

Cement Sustainability Initiative (CSI)



Guidelines on Quarry Rehabilitation

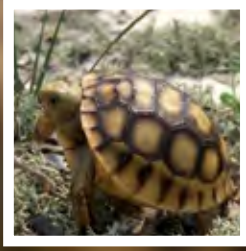
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Biodiversity and
land stewardship

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1 Background

The first step in cement production – the extraction of raw materials from the earth’s crust – inevitably impacts on the surrounding natural and social environment. In particular, the removal of soil and changes in topography of the area are likely to affect local ecosystems and watersheds. However, these impacts can be successfully addressed and mitigated through the development and implementation of an effective quarry rehabilitation plan. In some cases, the effective implementation of a well designed rehabilitation plan can result in significant environmental and social benefits.

The Cement Sustainability Initiative (CSI) member companies recognize that they are responsible for the effective management and rehabilitation of the quarries they operate. Quarrying activity carries with it the obligation to rehabilitate both the site and, wherever necessary, the surrounding area while operating and upon completion of operations.

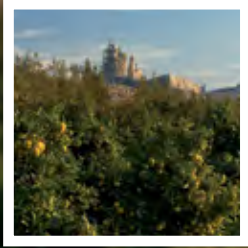
In recognition of their responsibility for effective quarry rehabilitation, CSI member companies have

committed, as part of the CSI Charter, to draw up rehabilitation plans for operating quarries and plant sites, and communicating these plans to stakeholders. A Key Performance Indicator (KPI) reporting the percentage of sites with quarry rehabilitation plans in place has been developed to support this commitment.

Successful quarry rehabilitation also carries commercial benefits for operating companies. The license to operate for both the industry as a whole and for individual companies is dependent on ensuring that land used for quarrying purposes is rehabilitated in an effective and responsible manner, taking into account the needs and expectations of stakeholders, and the influence of regional and local planning requirements. Companies that adopt the best practice in this regard can expect to realize significant benefits, including competitive advantage and long-term sustainability of their operations, which outweigh the short term financial costs of a rehabilitation program.

Principles

- > The **post-closure land use** needs to be clearly assessed when initiating a quarry rehabilitation plan, even if this can evolve over the lifetime of the quarry. The quarry rehabilitation plan will be based on a clear set of objectives reflecting the legislative requirements (as the highest priority), and encompassing the local social, economic and environmental (including biodiversity) considerations for the future use of the site. The objectives will be technically and financially sustainable.
- > **Legal compliance** must be the minimum requirement when establishing each quarry rehabilitation plan. The rehabilitation guidelines should never be in conflict with, but should always complement and go beyond legal compliance.
- > The rehabilitation plan will ensure the site is left in a **safe and stable condition**. The safety of the rehabilitated quarry includes the stability of slopes, roads and raw materials piles. Safety will always be considered as paramount for the rehabilitation plan.
- > **Stakeholders** will be listened to, and relevant stakeholders will be involved at all stages. The quarry rehabilitation plan must address stakeholder expectations, and be aligned with, or leverage from, the stakeholder view, experience, culture and customs.
- > An assessment of the **baseline conditions** will enable identification of the impacts and measurement of the changes that may arise as a result of quarrying activity. The assessment of baseline conditions will include air and water, flora and fauna, site safety, landscape integration, human activities and cultural heritage.
- > The **rehabilitation plan** will be developed prior to the commencement of mining for new sites, but should also be developed for operating quarries, where such a plan does not already exist. It will be aligned with the mining plan. Depending on the objectives and priorities set, the development and monitoring of management plans for biodiversity should, at a minimum, be considered as a supplement to the quarry rehabilitation plan, and in other cases, as core parts of the plan.
- > A **monitoring plan and appropriate corrective measures** (if necessary) will be included in the rehabilitation plan, thereby ensuring the documentation and measurement of performance against the objectives.



2 Introduction

Objectives

The guidelines contain a clear set of recommendations for the development and implementation of a quarry rehabilitation plan. The objectives of the CSI in developing these recommendations are:

- > Support the process of quarry rehabilitation across member companies, and by doing so, improve the standard of rehabilitation projects for existing and new sites.
- > Ensure that CSI members have a common understanding of the CSI KPIs on quarry rehabilitation, and that reporting against these KPIs is consistent across members.

While the guidelines are aimed primarily at CSI member companies, it is also hoped that other industry participants will find the guidelines to be relevant and consider adopting them, thereby contributing to a wider improvement in standards.

Application

It is for each company to mandate and apply the guidelines within their operations to the extent and in the manner that they consider appropriate. Accordingly, the guidelines are designed to complement, rather than replace, existing successful rehabilitation practices and methodologies. In other words, it aims to enhance, rather than restrict, these practices and methodologies. Further, local legal obligations and requirements should always be complied with.

Scope

The guidelines are designed to be applicable to:

- > New quarries (“green-field” projects) as well as existing quarries.

- > Quarrying for cement and aggregate materials.
- > A broad range of rehabilitation processes and techniques.
- > A variety of land end uses including provision of ecosystem services, agriculture, forestry, natural reserves, commercial and residential development and recreational facilities.
- > Rehabilitation in a broad range of environments, climates and geographies.

Structure

The first part of the guidelines sets out the external factors of particular relevance to establish and / or revise a rehabilitation project. The second part contains guidance for each stage of rehabilitation planning, from defining the context for the rehabilitation plan to post-rehabilitation monitoring. A glossary of relevant terms is also provided.

Whereas the guidance provided is generally applicable, more detailed information on specific tools and techniques is illustrated through case studies from CSI member companies.

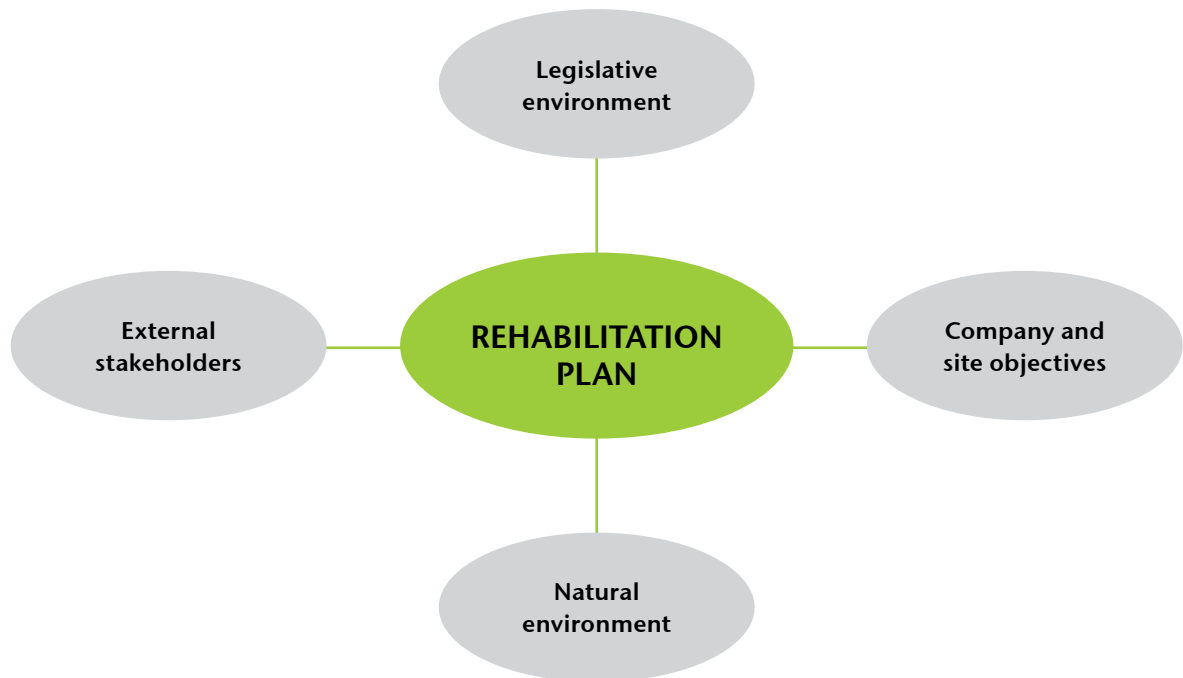
Case studies

The case studies provided in this document highlight responsible quarry rehabilitation activities drawn from a range of quarry types and local habitats around the world. They are all applicable experience shared by CSI members, intended as a reference to other companies involved in similar quarrying or rehabilitation activities. The contributions remain anonymous in this document, but readers can obtain full details, including contact information at www.wbcscement.org/QRGcasestudies.



3 External context

As illustrated in the diagram below, the development and execution of a rehabilitation plan is affected by several factors. In particular, the development of the plan cannot be isolated from the external context.



Influences on the rehabilitation plan

3.1 Legislative environment

These guidelines promote an overall consistent approach to quarry rehabilitation management. They are a complement to applicable local or international legislation, and must not be used as a substitute. The guidelines should be applicable to quarry closure programs without any conflicts with legal compliance. It should be clearly understood and accepted that the legislative requirements are the minimum standard required, which best practice should exceed wherever possible.

National legislations on quarry rehabilitation vary greatly across the globe, from very strict and detailed legal requirements in some countries,

to more loose and generic in others. Where companies operate in more than one country, different legislations will apply to their quarries, and therefore these guidelines can be adopted as a complement to achieve a raised and consistent standard across operations.

Further, national legislation frameworks and specific provisions for quarry rehabilitation tend to be 'dynamic', quickly changing to higher level, and consequently more demanding. It is good to establish a base-line of requirements, in the form of guidelines that could – today – be over and above the legislation for each country, but – in general terms – should cover the needs of operating for tomorrow in many countries.

Partnering for effective rehabilitation in Thailand



The Cha-am limestone quarry is located in Thailand's Cha-am district in Petchburi province. The quarry is included in the perimeter of the King's project for conservation and restoration of the Khao Nang Panturat. The project, which started in 1996, has the objective to maintain and increase the native biodiversity and preserve the area of Khao Nang Panturat as a national park with tourist areas and a nature observation center. The King's project is good example of high-level collaboration between state agencies, local authorities, universities and business organizations to restore a natural environment.

Supporting local biodiversity plans at Sonadih and Arasmeta cement plants in India



Biodiversity improvements around the Sonadih and Arasmeta cement plants have been designed and implemented to contribute to local biodiversity plans. A total of 70,000 tree saplings will be planted as part of the local "Green Chhattisgarh" program to preserve unique natural heritage. Following advice from the authority & non-governmental organizations (NGOs), they brought the saplings, supervised the planting and maintained the land. Species chosen are robust with a long expected life span like teak & tamarind or fruit trees like mango & jackfruit. Implementation was brought about in partnership with local communities, particularly school children, in order to raise their awareness of environmental issues.

Valorization of biodiversity in Portugal



In 2007, a partnership with University of Évora was started to characterize and evaluate the occupation level of fauna at the Outão plant in Portugal. The study began with the survey of vertebrate and invertebrate terrestrial fauna in 10 landscape units, defined on the basis of soil type, succession state and restoration age.

This baseline data was used to define an action plan for fauna recovery and colonization that included six groups of actions: environmental awareness, prevention, feral animal control, vegetation management, shelter, and water availability improvement. The strategy devised relies on an active and adaptive management through fauna and action effectiveness monitoring schemes.

Nature Reserve in Attenborough in UK



Previously a place for sand and gravel excavations, Attenborough Natural Reserve is now an integral part of the UK's national and Nottinghamshire's local biodiversity action plan. Its large expanses of open water are now home to a wide range of aquatic and waterside habitats, including a big variety of birds, reptiles and mammals. The nature reserve is designated as a Site of Special Scientific Interest (SSSI). In June 2006, the reserve was awarded the prestigious Cooper Heyman Cup by the Quarry Products Association for its restoration work. The reserve is also a popular visitor center that holds various types of events all year round.

A charity to manage Austerfield quarry restoration in UK

Austerfield quarry in South Yorkshire, England, is an operational sand quarry that is being progressively restored. A charity, the Mosaic Trust, was set up in 2000 to manage 29 hectares of restored land and there is also a small field study center that is regularly visited by local schools, colleges and community groups. The company has long provided educational programs and teaching aids, linked closely to both the quarrying industry and the national curriculum. Habitats created at the site include lowland heathland, lowland heathy oak woodland, species rich hedgerows and small open water bodies, all of which are on national and/or local biodiversity action plan targets.

3.2 Stakeholders

Stakeholders are people or institutions that feel they may be affected by, or may affect, an organization's activity. Stakeholders can be either internal to the organization (e.g. employees, shareholders) or external (e.g. land owners, local communities, authorities, NGOs).

Rationale for stakeholder involvement

Effective stakeholder engagement throughout the rehabilitation project results in benefits for both stakeholders and the operating company. By engaging with stakeholders, companies can open up a constructive and long-term dialogue

that facilitates the sharing of knowledge and understanding by all parties, and enables the exchange of views and feedback. Such dialogue can inform the development of a rehabilitation plan that reconciles company objectives and stakeholder needs, including local social aspects, and is therefore more likely to be successful. Furthermore, incorporating stakeholder feedback into the rehabilitation project will improve public perception and acceptance of the extraction project, and of the operating company. On the contrary, failure to identify and consult with stakeholders can result in inappropriate and less credible rehabilitation choices, with associated negative impacts on the perception of the extraction activities, and of the operating company.

A nature trail set up in Nussloch quarry in Germany



A nature trail has been created at the 238 hectares Nussloch quarry in Germany to allow safe public access while leaving operations unaffected. As a result, 20,000 people have visited the site and enjoyed the restored areas that are now home to a wide range of wildlife. In addition, more than 60 guided tours for schools, universities, nature protection associations and interested individuals are held each year. As well as 2.7km of public trails, there is a viewing platform from where the active limestone quarry can be seen and a number of boards providing information about biology, geology, historical mining, agriculture and active quarrying.

Rehabilitation for local communities at Yepes quarry in Spain



Educational programs for schools

The quarry extends over 200 hectares in Castilla la Mancha, Toledo in Spain. The semi-arid hills are dominated by bushes and olive trees, comprising thyme and alfa-grass fields with kermes oak bushes.

Two endemic protected species have been identified.

The company has partnered with a university on natural succession and education, World Wide Fund (WWF) Spain on communication issues and tree



Bird observation hide

planting, as well as the local cross country cycling association and ecological restoration engineers. This program has created a botanical and avian field observation, cycle tracks, an education center, and facilitated many research programs. Visiting programs have been designed to share and spread knowledge on the botanical and avian species with school children.

Identification of stakeholders

Stakeholders will be specific to each project, and should be extended beyond the immediate area of the quarry site, depending on the natural and social environment and circumstances. In addition, there are a number of legally prescribed statutory consultees in some countries, and consultation processes should reflect this. A list of stakeholders could include:

- > Local landowners.
- > National and local government agencies.
- > International, national and local inter-governmental and non-governmental organizations.

- > Neighbors and community based organizations.
- > Users of the land or other nearby natural resources.
- > Private companies with an interest in the local land use.
- > Any relevant universities and research institutes.
- > Internal stakeholders such as employees and shareholders.

Consideration should be given to developing and maintaining a stakeholder database to keep record of information provided and contact details.

Analysis of stakeholders

It is important to recognize that each stakeholder will have a differing, and possibly conflicting, set of perspectives and priorities for a rehabilitation project, and that the ability of each stakeholder to make and influence decisions in relation to the rehabilitation project will also vary. By conducting a stakeholder analysis, a company can identify those stakeholders who can have a significant impact on the success, or otherwise, of the rehabilitation project, and their interests, goals and roles. The results of this analysis can be used to ensure that the rehabilitation plan is appropriately balanced, thereby improving the likelihood of acceptance.

Levels of stakeholder involvement

Stakeholder engagement encompasses a range of levels and activities, including information provision, consultation, participatory planning or decision-making and partnership. The appropriate level of engagement will depend upon the stage of the rehabilitation process and upon the interest and / or influence of the stakeholder.

While the active engagement of key stakeholders is important, it is also important that other stakeholders be informed and not neglected.

The management of external stakeholder expectation is needed, as the likely resolution would be a combination of preferred outcomes of several groups.

Continued stakeholder engagement

Stakeholder engagement should be an ongoing process, and not a one-off exercise, conducted in the early stage of the rehabilitation project. It is important to recognize that constructive relationships take a long time to develop, and are based on the trust that develops through listening to stakeholders and addressing concerns, engaging in regular communication and delivering on promises over a sustained period. Accordingly, companies should be prepared to commit both time and resources to this process. As part of this process, it is important to recognize that the operating company has a fundamental role to play in raising awareness and educating the broader community, with respect to the company's operations and objectives.

Quarry rehabilitation in Canada – stakeholder engagement showcase



The company operates a quarry along the Niagara Escarpment in Milton, Ontario. Since 1987, rehabilitation and water management are an integral part of the overall land management program at the quarry.

At the 10th Conference of the Parties (COP10) of the Convention on Biological Diversity (CBD) the private sector was asked to present best practices of the private sector engaged in conserving biodiversity. The Milton quarry was one of the case studies selected by Canada.

Communication with stakeholders has to happen at all levels. At CBD, heads of state and environmental ministers did get a chance to see how active the CSI members are in rehabilitation work.

Wetland conservation with scientific and educational focus in France



The sand and gravel pit was rehabilitated into a nature reserve in partnership with a local conservation organization in Chambeon, France. The 150 ha of restored wetlands is now the heart of a Natura 2000 site and offers a unique experimental area for research on ecological engineering, hydraulics, hydrogeology and sociology. There are 240 species of vascular plants, 55 nesting birds, 300 lepidoptera, 9 reptiles, 7 amphibians, 24 fish, 36 mammals; several of them are protected. Each year, 70,000 visitors, of which 20,000 are school children, come and learn about nature at the public information center and on the site's 6km didactic trails.

Cooperation between school and industry in Germany



The company has created a 'living dialogue' with schools across Germany to enhance its image and generate interest for jobs in the building industry. The initiative involves employees presenting and holding events in schools, as well as students and teachers visiting the company's cement plants and quarries. Among the key topics covered are sustainability, architecture, production of construction materials, job application skills and the economy. The project manager shared that, "This initiative gives pupils and teachers the opportunity to gain insights into an international company while inspiring young people to consider a career in our industry."

Continued stakeholder engagement can provide mutual benefits for companies to learn from stakeholders, explore uncharted options, and

potentially benefit from lower rehabilitation costs, improved legitimacy, local knowledge and skills.





4 Rehabilitation steps

To be fully effective, rehabilitation planning should begin as early as possible in the quarry life cycle and be reviewed and updated on an ongoing basis. Since the ability to implement any given rehabilitation plan is related to how the site is operated and decommissioned, rehabilitation needs to be considered and integrated at all stages of the project life cycle. As such, planning for rehabilitation should ideally commence prior to operation as part of the Environmental and Social Impact Assessment (ESIA). Such long-term planning will contribute to a successful rehabilitation plan.

However, it is important to recognize that in many cases, rehabilitation planning may not be initiated until the quarry is already established, sometimes for a considerable period of time. Similarly, an existing rehabilitation plan may have to be revised significantly for a number of reasons: changes in regulation, revision of permit requirements, changes in the objectives of local development plans, changes in stakeholder opinions and expectations (such as increasing awareness and general interest in biodiversity and ecosystem services), purchasing of the site from another company. It should be noted that significant revisions to the rehabilitation plan are, in the majority of cases, subject to a formal permitting process. Only limited changes to the rehabilitation plan can be accepted and applied without formal approval by the authorities.

4.1 Defining the context of the rehabilitation plan

Wherever possible, and ideally in all cases, it is important to identify and assess the impact of an extraction project before it commences to ensure:

- > An appropriate rehabilitation plan that takes into account impacts from quarrying activity is developed and maintained.
- > The establishment of a rational baseline, against which the progress and success of the rehabilitation plan can be measured.

The method used for identifying and assessing impacts should be tailored to the specific project and to the environmental, economic, social and legal context. An ESIA is generally the most useful tool for evaluating and managing the positive and negative impacts of a site and for detailing the specific context in which the project takes place. Baseline assessment and recording, by following an initial ecology scoping study, depending on the local conditions and characteristics, is essential as part of the ESIA. Further guidance can be found in the CSI guidelines on ESIA. Where an ESIA is not possible, a minimum study of baseline conditions is essential, to identify the impacts that may arise as a result of quarrying activity. The 'baseline' approach is especially important for green-field

quarries. It is necessary to decide, substantiate and clarify the period to which the baseline should refer, either in the ESIA and / or as a separate 'initial ecology assessment' study / project. For

existing quarries, it may prove to be difficult to properly assess the baseline on the basis of the situation before the quarrying activity started, particularly if the activity was initiated long ago.

ESIA for Antea green-field project in Albania



To align with the company's targets for environmental sustainability, an ESIA was conducted in 2008 by international consultants (ATKINS) for the Antea green-field project for development of cement production plant and associated quarrying activities in Albania. Among the environmental issues covered, the ESIA assessed the impacts of the different project phases, namely construction, operation and closure on ecology, biodiversity and landscape. The ESIA then proposed specific mitigation measures and rehabilitation plans for Antea quarries that will incorporate the needs of the local ecology. The quarry rehabilitation plans are an integral part of the Antea plant Environmental Management System (EMS), including all relevant procedures, working instructions and monitoring practices.

In this case, and in the case of existing sites undertaking a revision of their rehabilitation plan, the assessment of the environmental, social and economic conditions, should focus on the current situation (at time of analysis) to establish the baseline. This should be supplemented by bibliographic research and stakeholder involvement to recover historical data prior to the site commissioning. Both of these elements should be considered during the process of defining rehabilitation objectives.

The assessment should capture and quantify both positive and negative impacts in relation to air,

water, occupational health and safety, flora and fauna, wider landscape, cultural heritage, and social impacts, such as community well-being, public health and safety, the living environment, and landscape aesthetics. It is also important to consider:

- > The inter-linkages between different impacts.
- > The secondary impacts of a project.
- > Cumulative impacts.
- > Impacts outside the boundaries of a project.



Plant nurseries in several quarries in Mexico



The company has developed an original approach to quarry and green spaces restoration in Mexico. With its 13 tree nurseries, it is possible to grow adequate plant species for each site, according to their biodiversity needs. Tree nurseries are a powerful tool to involve children and the community on environmental and biodiversity issues. Children have the opportunity not only to reforest green areas, but also to receive a tree adoption certificate which provides a list of activities describing how to take care of it. The nursery also provides free courses on hydroponic growing and vegetable cultivation. The company also celebrates the International Day of the Tree nationwide to carry out a massive reforestation event.

Rehabilitation of Bamburi cement quarries for biodiversity conservation and to provide other ecosystem services in Kenya



The ex-quarries of the Bamburi cement plant have been successfully restored over the last 40 years into coastal forests, wetland and grassland areas. These restoration projects include managed forests producing wood as biofuel, hardwood trees for carving, aquaculture as a sustainable food source, a plant nursery promoting indigenous plants as ornamentals, game farming, a wildlife reserve as a refuge for local animal species and an education facility for the locals. The project has received recognition both nationally and internationally and is striving to become economically self-sustaining. Over 350 native plant species have been successfully planted, including 30 International Union for Conservation of Nature (IUCN) Red List species, as well as others that are important for local wildlife and sustainable development.



To ensure that the full range of impacts is captured, external stakeholders should be involved in this stage. The role of internal stakeholders

should be considered with structures and processes established to facilitate contributions and actions from all relevant parts of the business.



In 2008, World Resources Institute (WRI), World Business Council for Sustainable Development (WBCSD) Ecosystem Focus Area, and a number of WBCSD members developed, the Corporate Ecosystem Review (ESR). It is a structured methodology for managers to proactively develop strategies for managing business risks and opportunities arising from their company's dependence and impact on ecosystems. When determining future land use, this tool can help to engage with local stakeholders and provide the following benefits:

- > Provide a framework for stakeholder engagement.
- > Improve stakeholder relationships by enhancing understanding of how stakeholders value different services coming from the same ecosystem.

ESR and valuation usage in UK



The ESR tool was used by the company and helped to engage with local stakeholders and decision makers to explore the best options for future land use with an ecosystem services license. In the UK, the ESR was the first step before venturing into Corporate Ecosystem Valuation (CEV) for the Ripon quarry using WBCSD's Guide.

By applying a systematic review on the impact and dependencies of all potential ecosystem services, the future land use options were compared in a more rational and fact based manner.

CEV at Presque Isle aggregates quarry in Michigan in USA

The company road tested the WBCSD's Guide to Corporate Ecosystem Valuation (2009-10) with the support of a number of international NGOs. The initial phase of the study was to use the ESR as a structured methodology that highlights business risks and opportunities associated with ecosystem change, as a tool to identify key ecosystem services at the subject site. The study then assessed the value of key / priority ecosystem services to enhance land management planning for future reclamation of a quarry in Presque Isle, Michigan. The ecosystem services evaluated include erosion regulation, water purification, recreation / ecotourism, and education.

The options for rehabilitation may be limited by outside factors. Specifically, land tenure patterns may restrict the company from realizing the best possible outcome for stakeholders. Similarly, rehabilitation outcomes may be constrained in cases where a quarry is part of a merger and acquisition project, and there are legal arrangements and / or permit conditions that exist before the acquisition and continue to apply.

Further, while local planning requirements and legislation may limit the options for rehabilitation, there may be scope for companies to partner with other operators to identify opportunities for the realization of benefits.

Storm water management in Australia



Glasshouse quarry in Australia's Northern Region produces between 400,000 and 600,000 tonnes of aggregate a year. Due to the sub-tropical climate, the installation of a storm water management system to control high levels of runoff is a vital part of the quarry's best practice guidelines. In addition, work has been carried out to minimize the amount of soil exposed, with replanting as necessary, and sediment control measures, such as settling ponds, have been installed. The storm water management system is regularly reviewed to ensure it remains effective and landscaping work is creating new habitats for species such as eucalyptus, acacia and peregrine falcon.

Species restoration in a tropical dry forest in Costa Rica



The 290 hectares Colorado cement production site is surrounded by a tropical dry forest highly fragmented by human activities, especially cattle-raising and overexploitation of high-value wood.

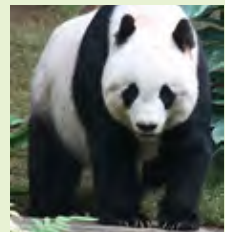
Initially focused on the rehabilitation of the exploited areas through reforestation, the company changed its approach and dedicated 100 hectares to an ecosystem restoration project and the adoption of a biodiversity action plan. 6,000 trees were planted to reforest 12 hectares of the clay quarry and 50 hectares were rehabilitated through natural regeneration.

Another 100 hectares were mapped and a biological survey was conducted; nearly 450 species from diverse taxonomic groups were identified. A biodiversity database was also developed to record all the species inventoried.

Minimization of impact on local habitat in Sichuan DujiangYan cement plant in China



The DujiangYan cement plant was designed and constructed to minimize environmental impacts. In particular, important local habitat was protected from an original proposal to construct a new road for transportation of materials. It would have traversed the buffer zone for a protected area, which includes habitat for giant pandas, potentially opening up the area to agriculture and other induced development. Following consultation with NGOs, it was decided to construct a state-of-the-art 6km conveyor – complete with three km of tunnels and 18 bridges – to avoid damaging this valuable local habitat. Further environmental features include complete water recycling, bag filters to minimize particulate emissions and the use of energy-efficient dry process technology.



4.2 Setting objectives for the rehabilitation plan

The overarching post-rehabilitation vision for a site should be captured in a summary statement. This statement should outline a clear set of specific objectives for quarry rehabilitation. These objectives will help to guide the development of the plan, and can eventually be used by internal and external stakeholders to assess the success of the rehabilitation project. Such objectives may vary significantly, as each project will need to be adapted to the local situation, which is specific, and sometimes unique.

Principles for setting objectives

The objectives should aim at ensuring that the following criteria are met:

- > Sustainability of post-closure land use.
- > Mitigation of operational impacts identified during the ESIA and maximization of (social and environmental) benefits to local communities.
- > Economic viability and possible positive economic impact to local communities.
- > Consideration for the needs of stakeholders, both internal and external.
- > Reintegration of the site into the surrounding area – how the quarry should ‘blend’ with the environment.
- > Opportunities to rehabilitate, restore and enhance biodiversity.

An assessment of risks and opportunities associated with the objectives should also be considered **during the ESIA**.

The objectives of the rehabilitation plan should be realistic. For example, at existing quarries, the current status of the extraction and the landforms of the quarries, have to be taken into account since this might limit or reduce the number of possible options. This reinforces the fact that rehabilitation planning should begin as early as possible in the quarry life cycle in order to be fully effective. Once objectives are set, rehabilitation activities should be defined and performed in order to achieve these goals. By clearly defining and communicating the objectives, internal and

external stakeholders are able to monitor and assess progress of the rehabilitation plan. For existing quarries, the current status of areas outside the quarrying site, can be used as a benchmark to monitor the effectiveness of the rehabilitation plan and the progress of its implementation.

Context for setting objectives

The objectives of a rehabilitation plan should be based upon the specific characteristics of the extraction site and should reflect:

- > Legislative requirements in the area – these should always be met.
- > Health and safety considerations.
- > Environmental and social characteristics of the quarry and surrounding area.
- > Biodiversity in the area.
- > Ecosystem services provided within the site’s ecological boundaries.
- > Operating plan for the quarry – technical feasibility of rehabilitation objectives will be affected by the manner in which the quarry operates.
- > Status of the quarrying area of existing operating site.
- > Characteristics of the deposit (geology and hydrogeology).
- > Impacts arising from operation of the site.
- > Post-closure land use plan.

In the early stages of quarry life cycle, the impacts of extraction can be identified and assessed through an impact assessment, as outlined in Chapter 4.1. In the later stages of life cycle, actual impacts can be identified through site investigations and field work. Future land uses are always influenced by regional and local planning requirements, either directly or indirectly; the end-result of quarry rehabilitation needs to be a win-win outcome of dialogues with stakeholders, not necessarily limited to conditions of the mining permit or environmental license.

Examples of rehabilitation objectives

Although the form of objectives will vary depending on stage of planning and site specific factors, typical objectives based on the principles outlined above could include:

- > Sustainability of post-closure land use

Fruit production in Spain



In addition to 1.6 million tons of cement produced each year, the quarry and cement plant of Alicante – El Clotet in Spain produces plums, oranges and mandarins, grown on restored parts of the quarry for onward shipment to supermarkets in Europe (UK, Germany, Italy, France) and the US. The project has been granted the Global GAP (Good Agricultural Practices) Standard, which certify environmental and employment standards. In 2010, to celebrate 25 years of success, 14,000 additional citrus trees were planted, in collaboration with employees and local communities. With 48,500 fruit trees in the 138 hectares of plantation, over 1,000 tons of fruits were produced annually and 70 seasonal workers were employed.

- > Economic viability and possible positive economic impact to the local communities

Nesting sites for peregrine falcons in Shek O quarry in Hong Kong



A rehabilitation contract agreed with the Chinese government has provided nesting sites for peregrine falcons at the 45 hectares Shek O rock quarry on Hong Kong island. It has also led to the establishment of a self-sustaining ecosystem and created a range of habitats for birds, mammals and insects. In addition it has harmonized the quarry with the natural landscape by creating a mix of grass and low shrubs, shrub land with groups of trees, woodland, salt tolerant species and fast growing ornamental plants. Several streams have been cut into the slopes, linked in with site drainage, to provide additional features and a varied ecosystem.

- > Consideration for the needs of stakeholders, both internal and external

Restoring water provision in a dry area in India



The Sitapuram limestone quarry is located at Dondapadu, in Nalgonda District, in southeastern India. The area has a tropical climate and is subject to monsoon regime leading to alternation of wet and dry periods. The largest part of the rocky area supports only sporadically growing thorny bushes and shrubs. The area includes several villages, of which farming is the main source of revenue. The rehabilitation project has consisted of converting an extraction pit into a lake, which includes small ponds and a large water reservoir. The reservoir is also beneficial to local communities that often face water scarcity and can use the reservoir for agricultural irrigation and fish cultivation.

- > Reintegration of the site into the surrounding area – how the quarry should ‘blend’ with the environment

Land management for multiple uses in USA



The Theodore Plant operates the Crystal River limestone quarry in Florida. In addition to the area for the limestone quarry, 1,250 acres are dedicated pasture land and 5,000 acres are pine tree timberland. In addition, the company donated approximately 700 acres of property to the state of Florida to be included in the Cross Florida Greenway and other recreational state lands.



The combination of these various land uses has ensured a better “blend” into the environment and satisfies more stakeholders.

- > Opportunities to rehabilitate, restore and enhance biodiversity

Protecting and expanding habitats of rare plants through biotechnology in Japan



The Minowa Quarry (located in Chichibu City, Saitama Prefecture, Japan) has been working to protect and nurture rare species of native plants since 1972.



In addition to creating a botanical garden at the quarry for the preservation of rare plants, they continue to repopulate former excavation sites

with these plants by scattering seeds and planting cuttings. These activities have been carried out with much engagement and cooperation from local authorities and stakeholders.



Rare plants are maintained and preserved by biotechnology (tissue cultures), in case they are wiped out due to unforeseen events, such as a blight or pest infestation, etc.



4.3 Developing the rehabilitation plan

Once objectives are set, the rehabilitation plan aimed at meeting these objectives can be established and is aligned with the mining or extraction plan. The plan should illustrate what the site will look like post-closure and how the company intends to restore the site to meet the agreed objectives.

The rehabilitation plan should always meet the legal requirements of the relevant country. It should be technically viable, both in the short term and over longer term, and financially viable under a range of plausible scenarios.

Framework for a rehabilitation plan

While the contents of a rehabilitation plan for any given site will vary according to local factors, the following elements should be considered:

- > **Context:** The rehabilitation plan should set a background. This should include details of the physical, natural, economic and social environment, in line with ESIA.
- > **Objectives:** Objectives of the quarry rehabilitation plan, as set according to Chapter 4.2) should be outlined.
- > **Action Plans:** Detailed action plans should be developed to determine how the objectives are to be achieved. These action plans should cover: what is to be done, who is responsible, the resources required, and the timeline for delivery. They should also establish milestones to facilitate monitoring and measurement of progress toward the final objectives. Although varying across sites, it is likely that action plans will be necessary in relation to:
 - Post-closure land use(s).
 - Final land form.
 - Slope stability and other health and safety concerns.
 - Biodiversity conservation and ecosystem services.
 - Soil conditions and management.
 - Habitats and vegetation.
 - Hydrology & hydrogeology.
 - Stakeholder engagement plan (seeking opinion and disclosure of rehabilitation activities) throughout the quarry lifetime.

Safe-guarding an endangered species in USA



The Center Sand aggregates quarry (Florida, USA) is adjacent to a state preservation which hosts the endangered species of the gopher tortoise. Under the Center Sand mining plan, operations would encroach on the tortoise's burrows, hence the quarry planned and implemented the relocation of gopher tortoises in a nearby and safe "no-mining" preservation area. The whole program included: surveying and excavation of burrows, capturing of 56 turtles, and placing them in their new protected habitat specifically prepared beforehand with an 'eco-friendly barrier' and the reseeded of land with foraging plants suitable for the turtles.



Successful sowing of a mixed forest in Vohenbronnen quarry in Germany



Permission for mineral extraction in the forest-rich Blaubeuren area of Germany is granted for a limited time to ensure that the cleared areas are reforested quickly. At the Vohenbronnen limestone and marl quarry, the area has been restored to a mixed deciduous forest by hand sowing seven tree and six shrub species, including key groups such as beech, hornbeam, maple, ash and common oak. The success of the project, which attracts many visitors and stakeholders, demonstrates that even forests can be re-established when care is taken to include quickly germinating species suited to the location in the seed mix.

Ecological rehabilitation in Mediterranean conditions in Spain



The primary aim of the rehabilitation work at Alcanar is to integrate the quarry with the natural landscape and restore the native vegetation, imitating the geomorphology of the area, and the natural vegetation succession through seeding of native herbaceous and shrub species.

As a pilot site of the EcoQuarry program, this rehabilitation project also aims to contribute to the development and sharing of rehabilitation best practices for limestone quarries in a Mediterranean environment.

To better integrate the site with its natural landscape, technologically innovative computer simulation software tools were utilized for visual impact evaluation and simulation of the foreseen restored site.

Progressive rehabilitation of Halle cement quarry in Korea



Gathering soil sample

As part of the progressive restoration of Halle cement quarry near Backdudaegan in Korea, a trial rehabilitation program was setup to cover an area of 17 hectares to determine the best method for restoration. The three year trial determined the indigenous fauna best suited to the geology and climatic conditions, and the best planting and transplanting methodology. The trials have been

conducted in close cooperation with the local university, consultants, NGOs, government officials and local residents.

Each year, approximately 13,500 indigenous trees are planted; the project is visited by 2,500 students as part of their training program and local citizens are involved in the forest management which typically covers nine hectares annually.



Install regular form to check survival curve



Survey blooming

- > **Prioritize actions and schedule:** The rehabilitation plan should give details of the timing and sequencing of the rehabilitation program, in line with the most up-to-date mining or extraction plan. The prioritization of these actions is important to help make decisions and manage the expectations of the stakeholders.
- > **Monitoring and evaluation:** The plan should detail the monitoring programs with KPIs that will be introduced to assess whether the rehabilitation project is meeting its stated environmental, economic and social objectives. These monitoring programs should be designed to enable progress measurement and achievement of objectives. When changes occur in the mining or extraction plan, the rehabilitation activities need to be adjusted accordingly.
- > **Rehabilitation and post-closure costs:** The plan should contain details of the expected costs of both the rehabilitation activities and the ongoing monitoring and management of the site, post-rehabilitation. The viability of the rehabilitation plan is dependent on accurate estimation of costs. It is therefore important that uncertainties associated with the estimates should be identified and quantified, particularly in the early stages of the rehabilitation planning, so that the rehabilitation plan can be adjusted in consultation with relevant stakeholders, if so needed. The rehabilitation plans should also identify where ownership of the rehabilitation costs lies within the organization.
- > **Responsibility:** A successful rehabilitation outcome is more likely when the organization is structured to support the process of designing and implementing the plan. An individual or a role with overall responsibility for both the rehabilitation plan and each action plan should be identified and appropriately resourced.
- > **Compatibility with biodiversity:** The plan should align with other aims (such as agriculture) and the implementation of more than one rehabilitation target or outcome in each project.

The rehabilitation plan will evolve over the life of the quarry, for instance, becoming more detailed as the site moves closer to end of life. It is important that any significant changes are agreed upon with all necessary authorities and relevant stakeholders.

4.4 Implementation of the rehabilitation plan

Rehabilitation should be considered as a core part of the business, and should be fully integrated with the planning of quarry operation. Similarly, the rehabilitation plan and decommission plan need to be fully integrated, so that activities undertaken during operation and decommission do not impair the ability to execute the rehabilitation plan.

The implementation of the rehabilitation plan involves carrying out the actions and processes detailed in the plan to meet the established objectives. While specific techniques and practices employed will be dependent on the objectives of the rehabilitation plan and on the characteristics of the site in question, some general principles (as below) should be considered.

- > **Safety:** health and safety should always be the first concern.
 - Upon closure of the site, infrastructure and equipment should be removed and waste disposed of appropriately. Measures should be taken to ensure that access to a post-closure site is restricted as necessary.
 - At a minimum, slope stability should be ensured in line with any relevant legal requirements and best practices.
- > **Resources for rehabilitation:**
 - The company should provide adequate resources (financial and otherwise) to ensure effective implementation of the rehabilitation plan.
 - In particular, sufficient resources must be allocated to site preparation, top soil management and other areas crucial to the success of the rehabilitation plan.
 - Adequate staff training should be provided to ensure organizational capacity for effective rehabilitation.

- > **Progressive rehabilitation:** progressive rehabilitation should be undertaken wherever possible. This has the advantage of reducing open areas within the quarry, reducing potential soil erosion and increasing confidence in the rehabilitation plan among stakeholders. It also provides a timely and positive visual impact, allowing stakeholders to see and anticipate future rehabilitation outcomes.
- > **Review:** the progress made during implementation should be reviewed on a regular basis.
- > **Stakeholder involvement:** the expertise, resources and skills of stakeholders should be involved wherever possible to help implement the rehabilitation plan, e.g. local communities can be involved in replanting programs. Sharing information on progress and activities related to rehabilitation on a regular basis will foster the relationship with local stakeholders and help identify mutual benefits. Management of stakeholders' expectations is necessary to accomplish a win-win outcome of this process. Companies must leverage on the process of stakeholder engagement, involvement and open dialogue; they can also benefit from

communicating the value of the quarry as a “hidden asset”, both as land with future value/use to the local economy and as an enhanced ecosystem.

During the implementation project, objectives of the rehabilitation plan and processes may need to be modified to reflect the operating environment. Such modifications and the reasons for them should be clearly communicated to all interested parties.

4.5 Management & monitoring

The goal of monitoring is to ensure that the planned rehabilitation schedule is met, and that costs incurred are in line with estimates. If time scale or costs are not in line with expectations, a review is required to establish why not and to make any necessary changes.

The degree of monitoring (intensity, frequency, etc.) and the monitoring parameters will depend not only on external requirements that might be linked to operating permits, but also on meeting the internal needs of performance evaluation and available resources.



A foundation for forest protection in Ecuador



The Cerro Blanco Protected Forest (CBPF) in Guayaquil Ecuador is one of the few remaining pristine dry limestone forests, which today covers 6,078 hectares. The Pro-Forest Foundation was established some 20 years ago to protect the forest and has been classified as an eco-region with maximum regional conservation priority. More recently, the Netherlands Committee of the IUCN and the World Land Trust US have also purchased 2,000 hectares of land for the CBPF.

Ecotourism, a visitor and fire fighting training center, as well as a tree nursery and the Macaw conservation center rescuing injured endangered species, are the types of biodiversity-based activities managed by Foundation Pro-Bosque.

Angling organization in UK



Angling developed out of the company's rehabilitated sand and gravel pits and can be traced back to the late 1960s. Representing 70 lakes and 20 stretches of river, it is now the largest commercial angling organization in the UK. It offers mature fish-filled lakes and stretches of river with purpose-built disabled access, available at the company's day ticket fisheries. An Angling and Environmental Centre is housed at one of the sites to teach young children the basics of the sport. In 2005, the location was chosen to hold the annual exhibition of British Carp Fishing (Carpfest). The area is visited by 3,500 day ticket customers and trains 1,000 young anglers each year.

Trout pond in an old limestone pit in USA



An old limestone pit in Virginia, USA has been turned into a lake, filled by groundwater inflows and rainfall. Under adequate control of water level for preventing flooding conditions, the lake has easily met the requirements for hosting the



environmentally sensitive trout. Under a new partnership with Trout Unlimited, 350 rainbow trout were "released" into the quarry pond. People from neighboring communities participate in annual events like 'fishing days' in the trout pond. The company has developed and applied a long-standing water and land management program and has also committed to provide funding for a grassroots program, to raise awareness on preserving valuable watershed resources.

Monitoring

Once a rehabilitation plan has been set, some monitoring activities need to be put in place to verify the progress made on the rehabilitation objectives and targets set. However, this effort needs to be commensurate with the level of impact identified, and limited in time.

The monitoring plan included in the rehabilitation plan should be carried out in accordance with the corresponding rehabilitation plan and sufficient funds should be budgeted for this activity.

- > **Objectives of the monitoring:** an effective monitoring plan should:
 - Determine the level of effort and extent of monitoring needed (from minimum to extensive).
 - Measure performance against objectives set in the rehabilitation plan.
 - Measure the success of techniques employed.
 - Ensure corrective action is taken.
 - Assess long-term effects of the rehabilitation program, if relevant.
 - Determine timeframe for monitoring responsibilities and when the responsibilities are to be transferred (e.g. to landowner).
- > **Elements of the monitoring plan:** the monitoring plan should include:
 - Level of information and details proportionate to the level of impact and sensitivity.
 - At minimum, a baseline of the area and surroundings, with a short description of the activities planned to achieve the rehabilitation objectives.
 - For more sensitive areas, a more complete baseline and ongoing monitoring of reference areas, documentation of rehabilitation procedures, monitoring after rehabilitation establishment operations have been completed and long-term monitoring.
 - A monitoring program covering both environmental and socio-economic factors.
 - Means for recording the monitoring results systematically.

- > **Implementation of the monitoring plan:**
 - Monitoring during operations is recommended as it reduces cost and prepares for the handover of responsibility of post-closure rehabilitation activities.
 - Post-operation monitoring should be prepared and conducted, to ensure that the site will be left in a safe and sustainable state and that the rehabilitation objectives planned initially can be achieved. However, the responsibilities / handover for carrying out these activities are to be laid out upfront.
 - Monitoring in sensitive areas should be conducted using transparent and scientifically rigorous procedures, by internal or external resources, and is best carried out by involving local experts.

Post-Closure Management

A plan for long-term management of the site following rehabilitation should be defined, as well as the handover of responsibilities determined upfront, when possible. This should be implemented in partnership with the relevant authorities and stakeholders. Responsibility and handover of the management and execution of this long-term plan should be clearly identified and is often determined by the landownership at the deliverance of operation permit.

Where necessary, a separate post-rehabilitation plan should be drawn up and adhered to.

Stakeholder engagement in management and monitoring

Stakeholders can contribute to the monitoring process by using their expertise, skills or resources to monitor the success of some rehabilitation works, report on progress of the rehabilitation plan and discuss needs for adaptation.

Where it is appropriate, external stakeholders should be engaged in the ongoing management of the rehabilitated site. This will require that these stakeholders are involved throughout the development and implementation of the rehabilitation plan.

This will also ensure the continuity between the realized rehabilitation activities, the ultimate rehabilitation objective and target to be achieved, even after the handover of the responsibility to another party.

4.6 Financial planning

To ensure that adequate funds are available, the costs associated with quarry rehabilitation need to be fully identified and included in the financial plan for the quarry's operation. Estimates for these costs should be included in the initial financial plan and be updated throughout the project life cycle, as appropriate. In early stages of the quarry life cycle, estimates are probably imprecise, so it may be helpful to provide an accompanying description of the key factors affecting rehabilitation costs and how these factors may change.

Key cost areas to be considered when estimating costs include: the creation of landscape morphology (from blasting, filling, shaping, surface water management); the preparation of habitats (forest, grassland, arable land); and long-term maintenance and monitoring.

In addition to ensuring that costs are adequately captured in the budget for the quarry's operation, it is also important to ensure that yearly provisions are made throughout the entire lifetime of the quarry in the accounts of the operating company, in line with relevant accounting practices and legal requirements. These provisions should take into account the overall estimated rehabilitation cost allocated throughout the timeline of the quarry, while accounting for progressive rehabilitation activities. However, the country and company's specific accounting rules for quarry rehabilitation provisions prevail.





5 Additional guidance and documentation

Full details of all the case studies quoted in this Guidelines document are available at www.wbcscement.org/QRGcasestudies.

- > CSI ESIA guidelines
- > Corporate Evaluation Services Review, 2008, WRI, WBCSD, Meridian Institute
- > Guide to Corporate Ecosystem Valuation, 2011, WBCSD
- > EarthWatch, Business & Biodiversity, Site Biodiversity Action Plans: a guide for managing the biodiversity on your site, 2003
- > International Council on Mining & Metals (ICMM), Good Practices Guidance for Mining and Biodiversity, 2006
- > ICMM, Planning for Integrated Closure: Toolkit, 2009
- > ICMM, Guidance Paper: Financial Assurance for Mine Closure and Reclamation, 2006
- > British Geological Survey: www.bgs.ac.uk
- > www.businessandbiodiversity.org
- > Mine Rehabilitation Guidebook, Mineral Councils of Australia, 1998
- > Business & Biodiversity, IUCN National Committee of the Netherlands
- > Natura 2000 Guidelines
- > International Finance Corporation (IFC) Performance Standards
- > European Bank for Reconstruction and Development (EBRD) Performance Requirements
- > Corporate Biodiversity Management Handbook, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)
- > Rehabilitation and Revegetation, Environment Protection Agency, Australia
- > Principles of ecosystem management, CBD



6 Glossary

Term	Definition
Biodiversity	The variability among living organisms within species, between species, and between ecosystems.
Community involvement	The act of involving the community (however defined) in the decision making process in order to reach a desirable outcome which benefits both the community and the company.
Cumulative impacts	Impacts on natural and social systems that accumulate over time and space.
Decommissioning	The cessation of operations of a cement manufacturing site. May include demolition and reclamation and/or redevelopment of the site.
Diversity	Variety of biotic systems; diversity in species, structure and function may be distinguished in spatial and temporal coordinates.
Ecosystem	A dynamic complex of plant, animal, and micro-organism communities and their nonliving environment interacting as a functional unit.
ESIA	Environmental and Social Impact Assessment.
Flora	Entirety of all plant species of an area.
Habitat	Place where an individual or a population lives.
Indicator	An indicator shows the change or the achievement of a state, for instance, indicators for measuring biodiversity.
Mitigation	Mitigation means that companies do their best to reduce, neutralize, and repair the impacts of their activities on people and the natural environment.
Reclamation	To return disturbed areas to a stable condition which does not create adverse environmental impact (e.g. returning disturbed quarry areas to a designated post-mining land use as required by the permit).
Re-establishing	Comprises only the targeted reintroduction of plants and animals. For instance, through sowing, or planting or through catching and releasing, in order to increase biological diversity.
Rehabilitation	Establish and provide stewardship for stable, safe state land area, and self-sustaining ecosystem that must be compatible with its natural environment, and suitable for the proposed future use of land.
Rehabilitation project	Encompasses the planning, implementation and monitoring of rehabilitation of a quarry. Planning is implied as the formal and public outcome of the process for organizing rehabilitation works.
Restoration	Re-establishing the original ecosystem, the habitat or their functions in the undisturbed way in which they originally existed, including biological, chemical and physical elements.
Secondary impacts	Impacts on natural and social systems that may be secondary or 'knock on' effects, including direct biophysical impacts that can lead to secondary social impacts and vice versa.
Stakeholders	Stakeholders are people or institutions that feel they may be affected by, or may affect, an organization's activity.
Topsoil	Upper part of the soil containing a characteristic percentage of humus and micro-organisms and thus darker than the subsoil.
Vegetation	Entirety of plant communities in an area.

ANNEX

Stakeholders engagement checklist

The following checklists may assist in the identification and analysis of stakeholders:

Identification of stakeholders

- > Who in the area may be directly or indirectly affected by the quarry, the rehabilitation project or the future land use of the site?
- > Who may influence the ability of the project to gain or retain its license to operate?
- > Who makes use of or affects the management of the land and resources in the area?

Analysis of stakeholders

- > Defining the characteristics of key stakeholders: who will be the most negatively affected by the project? Who will benefit the most from the project?
- > Identifying the perspectives of stakeholders on the project: who supports and who opposes the project?
- > Understanding the relations between stakeholders: which stakeholders have shared mandates or interests? Which stakeholders have conflicting interests?

- > Analyzing the influence of stakeholders: who are the key decision-makers? Who has influence on other stakeholders and could play a leadership role in the opposition or support to the project?
- > Analyzing the capacity of stakeholders to participate: whose cooperation, expertise or influence would be helpful for the success of the project? Who might have resources to contribute to the project?

About the Cement Sustainability Initiative (CSI)

The CSI is a global effort by 23 leading cement producers, with operations in more than 100 countries. Collectively, these companies account for around 30% of the world's cement production and range in size from very large multinationals to smaller local producers. In India, CSI members account for 54% of production.

All CSI members have integrated sustainable development into their business strategies and operations, as they seek strong financial performance with an equally strong commitment to social and environmental responsibility. The CSI is an initiative of the World Business Council for Sustainable Development (WBCSD).

www.wbcscement.org

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About the World Business Council for Sustainable Development (WBCSD)

The World Business Council for Sustainable Development is a CEO-led organization of forward-thinking companies that galvanizes the global business community to create a sustainable future for business, society and the environment. Together with its members, the council applies its respected thought leadership and effective advocacy to generate constructive solutions and take shared action. Leveraging its strong relationships with stakeholders as the leading advocate for business, the council helps drive debate and policy change in favor of sustainable development solutions.

The WBCSD provides a forum for its 200 member companies - who represent all business sectors, all continents and a combined revenue of more than \$7 trillion - to share best practices on sustainable development issues and to develop innovative tools that change the status quo. The Council also benefits from a network of 60 national and regional business councils and partner organizations, a majority of which are based in developing countries.

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