

**SUSTAINABLE DEVELOPMENT AND
THE INDUSTRIAL MINERALS SECTOR:
INTEGRATING THE PRINCIPLES OF
SUSTAINABLE DEVELOPMENT WITHIN
JAMAICA'S INDUSTRIAL MINERALS SECTOR**

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ABSTRACT

Jamaica has embraced sustainable national development as a policy priority. This paper therefore addresses the integration of sustainable development principles within the country's Industrial Minerals Sector, which has become a concerted focus. This is especially so as it relates to the protection of the environment and the welfare of the Jamaican people, particularly those living in areas hosting minerals-related operations. Indeed, over the last fifteen years the Government has placed more emphasis on environmental management as is reflected in the enactment of legislation, institutional strengthening, and effective participation at the global level in agreements aimed at fostering sustainable development. The mining and quarrying sector has itself embraced this concept, noting in particular the development of an Environmental Code of Practice for the Industrial Minerals Sector, the development of waste minimization strategies, such as tailings management and disposal; improving human resources capacity within the sector; and ensuring that the wealth generated is used to improve national sustainability.

Keywords: sustainable development; weak sustainability; industrial minerals sector; environment

1.0 Introduction

Sustainable development is a contestable concept. It is more a framework for change than a prescriptive approach to confront national or global challenges. There is no single path to achieving it largely because of its similarity to ideas such as liberty, freedom of speech, democracy and justice that also find wide support, but generate a similarly large number and often divergent interpretations as to how it can be implemented. Sustainable development therefore requires the integration of a range of approaches, including policies, actions and development strategies to satisfy present and future population needs, improve quality of life, and protect the environment.

The application of sustainable development to the minerals industry is especially concerned with employing technology to find new reserves, recycling materials, embracing cleaner technology, minimizing waste, effectively managing mineral resources and mineral-bearing lands, including rehabilitating mined lands, ensuring acceptable environmental practices and limiting negative impacts on communities. Additionally, it involves the application of visionary management to invest the proceeds of mineral exploitation in health, technology, education, physical amenities, good governance, and other areas of the economy to create sustained economic opportunities.

Many participants in the sustainable development debate often restrict their views to strong sustainability. However, to the extent that minerals are wasting resources, the concept of 'weak sustainability' readily applies to their management. As such, the view that sustainability and sustainable development cannot be applied to the minerals industry, and are contradictory in respect of their application to wasting resources, is not a position embraced by this paper. Certainly, while the resource is being depleted the introduction of appropriate technology not only checks the rate and speed of depletion, but provides for the possibility of substitution of one resource by another.

The application of sustainable development to the minerals industry is not without difficulties. Additionally, many who promote only

strong sustainability argue that the concept of sustainable development cannot be applied to the industry since the resources will eventually be depleted. This is a narrow view of the concept, which fails to accept that the application of sustainable development to mineral extraction cannot take the same form as its application to biological resources and other resources such as water and air. Unused, the minerals are of very limited value to human development. The challenge therefore is the approach to their use.

At the current stage of human civilization huge quantities of minerals are needed to facilitate our continued development. The largely non-renewable nature of many mineral resources provokes concerns of eventual depletion, plus the possibility for large scale environmental damage. Admittedly, mineral exploitation has the potential to effect significant changes to the landscape, particularly in the case of surface mining. However, the prediction of mineral depletion and large scale environmental damage can be prevented by applying a proactive and logical set of policies, technologies and management strategies within the framework of sustainability and sustainable development.

As the operational life of a mine is finite, effective management and planning are required to ensure that the socio-economic benefits derived from minerals development last for an extended period after mine closure, while any social dislocation and environmental damage are kept to a minimum and adequately addressed. The application of sustainable development in the minerals industry is therefore especially concerned with employing technology to find new reserves, recycling materials, embracing cleaner technology, minimizing waste, effectively managing mineral resources and mineral-bearing lands, including rehabilitating mined lands, ensuring acceptable environmental practices and limiting negative impacts on communities. Additionally, it involves the application of visionary management to invest the proceeds of mineral exploitation in health, technology, education, physical amenities, good governance, continued wealth and employment-creating activities, and other areas of the economy. Ensuring that host communities benefit from minerals operations, despite an increasing trend towards mechanization and

declining employment opportunities, is also a significant challenge to resolve within the construct of sustainable development.

1.1 Jamaica's Minerals Industry

Divided into the Bauxite/Alumina Sector, the Industrial Minerals Sector, and the Precious and Base Metal Sector, Jamaica's minerals industry is a net earner of foreign exchange, the largest merchandise exporter by value and volume, provides some of the highest salaries, contributes in excess of US\$100 million to the government's coffers annually, and officially accounts for at least 5.2% of the country's GDP¹.

The Bauxite/Alumina Sector and the Industrial Minerals Sector are the two major segments of the minerals industry. However, without the benefit of a thorough knowledge of the industry, the average reader of Jamaica's annual official statistics on economic performance² may form an inaccurate view of it being a mono-mineral industry. This is not so. Without contest, the industry is dominated by the Bauxite/Alumina Sector, which officially accounts for over 95% of the value of its output³, the overwhelming majority of foreign direct investment, and is the most formally organized of the three major sectors. However, the Industrial Minerals sector is not as small as it is officially portrayed.

The officially published figures in respect of the minerals industry are a point of contention to the extent that the Statistical Institute of Jamaica (SIJ) employs a flawed classification of economic activities within the industry. The manufacturing of alumina, the major part of the Bauxite/Alumina Sector, is seen as being directly linked to bauxite mining and is thus apportioned to that sector. The officially published figures for the sector are therefore impressive. However, lime, cement and other value-added intermediary products similar to alumina, but generated by the Industrial Minerals Sector, are classified by the SIJ as manufacturing,

¹ Economic and Social Survey Jamaica 1998-2006.

² These figures are presented in the annual Economic and Social Survey Jamaica, a major publication by the Planning Institute of Jamaica.

³ Economic and Social Survey Jamaica 2000-2006.

and apportioned to the manufacturing sector, not to the Industrial Minerals Sector. The officially published figures for the sector are therefore relatively small due in part to this action. This inconsistency in classification, and the consequent differential in apportioning economic value to both the Bauxite/Alumina and the Industrial Minerals sectors, creates the mirage of the latter contributing far less value to the economy than it actually does (Rainford, 2008).

Were the manufacturing of cement, lime, construction blocks and several other intermediary products created by the Industrial Minerals Sector shown in the country's official statistics as a part of the value that this sector annually creates, the SIJ would assign it an increased percentage of GDP. Thus, while projected as small, the Industrial Minerals Sector is not only larger than depicted in the officially published statistics; it has also grown at more than 4.00% per annum over the period 1992 – 2005⁴. This compares favourably with the country's overall economic growth of less than 2.0% per annum during the period. With projections for improved growth of the wider economy, increased alumina production that depends on key products from the Industrial Minerals Sector, increased production of value-added industrial mineral products and the expansion of the country's physical infrastructure, it is expected that the sector's continued growth will allow it to more easily stake the claim of being a pillar of Jamaica's economic transformation (Rainford, 2008).

1.2 Industrial Minerals

Industrial minerals are non-metallic and non-fuel minerals and rocks used in both their natural and processed states in various segments of industry. This definition excludes fossil fuels and metallic ores. Some metallic minerals such as chromite, rutile and bauxite, the aluminium-rich ore for which Jamaica's minerals industry has been best known since the late 1940s, are viewed as industrial minerals in advanced mineral economies such as the United States, China and several countries within

⁴ Economic and Social Survey Jamaica 1995 – 2005.

the European Union. However, consistent with the definition given above, bauxite is not treated as an industrial mineral in Jamaica, and, understandably, is not the focus of this paper.

1.3 Overview of Jamaica's Industrial Minerals Sector

Concerned with the exploration for and development of industrial minerals, and the production of value-added minerals-based products, the Industrial Minerals Sector plays a meaningful role in Jamaica's economy. Our primary industrial minerals are limestone, hard volcanic rocks (for the manufacturing of skid resistant aggregates, dimension stones and other materials used in construction), sand and gravel, gypsum, clay, shale, marble, silica-sand and dolomite. Limestone and volcanic rocks form the two largest groups of industrial minerals with estimated resources in the billions of tonnes (Ministry of Land and Environment, 2005).

Estimates of the quantity of the major industrial minerals vary. The Mines and Geology Division (MGD) estimates limestone resources at 310 billion tonnes, with 108 billion tonnes being declared proven reserves (Ministry of Energy, Mining and Telecommunications, 2008b). An inferred resource estimate of 11.15 billion tonnes of high quality whiting grade limestone and 57.5 billion tonnes of chemical, industrial and metallurgical grade limestone are theorized to exist within the island. Total reserves of whiting, industrial, chemical and metallurgical grade limestone are yet to be quantified (Ministry of Energy, Mining and Telecommunications, 2008a).

The terms inferred and estimated are employed to describe these resources in recognition of the fact that only preliminary prospecting work has been executed to locate, sample and provide crude data on their quality and quantity. A discussion on reserves of industrial minerals, particularly limestone, has to be restricted to the exploration work that has been conducted by several of the leading companies within the sector. These include Chemical Lime Company, Caribbean Cement Company Limited, and Lydford Mining Company Limited, which have jointly reported reserves of chemical and metallurgical grade limestone exceeding

2.85 billion recoverable tonnes. These reserves are less than 4% of the estimated limestone resources, which are being depleted at less than 11.5 million tonnes per annum⁵. The hard volcanic rocks are yet to be exploited. Appendix I provides details of the country's industrial mineral resources and reserves.

The wide spectrum of activities included in the sector range from quarrying, block manufacturing, stone-cutting and polishing, to the manufacturing of various types of mineral-based bonding agents, including Portland cement, lime and other mineral-based products. It also includes engineering, haulage, equipment sales and rental, and professional services dedicated to the sector.

Table 1, Production of Major Industrial Minerals 2001-2006, provides production figures for limestone and sand and gravel.

Annual official statistics cite the sector as contributing only about 1.5% of GDP (Planning Institute of Jamaica, 2003, 2004). These figures undervalue the sector and are therefore disputed. Specifically, significant production and value associated with the manufacturing of minerals-based value-added products such as cement, lime and construction blocks are excluded from these figures, and are apportioned to other categories of economic activity, which were mentioned earlier. Over 95% of the sector's output is consumed locally, less than 4.0% is exported and annual direct foreign exchange earnings are estimated to be about US\$10 million. However, it is estimated that through import substitution the sector saves Jamaica between US\$65 and US\$110 million annually.

The Industrial Minerals Sector is largely informal, thus presenting numerous managerial challenges to the government. Of the 215 quarries which were licensed to operate at the end of December 2006, only 122 submitted returns reporting some degree of operation during the year. Approximately 1625 persons were directly employed in these operations, with a further 6500 – 8125 being indirectly employed (Ministry of Mining, Energy and Telecommunications, 2008b). The thirty largest quarries account for over 70% of the sector's annual production. Over 85% of the

⁵ Economic and Social Survey Jamaica 2007

TABLE 1
Production of Industrial minerals 2001-2006 ('000 Tonnes)

INDUSTRIAL MINERALS	PRODUCTION DATA, '000 Tonnes					
	2001	2002	2003	2004	2005	2006
Silica Sand	8.2	9.4	12.8	11.2	14.3	9.6
Crushed Limestone	2442	2430.0	2483.0	2500.0	2610.0	2801.0
Gypsum	320	165.0	249.0	283.0	302.10	364.4
Marble	0.15	0.16	0.16	0.12	0.12	0.1
Sand and Gravel	2205	2249	2316	2362	2392	2760
Marl & Fill	4322	5693	6376	5900	5310	3001
Pozzolan	0.0	0.0	0.0	0.0	79.0	149.3
TOTAL	10,397.35	10,546.56	11,436.96	11,056.32	10,707.52	9,085.4

Source: Economic and Social Survey 2005, 2006

quarries and their directly integrated businesses, particularly block manufacturing, marble cutting and lime manufacturing, are located in rural and semi-rural areas, where they play a meaningful role in maintaining the socio-economic fabric of sections of these communities. Residents depend on them for employment, the provision of affordable construction materials and assistance to fix, maintain and clear roadways, especially after floods and storms, among other forms of support such as contributing to the operation of pre-primary schools. Over 90% of these operations are locally owned.

The companies comprising the sector are generally micro to small (annual production less than 250,000 tonnes and between 250,000 and 499,000 tonnes, respectively) with fewer than 10% being regarded as medium (500,000 – 1,000,000 tonnes annually). Although the potential exists, there are no entities of a world-class size with annual production of over 4 million tonnes. Currently, there are fewer than five companies that can be classified as large with annual production of over 1,000,000 tonnes. However, through joint ventures and take-overs, several multinational companies, with plans to each produce over 6 million tonnes of material per annum, have since 2007 established a presence in the sector. These projected volumes exceed those currently produced by the largest entities in the more mature and formally structured Bauxite/Alumina Sector. The sector is therefore changing. Additionally, it is expected that by 2012 its annual production and export volumes would have surpassed that of the Bauxite/Alumina Sector, which hovers between 14.0 – 16.0 million tonnes of bauxite and bauxite equivalent⁶. In terms of foreign exchange earnings, contribution to government revenues, and direct employment, the sector will continue to lag behind the Bauxite/Alumina Sector until it significantly increases its output and export of high-end value-added products such as lime, hydrated lime, precipitated calcium carbonate, cement and marble products.

Since 2001, over forty of the operations have improved their equipment and machinery. Notwithstanding this, in many of the smaller

⁶ Bauxite equivalent means all the bauxite that has been processed into alumina (a ratio of roughly 2:1).

entities, these remain largely outdated and inefficient. Additionally, there is limited product research and development, but there has been a greater penetration of environmental management and sustainable development practices, which are becoming evident in improving waste management practices, increased attention to applying more appropriate technology and improving quarrying practices.

Illegal recovery and under-reported production are known practices, which in 2001 accounted for an estimated 10 – 25% of the production of particular minerals, particularly river-deposited sand. However, owing to strategic interventions by the authorities, these figures have been trending downwards (Ministry of Agriculture and Lands, 2006). These interventions include more frequent visits to operations that have been known to under-report their production, the use of survey equipment, photographs and other tools to determine quantities of material removed from areas being quarried, and the requisitioning of the files of companies that purchase large quantities of quarry materials from quarry operations which it was deemed necessary to investigate.

1.4 Possible Environmental Impacts of Mineral Extraction

Mineral extraction, particularly in the absence of the professional application of mining engineering practices and an effective monitoring regime, can occasion serious negative environmental impacts. These include deforestation, soil erosion, localized and regional subsidence, air pollution, ground and surface water pollution, sedimentation, ecosystem disruption, and changes in the landform. The generation of huge quantities of waste, particularly hazardous waste, social dislocation and visual intrusion are other problems which may be associated with mining. Significantly, many of these problems can be successfully mitigated with a combination of the application of appropriate technologies, proper management, location and sequencing of activities, and land rehabilitation.

2.0 The Application of Sustainable Development Principles to Jamaica's Industrial Minerals Sector

Sustainable development is a particularly complex concept (Dresner (2002), Gray and Bebbington (2001), Langhelle (2001) and Harris (2000). Even before Brundtland's accepted definition of development that meets the needs of the present without compromising the ability of future generations to meet their own needs (WCED, 1987), it was realized that a myriad of issues would need to be addressed in order for this ideal to be achieved. Accordingly, the concept advances the interdependent and mutually reinforcing notions of economic development, social development and environmental protection in addition to governance and cultural preservation, which are necessary to satisfy present and future population needs, improve quality of life, and protect the environment.

Of course, the term has different meanings to specific countries, and small island developing states (SIDS) like Jamaica need to pursue a model adapted to their specific realities and aspirations (Kaly et al. 2002). Such a model should take cognizance of vulnerabilities exacerbated by small size, lack of economies of scale and susceptibility to the impacts of natural disasters, economic shocks and globalization. It was against this background that the Barbados Programme of Action (BPOA) was enunciated and these concerns and challenges reiterated in the Johannesburg Plan of Implementation (JPOI) and the Mauritius Strategy for the Further Implementation of the BPOA (MSI).

2.1 Sustainable Development: The Industrial Minerals Sector Perspective

One of the greatest challenges facing many national governments is integrating economic activities with environmental integrity and social concerns. Therefore, on the basis that a sustainable approach to minerals development is essential to effective and continued wealth creation and poverty reduction, the industry has been challenged, particularly since 2003, to address this problem.

The application of sustainable development to the industrial minerals sector is effected primarily through the application of education, technology and a proactive legal and regulatory framework to uncover new reserves, promote recycling, substitute one mineral for another, embrace cleaner technology, minimize waste generation, effectively rehabilitate disturbed lands, ensure acceptable environmental practices and minimize negative impacts on human populations. Additionally, it involves the application of visionary management to invest the proceeds of mineral exploitation in health, education, technology, physical amenities, good governance, equity, effective environmental management and other areas of economy in a planned and sustained attempt to improve the well-being of current and future generations.

Agenda 21 outlines several principles to be considered for a country to progress along a sustainable path. Those of particular significance to the minerals industry include the precautionary and the polluter pays principles, sustainable patterns of production and consumption, and the principles relating to social equity and governance.

In this regard, the Government of Jamaica has advanced improvements in national capacity for policy and legislation formulation, the development of databases and assessment of mineral and aggregate resources. As the Mauritius Strategy of Implementation (MSI) outlines, Jamaica has also developed its capacity to evaluate mineral sector projects, including using environmental and social impact assessments to identify opportunities and risks and ensuring compliance with mitigatory and ameliorative measures where impacts are negative.

Since the promulgation of the National Industrial Policy in 1995, the Government has sought to infuse greater levels of environmental stewardship in the minerals industry. The application of sustainable development to the industry has, however, been more recent. Actions such as the refinement and expansion of the Bauxite Community Development Programme, community-based Quarry Monitoring Committees, the presentation of sustainable development courses that have been aimed at the Industrial Minerals Sector, policy development, amendments to relevant and associated legislation and strengthening the

working relationship with all stakeholders indicate the state's attempts to ensure that sustainable development is embraced by the industry.

2.2 The Licensing Approval Process

The approval of a mining lease or a quarry licence is the remit of the Minister responsible for the minerals sector. However, the approval process is rigid and takes into consideration the technical views of several independent agencies, as a mechanism to ensure that sustainable development considerations feature in the decision-making process. In recommending the granting of a licence therefore, the regulatory entity, the Mines and Geology Division, consults the National Environment and Planning Agency, the Water Resources Authority and the local planning authorities, for environmental and planning concerns; the Rural Physical Planning Division for concerns relating to the use of agricultural lands; the Ministry of Health for public health concerns and the National Works Agency for concerns relating to civil infrastructure. Other entities are consulted on a needs basis.

2.3 Environmental Management

Like other developing countries, Jamaica experiences challenges to integrate environment and development considerations while addressing pressing social and economic issues (Ministry of Land and Environment, 2002). However, recognising the likely negative impacts of mineral exploitation activities on the environment, the Government has developed policies to treat with such possibilities. As such, over the last fifteen years, greater emphasis has been placed on environmental management. This is reflected in the establishment of the Natural Resources Conservation Authority (NRCA), the National Environment and Planning Agency (NEPA),⁷ the enactment of legislation,

⁷ The National Environment and Planning Agency was established in 2002 as a merger of the Natural Resources Conservation Authority, the Town Planning Department and the Land Development and Utilization Commission.

dissemination of environmental information through public education and sector-specific outreach programmes, the participation in environmental initiatives at various levels and the development of National Plans of Action (NPAs).

Management of mining wastes, air quality and effluent standards are routine conditions of the licence. All applicants for a mining lease or a quarry licence must also produce a Mine/Quarry Development Plan, which, among other things, shows the rate of resource extraction, land rehabilitation plans and waste management and pollution abatement strategies.

As required under the NRCA Act, 1991, before approval is given for a major quarrying operation, an Environmental Impact Assessment (EIA) has to be submitted. For smaller operations, environmental, social and economic impacts on host communities are considered in their mine/quarry development plans.

In the case of operations requiring the completion of an EIA, the process allows multi-stakeholder involvement, the identification and the resolution of some potential problems before the operations commence. Importantly, preliminary assessments by the Minerals Policy and Development Division indicate that community support, concern or opposition for a proposed project or aspects of the project is established early and provides an arena for the proponents, the policy and regulatory directorate, residents and other stakeholders to resolve their differences amicably.

The Quarry Development Plans submitted by the small operations (operations with annual output below 250,000 tonnes) allow the regulatory authorities, especially the ministry with responsibility for mineral resources, to obtain a clear idea of the validity of the proponents' stated environmental and socio-economic impacts on the host communities. Any perceived over-simplification or understating of these impacts can be readily pointed out, and the proponents directed to have them addressed.

2.4 Environmental Code of Practice

In conjunction with the Government, the private sector-based Mining and Quarrying Association of Jamaica (MQAJ) developed a draft voluntary Environmental Code of Practice (ECP), which enunciates an environmental stewardship programme for the Industrial Minerals Sector. It addresses issues such as the management of biodiversity, waste management, land rehabilitation, energy management, partnerships with other entities to maintain standards, and occupational health and safety.

This modern approach of self-regulation is a shift from the usual command and control method, which requires considerable resources for monitoring and enforcement. It is able to command substantial practical experience, which often enables the private sector to address problems more capably. Self-regulatory efforts are often less adversarial, more flexible and sometimes less burdensome than governmental regulations as they relate to adopting and enforcing standards. In several instances, private sector self-regulation promotes innovation. Importantly, this approach promotes corporate responsibility, enhances the interaction between the Government and the private sector and allows the Government to devote its scarce resources to other areas.

The Government has not yet conducted an assessment of the impact of this ECP, especially because the draft document was only ratified by the MQAJ in July 2007.

2.5 Land Rehabilitation

The rehabilitation of mined/quarried lands is an essential link in the mineral exploitation cycle and the general management of the Industrial Minerals Sector. It allows for sequential land use planning as embodied in the appropriate post-mining use of these lands.

Within natural ecosystems, biological diversity is a key characteristic and forms the basis of all ecosystem goods and services upon which sustainable livelihoods and food security depend. Many minerals operations have historically failed to recognize this fact and have

thus invited blame for damaging ecosystems, the full recovery of which may take many years. As such, the safety, environmental and social risks arising from inappropriate rehabilitation or failure to rehabilitate disturbed lands can result in significant liabilities for the companies and the affected communities. The Government of Jamaica recognizes this and has developed policy initiatives to avoid negative impacts and, where necessary, to restore impacted environments. Land rehabilitation is therefore an essential step if the sector is to contribute significantly towards sustainable national development.

The Quarries Control Act, 1983 (under Section 12) and the Mining Act, 1947 and their respective Regulations are the major pieces of legislation governing land rehabilitation in Jamaica. The country's post-mining regeneration priorities include restoration of the land to a sufficient quality to support pre-mining land use potential such as agriculture (including forestry), and restoration of its biological diversity, and improvement of its wider ecological functions. These rehabilitated lands have to be certified by the Commissioner of Mines that such quality has actually been achieved. The Forestry Department has assisted several minerals operations by working along with the Commissioner of Mines to return mined lands to pre-exploitation conditions. Other environmental considerations include the minimization of current and potential future impacts on water quality and supply. On the social side, job creation through training, education, promotion of economic projects and community enhancement are important considerations.

The need to rehabilitate limestone quarries is most pressing particularly because the vast majority of them advance slowly owing to their small annual production. The slow rate of plant growth and ecosystem regeneration in dry limestone ecologies where there are the challenges of thin soils and low annual rainfall are other major problems impacting rehabilitation of some of Jamaica's limestone quarries. Consequently, the scars created in the white limestone set in a green background contribute to visual intrusion for protracted periods. Reducing the number of quarries and creating larger quarries, which are better capitalized and advance at a much faster rate, have been posited as

possible solutions to these problems. There are also concerns relating to river-based sand and gravel quarries; however, these areas are often naturally rehabilitated after major rains.

The draft Quarry Rehabilitation Bond Policy promotes sequential land-use as a key aspect of land-use planning and is intended to assist the Industrial Minerals Sector to minimize any negative impacts on the environment and protect and re-establish ecosystems. The policy sets out the posting of a restoration bond as a specific condition of each quarry licence. The provisions of the Policy are in accordance with the National Quarry Policy, which speaks to the progressive rehabilitation of disturbed areas. In support of the Quarries (General) Regulations, the National Quarry Policy, which has been subsumed in the larger draft National Minerals Policy, promotes the implementation of penalties for failure to rehabilitate an area to specified standards. These penalties include forfeiture of the restoration bond, appearance before a resident magistrate, cancellation of a licence and refusal of an application for renewal of a licence or for a new licence.

The major purposes of the restoration bond are to influence operators to employ a mining ethic consistent with technically efficient mining and environmental stewardship, as well as to ensure that a pool of funds exists to offset the cost of rehabilitation should an operator fail to do so to the satisfaction of the Commissioner of Mines. Factors considered in calculating the size of the bond include the type of quarry, the location of the quarry, complexity of the terrain and the general ecosystem, the planned use of the rehabilitated area, size of the area to be rehabilitated and the over-all projected cost to execute the project.

2.6 Data Gathering as a Basis for Decision-making

Both the JPOI and the MSI speak to the promotion and development of appropriate systems at the national level to ensure that scientific data are utilized in the decision-making process. Indeed, one of the accepted fundamental principles of sustainable development

mentioned above is the precautionary approach to development in the absence of sound data.

Jamaica is now more informed about the state of its natural resources as a result of a concerted effort to gather and maintain databases. Several of the policies that have been developed to guide industrial practices and urban management have benefited from this process, which is an essential tool in the decision-making process in both the public and private sectors. In 2001, the first detailed quantitative *Environment Statistics and State of the Environment Report* was produced, following earlier State of the Environment reports done in 1995 and 1997. As it relates specifically to the Minerals Industry, the Statistical Institute of Jamaica has been producing an *Environment Statistics and Mineral Accounts* publication since 2003, the overall objective of which is to provide statistical information in support of national policies to promote the productive and sustainable use of resources.

A *Sediment Budget* Report on the most quarried river in Jamaica was completed in 2006 and will guide the work of the Mines and Geology Division as it relates to regulating the rate of sand and gravel removal from rivers being quarried. Additionally, a *Survey of Local Quarry Operations* was completed by the Minerals Policy and Development Division in 2006 and will assist in facilitating the development of robust sets of indicators for public and private sector decision-makers to measure progress toward sustainable development in the sector.

The Industrial Mineral Resources Development Project between Jamaica and the Czech Republic, which targets non-metallic minerals such as limestone, marble and volcanic rocks, has also assisted in the identification of new commercial mineral deposits in Jamaica.

The documents and programmes mentioned above were developed or implemented only in the last six years, and in some instances, less than a year. Consequently, an assessment of their contribution to the development of greater levels of sustainability within the Industrial Minerals Sector is yet to be completed. Note, however, that to the extent that other countries such as Canada, England, the Czech Republic and Ireland have instituted similar projects that have benefited

their minerals industry, it is expected that the course of action taken in Jamaica will also provide positive results.

2.7 The Development of Policies

There are ongoing consultations to finalize a National Minerals Policy, which will subsume the 2003 National Quarry Policy, and which outlines initiatives and strategies to be employed to facilitate the industry's continued development, its coexistence with other segments of the economy, and the management of mineral resources. When completed, it will provide a formal framework within which all segments of the minerals industry can develop. The draft policy promotes the principles of sustainable development as fundamental tenets in the overall development of the industry. There is a particular focus on minimizing negative impacts on communities and the natural environment.

Significant initiatives outlined in the draft policy include *inter alia*:

- i) The establishment of officially declared mineral development zones (Quarry Zones and Mining Zones) including the establishment of buffer zones to restrict the proximity of human settlements to mineral operations, thereby minimizing adverse impacts on communities.
- ii) The application of cleaner technologies to reduce waste and energy use.
- iii) The establishment of a National Mineral-bearing Lands Bank to monitor resource holdings and use of reserves.
- iv) An emphasis on host-community impact development plans as a significant aspect of mine development and closure plans.

There is also a plethora of policies and action plans directly or indirectly related to sustainable development in the sector, several of which deal with the management of natural resources. These include *inter alia* the National Land Policy, the Strategic Environmental Assessment Policy, the Watershed Policy, the Energy Policy, the Forest Management

and Conservation Plan, and the National Biodiversity Strategy and Action Plan.

2.8 Legislative Amendments and Institutional Strengthening

The management of Jamaica's mineral resources finds legal support in several pieces of legislation. Government, in recognizing the large-scale impact the Industrial Minerals Sector can have on public health and the environment, promulgated the Quarries Control Act in 1983 which gives the Minister the authority to refuse the issuance of a quarry licence if this were thought to be in the public's interest. Factors such as the preservation of the environment, the availability of recreational areas for the public and the possible pollution of communities within their environs are taken into account.

There has also been an ongoing review of legislation governing the sector, including amendments to the Quarries Control Act and the Mining Act. The amendments proposed for the Quarries Control Act include the establishment of a Minerals Development Advisory Council to promote sustainable development of the minerals industry, the introduction of fines for failure to rehabilitate quarried lands as well as an increase in penalties for other contraventions. There is also a proposal for the creation of a comprehensive Minerals Development Act to replace the Quarries Control Act and the Mining Act.

The Mines and Geology Division is to be transformed into a performance-based institution to ensure the promotion of transparent and efficient management, the enhancement of the delivery of services to the public, and business facilitation, which will pave the way for the canvassing of investment opportunities as well as research and development. There are also discussions to create a National Minerals Institute.

The development of international environmental law and initiatives has been catalytic in the development of domestic legislation (Davis-Matthis, 2002). Jamaica is signatory to many of the major environmental treaties and has accepted the contents of the following, which relate

directly to the minerals sector: the 1996 and 1997 Santiago Declarations, the 1997 Declaration of Arequipa, the 1998 Declaration of Buenos Aires, the 1999 Declaration of Caracas and the Vancouver Declaration of 2000.

2.9 Capacity Building and Public Education

In 1998, the Government launched the National Environmental Education Action Plan for Sustainable Development, which included a commitment to implement a National Environmental Communications Campaign with an objective to increase and coordinate communication around the issues of environment and sustainable development. Communities hosting minerals operations were specifically targeted to improve their knowledge of the quarrying sector through the formation of Quarry Monitoring Committees and presentations to community groups. However, these activities have not been sustained at the level expected.

The launch in 1999 of the MQAJ, a trade and development-focused private sector group representing the interests of the minerals industry, was to assist in developing capacity within the private sector and to encourage its members to apply sustainable development principles to their businesses. Through this entity, the importance of compliance with applicable laws is further enhanced.

Staff in the main regulatory and policy entities associated with the Industrial Minerals Sector are being constantly upgraded through structured exposure to training in sustainable development and related fields. Under the 2001 Czech Republic Technical Cooperation project, several technical staff at the MGD have been trained in minerals development, mineral planning and quarrying issues.

A continued drive to inform members of the judiciary and the police about the importance of ensuring compliance with the laws governing the industry has been particularly productive. In 2003, NEPA hosted a series of symposia specifically geared towards resident and lay magistrates in respect of increasing knowledge of the laws relating to natural resource management. NEPA also introduced its Compliance and Enforcement Field Guide, which addresses compliance under a raft of

legislation. Consequently, persons monitoring the minerals industry have increased their knowledge of the applicable laws.

Through environmental programmes in the school curriculum and numerous media presentations, the general public has become more environmentally concerned. Citizens are therefore more willing to lodge complaints against mining/quarrying entities for various infractions. This level of public vigilance has pressured these entities into heightening their levels of compliance with the various laws under which they operate.

2.10 Repositioning of the Industrial Minerals Sector

To be better able to implement mechanisms to foster its sustainable development, the Government has decided to reposition the Sector by re-emphasizing its significance to the economy. The creation of a National Minerals Week in 2006 culminating in a Minerals Industry Trade Fair, Exhibition and Symposium as a part of the minerals industry calendar is a promising indication of the focus of the industry and the move towards integrating sustainable development within the sector.

The National Minerals Industry Awards will also be restructured to recognise achievements in the production of value-added products, the application of science and technology, improvements in efficiency, investment in human resource development and association with host communities. Currently, there is a focus on recognising primarily achievements in health and safety in the Bauxite Alumina Sector. Broadening the scope of the awards should encourage investors to do more to improve their businesses, positively affect employment and wealth creation, and contribute to overall sustainable national development.

With the success of National Minerals Week 2006, a similar event has been scheduled for February 2009. The exhibitors, presenters and visitors to the events marking the week of activities have agreed that it provides a very meaningful forum to focus on the contributions and challenges created by the minerals industry. Participants have pointed to the broad body of information that they were able to obtain from the

events, the extent to which issues of concern relating to the operations of mineral development companies were clarified and their ability to have developed a greater insight into the operations of the industry as important positive features. The week of activities has therefore been slated to be hosted every two years.

3.0 Conclusions and Recommendations

In a small island developing state such as Jamaica, the future of the Industrial Minerals Sector hinges on its ability to coexist with competing forms of land-use and to contribute to national sustainable development, and particularly the sustainability of the host communities in which its various operations are located. Therefore, the sector's continued existence and development must be evaluated on the basis of its contribution to national sustainability. In keeping with worldwide trends, development in the sector should have social, economic, environmental and political justifications, and thus proceed on a path of eco-efficiency. This approach is necessary to, among other things, minimize environmental degradation that might be associated with mineral exploitation, optimize the economic and social benefits to be derived from our mineral wealth, sustain the sector's structured development and ensure harmonious co-existence with other competing forms of land-use.

The Government of Jamaica, through the enunciation of national policies, has embraced the general concept of sustainable development as such a strategy will not only result in the reduction of poverty and social and economic development, but also consider the fundamental principles of environmental conservation and preservation, governance, equity and, synergies and constraints on development initiatives. In keeping with the sustainable production and consumption thrust of Agenda 21, and other global agreements which the government has ratified, it is important to note that integrating social, economic and environmental concerns into the industry is the only path along which to proceed.

To build on the progress already made, as a matter of priority, the Government should fast-track the completion and implementation of the

National Minerals Policy. The necessary legislative amendments also need to be undertaken particularly as they relate to provisions for penalties for quarry operators that fail to rehabilitate lands and the introduction of a comprehensive Minerals Development Act. Economic development of the sector must be prioritized in order that the profits generated are appropriately invested in social programmes, community development, and economic ventures that will generate profits for reinvestment in the country. In fact, the creation of a Development Strategy for the sector, including ports to facilitate export, should be urgently addressed.

Although there have been notable instances of capacity development, the Government and the private sector must focus on training, retooling, and research and development for the sector, including greater promotion of resource efficiency and the production of value-added mineral-based products. This is especially so as it relates to highlighting the ways in which sustainable development principles can be infused into business. Increasing the opportunities and strategies for community involvement and stakeholder engagement in decision-making would also prove beneficial and conform to the Rio principle of participatory governance.

Specifically as it relates to land rehabilitation, and based on experiences, it is suggested that quarry/mine inspectors become more involved with the stewardship of rehabilitated lands. This would indeed form part of the integrated approach to quarry/mine closure planning.

It was only in 2004 that the ministry with responsibility for the management of the country's mineral resources agreed to formally introduce sustainable development as a core feature of the management and development of the Industrial Minerals Sector. Many of the projects aimed at assisting the sector to obtain these objectives were introduced in a coordinated and deliberate form in only the last two years. It is true that aspects of environmental management, resource management and other important aspects of a sustainable approach have existed for many years. However, the coordinated approach within the construct of sustainable development is recent. As such, the country is yet to make a detailed, continued and integrated assessment of the projects' impact on furthering

the objective of ensuring sustainability within the sector. That task will be the subject of a future paper.

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APPENDIX I**Major Industrial Mineral Resources of Jamaica****CLAY**⁸

Deposit Type	Deposit Location	Parish	Estimated Reserve/ Million mt
Alluvial Deposit	Frome Plains	Westmoreland	152.4
Alluvial Deposit	Black River Valley	St. Elizabeth	0.508
Alluvial Deposit	Holland	St. Elizabeth	0.254
Alluvial Deposit	Frenchman's	St. Elizabeth	0.03
Alluvial Deposit	Cow Market	St. Elizabeth	0.304
Alluvial Deposit	Nassau and Essex Valley	St. Elizabeth	2.54
Alluvial Deposit	Bog Walk	St. Catherine	2.15
Alluvial Deposit	Cave Valley	St. Ann	0.762
Alluvial Deposit	Liguanea	St. Andrew	Unknown
Residual Deposit	Above Rocks	St. Andrew	Unknown
Residual Deposit	Golden River	St. Andrew	0.002
Hydrothermal Deposit	Jobs Hill	St. Mary	0.007

⁸ Inferred Estimate of Total Clay Resources = 158.9 million metric tonnes.
Source: Bailey, B. V. (1970) Jamaican Clay Deposits, Economic Geology Report, Geological Survey Division

GYPSUM⁹

Deposit Name	90% Gypsum	80% Gypsum	70% Gypsum	Anhydrite
Brooks	1,299,770 mt	1,524,200 mt	1,645,100 mt	3,097,400 mt
Av. Grade	94.29%	92.89%	91.66%	22.55%
Bito	1,539,400 mt	2,060,700 mt	2,229,900 mt	2,154,600 mt
Av. Grade	93.98%	92.43%	91.22%	35.79%
Halberstadt	3,663,500 mt	3,668,600 mt	3,688,600 mt	2,366,900 mt
Av. Grade	93.49%	93.44%	93.44%	11.97%
Total Reserves	6,502,600 mt	7,273,500 mt	7,563,600 mt	7,618,900 mt
Wtd. Av. Grade	93.76%	93.03%	92.39%	23.00%
Life (Years)	33	36	38	

⁹ Source: Jamaica Gypsum Ltd (Technical Reports – MGD/JBI) 1957 - 1980

CALCAREOUS DOLOMITE/DOLOMITIC LIMESTONE ¹⁰

Known Dolomite/Calcareous Dolomite/Dolomitic Limestone Reserves

Deposit Name	Parish	MgO Range	CaCO ₃ Range	Estimated Reserve
Stewart Bay/ White Bay	Trelawny	0.49% - 19.64%	58.94% - 99.33%	2.632 billion mt
Port Henderson	St. Catherine	17.99% - 21.7%	32.16% - 35.04	150 million mt

SKID RESISTANT AGGREGATES ¹¹

Deposit Name	Deposit Location	Reserves
Bito Ramble	St. Andrew/ St. Thomas	122 million metric tonnes (Confirmed) Approx. 1 billion metric tonnes (Inferred)
Lottery	St. James	12.6 million metric tonnes
Tom Spring	Hanover	11.5 million metric tonnes
Nutfield	St. Mary	14.64 million metric tonnes

¹⁰ Source: Mineral Resources of Jamaica, Bulletin No. 8, 1981, Mines and Geology Division, Kingston. NB: Total dolomite reserves currently unknown.

¹¹ Source: Phase 1 - Skid Resistant Aggregates of Jamaica, Bulletin No. 13, Economic Minerals Unit, Mines and Geology Division, Kingston. Total known reserves currently approximately 160 million metric tonnes. N.B.: Project ongoing with two other potential reserves being evaluated.

ALLUVIAL SAND AND GRAVEL

Deposit Name	Deposit Location	Estimated Replenishment Rate¹²	Extraction Rate (2004)
Rio Minho ¹³	Clarendon	24 million mt (extreme flood events) 29.8 million mt (small flood events)	352,272 mt
Yallahs ¹⁰	St. Thomas	17.1 million mt (extreme flood events) 24 million mt (small flood events)	915,002 mt
Rio Grande	Portland	unknown	14,348 mt
Morant River	St. Thomas	unknown	13,446 mt
Wagwater River	St. Mary/St. Andrew	unknown	215,167 mt
Rio D'Oro	St. Catherine	unknown	4,334 mt
Dry River	St. Mary	unknown	17,796 mt
Rio Pedro	St. Catherine	unknown	3,922 mt
Flint River	St. Mary	unknown	1,011 mt

¹² Estimated replenishment rate over a ten year period.

¹³ Sediment Budget Resource Estimate (SEBRA) Project, Technical Report, N. Miller, 2004. Source: Mines and Geology Division

MARBLE DEPOSITS¹⁴

Location	Parish	Colour	Estimated Reserve/ mt
Brazilletto	Clarendon	off-white, beige	50
Rodon Store	Clarendon	variety of brown, beige	20
Thatch Pen	Clarendon	off-white, beige	4
Cave Valley	Hanover	off-white, beige, variety of brown	-
Cuckold Point	Manchester	cream-beige to brown, pink	50
Troy	Manchester	cream-beige, pink, brown	50
Chepstowe	Portland	grey and black	10
Mavis Bank	St. Andrew	white, grey and black	10
Lumsden	St. Ann	variety of brown, pink	5
Above Rocks	St. Catherine	black and pink "granite"	-
Colbeck	St. Catherine	off-white, beige, pink	20
Fort Clarence	St. Catherine	off-white, beige	20
Hellshire	St. Catherine	off-white, pink, variety of brown	50
Paul Mountain	St. Catherine	cream, pink	10
Point Hill	St. Catherine	off-white, beige, pink, variety of brown, yellow	20
Redground	St. Catherine	variety of brown, yellow, pink	5
Flower Hill	St. James	off-white, pink	5
Garbrand Hall	St. Thomas	grey, black and green	10
Greenfields	St. Thomas	green	-
Serge Island	St. Thomas	red and white, green and maroon	3.5
Stewart Bay	Trelawny	white and off-white	8

¹⁴ Source: Jamaica Marble, Bulletin No. 12, Mines and Geology Division, 1998