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QUARRY CODE OF PRACTICE

GENERAL REQUIREMENTS FOR ESTABLISHING AND OPERATING A QUARRY IN DOMINICA

DOMINICA PHYSICAL PLANNING DIVISION

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DOMINICA PHYSICAL PLANNING DIVISION

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PREFACE

This document was by the Development and Planning Corporation — The Planning Authority— and is not a substitute for independent legal advice or other professional advice.

Although every care has been taken in the production of the work, the Planning Authority nor any servant or agent of the Authority accepts responsibility for any loss or damage suffered at any time by any person as a result of any error or inaccuracy in the publication, whether or not the error or inaccuracy has resulted from negligence or any other cause.

The information contained within this document is designed to give guidance and to provide acceptable/minimum standards to the operators of quarries, sand pits and extractive pits in Dominica. More specific guidelines may be required for sites or issues and will be provided on a case by case basis by the Planning Authority upon submission of a quarry application.

The General Requirements — referred herein to as the Quarry Code of Practice — shall be applied to all current and proposed quarry applications as well as existing quarries. With respect to the latter, permits and operations shall be reviewed and modifications applied under the Physical Planning Act, Section 34 of 2002, which will enable the introduction of new or modified controls on the operation of all quarries.

In drafting this code, the Development and Planning Corporation has taken cognizance of other similar and parallel work of the Irish Concrete Federation, the Irish Department of Environment, Heritage and Local Government, and the Tasmania Department of Primary Industries Water and Environment.

Acknowledgements

The Quarry Practices Working Group consisted of:
Chairman, Development and Planning Corporation
Physical Planning Division
Fisheries Division
Forestry Division
Environment Health Officer
Land and Surveys Department
Environmental Coordinating Unit
Dominica State College

GLOSSARY OF TERMS

Acceptable Standard:

Commonly agreed standards that will normally ensure acceptable environmental performance is achieved. Where a specific issue requires attention at a quarry, the acceptable standard may be modified by the approval authority for inclusion in the permit.

Air Blast:

Air vibration or air blast is the pressure or shock waves that radiate in air from an exploding charge. When a pressure wave passes a given point, the pressure of the air rises rapidly before returning to atmospheric pressure after a period of oscillations. The maximum pressure is the 'Air Blast Overpressure' measured in dB.

Ambient Noise:

The total encompassing sound in a given situation, at a given time, where no particular sound is dominant. It is composed of sound from all sources near and far, normally experienced in the area. Ambient noise is measured as dB(A) over a set period of time.

The Approval Authority:

The Development and Planning Authority is the Approval Authority with responsibility for issuing permits, environmental assessment and ongoing inspection of quarry premises.

Batter:

The uniform side slope of walls, banks, cuttings, etc.

Bench:

A ledge constructed in a batter or natural slope.

Blasting:

The firing of explosive charges.

Bond:

The rehabilitation bond determined and held by MRT, as a guarantee that the mining lease will be rehabilitated after the extractive activity has ceased.

Bund:

An earthen mound wall may be used for noise attenuation or visual screens. Bunds may also be used to contain spillage of liquid materials.

Contour Bank:

An earth mound or similar bank, constructed approximately along the contour that is designed to control run-off.

Contour Drain:

Drainage channel constructed approximately along the contour, designed to permit the flow of water to a control feature sediment trap on site.

Cut-off Drain:

A ditch and earth bank constructed at an angle to a track, preventing water from building up speed along the track and allowing redirection of running water into surrounding areas.

dB(A):

To approximate the human response to sound, noise level meters have weighting networks that correspond approximately with subjective loudness. The 'A-weighting' is used to stimulate human hearing.

Decibel (symbol dB):

In acoustics, the decibel is used to express the ratio of quantities related to power. Direct sound pressure levels are measured in decibels and are referred to as dB Linear.

Drainage Line:

A natural depression with no streambed channel that may only carry surface water during rainfall events.

Environment:

Surroundings in which a quarry operates, including air, water, land, natural resources, flora and fauna, humans, and their interaction.

Environmental Aspect:

An element of a quarry's activities or products or services that interact with the environment.

Environmental Impact Assessment (EIA):

The environmental impact assessment' (EIA) involves the process of identifying, Predicting, and evaluating potential environmental impacts of development proposals. The term describes a technique and a process by which information about the interaction between a proposed development project and the environment is collected, analyzed, and interpreted to produce a report on potential impacts and to provide the basis for sound decision-making. The results of the study are taken into account by the Regulatory Authority in determining whether the proposed development should be allowed, and under what conditions.

Environmental Impact:

Any change to the environment, whether adverse or beneficial, wholly or partially resulting from a quarry's environmental aspects.

Environmental Management System (EMS):

Part of a quarry's management system used to develop and implement its environmental policy and manage its environmental aspects.

Environmental Performance:

Measurable results of a quarry's management of its environmental aspects.

Firing:

The act of initiating an explosion.

Flume:

Artificial channel that conveys run-off down a steep slope or diverts a watercourse without causing erosion (concrete, riprap, plastic, etc).

Fly-rock:

Rock thrown an excessive distance from the blasting site.

Ground Vibration:

This is expressed in terms of peak particle velocity (symbol v_p) and is measured in mm/s. People can feel ground vibration levels of approximately 0.5 mm/s, a level well below vibration levels, which are likely to cause damage to buildings.

Marine Environment:

The natural and biological resources comprising any marine ecosystem within the Exclusive Economic Zone's waters, seabed and subsoil including both the living and nonliving components of marine ecosystems, and the ecological patterns and processes that occur within marine ecosystems.

Noise Level:

The A-weighted sound pressure level measured in decibels over a period of time.

Permit:

A Permit issued by a Planning Authority under the Physical Planning Act 2002.

Quarry:

All extractive pits from which building construction and road making materials (including sand, soil and clay) are obtained. It is normally referred to as an Extractive Industry in Planning Schemes.

Quarry Face:

The vertical or near vertical working surface of a quarry, rock excavation or gravel pit; also the steep section between benches.

Ravine:

A river or stream bed that contains flowing water for only part of the year.

Residential Premises:

Any building or part of a building lawfully used as, or for the purposes of, a private residence including the curtilage of the building or, where the boundaries of the curtilage are not ascertainable, the land within a distance of 25 meters from the building.

Riprap:

Medium to large-sized rock protection applied to the face of an embankment.

Sediment Trap:

A structure or pond barrier or filter to collect sediment.

Sensitive Use:

Noise sensitive premises, including but not limited to, areas occupied by libraries, schools, hospitals, aged and child-care facilities, and other places at which individuals may abide for long periods for reasons other than employment or active recreation, but not including 'residential premises.'

Slash:

The term for the seed bearing branches spread on stabilized surfaces as a part of the rehabilitation method.

Souring of Topsoil:

Death of beneficial microbes that may occur if topsoil is stored for long periods in large stockpiles.

Spillway:

Drainage channel designed to allow for overflow from one water body to another without damaging the dam structure (i.e., pond/dam to a river or other pond/dam).

Toe:

Unbroken rock left on the floor of a bench after a blast.

Water Course:

A natural depression carrying perennial or intermittent flows of surface water for part or all of the year in most years.

INTRODUCTION

The quarrying industry's role is to provide a reliable supply of construction materials for road making, building construction, and the maintenance of road networks on which other industries depend.

As observed in other industries, successful market leaders are those who provide an efficient and effective service, and are mindful of all aspects of their public image. The modern community demands that these premises be managed carefully with consideration of the needs of the environment, neighbors and employees.

The general objective in planning for the provision of these materials is to ensure that the supply is managed in a sustainable way so the best balance is obtained between environmental, economic, and social considerations. This is particularly true in Dominica given government's economic thrust toward eco-tourism as a viable alternative to agriculture as the mainstay of the economy. In this context, the recently prepared Tourism Policy and Master Plan have both identified the currently unregulated and haphazard quarry industry as a significant threat to tourism development.

The contents of this code have been reviewed by the Board of the Development and Planning Corporation and senior technical officers from government agencies, conservation groups, and established quarry operators through a consultative process. The code is to be enforced as a Regulation under Section 88(1) of the Physical Planning Act.

The code shall be applied to all current and proposed quarry applications as well as existing quarries. With respect to the latter, permits and operations shall be reviewed and modifications applied under the Physical Planning Act, Section 34 of 2002. This will enable the introduction of new or modified controls on the operation of all quarries.

The code comprises elements for both the sustainable use and development of land for extractive purposes as well as long-term environmental management. It is intended to encourage quarry operators to achieve good environmental performance and compliance with the acceptable standards and/or other legal requirements. The code outlines acceptable standards that must be attained by all existing and proposed quarry operations.

SECTION 1: PURPOSE

The purpose of the code is to document acceptable safety and environmental standards for quarrying in Dominica, in order to:

- Assist the Development and Planning Corporation in carrying into effect the provisions of the Physical Planning Act 2002;
- Promote industry self regulation;
- Provide information for the Physical Planning Division on the assessment and control of quarries under the Physical Planning Act of 2002;
- Provide the basis for uniform planning standards;
- Ensure the sustainable development of Dominica's non renewable resources;
- Further the objectives of the Environmental Health Act 1997;
- Provide a safe workplace environment;
- Protect human health and natural resources;
- Assist in compliance with the Mines and Minerals Act of 1996 and provide an assessment standard for quarry licenses and registration of quarries;
- Increase general community awareness about environmental management within the industry; and
- Assist operators in the operation and rehabilitation of quarries.

SECTION 2: POLICY AND LEGISLATION

Government of Dominica policies, legislation, regulations and environmental standards pertaining to existing and proposed quarry operations are presented within this section of the code to familiarize quarry operators with their obligations under law. The objective is to ensure that quarry operations comply with all policy, legal and regulatory requirements.

A number of Acts contain clauses or sections that have implications for existing and proposed quarry operations. These include:

- Physical Planning Act 2002
- Mines and Minerals Act 1996
- Environmental Health Act 1997
- Public Health Act 1968
- Solid Waste Management Act 2002
- Occupational Health and Safety Act 1982
- Noise Abatement Act
- Liter Act 1990

PHYSICAL PLANNING ACT 2002

Compliance with this code should reduce the potential for environmental damage or environmental nuisance. The Physical Planning Act 2002 provides enforcement mechanisms such as enforcement notices and stop orders that may require the closure of operations to prevent further environmental damage, or remediation of damages at any quarry site.

MINES AND MINERALS ACT 1996

Operators of quarries are also required to (1) register the quarry and (2) obtain a quarry permit under the Mines and Mineral Act 1996 administered by the Inspector of Mines. These steps are required subsequent to the grant of planning permission to develop land as a quarry under the Physical Planning Act 2002. The Mines and Minerals Act 1996 also provides mechanisms to penalize companies non-compliant with conditions of quarry permits issued.

The Mines and Minerals Act Sections 92, 93 and 94 require the protection of natural resources to be taken into account; conditions for the protection of the environment; and rehabilitation of areas damaged by prospecting or mining respectively.

ENVIRONMENTAL HEALTH ACT 1997

Operators must apply and obtain an Environmental Health Permit and be subjected to annual reviews of their operation, to comply with the safety requirements of the Environmental Health Act 1997. This applies to owners, managers, contractors and employees at all quarries. The Environmental Health Department is responsible for the enforcement of this Act in terms of the contaminants produced, dust emissions, pollution of both the marine and freshwater environments, disposal of used oils, noise as a problem to workers, and vibration levels on premise.

The Noxious and Dangerous Substances Act #4 of 1982 prescribes measures for the storage and handling of various classes of dangerous goods such as fuels, oils, explosives, and corrosives. The Department of Noxious and Dangerous Substances is responsible for the enforcement of these regulations.

OCCUPATIONAL HEALTH AND SAFETY POLICY

Principle

All extractive operations must have an Occupational Health and Safety (OH&S) Policy in accordance with the Environmental Health Services Act and Occupational Health and Safety Act.

What is a policy?

A policy is a general statement of intent by an organization.

What is an Occupational Health and Safety policy?

An OH&S Policy is a statement that sets out the organization's commitment and intent toward occupational health and safety. It describes how the organization is going to meet their occupational health and safety objectives. It should be signed by senior management and reflect their personal commitment and support. As a public statement, it should be displayed in prominent areas as a visible reminder that occupational health and safety is a vital component of the business.

The inclusion of accountability, employee consultation, strategies for the prevention of workplace injury and illness, and compliance with legislation and codes of practice make an Occupational Health and Safety Policy a document that provides direction.

The policy should be in keeping with the organization's overall philosophy and vision and provide a cornerstone for planning and decision making.

An Occupational Health and Safety Policy should not be a static document and it should be reviewed and updated so that it reflects the organization's current and future goals, and direction.

Each company should develop a formal OH&S Policy statement.

The policy statement should at least declare the Company's commitment:

- To provide a safe and healthy work environment and to develop safe methods of working;
- To provide appropriate induction and training for its employees, contractors and visitors; and
- In the event of injury or illness occurring, to provide appropriate assistance to its people to achieve full recovery as soon as possible through prompt treatment and active rehabilitation programs.

Management Responsibility

The provision of a safe and healthy workplace is a management responsibility. No company occupational health and safety program can be successful without the full, visible and audible support of management. All levels of management have to show commitment to the program through their own personal involvement with health and safety issues in their area of responsibility.

Specific management responsibilities are:

- To display the Company's OH&S Policy in prominent places in each work location;
- To implement the Company's OH&S Management System and supporting procedures;
- To set occupational health and safety objectives and develop plans to implement programs and procedures to ensure compliance with the relevant health and safety legislation and standards;
- To determine OH&S performance measures for the business, which include positive measures based on program objectives;
- To encourage the involvement of all people in achieving a safe and healthy workplace by establishing and supporting Occupational Health and Safety Committees and, where appropriate, appointing suitably trained personnel to provide professional input to the OH&S program and at a local level appoint Plant Safety Officers and/or Workplace Health and Safety Officers;
- To provide and maintain plant, equipment and mobile machinery to ensure a high standard of health and safety;
- To provide documented systems of work and safe working procedures to ensure that people can work safely and without risk to health;

- To provide training and instruction for all employees to ensure that they understand their responsibilities to work without risk to themselves and others, and to maintain a safe and healthy working environment;
- Induction training must be given to all new employees or employees transferring to a different job or work location. Records must be kept of all training that takes place;
- To participate in ongoing OH&S education programs;
- To support and encourage all employees attending OH&S education programs and those participating in pre and post-course OH&S projects;
- To ensure that as part of the recruitment process, all employees have a pre-placement medical;
- To enable employees who require regular health surveillance to attend for examination when required;
- To support the Company's rehabilitation program so as to encourage the early return to work of employees suffering from a work based injury or illness;
- To ensure safe handling, use, labeling and storage of chemical substances, and to obtain material safety data sheets for materials used;
- To ensure that all workplace incidents, accidents and injuries are fully reported, recorded, and investigated, and people notified;
- To ensure that adequate first aid provisions and trained first aid personnel are available at each work location;
- To involve OH&S services during the planning stages and installation of new plant and equipment or modification to plants and equipment or workplace changes as well as when seeking advice on matters relating to workplace health and safety; and
- To ensure that contractors and site visitors understand and observe the Company's health and safety practices and procedures.

Employee Responsibility:

In accordance with the occupational health and safety legislation, employees have certain responsibilities with regard to their safety and health and to that of others. These are:

- To work with due care and consideration to safeguard their own health and safety and the health and safety of others;

- To comply with all safe working practices and procedures set in place by management;
- To report any potential hazards identified in the workplace or any mishaps, incidents, or injuries, that may occur during the course of work;
- To observe all instruction issued to protect their health and safety or the health and safety of others and to attend, when directed, any course of training or instruction related to health and safety;
- To use any equipment that is issued for personal protection, and to ensure that it is maintained in proper order;
- To co-operate with any rehabilitation program that is arranged to assist recovery from injury for themselves or for fellow employees;
- No person shall willfully, recklessly, or intentionally, interfere with, remove, misuse, or damage, anything that is provided in the interests of health, safety and welfare nor willfully place at risk the health or safety of any person at their workplace;
- To comply with regulatory practices and procedures; and
- To co-operate with authorities investigating incidents, accidents and injuries.

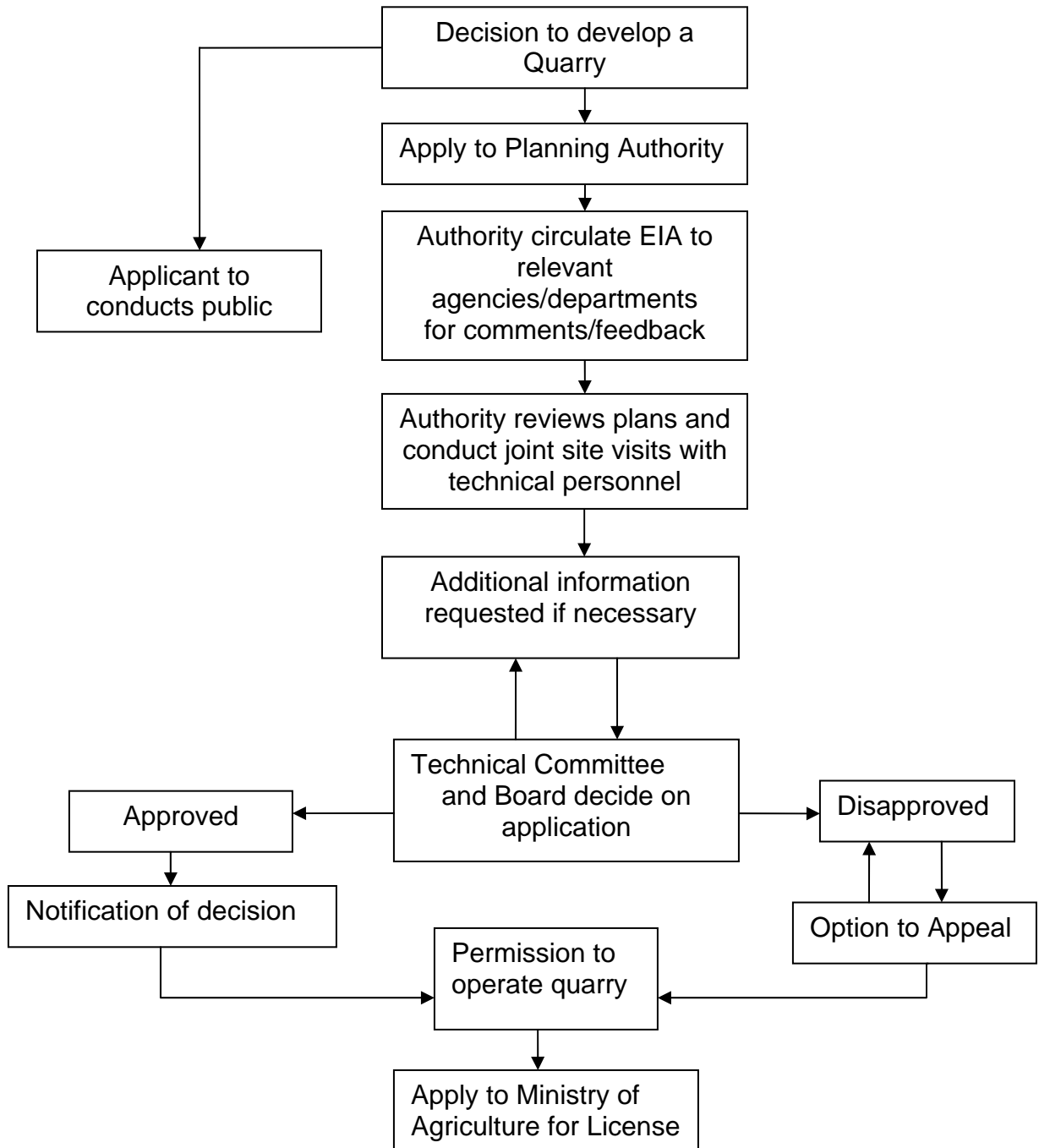
Acceptable Standard

Each operation should have and operate a formal Occupation Health and Safety System that meets the requirements of the Environmental Health Services Act — Certificate of Approval — and Occupational Health and Safety Act that has been properly documented. The system should include documented safe working procedures.

SECTION 3: THE APPLICATION PROCESS FOR QUARRY OPERATIONS

The process for gaining approval from the Planning Authority to operate a quarry is demonstrated in a comprehensive flow chart of the application process is presented in Figure 1.

Figure 1: Overview of Process for Quarry Approval, Planning Authority, Dominica



CONSULTATION WITH GOVERNMENT

The Physical Planning Act 2002 makes provision for consultations with the Planning Authority and publicity of applications. The consultation will include, but not be limited to:

- The developer of a quarry should consider at the outset whether the development would be in accordance with the development plan for the area.
- Owners and operators will be aware of the public concern that extractive industry developments can give rise to, and should take the earliest opportunity to explain their proposals to the Planning Authority, and to ensure that all planning and environmental issues are fully addressed in any subsequent planning application.
- They should discuss significant operational issues, such as working hours and likely traffic volumes, at the pre-application stage. Rehabilitation of the site after the end of extraction should be considered at the design stage.
- Prior to the preparation of an Environmental Impact Assessment (EIA), a prospective applicant should request the Planning Authority to provide Terms of Reference (TOR) for the EIA.

SUBMISSION OF APPLICATION

The developer should consider whether the following items are relevant to the proposed development and, if so, should ensure that they are adequately documented as part of the planning application. Failure to do so is likely to lead to a request from the Planning Authority for further information and thus delay consideration of the application.

Checklist:

- Map(s) showing (a) total site area, (b) area to be excavated, (c) any ancillary proposed development, (d) all dwellings or other development — within one kilometer of site;
- Description of the aggregate(s) to be extracted, method of extraction, ancillary processes — such as crushing, concrete manufacture — equipment to be used, stockpiles, storage of soil and overburden, storage of waste materials, settling ponds;
- Total and annual tonnage of excavated aggregates, expected life of the excavation, maximum extent and depth of working — drawings should include sections across the site, including hedgerows and other natural features — phasing program;

- Description of development works — buildings, fixed and mobile plant, roads, fuel tanks, water supply and drainage, earth mounds, boundary treatment;
- Estimated traffic volumes;
- Environmental Impact Assessment (EIA)
- Rehabilitation plan
- Proposed hours of operation.
- An Environmental Management Plan (EMP), including project description — construction, operation, decommissioning, growth, associated developments — environmental impacts — effects on humans, plants, fresh water and marine resources, flora — and possible mitigation measures to control impacts.

Where the expected life of the proposed quarry exceeds five years, it will normally be appropriate to grant permission for a longer period (such as 10-20 years), particularly where major capital investment is required at the outset. In deciding the length of the planning permission, planning authorities will assess the expected life of the reserves within the site. The purpose of setting a finite period is not to anticipate that extraction should not continue after the expiry of that period, but rather to enable the Planning Authority, in conjunction with the developer and environmental authorities, to review changes in environmental standards and technology over a decade or more since the original permission was granted.

In considering whether a further permission should be granted, the Planning Authority will consider the following factors:

- (a) The extent of the remaining mineral resources; and
- (b) The extent of existing capital investment in infrastructure, equipment.

PROOF OF OWNERSHIP

It necessary to submit as part of an application to quarry, the proof of ownership as per Section 21 of the Physical Planning Act 2002.

ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

The preparation of an Environmental Impact Assessment (EIA) is mandatory to accompany any application to quarry lands under Physical Planning Act 2002. Terms of reference for preparing the EIA are provided in Appendix I. The project shall be carried out in accordance with plans and particulars submitted in the planning application and EIA.

The EIA involves the process of identifying, predicting and evaluating potential environmental impacts of proposed quarry operations. The results of the study are taken

into account by the Planning Authority in determining whether the proposed development should be allowed, and under what conditions.

The term environment in this regard, includes all aspects of the natural and human or built resources on the project development site, as well as within the sphere of influence (setting/situation) of the proposed development. The EIA investigates the characteristics of the environment into which the development will be placed, and evaluates the expected interaction with the physical, biological and built environment. The EIA is therefore based on predictions, and must use informed and experienced professional judgment based on scientific method to attempt to predict the potential changes in environmental quality that could result from the proposed project/action, or the proposed challenges that the environment may present to the development.

The study therefore requires a multi- and inter-disciplinary approach to be undertaken by experienced professionals. It should be carried out as integral to the project evaluation process, adding the environmental dimension to the financial and economic feasibility analysis.

The EIA also compares alternatives by which the project could be realized and seeks to identify the one that represents the best combination of economic and environmental costs and benefits. Alternatives include location as well as approach to design, process, and construction technology. The EIA is one of the most commonly used environmental management tools to integrate environmental concerns effectively into project design and the development process. The EIA examines, analyzes and assesses planned activities with a view to ensuring environmentally sound and sustainable development.

The EIA as a procedure is used to examine both beneficial and adverse environmental consequences of a proposed development project, and should be viewed as an integral part of the project planning process. Findings of the study should be taken into account in project design and recommendations implemented should the project be approved.

The development shall be carried out in accordance with plans and particulars submitted in the planning application and EIA. In particular, the developer shall ensure that all proposed environmental mitigation measures are implemented, except as may be required by other conditions attached to this permission.

QUARRY ENVIRONMENTAL MANAGEMENT PLAN

The developer shall ensure that all proposed environmental mitigation measures are implemented as described in the environmental management plan (EMP), except as may be required by other conditions attached to this permission. Terms of reference for preparing the EMP are provided in Appendix II.

NOTICE OF MODIFICATION AND RE-APPLICATION

The notice of modification will allow planning authorities to impose new or modified conditions on the operation of quarries where necessary and appropriate, or to require certain quarries to apply for planning permission and submit an Environmental Impact Statement.

The basic steps in the process are:

1. Consultation with quarry operators;
2. Decision on whether to restate or change the conditions of operation of a quarry;
3. Requiring an existing quarry to apply for planning permission accompanied by an EIA where applicable;
4. Appeal, where appropriate;
5. Claim for compensation where appropriate.

The owner or operator must provide the following information on their quarry to the Planning Authority in the new application:

- The total area of the quarry, including the extracted area delineated on a site map, (see sample registration form for scale);
- The material being extracted and processed; indicate wherever the quarry is not in use;
- The date when the quarrying began, if known. The owner/operator must provide any evidence of when the operations began, for example, records such as invoices for materials supplied to or from the operation. The Planning Authority could refer to any previously supplied information by the owner/operator of the quarry that may indicate the age of a particular quarry;
- The hours of the day for which the quarry is in operation, including plant operating hours and loading/off-site haulage hours. If exceptional customer requirements have required the quarry to open at unusual times in the previous five years, these periods should also be indicated;
- The traffic generated by the operation of the quarry including the type and frequency of vehicles entering and leaving the quarry;
- The levels of noise and dust generated by the operations in the quarry;
- Any changes that have occurred between the date of commencement of the section and the date that the information was provided.

A sample re-application form is provided at Appendix III. The Planning Authority can seek further information on a quarry operation where necessary, which must be provided in the time specified. Failure to respond will have serious consequences for the quarry's future in that it will be considered an unauthorized development, and, may be subject to enforcement proceedings. However, quarries that have been abandoned for a considerable amount of time — several years — will not be able to recommence operations without seeking planning permission.

SECTION 4: REQUIREMENTS FOR ESTABLISHING AND OPERATING A QUARRY

When making decisions in relation to the effect quarry activities may have on the environment, the assessment will need to adopt a precautionary approach to ensure all aspects of the environment are considered. Where approved, an operation should provide for the fair, orderly, and sustainable use and development of the resource for the benefit of the community.

PRE-PROJECT PLANNING REQUIREMENTS

SITE SELECTION

Principle

Careful site selection after considering all possible alternatives may reduce future problems, particularly with respect to neighbors. Consideration should also be given to factors such as native or endemic flora, fauna, and proximity to ravines, rivers, and the marine environment.

Acceptable Standards

Disturbance should not occur within 40 meters of any ravine or water course, or within 10 meters of obvious drainage lines except with the prior consent of the Planning Authority after consideration of sediment control measures and the nature of the water course.

Quarries shall be located to minimize visual dust, and noise impacts on adjacent sensitive uses to reduce potential for environmental nuisance.

New quarries shall not be located close to residences or other sensitive places. Similarly, proposals to locate new residences adjacent to quarries shall be discouraged to reduce the potential for environmental nuisance. The Planning Authority and operators shall maintain the following separation distances, measured from the planned maximum extent of quarry operations to any sensitive areas:

- 1,000 meters from regular blasting;
- 750 meters from crushing operations;
- 500 meters from sorting with the use of vibrating screens utilized; and
- 300 meters from areas not involving blasting, crushing or screening.

The Planning Authority may consider variations of the above distances where the nature or manner of the operation can justify this.

Sites of possible cultural and heritage significance should be identified during the site selection phase for protection. For advice regarding the surveying and protection of cultural and heritage sites contact the Physical Planning Division and/or the Division of Culture.

SITE PLANNING

Principle

Consideration of the layout of a quarrying operation prior to the opening up of new areas will greatly reduce the effort required to meet environmental and safety requirements. Initial earthworks on any site or stage of an operation are the ones with the greatest potential for adverse impact. An inappropriately located initial test pit or access track, for example, may lead to problems for the life of the excavation.

Site planning is essential to the successful and cost effective rehabilitation of all quarries. Rehabilitation planning should commence even before the site is opened up and all rehabilitation effort should be focused toward a clearly defined end land use for the site. Good planning will save time and money in the long run.

Prior to the commencement of development, the developer shall confirm in writing with the Planning Authority, the details of, and the program for, implementation of:

- i. The operational landscaping scheme; and
- ii. The restoration scheme as set out in the planning application/EIA.

Under Section 30 of the Physical Planning Act, the quarry developer shall be required to lodge with the Planning Authority an index-linked bond of an insurance company or other security to secure the satisfactory completion and aftercare of the site in accordance with the terms of the planning permission — In many cases, phased restoration will be both possible and desirable, in which case the costs of the final phase may be as little as 20 percent to 30 percent of total restoration costs — This lodgment shall be coupled with an agreement empowering the Planning Authority to apply such security (or part thereof) to the satisfactory completion of the rehabilitation and aftercare works. The form and amount of the security should be agreed between the developer and the Planning Authority, having regard to a realistic estimate of the cost of such works — including any likely significant increase in such costs over time — and should be reviewed if permission is subsequently granted for increased operations on the site.

Acceptable Standards

The applicant shall submit a management plan with any application to operate a quarry. Headings that should be included in a management plan are detailed in Appendix II. An approved management plan will be made binding on the applicant. An application to operate a quarry must include a statement of the proposed annual rate of production from the quarry. This amount will be recorded on the permit, and must not be exceeded without prior approval. A section of the management plan for each quarry should be dedicated to rehabilitation (see additional measures on page 26).

A surface water quality baseline study may be required to assess water quality in adjacent surface watercourses by the Planning Authority to define the hydrogeological regime

around the quarry, to protect groundwater and the water supply to sensitive wetland systems or water-dependent habitats.

The applicant shall also submit a comprehensive Environmental Impact Assessment including a large-scale map of operations. The terms of reference for the document shall be prepared by the Planning Authority.

Additional Measures

The best direction in which to work the deposit should be planned early to assist in determining the best location for topsoil stockpiles, working areas, and progressive rehabilitation.

Neighbors and vantage points should be considered during site planning, keeping in mind the use of vegetation and topography for screening and reduction of noise, dust and visual impacts. Noise attenuation benefits of vegetative screens are marginal, however.

Community consultation is an important part of site planning, design, operation and rehabilitation. It helps the local community to understand what the extractive industry does, and how it may affect community life. It enables the operator to identify concerns early and take action where necessary. Community consultation creates a relationship with the extractive operator, which is designed to increase trust and awareness.

Operators may wish to discuss with the Planning Authority whether land use controls on surrounding lands are adequate to reduce encroachment of residential development into the area affected by quarry operation. Alternatively, operators may consider purchasing, leasing, or entering into an agreement over surrounding lands.

Operators and the public stakeholders may influence the development of lands adjacent to their premises under the Physical Planning Act of 2002. The opportunities provided include:

- Any person may comment on an application to develop land at any stage during the period that it is being considered for approval;
- Any person may make comment during the public notification period of a Permit application; and
- Any person who made comment as above may appeal against the decision of a Planning Authority to the Physical Planning Appeals Committee.

Consideration should be given to the location of the access to the quarry and haulage road. Access and haulage roads should be located and constructed to provide safe passage by heavy vehicles and to reduce the disturbance caused to residents and the environment.

PLANNING FOR FINAL REHABILITATION

Principle

In order for final rehabilitation of the site to be successful, it is essential that the future rehabilitation requirements are considered in the planning stages.

Acceptable Standards

Operators shall submit a rehabilitation plan with a brief description of the site prior to the commencement of operations, including: soils, landform, flora and fauna, drainage and conservation values, and a plan for progressive rehabilitation while operations are ongoing.

The following sections shall also be included in the rehabilitation plan:

- The location of topsoil stockpiling sites shall ensure that topsoil will not be buried or contaminated and shall not be in the way of future site development.
- Sections of the quarry that will be highly visible from frequently used roads or vantage points shall be given high rehabilitation priority.
- A plan of drainage works and final drainage pattern shall be included in the rehabilitation plan for the site.
- Plans for removal and disposal of wastes and any hazardous or contaminated materials — fuel drums, soil contaminated by leaked fuel or oil, and weed-infested soil — shall be described, as appropriate for the scale of the operation.

Additional Measures

Planning of final rehabilitation of a pit should occur well before the cessation of operations. The future intended land use of the site should be determined at an early stage (the rehabilitation objective) in consultation with the landowner, the Planning Authority or government agencies, because this will guide site planning. Examples of rehabilitation objectives include: native vegetation, wetlands, building site and pasture. Plans for the location of roads, working areas and facilities should seek to minimize the total area required to be disturbed. More comprehensive information on rehabilitation is contained in post project management and rehabilitation on page 46.

ACCESS

Principle

Access to quarry sites is of primary importance and should be considered very early in site planning because this will constrain management alternatives for the quarry in future.

Acceptable Standards

Factors to be considered in siting the access track include: drainage, visibility, proximity to neighbors, dust control, gradient, type of equipment used on the road and access to benches at different levels of the face.

- Tracks shall be well maintained and provided with drainage, as poorly maintained tracks will increase the level of noise emitted by the quarry.
- Provision shall be made for safe line of sight along access tracks
- Tracks provide corridors for the invasion of weeds. Weed management along tracks shall ensure that weed species are not introduced into new areas.

Additional Measures

When determining the point of access to the site and internal haulage roads, it is important to remember that empty trucks are louder than full ones, and that vehicle speed may significantly affect the noise of a vehicle. The gradient of tracks may also result in increased noise from vehicles due to greater use of brakes or increased engine power to climb slopes, especially when under load.

Provision of road signs should be considered in conjunction with the Traffic Department and the Physical Planning Division.

The location and direction of tracks where they meet public roads and the provision of slip lanes should be agreed with the Traffic Department and the Physical Planning Division.

ROAD TRAFFIC

Principle

The effects of traffic density and traffic noise associated with a quarry's transport operation may, in certain circumstances, have a significant impact on other road users and/or the amenities associated with residential and/or sensitive use areas. Operators should be aware of these potential impacts and take them into consideration.

In certain cases, the additional traffic — particularly heavy goods vehicles — generated by the proposed quarry may result in additional expenditure by the Planning Authority on the surrounding road network, including additional maintenance costs. A contribution may be required toward the cost of local authority inspections and monitoring in respect of public infrastructure and facilities that benefit the proposed development.

Acceptable Standard

The condition of cartage vehicles shall be in accordance with the applicable transport regulations; that is, they shall be in safe and road worthy condition.

All vehicles shall be operated by appropriately licensed operators, and loaded and driven with care in accordance with traffic laws.

Trucks shall be loaded and covered to prevent spillage and no mud shall be carried out onto the public road.

Additional Measures

When planning new quarry developments, access to the site needs to be considered in relation to the impact of any change in traffic movements on roads, taking into account the road's category classification and/or traffic movements. Depending on the Road Category, provisions may need to be made for site-specific entry onto the public road.

Attention may need to be given to noise emissions related to engine noise and, when running empty, to possible body noise. If the access route has a significant gradient, noise associated with engine braking may also need to be addressed, and its impact on the drainage of the area.

PLANT LOCATION

Principle

Fixed plant and other working areas should be located on the premises with due regard to dust and noise emissions that may affect neighbors outside the premise's boundary. Plant location should also take into account the visibility of the plant.

STAGING OF OPERATIONS

Principle

Deposits should be worked in a systematic manner, generally across or down the slope, so that worked out sections can be rehabilitated and left to revegetate without further disturbance.

Acceptable Standard

In all cases, operations shall be conducted in discrete stages with all valuable material fully extracted so that progressive rehabilitation can be carried out. At older quarries, partially extracted areas and abandoned sections must be fully worked out and closed.

The regulatory authority shall specify a maximum total disturbed area for the premises. This must not be exceeded.

Additional Measures

Where substantial volumes of waste rock or overburden will be produced by the operation of the quarry, this material should be placed in properly designed dumps, which are located and shaped to blend in with the surrounding landscape. Costly reshaping of dumps during the rehabilitation phase is then avoided.

MINIMIZING EROSION AND DISTURBANCE

Principle

Environmental impacts, such as erosion caused by storm water run-off and weed invasion, increase proportionally with increasing area of disturbance. It is very important that the total disturbed area be minimized.

The developer shall construct and commission the proposed settlement lagoons/silt ponds prior to the commencement of extraction operations.

Acceptable Standards

Boundary markers, such as stakes and flagging tape, shall be used to indicate to machinery operators the extent of areas to be cleared.

Additional Measures

Minimizing the total disturbed area is the best method of reducing final rehabilitation costs.

Limiting the area disturbed to the minimum that is required for efficient operations. Surrounding vegetation is a valuable resource that can be needlessly destroyed by brief activities with heavy machinery at the pit boundary.

Supervising machinery operators during operational hours. It is not usually necessary to clear ground for the entire life of the operation in the first year.

PROGRESSIVE REHABILITATION

Principle

Progressive rehabilitation refers to the rehabilitation of worked out, or surplus areas, while extractive operations are ongoing. Progressive rehabilitation is an important component of quarry management, particularly where the pit is large or expanding.

Acceptable Standards

Quarries and pits shall be developed systematically as a series of benches or bays. This allows rehabilitation of discrete sections when worked out.

Additional Measures

Each section of the quarry should be fully worked out and should be programmed for rehabilitation works as soon as possible.

As new sections are opened up, worked out areas should be progressively rehabilitated to avoid increasing the total disturbed area of the quarry. Topsoil can be stripped from areas being opened up and placed directly onto worked out areas that are being rehabilitated, to avoid double handling of soil, and to prevent degradation of the soil while in stockpile.

Rehabilitation works may be considerably more efficient if carried out while the necessary machinery is on site and the pit is operating, rather than if machinery has to be transported back to the site. Progressive rehabilitation can reduce the total liability of rehabilitation. Rehabilitation should not be left entirely until the deposit runs out or the resource becomes less economical to work.

OPERATIONAL REQUIREMENTS FOR PROJECT IMPLEMENTATION AND MONITORING

ENVIRONMENTAL COMMITMENT

Principle

All quarry personnel must be made aware of this code and its contents and be encouraged to develop a commitment to compliance with the legal requirements, enhancing community consultations and being stewards of environmental protection.

The permit holder is ultimately responsible for ensuring compliance with the legislation. All persons who may be responsible for the operation of the premises should be familiar with the content of the code and manage the operation accordingly.

Acceptable Standard

When any accident, breakdown or malfunction of equipment may or does result in the unplanned emission of a pollutant or noise from the premises, the proponent shall IMMEDIATELY contact the Inspector of Mines and the Physical Planning Division, AND take all practicable action to contain the emission(s) and to minimize adverse environmental impacts.

The permit holder shall not without prior approval in writing from the Planning Authority:

- 1) Change the process used at the premises;
- 2) Construct or remove any structure associated with the premises;
- 3) Increase the quantity of materials dealt with at the premises from that specified in the permit; or
- 4) Change the nature of materials dealt with at the premises, in any manner that might cause, or substantially increase, the emission of a pollutant or noise from the premises.

HOURS OF OPERATION

Principle

The duration of quarrying operations — other than blasting — may require controlling in order to protect the amenities of area residential properties.

Acceptable Standard

Normal operations should be confined to the hours between 07:00 and 18:00, Monday to Friday inclusive (excluding bank holidays) or as may be agreed with the Planning

Authority, and between 07:00 and 14:00 on Saturdays, with no quarrying, processing or associated activities permitted on Sundays or public holidays.

NOISE

Principle

All earth-moving operations have the potential to produce noise, and this can be a source of public disapproval of quarries. Where residences are adjacent to a quarry, precautions should be taken to reduce the impact of noise. Confining operations to reasonable operating hours is the simplest means of avoiding unreasonable noise impacts. Another effective means is to provide appropriate separation distance to enable the noise to dissipate to acceptable levels.

Acceptable Standard

With the exception of blasting where permitted, noise from activities in a quarry affecting residential premises, shall not exceed 10 dB(A) above the normal ambient noise levels during daytime operations. This is achieved by restricting operating hours of quarries in the vicinity of residential premises, to 07:00 to 17:00 hours, Mondays to Fridays.

Extended operating hours may be approved by the Planning Authority and other authority following submission of supporting noise monitoring reports and/or consultation with affected neighbors.

Where extended hours of operation are approved (outside those referred to above) a noise level of no more than five dB(A) above the normal ambient noise level must be achieved during the extra hours.

In areas of 'sensitive use' or other uses that are likely to be adversely affected by noise of 10 dB(A) above ambient, noise levels from quarry activities shall not exceed more than five dB(A) above the normal ambient noise levels during regular working hours.

Where noise is identified as an issue at a quarry, operating hours negotiated between the approval authority and the operator shall be specified as a Permit condition.

The Planning Authority may approve a one-off extension of operating hours if an appropriate case is established and where this allowance is provided for in the Permit. Where permits do not contain provisions for one-off extensions, a variation of planning permission under Section 34 of the Physical Planning Act may be considered.

Additional Measures

Under certain circumstances, it may also be appropriate for the Planning Authority to differentiate between certain activities taking place on the land. For example, to allow carting of materials to take place at the site at a wider range of hours than other extractive activity or materials handling, enclosures may be required around crushing and screening plants.

Solid barriers, such as bund walls, trees and topographical features may be required as they provide the most effective 'in line' reduction of sound levels. These mounds should be temporarily landscaped to reduce the impact of dust. Reliance on a barrier of vegetation alone will result in only marginal reduction in noise levels.

Access tracks and haul roads should be well maintained to prevent corrugation that contributes to truck noise, and truck drivers should be encouraged, where possible, to use access roads that have the least impact on the community. Those within the site should have as low a gradient as possible, and paving should be considered if practicable where noise-sensitive receptors are likely to be affected.

Machinery should be well maintained and lubricated. Compressors, noisy engines, generators, and exhausts should be fitted with silencers. Conveyor belts and crushing/screening equipment can be housed to provide acoustic screening.

DRILLING

Principle

Accurate blast-hole drilling is essential for good blasting performance. If drill-hole position and alignments are not properly controlled, the subsequent blast may cause uncontrolled fly-rock, high levels of ground vibration and air-blast noise, unsafe bench faces and quarry floors.

The immediate impact of drilling may be generation of undue noise and dust during the drilling process.

Acceptable Standard

All drilling for quarry blasts shall follow a pre-determined blast design plan, which includes drilling prescriptions.

Deviations from the design of drill holes shall be identified prior to blasting and corrective measures should be taken. Such measures may include re-drilling the holes and/or adjusting explosive loading. All details of corrective measures should be incorporated in the Blast Report.

Additional Measures

Each blast should be planned in advance with the drill pattern marked out on the quarry bench by an appropriately competent person. The design should define; drill-hole diameters, drill hole depth, drill hole inclination and drill hole direction (azimuth).

The drill plan should form part of the Blast Report.

Each drilling operation should be executed in accordance with the drilling plan, and proposed modifications should be evaluated and approved by the responsible person prior to implementation. Drill holes identified as being outside design tolerances should either be discarded and re-drilled or explosive masses should be adjusted.

Drilling equipment should be of appropriate capacity to drill the required holes to specified diameters, depth and true to line.

Drilling machines should be provided with appropriate measuring tools to set and maintain booms to specified inclination and azimuth.

Dust extraction and collection equipment should be provided to minimize dust escaping to the atmosphere.

Noise suppression on drill hammers and/or engines may be required in exposed drilling situations. If noise emission remains high, drilling hours may need to be restricted to coincide with times of day when background noise masks the noise emanating from the drilling operation (see Noise section on page 31).

Drilling tasks should be performed and overseen by personnel possessing proven competencies. The professional control of drilling and blasting operations can ensure, through design of the layout of the workings, that blasts are directed away from sensitive neighboring dwellings. Use of the “delayed” blasting technique, whereby the blast takes place in a series of timed small explosions rather than a single large blast, helps to minimize the vibration in the rock body.

BLASTING CONTROL

Principle

Blasting is necessary at some operations. Operators should be aware that blasting may be distressing to the public. Blasting produces ground vibration and low frequency air blast, both of that should be minimized.

Acceptable Standard

Blasting shall not take place unless specifically authorized in the permit issued by the Planning Authority, and carried out in accordance with any conditions imposed therein.

Secondary breaking with explosives shall not be allowed unless specifically authorized in a permit issued by the Planning Authority.

Blasting shall take place during the specified blasting hours within the permit. The approval authority should be advised in advance of any blast on the premises. Nearby residences shall also be informed in advance of blasts.

Blasting shall be carried out such that, when measured at the curtilage of the nearest residence (or sensitive use) in other occupation or ownership, air blast and ground vibration comply with the following:

- a. For 95 percent of blasts, air blast over pressure shall not exceed 115 dB (Lin Peak);

- b. Air blast overpressure shall not exceed 120 dB (Lin Peak) at all; and
- c. Ground vibration shall not exceed 5 mm/s peak particle velocity.

Additional Measures

Nearby residents (e.g., within 500 meters) need to be given advance notice when blasting operations are due to take place, which should only be carried out between 09:00 and 18:00 hours, Monday to Friday (except in emergencies or for health and safety reasons beyond the control of the developer). Similarly, such residents should be given the “all clear” signal by means of sirens or other agreed measures when blasting has been completed.

Hydraulic rock breakers produce less noise than secondary blasting with explosives.

In general, operators should avoid using surface detonating cord for charge initiation.

Sufficient stemming and appropriate delays between shot holes should always be used. Use of non-electric detonators has won widespread approval as the quietest delay system for initiating blasts.

Avoid blasting in overcast and other adverse weather conditions. Regular blasting time should be adhered to (refer to hours of operation on page 30).

Safety

The holder of a shot firer’s permit must be responsible for loading and firing shots. All persons handling explosives must be under the control of the holder of a shot firer’s permit.

Storage of explosives must be in licensed magazines.

Blasts must be designed to prevent fly-rock from leaving the site.

The site must be evacuated and all approaches guarded before shots are fired. A distinctive, audible warning signal must be given before firing, and at the all-clear.

Adequate provisions must be taken to prevent fly-rock, excessive noise and vibration.

Transport of explosives on public roads must comply with transport laws.

AIR POLLUTION AND DUST CONTROL

Principle

The primary air emission associated with quarry operations is dust. Dust can be a nuisance to neighbors and may be a safety hazard to quarry employees. Generally, the emission of visible dust should be confined within the boundary of the premises, except in remote areas.

Residents living in proximity to quarries can potentially be affected by dust up to 0.5km from the source, although continual or severe concerns about dust are most likely to be experienced within about 100m of the dust source. The main potential impacts of dust are visual impacts, coating/soiling of property (including housing, washing, and cars), coating of vegetation, contamination of soils, water pollution, change in plant species composition, loss of sensitive plant species, increased inputs of mineral nutrients and altered pH balances. Respirable particles, i.e., those less than 10 micrometers in diameter, have the potential to cause effects on human health, depending on exposure levels

Acceptable Standard

Dust shall not be visible crossing the boundary of the premises. Total dust deposition (soluble and insoluble) shall be no greater than: 350 milligram per square meter per day (when averaged during a 30-day period).

Environmental factors, such as wind conditions, may on occasion, make the retention of all visible dust on the site impossible. In such cases, the operator shall take all reasonable actions to ensure that the emission of dust from the premises is minimized.

Roads within the boundary of the premises shall be watered or sealed when necessary or when directed by the Planning Authority, to minimize environmental nuisance.

Trucks shall utilize effective dust control measures when traveling by public roads and carrying loads containing a significant quantity of material that passes a four-millimeter sieve.

Wheel washing of vehicles leaving the site, covering of fine dry loads, or spraying of loads prior to exiting the site, and if necessary regular cleaning of public roads in the vicinity of the entrance.

The nature of the material transported and its potential to emit dust shall be considered in the loading of trucks. Generally, the highest point of the load shall not exceed the height of the tray walls, unless the load is covered.

Stockpiles and roads shall be sprayed with chemicals such as magnesium chloride to produce an impermeable layer, which reduces dust development. Alternatively, regular spraying with water shall also be used to suppress dust. Waste oil must not be used as a dust suppressant.

Dust produced by the operation of the quarry or by transport, crushing and screening plant shall be effectively controlled to the satisfaction of the approval authority.

Additional Measures

The direction of the prevailing winds and the placement of the stockpile on the site should be considered during the planning stage.

Trees should be planted for windbreaks or topography and/or embankments utilized, to shield stockpiles and working areas from prevailing winds.

As conveyors and transfer points can be major sources of dust, enclosures, mist sprays, or approved dust extraction equipment may be required. Drop distance between discharge point and top of the stockpile should be kept to a minimum.

The speed of vehicles is an important factor in the generation of dust. The speed of vehicles on site may need to be restricted. In addition, where transport routes are along unsealed roads, it may be advisable to slow down in the vicinity of residents.

Environmental factors play a large role in the nature of air pollution and dust emissions. Extra care should therefore be taken at times of high wind speed, or during adverse weather conditions to minimize dust emissions. Decreased vehicle speeds, increased watering of roads, and stockpiles and reduction of the amount of product transported per load, may be appropriate in adverse weather conditions.

BENCHING

Principle

Quarrying should be carried out in a series of working benches if the material is stable. Lower face heights between benches are safer and considerably easier to rehabilitate.

Acceptable Standards

Orientation of benches shall take into account the underlying geology and vantage points from which the quarry is visible.

All benches shall be self-draining. Each bench shall act as a table drain, carrying water along the bench to a suitable discharge point or settling pond. If drainage is allowed to flow down the face from one bench to the next, erosion will occur and the benches may be lost.

Benches shall not overhang and batters must be constructed at a safe angle. Quarrying activity shall generally not extend within 10 meters of a boundary.

When worked out, loose material shall be scaled off faces, leaving benches in place. Loose material shall be pushed to the toe of the faces.

Face heights in hard rock shall be determined on the basis of topography, rock type, and the final land use. The distance between these benches shall not exceed 15 meters. Benches in loose material such as sand or gravel that can be dug without blasting shall be no higher than the vertical reach of the excavating equipment used. For clay pits, it is usual to have active bench widths of more than twice the vertical height of the face.

Where practicable, the uppermost benches of the quarry shall be established and worked out first. This allows the upper sections of the face that are often the most visible to be rehabilitated early in the life of the operation. Rehabilitation can then progress downhill as successive benches are worked out.

Additional Measures

Face height and bench width will be dictated by practical and economic considerations. Lower face heights (e.g., < 5 meters) are preferable for final rehabilitation of the site, because they will be screened more quickly by establishing vegetation. Toward the end of the productive life of a high face, intermediate benches should be constructed thereby cutting the existing face in half, or into three lifts if necessary, to give a maximum final face height between benches of five meters.

For rehabilitation, benches should be irregularly shaped and the top of the quarry face scalloped to blend in with the surrounding landscape.

VEGETATION CLEARING AND TOPSOIL STRIPPING

Principle

Topsoil is usually the darker, upper soil layers. Though only 10 cm to 30 cm deep, the topsoil contains nutrients, minerals, seed, and organic matter that helps bind it all together. A thin layer of topsoil can support a forest and protect the subsoil from erosion.

The regenerative capacity of the natural soil should be protected during the opening up of new areas at quarries.

Additional Measures

Vegetation being cleared may contain small amounts of seed, or provide useful fauna habitat. Logs, limbs, and stumps should be cleared and stockpiled — or cut and removed for timber — separately from the topsoil stripping operation.

Smaller-sized vegetative material may provide useful mulch for later use in erosion prevention works, or else it should be combined with the topsoil.

Topsoil is a very important requirement for low cost revegetation of disturbed sites. Topsoil from all working areas and access tracks should be stripped carefully and stockpiled, or used immediately to rehabilitate worked out areas.

Wherever possible, stripped topsoil should be placed directly onto an area being rehabilitated. This avoids stockpiling and double handling of the soil. Topsoil placed

directly onto rehabilitation areas contains viable seed, nutrients and microbes that allow it to revegetate more rapidly than topsoil that has been in stockpile for long periods.

Do not strip topsoil when saturated, as this will exacerbate the damage to the soil structure.

If topsoil must be stockpiled, remember that it does deteriorate in quality while stockpiled. The following practices will help maintain soil quality:

- Topsoil should be kept separate from overburden, gravel, and other materials;
- If possible, windrows of topsoil should not exceed one meter in height to reduce 'souring';
- Topsoil stockpiles should be protected from erosion;
- Growing vegetation on the stockpiles (shrubs or grasses) reduces erosion and will maintain biological activity in the soil;
- Topsoil should not be buried or driven on as this will damage soil structure. Soil should be stored somewhere out of the way; and
- Excessive handling of topsoil should be avoided. On hillside operations, it is best to store topsoil above or beside the excavation — depending on which direction the deposit is being worked. This provides storage safe from contamination and low respreading cost.

Overburden — reject material between the topsoil and the product mined — should also be stockpiled as it may be useful later for rehabilitation purposes such as backfilling of hollows, and providing additional rooting medium over hard rock areas.

COASTAL AND WATERSHED PROTECTION, DRAINAGE, AND EROSION CONTROL

Principle

Sediment derived from erosion by water, and other water borne contaminants such as oil, are often sources of pollution from quarries. If environmental management is inadequate, water quality may be affected far beyond the premises boundary. Water leaving the quarry premises should be treated to minimize sedimentation and turbidity problems.

A good drainage and sediment capture system may have a number of useful benefits, such as reducing water logging thereby making machinery operations more efficient, reducing sediment movement off the site.

The quantity, and physical and chemical quality of surface waters and groundwater may be affected by quarrying activities; flows can be increased or decreased, and may be contaminated by runoff or dust from the quarry. The removal of topsoil, overburden and aggregates may affect the quality of water, and excavation below the water table may lead to de-watering of adjacent watercourses.

ACCEPTABLE STANDARD

Drainage

Wherever possible, drainage works shall mimic natural drainage regime (patterns) and utilize natural drainage lines with retained vegetation.

A cut-off drain or diversion banks above the excavation will help prevent water from entering the site and adding to erosion problems. Cut-off drains shall discharge into vegetated natural drainage lines or via a level sill that distributes run-off across a stable area.

Contour banks and contour drains shall be used to capture and slow down water that would otherwise gather momentum as it travels down the slope.

Working areas shall be kept in as dry condition as possible, and machinery shall not be driven through flowing water.

Rate of run-off increases dramatically following vegetation removal, hence the total area exposed shall be kept to a minimum as defined by the Planning Authority.

Access tracks often have a major impact on water quality. Gradients shall be controlled, table drains well maintained, and regular cross drains or culverts installed.

Sediment Control

All run-off from working areas, which contains sediment, shall be collected in settling ponds before being discharged from the premises. Water from washing, screening, or dust reduction plants shall be treated in a like manner.

Accepted methods for removal of sediment from run-off include settling ponds, aggregate filters, wetlands — shallow ponds planted with suitable swamp plants.

For quarries in vegetated areas, run-off shall be directed through vegetation prior to reaching any water course to enable further filtering of sediment.

Sediment shall be removed from settling ponds as required, so that excess capacity is always available for the next storm event.

Settling ponds shall discharge into natural drainage lines that are stable and vegetated via properly constructed spillways, ripraps or culverts.

Water Quality

Measures of turbidity and total solids, dissolved solids, suspended solids, and temperature in run-off discharged from the site of quarry operations shall not exceed 10 percent of natural background levels as determined by the regulatory authority. If cut-off drains are not in place and effective to divert water around the site, more stringent limits should be

imposed. Weekly checks shall be made of surrounding inland and coastal waterways to ensure that there is no noticeable discoloration or sediment build up.

Temperature values in adjacent rivers less than 1,000 meters from the quarry property shall not exceed 10 percent of natural background levels.

Sampling shall be conducted over a wide range of rainfall events to obtain an accurate water quality sample.

Discharge shall be visibly free of oil and grease. Interceptor traps and oil absorbent materials are required to capture oil and grease.

The developer should maintain on site an adequate supply of containment booms and suitable absorbent materials to contain and absorb any fuel spillage.

All run-off from quarry roads and paved areas should pass through adequately sized and located oil/petrol interceptors before discharge to surface water drainage. Refueling should only take place on such paved areas with interceptors.

No surface water should be allowed to flow from the site onto the public road during the construction or operational phases of the development.

Discharge water shall be recycled for watering roads, washing, promoting vegetation.

Disturbance shall not occur closer to a water course than is specified in the permit.

Disturbance should not occur within 40 meters of any water course, or within 10 meters of obvious drainage lines.

There shall be strict control of run-off from pits, quarries, spoil heaps, embankments, and all other parts of sites, including access roads and wheel-wash facilities.

Washing ponds — used to settle out the suspended solids from the aggregate washing process — shall be carefully designed and operated to ensure that, where practicable, water is recycled and not discharged to watercourses.

The developer should carry out monitoring of surface water in the vicinity of the site, as designated in the approved environmental management plan. The monitoring locations, sampling procedure, and suite of water quality parameters to be tested for should be as agreed in advance with, and reported to, the Planning Authority. Monitoring should be on a quarterly basis and begun within three months of the commencement of development.

Certain minerals have the potential to cause acid drainage pollution when exposed to air and water. A site's potential for causing acid drainage is not likely to be identified until it is being worked. Likely visible signs include the presence of pyrite minerals and iron rich precipitates; these may be evident in the form of brown staining on rocks or in water. If

such staining is observed it is the responsibility of the permit holder to contact the Planning Authority and the Inspector of Mines.

PORT/JETTY OPERATIONS, POLLUTION CONTROL, AND STOCKPILING

Refueling and Vehicle Maintenance

Refueling and maintenance for all vehicles and heavy machinery shall take place in a designated flat and impervious area, not in close proximity to river or sea. The area will be surrounded by impervious curbing, and include a sump and collection system (e.g., an oil water separator) for the proper containment of any inadvertent spills.

Dumping of Litter and Garbage

There shall be no dumping of litter or waste on the property, in ravines and rivers, on the beach, or in the marine environment. All waste and scrap metal shall be delivered to the Fond Cole disposal site for proper disposal.

Barges and ships servicing the quarry area shall not dispose of waste, fuel, or scrap metal while docked, approaching, or leaving the quarry site.

Staging Area and Loading Dock

Near shore staging areas shall be surrounded with impervious curbing to prevent erosional deposition of sediments from stockpiles, particularly during precipitation events. Areas shall be surrounded with sedimentation ditches that are regularly cleared and maintained.

Stockpiles shall be covered at all times to prevent erosion from wind and rain.

Inspection of Erosion and Sediment Controls

Erosion and sediment controls must be inspected at least once a week and within 24 hours of the end of a storm depositing 0.5 inches of rainfall or more. Sediment deposits must be removed when the sediment reaches approximately half the height of the silt fence or other barrier.

Jetty Construction

Prior to construction of the jetty, a map shall be prepared identifying the location of critical hard bottom habitat or coral communities. The construction activity shall not occur within a 50-meter buffer area of any hard bottom coral communities, in order to avoid their physical destruction. The location of jetties and loading docks shall not take place in areas documented as critical nesting habitat for turtles.

Construction will occur only within authorized windows of time when critical activities of marine life shall not be disturbed so that these species are preserved and protected, for example, coral spawning, fish migration, sea turtle nesting, incubation, hatching, and emergence, shorebird nesting, and migratory bird movement. The Fisheries Division shall be the authority that identifies these activities within the proposed jetty construction area.

Turbidity barriers shall be used to reduce the impact of sedimentation from dredging or jetty construction. Examples include open-ended barriers along channel edges, enclosed barriers for dredging, staged barriers for small enclosed areas, and box curtains for low-flow areas. Turbidity barrier bottoms shall be sufficiently anchored with weights or connected to sandy substrate via anchors. Positioning of the turbidity barrier to capture sediment laden water is critical to success. Barriers must remain in place and operational throughout construction.

Sea Turtle Deflectors

To prevent sea turtle mortality, sea turtle deflectors shall be utilized to ward off any sea turtles in or near the path of the draghead during dredging activities. A turtle deflector is a rigid adjustable attachment installed on the hopper dredge draghead that deflects any turtle that may be in or near the path of the draghead during dredging. The V-shaped deflector has an included angle of less than 90 degrees and internal reinforcement to prevent structural failure of the device.

Appropriate instrumentation will be installed on the draghead to ensure that the appropriate approach angle is used. The openings of the hopper inflow will have baskets or screens installed with less than 0.1m x 0.1m (~4.0in x 4.0in) openings to provide 100 percent screening of the hopper inflow(s), and will remain in place throughout the dredging operations. Floodlights will be installed for illumination of the baskets or screening to allow the observer to monitor for turtles, turtle parts, or damage at night or during low-light conditions.

Floating Tow Lines

If jetty construction or barge loading activities require the use of steel, nylon or polypropylene lines to tow equipment or vessels, they shall be floating towlines to prevent dragging of heavy tow lines and cables on the seafloor and avoid direct contact with submerged resources and habitat.

Vessel Ingress/Egress Corridors

Vessel ingress and egress corridors shall be identified for impact avoidance from the movement of vessels to and from a coastal construction site. After the identification of the extent of the hardbottom and corals located in the vicinity of and near the quarry and jetty area, corridors for vessels to access the site should be identified. The water depth of the hardbottom and corals should be known as well as the maximum draft for vessels that may access the site. A minimum distance of six feet shall be maintained at all times between the bottom of the vessels and the top of any hardbottom or coral features. The location of the vessel corridors should be adequately identified via GIS maps, GPS locations, buoys or channel markers.

Considerations when planning the location of the vessel corridors include, but are not limited to:

- The mean tidal range;
- The difference in draft between a fully loaded and empty vessel;
- The width of the vessels and the appropriate width of the corridor necessary to protect adjacent hardbottom and corals; and

- Turning radius for vessels.

WASTE DISPOSAL AND STORAGE OF CHEMICALS

Principle

All waste materials shall be stored, collected, recycled and/or disposed of in accordance with the requirements of the Planning Authority. A record of the volumes of waste oils, used batteries, used tires, disused plant and machinery, and scrap metal arising within the site should be kept by the developer. These records should be kept on-site and made available to the Planning Authority on request.

Quarries should not be allowed to accumulate rubbish, disused plant, waste oil, or other waste materials. Unsuitable materials, such as clay/silt materials from settlement ponds, should be re-used and recycled as far as possible. Chemicals and fluids should be kept in approved storage areas. On-site sewage treatment should not result in the pollution of surface or groundwater and must be approved by the Environmental Health Department.

All solid waste — except hazardous and oil wastes — should be removed from the site and disposed at the Fond Cole landfill.

Acceptable Standard

All rubbish, equipment, structures, and waste material including clay/silt materials from settlement ponds shall be removed on a progressive basis from the premises and recycled wherever possible, or disposed of at an approved disposal site, unless otherwise approved in writing.

Hazardous materials shall only be disposed of at an approved hazardous waste disposal facility. Transporters of hazardous waste must have an Environmental Protection Notice permitting transport of hazardous waste.

Operators shall seek approval from the regulatory authority to dispose of any hazardous waste. Extractive industry operations may use a variety of chemical, hydrocarbons and explosive products. Operators shall apply for the use, storage and disposal of such substances.

Above ground storage tanks with impervious bunds shall be used in preference to underground storage tanks, as these reduce the risk of groundwater contamination. Bund walls shall be used to divert storm water away from storage areas. Storage areas shall be located away from waterways and areas prone to flooding. Bunding should be impermeable and capable of retaining a volume equal to 110 percent of the capacity of the largest tank. Drainage from bunded areas should be collected and disposed of in a safe manner. The integrity and impermeability of such areas should be assessed by the developer annually and a report submitted to the Planning Authority.

Fluids released during machinery maintenance operations shall not be spilled on the ground. They shall be caught and removed to an approved disposal site, or recycled, in order to avoid long-term site contamination.

Hazardous materials shall be disposed of at designated sites; contact the corresponding authority.

Additional Measures

Materials imported to the site should be carefully selected and care taken when importing clean fill or topsoil to avoid introducing weed species or contaminated materials.

Fuel, lubricants, coolant, waste oil, and waste chemicals must be stored in an approved manner, such as in drums or surface tanks with impervious bunds to contain spillage, and located away from operating areas and drainage lines. Specifications for storage will depend on the quantity and class of the material being stored.

Hazardous material management procedures, which aim to minimize risks to the environment and include emergency response plans, should be developed. Regulations apply to the storage of explosives and other hazardous materials.

VISUAL MANAGEMENT

Principle

The visible intrusion of quarries into the landscape may be out of all proportion to the area they occupy; hence any new quarry should be located to manage its visibility from neighbors, roads, and vantage points. Visibility is the cause of much public complaint at many, otherwise well managed, quarries. It is essential that the visual impact of a proposed quarry be considered in the planning stages.

Neighbors and vantage points should be considered during site planning, in particular, planning should consider use of vegetation and topography for screening and reduction in noise, dust and visual impacts.

Quarry faces SHALL be screened from frequently used roads and commonly visited vantage points. Topographic features shall be utilized as effective screens and any landscaping undertaken shall be designed to be visually compatible with the surrounding natural landscape.

Where practical, working faces shall be oriented away from vantage points and neighbors and the direction of working shall be carefully chosen so that the working face is hidden from the most critical view. Where possible, uppermost benches shall be worked out and rehabilitated as soon as possible.

NEW quarry operations shall not be opened adjacent to roads frequently used by the public, unless adequately screened by topography and/or vegetation. Access tracks shall be aligned to avoid continuous line of sight from vantage points.

All exterior surfaces of buildings and fixed plants shall be designed to blend in with the environment.

Additional Measures

The visual impact of a site will be dependent on:

- The size of the area exposed;
- The orientation of the site in regard to residential areas, public roads and vantage points;
- The visual contrast between the quarry and the surrounding area (e.g., pale colored rock in the quarry will have a high degree of visual contrast when surrounded by forests;
- The distance of the site from residential areas, public roads, and vantage points; and
- The perceived aesthetic value of the area. This impact will vary markedly from site to site, even if operations are similar.

The operational features of a quarry that have the potential to visually affect the environment include:

- The color, form, and bulk of plant and buildings;
- The clearing of vegetation;
- The exposure of the ground surface or rock face;
- The location, size and shape of bund walls, stockpiles and waste disposal areas;
- Operating equipment;
- Location of access roads; and
- Fences

Acceptable Standards

Natural vegetation is a valuable resource for screening purposes. Vegetation may needlessly be destroyed by brief activities with heavy machinery at the pit boundary. Clearing shall be kept to the minimum absolutely necessary for efficient operations. Planting of vegetation shall also provide additional screening.

Quarry faces SHALL be screened from frequently used roads and commonly visited vantage points. Topographic features shall be utilized as effective screens and any landscaping undertaken shall be designed to be visually compatible with the surrounding natural landscape.

Where practical, working faces shall be oriented away from vantage points and neighbors and the direction of working shall be carefully chosen so that the working face is hidden from the most critical view.

Where possible, uppermost benches shall be worked out and rehabilitated as soon as possible.

NEW quarry operations shall not be opened adjacent to roads frequently used by the public, unless adequately screened by topography and/or vegetation. Access tracks shall be aligned to avoid continuous line of sight from vantage points.

All exterior surfaces of buildings and fixed plants shall be designed to blend in with the environment.

MONITORING IMPACTS

Quarry operators SHALL establish, implement and maintain a program to monitor and measure on a regular basis the key characteristics of their operations that can have a significant environmental impact (refer to Appendix II). Environmental quality parameters will be monitored and measured to determine and ensure compliance with the legal requirements or standards. The monitoring program must be reviewed and approved by the regulatory Authority.

The program or monitoring plan should clearly state:

1. Institutional arrangements for carrying out the parameters to be monitored
2. Methods to be employed
3. Legal requirements or standards to be achieved
4. Evaluation of results
5. Schedule and duration of monitoring
6. Format and frequency of reporting

POST PROJECT MANAGEMENT AND REHABILITATION

Principle

Quarrying activities create changes to topography that may continue to cause visual impacts and water pollution long after the productive life of the operation. The term rehabilitation is used to encompass all of those measures, which seek to repair disturbed or degraded land, and to return such land to a stable and nonpolluting state, which is suitable for the proposed future use of the land.

The main aims of rehabilitation work are to:

- Achieve long-term stabilization of all worked out areas to minimize ongoing erosion;
- Revegetate all worked out areas with suitable plant species;
- Minimize visual impact of disturbed areas; and
- Ensure that worked out areas are safe for future uses.

Rehabilitation of extractive pits is a legally enforceable requirement of quarry permits issued under the Physical Planning Act 2002.

SITE CLEAN UP

Principle

The first step in the rehabilitation operation is a general clean up and making safe of the area.

Site clean up works to be undertaken after cessation of extractive operations include:

- Removal of all fixed and mobile plant;
- Removal of all temporary and permanent structures unless required for an agreed future use;
- Leveling of noise control bunds and overburden stockpiles;
- Removal and appropriate disposal of all waste materials including hazardous materials;
- Break up and burial or removal of concrete slabs;
- Rehabilitation of surplus roads, office sites, and hard standing areas, and
- Identification of any hazardous or contaminated materials, and weeds. Approval to retain any of the above items, which may be consistent with the proposed final land use, should be sought from the regulatory authority.

After site clean up, it may be appropriate to deny vehicular access to the site by erecting gates, fences, trenches, as necessary, to prevent unauthorized four wheel drive or motor cycle access, which is likely be detrimental to regenerating vegetation.

SITE PREPARATION

Principle

Site preparation is vital to the successful stabilization and re-vegetation of any disturbed site. The largest proportion of the cost of rehabilitation is usually incurred here. Cutting corners will jeopardize the success of the entire re-vegetation program.

Additional Measures

The first step in site preparation involves reshaping the area. The final land use of the site will determine the final landform. Generally, the site should be shaped so as to blend in with the surrounding landscape. Knobs and stockpiles should be leveled or re-graded, steep slopes battered back, and waste rock/overburden pushed into hollows or the toes of faces. The site should generally be left in a stable, free draining state that blends in with the surrounding area.

On erodible sites, it is most important that slopes be reduced during site preparation. Steep slopes of greater than about three to one (20° or 36 percent) will generally continue to erode unless expensive stabilization measures such as benching to break up the slope is undertaken.

Where long slopes cannot be avoided, the slope should be broken up by construction of benches at 30 meters intervals, or at shorter intervals for slopes of greater than three to one gradient.

Quarries with high visual impact may require special measures to rapidly ameliorate the impact. In critical areas, benches may be cut in half thus reducing the time for trees or shrubs to effectively screen faces. Where there is high visual contrast between the quarry and the surrounding vegetation, matting products in appropriate colors can be used during re-vegetation.

A stable final landform should be created before topsoil spreading and re-vegetation works commence.

Topsoil should be re-spread uniformly over the area at a suitable depth to support re-vegetation. Remember that a thin layer of topsoil is far better than none at all.

Re-spread soil should be left with a rough surface with many suitable locations for lodgment and germination of seeds. Smooth surfaces should be ripped, ploughed, or manually cultivated to improve the roughness of the seedbed, and provide suitable sites for lodgment and germination of seeds.

Avoid spreading soil when saturated or sticky, as compaction and other damage to the soil structure will occur.

Where topsoil is not available on site, alternatives must be sought — these may include any clay material available on site, any overburden that includes a high proportion of fines, highly weathered rock, or imported topsoil — that can sometimes be back carted from construction sites.

Extreme care should be taken when importing topsoil because they often contain seeds of vigorous weeds.

All compacted areas should be deep ripped along the contour. This may be carried out before or after spreading topsoil. Ripping will promote water infiltration and root penetration. Ripping should be carried out when the soil is relatively dry to increase soil break-up. Ripping after soil spreading will also help to 'key' in the soil to the underlying material, and it provides a rough surface for seed application.

Where soils have been spread some time before seeding, settling and formation of a hard crust may have occurred. If this is the case, the area should be harrowed, contour ploughed, or manually cultivated to provide a receptive seedbed.

EROSION PREVENTION

Principle

Erosion will continue long after extractive activities have ceased unless preventative measures are implemented. Poor drainage management can lead to damage or destruction of the rehabilitation investment. The best erosion prevention at a site is the establishment of re-vegetation.

However, while re-vegetation is becoming established, it may be necessary to employ other erosion prevention techniques.

Additional Measures

It is generally wise to retain any existing drainage controls, such as contour banks, rock filters and cut-off drains, upslope of the area being rehabilitated, to slow down surface run-off.

A rough surface will capture more water and allow rainfall to infiltrate rather than flow directly downhill. Deep ripping will improve water infiltration. Rip when the soil is relatively dry to increase shattering.

Where settling ponds already exist on site, it may be beneficial to retain these in the long term — with the landowner's approval. These ponds will require periodic cleanouts in the first year after commencement of rehabilitation, as the first storms after rehabilitation may cause some erosion.

Settling pond outlets and drain outlet points will usually require erosion protection mechanisms. Erosion protection mechanisms may include; spillways to undisturbed natural drainage lines, level sill outlets, pond decant pipes, riprap outlets, straw bale barriers, flume or other forms of energy dissipaters.

Care should be taken to avoid leaving any 'up and down' features on slopes, such as bulldozer tracks on re-soiled areas, as these will channel run-off downhill and increase erosion. Where possible, machinery should travel along the contour.

Surface mulches around growing seedlings and on steep batters may help to reduce erosion, reduce weed establishment and conserve soil moisture, as well as adding useful nutrients and organic matter.

Materials that may be used in surface mulches include:

- Compost;
- Wood waste — chips/sawdust — use of these materials will increase fertilizer requirements;
- Bark — may be toxic in large quantities;
- Spray on wood fiber matting;

Slopes and faces should be battered back, preferably to slopes of three to one or less, or approximately 20° (36 percent), which will be more likely to hold topsoil and seed without slumping.

Where batters are slumping, the toe of the slumped area should be shored up and allowed to drain using rocks or log crib-work or other form of landslide prevention work. Expert advice should be sought where landslips occur or are known to be prevalent.

The following soils are known to be prone to erosion, hence special care should be taken when disturbing the soil, particularly in steep areas:

- Gravelly soils — particularly granite or quartzite gravels;
- Soils on steep mudstone sites carrying dry forests — dispersible clays;
- Sandy soils and soils formed on sandstone bedrock; and
- Soils that are actively eroding even before the operation has commenced.

REVEGETATION

Principle

Establishment of a self sustaining cover of vegetation is the best low maintenance stabilizer of disturbed sites in the long term.

Revegetation also minimizes the impact of visual intrusion. Generally, the vegetation type that existed before the disturbance or a similar vegetation type will be most successful afterwards, following an initial re-establishment period. Revegetation will be considerably easier to achieve where site preparation has been done well.

Where the establishment of forest is unreasonable, the objectives of revegetation should be; to establish a native ground cover; to prevent erosion on the site; and to manage adverse visual impacts from critical viewpoints.

Private Land

On private land, depending on the proposed final use, revegetation may aim to establish native plants, pasture, a plantation for forestry purposes, or other approved means of land stabilization. Establishment of nonnative vegetation types often requires more input than re-establishment of the original vegetation: soils for exotic species must be relatively fertile and maintenance treatments such as fertilizing and thinning may be necessary.

Species Selection

Native plants, which are colonizing road sides and other disturbed sites adjacent to native vegetation in the area, are likely to be useful for quarry rehabilitation.

Non-local native species may be required where the site has been impacted to such an extent that the original natives cannot establish under the altered conditions. Hardy colonizing species that are relatively short-lived should then be sown, with the aim of allowing the naturally occurring species to move in and dominate over a period of time.

Exotic grasses and clovers can quickly provide vegetation cover and a fibrous root mat that will bind the soil against erosion.

On steep or highly erodible sites, it may be necessary to provide a fast growing cover crop to stabilize the soil while the natives become established.

Mulching

Surface mulches, while beneficial around seedlings, may inhibit the germination of the seed of some species.

Fertilizing

Nutrients are lost during the disturbance of quarry sites. Fertilizer application will promote growth of both exotic and native species. Care should be taken when fertilizing native vegetation because excessive application rates can encourage weed invasion, and even 'burn' natives. A general purpose chemical fertilizer — such as an 8:4:10 magnesium mix — should be applied at 250 to 300 kilograms per hectare.

Where necessary — especially if the topsoil has been lost — repeat fertilizer applications should be made every one to two years until vegetation is healthy and self sustaining.

Slow release fertilizers are recommended where soil and organic matter have been completely lost from the site. These fertilizers may be more costly to apply, but will assist in the long term by promoting deeper root development and adding humus to the soil.

Chemical fertilizers are easier to apply. However, these fertilizers are generally highly soluble and some of the nutrients will be carried away in run-off if there is no topsoil, or plant root systems, to bind up the nutrients.

Browsing

Browsing by livestock, native wildlife, and/or rabbits often becomes a severe problem at rehabilitation sites. Poisoning and shooting campaigns give only short-term relief. Perimeter fence construction — fences should be stock and rabbit proof — has been shown to produce excellent results, giving the effect of an extra year of growth on re-vegetated. When plants are large enough fencing materials can be re-utilized elsewhere on the premises.

MONITORING AND MAINTENANCE

Principle

Rehabilitation is a process that may take several years to produce a stable and self sustaining ecosystem. Aftercare is vitally important and any failures should be rectified quickly.

An agreed monitoring program (refer to Appendix II), funded by the developer, shall be instituted to provide reassurance for both the Planning Authority and any concerned third parties that these conditions are being observed in the day-to-day operation of the quarry, and that in the event of a breach, appropriate remedial action will be taken. Quarries must operate in conformity with an internationally accepted environmental management system and should be re-certified each year by a third party auditor to this international standard.

Additional Measures

Rehabilitated areas should be inspected regularly to assess the health of the vegetation and to check for erosion, browsing damage, and weed infestation.

A site inspection — preferably a joint inspection — should be arranged with officers of both the Ministry of Agriculture and the Environment to inspect the rehabilitation works. Annual joint inspections may be required at some larger sites after the cessation of operations to ensure the ongoing success of the revegetation.

In areas where germination has failed, enrichment planting — planting seedlings into unstocked areas — or spot sowing — hand sowing of seed into small cultivated patches — should be undertaken.

Natural disturbances such as: fire, flood, pests, disease, and drought have the potential to compromise the success of the rehabilitation project. Where revegetated areas are affected by natural disturbances, it may be necessary to carry out enrichment planting and/or spot sowing to enable the area to recover. The most effective protection against natural disturbances is to plant as diverse a range of locally occurring species as possible.

Where significant erosion has occurred, it will be necessary to bring machines back onto the site to repair the damage as quickly as possible. It is very important to protect any valuable rehabilitation investment from the impact of erosion.

After completion of all the rehabilitation operations and a reasonable maintenance period, the operator may wish to request a letter from the Planning Authority stating that the rehabilitation of the site has been satisfactorily completed.

CRITERIA FOR DETERMINING COMPLETION OF REHABILITATION

Principle

The following measures a guide to assist regulatory authorities and quarry operators in jointly assessing rehabilitated areas, so that a notice of 'completion of rehabilitation' may be issued, effectively absolving the operator of the need to conduct further rehabilitation works.

Acceptable Standards

Minimum standards for the issuance of a Notice of Completion of Rehabilitation unless otherwise specified in the quarry permit are:

- The rehabilitated area should be left in a stable and non-polluting state;
- The area must be suitable for the planned final use or rehabilitation objective;
- Rehabilitated areas should not be affected by continuing erosion;
- Revegetation should be established and effective over the whole site.

Evaluation of revegetation will be dependent on factors including: tree density; species diversity; and vegetative cover, as agreed with the regulatory authority.

APPENDIX I – GUIDELINES FOR THE PREPARATION OF AN ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

1. The EIA Methodology

The EIA study is based on a systematic process that includes the following steps:

- A. Description of the proposed project
- B. Description of the proposed site location
- C. Liaison with Planning Authority to determine legal requirements
- D. Determination of the terms of reference and scope of work
- E. Collection and analysis of baseline data conditions
- F. Identification and description of applicable legal and regulatory framework
- G. Identification of critical issues
- H. Determination of potential impacts
- I. Determination of mitigation measures
- J. Consideration of project alternatives
- K. Determination of environmental quality objectives (recommendations for sound environmental management/best practices)
- L. Identification of post permit requirements

The presentation of data for the EIA must include information from studies and reports as well as data from field research. All information should be properly sourced for accuracy of the information and the date it is presented.

2. Description of Existing Environment (Baseline Data)

An EIA must be a site specific and project specific study. An EIA for a particular development in a particular setting cannot be transferred either to another development or even the same development in another setting.

The EIA is a multi-disciplinary study that must span aspects of the natural and built environments. Critical areas to be studied will be dependent on the project site and the project details. The checklist below gives some of these critical factors, which should be considered in describing the environment. This description of the environmental setting is a record of conditions prior to implementation of the proposed project. It is primarily a benchmark against which to measure environmental changes and to assess potential impacts.

Basic checklist for critical areas to be considered in the EIA:

Physical environment:

- Climatic variables (e.g., rainfall patterns, prevailing winds, extreme events, temperature patterns)

- Geology
- Topography
- Coastal dynamics
- Soil
- Drainage
- Water quality
- Air quality
- Noise
- Natural hazard risk (e.g., hurricanes, flood hazards)

Biological environment:

- Flora
- Fauna
- Terrestrial ecology
- Marine/coastal ecology
- Fresh water ecology (river)
- Nuisance species
- Aesthetic appeal
- Landscape vistas

Human environment:

- Sphere of influence
- Land use – site and situation
- Zoning and density regulations
- Livelihoods
- Demographics
- Community structure
- Proposed developments
- Transportation and traffic patterns
- Settlement patterns and social structure
- Water supply
- Energy supply
- Telecommunications
- Services – health, educational facilities, recreational facilities
- Archaeological heritage
- Cultural values
- Natural Hazard Vulnerability and History

3. Description of the Project

This is a detailed statement of all the critical components, attributes or phases of the proposed development. This should also include pre-construction, and construction phase activities, through commissioning, to the operational phases of the development.

4. Legislative and Regulatory Framework

This section of the report should present information on the regulatory framework within which the potential development will have to operate.

5. Identification of Impacts

The objective of prediction is to identify the magnitude, significance, and other dimensions of potential change in and interaction with the environment given the project intervention. This should be an objective exercise utilizing scientific knowledge with a combination of informed professional judgment according to accepted procedure.

The following aspects should be covered in impact prediction:

- Direction (positive or negative)
- Duration (long-, medium- or short-term, episodic)
- Location (direct or indirect; project on environment or environment on project)
- Magnitude (large or small – major, minor)
- Extent (sphere of influence – local or national)

6. Mitigation Measures

It is recognized that it is seldom possible to eliminate an adverse environmental impact altogether, but it is often feasible to reduce its intensity. This reduction is referred to as mitigation. For each potential adverse impact the plan for its mitigation at each stage of the project should be documented and its cost assessed. This is an important consideration in the selection of the preferred alternative. In the case of beneficial impacts it should be demonstrated how these can be optimized.

7. Public and Community Involvement

Civil society, which includes citizens, community-based and nongovernmental organizations (NGOs) within the sphere of influence of the project (project setting) should be given the opportunity to share information for the EIA study. This will facilitate obtaining views and perceptions of the proposed development, as well as the inclusion of local knowledge and expertise. Local anecdotal knowledge can sometimes help to facilitate differentiation between those impacts that are of major importance in the local context and those that are not.

Civil society should include but not necessarily be limited to:

- Environment and development NGOs
- Chambers of commerce
- Service clubs
- Citizens associations
- Local government authorities and community councils

Information obtained from NGOs and community groups can be of invaluable assistance in providing approaches to problem solving and resolving conflicts. This information obtained as part of the public consultations should be documented in the EIA report.

8. The EIA Report

The EIA should be documented by a written report, supported by references, photographs, maps, plans and data tables. The report should contain an introduction explaining the need for, and context of the project. This document should have the following basic aspects included in the table of contents, unless specified otherwise in the terms of reference:

- Executive summary
- Description of the proposed project in detail
- Identification and analysis of alternatives
- Description of the existing environment
- Policy, legal and administrative framework
- Identification and assessment of potential environmental impacts:
 - physical
 - natural hazard risk
 - biological
 - human/social
- Cumulative impacts
- Positive impacts
- Public involvement
- Recommended mitigation measures
- Environmental management of the project
 - Environmental quality objectives
 - Training
 - Draft outline monitoring program
- List of references
- Appendices including:
 - Reference documents
 - Photographs/ maps
 - Data tables
 - Terms of reference
 - Composition of the consulting team
 - Notes of public consultation sessions

APPENDIX II – GUIDELINES FOR THE PREPARATION OF A QUARRY ENVIRONMENTAL MANAGEMENT PLAN (EMP)

General headings to be addressed:

- 1.0 Introduction
Identify the proponent and explain the need for the quarry establishment. Indicate what other approvals are sought.
- 2.0 Site Description
Location; history; existing excavations; vegetation; topography; drainage; geology; soil; land tenure; current land use; location of neighbors; access route; special conservation values; landslide potential; heritage values; geo-heritage values and fauna values.
- 3.0 Development Plan
Submit at a scale of 1:5000 or better showing: resource available; projected extent of quarry; sequence of development; screening; location of stockpiles; location of water courses; access; proposed quarry boundaries
- 4.0 Methods
Quantities to be extracted; stockpiling of topsoil; hours of operation; benching; blasting; ripping; buildings; volume of overburden to be removed; crushing; truck movements; major items of equipment; slope of faces.
- 5.0 Waste Management Plan
Location of stockpiling of waste process material; storage and disposal of solid and hazardous wastes
- 6.0 Environmental Management
Identification of all aspects of the operations likely to have a significant impact on the environment (i.e. humans, flora, fauna, rivers, watersheds, marine resources, noise, air quality, solid waste).

Program to monitor and measure on a regular basis (frequency to be determined by regulatory Authority) key environmental parameters (e.g., for water and air quality) that are legal requirements or industry standards. Emergency procedures for taking corrective action and preventative action to minimize the environmental impact.
- 7.0 Rehabilitation
End use of site; re-vegetation already carried out; re-contouring; ripping; benching; bench height; re-spreading topsoil; source of soil; seeding; planting; species; fertilizing; rehabilitation; timetable; plan for progressive rehabilitation concurrent with extraction. Maps, overlays, photographs to be included as appropriate.

**APPENDIX III – RE-APPLICATION FOR PLANNING PERMISSION TO QUARRY
UNDER SECTION 34 OF THE PHYSICAL PLANNING ACT, 2002**

1. Name of owner/operator of quarry(s):

2. Address:

3. Telephone number:

4. E-mail address (if any):

5. If owner/operator is a company -

- a) Name of company:
- b) Name of company directors:
- c) Registered address of company:

6. Location, or postal address of quarry concerned:

- Please indicate an Ordnance Survey Map Ref. No., and the Grid Reference where available.
- A site location map to a scale of not less than 1:2500 should be also be attached. The map should indicate (a) the site boundary (outlined in red) and (b) the current workable area (outlined in blue).

7. Total site area of quarry (acres):

8. Extraction area of quarry (acres):

9. Types of material being extracted:

10. Quarry operating hours:

(i) Plant operating hours:

- (a) Weekdays
- (b) Saturdays

(ii) Loading/off-site haulage hours (if different from above):

- (a) Weekdays
- (b) Saturdays

(iii) Hours (outside normal opening hours) required to service exceptional customer requirements:

11. The traffic generated by the operation of the quarry? (Type and frequency of vehicle entering and leaving the quarry).

12. Please give details of emissions (noise, dust, water, etc.) from the quarry where measurements are available.

Please note that any changes to the particulars noted above must be brought to the attention of the Planning Authority as soon as possible.

Name (BLOCK CAPITALS):

Signature:

Position with firm/company:

Date: