & Grease	PR/GRV	6.4	-	-
Nitrate (mg/L)	H-8039	2.7	< 7.5	10 (Total Nitrogen)
Sulphate (mg/L)	H-8051	240.0	-	250 mg/l
Phosphate (mg/L)	H-8048	0.05	< 0.8	4
pH	OS	7.66	7.0 – 8.4	6.5 – 8.5
TSS (mg/L)	SM-2540D	43.0	-	20
Conductivity (mS/cm)	OS	19.4	-	-
Fecal Coliform (MPN/100ml)	SM-9221	< 7	-	1000

The result of the water quality analysis revealed that the overall quality of the water in the Bowers River was of reasonable quality with only BOD being marginally outside the limits of the standard for ambient fresh water.

7.1.2.4 Coastal and Marine Environment

The coastal zone of potential influence by the proposed development of the cement plant and limestone quarry is the Old Harbour Bay as shown in ***FIGURE 7.1.15.1***. As part of this report, the findings of previous recent studied of the coastal and marine environment of the Old Harbour Bay done by CL Environmental was review and the information garnered summarized as follows:

The percentage cover of the inshore environment shows 94% cover of sand and mud. This indicates a highly disturbed coastal environment as evidenced by visibly high turbidity, occasional high wave action and the industrial influences acting on the site (Windalco Bauxite Operations, JPS Power Plant Operations, JB Ethanol Operations, and related port activities).

*The offshore sites, located about 3 km from the shore, are characterized by shallow (1.5m), flat pavement covered by a thin layer of white, medium grain sand. Here exists extensive, healthy, seagrass meadows comprised solely of Thalassia testudinum (see **FIGURE 7.1.15.2**), with interspersed benthic macroalgae such as Halimeda sp., Caulerpa racemosa, Caulerpa sertularoides, Dictyota, and Padina.*

FIGURE 7.1.15.1: *MAP OF OLD HARBOUR BAY SHOWING PORT ESQUIVEL, ROCKY POINT, AND CABARITA POINT*

FIGURE 7.1.15.2: *SEAGRASS (Thalassia testudinum) WITH EXCESSIVE SEDIMENTATION*

The satellite image of Old Harbour Bay (***FIGURE 7.1.15.3)*** shows that the plant site and the quarry site are approximately four (4) and six (6) kilometers away from the coastal environment. There will be no effluent discharge from either the plant or the quarry, and therefore no possibility of waste from either locations being transported to the marine environment. Control features are needed at the quarry during operations and at the plant site during construction to ensure that in major rainfall events, sediments are not transported to the coastal environment.

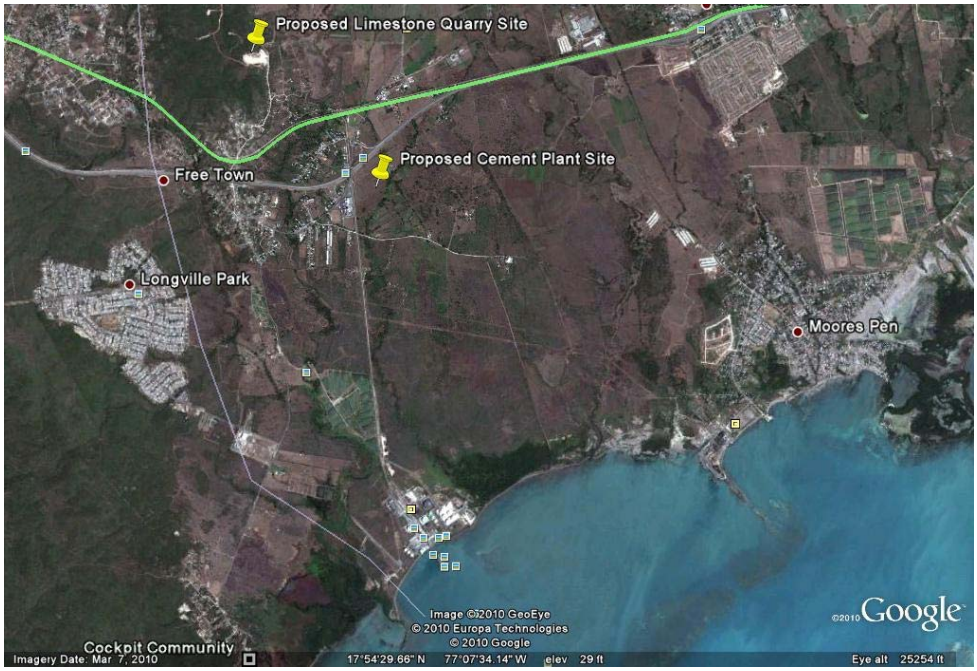


FIGURE 7.1.15.3: *SATELLITE IMAGE OF OLD HARBOR BAY IN THE AREA OF PORT ESQUIVEL SHOWING THE RELATIVE DISTANCE TO THE PLANT SITE AND QUARRY SITE FROM THE COAST (4-6 KM AWAY)*

The proposed project is likely to result in increased runoff to the marine environment but this should not have any significant impact on coastal and marine ecosystem. The Windalco Port at Port Esquivel will be utilized for import of equipment and raw material and the export of product. The project should result in an approximately 30 percent increase use of the existing port when compared with present usage. The increased port activities could result in some impact on the coastal environment; however, the operators of the port (Windalco) have assured that they will mitigate any potential impact.

7.1.3 Climate

7.1.3.1 Rainfall:

The mean annual rainfall for the Bodles Agricultural Research Station for the 30-year period 1951 to 1980 was ~1052 mm. St. Catherine and Clarendon plains are typically dry areas compared to the rest of the island, being in the rain shadow of the Blue and John Crow Mountains. There is considerable variation in total annual rainfall in the area. The years of 2002 and 2005 were the wettest years in the 14 year period. Seven (7) of the fourteen (14) years experienced rainfall over 1000 mm, but less than 1500 mm. Six (6) of the fourteen (14) years had less than 1000 mm of rainfall.

The annual distribution of rainfall is presented in graph below;

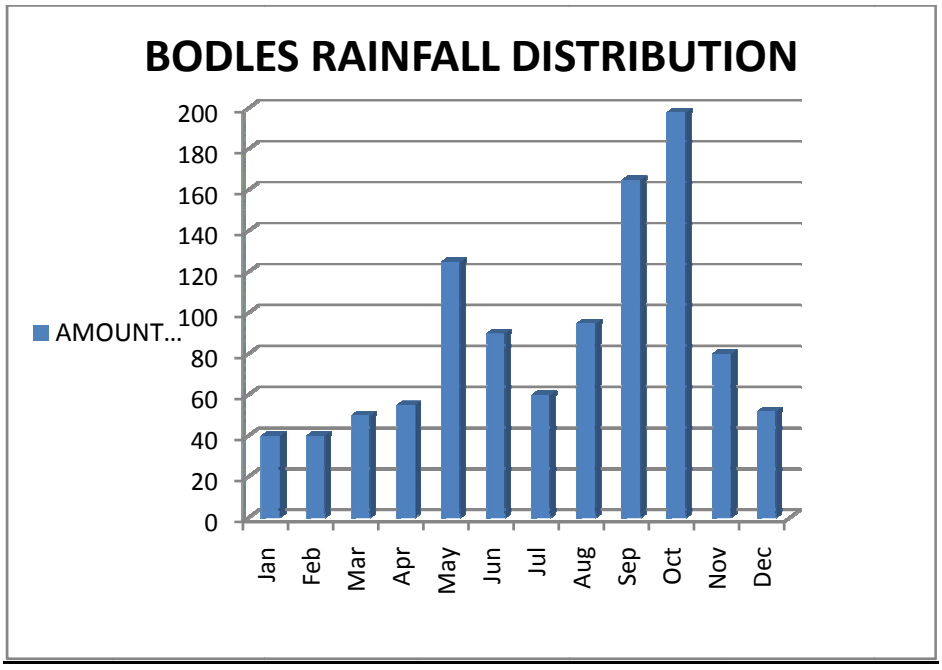


***TABLE 7.1.3.4**: PREDICTED RAINFALL INTENSITY FOR DIFFERENT RETURN PERIODS AT THE BODLES STATION*

Return Periods	**2**	**5**	**10**	**50**	
Predicted Rainfall Intensity	94	140	170	236	mm/24 hrs

7.1.3.2 Temperature & Relative Humidity:

Jamaica, mean monthly temperatures exhibits only minor variations with the summer (June to October) and winter months (November to March). Temperatures range between lows of ~16 °C in the winter months and highs approaching 34 °C in the summer months. Relative humidity is lowest in the drier months and higher in the wetter months. On average, the relative humidity ranges between 74% (in July) and 82% (in October).

7.1.3.3 Wind:

Representative data from the NMIA indicates that wind speeds are greatest in the dry hot summer months (June to August), often exceeding 18 kilometers/hour. After September, average conditions tend to be relatively calmer (less than 10 kilometers/hour) until about mid-January. Between that time and the end of May, conditions are somewhat windier. Windy conditions during the winter months (January to March) are often associated with northwesters, blowing in from the northern latitudes. In terms of wind directions, the prevailing winds come from between 0 degrees and ~135 degrees (north to north-east). This is expected as the dominant system affecting the island is the North East Trade Winds. Between May and August, prevailing winds appear to come from the east.

7.1.4 Air Quality

As part of the Environmental Impact Assessment conducted for the proposed facility, an air dispersion modelling analysis was undertaken to determine the impact of the air pollutants from the proposed facility on the ambient air quality. A determination was also be made as to whether a significant air quality impact will be created based on the incremental contributions of the proposed facility to the cumulative air quality impact. In this regard, Jamaica's Natural Resources Conservation Authority (Air Quality) Regulations of 2006 has defined as "significant air quality impact" as follows:

(a) the increment in the predicted average concentration of sulphur dioxide (SO_2), total suspended particulates (TSP), particulate matter less than ten microns

(PM_{10}), or nitrogen dioxide (NO_2) is greater than an annual average of 21 µg/m^3 or a 24-hour average concentration of 80 µg/m^3; or

(b) the increment in the predicted average concentration of CO is greater than 500 µg/m^3 as a 8-hour average or 2000 µg/m^3 as a 1-hour average

For cement plant operations, the *primary* air pollutant to ambient air quality is the *secondary* air pollutants, as defined above, are NOx, SO_2 and CO.

An air dispersion modeling using AERMOD (the **A**MS/**E**PA **R**egulatory **Mod**el) was conducted to predict the impact of the emissions on ambient air quality from the proposed cement manufacturing facility. The Air Quality Modeling Report, in its entirety, can be found in ***APPENDIX 7.1.4.*** This appendix describes the air dispersion modeling analysis for SO_2, PM_{10}, NO_2 and CO from the proposed facility only and the consequent comparison with the Jamaican National Ambient Air Quality Standards, as well as a determination of whether the proposed facility's air emissions will create a "significant air quality impact". Importantly, a cumulative air quality impact analysis can also found in this ***APPENDIX 7.1.4.***

The conclusions of AERMOD Report are summarized as follows:

7.1.4.1 The emission rates for PM, NO_x and SO_2 that will be emitted from the proposed cement manufacturing facility are in compliance with their respective emission standards as shown in ***TABLE 7.1.4.1***. It may be inferred that these emission standards will not be exceeded based on the superior suite of air pollution control technology (fifty sets of fabric filters and a desulphurization unit) to be employed by the proposed cement manufacturing facility. That is, the contribution of the proposed cement manufacturing facility to the overall air quality impact in the local air shed can be expected to be negligible (see ***TABLE 7.1.4.2***).

7.1.4.2 The proposed cement manufacturing facility only has a minor contribution to the overall peak modeled short term concentrations for CO, PM_{10}, NO_2 and SO_2 as shown in ***TABLE 7.1.4.2***. As shown, other nearby sources includes the Jamaica Public Service Company (JPS) Old Harbour Bay Power Plant, the Jamaica Energy Partners (JEP) Dr. Bird Power Barges, the Best Dressed Chicken Feed Mill facility, and the Jamaica Broilers Ethanol facility. These sources were included in the modeling analysis in order to capture the cumulative air quality impact at the identified receptor locations.

7.1.4.3 The model predictions for the proposed cement manufacturing facility revealed compliance with the CO, PM_{10}, NO_2 and SO_2 ambient air quality standards and guideline concentration for the requisite averaging periods.

Moreover, the incremental impact of these air pollutants were also less than the established values that would have created a "significant air quality impact". However, design changes will need to be made by the EPC Contractor to achieve compliance with the PM_{10} and NO_2 ambient air quality standards and guideline concentrations. Specifically:

7.1.4.3.1 The vent height of the fabric filter associated with the quarry crushing plant will need to be increased from 8.5m to 10.5m, while the vent height of the fabric filter associated with the additives and coal pre-blending area will need to be increased from 3m to 8m.

7.1.4.3.2 Additionally, the design NOx specification for the cement kiln will need to be changed from 800 mg/Nm^3 to 400 mg/Nm^3.

Since the proposed cement manufacturing facility sources demonstrates compliance with the ambient air quality standards and the guideline concentration, as well as the significant impact incremental values, it is envisaged that approval will be granted for the establishment of the facility. That is, it has been determined that the predicted maximum concentrations as a result of the implementation of the proposed cement manufacturing facility (including the quarry footprint) would not exceed the concentrations that would have caused a significant air quality impact. Additionally, the proposed cement manufacturing facility also achieves compliance with the various ambient air quality standards for all applicable averaging periods.

TABLE 7.1.4.1: *SUMMARY OF MODEL RESULTS FOR THE PROPOSED CEMENT FACILITY*

Pollutant	Average Period	Background (µg/m^3)	Significant Impact Concentration (µg/m^3)	Jamaican NAAQS (µg/m^3)	Proposed Cement Plant Sources Max Concentration (µg/m^3)
PM_{10}	24-hr	9	80	150	**59**
	Annual	20	20	60	**16**
NO_2	1-hr	0	N/A	400	**369**
	24-hr	0	80	N/A	**24.4**
	Annual	0	20	100	**4.2**
SO_2	1-hr	0	N/A	700	**424**
	24-hr	0	80	280	**28**
	Annual	0	20	60	**5**
CO	1-hr	0	2000	40000	**3.44**
	8-hr	0	500	10000	**0.67**

The contribution of mobile source emissions both on and off the facility was not considered in the modeling project, however, the emissions from these vehicles were considered as part of the background concentration value for particulates and nitrogen oxides. ***TABLE 7.1.4.1*** highlights the emission standards to be applied to the proposed cement manufacturing facility. These standards are based on the Jamaica NRCA (Air Quality) Regulations, 2006.

TABLE 7.1.4.2: *SOURCE CONTRIBUTIONS TO PEAK MODELED SHORT-TERM CONCENTRATIONS*

Facilities	Concentrations, µg/m^3						
	PM_{10} – 24h	**NO_2 – 1h**	**NO_2 – 24h**	**SO_2 – 1h**	**SO_2 – 24h**	**CO – 1h**	**CO – 8h**
New Cement Jamaica Limited	17.996	0	0.245	0.01	0.3	0.0002	0.006
Existing JPS Operations	1.3	0	0.028	6911.63	567.2	2128.4	0.052
Existing JEP Operations	0.4	0.0004	0.093	1056.36	84.5	107.5	0.003
Existing Feed Mill Operations	162.3	2904.74	679.157	0	0.0003	0	470.066
Existing JB Ethanol Operations	0.004	0.0236	0.02	0	0.0007	0	0.006
Totals	**182**	**2905**	**680**	**7968**	**652**	**2236**	**470**

Since the entire proposed cement manufacturing facility will be designed to accomplish a PM emission standard of 30 mg/m^3, it is therefore concluded that compliance will be achieved. Also, the same 30 mg/m^3 PM emissions will be applied to the coal-fired power generating facility. With a fuel (coal) heat input to the coal-fired power plant of 27.95 MJ/kg and a coal usage of 6.55 kg/s, a PM emission rate of 8.15 ng/J input is obtained, which complies with the stipulated standard as shown in ***TABLE 7.1.4.3***.

TABLE 7.1.16.3: *EMISSIONS RATE COMPARISON WITH STANDARDS*

Facility	Pollutant	Emission Standard	Emission Rate, mg/m^3 or ng/J
New Cement Manufacturing Plant	PM	100 mg/m^3 (20°C, 101.3 kPa, dry gas) from clinker cooler; 50 mg/m^3 from kilns, finish grinders and all other sources (20°C, 101.3 kPa, dry gas)	30 mg/m^3 for all unit operations
New Fuel Combustion - Coal Fired < 70 MW	PM	60 ng/J input, except during start-up, shut-down, soot-blowing or malfunction for each stack	8.15 ng/J
	SO_2	520 ng/J input	267.2 ng/J
	NOx	260 ng/J	28.9 ng/J

Finally, the coal-fired power generating facility will be designed to achieve a maximum emission rate of 740 mg/m^3 SO_2 and 80 mg/m^3 NOx. When these values are applied to a

fuel (coal) heat input of 27.95 MJ/kg and a coal usage of 6.55 kg/s, emission rates of 267.2 and 28.9 ng/J are, respectively, determined and are in compliance with the designated emission standard.

In summary, the maximum predicted concentrations for the proposed cement facility sources have been determined and compared with their Significant Impact Concentrations, as well as the Jamaican National Ambient Air Quality Standards (NAAQS). The results reveal that the maximum predicted ground level concentrations from all the proposed sources of the cement facility (including the quarry) do not exceed the Significant Impact Concentrations. Additionally, the maximum predicted ground level concentrations from all the proposed cement facility sources plus the background concentrations (as recommended in the Air Quality Guideline Document) were all less than the NAAQS.

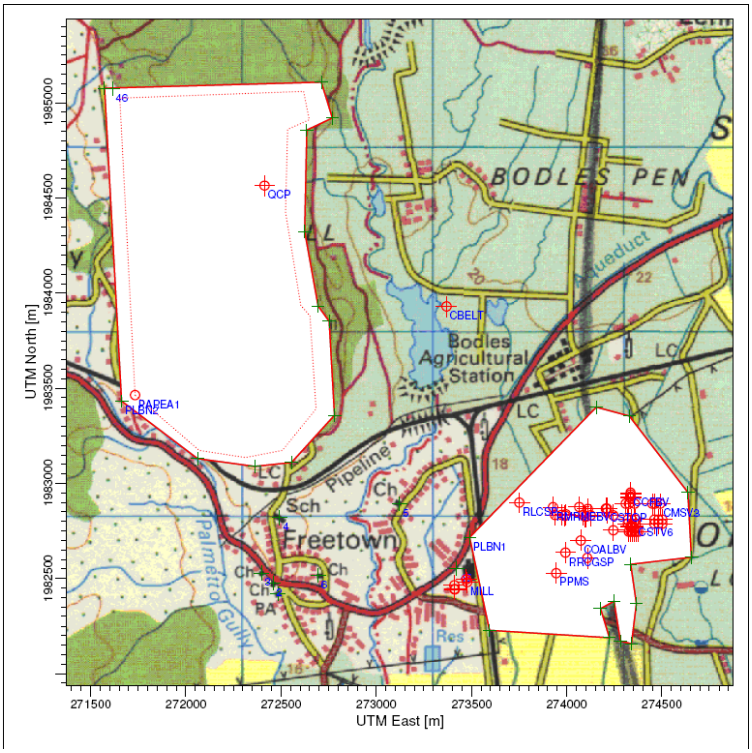


FIGURE 7.1.15.1: *MAP SHOWING THE SPECIFIC LOCATIONS OF THE POINT SOURCES FOR THE NEW CEMENT PLANT*

7.1.5 Noise

A "base-line" noise assessment was performed at six (6) pre-selected locations in the Bodles area in St. Catherine from Tuesday November 23rd, 2010 at 7:00pm to Wednesday November 24th, 2010 at 6:00pm. Six (6) stations were monitored over a twenty four hour (24 hour) period.

The National Environment and Planning Agency's has two guidelines as it relates to noise levels. The first is designated occupational and the second environmental noise. Stations 1 to 5 were within the occupational/industrial noise guideline. The environmental guideline is broken-down into zones and time periods (10 pm to 7 am and 7 am to 10 pm) as shown in TABLE 7.1.17. Environmental noise guidelines include industrial, commercial and residential noise. For the purposes of this study, station 6 is considered residential and is well beyond the perimeter of the plant. As shown in ***FIGURE 7.1.5***, during the 7 am to 10 pm time band, all stations except station 6 (58.0dBA) complied with the NEPA guidelines. During the 10 pm to 7 am time band, again station 6 (53.4dBA) was non-compliant with the NEPA guidelines. Numbers in red shows are not currently in compliance with NEPA day and/or night standards.

TABLE 7.1. 5 *COMPARISON OF AVERAGE NOISE LEVELS AT STATIONS WITH NEPA PROPOSED NOISE GUIDELINES*

STN #	ZONE	ACTUAL AVG. LEVELS (dBA) (7 am. - 10 pm.)	NEPA DAY STD. (dBA) (7 am. - 10 pm.)	ACTUAL AVG. LEVELS (dBA) (10 pm. - 7 am.)	NEPA NIGHT STD. (dBA) (10 pm. - 7 am.)
STN 1	Industrial	57.1	75	54.3	70
STN 2	Industrial	46.6	75	45.2	70
STN 3	Industrial	45.1	75	49.9	70
STN 4	Industrial	46.8	75	47.4	70
STN 5	Industrial	-	75	-	70
STN 6	Residential	**58.0**	55	**53.4**	50

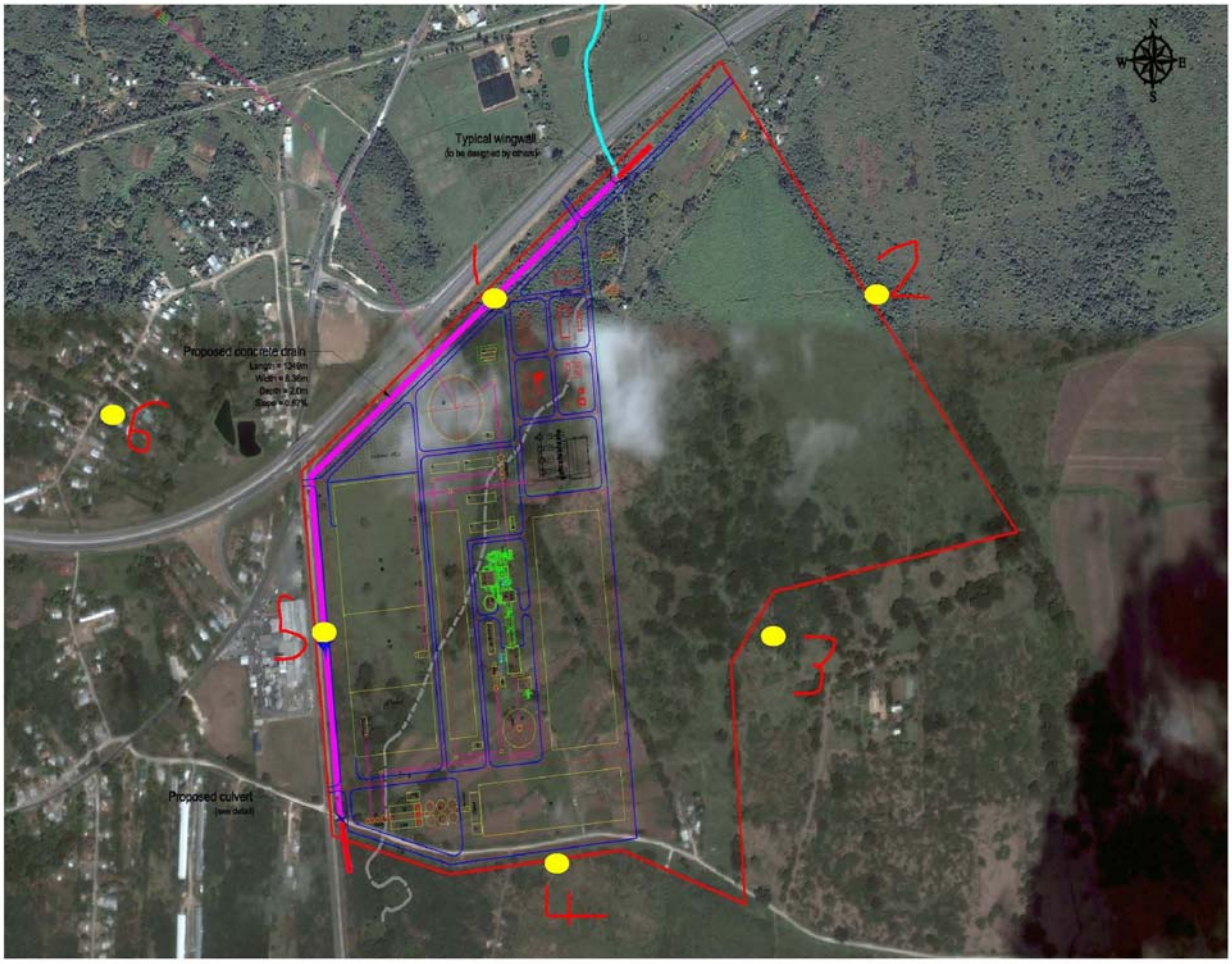


***FIGURE 7.1.5**: MAP OF FUTURE PLANT SITE SHOWING THE SIX (6) LOCATIONS OF THE BASELINE NOISE MONITORING SURVEY*

The complete Background Noise Study and Report can be found in ***APPENDIX 7.1.5***. As indicated, all the stations, except Station 6 (58.0 dBA – day time and 53.4 dBA night time) were also compliant IFC/World Bank guidelines.

7.1.6 Solid Waste

The National Solid Waste Management Authority (NSWMA) has responsibility for collection and disposal of solid waste within the project area. The approved disposal site is Riverton City and the service provider for domestic waste is the Metropolitan Parks and Markets (MPM). Contract haulage firms will be used for the construction waste. The solid waste management requirements of both phases of the development require prompt and efficient removal of solid waste to an approved disposal site. Stockpiling and composting of organic waste is recommended.

7.1.7 Heritage Sites Considerations

The developments lie in an area whose settlement dates back in the records to the Spanish and early British period. They both lie on a historically important trade, communication and security route between May Pen and Old Harbour. Sugar cane, tobacco, cattle and other livestock rearing were well established and documented activities. There is therefore the likelihood that although reconnaissance revealed no artifacts of interest, the sites may contain subsurface artifacts. It is therefore proposed that the Jamaica National Heritage Trust (JNHT) be asked to undertake a watching brief at the time of site clearance and excavation.

7.2 Biological Environment

7.2.1 Cement Plant Site

The project site is highly disturbed and does not exhibit a great deal of biodiversity. The sparse vegetation indicates that most of the site may have been cleared in the past for agriculture and is only partially re-colonized by a few naturally occurring species. The southern section of the site had been leased for farming and was used by small farmers for short term crops.

Site proposed for cement plant

Short term crop in the southern section of site

7.2.2 Limestone Quarry Site

Vegetation coverage of the limestone hills is typically thick shrubs and tree forests. The forest tends to be in the higher elevations and consists of trees such as cedar. Several local fruit trees are also noted scattered through the area, including ackee (Blighia sapida), lime, sweetsop (Annona squamosa) and guinep. Shrubs include thatch (Coccothrinax argentata) and broom weed (Amphiachyris).

7.3 Socio-Economic and Cultural Environment

7.3.1 Survey Findings

A survey of the residents in the local community in the area of the cement plant and quarrying facility was conducted by the EIA Team. The survey form is shown in ***APPENDIX 7.3.2.6.***

The results of the survey indicated that the majority of the residents are looking forward to the project and see it as a means for increasing the socio-economic quality of their lives. Some are currently employed, but they see the project as enhancing current inflows or providing employment for others. Survey findings revealed that residents of the area hold the following views about the project:

- 95.5% - project will provide jobs
- 87.3% - project will attract others to live/work in community
- 74.5% – project will not destroy natural environment
- **25.4% - project will destroy natural environment**
- 85.5% - project will not damage farmland
- **11.1% - will cause flooding**

- 88.9% - project will not cause or contribute to flooding
- **35,5% - project will have significant impact on environment**
- 64.5% - project will have no significant impact on the environment.
- 78.5% - project will create/contribute dust nuisance during construction pha**se**
- **21.5% - project will not create/contribute to dust nuisance during the construction phase.**

7.4 Traffic Assessment

The proposed site for the development of the Cement Plant is located adjacent to Highway 2000 at the entrance from the Old Harbour main road. This section of the Highway was completed in 2006, and was built to international standard, comprising of four traffic lanes, two in either direction with soft shoulders on both sides. The surface of the road is in excellent condition and is a dual carriage way.

Public transportation to the site is provided by the many buses, minivans and taxis which operate along the main road between Old Harbour and May Pen and the other towns and communities in between.

Monitoring of traffic movement passing the site was done for a nine hour period 8:00 am to 5:00 pm. This represents the typical working hours in Jamaica for operations of this nature. For observation purposes vehicles were divided into two categories;

1. Buses and Trucks
2. Others (Cars, Pckup, SUV Etc)

The number of vehicles going in both directions along the Highway, as well as the number passing in both directions along the main road was recorded. The results are presented in ***TABLE 15***:

TABLE 15*: TRAFFIC SURVEY CONDUCTED BY ENVIROPLANNERS*

Description	Number of Vehicles
Total number of Bus/Truck passing site on highway easterly	396
Total number of Other vehicles passing site on highway easterly	1290
Total number of vehicles passing site on highway easterly	1686
Total number of Bus/Truck passing site on highway westerly	323
Total number of Other vehicles passing site on highway westerly	1396
Total number of vehicles passing site on highway westerly	1692
Total number of vehicles passing site on highway in both directions	3378

7.5 Hospitals

The nearest hospitals are both Type B, May Pen with 150 beds and Spanish Town with

320. The Spanish Town the hospital being the more equip is recommended for emergency cases originating in the project area.

7.6 Police Stations

The projects fall within Area 5 of the Constabulary Forces, headquartered in Portmore. The Old Harbour Police Station is one of seven Out Stations within the Division. Crime in the area has been on the increase, and there is a shortage of man power. It is not envisioned however that the project will have any significant demand on the security forces.

7.7 Man-made and Other Hazards

7.10.1 Natural Hazards

7.10.1.1 Flooding

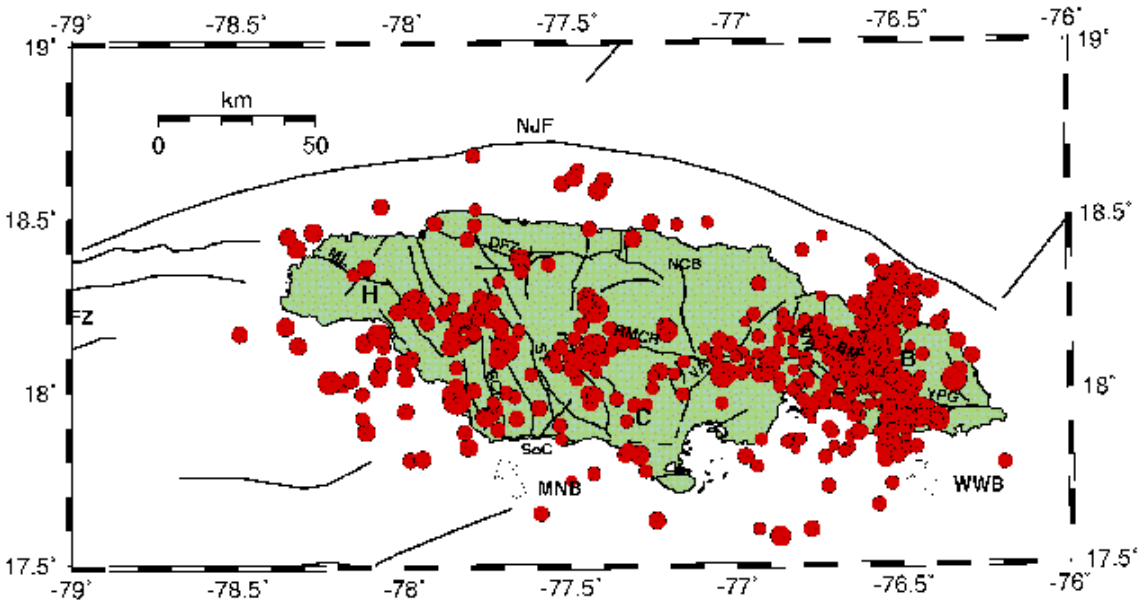
Flooding is not considered to be of significance at any of the two project sites. This is however presented and discussed in detail in the respective sites drainage study.

7.10.1.2 Earthquakes

The site is prone to the worst effects of earthquakes by virtue of its proximity to a seismically active zone (Wagwater Fault). In addition, it is likely that it is particularly prone to liquefaction because of acceleration of the seismic waves in the alluvial soils.

About 200 earthquakes are located in and around Jamaica per year most of which are minor, having magnitudes less than 4.0. The most seismically active areas are the Blue Mountain block in eastern Jamaica and the Montpelier-Newmarket belt in western Jamaica. Other areas of notable seismicity include the near offshore south-west of Black River on the south coast, and offshore Buff Bay on the north–east coast.

JAMAICA SEISMICITY 1997-2007



Offshore: WFZ - Walton Fault Zone; NJF - North Jamaica Fault; EF - Enriquillo Fault
Major land faults: ML - Maryland; DFZ - Duanvale; SCr - Santa Cruz; ST - Spur Tree; SoC - South Coast; RMCR - Rio Minho-Crawle River; WW - Wagwater; BM - Blue Mountain; YPG - Yallahs-Plantain Garden
Other Structural features: H - Hanover Block; NCB - North Coast Block; C - Clarendon Block; B - Blue Mountain Block; MNB - Montpelier-Newmarket Belt; WWB - Wagwater Belt
(After Jamaica Geological Structure Series Map 92-21, 1992)

7.10.1.3 Hurricanes

Jamaica lies within the Caribbean hurricane belt and has been directly affected by numerous hurricanes. During the hurricane season (June to November) these low-pressure systems form in the mid-Atlantic off the African west coast between latitudes 5 to 25 N, and move northwesterly into the Caribbean basin. Hurricanes normally steadily progress from a tropical wave, to a tropical depression, to a tropical storm, then to a hurricane. The hurricane itself has five categories according to the Saffir-Simpson Hurricane scale with a category one having the lowest wind speeds and the category five with the highest. Although the category of the hurricane indicates its intensity and subsequently its damage potential, the impacts of the hurricane depend on when and where the storm strikes.

The intensity and frequency of storms vary with various global meteorological conditions from year to year, and it is suggested that it may be influenced by the occurrence of the El Nino/La Nina phenomena and

the development of high pressure cells, mid-Atlantic sea surface temperatures and the amount of Sahara dust in the upper atmosphere. Although the eyes of the storms generally track south of the island, hurricane force winds can be felt across southern parishes and even northern parishes. Depending on the distance from the shores, and the actual size and organization of the storm, hurricane or tropical storm winds may be felt from the outer bands in the vicinity of the site.

8.0 IMPACT SUMMARY AND MONITORING PLAN

An impact is any change to the existing condition of the environment caused by human activity or an external influence. Impacts therefore may be positive (beneficial) or negative (adverse). They may also be direct or indirect, long-term or short-term, and extensive or local in effect. Impacts are termed cumulative when they add incrementally to existing impacts. Both positive and adverse environmental impacts could arise during the site preparation, construction and the operations phases of the cement plant and limestone and clay quarry.

8.1 Impact during the Construction Phase:

The main contractor for the development is an EPC Contractor who has significant experience in similar construction developments. It is expected that a maximum of 800 workers will be on site at any one time and it is planned that they will live in a specially constructed camp. The camp will be located adjacent to the construction site to the east of plant site and will have all the necessary facilities to make the camp self-contained, including recreational facilities. The construction camp will consist of several pre-fabricated buildings and necessary infrastructure.

The construction activities will include:

- Site clearance, ground modeling and landscaping;
- Utilities and services connections to site;
- Foundation excavations and installation of concrete footings;
- Erection of building steel frames and cladding;
- Installation of equipment;
- Ancillary facilities erection;
- Services and utilities connections;
- Building fitting-out; and
- Commissioning.

The main direct ecological impact resulting from the construction phase of the project will be the loss of vegetation associated with the "clearance" at the quarry areas, and the access road alignments. The cement plant and construction camp sites are inside an existing Industrial Complex. With soil and vegetation removed, the habitat for fauna (mammals, birds, reptiles, amphibians, invertebrates) will also be destroyed along with any fauna that cannot readily move away when site clearance takes place.

Translocation of vegetation on a large scale is unlikely to be feasible. However, Cement Jamaica Ltd. shall establish forest nurseries in association with this project. Tree seedlings are used (i) to provide physical screening of quarries and cement plant sites and (ii) for subsequent site restoration. The establishment of one or more nurseries in relation to the three (3) proposed project sites should assist with short-term mitigation and longer term on and off-site restoration of damaged habitat.

Vegetation loss at the quarries and cement plant sites cannot be avoided, but successful restoration, improvement and long term management of the surrounding areas for conservation and productive uses will provide significant compensation. Careful consideration needs to be given to the plant species that are to be raised in a nursery. For habitat restoration, native species should be used in preference to exotic and/or commercial forestry species, though there may be a role for commercial species if there is local demand for wood-producing plantations. In particular, consideration should be given to the propagation of indigenous herbal species with medicinal and other practical uses. i.e. species that are favored by neighboring communities. Species of known biological conservation value should also be favored i.e. rare or threatened plant species and those known to be important food plants for wildlife, e.g. butterflies.

To achieve this, a "habitat survey and management study" needs to be conducted in and around the two (2) sites in order to:

(i) Assess in more detail the type, distribution and condition of the existing vegetation (and soil cover);
(ii) Assess better the presence and status of fauna, especially species of conservation significance, and
(iii) Develop habitat and species management proposals. This will require close consultation with local scientists and communities to ensure that their requirements are met and that they subsequently comply with any management practices.

It is proposed that seed and other propagation material (e.g. bulbs and cuttings) will be collected for the plant nursery in the area adjacent to the development. A competent horticulturalist (preferably with ecological training or interests) will be required to oversee the collecting of the material, its propagation at the nursery and its subsequent planting). The horticulturalist should also participate in and contribute to the quarry extraction plan with regard to the sequence of the quarry development. With knowledge of the clearance sequence and time-table and subsequent quarrying schedule, any programs for surveying fauna and vegetation can be tied into the site-stripping programe. In addition to the horticulturalist, an ecologist will need to be appointed (with some occasional international support if he/she is lacking in experience of ecological mitigation) to contribute to the habitat survey and management study, and to survey and conduct the translocation of fauna, where this is deemed desirable.

For the quarry access roads, an Ecological Method Statement should be developed in conjunction with the designer/contractor to provide a mechanism to ensure that the necessary protection measures are put in place. Adjustments to the alignment and

construction methods will be made to avoid sensitive areas wherever practical and to allow e.g. suitable stream/river crossings to be incorporated.

With regards to emissions to air, construction activities can generate dust that can cause a nuisance to local residents and cause a health risk to construction workers. As the nearest residential receptors are approximately 1 kilometer from the main development site it is considered unlikely that there will be an impact on local people. The main risk is considered to be the exposure of workers on site.

Dust control measures, together with the use of appropriate personal protective equipment and appropriate maintenance of vehicles will be used to mitigate this impact. The impact of emissions of vehicle exhaust gases on air quality is considered negligible.

Water in the vicinity of the construction site can become polluted as a result of releases of materials used during construction. Potentially polluting materials will be carefully stored in suitable containment in order to reduce the risk of pollution incidents from spills and leaks.

In order to manage the domestic effluent produced at the site which will be an issue particularly during construction with the large numbers of workers present at the site, a sewage treatment plant will be constructed. The plant which is being designed at the time of writing will be designed to take into account the load placed upon it during the construction phase and will be permanent for use treatment of domestic effluent during the operational phase of the project. The final effluent will be of a quality that meets the requirements for irrigation and will be used to irrigate green space on the site.

Due to the semi-natural rural character of the proposed site, the transitory visual impacts of construction works are expected to be moderately adverse due to the introduction of prominent structures and construction equipment. However, the topography of the area will provide a natural level of screening of the works and the layout of the site will be sensitively planned to use this to minimize negative visual impacts.

The effects of the traffic generated by the construction phase are likely to be moderately adverse when considered within the context of the relatively low volumes of traffic that passes through the local area daily.

Finally, noises levels are likely to be fairly high and any noise associated with construction activities is likely to have negligible impact. Measures to reduce construction noise levels will be included in the Environmental Management Plan and Monitoring Program.

Overall, with the exception of the impacts on ecology within the boundary of the development area, the construction activities are transitory, and are considered likely to have a minor adverse impact on dust levels and a moderate adverse visual impact.

8.1.1 Loss of Terrestrial Habitat and Biodiversity

Impact: The site has already been cleared of most of its vegetation, the clearing and grading of the site will therefore not have significant impact on biodiversity. Removal of the sparsely vegetated grass will result in a minor loss of vegetation in the short term and in the longer term the development will prevent the possibility of re-colonization by invasive species.

Mitigation: The overall objective of this mitigation is to establish as many green areas as possible around the facility. Site clearance and setting out of the facility must avoid the removal of trees wherever possible. The establishment of green areas on the site should include the planting of bird feeding trees.

8.1.2 Loss of Land Use Options

Impact: Construction of the facility will result in a loss of the options for alternative use of the land and thus represents an irreversible commitment of land resources. Loss of the option to utilize the land for any other purpose can be considered to be a negative impact.

Mitigation: Mitigation is not considered for this impact, but it has been addressed in Section 3.0 of this report (Analysis of Alternatives).

8.1.3 Soil Erosion

Impact: Excavation works for construction of the cement plant will expose soils in the affected areas, leaving them vulnerable to erosion by surface run-off during heavy rainfall. However, the flat topograghy of the site should minimize this negative impact.

Mitigation: The EPC Contractor must minimize the area of exposed soil at any given time and to wet, compact and resurface the disturbed areas as soon as possible. The EPC Contractor must also construct the drainage system during the very initial stage of the project.

8.1.4 Noise

Impact: The use of heavy equipment during site clearance and construction works will inevitably generate noise, which may create a nuisance for persons in the vicinity. This is a negative impact but is not considered to be significant, as the duration will be short-term and there are no communities close to the site.

Mitigation: Warning signs will be posted within the vicinity of the impact and all personnel shall be provided with personal protective equipment. For example, workers operating equipment that generates noise should be equipped with the appropriate noise protection gear. Construction activities that will generate disturbing sounds shall be restricted to normal working hours.

8.1.5 Dust

Impact: The site clearing and excavation works will produce fugitive dust which may result in increased levels of air borne particulate matter. This situation will be worst during the dry periods and prevailing winds. The occurrence of dusting is periodic and short-term, lasting only for the duration of the construction activity.

Mitigation: Dust Exposed surfaces should be regularly wetted in a manner that effectively keeps down the dust. Stockpiles of fine materials shall be covered during windy conditions. Workers on the site shall be issued with dust masks/respirators for use during dry and windy conditions

8.1.5 Traffic

Impact: Based on the nature and size of the operation, it is anticipated that about 100 vehicles per day will enter and leave the site during construction and about 200 vehicles per day during operation. This will have an impact on the traffic, however, because the entrance is located on the Port Esquivel road where existing traffic is sparse, there should be minimum impact. The volume of vehicles using the highway is moderate and the increased volume over time is not expected to result in any major negative impact.

Mitigation: The gate to the property will be set-back by at least 30 meters to allow for vehicles entering the property to clear the roadway. Adequate parking will be made available. Warning signs and sight mirrors shall be installed at appropriate places on the roads.

8.1.6 Socio-Economic

Impact: During both the construction and the operation phases, the development will provide direct and indirect opportunity for employment of both skilled and unskilled personnel. An estimated 300 people will be directly employed during construction and about 450 people will be employed during operations. In addition, the small businesses in the area such as grocers wholesalers, restaurant operators and transportation operators will experience positive spin-off as the development of the project will boast economic activities, resulting in greater disposable income among residence of the area. It is expected that 1,000 people will be indirectly employed in cement or related industries as a result of the

development. This is considered to be a positive significant impact as the effect will be long term and directly or indirectly will impact a wide cross-section of persons all across the country.

Mitigation: No mitigation will be considered for this positive impact.

8.2 Impact during the Operation Phase:

The potential effects of the proposed development during operation can be divided as follows:

- Impacts on air quality as a result of emissions from the cement production process and dust from the quarry activities and crushing and grinding processes. Also, international scale impacts as a result of the emissions of greenhouse gases from the production process.
- Impacts associated with noise, particularly the impact of noise on nearby human receptors.
- Impacts of the plant and quarries by changes to the landscape and visual impacts.
- Impacts on the local ecology by the loss of habitat taken by the development and impacts associated with the operations on the surrounding ecology.
- Impact on the surface water regime (hydrology) by changes to the natural drainage of the landscape within the development area and potential emissions of fine particles (suspended solids) into the water as a result of the industrial activities. Potential release of contaminated effluents into the surface water drainage. Also, impact on the underground water, called groundwater (hydrogeology) as a result of extraction of raw materials for use in the industrial process.
- Use of significant volumes of raw materials and the production of waste on an industrial scale.
- Impacts of transport.

Each of these potential issues is addressed in the following sections:

8.2.1 Effects on Local Air Quality

A detailed study of the potential atmospheric emissions from the proposed cement works was undertaken for the proposed development. This study addressed the emissions to air which may occur during the normal operation of the cement kiln, as well as the minor emissions of fine particulate matter from other process stacks. The aim of this study was to assess the effects of these emissions in terms of ground level pollutant concentrations at ground level. These changes in local air quality were then compared with the Jamaica air quality criteria and National Environment Plan Agency (NEPA) guidelines as well as the Inter-America Development Bank (AIDB) guidelines.

The emissions to the atmosphere were modeled using the latest version of the US Environmental Protection Agency (EPA) atmospheric dispersion model AERMOD. This is internationally recognized as an advanced dispersion model and is widely used in industrial regulation. The model was used with four years of meteorological data from a nearby representative location. The AERMOD model takes account of the influence of major buildings and local terrain on the dispersion of atmospheric emissions. The latter feature of the model is of particular relevance given the location of the proposed plant on a plateau above the town of Free Town, not far from a ridge of higher ground forming part of the foothills of the mountainous region inland.

The assessment focused on the locations of local residential areas (sensitive receptors) where individuals may be exposed for relevant time periods according to the air quality criteria. The wider surrounding area was also modeled in order to generate graphical results which demonstrate the maximum effects due to the plant. These maximum concentrations occur in the uninhabited areas on higher ground in the surrounding area.

It was concluded that at all sensitive receptors, the maximum changes in sulphur dioxide, carbon monoxide, particulate matter and annual average nitrogen dioxide concentrations due to plant operation are a small fraction of the relevant air quality criteria, and future air quality will remain well within these criteria. The principal emission from the cement kiln is oxides of nitrogen.

Given the likely very good existing background air quality in these largely rural locations, air quality will remain well within the hourly limit value.

The overall conclusion from the dispersion modeling study is that when the plant is in operation future air quality will be well within the NEPA limits and AIDB guidelines specified for the protection of human health. These limits are set well below the levels at which there are any observable effects on human health or respiratory function in order to protect vulnerable individuals within the population. On that basis, it is concluded that there will be no adverse health effects in the local population due to the operation of the cement plant.

Screening level assessments of the potential impact from dust emissions from the quarry areas and the potential for pollution from traffic movements associated with the operational phase of the development were also undertaken. Both of these assessments indicated that there will be no significant effects on air quality either as a result of dust emissions from the quarries or due to vehicle emissions.

8.2.2 Emissions of Greenhouse Gases

An assessment of the potential emissions of greenhouse gases from the proposed installation has been undertaken. The assessment concentrated on the main greenhouse gas emission which will be released, which is carbon dioxide. No other significant sources of greenhouse gas are likely to be released as a result of the proposed operations. As with all cement manufacturing processes, large volumes of carbon dioxide are releases as a result of the chemical reactions taking place during manufacture of clinker. In addition, the burning of large volumes of solid fossil fuels to drive the process leads to the release of significant volumes of carbon dioxide. Finally, energy is used to drive auxiliary processes associated with cement manufacture. The energy is delivered as electricity and as in this case is generated on site rather than often derived from outside sources. Most of Jamaica's electricity is diesel generated power. Diesel generated power involves the production of carbon dioxide similar as coal generated power. The greenhouse gas assessment has taken this into account. However, because of problems with power supply within the country of Jamaica, it is likely that, in the short, current, and medium term, insufficient electricity is available for the new cement production line and, Jamaica, being an island country cannot import electricity from surrounding countries.

In the cement plant design, a 9 MW cogeneration power plant is adopted to recover the hot waste gas from pyro system, which will provide about one third of the electricity consumed in cement manufacture. The rest of the electricity for cement production will be provided by a coal power plant associated with the cement plant.

The greenhouse gas assessment indicated that the proposed technology has been designed to minimize CO_2 emissions and is in line with the guidelines for the best available techniques for cement manufacture. Since the cement will be produced locally and used for infrastructure development within the country, this will reduce the greenhouse gases produced to transport cement into the country.

In order to ensure that once operational the cement production process is as energy efficient as possible, the operator will be required to conduct a detailed energy survey 2 years after the plant is fully operational. The aim of the assessment will be to ensure that the plant is operating as efficiently as possible in order to reduce the carbon footprint of the plant operations. This requirement has been written into the Operational Environmental and Social Monitoring Plan. Additionally, during operation Cement Jamaica Limited will review the market conditions to identify whether further energy saving technologies could be

installed at the site, in particular with view to burn the bagasse partially in cement plant and power plant, as well as install wind power or solar power in the future.

8.2.3 Other Operational Effects

8.2.3.1 Noise: At the time of undertaking this assessment measured ambient noise data were not available for the local area, and only limited information was available on noise levels from the processing plant, traffic and quarrying activities. Since this time, however, the noise study has been completed and can be found in ***APPENDIX 7***.

Traffic data has been used to estimate the likely ambient noise levels at noise sensitive receptors and noise source levels for a similar plant in China have been used as the basis for the impact assessment. Using this approach it can be estimated that noise levels generated from the cement production plant are unlikely to cause disturbance in any of the nearby communities during the evening or night. There may be some disturbance during the daytime at the communities nearest to the quarrying activities. This disturbance would be greatest when the quarrying activities are closest to the communities, and before the depth of the quarry provides natural screening of noise to these communities.

Changes in traffic on the local road network when the plant is operational would not give rise to perceptible changes in noise. Properties near the new link roads may be affected by increases in noise from traffic using them.

Vibration is unlikely to be perceptible from any aspect of the project. The company has committed to implement appropriate noise management practices in all aspects of the design and operation of the cement plant, quarry and transport.

A covered conveyor belt with about 2000 meter in length will be built for crushed limestone and clay transportation from the crusher station in limestone quarry to cement plant site. It will be designed away from the resident houses and running with crusher in daytime only. The conveyor belt operation, comparing with road transport, will be with much less CO_2 emission and dust emission, low noise and low vibration. It will also reduce the local road transport load extremely.

In the future, another conveyor belt for coal transportation and pneumatic pipeline transportation for bulk cement will be considered from port to the cement plant, which will improve the environment impact significantly.

A key area of potential noise and vibration emissions is the blasting associated with the limestone quarry. Note there will be no blasting at the clay quarry. In order to minimize impact of blasting at the limestone quarry, the operator will use internationally recognized techniques of sequential blasting in order to minimize the blast wave and therefore reduce any impact of the blasting. Also, blasting will be kept to a minimum and limited to the daytime. Finally, due to the unique nature of the limestone found at Rose Hall, alternative mining techniques, such as ripping, shall be employed to minimize the frequency of blasting.

8.2.3.2 Landscape and Visual: The landscape and visual impacts will be:

- Change in land cover, use and character, including an increased intensity of activity;
- Visual impact of night time lighting, including the movement of vehicles at night and the provision of above ground utilities;
- Visual impact of the movement of works vehicles and commuter traffic to, from and within the site;

8.2.3.3 Ecology: To reduce impacts on the local ecology as a result of increased human presence, disturbance and exploitation, an educational program is recommended to inform employees and their families of legal requirements and responsibilities towards wildlife. This should be conducted in a participatory manner since many of the local population may already be well-informed on the renewable natural resources of the area and be a useful source of knowledge. The environmental educational programme could be conducted / facilitated by the on-site ecologist and/or horticulturalist.

8.2.3.4 Ground, Surface Water: The operation of the facility will incorporate measures to prevent releases to ground, surface water and groundwater. Present, indications are that these will be appropriate to the nature and scale of the installation and that significant impacts should not occur. Cement Jamaica has obtained the permit from JB Ethanol to provide groundwater from its existing water well nearby for use in the industrial activities.

Information available indicates that the existing groundwater reserves will meet the exploitation rate for water supply and cement production purposes.

8.2.3.5 Raw Material Use and Waste Management: The bulk of the raw materials used in the production process will be obtained locally from the limestone and clay quarries. Available information indicates that the company has thoroughly investigated the nature of the raw material reserves and that there should be no issues associated with the use of in appropriate raw materials leading to significant emissions to air from the process. Further, on line testing in the production process will ensure that no unsuitable materials will enter the process. The process produces very little waste and that which is produced will be recycled back into the process.

Waste effluent produced from domestic activities will be treated using a package treatment plant which will be permanently situated at the site and will be operational before the peak of the construction activities. The treatment plant will be designed to take into account the load placed during the maximum number of persons on site. Design details of this plant were being discussed at the time of writing and will comply with the standard GB8978-1996.

Review of the available information of the sewage treatment package indicates that the design is appropriate to the load which will potentially be placed upon it. As part of the management programme, the operator is required to submit the final design, location of discharge point and potential impacts, if any, of the discharge.

8.2.3.6 Transport: Access to the plant area will be achieved through a 3500 meter road from Highway2000 to Windalco Port. This is clearly an easy connection especially for heavy vehicles both from the geometric and road safety point of view.
A second access to the limestone quarry locations is provided through a new road to be constructed, which will be considered together with the belt conveyor arrangement.

It is anticipated that the traffic generated by the construction phase will not have significant impact on current volumes of traffic that use the main arterial highways and the local routes. However, the level of disruption is

not expected to be significant and it should be noted that most of heavy transportation connected with ground works will not leave the plant, as excavation material will be stored within the limits of the site area.

The raw materials of limestone and clay will be transported to the cement plant via a 1,500 meter belt conveyor between the two quarries and the plant. Clay will be transported in 20 ton trucks, and will seek to uuuse routes that will avoid residential areas, the clay truck will be covered with tarp in operation, it is not expected that there will be any public exposure to emissions from these vehicles.

The production of 5,000 tons of product per day will necessitate 138 movements of 40 ton trucks. In order to supply the factory with raw materials (including red mud, gypsum and coal, which will be transported with 40 tonne truck into cement plant.) it is estimated that 1,683 tons of freight will be entering the plant per day in average – the equivalent of approximately 42 truck movements per day.

In total, 180 truck trips per day will be needed to adequately serve the factory in the period of full production. This figure is multiplied by 1.3 to provide for future growth and coverage of production peaks. The resulting figure comes up to 234 truck trips per day or an hourly demand of 30 truck trips (for a 8 hour period). This figure translates to one truck movement every 2 minutes in each direction. In conclusion, the maximum traffic demand in and out of the factory is estimated to come up to 120 private cars and 40 heavy vehicles (buses and trucks) for the peak hour per direction. The safety issues to the local communities associated with the development of the roads has been assessed as part of a Transport Safety Study, the results of which are discussed in the 'Social and Economic Issues' section below.

The impacts of the plant operation on the port infrastructure would be the exclusive dedication of 47.4 % of the Windalco Pier to the plant needs. The Bauxite operation will take another 26.3% of port occupancy level. The total port occupancy level is 74%. As a result the Windalco Port will receive considerable income.

8.3 Impacts during Decommissioning Phase:

8.3.1 No detailed assessment of environmental impacts associated with decommissioning can be made at present. The plant has an expected lifespan of over 50 years and so only general principles can be established at the present time.

8.3.2 In broad terms, the process of decommissioning is likely to give rise to impacts similar to those experienced in the construction phase. The methods and techniques selected are expected to be in accordance with national and international standards prevailing at the time of decommissioning.

8.3.3 Decommissioning will require the following activities:

8.3.3.1 Removal of all surface equipment and units;

8.3.3.2 Potential removal of hard standing and surface cover;

8.3.3.3 Abandonment of sub-surface utilities or filling and abandonment as appropriate;

8.3.3.4 Reinstatement of the site and all project areas to pre-construction conditions. With regards to the rehabilitation of the quarries during operation, the works shall be conducted on an on-going basis in accordance with the accepted timetable set out in the planning proposals to the Jamaican authorities.

8.3.3.5 For the cement plant, Jamaica Cement Limited will develop a site closure plan during the later stages of project design and maintain the plan throughout the life of the development. The plan should include arrangements for decommissioning the plant in a manner which avoids any pollution and return the site to an acceptable state. In addition any decommissioning plan should take into account the social and economic impacts and include mitigation measures where necessary.

8.3.3.6 The opportunities the site provides for long term biodiversity conservation purposes should be investigated as part of the site closure plan. There are no identified sites of ecological significance outside the main development areas that should be affected by decommissioning activities, though consideration will need to be given as to the long term use of the access roads to the two quarries. This will depend on their future use. It may be necessary to remove the roads and “re-instate” the ground and vegetation, but maintaining vehicle access or foot access only are also possibilities.

8.3.3.7 The site closure plan and preceding rehabilitation plans will need to be reviewed and updated in the light of experience with implementing the ecological mitigation and compensation measures – especially the “Habitat Restoration” proposals. These habitat restoration activities will

need to be monitored, during the course of the project, so that lessons can be learned and applied prior to and at the time of final site closure.

8.3.3.8 Overall, decommissioning activities are transitory, and are likely to be similar in magnitude to construction impacts.

Once a permit is granted for the proposed development and before site preparation and construction activities begin, a detailed Monitoring Program will be prepared for submission to NEPA, for approval. The Monitoring Program should include the following components; an inspection protocol; parameters to be monitored; frequency of monitoring and reporting procedures. The duration of the monitoring program should be for the entire construction period, with monthly reporting. The detailed Monitoring Program is best prepared after the permit is received as this would allow for the Terms and Conditions of the permit to be taken into consideration, and included in the monitoring program as appropriate.

In summary, the main potential environmental effects resulting from the development are likely to be associated with the following:

- Loss of local habitat: The plant site is located in an existing industrial complex and mining operations (by others) have already taken place on a small scale at both the limestone and clay quarries. Therefore, it is possible with appropriate management of the surrounding area, an improvement to the local ecological conditions could actually be made – especially considering CJL's planned use of existing waste materials such as red mud from the bauxite industry.
- Visual impact: The scale of the construction and operation of the cement plant and local quarries will certainly have a visual impact. Significant impacts, however, can be mitigated by means of the plant design and mining plans, including re-vegetation means and methods.
- Noise impacts: Local noise impacts will dominate particularly during the construction phase. Baseline noise testing performed by CJL suggests that the noise impact of the plant during operation is likely to be negligible at the plant perimeter. However, noise impacts of the quarries, particularly the limestone quarry blasting will be intermittently significant. This impact, together with the noise impact from increased traffic, can be mitigated through proper design of blasting techniques and modernization of existing highway and the construction of new roadways.
- Air Emissions: There will be impacts to both local air emissions and international greenhouse gas emissions, but full compliance with national and international standards will be maintained.
- Releases to ground, surface water and groundwater: The development will not have any routine discharges. However, emissions to ground, surface water and groundwater may

occur in the absence of proper controls during all phases of the development (construction, operation and decommissioning).

- Traffic and Congestion: It is anticipated that the traffic generated by the construction phase will not have a significant impact on current volumes of traffic that use the main arterial highways because the vast majority of cargo will be limited to local routes, especially Windalco Private Road leading to Port Esquivel.
- Groundwork Disruption: The plant site is fairly level. Therefore, the amount of groundwork disruption on the plant site is not expected to be significant and it should be noted that most of the heavy transportation connected with groundworks will not leave the plant, as excavated material will be stored within the limits of the site area.
- Socio-Economic Impacts: These impacts will be both local and regional and both positive and negative. However, negative socio-economic impacts will only be local and only during the construction period due to the cultural interactions between the local Jamaicans and the foreign visitors. Thereafter, there should be increase employment opportunities for Jamaicans and a strengthen construction industry for Jamaicans.

The detailed summary of these effects, the mitigation measures, and the environmental monitoring plans are found in the following ***TABLE 8.4.***

Summary of Construction Phase Impacts and Proposed Mitigation Measures

AIR			
Impact	**Proposed Mitigation**	**Residual Impact**	**Residual Impact Rating**
Air quality: - dust emissions during construction and ground works.	Development of procedures for: -water spraying roads and dusty materials stockpiles -sheeting vehicles carrying dusty materials on leaving the site to prevent materials being blown from the vehicles -speed limits on unmade surfaces on site to limit dust.	Dust propagation will be limited to construction area and will not influence local community. However workers will be supplied with dust masks especially on dry days.	Minor adverse.
GROUND AND WATER			
Impact	**Proposed Mitigation**	**Residual Impact**	**Residual Impact Rating**
Importation of pollutants already present within the materials to be used for filling and site leveling operations.	Ensure that pollutants are not present in materials imported onto the site by appropriate selection of source material by EPC Contractor and chemical analysis by CJL if required.	Potential for importation of pollutants in the material will be minimized through Cemcorp's specifications to EPC Contractor and by monitoring by CJL project engineering team.	Minor adverse.
Accidental release of fuels, oils, chemicals, hazardous materials, etc., to the ground, especially in the construction lay-down area, *during delivery to the site*.	Appropriate procedures and protocols to be established and monitored for materials delivery and handling to ensure there are no spills.	Potential for accidental release during delivery of materials to the site will be minimized via written procedures and protocols.	Minor adverse.

GROUND AND WATER			
Impact	**Proposed Mitigation**	**Residual Impact**	**Residual Impact Rating**
Accidental release of fuels, oils, chemicals, liquid waste, hazardous materials, etc, to the ground, especially in the construction lay-down area, *during storage*.	All storage areas will have appropriate environmental security measures to prevent accidental release to ground.	Potential for accidental release of materials during storage on the site will be minimized.	Minor adverse.
Accidental release of fuels, oils, chemicals, hazardous materials, etc, to the ground, especially in the construction lay-down area, *during transport to the area of use.*	Appropriate procedures and protocols to be established and monitored for materials transport and handling whilst on the site.	Potential for accidental release of materials during transport within and handling on the site will be minimized.	Minor adverse.
Accidental release of fuels, oils, chemicals, hazardous materials, etc, to the ground, *during use*, for example, re-fuelling, maintenance, etc.	Appropriate procedures and protocols to be established and monitored for materials handling and use. Where possible, re-fuelling and maintenance areas will include some form of secondary containment.	Potential for accidental release of materials during use will be minimized.	Minor adverse.
Accidental release of liquid wastes *during removal* from site.	Appropriate procedures and protocols to be established and monitored for waste materials removal.	Potential for accidental release of waste during removal from the site will be minimized.	Minor adverse.
Accidental discharge of sanitary wastewater to ground and groundwater from the workers camp.	Sanitary waste will not be discharged to the ground. EPC Contractor will provide modern Sewage Treatment Facilities.	None.	Negligible/Nil.

GROUND AND WATER			
Impact	**Proposed Mitigation**	**Residual Impact**	**Residual Impact Rating**
Contamination of local water ways from proposed effluent plant discharge.	Ensure that the plant complies with NEPA standards and international guidelines. Final effluent should have no significant negative impact on the receiving water. The plant will be designed for the full load (1200 persons) during construction.	Potential for release of harmful of effluent if the facility is underspecified or not managed correctly.	Minor adverse.

GROUND AND WATER			
Impact	**Proposed Mitigation**	**Residual Impact**	**Residual Impact Rating**
Discharge of pollutants in water used for plant, equipment and vehicle washing to ground.	Washing activities will take place on areas with appropriate containment and procedures and protocols will be established and monitored to ensure that the preventative measures are sufficient to meet NEPA effluent standards.	Potential for accidental release of pollutants to the ground during washing activities will be minimized.	Minor adverse
Increase of sediment load in natural aquatic receptors resulting from direct runoff disposal.	Minimization of excavations face during construction Temporary drainage grooves and sedimentation ponds for surface runoff collection. Note: EPC Contractor to design for tropical climate and impacts of hurricanes. The topography is nearly flat.	None.	Negligible.
Natural aquatic receptors degradation due to direct disposal of domestic type wastewater.	Construction of appropriate sewage system and wastewater treatment facility by EPC Contractor. Effluent if any will meet NEPA standards.	None.	Negligible.
Groundwater contamination from leakage of polluting substances.	Usage of non-hazardous construction materials for human health and environmental protection. Storage of potential polluting materials in appropriate areas, including secondary containment. Any contaminated land occurred during construction will be directly removed and disposed of in accordance with local regulations for waste disposal.	None.	Negligible.

MATERIALS USE AND WASTE MANAGEMENT		
Impact	**Proposed Mitigation**	**Residual Impact**
Waste generation.	Introduction of waste storage and control procedures Segregation and recycling of waste by EPC Contractor into metal components, plastics, glass separately.	Waste for disposal will be disposed of at an approved waste disposal site.

ECOLOGY		
Impact	**Proposed Mitigation**	**Residual Impact**
Rose Hall and Clarendon/St. Catherine Areas – Cement Plant and Quarry Sites:		
Loss of vegetation on site Clearance.		Vegetation loss cannot be avoided, but successful restoration, improvement and long term management of the surrounding areas for conservation and productive uses will provide significant compensation. It should be noted that most of the identified lands at the Port Esquivel Industrial Complex, Rose Hall, and Tarentum are already highly disturbed.
Further land take (habitat loss) for temporary Construction Camp.	Build temporary construction camp on land that will in due course be re-used for bagged cement storage. EPC Contractor/Cemcorp will also restore, wherever possible to green areas such as the planting fruit trees.	No additional impact since land take would occur anyway at Plant site.
Destruction of fauna and habitat for fauna (mammals, birds, reptiles, amphibians, invertebrates).	Further ecological/fauna survey at appropriate seasons and translocations monitored by the company specialist.	Moving fauna to neighboring sites may help short-term survival, but not medium-term if these sites are already occupied. In long-term populations may recover on restored sites.

ECOLOGY			
Impact	**Proposed Mitigation**	**Residual Impact**	**Residual Impact Rating**
Increase in exploitative pressures on habitats neighboring the sites.	Conduct and implement "Habitat Survey and Management Study", in close consultation with local communities.	With co-operation of local community and project providing alternative source of income, habitats should be improved.	Moderate to substantial beneficial.
On ecology of surrounding area by temporary foreign workforce as a result of removal of vegetation and the displacement of wildlife.	Education, monitoring and enforcement program. Adequate waste management and sanitation facilities. No permits will be provided to EPC Contractor for any burning.	Implementation may be difficult and some impact can be expected.	Minor adverse (subject to implementation and enforcement).

LANDSCAPE & VISUAL			
Impact	**Proposed Mitigation**	**Residual Impact**	**Residual Impact Rating**
Damage to the landscape character and visual amenity due to introduction of incongruous features and activities.	Sensitive planning of site works and worker's compound. Advanced structure planning. Minimize lighting and night time workings.	Some exposure to alteration of the landscape character and loss of visual amenity, predominantly due to out-of-site activity. Again, existing site view from Highway 2000 is highly disturbed.	Minor adverse impact.

NOISE AND VIBRATION (incorporating Transport)		
Impact	**Proposed Mitigation**	**Residual Impact**
Noise from construction of new plant/quarry and link roads.	Good site management; Appropriate choice of machinery; Methods of working; Hours of working; Efficient material handling. Goods will be imported through Port Esquivel.	A baseline noise study has been completed, but further study may be needed to predict whether there may be noise increases at nearby residential properties.

NOISE AND VIBRATION (incorporating Transport)		
Impact	**Proposed Mitigation**	**Residual Impact**
Noise from traffic relating to construction using existing roads through local residential areas.	Define access routes to the site with the smallest number of properties in proximity to it. Keep vehicle movements to a minimum. Once link roads are completed, all construction traffic to/from the site should only use the link roads.	There may be noise increases at residential properties in proximity to the chosen access route, and then from the link roads once completed.

SOCIAL			
Impact	**Proposed Mitigation**	**Residual Impact**	**Residual Impact Rating**
Foreign worker health problems may impact on work and wage payment.	Specification by EPC Contractor of reasonable sickness benefits and sick leave with pay.	Sickness over specified period may affect earnings. Early return to work may damage health.	Minor adverse.
Worker -industrial emergency.	Prearranged quality curative treatment in May Pen Hospital for all emergencies.	Depends on nature of emergency.	Minor adverse.
Foreign worker living conditions and quality of life. Utility and service provision impacts on local villages.	EPC Contractor will provide detailed specification of camp layout, facilities, and utility provision (and disposal) in accordance with identified international standards. CJL to monitor health and safety and terms and conditions of employment. To do this a foreign language speaker should be part of the team.	Depends on individual worker susceptibility. If conditions are poor multitude of issues could arise in camp and spill into local communities.	Minor / Moderate adverse.
Disturbance and conflict in camp.	In-camp codes of conduct and enforcement of key behaviors and reasonable use of alcohol shall be required.	None identified.	Minor adverse.
Disturbance and /or conflict with local population.	Camp code of conduct upheld by workers and enforced by camp. Provision of employment and opportunities to local population to minimize hostility.	Some residual impact expected but scale limited by worker free time, and local interaction with camp, especially if "Liaison Committee" is formed early.	Minor / Moderate adverse.

SOCIAL			
Impact	**Proposed Mitigation**	**Residual Impact**	**Residual Impact Rating**
Opportunities for local procurement	CJL to arrange initial contacts and encourage EPC Contractor to maximize local procurement.	EPC Contractor will commit to do it.	May vary from negligible to moderate beneficial depending on the effort and incentives.

SOCIAL			
Impact	**Proposed Mitigation**	**Residual Impact**	**Residual Impact Rating**
Potential for increased incidence of sexually transferable disease (STD) in local populations and amongst workers.	Preventative health awareness campaigns for STDs provided to foreign workers and targeted at key urban locations / groups. Provision of free condoms in pharmacies and toilets or similar common access facility. EPC Contractor will provide health checks and immunizations before expatriation.	Difficult to identify cause or source of such disease as this is commonly hidden and poorly reported. However some disease may be spread and curative treatment may be required for the different diseases, in case of HIV this would be of a long term nature.	Moderate adverse.

Summary of Operational Phase Impacts and Proposed Mitigation Measures

AIR QUALITY			
Environmental Impact	**Proposed Mitigation**	**Residual Impact**	**Residual Impact Rating**
Release of combustion gas emissions from the kiln stack.	Equipment design and primary operational management control techniques.	Local air emissions will be based on IDB and IFC Guidelines for the protection of human health at all emission point sources. On that basis, it is concluded that there will be no adverse health effects in the local population due to the operation of the cement plant.	Not significant.
Release of particulate emissions from the kiln, the clinker cooler, the coal mill and the cement mill.	Bag filters – dust abatement using very stringent 30 mg/Nm^3 standard.	Local air quality will be virtually unaffected in Clarendon/St. Catherine and will be based IFC Guidelines for the protection of human health. Licenses issued on 3-year basis.	Negligible.
Release of dust emissions from the quarry operations.	Use of best practice management techniques during extraction and loading of raw materials.	It is unlikely that there will be any discernable adverse effect due to dust deposition at any residential properties.	Negligible.
Release of combustion emissions from transport associated with transport of materials to and from the site.	Use of new, efficient vehicles, driver training to minimize emissions (e.g. prevention of over revving, shut off engines when vehicles not in use), rationalization of traffic management system to optimize transport efficiency.	Localized minor effects on air quality at properties very close to certain roads, but increments a very small fraction of air quality criteria. Given the volume of trucks, however, impact is Moderately adverse.	Moderate.

SURFACE WATER AND GROUNDWATER		
Environmental Impact	**Proposed Mitigation**	**Residual Impact**
Increase of sediment content in surface waters due to fugitive dust dispersion.	For cement plant: Storm water management through ditches and/or gutters and settlement ponds. For quarries: Quarry face will be kept minimal. Gradual rehabilitation (through landscaping and planting) of the locations where extraction works have been completed. Storm water management through peripheral ditches and settlement pond.	None.
Degradation of surface waters quality due to process water direct disposal or leakage of polluting materials.	For cement plant: Process water circulation is closed circuit including settlement tank for treatment. Storage of fuels for cement production in enclosed storage area. Tidying the plant on regular basis with mechanical sweepers removing dust collected on the streets and gutters. Thorough washing of surfaces in case of polluting materials spillages and further processing of collected washings as special waste. For quarries: special considerations for clay quarry. Preventative Maintenance of quarry equipment, protocols and procedures.	None. Appropriate collection and transportation of potential polluting materials (e.g. spent oils, lubricants, etc.).

SURFACE WATER AND GROUNDWATER		
Environmental Impact	**Proposed Mitigation**	**Residual Impact**
Pollution of surface water due to release of harmful/untreated sewage.	The sewage treatment system will be sized for peak demand during construction phase and therefore will cope with the demands during operational phase. No hazardous liquids will be released in to the sewage treatment system. The provision of a large balancing tank before final release will act as a storage unit in the event of accidental release into the sewage system.	None.
Soil Erosion.	For cement plant: EPC Contractor to design proper drainage system consistent with Seasonal Hurricanes. For quarries: Proper Drainage design by EPC Contractor as well as Gradual rehabilitation of locations where extraction works have been completed.	Soil erosion will be limited on-site the quarries.
Ground and Groundwater contamination.	For cement plant and quarries: Secondary containment for potential polluting materials. Any contaminated land removal and disposal in accordance with local and general international requirements.	Potential contamination will be limited on-site.

SURFACE WATER AND GROUNDWATER		
Environmental Impact	**Proposed Mitigation**	**Residual Impact**
Groundwater depletion.	For cement plant and quarries: groundwater reserves are considered adequate based on existing capacities at Port Esquivel Industrial Complex, especially due to low usage/high availability of the port. Abstraction rates will, at all times, be kept in accordance with Jamaican Underground Water Authority.	Existing groundwater reserves exploitation rate for water supply and irrigation purposes, exceeds by far water requirements for cement production.

LAND QUALITY			
Environmental Impact	**Proposed Mitigation**	**Residual Impact**	**Residual Impact Rating**
Accidental release of fuels, oils, chemicals, hazardous materials, etc, to the ground during delivery to the site.	Appropriate procedures and protocols to be established and monitored for materials delivery and handling. CJL and EPC Contractor will have, at all times, clean up kits available.	Potential for accidental release during delivery of materials to the site will be minimized.	Minor adverse.
Accidental release of fuels, oils, chemicals, liquid waste, hazardous materials, etc, to the ground during storage.	All storage areas will have appropriate environmental security measures to prevent accidental release to ground. EPC Contractor to design the plant for berms/perimental retainer walls that are designed for 1.5 times the capacity of any such storage tanks.	Potential for accidental release of materials during storage on the site will be minimized.	Minor adverse.
Accidental release of fuels, oils, chemicals, hazardous materials, etc, to the ground during transport to the area of use.	Appropriate procedures and protocols to be established and monitored for materials transport and handling whilst on the site.	Potential for accidental release of materials during transport within and handling on the site will be minimized.	Minor adverse.

LAND QUALITY			
Environmental Impact	**Proposed Mitigation**	**Residual Impact**	**Residual Impact Rating**
Accidental release of fuels, oils, chemicals, hazardous materials, etc, to the ground, during use, for example, re-fuelling, maintenance, etc.	Appropriate procedures and protocols to be established and monitored for materials handling and use. Where possible, re-fuelling and maintenance areas will include some form of secondary containment.	Potential for accidental release of materials during use will be minimized.	Minor adverse.
Accidental release of liquid wastes during removal from site.	Appropriate procedures and protocols to be established and monitored for waste materials removal.	Potential for accidental release of waste during removal from the site will be minimized.	Minor adverse.
Accidental discharge of sanitary wastewater and wastewater to ground	Sanitary wastewater will not be discharged to the ground. Wastewater sumps and pits will be properly designed. Pipe-work will be inspected periodically by CJL and EPC Contractor will exhaust all means to recycle water wherever possible.	None.	Negligible/Nil.

LAND QUALITY			
Environmental Impact	**Proposed Mitigation**	**Residual Impact**	**Residual Impact Rating**
Discharge of pollutants in water used for plant, equipment and vehicle washing to ground.	Washing activities will take place on areas with proper drainage systems with containment and treatment. Again, EPC Contractor will exhaust all means to recycle water wherever possible. Effluent, if any, will meet NEPA standards.	Potential for accidental release of pollutants to the ground during washing activities will be minimized by proper design by EPC Contractor and use by CJL.	Minor adverse.

ENERGY AND GREENHOUSE GAS BALANCE		
Environmental Impact	**Proposed Mitigation**	**Residual Impact**
Use of solid fuels and direct and indirect greenhouse gas emissions.	Ensure that combustion and processing is as efficient and in full compliance with IDB's requirements for 820 kg CO_2/tone clinker and maintenance and monitoring by CJL.	Emissions of greenhouse gases.

MATERIALS USE AND WASTE MANAGMENT		
Environmental Impact	**Proposed Mitigation**	**Residual Impact**
Storage of solid and liquid wastes.	Inspection of all waste storage areas to ensure appropriate identification, segregation, and containment.	Potential releases into the environment.
Waste management.	Arrangement of all solid waste management licenses and permits. Establishment of waste management disposal/recycling techniques and appropriate choice/negotiation of contractor by CJL. Establishment of filter dust handling procedures and choice of the contractors. Hazardous waste disposal techniques to be established. Review of waste minimization and recycling options for all wastes will be exhausted by EPC Contractor.	Waste management will be covered by internal procedures and will be regulated through local NEPA regulations. Increased quantity of waste will be disposed of off-site. CJL will monitor its procedures to increase or maximize recycling/reuse of any waste generated, including firing in the cement manufacturing process and composting.

ECOLOGY			
Environmental Impact	**Proposed Mitigation**	**Residual Impact**	**Residual Impact Rating**
Clarendon/St. Catherine/Rose Hall Areas – Cement Plant and Quarry Sites			
Dust deposition on leaves leading to loss of vegetation productivity and health.	The planting of tree lines by EPC Contractor during the construction phase to provide local screening in accordance with EnviroPlanner Limited's recommendation as a means to reduce dust emissions at the source. CJL will ensure that the trees are planted to aid in the prevention of dust accumulation on foliage outside the plant.	Some dust emissions at the quarry sites, associated with blasting etc, are inevitable, but emissions and impacts can be kept to an acceptable level by use of latest technologies and best working practices. Mining plan and procedures to be implemented per the recommendations and approval by EnviroPlanners Limited.	Minor Adverse.

ECOLOGY			
Environmental Impact	**Proposed Mitigation**	**Residual Impact**	**Residual Impact Rating**
Productivity and quality of vegetation for herbivores reduced.	In-plant roads will be paved by EPC Contractor. Quarry access roads will be gravel and will be periodically wetted by CJL to minimize any impact.	Some impact is inevitable, but CJL will make it a priority.	Minor Adverse.
Disturbance of wildlife by noise.	Reduced at source and less than 60 dBa at the plant fence.	The project site is highly disturbed so more sensitive species have already avoided the project areas. However, alternative areas for the wildlife will be created by CJL, such as the planting of fruit-bearing trees in strategic areas (sanctuaries).	Minor Adverse.
Disturbance of wildlife by human presence and activities.	Environmental educational program. On-site ecologist by CJL.	There should be some habituation to human presence by some wildlife, but more sensitive species may avoid the project areas. Again, the existing plant site is already highly disturbed.	Minor Adverse.
Wildlife "Road-Kills" along access roads.	Ecological Survey. Ecological Method Statement. Road Warning Signs. Driver Briefings.	With compliance, road-kills should be reduced but some are still inevitable.	Minor Adverse.

LANDSCAPE AND VISUAL			
Environmental Impact	**Proposed Mitigation**	**Residual Impact**	**Residual Impact Rating**
Damage to the landscape character and visual amenity due to introduction of incongruous features and activities.	Proper design of light sources by establishing an effective balance between safety/security and environmental sensitivity. Sensitive and uniform (paint specifications) coloration of cement plant and vehicles. Minimize the time between working and restoration phase of quarry.	Some exposure to alteration of the landscape character and loss of visual amenity, predominantly due to off -site quarry activities.	Minor to moderate adverse impact.

TRAFFIC AND TRANSPORT			
Environmental Impact	**Proposed Mitigation**	**Residual Impact**	**Residual Impact Rating**
Increased heavy vehicles traffic both locally and nationally.	Maximize the use of the rail network for bulk deliveries and abnormal loads. Restricting delivery hours to reduce noise nuisance; avoid heavy truck movements in the night hours will be considered whether deliveries should be scheduled to avoid peak times to reduce congestion; Heavy construction traffic will be subject to a traffic management plan, as necessary.	The traffic has the potential to contribute to congestion and lead to complaints due to noise/vibration nuisance on a local basis. However, the transport study indicates that there will not be a significant impact.	Minor Adverse.

NOISE AND VIBRATION			
Environmental Impact	**Proposed Mitigation**	**Residual Impact**	**Residual Impact Rating**
Noise from cement plant.	None recommended unless the plant and various installations differ significantly from similar established cement plants used as a reference.	None expected.	Nil. Less than 60 dBA.
Noise from quarrying activities	Good site management; Appropriate choice of machinery; Methods of working; Hours of working; Efficient material handling. EPC Contractor to design proper primary crusher building with barriers or baffles.	There may be noise increases at residential properties in proximity to the quarry site boundary.	Minor Adverse.

NOISE AND VIBRATION			
Environmental Impact	**Proposed Mitigation**	**Residual Impact**	**Residual Impact Rating**
Noise from increases in traffic on the local and wider road networks.	For the cement plant, no proposed mitigation efforts are recommended on existing Windalco road due to no predicted perceptible increases in noise levels due to the extra traffic. However, for the clay quarry trucks, CJL will design and install a new road to be diverted away from the Parochial Road Foothill Community on to Bodles where population density is significantly lower.	None expected on existing roads. Noise level increase possible for residential properties in proximity to the new link roads.	Minor Adverse.
Noise from traffic on new link roads.	Again, CJL will design and install a new road to be diverted away from the Limestone Quarry Foothill Community onto Bodles where population density is significantly lower.	There may be minor noise increases at residential properties in proximity to the link roads alignments.	Minor Adverse.

SOCIAL			
Environmental Impact	**Proposed Mitigation**	**Residual Impact**	**Residual Impact Rating**
Increased Employment. (positive change)	Measures to maximize local employment. Recommended: • Local recruitment and training. • Prioritization of employment of Project Affected People (PAP's) • Identification of targets of local people to be employed by skill levels. • Publication of local employment opportunities and Re-employment of people layed-off from Bauxite Plants.	This depends on skills of the people. Enhanced apprenticeship / training for some local people whose skills could be improved including Recruitment policy to extend in future to limited sponsorship BSc (or equivalent) for workers / local people children.	Major beneficial.

SOCIAL			
Environmental Impact	**Proposed Mitigation**	**Residual Impact**	**Residual Impact Rating**
Increased National tax and budget (positive change).	Assistance to villages to formulate projects and strengthen advocacy. Money from improved budget can be used to realize these objectives. CJL may be prevailed on to offer skills training for improved planning & project formulation.	Increased National Budget and secondary impact on local Clarendon/St. Catherine Communities. Residual impact will depend on effectiveness of allocation process in favor of affected villages. A ineffective process would cause conflict / discontent.	Major beneficial.
Electrical and other infrastructure improvements (neutral or positive if realized).	CJL will be self-sufficient from the National Grid so there is no mitigation. On the contrary, CJL may be able to also supply excess power to the National Grid via JPS. This will have benefit to Jamaica external to the project.	Potential positive impact on visual impacts due to infrastructure improvements.	Neutral / Minor beneficial.
Loss or reduction of livelihoods for: Herb and Vegetable Farmers (medium adverse) Graziers (medium adverse).	Confirmation of potential impact on animal nutrition and impacts on production and budgetary implications by specialist and similarly for herbs and vegetable farmers. Appropriate form of compensation is needed for each affected household. JCL to consider feasibility of job share schemes, and gender sensitive arrangements (e.g. for child care arrangements). Specific attention to be given to vulnerable households.	The majority of the Project Affected People (PAP's) surveyed have indicated a preference for employment rather than other forms of compensation. No household will lose their livelihood, and the income from employment (full or part time) of one or more household members, or alternative compensation, should be sufficient to compensate for expected reductions in the affected activities.	Neutral / minor beneficial.

SOCIAL			
Environmental Impact	**Proposed Mitigation**	**Residual Impact**	**Residual Impact Rating**
Extended and Improved Road and implications for local economy (minor/moderate beneficial).	Regulations relating to roadside and commercial activities to be adhered to by business persons and enforced by Community. Monitoring of health, road safety issues. Curative and preventive action to be taken if issues identified by monitoring.	Improved opportunities should be seen in increased opportunities and wealth of village. It may be difficult to apportion this only to the new road or cement works given the current increasingly dynamic economic environment. Residual impacts of noise and dust for local residents near the road and indirectly affected.	Minor beneficial

SOCIAL			
Environmental Impact	**Proposed Mitigation**	**Residual Impact**	**Residual Impact Rating**
Loss of land and property for 4 -9 households and compensation (minor beneficial / minor adverse)	An appropriate compensation plan will be developed and agreed upon. Compensation Plan & Framework Documents will be prepared.	No negative residual impact should be incurred by Project Affected People (PAP's). The assessment should include all applicable entitlements. Monitoring process to review and report.	Negligible / minor beneficial
Hazards associated with development of new roads from main intersection to the cement plant and from the clay quarry to the cement plant.	With regards to identified 'high' risks: -Design measures to ensure landslips/falling rocks do not cause accidents -Inclusions of pedestrian walkways and crossings -Lighting, particularly at intersections. -Planned access and parking. Risk of accident shall be reduced by implementation of education (road safety awareness) programs and liaison with the local communities as well as driver training programs and implementation of near-miss/accident reporting procedures. Communities to consider the need for additional safety bylaws or regulations for local businesses or schools near roads.	Some residual impact is expected ,but should be limited by implementation of aforementioned mitigation measures.	Moderate adverse – possibly severe adverse if there is disregarded for safety issues by the road users.

SOCIAL			
Environmental Impact	**Proposed Mitigation**	**Residual Impact**	**Residual Impact Rating**
Roadside residents health and quality of life.	Risk assessment to cover these aspects and identify mitigation. Health records of dust related disease to be maintained by local health workers. Quality of life questionnaire to monitor noise and disturbance (base line testing is already complete). Further mitigation to be decided on basis of noted impacts via monitoring.	Depends on both cases a) effectiveness of monitoring undertaken b) corrective measures taken – depends on severity of case e.g. treatment may not solve the problem – extreme health issue may require re housing. However, numbers involved are expected to be no more than 20 households at most though consequences for individuals may be severe.	Minor/ moderate adverse.
Cultural and heritage site: (positive impact)	The culture and heritage sites will be more easily accessible by monitoring site excavations.	The Indigenous People (Tienos) are believed to have resided here, but it cannot be proven until excavation.	Minor beneficial (learning).

Summary of Site Closure Impacts and Mitigation Measures

Environmental Impact	Proposed Mitigation	Residual Impact	Residual Impact Rating
Emission prevention.	Development of Site Closure Plan (see mining plans). EPC Contractor will have the plant site closure plan for cement plant construction in EPC Contractor's construction plan.	Updated information on risks and requirements will be made available at site closure.	Minor Beneficial.
Dust emissions during ground works.	Water spraying roads. Sheeting vehicles carrying dusty materials Speed limits on unmade surfaces. Dust emission monitoring in selected points	Dust propagation will be limited to demolition area and will not influence local community. However, workers should be supplied with dust masks especially during dry days.	Minor adverse.
Discharge of silty and contaminated storm water to surface water. Ground contamination by leakages from machines.	Potentially polluting materials will be stored in dedicated storage areas. Machines and equipment condition will be reviewed periodically. Machines and equipment will be sited on hard surfaces. All storm water will go via sedimentation ponds and oil separation procedures for finding contaminated material during excavations will be established. Covering and damping of excavated materials. Appropriate storage of contaminated material if found.	Ground contamination and storm water contamination will be limited on site by proper handling and storage of materials and equipment. Storm water will be treated in sedimentation ponds, the impacts on overall quality of discharge wastewater will be minor.	Minor adverse.

Environmental Impact	Proposed Mitigation	Residual Impact	Residual Impact Rating
Emergency situations during decommissioning works.	Local fire and emergency squads available on-site. Availability of CJL and contractor's inspectors on site.	Procedures for prevention and dealing with emergency situations will be implemented. Proper training and equipment need to be delivered to the staff.	Minor adverse.
Social impacts. There will be job losses.	An exit strategy should be devised to minimize losses and assist re-employment. It should include options for retraining / early retirement / assistance in job searches and positioning / identification of jobs within the group and possible relocation assistance.	Plans to re-deploy workers will be developed.	Moderate adverse.

Environmental Impact	Proposed Mitigation	Residual Impact	Residual Impact Rating
Disturbance of bats or birds that may have colonized the cement plant structures.	Survey, translocation, demolition at appropriate times of year.	Some disruption of breeding still possible while adapting to new sites.	Minor Adverse.
Some loss of flora and fauna that are re-colonizing quarry.	Some loss of flora and fauna that are re-colonizing quarry.	Quarry Restoration Plan incorporating habitat creation and use of native species.	Depending on proposed future use of quarry, habitat creation could lead to significant improvement for biodiversity over value when used as an active quarry.
Damage to the landscape character and visual amenity due to introduction of incongruous features and activities.	Restoration of the plant and quarry sites including a reforestation program.	Return of the sites to existing to better than existing condition.	Minor beneficial.
Solid waste generation.	Segregation and recycling of waste and proper storage in isolation from the ground.	Solid waste will be managed by local waste contractors and disposed according to their permits and in compliance with local regulations.	Minor adverse.
Noise and emissions generated by vehicles.	Traffic management near plant. Use of rail traffic for bulk transportation for abnormal loads.	Local traffic congestions problems avoided.	Moderate adverse
Noise from decommissioning of plant and quarry.	Good site management; Good choice of machinery; Methods of working, including sequential blasting; Hours of working; Efficient material handling; Construction of noise barrier or baffle or mound and maximizing site distances.	Until further details are known, it is not possible to predict whether there may be noise increases at nearby residential properties.	N/A

Construction Phase Environmental and Social Monitoring Plan

Items	Measures	Responsibility	Schedule
Noise/vibration from construction traffic	Ensure construction traffic only uses pre-determined routes to access the sites until completion of the link roads. Once link roads are completed, all construction traffic to/from the site should only use the link roads.	EPC Contractor	During construction phase
Dust	Constant visual vigilance of dust issues throughout the construction phase is necessary. All activities should be assessed for the potential for dust creation prior to their undertaking. Observation of the weather conditions is particularly important.	Contractor/ EPC Contractor/ CJL	Throughout the construction phase but particularly when undertaking activities or handling materials which may lead to dust creation problems.
Communications	Compile and maintain register of environmental and social communications including complaints. These can be made through the grievance mechanism which will be established.	CJL	Suitable preventive and corrective action to be taken if required. Actions to be recorded in register.
Accidents and Incidents	Compile and maintain register of environmental accidents and incidents	CJL and EPC Contractor and Contractor	Suitable preventive and corrective action to be taken if required. Actions to be recorded in register.
Waste	Visual inspection of waste storage, collection and disposal areas monthly by EPC Contractor/Contractors. And random verification inspection by CJL. Records to be maintained of inspections by all.	CJL /EPC Contractor/Contractors	Monthly inspections. Suitable preventive and corrective action to be taken if required
Waste Effluent	EPC Contractor/Contractors ensure that the proposed effluent treatment plant (sewage) is of an appropriate specification to prevent significant impact to the receiving water way. When detailed design and specification of the effluent treatment plant are available the operator is required to submit full details of the water treatment plant (including its	EPC Contractor/Contractors	As soon as the design of the effluent treatment plant is available and before it is commissioned for use during the construction phase of the rest of the development.

Items	Measures	Responsibility	Schedule
	management requirements) the expected loads, the quality of emissions, the emission point, the quality of the receiving water and the potential impact on that water.		
Storage areas	Visual inspection of all materials (including fuel) storage areas. Records to be maintained of inspections.CJL should do the random inspection.	EPC Contractor/Contractors/CJL	Monthly inspections. Suitable preventive and corrective action to be taken if required

Items	Measures	Responsibility	Schedule
Ecology Terrestrial	Belts of trees to provide local screening Environmental educational programme Access Road Wildlife Monitoring. Quarry site monitoring. Monitoring of Habitat. Restoration Programs	CJL	Monthly monitoring with annual reports
Ecology – Marine (Port)	Monitoring of vessels (waste disposal practices) Monitoring of shore-based solid and liquid waste disposal facilities	CJL/Port Authority	Routine review of documentation and spot checks. Every 6 months and occasional spot checks
Socio-Economic: Camp planning	Provision of camp specification and plans against international "norms" EPC Contractor/Contractors should review the specification and identification of amendments Codes of conduct developed /agreed and provided for information to Liaison Forum	EPC Contractor/Contractors/CJL/Cemcorp to review with advice from Liaison forum	Prior to development of camp
Socio-Economic: Standard of Construction worker accommodation	Worker questionnaire and inspection	CJL	Quarterly

Items	Measures	Responsibility	Schedule
Socio-Economic: Standard of Construction worker catering	Worker questionnaire and inspection	CJL	Quarterly
Socio-Economic: Construction worker quality of life	Worker questionnaire, Site visit. This and other questionnaires to be undertaken. Foreign language speaker trained and experienced in labor standards and issues.	CJL	Quarterly
Socio-Economic: Construction worker quality of life	Construction worker accommodation suggestion box	CJL and EPC Contractor contractor	On-going
Socio-Economic: Resident quality of life	Liaison forum or committee to be formed. Members to include: community representatives, local authority and health representatives and CJL and EPC Contractor/Contractor camp representative(s). To monitor a list of potential issues /concerns (including road accidents, local transport availability, health aspects, potential conflict and others issues) on a regular basis, identify early preventative measures and emergency actions.	Cemcorp/CJL and EPC Contractor contractor and Local Authority of Rose Hall and surrounding communities	Monthly
Socio-Economic: Health monitoring	Identify indicators and provide statistics of worker health. (EPC Contractor/Contractor)	EPC Contractor/Contractor Camp Doctor	Monthly
Road Safety Measures	Implementation of physical measures proposed in Road Safety Study to minimize road safety issues. Implement awareness	CJL	Design and construction of roads, before operation.

Items	Measures	Responsibility	Schedule
	campaign of road safety issues. Resident comments to be included and considered in the final design/safety issues;		

Items	Measures	Responsibility	Schedule
	Ensure driver contracts are contiguous with responsible driving. Implement road safety awareness/training to drivers prior to operation.		
Socio-Economic: New Road Projected Affected People (PAP's) compensation process	Verification that: Entitlement leaflet Process statement AVF valuation document. Entitlement table Produced, with adequate detail and distributed to all stakeholders Grievance processes – number of complaints / issues identified and their status. Monitoring of compensation transaction process to be undertaken by Commune. Report to be provided to CJL for annual reporting to investors and to local inhabitants	Local community based organization (CBO)	At times specified in the agreed compensation process/plan.

Operational Environmental and Social Monitoring Plan

Items	Measures	Responsibility	Schedule
Emissions to air from main stack	Constant monitoring of the key parameters and spot sampling of secondary parameters. Monitoring equipment and methods shall be in accordance with: National Jamaica requirements. The EU BAT Reference Document for Cement and Lime Manufacturing Industries. The guidelines set out in the IFC's EHS Guidelines for Cement and Lime Manufacturing and IDB's requirements.	CJL	Throughout the operation of the plant from commissioning to closure of the plant.
	The daily averaged air emissions from the main stack shall not exceed the following primary limits (mg/Nm3): y Particulate Matter: 30 y SO2: 400 y NOx: 600 The operator shall also observe the limits for secondary parameters (HCl, hydrogen fluoride, dioxins-furans etc) as stated in the IFC's EHS Guidelines.	CJL	Throughout the operation of the plant from commissioning to closure of the plant.

Items	Measures	Responsibility	Schedule
	Consideration of the necessity for installation of abatement equipment significant emissions from the cement plant. The operator is required to present a report which considers the emissions from the installation against the benchmarks, the potential reduction of local air quality as a result of the emissions and the impact on sensitive receptors. The assessment should also take into consideration the proposed future operations of the plant, particularly the main fuel to be used.	CJL	The report should be submitted to the IFC and IDB within three years of start up of the cement plant.
Emissions from other parts of the installation	Dust Emissions from clinker cooling, cement grinding etc shall not exceed 30 mg/Nm3	CJL	Throughout the operation of the plant from commissioning to closure of the plant.
Fugitive emissions to air	Constant vigilance and regular visual assessment of dust emissions.	CJL	Throughout the operation of the plant from commissioning to closure of the plant.
Operational Noise – Health & Safety	Noise Monitoring programme. Noise levels in operational areas of the plant should be measured, and the risk of damage to hearing arising from high noise levels. Staff working in areas of high noise levels should undergo training and be provided with ear protection devices and undergo regular hearing checks.	CJL	High Noise Levels areas should be identified when expected noise levels are available, and verified once the plant is operational. Staff training and hearing checks should be ongoing.
Protection of ground and groundwater	Fuels, chemicals, liquid wastes and potentially hazardous materials will be kept in designated storage areas. Refueling will be effected with a mobile bowser with suitable secondary containment and spill protection equipment.	CJL	Secondary containment for all storage tanks and containers above 20-litres in total capacity (including loading areas) must be used. These must have impervious surfaces, free of voids; gaps, cracks and the material used must be compatible with the materials contained. The total bund capacity must be at least 110 % of the volume of the largest container or tank in the

Items	Measures	Responsibility	Schedule
	Plant maintenance and plant/vehicle washing will be carried out in dedicated areas with spill containment		storage area; Proper maintenance of the secondary containment must be undertaken to keep debris, vegetation, leaked hazardous materials and storm water from accumulating; Roofs or covers should be constructed over transfer areas to minimize contact with surface water; All storage areas should be located in areas away from main construction activities and heavily trafficked routes; Areas must be kept dry and free of combustible materials; entrances, exits and aisles must be clear and unobstructed; Adequate lighting and ventilation must be provided; The areas must be secure from unauthorized access; All spills and leaks must be cleaned up promptly; Hazardous materials should be stored away from other storage areas. Suitable spill kits should be provided at all storage areas and at other suitable locations across the site. Workers should be trained in their use. All storage areas must be visually inspected at least monthly and the inspections recorded.
Landscape and Visual	Monitor soil erosion and establish a planting scheme, including advance planting with the aim to reduce erosion due to deforestation. Monitor the establishment of on and off site planting with a permissible failure rate of with no	CJL	Annually

Items	Measures	Responsibility	Schedule
	more than 10% per year. Manage access via the proposed access roads to reduce illegal stone mining Phase the quarry works and localized restoration to minimize the extent of exposed quarry face and window between extraction to restoration. Monitor biodiversity enhancement through annual surveys		
Nocturnal	Monitor the impacts of lighting through night time surveys	CJL	Annually
Waste	For all waste streams (solid and liquid) data should be kept of: Waste quantities. Physical form and containers used/packaging Disposal/treatment route. Final disposal point Recycled/reused quantities. All in house waste disposal/treatment facilities suitable monitoring/inspection in accordance with the relevant permit/license and legislation. Any breaches of legal requirements, including permits must be reported immediately.	CJL	Monitoring data and a statement on compliance with this EMP shall be reported in the Annual Monitoring Report to all relevant stakeholders.
Waste waters	Regular inspection of drainage and all waste storage tanks (including domestic) will be included in the wastewater monitoring plan.	CJL	Frequency and methods will be determined before the beginning of the work of the plant. Monitoring data and a statement on compliance with this

Items	Measures	Responsibility	Schedule
			EMP shall be reported in the Annual Monitoring Report to relevant stakeholders.
Energy	Regular internal energy inspections on the plant; testing and tuning of burners, boilers etc and so on will be undertaken annually by competent experts. Ensure that energy management is as efficient as possible. Undertake detailed study of the plant efficiency once the plant is operational to assess whether waste heat recovery for power generation or any other purpose is viable.	CJL	Monitoring data and statement on compliance with this EMP shall be reported in the Annual Monitoring Report to relevant stakeholders. Recommended that this assessment be undertaken and submitted two years after the plant has become fully operational.

Item/ Performance Criteria	Measures	Responsibility	Schedule
Determination of impacts on Project Affected People (PAP's)	Establish the grievance mechanism to facilitate the timely monitoring of impact on PAP's to ensure the quality of life is not negatively impacted in the medium to the long term period. Early indicator system to be established via forum and village representative member.	CJL to employ specialist Liaison officers	Annual quality of life survey to be conducted on PAP's using appropriated designed survey instruments.
Employment and other compensatory measures	Monitor local employment and skill levels against established targets Employment of PAP's, any reasons for non-employment to be given and alternative solution reported. Forum to arbitrate if contacted by PAP.	CJL Liaison Forum CJL to monitor and report to Liaison forum	Annual Quarterly in accordance with the requirement of the compensation plan,
Communication policies and stakeholder engagement	Satisfaction and use questionnaire to all attending. Activities identified on communications to be completed and summarised by forum and questionnaire results to be reported in CJL and Corporate Social Responsibility (CSR) activities and appropriate CJL reports	Liaison Forum /CJL	Annually for the first 3 years. And then once every 3 years.
New Road	Health of residents near road in relation to dust and associated diseases. No. cases diagnosed.	Director, Health Centre, Rose Hall reporting to Liaison committee	6 months interval

Item/ Performance Criteria	Measures	Responsibility	Schedule
	Monitor incident related to new roads and transportation to and from the plant site and quarries. Identify accident/potential accident hotspots Detail measures undertaken to make further improvements to road safety.	CJL/ Commune to instigate. Reporting to Liaison Forum to consider action CJL H&S/EHS Coordinator	Annually

9.0 SOCIAL AND ECONOMIC IMPACTS

The key impacts of the proposed development relate to four main aspects and these are:

9.1 Employment of construction workers and operation of the construction camp, in particular terms and conditions of foreign worker employment and living conditions;

9.2 The livelihoods of people from the local population whose activities may use some of the land to be used by the quarry and cement plant, some of these households are considered as vulnerable households;

9.3 Employment opportunities with Jamaica Cement Limited and local suppliers to the company and subsequent benefit to the municipal budget, and

9.4 Road and transport.

9.5 Local Labor and Risk Assessment:

The employment of foreign construction camp workers will meet the requirements of the national law for wages, tax and insurance. Foreign workers will have prepaid return transportation guarantee to China by the EPC Contractor.

1. Please find the attached sample of employment agreement from the EPC Contractor in APPENDIX 7.1.
2. Also, please see the attached construction site and work camp design information provided by the EPC Contractor as found in APPENDIX 7.2.
3. Finally please see the Health and Safety Plan of the EPC Contractor as found in APPENDIX 7.3. Details are already available on the living conditions and the design of the camp and review of this information and the monitoring of worker quality of life is available to IDB and NEPA.

Worker health, other than minor first aid, will be undertaken via the May Pen Public Hospital and local services. Major emergencies will be dealt with in May Pen which is the capital of the local town Clarendon. The local public health officer will provide targeted awareness training for communities who may be more susceptible to different transmittable diseases. A local liaison forum will be established to develop good two-way communications, allowing the information and feedback between the camp and local stakeholders.

A number of households depend for their livelihood on activities that use part of the lands which are to be included in the cement plant site (predominantly farmers). Vegetable farming and grazing activities are likely to be the most affected within the boundary of the proposed development. The ESA identifies the potential scale of these impacts and recommends that a more detailed assessment of the land use by affected farmers. A full list of farmers in 2010 should be identified to arrive at a form of compensation, taking into account vulnerable and low income households. The EIA identifies vulnerable households whose activities and quality of life are expected to be impacted. In the light of the EIA results and further assessment, CJL is developing a compensation plan. The

plan and criteria for eligibility will be informed by the EIA base line information. In developing this plan all Project Affected People (PAPs) will be invited to register during a 3 month planning period and an assessment of each case will be undertaken. Project affected people have identified a strong preference for livelihoods compensation to be provided in the form of employment by the new cement plant. CJL's business plan takes into consideration the employment of Jamaicans. These figures are found in Section 2 of this report. This will be taken into account in case assessments. A compensation framework document accompanies the EIA and sets out the principles which will guide the final plan.

A risk assessment of the traffic routes has been undertaken and has identified inconvenience and health and safety issues to stakeholders. The study was undertaken by EnviroPlanners Limited. It encompassed the proposed roads between the Clarendon/St. Catherine Plant Site and Highway 2000 and between the Quarry and the Cement Plant Site. The assessment was conducted according to the Methodology for Jamaican National Work Agency. Mitigation measures can be summarized as follows:

- Installation of mirrors will be used for 'blind spots'.
- The preliminary design did not indicate appropriate facilities for pedestrian walkways or crossings. These will be implemented into the design at the locations where potential problems may arise. Areas where such problems may arise have been identified as intersections, major access / egress locations the public schools, recreational facilities, and the bridge situated along the route of the road to the Limestone Quarry.
- Lighting not included in the preliminary design that could lead to accidents, particularly at intersections. Lighting is proposed particularly at intersections.
- Risk of accident shall be reduced by implementation of education (road safety awareness) programs and liaison with the local communities as well as driver training programs and implementation of near-miss/accident reporting procedures. CJL to consider need for any additional safety bylaws or regulations for local business activities near roads as a result of increased traffic (in the number of drivers directly related to CJL activities).

Impacts during the Construction Phase: The main contractor for the development is an EPC Contractor who has significant experience in similar construction developments. It is expected that a maximum of 1,200 workers will be on site at any one time and it is planned that they will live in a specially constructed camp. Importantly, as shown in ***Figure 9.1***, the design of the sewage treatment system will be fully capable of handling the peak demand of 1,200 construction workers. The camp will be located inside the fenced area of the entire plant site and it will have all the necessary facilities to make the camp self-contained, including recreational

facilities as shown in ***Figure 9.2***. As shown, the construction camp will consist of several pre-fabricated buildings and necessary infrastructure.

The location of the camp within the overall plant site is shown in Figure 6.3.

As shown, the total camp area is a minimum of 23,500 m^2 and a maximum of 26,800 m^2. The lay-down area is 600 m^2 and the fabrication yard is 5000 m^2 for a total of 5,600 m^2. In total, 65,000 m^2 of land area will be considered as the "Works Area" during the construction phase. Please see ***Table 9.0*** for a complete description of the construction camp.

The construction activities will include:

9.1.1 Site clearing, civil works, grading and landscaping;
9.1.2 Utilities and wired/wireless service connections;
9.1.3 Foundation excavations and installation of concrete footings;
9.1.4 Erection of buildings, steel frames, and cladding;
9.1.5 Installation of equipment;
9.1.6 Auxiliary and ancillary facilities erection;
9.1.7 Installation of equipment'
9.1.8 Building fitting-out; and
9.1.9 Commissioning (expected in 2013).

10.0 EMERGENCY PREPAREDNESS AND RESPONSE

The implementation of a project of this nature will, from time to time, encounter emergency situations which could result from man-made or natural occurrences. The project sponsors are cognizant of this and have put systems in place to plan and manage such emergency-related processes.

The EPC Contractor has established policies and procedures for such emergencies as a part of this EIA study. The complete Emergency Preparedness and Response Program (in draft form) for Cement Jamaica Limited can be found in ***APPENDIX 10.*** The Emergency Response Plan includes the following attributes:

10.1 Emergency Program:

The emergency program is founded on five (5) main principles:

10.1.1 To minimize the loss of human lives in case of emergency;

10.1.2 To reduce damage to the environment, equipment, and infrastructure;

10.1.3 To provide an organization chart and emergency management program;

10.1.4 To control and reduce emergencies, all emergency response members must pass specialize training;

10.1.5 To resume normal working activities in minimum time.

Potential impacts that are address by the Program include the following:

10.1.6 Fire;

10.1.7 Earthquake;

10.1.8 Floods;

10.1.9 Explosions;

10.1.10 Hazardous Material Leaks;

11.1.1 Civil Unrest;

11.1.2 Attacks and Other Accidents.

The Emergency Management Plan found in ***APPENDIX 10*** details the hierarchy of responsibility, training requirements, and activities at the various stages such as before (prevention), during, and after the incident. Reporting, evaluation, cause analysis, and corrective actions are to be done for all emergencies that occur. Protocols are also established for the specific emergency to include both internal and external communications.

11.0 Environmental Health and Safety (EHS) Management and Monitoring Plan

The implementation of a project of this nature will continuously give rise to personal health & safety issues which could result from man-made or natural occurrences. The project sponsors are cognizant of this and have put systems in place to plan and manage EHS-related processes.

For example, the EPC Contractor has established policies and procedures for Environment, Health, and Safety which were reviewed as a part of this EIA study. The complete EHS document (in draft form) for Cement Jamaica Limited can be found in APPENDIX 11.

The Environmental Health & Safety Program is an established system which is documented in an EHS manual. The information (policies and procedures) are general at this stage of the development, but the formal document will be tailored to address specific conditions and requirements associated with the construction and operation of this project. Best practices are the basis for the development of the document, but learning is applied over time, and the result is intended to be a "living document".

The EHS management system includes a commitment to comply with all applicable laws. Other features of the EHS program are as follows:

11.1 A system for the identification and categorization of EHS aspects. Some of the aspects identified are:

- 11.1.1 Hazardous material handling;
- 11.1.2 Working in confined space;
- 11.1.3 Working at heights;
- 11.1.4 Crane and other equipment operation;
- 11.1.5 Welding and cutting.

11.2 For all the identified critical aspects, there is a requirement as is necessary for, method statement, personal protective equipment, and permit to work.

- 11.2.1 Establishing objectives and targets for the aspects that have been determined to critical.
- 11.2.2 Training program for relevant workers in EHS management system;
- 11.2.3 Evacuation plan and procedures;
- 11.2.4 Emergency response drills;
- 11.2.5 Fossils and Heritage facility preservation;
- 11.2.6 Security and housekeeping requirements.

The requirements states in the Environmental, Health, Safety and Emergency program are comprehensive and should be adequate to ensure prevention/minimization and management of related issues. The project monitoring program should incorporate these requirements to ensure effective implementation and maintenance.

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