

## Think Tank on Sustainable Rehabilitation of Mines and Quarries (2008-2009)

### Provisional Report

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Appendix: Map and list of abandoned mines and quarries visited throughout Cyprus.

**Think Tank  
on  
Sustainable Rehabilitation of Mines and Quarries  
2008-2009**

*A bi-communal Think Tank was established as part of the objectives of the project on Sustainable Rehabilitation of Mines and Quarries undertaken by the Laona Foundation in 2007 with funding from UNDP-Act. The Think Tank met six times over a period of approximately one year from June 2008 to April 2009. This report summarizes the deliberations and suggestions raised during the TT meetings.*

The names of the participants in the Think Tank are set out below

(Surnames in alphabetical order)

1. Mr Mustafa Alcaravli, Mining Engineer
2. Mr Erotokritos Anastasiades, Mining Engineer, Mineralogist
3. Dr Cavit Atalar, Mining Engineer
4. Dr George Constantinou, Geologist
5. Mr Halil Erdim, Mining Engineer
6. Mr Nicos Georgiades, Geographer, Town Planner, Environmental Mgr
7. Mr Bektas Göze, Mining Engineer
8. Dr Vassiliki Kassianidou, Archaeologist, Archaeometallurgist
9. Dr Michalis Loizides, Chemical/Environmental Engineer
10. Dr Eleni Morisseau, Geologist specializing in mineral resources development
11. Mr Mehmed Necdet, Geologist
12. Mr Andreas Panayiotou, Geologist
13. Mr George Petrides, Geologist
14. Dr Dogan Sahir, Architect
15. Mr Nick Symons, Biologist-Ecologist
16. Mr Dimitris Vattis, Mining Engineer
17. Mr Dinos Xydas, Mining Engineer

## PROVISIONAL REPORT

### 1. Introduction

- 1.1 Cyprus has one operating mine and about 40 abandoned mines and over 300 abandoned and functioning quarries. The abandoned sites have not been rehabilitated (with the exception of the Asbestos Mine at Amiantos and Limni Mine, which is in the process of rehabilitation) and this has led to a variety of problems, such as land degradation, water runoff and the inevitable usage of the sites as unregulated dumping areas. Operating sites have no long-term closure strategy other than a never-ending procedure of rather unsuccessful tree planting (usually pines and acacia), regardless of local conditions.
- 1.2 The project 'Sustainable use of abandoned Mines and Quarries in Cyprus', was initiated by the Laona Foundation, in order to frame the right questions and produce needed answers, for the development of legal and regulatory tools regarding the fate of abandoned mines and quarries in Cyprus. To this end the project undertook inter alia to:
- Set up a bicommunal, inter-disciplinary Think Tank (TT) that can develop a working sustainable strategy for mines and quarries
  - Perform an island-wide survey of abandoned mines and quarries (partly covering operating quarries), incorporating information and input from local communities
  - Perform a site-specific study of Apliki, Mavrovouni and Skouriotissa mines and develop a pilot proposal
  - Publish and disseminate its findings

### 2. The concept and terms of reference of the Think Tank

- 2.1 The concept of setting up a Think Tank to address a specific problem is commonplace in the western world, but not yet in Cyprus. As far the TT is aware, this might be the first attempt to convene a TT with an ongoing brief and, in any case, it is the first bicommunal TT to formulate an overall strategy touching on the full spectrum of the extraction industry in Cyprus, covering cultural, economic, environmental and other issues, concerning abandoned mines and quarries, as well as those still operating. The aim was to generate proposals for the sustainable exploitation of mines and quarries that will be friendly to the environment, sensitive to local history and applicable to the whole of Cyprus.
- 2.2 As already stated, the perceived problems that led to this project were:
- The existence of long abandoned mines and quarries, possibly contaminating or polluting the soil, air, and water\*<sup>1</sup>, the absence of a policy or legislation specifying how to deal with sites abandoned before the 1980s, and who is responsible to undertake and pay for the task of rehabilitation, vis-à-vis pre-and post-accession to the European Union in 2004.
  - The limited concept of rehabilitation that has been practiced since rehabilitation became obligatory in 1980, which basically amounted either to cursory replanting undertaken in an ineffective way, or to utilization of pits as unregulated rubbish dumps.
  - The fact that residential development has been creeping nearer and nearer to mine/quarry sites, leading to conflicts with the locals.
- 2.3 It was felt that if the ownership of abandoned sites were known, a considerable part of the problem might be better addressed in relation to the accepted principle "the polluter pays" and to answering the question "who is the polluter at an abandoned mine?". The project intended to tackle this task, bearing in mind that site ownership falls into the following categories:

\*<sup>1</sup> It is generally held that contamination is the infection caused by biological factors, e.g microorganisms on humans and the environment; whereas pollutions is the introduction of chemical substances (liquid, solid, gas)

that can pollute the environment and interfere with human health and the natural functioning of ecosystems. However, it is also understood that engineers may interpret these terms differently from other scientists, so both terms are used in this report.

- sites on land requisitioned by the operator under earlier legal regimes;
- sites on land owned privately (usually by local people) and leased to the operator;
- sites on land owned by the Government, on hali or forest land, and leased to the operator;
- sites owned by the operator – the current preferred government policy for licensing.

2.4 In the process of the project and the TT's work it became clear that within the time span available it could not get to the bottom of the land ownership issue, mainly because information could only be obtained via the cumbersome and costly route of applying to the Lands and Surveys Department, and this Department has stated to the Mines Service that such a task, if undertaken, would take a very long time to complete.

However, it also became evident that there were so many other issues to consider, that the TT could usefully focus on those for which knowledge of who owned the land was not a prerequisite. Moreover, since the sites being worked today will be the abandoned sites of tomorrow, the TT decided to explore not only the issue of rehabilitation vis-à-vis already abandoned sites, but to also address considerations regarding the best policies for dealing with current working sites and the conditions to be imposed on future licensing applications.

### **3. Basic facts established from site visits conducted during 2007-2008\*<sup>2</sup>**

- Non-operational mines and quarries are not only abandoned, but for the most part are unsecured and unsupervised, i.e. no security fence, no warning signs and no policing.
- Those close to and with easy access to rural communities are becoming sites of unregulated dumping, whereas those that are located away from communities and have difficult access, are undisturbed and natural regrowth has taken over.
- There are no planned or ongoing rehabilitation efforts for any abandoned, inoperable or closed mines, other than the Amiantos and Limni mines. The open pit of Mavrovouni mine is currently used as a designated dump site.
- Visual evidence from visits by the working group indicates that rehabilitation efforts throughout the island have not been very successful.
- Many operational quarries that were designed to be located at a safe and discreet distance from local communities, now find themselves next to housing developments that are the result of an expanding community. Quarry managers acknowledged a plethora of unanticipated complaints from local communities and residents.
- All quarry managers interviewed for this project expressed frustration, dismay and disappointment with the licensing process. They specifically blamed the licensing authorities for policies that:
  - promote short-term over long term planning
  - foster friction between communities and quarries
  - force a choice between tourism interests and quarry operation
- All Community Council Presidents interviewed expressed a preference for quarry closure and re-use of the space in a more people-friendly manner, such as agrotourism.
- It should be noted that Skouriotissa is now the only operational mine throughout the island (and holds the distinction of having operated almost continuously since antiquity). This operation is still profitable, despite the recent economic crisis. Apliki mine, part of which is in the buffer zone, is non operational, though with promising ore reserves, and is undergoing natural and effective rehabilitation. However, the water in its pond remains acidic. There are no structures or abandoned heavy machinery on site. The abandoned structures at Lefka and Mavrovouni mines are undisturbed, but the open excavation pit is currently a licensed, though unsecured, non-segregated rubbish dump.

\*2 Site visits were conducted by the working group carrying out this project.

#### **4. Some of the additional problems that came to the fore at this time were:**

- 4.1 The acknowledgement that some materials (e.g. diabase) are only found in forested areas, thus intervention in forests by quarrying may, in some cases, be inevitable.
- 4.2 The complete reversal in public acceptance of mining/quarrying sites. Whereas this activity was welcomed in the past as the provider of local employment, it is now viewed in a negative light, as a disturbance that also prevents land owners from developing their land and, moreover, reduces the value of nearby land.
- 4.3 The absence of integrated government planning. While four departments are mainly involved - Mines, Geological Survey, Town Planning, Environment Service – the last two have different agendas and their approach is often quite antithetical to those of the first two. On the other hand, in a number of state development plans, the mining and quarrying activity was encouraged and considered as a strong contributor to economic progress and development.
- 4.4 The Town Planning Department's policy over the last years has been to push for ever shorter operating licenses while concurrently approving building licenses for homes that are gradually approaching the quarrying site and are thereby exposed to the dust, ground vibrations, noise (caused by explosions heavy machinery and traffic and crushing plants) and other disturbance created. This is leading to an ever increasing lobby against quarrying activity.
- 4.5 At the same time, the pro-construction policy followed by successive governments has developed a 'chicken and egg' situation. If more houses, roads, marinas and other infrastructures are promoted, then more building material (cement, aggregates, stone etc.) has to be quarried. Moreover, the more we build in concrete and bricks, which have a finite life span, the more we need to consider what will happen to this material at the end of its life.
- 4.6 Finally, although it has been estimated that in Cyprus there are still untapped resources that will provide building materials (aggregates and gypsum) for the next 25 years (Wardell Report 2003, pp. 5-6) at current rates of development, there is actually no long-term planning about the mining quarrying/ industry (presentation by E. Morriseau).

#### **5. Revised remit of Think Tank**

After consideration of various issues, the original remit of the Think Tank proved to be too broad, and by the third meeting the Think Tank had sidelined some issues as symptomatic rather than causal/root problems and focused on some fundamental questions. The Think Tank determined that answering such questions directly affected underlying policies. These questions were:

- 5.1 'What is an abandoned mine/quarry'? The answer determines not only re-use issues, but actual costs for rehabilitation of the site.
- 5.2 'What is sustainable quarrying'? In other words are we either depleting the resources too quickly and or are we creating serious irreversible collateral damage in other sectors through excessive extraction? The quarrying industry has received a tremendous boost by a rapidly expanding, even superheated, Cypriot economy. The demand for housing, commercial buildings and infrastructure such as roads, dams, marinas, sewerage and water systems has been such that there has been no time by the government or civil society to consider the sustainability and the ramifications of increased quarrying. Is the approach currently used, a valid and sustainable model for the desired development of Cyprus?
- 5.3 Does the "polluter pays" principle apply? If so, how should the polluter be determined? How is this principle applied to long abandoned sites?
- 5.4 Should the standard reforestation "blanket approach" to site rehabilitation be challenged in light of ecological evidence?
- 5.5 Should the TT take issue with the current quarry licensing regime? The proposed Turkish Cypriot licensing scheme which is based on a graded points system was presented and considered worthwhile.

## 6. When can a site be considered abandoned?/Definition of an abandoned mine/quarry

Considerations concerning the rehabilitation of abandoned sites inevitably led to the question: when can a site be considered abandoned? This question becomes more relevant today when new technologies make it feasible to process mineral ores that were previously too difficult or costly to access. Also, prices in the global market may now make the re-working of what used to be considered secondary materials of little value, an industrially useful and economically viable proposition.

EU Directive 2006/21 on the management of waste from the extracting industries at article 12 para 3 provides that "a waste facility may be considered as finally closed only after the competent authority has, without undue delay, carried out a final on-site inspection, assessed all the reports submitted by the operator, certified that the land affected by a waste facility has been rehabilitated and communicated to the operator its approval of the closure. That approval shall not in any way reduce the operator's obligations under the conditions of the permit or otherwise in law".

The Think Tank did not consider that a "closed facility" corresponds with its own understanding of an abandoned site for the purpose of this report, and therefore, offers the following definition of an abandoned site:

*A site which is inactive (not operational) for almost 20 years, it has not been rehabilitated and there is no serious investor interested to re-operate it.*

In the case of a former mining site a more specific qualification could be that

*It has remained inactive for at least two commodity price cycles (each cycle being estimated at around seven years) and there is an absence of investor interest for reopening, evidenced by the non-issuance of a prospecting permit (the pre-mining lease license).*

## 7. Parameters of sustainable rehabilitation

The Think Tank considers that sustainable rehabilitation must address at least six parameters:

- Health and safety: is there contamination/pollution in the ground, water or air that needs to be addressed?
- Aesthetics: how can we overcome what many consider a gaping "wound" in the landscape? Is it really a wound, or a cultural monument that forms an important part of our industrial heritage?
- Ecological sustainability: is the proposed solution compatible with the local ecology and does it support and enhance local species, as well as biodiversity in general? Is it working with natural processes?
- Economic viability: not only as regards the cost of rehabilitation but reduction in value of the countryside. How does it affect the value of adjoining lands?
- Alternative re-use: what new use would be suitable not only for the site itself, but within our country's overall land use policy, so that open spaces are utilized wisely. Under this last parameter it became clear that sustainable rehabilitation is not only concerned with the site itself and its effect on the immediate environment and landscape, but must take into account broader national planning issues.
- Opinions, hopes and aspirations of local communities.

## 8. Rehabilitation considerations

Addressing the parameters outlined in para 7, the Think Tank expressed the following views.

### 8.1 *Health and safety considerations:*

- 8.1.1 This is obviously **the** one most significant consideration, yet there still seem to be a lot of unanswered questions (or unconvincing replies) and half-measures taking place, giving rise to public misconceptions. Safety issues arise from potential erosion of steep slopes and from toxic waste materials (usually in the form of acid drains) either exposed or buried without due care<sup>\*3</sup>. Contamination/pollution questions have been raised in connection with the asbestos mine at Amiantos and the tailings ponds at Xeros near Lefka. Land slide issues have also been connected to Amiantos, and appear to have been addressed, whereas they continue to pose a problem at e.g. Larnaka tis Lapithou on the southern slopes of Pendadaktylos. Safety issues from heavy truck traffic are not addressed in this report, as that would again over-broaden the scope of this work.
- 8.1.2 Licences granted after the accession of Cyprus to the EU in 2004, are largely governed by two EU Directives: the first is Directive 2004/34/EC on Environmental Liability, which became law in 2007 and is based on the 'polluter pays' principle, and the second is Directive 2006/21/EC concerning the management of wastes from the extracting industries, not yet enacted into law. However, the situation is not straight-forward. Regarding the first Directive (on environmental liability), the liability is for damage caused to the environment in general, not to specific persons (who can claim damages through civil actions in court). It is assumed that the law does not provide a remedy for pollution created in earlier times, although it could be argued that if the pollution continues after 2004, even though operations ceased before that time, it would fall within the ambit of the current law, if the polluter were traceable. However, even if this were the case, the law does not currently apply in the northern part of Cyprus where the potentially polluting tailings of the Lefka/Xeros area are still considered to be causing problems.
- 8.1.3 Under the English Common Law, which has applied in Cyprus since colonial times, the legal remedy has in the past been addressed through an action for nuisance (οχληρία). This concerns damages to a specific party, but does not provide recourse where damage is to the public at large by affecting the surrounding environment. While there has always been a legal resource as just mentioned, there has also been a reluctance on the part of Cypriot courts to award substantial damages against offenders and a reluctance on the part of governments to make the offenders responsible. In the case of the declaration of bankruptcy by the Asbestos Mine at Amiantos and its subsequent closure, it was left to the Government to proceed with rehabilitation.
- 8.1.4 In cases where the cost of remedying the damage left behind by mining activities is substantial (as in Skouriotissa, Amiantos and Lefka) the operators of the sites were not obliged to make good and public authorities are unwilling to get involved, unless the funds are externally provided. In Skouriotissa the clean-up was achieved by allowing re-operation of the mine on condition that part of the income generated would cover the cost of remediation. In Amiantos the rehabilitation has been funded from the Rehabilitation Fund administered by the Geological Survey Department to which all

- \*3 It is scientifically accepted that whereas most chemicals could impact ground water through vertical migration, heavy metals are trapped within a shallow horizon near the soil surface. For this reason mine ponds with a high acidic content, while not inherently dangerous to humans (unless deliberately ingested) could be harmful to fauna. However, the absence of animal or bird remains near such ponds indicates that fauna are able to distinguish and avoid these ponds.

licensed operators contribute, and this has used up a large part of the Fund's resources. In Lefka the problem remains, partly because the polluter, viz. the US-based Cyprus Mines Corporation, ceased operations and withdrew in 1974, and so far no legal redress has been sought in the US courts. Nevertheless, part of the EU assistance offered to the Turkish Cypriot community has been devoted to exploring the situation at Lefka and considering possible scenarios to address it.

## **8.2 Aesthetic considerations**

- 8.2.1 Historically most Cypriots have been largely indifferent to destruction of their landscape, but they are very conscious of what might be perceived as a threat to their own property interests. Now that sale/development of land is considered the best, if not the only, profitable investment, and that interest by property developers has moved beyond the coast to rural areas, objections to the operation of mines/quarries are often expressed in terms of aesthetic and environmental considerations, whereas in many cases, the local land owners, understandably, want to protect their direct interests.
- 8.2.2 The aesthetics of rehabilitation among both the Greek Cypriot and Turkish Cypriot communities have so far been limited to tree-planting by introducing young trees, sometimes on terraced land. This has mostly proved ineffective.
- 8.2.3 There is an alternative school of thought, supported by mining engineers, geologists and archaeologists, that since mining has been associated with the wealth and fame of our island from ancient times, the evidence of mining/quarrying activity is part of our cultural heritage. So, far from obliterating all traces of this activity, we should protect the remains as cultural (industrial) monuments and utilize them for educational purposes and as tourist attractions.
- 8.2.4 In fact, the project's observations of 40 sites throughout the island seem to indicate that the most harmonious rehabilitation in the landscape is where Nature is allowed to take over, whereby the forest or flora returns, but the historical activity is still visible and open to interpretation. This has been observed both at Petra abandoned mine in the Larnaka district (Kalavassos/Asgata area) and Kilanemos abandoned quarry in the Karpass. It was noted that in some cases, notably at Vitsada in the Mesaoria plain, the stark remains of the quarrying activity provide an almost 'natural' stone monument in the horizon, whereas the half-hearted attempt to plant pines is not only superfluous, but ineffective, since it is a species not suited to dry plains. So it could be said that this is a case of "less is more" - the less you interfere, the better it could be.
- 8.2.5 However, given that modern-day quarrying takes up extensive land areas, and that residential building is no longer limited to the village nucleus, but occurs much closer to the site than in the past, it is probably **not appropriate or sufficient** to prescribe that leaving abandoned sites alone to recover, should be applied. A better policy would be to give Nature a helping hand by working with natural succession processes. There are also other reasons, which we shall see below, advocating in favour of alternative re-use, in various cases.

## **8.3 Considerations of ecological sustainability**

- 8.3.1 The term ecological sustainability refers to whether a solution can support the species native to that area, and whether it enhances natural biodiversity. The practice of planting young pines already referred to, is not ecologically ideal. Pine forests are low in bird diversity, and in any case, pines would have a better chance of survival if planted as seeds and allowed to grow together with the natural vegetation of the area which is more robust. A botanical study undertaken at Skouriotissa (Andri Yiangou, 2008) shows that

over 112 species of natural flora continued to grow in the area, despite the long and extensive mining operations, and it is our strong recommendation that any replanting

should involve the local shrubs and other flora which in turn support local fauna. Additionally, the practice of terracing is unnecessary where there is no danger of landslide or erosion, since it causes further disturbance to the recently established condition of the area. On the contrary, maintaining the cliff edges left on the site provides a habitat for birds of prey. For this reason cliff faces should be secured and enhanced wherever possible both by creating some openings on the cliff face for nesting purposes, and also by encouraging shrub growth.

#### **8.4 *Economic viability of rehabilitation***

8.4.1 It is generally considered that rehabilitation solutions are harder and costlier to implement if decided when operations cease, rather than if they have been planned in advance and built into the cost of the operation and its design. This consideration requires, both in the case of future licensees and of re-licensing, that:

- there should be a requirement for long term land-use planning which is compatible with the countryside and the rural landscape;
- the licensing authority should be aware of such planning and guide the applicants rather than leave it to them to propose the easiest solution;
- more realistic amounts than hitherto should be paid into the Rehabilitation Fund.
- stricter standards should be introduced by the statutory licensing authorities, as to who can be defined and accepted as a potential natural resource prospector.

8.4.2 In the case of already abandoned sites, if allowing Nature to take over while giving it a helping hand is the most economic solution, this should be assisted with regulatory and practical measures which ensure that these sites do not end up as rubbish dumps, unless so decided. Proposed interventions to improve the quality of habitats for biodiversity are given under paras 10 and 11.

#### **8.5 *Alternative re-use***

8.5.1 Although there is a tendency to think that acceptable future re-uses have to be attractive – e.g. forests, open air museums, tourist complexes – as opposed to rubbish dumps, this way of thinking has to be tempered with reality. In effect a mine or a quarry often leaves behind an open pit which is a very convenient place to dump waste. Since we **do** need places to deposit our wastes, it makes more sense to do so in a location that has been already degraded, than to seek out other rural, and possibly pristine, locations to turn into landfills. Additional needs imposed on us by EU directives call for establishing areas to deposit inert waste, or for waste sorting before final treatment. Having said this, the Think Tank is concerned that it should not be interpreted as encouraging re-use of our industrial heritage strictly as waste dumps. The first obligation vis-a-vis waste treatment, is to minimize waste, particularly on permeable substrata such as limestone. Consideration also needs to be given to the whole mechanism of attracting users to the land-fill and to its appearance on closure. Furthermore, one has to consider seriously the concerns and objections of the local communities bordering the various sites. If the local communities do not want mines or quarries to operate in their proximity because their land values or quality of life are adversely affected, why should they consent to changing the use of the existing/abandoned mine or quarry with another activity imposing an equal degree of nuisance?

8.5.2 Nevertheless, the fact remains that abandoned mines and quarries could be used to host installations and activities which could not be established in other areas. Such might be the use of pits as water reservoirs and the use of abandoned sites to install photovoltaics or sewage plants. Not to mention that the amphitheatrical structure of opencast quarries is the ideal lay-out to host open air theatres in some locations, as has actually happened in other countries.

Development of tourist complexes is already considered to be a suitable re-use in Cyprus; Limni Mine has obtained official approval to be privately redeveloped in this way, and the owner of Zygi quarry also plans to develop a luxury holiday complex when the quarry's useful life is over. Where the historical/visual remains of a site are to be obliterated, serious consideration must be given as to whether another one, with similar characteristics, remains as an example of this particular industrial heritage.

- 8.5.3 Additionally, serious consideration must be given to the historical significance of a site. Mining and production of copper has been taking place on Cyprus at least since the second millennium BC and is, therefore, closely related with its history. For this reason, it is important that some mines, such as Mitsero, Kokkinoyia, Kokkinopezoula, Kalavassos/Platies, Mavrovouni, Lefka, are preserved as archaeological parks where both Cypriots and visitors from abroad can learn about this important part of our island's cultural heritage. Similar efforts have been extremely successful in other European countries (such as the Great Orme in Wales, Geological and Mining Park of Sardinia, Iglesias, etc). Las Medulas in Spain, where the remains of Roman gold mining are preserved, has been declared a UNESCO world heritage site attracting thousands of visitors every year. The creation of such an archaeological park, or circuit, in Cyprus will help boost the local economy by creating a new attraction which will bring visitors to areas thus far neglected as tourist destinations.

## **8.6 Local opinion and aspirations concerning rehabilitation and re-use of sites.**

- 8.6.1 This consideration has been left till the end, even though it is most important, because it is perhaps the trickiest. We have already discussed the perceived threat to communities from applications for new/renewed licenses. While rehabilitation and re-use is usually a welcome activity for the local community, the residents may not be fully aware of all possible options open to them, or of the needs that national planning must satisfy. For this reason they should be involved in the rehabilitation planning process at an early stage, before rumours and suspicion run rampant. In accordance with the precepts of the *Aarhus Convention on Access to Environmental Information* (to which Cyprus is a signatory), stakeholders should not only be informed, but be part of the decision-making. This means that the authorities should be prepared to consider with the local population, all parameters mentioned above and to share their reasoning in a transparent way.

## **9. Is a mine ever really abandoned?**

Given the fact that new technologies allow access to minerals which previously were either too costly to reach, or which had a low, or no market value, the Think Tank considered whether and what type of rehabilitation, if any, might be suited to a site that might be re-used in future. It concluded that if rehabilitation is seen as an on-going process (see below) rather than an activity that takes place only at the end of a site's economically useful life, it is possible to make appropriate arrangements, so that rehabilitation measures that work with nature are taken, which also allow for future access and re-use.

## **10. Conclusions**

- A. Mining, but especially quarrying, cannot be seen in isolation, but **within the context of our national sustainable development planning**, since it affects land-use both as an impact to the natural and social environment, and also as an input to the economy through the construction industry.

Consequently there is an urgent need **for long-term planning** which will address:

- Where mineral resources are and what is their long-term availability?
- How many resources we are likely to use over the next 25-50 years?

- Whether there is a useful correlation between the location of minerals and proposed development areas?
- Are concrete and bricks likely to continue to be the preferred construction material?
- Is there, or should there be, a point beyond which it would be more cost-effective to import minerals or change construction methods or reuse demolition/construction waste, or use recycled materials in order to avoid further social problems and environmental degradation?
- Would long-term site operation permits of 10 years or more help to ensure environmentally-friendly investment in machinery and operational philosophy?

## **B. Rehabilitation of sites**

- Rehabilitation should be planned from the inception of operations and should be on-going.
- Re-forestation with pine trees is not suitable except in forests, and is also wasteful if the young trees have to be watered. Reforestation with seeds and incorporation of local flora is recommended.
- Terracing should not be encouraged unless to protect the area from land-slides; instead there should be better utilization of the cliff edges left by the site operation.

## **C. Who pays?**

If it is agreed that helping nature to take over is the most advisable choice for mines and quarries, then the main expenses involved are limited to proper fencing, anti-erosion measures, control and, if need be, diversion of rainwater flow, as well as marking and interpreting such sites. These are tasks that can be funded through the Rural Agricultural Plan 2007-13. A pre-requisite will be to ensure that there is no contamination and, in order to apply common standards, this is a government task, specially since the appropriate departments are also in possession of the relevant information about past activities. Where the land belongs to the operator and is now used, or will be used, for other purposes the operator should bear the responsibility for clean-up and other safety costs.

## **11. Recommended actions**

*Regarding long-term planning:*

1. There is a need for a long term island-wide study on the advisability of extending quarrying zones, which should take into account the points raised at para 10A above concerning the availability and location of minerals, as well as the viability of continuing to use current construction methods and materials. A similar position has been expressed by the Cyprus Technical Chamber in its bulletin no. 109 of Feb. 2008<sup>\*4</sup>. Meanwhile all involved departments, viz., Mines, Geological Survey, Town Planning, Environment and Forests should, in their common deliberations, also consider the issues raised at para 10A, and reach a better consensus than exists at present, so that prospective operators can be suitably guided about rehabilitation and/or re-use.

*Regarding improved procedures*

2. Future licenses to be of long term (at least up to 10-year) duration, to allow for proper economic and sustainability planning.
3. Licenses granted by the authorities and all relevant information as to the terms and conditions of the license, including rehabilitation, and the ownership of land, should be available to the public. Such a register would also facilitate the operation of the 'polluter pays' principle.

<sup>\*4</sup> **Position of Cyprus Technical Chamber: study on the extension of quarrying zones** (bulletin 109, February 2008, page. 27.) (Extract)

*The Cyprus Technical recommends that an interdisciplinary study be carried out as regards the extension of quarrying zones in Cyprus. In addition to geological and mineral considerations, the study should take into account potential environmental impacts and existing settlement data. (This position is contained in a letter of 20 Feb 2008 addressed by the Chamber to the President of the Board for Consideration of Planning Deviations).*

4. Given that local participation is now an important part of equitable governance, it must be suitably conducted. Under the Aarhus Convention stakeholder participation can no longer be just a formal exercise of imparting information; since appropriate techniques and processes for public participation have been developed by European organizations, these techniques should be applied also in Cyprus. Thus, suitable training courses should be offered to Cypriot civil servants and others who will be involved in the process of public consultation.
5. The concept of a sustainable Mining and Quarrying Think Tank as a permanent practice should be considered. Such a body, with appropriate terms of reference could usefully follow up whatever actions are adopted, continuously appraising the new developments in the extracting sector.
6. The relevant departments (Mines, Geological Survey) should work with the Agriculture Department in developing suitable provisions for re-habilitation and/or re-use in the Rural Development Plan and, subsequently, should work with local communities helping them to secure funds from the Plan. Thus, the full spectrum of re-use probabilities should be discussed to broaden the limited local vision.
7. Guidelines for sustainable rehabilitation and potential re-use based on the points raised in this report and in particular on points 1, 4, 8, 9, 10 and 11 of this paragraph, should be developed. Additionally, the guidelines should provide what record should be kept (photographic and other) of the area, so that a base-line is available for comparison purposes, when rehabilitation is implemented.

*Regarding natural rehabilitation of operating sites and new licenses*

8. In cases of natural rehabilitation the operator should be required by the licensing authorities to work with the processes of natural succession and the surrounding landscape. For instance:
  - instead of planting trees on artificial terraces, to use seeds of shrubs/trees, including the site's natural vegetation. This will stabilize the ground and speed-up succession;
  - among the site operator's obligations must be the creation of a 'bank' of flora seeds;
  - allow breaking up and moderate use of drilling and blasting of solid rock floors to allow plants to colonize.
  - assisting re-growth should utilize ecological alternatives, see point 10 below.

*Regarding natural rehabilitation of abandoned sites*

9. For already abandoned sites, develop possible alternative scenarios, bearing in mind the points made at para 10C above, considering the responsibility for safety issues and the work required to assist natural processes.
10. In cases where there has been no natural re-growth, identify the reason and work towards over-coming it. Where the lack of, or inadequacy of, top soil is the cause, consider ecological alternatives such as spreading sludge on the surface or utilizing 'vinassa', the waste derived from wine production which is currently unutilised.

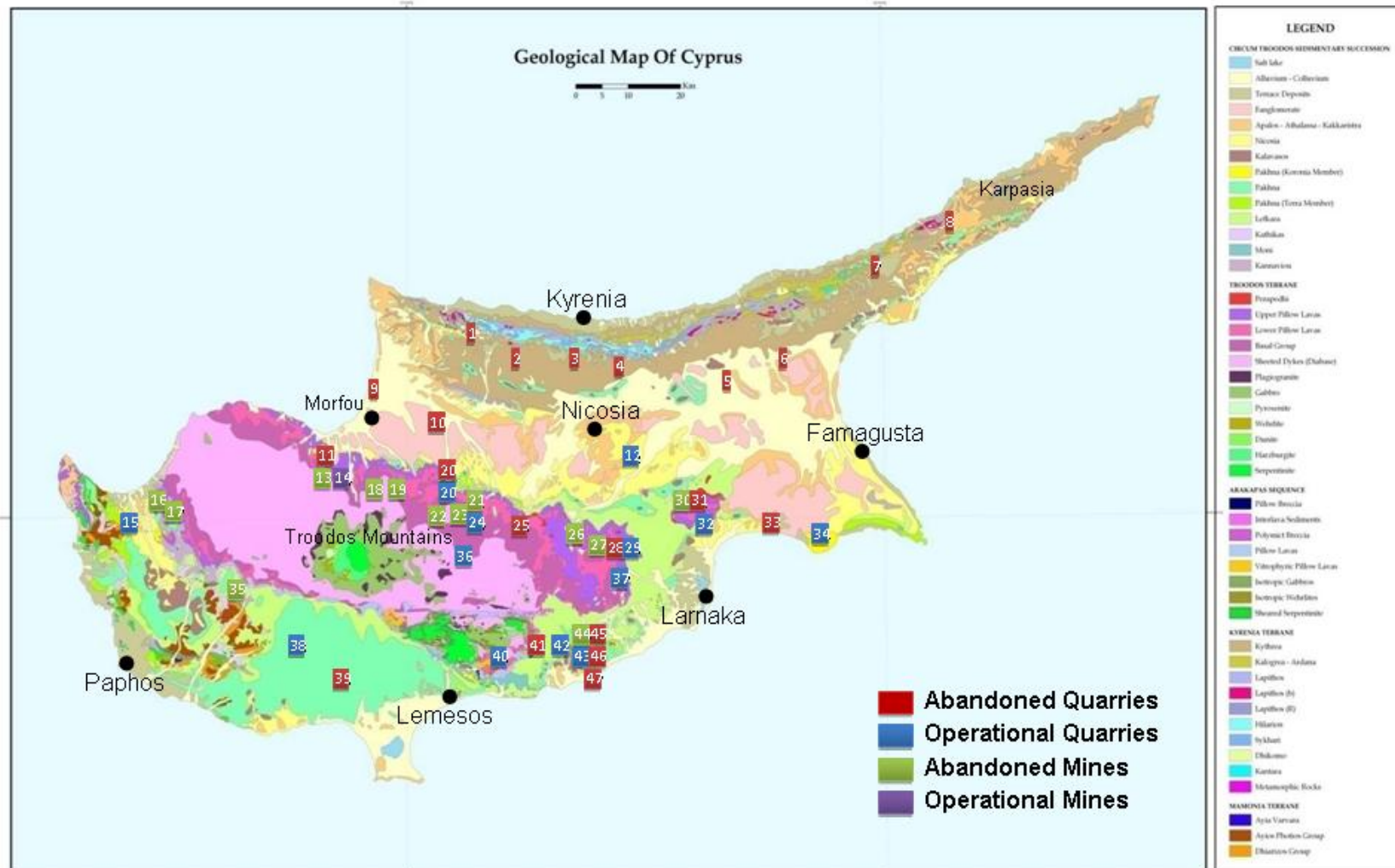
*Regarding alternative re-use of abandoned sites*

11. Consider the proposals discussed at paras 8.5.1 and 8.5.2 within the country's overall planning. Based on para 8.5.3 decide which mines/quarries could form the basis of an industrial history trail that might obtain international recognition. Aim for project funding to design and implement this.

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## Appendix: Map of abandoned mines and quarries visited throughout Cyprus



Map prepared by Elli Tzirkalli for Laona Foundation 2009, based on the Geological map of Cyprus (Geological Survey Department)  
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Appendix: List of abandoned mines and quarries visited throughout Cyprus

No	District	Owner	Location	Material	Operational status	Restoration status	Environmental issues	Potential uses
1	Kyrenia-Q	Road Works Department	Larnaka tis Lapithou	Sandy gravels	Abandoned	No restoration	Unstable slopes	Terraces/tree planting
2	Kyrenia-Q	Road Works Department	Kirni	Chalk and Lavas	Abandoned	No restoration	Steep slopes	Recreation field
3	Kyrenia-Q	Road Works Department	Pentadactylos	Limestone	Abandoned	No restoration	Steep slopes	Terraces/tree planting
4	Kyrenia-Q	Private	Sykhari	Limestone	Abandoned	No restoration	Rockslides	Agriculture activities
5	Famagusta-Q	Road Works Department	Vitsada	Soil	Abandoned	Under restoration	Alteration of Landscape	Natural trail/education
6	Famagusta-Q	Private	Gypsum	Gypsum	Abandoned	No restoration	None	Agriculture activities
7	Trikomo-Q	Road Works Department	Komi Kepir	Limestone	Abandoned	Under restoration	Steep slopes	Terraces/tree planting
8	Trikomo-Q	Private	Kilanemos	Building stone/Calcarenite	Abandoned	No restoration	None	Aphitheatre
9	Morphou-Q	Private	Syrianoxori	Sandy gravels	Abandoned	No restoration	Sea water intrusion	Wind park/photovoltaic site
10	Nicosia-Q	Symeon Aggregates Ltd	Astromeritis	Sandy gravels	Abandoned	Under restoration	Dumping site	Agriculture activities
10	Nicosia-Q	Symeon Quarries Ltd	Astromeritis	Sandy gravels	Abandoned	Under restoration	Dumping site	Agriculture activities
11	Morphou-M	Cyprus Mining Corporation	Lefka/Mavrovouni	Copper and Iron Pyrite	Abandoned	No restoration	Dumping site/contamination	Mining heritage site
12	Nicosia-Q	Latouras Quarries Ltd	Ayios Sozomenos	Calcarenite and sand	Operational	Under restoration	Large pit/altered Landscape	Fill up/replanting
13	Nicosia-M	Hellenic Mining Company Ltd	Apliki	Copper and Iron Pyrite	Abandoned	No restoration	Waste piles/acidic water	Education touristic site
14	Nicosia-M	Hellenic Copper Mines Ltd	Katydata	Copper and Iron Pyrite	Operational	Under restoration	Waste piles	Mining heritage site
15	Paphos-Q	Poullas Tsadiotis Ltd	Androlikou	Reef limestone	Operational	No restoration	Dust and noise	Revegetation/protect
16	Paphos-M	Cyprus Sulphur and Copper Corporation	Evloimeni	Copper and Iron Pyrite	Abandoned	No restoration	Waste piles/acidic water	None
17	Paphos-M	Cyprus Sulphur and Copper Corporation	Kinoussa	Copper and Iron Pyrite	Abandoned	No restoration	Waste piles/acidic water	None
18	Nicosia-M	Hellenic Mining Company Ltd M	Memi	Copper and Pyrite	Abandoned	No restoration	Waste piles	Wetland
19	Nicosia-M	Hellenic Mining Company Ltd M	Alestos	Copper	Abandoned	No restoration	Waste piles/acidic water	Reforestation
20	Nicosia-Q	Oryctaco Ltd	Kato Moni	Bentonite	Operational	No restoration	Degraded Landscape	Landfill
20	Nicosia-Q	Hellenic Mining Company Ltd	Kato Moni	Bentonite	Abandoned	No restoration	Degraded Landscape	Landfill
21	Nicosia-M	Hellenic Mining Company Ltd	Agrokkipia	Iron Pyrite	Abandoned	Some restoration	Waste piles/acidic water	Mining heritage site
22	Nicosia-M	Hellenic Mining Company Ltd	Kokkinogia	Copper	Abandoned	No restoration	Waste piles/acidic water	Mining heritage site
23	Nicosia-M	Hellenic Mining Company Ltd M	Kokkinopezoula	Copper and Gold	Abandoned	No restoration	Waste piles/acidic water	Mining heritage site
24	Nicosia-Q	Hellenic Mining Company Ltd Q	Mitsero	Reef limestone	Operational	Under restoration	Dust and noise	Replanting
25	Nicosia-Q	Farmakas Quarries Ltd	Politiko	Diabase	Abandoned	No restoration	Next to Natura 2000 site	Wetland/reforestation
26	Nicosia-M	Hellenic Mining Company Ltd	Kampia	Copper and Iron Pyrite	Abandoned	No restoration	Waste piles/acidic water	Mining heritage site
27	Nicosia-M	Hellenic Mining Company Ltd	Mathiatis North	Copper and Iron Pyrite	Abandoned	No restoration	Waste piles/acidic water	Education touristic site
27	Nicosia-M	Hellenic Mining Company Ltd	Mathiatis South	Copper and Iron Pyrite	Abandoned	No restoration	Waste piles/acidic water	Education touristic site
28	Nicosia-M	Hellenic Mining Company Ltd	Sia	Copper and Iron Pyrite	Abandoned	No restoration	Waste piles/acidic water	Education touristic site
29	Nicosia-Q	Sia Quarries Ltd	Sia	Diabase	Operational	Under restoration	Dust	Leisure facilities
30	Larnaca-M	Berdy	Troulloi	Copper and Gold	Abandoned	No restoration	Waste piles/UN Buffer zone	None
31	Larnaca-Q	Umber Corporation Of Larnaca Ltd	Troulloi	Umber	Abandoned	Under restoration	Dumping paint waste	Wetland
32	Larnaca-Q	Domokos Ltd	Oroklini	Calcarenite and sand	Operational	Under restoration	Degraded Landscape	Wetland/park
33	Larnaca-Q	Sand Works Ltd	Ormidia	Sandy gravels	Abandoned	No restoration	Dumping place	Fill up/reforestation
34	Famagusta-Q	Mouzouri Brothers Ltd	Xylofagou	Reef limestone	Operational	No restoration	Dust and noise	Fill up/reforestation
34	Famagusta-Q	Kaos Quarries Comp. Ltd	Xylofagou	Reef limestone	Operational	Under restoration	Dust and noise	Fill up/reforestation
34	Famagusta-Q	Iacovou Brothers Ltd	Xylofagou	Reef limestone	Operational	Under restoration	Dust and noise	Fill up/reforestation
35	Paphos-M	Cyprus Sulphur and Copper Corporation	Vretsia	Copper and Iron Pyrite	Abandoned	No restoration	Waste piles/acidic water	None
36	Nicosia-Q	Farmakas Quarries Ltd	Farmakas	Diabase	Operational	Under restoration	Dust and noise	Reforestation
37	Larnaca-Q	Pyrga Quarries Ltd [J. & P. Ltd]	Pyrga	Diabase	Operational	Under restoration	Dust and noise	Stadium
38	Paphos-Q	Peletico Ltd	Kidasi	Bentonite	Operational	Under restoration	Altered landscape	Natural trail
39	Limassol-Q	Elebem Ltd	Praskio/Audimou	Calcarenite	Abandoned	No restoration	None	None
40	Limassol-Q	Skyramont Quarries Ltd	Pareklissha	Diabase	Operational	No restoration	Dust/Large pit	Filled up/replanting
40	Limassol-Q	Medcon Construction Ltd	Pareklissha	Diabase	Operational	No restoration	Dust/Large pit	Filled up/replanting
41	Limassol-Q	Peletico Ltd	Monagroulli	Bentonite	Abandoned	Restoration Completed	Degradation of landscape	Replanting
42	Limassol-Q	Cyprus Cement Company Ltd	Pendakomo	Massive chalk	Operational	Under restoration	Dust	Filled up/replanting
42	Limassol-Q	Cyprus Cement Company Ltd	Ag.Georgios	Massive chalk	Operational	Under restoration	Dust/Altered landscape	None
42	Limassol-Q	Vasilicos Cement Works Ltd	Pendakomo	Massive chalk	Operational	Under restoration	Dust	Filled up/replanting
43	Larnaca-Q	Cyprus Cement Company Ltd	Mari	Mari	Operational	No restoration	Alteration of Landscape	Terraces/replanting
43	Larnaca-Q	Vasilicos Cement Works	Mari	Mari	Operational	No restoration	Alteration of Landscape	Revegetation
44	Larnaca-M	Hellenic Mining Company Ltd	Kalavastos (Petra)	Copper and Iron Pyrite	Abandoned	No restoration	Waste piles	None
44	Larnaca-M	Hellenic Mining Company Ltd	Kalavastos (Mousoulos)	Copper and Iron Pyrite	Abandoned	Under restoration	Soil/water pollution	Tourist attraction site
45	Larnaca-Q	Cyprus Cement Company Ltd	Tockni	Gypsum	Abandoned	Under restoration	Poor revegetation	Open theatre
46	Larnaca-Q	Hellenic Mining Company Ltd	Psematismenos	Gypsum	Abandoned	No restoration	Dumping place	Clean up/park
47	Larnaca-Q	Latouras Quarries Ltd	Zigi	Sandy gravels	Abandoned	No restoration	Destroyed beach	None