APPENDIX F

Revegetation Plan
By LSA Associates, Inc., August 2006

REVEGETATION PLAN

SUPER CREEK QUARRY

CITY OF DESERT HOT SPRINGS

RIVERSIDE COUNTY, CALIFORNIA

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1.0 INTRODUCTION

This revegetation plan has been prepared at the request of Webber and Webber Mining Consultants, Inc. for use with the Plan of Operations and Reclamation Plan (Revised December 2004) for the Super Creek Quarry Expansion. The Super Creek Quarry has produced building stone and rock since the 1950s (Figure 1). The existing quarry disturbance is 46.1 acres and is proposed to be expanded by 12.3 acres for a total disturbance of 58.4 acres. The existing level of operation is proposed to extend an additional 25 years. The quarry is situated on federal land administered by the U.S. Department of Interior, Bureau of Land Management (North Palm Springs Field Office), and within the City of Desert Hot Springs, which has not implemented the Surface Mining and Reclamation Act (SMARA); therefore, the lead agency for reclamation is the State Mining and Geology Board. Site photographs are included in Appendix A.

This document outlines an approach to concurrent reclamation that includes experimentation intended to lead to successful revegetation of mined areas. This revegetation plan is general enough to allow for adjustments as reclamation progresses. Concurrent reclamation allows revegetation to be at an advanced state at the completion of mining and allows for experimentation that can improve methods before mine closure. Reclamation activities consist of pre-disturbance salvage of soil and plant materials; post-disturbance planting, maintenance and monitoring; and ongoing seed and plant collection and propagation for use in future reclamation.

The primary goal for revegetation of the Super Creek Quarry is to ***revegetate all areas disturbed by mining with a self-sustaining vegetative cover of native species***. Related objectives include:

- Minimize erosion;
- Make the site suitable for use as wildlife habitat;
- Make the site suitable for use as open space;
- Minimize the occurrence of exotic plant species;
- Minimize the visual impact of surface disturbances; and
- Development of successful and cost-effective methods for performing revegetation.

Mine employees will be provided with training on the goals and practices of concurrent reclamation on the site including identification of revegetation areas, growth media piles, and how the reclamation plan integrates into mining.

Reclamation will occur in stages with site preparation and soil placement preceding revegetation efforts. The revegetation phase will also occur in stages with the first priority being to establish plants that will:

- Ameliorate environmental conditions at the site;
- Provide cover on the site;
- Provide nurse plants for seedlings; and
- Provide seed source for the site.

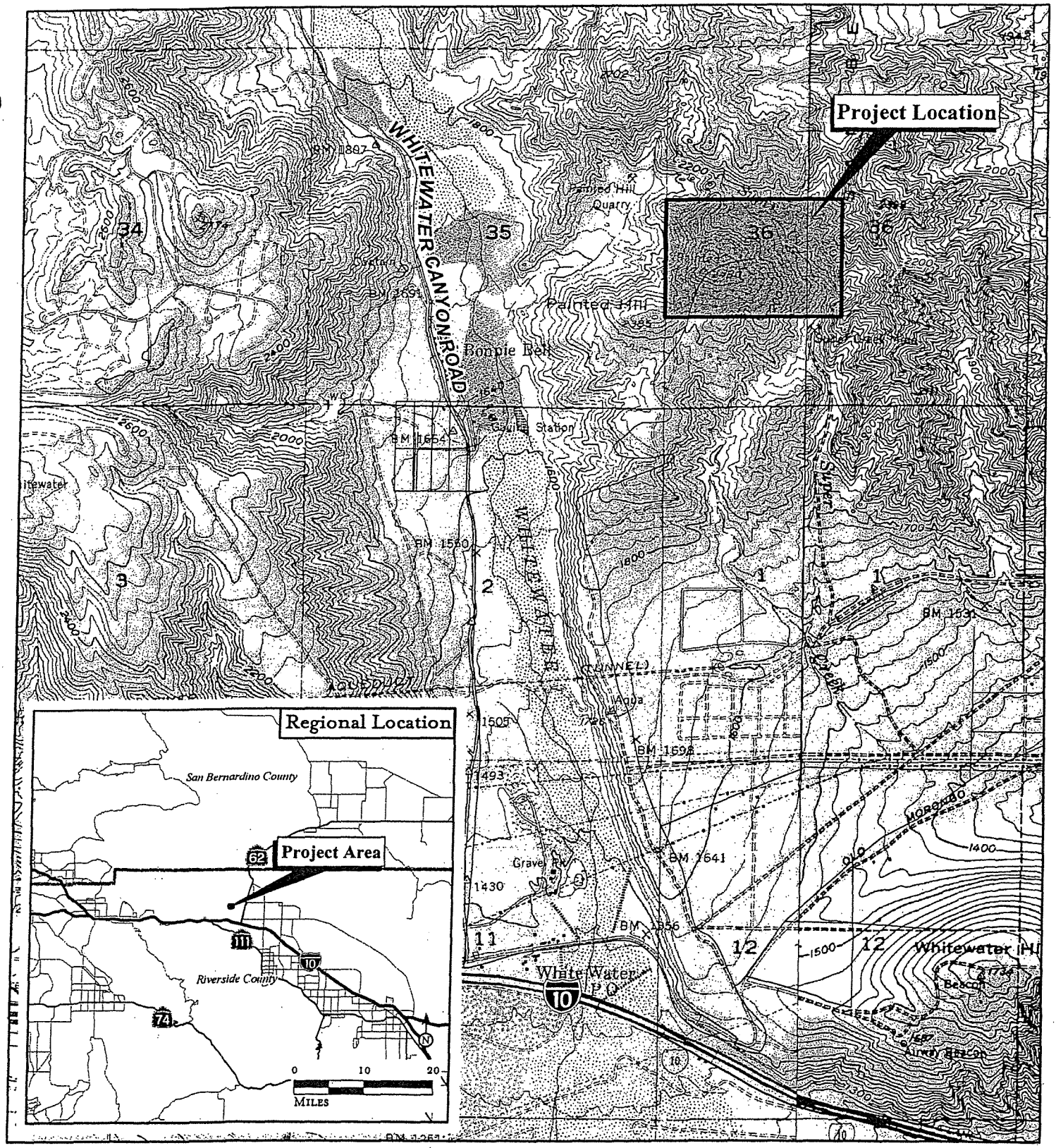

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FIGURE 1

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FEET

SOURCE: USGS 7.5' Quads: White Water (1988), Desert Hot Springs (1972), CA; County of Riverside (2006); Thomas Brothers (2004).

Super Creek Quarry
Revegetation Plan
Regional and Project Location Map

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2.0 PRE-DISTURBANCE SALVAGE ACTIVITIES

The following actions will be taken on all areas to be cleared for mining whether it is for quarrying, access, processing, or disposal of material. Plants will be salvaged first and then soil or growth media will be salvaged. Salvaged plant materials and growth media will be used in reclamation of previously disturbed areas. There is sufficient disturbed area that can be reclaimed now for the plants and soil salvaged from the expansion areas. If clearing activities must proceed faster than reclamation can occur, then plants and growth media will be stored for later use in revegetation.

2.1 Plant Salvage

Plants will be salvaged prior to new surface disturbance and used in reclamation of disturbed areas. This preserves local genetic material and local genetic diversity.

Whole Plant. In this method, the entire plant is excavated by hand or by using a tree spade, including as much of the root system as possible, and transplanted to a new site. For some shrubs and grasses, the tops are cut back (to minimize transpiration pressure) before excavating the root system. Whole plant salvage preserves mature plants and may preserve up to 100 years of growth.

Cuttings (Vegetative Reproduction). In this method, a portion of the plant is separated from the entire plant. This allows the unsalvaged portion to survive while the cutting is planted elsewhere (usually a greenhouse or nursery to allow rooting). For species that can be salvaged by cuttings, salvage can be delayed until plant material is needed because material can be salvaged from nursery stock, greenhouse stock, or areas that will not be disturbed by mining.

Salvageable Plants. Salvageable plants at Super Creek Quarry include the following species:

- **Yucca species (whole plant, cuttings).** Yucca species will be salvaged to provide mature plants in revegetation areas.
  - *Yucca schidigera* (whole plant or cuttings). *Yucca schidigera* can be salvaged whole or by breaking off rosettes at the base of the plant. Upon salvage by either method, plants will be maintained in salvage nurseries.
  - *Yucca whipplei* (whole plant). *Yucca whipplei* can be salvaged whole. Methods for salvaging are not well developed. Salvaged plants will be maintained in salvage nurseries.
- **Grasses.** Grasses will be salvaged to provide local genetic material when local seed is not available. Vegetative propagation will be used in a nursery or greenhouse to rapidly produce large numbers of plants for outplanting.
- **Cacti.** Although most cacti routinely produce viable seed, growth from seed is very slow. Salvage of cacti allows placement of mature cacti into revegetation areas and preserves local genetic diversity.
  - *Opuntia basilaris* (beavertail cactus). Beavertail cacti can be salvaged whole or by cutting off pads and rooting them in a nursery or greenhouse. If pads are salvaged, they can be salvaged

from areas that will not be disturbed by mining, without killing the plant from which they are salvaged. Salvage can be delayed until the year the plants are needed.

2.2 Soil (Growth Media) Salvage

Soil Salvage and Methods. The goal of soil salvage is to salvage the soil in which the majority of the plant roots are growing. Most desert soils have little topsoil development. Where there is no topsoil, the soil in which the majority of the plant roots are growing is referred to as "growth media."

Salvaged topsoil or growth media can preserve the following:

- **Soil Structure.** The act of salvaging growth media disturbs soil structure, particularly soil aggregation, but the mineral soil below the growth media has no soil structure at all.
- **Nutrients.** Functioning plant communities store and cycle nutrients, a large portion of which is stored within organic matter in the roots, soil, and litter layer.
- **Microflora.** A wide variety of beneficial microbes occurs in the soil associated with plant roots, nutrient cycling, and nutrient availability. Maintenance of these microbes may greatly facilitate reclamation. Soil from the reference areas will be tested for the occurrence of microflora especially vesicular arbuscular mycorrhizal (VAM) fungi.
- **Plant Propagules.** Seeds, rhizomes, and tubers are stored within growth media and may greatly facilitate reclamation.

By salvaging growth media and preserving these four components of the belowground ecosystem, revegetation of disturbed ground, in a habitat where plant growth and recovery are very slow, can be greatly facilitated.

- **Depth of Soil Salvage.** The depth of soil (growth media) at Super Creek Quarry varies from 6 to 12 inches in portions of the new areas that will be disturbed. The majority of this soil can be salvaged. Factors limiting this salvage include slope, rockiness, and the proximity of bedrock to the ground surface.
- **Removal of Remaining Plant Material.** After plant salvage is complete, the remaining plant material will be removed with a bulldozer and placed in a pile. This material will be used for mulch in revegetation areas.
- **Handling.** Handling procedures will minimize moisture content and compaction of the soil. High soil moisture content promotes decomposition of beneficial soil microorganisms. Compaction destroys soil structure and can lead to anaerobic conditions that are detrimental to soil microbes.

Growth media is salvaged with a blade or front-end loader. Salvaged growth media is then moved to a holding area that is protected from mine traffic. When possible, the growth media will be back-dumped with no vehicular traffic on top of the piles. If space limitations force piles to be deeper, truck traffic will be minimized on the piles and end dumping will not be allowed.

Topsoil (Growth Media) Conservation. In order to minimize the storage period for salvaged topsoil, Joshua trees, cacti, and topsoil shall be collected in increments, removed only from the area to

be disturbed during the next two years. Topsoil collection and stockpiling shall avoid sites now supporting rare plants until refugia have been established. Salvageable Joshua trees and cacti will be collected for direct transfer to revegetation site, temporary planting in a storage nursery, or bare root storage. To the extent feasible, woody material and other plant material shall be removed from the collection site before topsoil collection and mixed with subsoil. Storage time shall be minimized to avoid seed mortality. Where topsoil is removed more than five years prior to anticipated revegetation, stored seed viability is expected to be low.

3.0 POST-DISTURBANCE RECLAMATION

When disturbed areas are no longer needed for mining, processing, or access, they will be prepared for revegetation. While disturbed areas are undergoing revegetation efforts, other areas of the operation may be undergoing pre-disturbance salvage activities for future mining phases.

3.1 Site Preparation

Disturbed areas will be graded to minimize erosion and maximize rainwater holding capacity. Compacted areas will be ripped to a depth of 1 to 2 feet to relieve compaction and to create an uneven surface. This will aid in collecting windborne seeds and moisture and create more favorable microhabitats.

Mine spoils shall be deposited to meet stability and engineering requirements to within 18 inches of the site's intended final elevation. After final grading and contouring, stockpiled subsoil will be spread over the surface. Soil will be slightly compacted to reduce erosion. It will not be compacted to engineering standards.

The final surface will not be uniform; rocks, limbs, furrows, and crevices will provide topographic diversity, increasing the probability that seed will become located in suitable microhabitat for germination and long-term survival. If surface irregularities cannot be left because of the soil spreading techniques or other limitation, then soil "imprinting" will be used to create surface irregularities.

3.2 Soil Placement

Growth media salvaged from newly mined areas will be placed loosely on areas to be revegetated to create an uneven surface. Rocks and salvaged woody plants will be placed upon areas to be seeded to create "islands" where seeds can fall out of the wind and where moisture can be retained though the creation of shaded microhabitats. These "islands" will serve as nursery areas within the larger area to be revegetated.

3.3 Seeding

The initial seed mix (Table A) may be amended based upon monitoring of test plots. Seed will be placed by broadcast seeding or imprint seeding. Initially, seeded areas will be alternated with unseeded areas so that success of seed mix can be tested to determine if new plant recruitment is due

to seeding or colonization from the surrounding areas. Another test will include VAM fungal inoculum included in seeding.

Table A: Seeding Rates

Form	Species	Common Name	Pounds per Acre
Grass	*Achnatherum hymenoides*	Desert ricegrass	5
Grass	*Achnatherum speciosum*	Desert needlegrass	4
Shrub	*Chrysothamnus nauseosus*	Rabbitbrush	4
Shrub	*Ephedra nevadensis*	Joint fir	4
Shrub	*Encelia farinosa*	Brittlebush	5
Shrub	*Lotus scoparius*	Deerweed	4
Total			**26**

Seed Collection. Seed collection will be conducted continually at the mine utilizing a combination of collectors (mine employees, commercial nurseries, research nurseries, and educational institutions). Seeds are collected and either stored for use in broadcast seeding or germinated and used to produce plants that are grown in nurseries for later use in outplanting.

Seed is cleaned and weighed to determine total number of seeds per pound. Greenhouse germination analysis is conducted to determine percent viability. Seed of known viability will be scattered onto test plots at known densities to allow calculation of successful germination. Species, seeding densities, and viability will be recorded in permanent notes throughout the experiments.

Results of study plots will be evaluated by allowing growing seedlings to reach a stage where they can be identified to species. All identifiable plants will be recorded from each plot when it is identified. Total number of germinating plants will be tallied by species for each plot.

3.4 Placement of Salvaged Plants

Salvaged plants will be placed in revegetation areas by hand or tree spade and identified for data keeping. Most tagging methods cannot hold up to desert conditions. Tags will be developed that will last for up to five years. Information recorded for each plant will include date planted, history of salvaged plant, and method of planting. Altitude and site physical characteristics will determine which species are suitable for the site. Plant spacing and arrangement will be determined by measurements taken in reference areas.

Soil will be placed in patches, which will then be seeded and planted with species that commonly colonize disturbed sites, such as desert needlegrass, snakeweed, rabbitbrush, etc. As these plants become established, they will provide a source of seeds for the areas not directly planted, as well as a site more suited to the establishment of the climax plants species such as juniper.

Data for all outplantings will be kept in a log book showing propagation conditions, species, and height for each plant. Plants will be evaluated throughout the monitoring period.

Seeded areas and outplantings will be irrigated periodically during each of the first two growing seasons. Irrigation schedules will be determined by professional judgment, based on natural rainfall and soil conditions. The objective of irrigation is not to maximize growth rates, but instead to maximize establishment of plants to the point where artificial irrigation is no longer needed.

3.5 Placement of Container-Grown Plants

Plants may be grown in containers in order to preserve plants that are salvaged in excess of current need for plants or to increase the total number of plants available for revegetation. Container-grown plants will be placed in revegetation areas by hand and identified for data keeping. Information recorded for each plant will include the date that it was planted, history of seed or propagule plant was started from, plant propagation history, and method of planting. Tubex, TreePees, or hardware cloth herbivore protection will be placed around individual plants if necessary for protection from herbivores. VAM fungal inoculum will be added to plants during propagation if necessary.

Table B shows the planting rates for salvaged and container-grown plants.

Table B: Planting Rates for Salvaged and Container Grown Plants

Form	Species	Name	Plants per Acre
Succulent	*Opuntia* spp.	Cacti	12
Shrub	*Yucca schidigera*	Mojave yucca	12
Shrub	*Yucca whipplei*	Our Lord's Candle	12
Total			**36**

4.0 ONGOING ACTIVITIES

The following activities—seed collection, plant production, control of exotic plant species and herbivore exclusion—continue from the time seed or plants are first collected until the site is completely reclaimed. Consequently, these activities continue regardless of the reclamation status of areas currently being mined.

4.1 Seed Collection

Native seed has been and will continue to be collected for direct seeding and for plant propagation. A custom seed collection program will be developed to collect seed locally. Seed collected in larger quantities will be tested for viability. For plant species that will be direct-seeded, large quantities of seed will be necessary (hundreds of pounds). For plant species that will be grown from seed for outplanting, only small quantities of seed will be needed (a few pounds). In a given collecting area, some seed will always be left uncollected, to avoid potential damage to the ecosystem from over-collection. Seed collection will include sensitive plant species.

Seed will be obtained for each species in the following priority order:

- **Collected on the Mine Site.** In a given year, for a particular species, seed may not be available on-site at all.
- **Collected Locally Adjacent to the Mine Site.** In a given year, for a particular species, seed may not be available adjacent to the mine at all.
- **Collected Locally, where Seed is Available.** In a given year, for a particular species, some seed will generally be available locally if the local area is available for collection (all permits obtained) and well scouted; however, seed may not be available in sufficient quantities for broadcast seeding.
- **Purchased Commercially.** When seed is needed and cannot be obtained as above, the best available seed will be purchased. In this case, non-local native seed is deemed preferable to colonization of the revegetation area by invasive exotic species.

4.2 Plant Production

Establishment of seedlings in the Mojave Desert is a rare event. Limitations to the establishment of plants from seed include the following:

- Lack of water;
- High temperature;
- Granivores;
- Herbivory on seedlings;
- Sterile seed;
- Low seed viability; and
- No seed set.

Propagating plants from seed or cuttings for outplanting has several advantages:

- Less seed is needed for plant propagation than for direct seeding;
- No seed is needed for vegetative reproduction;
- Outplantings have established root systems (and if inoculated, have VAM fungi) and have a higher survival rate than seedlings; and
- Outplantings allow a higher species diversity to be placed in each revegetation area.

Production of plants for outplanting is an important revegetation method because it allows relatively mature plants to be placed in the field, allows VAM fungal inoculum to be placed in the field, and makes achieving species diversity much easier. Several scenarios will make individual plant species candidates for plant production.

- Species is threatened or endangered and will be propagated by all means possible (carbonate endemics);

- Species has genetic characteristics that make local seed collection essential and local seed is not abundant (endemics, subspecies);
- Species performs poorly in direct seeding trials and is not easily salvaged; and
- Species is easily salvaged by cuttings and rapidly multiplies in greenhouse or nursery conditions (grasses).

Methods. Since water is limited in the desert and limits vegetation growth, outplantings will be grown to maximize root depth. A shrub seedling may be one inch tall, but have six-inch deep roots when outplanted, giving it a major advantage over a seedling. Containers (1-inch diameter, six inches deep) and plant bands (paper pots, 1–2-inch diameter and 12–15 inches deep) promote deep rooting, are easy to transport and easy to outplant from. Tall pots, made from 5-inch diameter PVC pipe up to 30 inches deep, provide very high survival rates in outplantings, but have major drawbacks. The containers themselves are relatively expensive, they hold a significant volume of relatively expensive growth medium, are very heavy and difficult to transport, and can only be planted in ground where post holes can be easily drilled. Because of their expense, they should only be used for providing a few well established, well placed shrubs to ameliorate conditions in a bare area (cut wind speed, trap windblown fine particles). Plants will be hardened off before outplanting and watered during planting.

4.3 Control of Exotic Plant Species

Possible negative effects of exotic plant species are summarized below:

- Exclude native species;
- Degrade wildlife habitat;
- Change fire regime (increase frequency and intensity of fires);
- Lower water table;
- Destabilize slopes; and
- Die back during weather extremes and leave site unvegetated.

Several exotic plant species, including Russian thistle and tamarisk, have been present in the desert for 100 years. The Super Creek Quarry operation cannot eradicate exotic species that are already present in the region; however, it can work to create conditions at the mine that minimize the local abundance of exotic species.

Most exotic species that are considered a problem take advantage of disturbances to invade native ecosystems. The Super Creek Quarry operation can minimize mine disturbance; however, the mine cannot stop larger scale disturbances that are affecting the desert as a whole. Air pollution from the Los Angeles basin is depositing nitrates on the West Mojave. This disturbance is favorable for the establishment of many exotic plant species and is the large-scale anthropomorphic disturbance that the mine exists within and has no control over.

Occurrence of Exotic Species. For many plant species that occur in the Mojave Desert, their status as native or non-native is not definitely known. Most of the plants in question are not considered invasive, some are native to adjacent deserts, and their status is only important in whether to include them in the native seed collection program.

The presence and abundance of exotic plant species will be documented in the baseline vegetation surveys. This will demonstrate whether presence and abundance of exotics are increasing in either unmined areas or disturbed areas.

Important Factors Influencing Abundance of Exotic Species. The presence of exotic species at the quarry cannot be eliminated; however, local factors that limit their abundance can be. The following three important factors affect the abundance of exotics at the mine:

- Availability of large disturbance (large areas of bare ground);
- Availability of water; and
- Availability of nutrients.

The following exotic species are known to occur in the vicinity of the Super Creek Quarry:

Brassica spp.	*Descaurania pinnata*	*Marrubium vulgare*	*Sisymbrium altissimum*
Bromus diandrus	*Erodium* spp.	*Poa pratensis*	*Sisymbrium irio*
Bromus rubens	*Galium angustifolium*	*Salsola tragus*	*Triticum aesitivum*
Bromus tectorum	*Hirschfeldia incana*	*Schismus barbatus*	*Ulmus pumila*

Disturbances that leave bare ground provide space for exotics to invade; however, bare ground alone does not mean exotic plant species will grow. The low rainfall at the mine (8 inches per year) limits establishment from seed of all plant species. Many invasive exotics have evolved to respond to nutrient releases caused by disturbances and will not respond to bare ground and water as strongly if nutrients are limited.

Exotic Species Control. The mine operator controls some of the factors that will limit the abundance of exotic plant species.

Complete physical removal of exotics is often impossible and is always a short-term solution because mere removal of plants from an area does not remove the incoming seed, the seed bank, or the suitability of the habitat for the exotic.

- **Availability of Bare Ground.** The mine will minimize the size of all mining disturbances. Revegetation of all disturbed areas will begin as soon as use of disturbed ground is completed.
- **Availability of Water.** The mine generally will not irrigate any revegetation areas after initial establishment of outplantings. Irrigation will be used sparingly and then only to keep revegetated areas alive during drought periods.

The mine will not allow runoff from any water sources and will limit any ponding near water tanks, air conditioners, and other water sources.

- **Availability of Nutrients.** The mine generally will not fertilize any revegetation areas. If necessary, the mine will mulch revegetation areas to provide a "negative fertilizer" that limits growth of exotics. Areas to be revegetated are expected to have very little plant-available nutrients. Soil tests will be conducted in order to verify this assumption. Tests will include those necessary to identify VAM fungi as well.

4.4 Herbivore Exclusion

Cattle, sheep, burros, and rabbits all can do serious damage to revegetation areas. If cattle and burros are a problem on revegetation sites, the sites will be fenced. If rabbits are a problem, Tubex, TreePees, and hardware cloth cages can be placed around individual plants to allow them to establish. Timing of planting can also be manipulated to minimize rabbit damage. In a dry summer after a wet spring, outplantings are very lush compared to surrounding foliage and will be preferentially eaten by herbivores.

5.0 MAINTENANCE, MONITORING, AND REPORTING

Maintenance, monitoring, and reporting activities extend throughout the life of the mining operation until the site is completely reclaimed. These activities are necessary to keep the revegetation process continuing toward successful completion. The criteria below define successful revegetation of the site. The maintenance activities are the physical requirements necessary to establish a self-replicating vegetative cover.

5.1 Success Criteria

Success of revegetation efforts can only be measured if there is a reference data set to compare; therefore, baseline data will be collected for comparison to data collected on revegetated areas to ultimately determine revegetation success. Successful revegetation of the site will be achieved when there is a self-sustaining native plant cover established. The plants must be reproducing themselves without intervention such as irrigation, fertilization, additional seeding, or planting. The re-established plant cover will return other biological processes to the site. Wildlife will be able to re-occupy the site when plants are established providing cover and food sources. Soil development processes can begin; however, at this location, processes are limited by the arid climate and are not expected to progress noticeably at this site. These processes are complex and subject to a great deal of variation through time due especially to the variable rainfall at the site; consequently, they are difficult, if not impossible, to measure. A simplified approach can be established based upon direct measures of individual plants.

The three required measures are plant cover (vertical projection of the plant canopy over the ground surface), density (number of individual plants per unit area), and species richness (total number of plant species). A baseline measure has not yet been established for this site; consequently, it will be necessary to determine a baseline from a representative area. Successful revegetation will have been achieved when 25 percent of each parameter (cover, density, and diversity) of the baseline condition

has been established on mined areas. It is expected that, initially, species richness will be high and density and cover low relative to the reference areas. As time proceeds, cover and density are expected to increase and richness to level off.

Establishment of plantings and volunteers on revegetated sites shall be evaluated according to survival rates, total native plant cover, and species diversity on the monitoring transects. Survival, shrub species diversity (a gauge of successful volunteer establishment) and total native plant cover will be used to determine whether further plantings are needed. Diversity among annual and herbaceous native species will determine whether further seeding of annuals is needed.

If survivorship plantings is low but total native plant cover and shrub diversity are high (due to volunteers and/or vigor of surviving plantings), then success criteria will be met. Conversely, if survival is high but vigor and volunteer establishment are low, then remedial planting may be needed.

Supplemental planting will be needed if success criteria are not met. Replacement grasses and shrubs will be planted to raise overall survival and cover to meet success criteria. Replacement plantings may use the same proportions used initially, or these may be modified according to the success of particular species.

5.2 Monitoring

Monitoring and maintenance of reclamation is an ongoing responsibility of the operator. The quarry is inspected annually by the Mining and Geology Board. As reclamation efforts increase through establishment of test plots, nursery areas, and outplanting of native species, the frequency of monitoring will increase commensurate with the activities conducted. The individual monitor(s) shall be qualified revegetation specialists.

Revegetated areas will be monitored over a five-year period following initial planting. Data on plant species diversity, cover, survival, and vigor will be collected on revegetated sites and compared to baseline data from undisturbed sites to evaluate project success.

During each monitoring period (initially annually), a series of transect lines will be established across each revegetated area. At each center point, the permanent number of the outplanted seedling or cutting will be recorded and its survival will be noted (alive or dead). For all except dead plantings, height, sign of herbivore damage (including insect damage), reproductive condition (sterile, flower, fruit), and any other pertinent information will be recorded. Height data will be compared with height at planting date to indicate growth rate. The other information will be used to determine general trends and necessity for additional fertilization, irrigation, or other treatment.

Total native plant cover will be determined along the monitoring transects (modified transects will be applied on the slope planting). Point-intercept data will be collected at one-meter intervals on transect tapes. At each interval, the point directly beneath the mark on the tape will be recorded either as "bare" or as a plant species. During the monitoring program, additional baseline data will be collected from undisturbed plots on the project site.

Diversity of native annuals and weed abundance will be determined by identifying every plant growing within a 0.56-meter radius of the center point (total plot area = 1 square meter). Numbers

and percentage cover for each species will be recorded. The need for weeding will be evaluated twice yearly.

Defining Reference Areas. Revegetation areas are defined by where mine disturbance occurs. Defining the best areas for reference areas is more difficult. The best reference data include data on:

- The area to be disturbed before it is disturbed; and
- An adjacent comparable area that will not receive the planned disturbance with data being taken during both the disturbance and revegetation period.

The need for temporal measurements on reference areas is illustrated by the invasion of exotic plant species. Several exotic plant species have migrated out of the Los Angeles basin in recent years eastward and have increased steadily in abundance in the Mojave desert. If a static reference is used, it may not reflect possible increases in exotic abundance by the end of the mine life and mine disturbance could be blamed for the increase in exotics that was actually independent of mine disturbance.

Variability of Vegetative Production. Plant communities are not static and usually cannot be called undisturbed. Plant density, diversity, cover, age structure, and biomass are affected by a variety of factors including the following:

- **Season.** Plant biomass increases in the spring and decreases in the fall. Annual plants exist only as seed during the winter and in drought years.
- **Natural Disturbance.** Fire is a major natural disturbance in the Mojave Desert. Fire has a major effect on plant community structure because it affects each plant species differently. Herbivory by native herbivores is also a major natural disturbance. Cycles in herbivore populations have a major effect on plant community structure.
- **Weather.** Cycles in weather have major impact on plant community structure. Although rainfall is generally expressed in yearly average, periods of high rain and periods of drought are cyclic and very important.
- **Anthropogenic Factors.** Human impact causes a wide variety of disturbances in the Mojave Desert. Disturbances to the mine include historic mining that preceded current mining; introduction of non-native grazers (past and present) such as burros, cattle, and sheep; exotic plant species; changes in fire frequency and intensity; and air pollution from the Los Angeles air basin.

Data Collection. Data will be collected at all stages of reclamation and work will be designed to maximize knowledge that can be gained with data collection. A variety of quadrat and transect methods are effective for measuring particular aspects of plant communities (Bonham 1989).[1] Species diversity, cover, and density of native perennials will be measured to establish reference data. Cover

[1] Bonham, Charles D. *Measurements for Terrestrial Vegetation*. Wiley – Interscience, 1989.

and density of exotic plant species will be measured to determine baseline levels of exotics. Transect length and quadrat size will be determined in reference to what measurements can ultimately be made on revegetation areas of varying sizes and shapes. Baseline data collection methods and revegetation area data collection methods will be comparable so that the data can be compared statistically.

5.3 Maintenance

Maintenance actions will be performed as needed based upon regular inspections. Inspections will be conducted twice each year in spring and fall and after any significant rain event (≥2 inches/24 hours). Inspections will be conducted to evaluate the condition of planted areas as well as general site conditions (e.g., soil erosion, exotic species occurrence). Remedial actions will be taken as appropriate to prevent impairment of the revegetation effort.

Planted areas will be weeded, if non-native plant species average 15 percent or greater cover on monitoring plots at a given monitoring period. Soil erosion will be repaired if it impairs the mine operation or interferes with revegetation. Typically, development of a rill greater that 100 square inches in cross-sectional area and longer than 5 feet will require filling.

5.4 Reporting

The Operator of Super Creek Quarry submits an annual report to the State Mining and Geology Board. These annual reports will include evaluation of progress for the following topics:

- Preparation of Areas for Vegetation;
- Plant Salvage and Salvage Nurseries;
- Growth Media Salvage and Storage;
- Baseline Data Collection and Analysis;
- Seed Collection and Storage;
- Plant Production;
- Exotic Species Control;
- Results of Reclamation Tests; and
- Reclamation Success.

APPENDIX A

SITE PHOTOGRAPHS

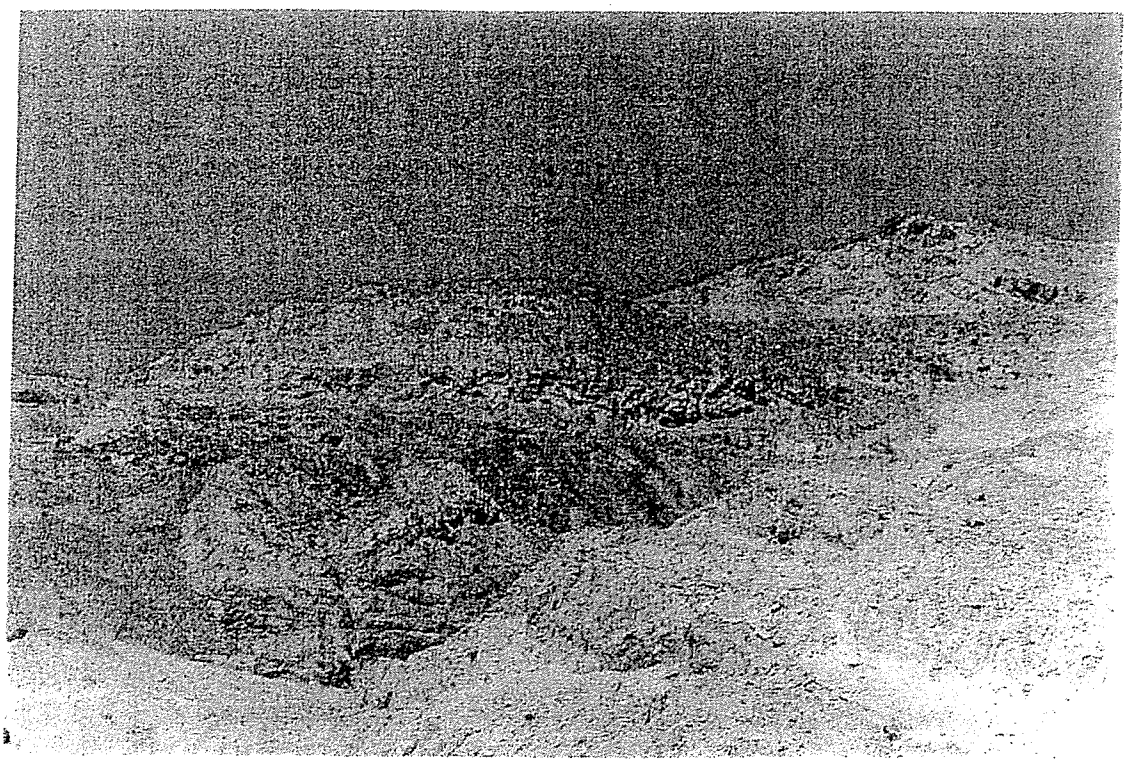

Photo #1: On the east side of the expansion area, looking up the slope (west). Shows the existing conditions of the slopes with their sparse vegetation.

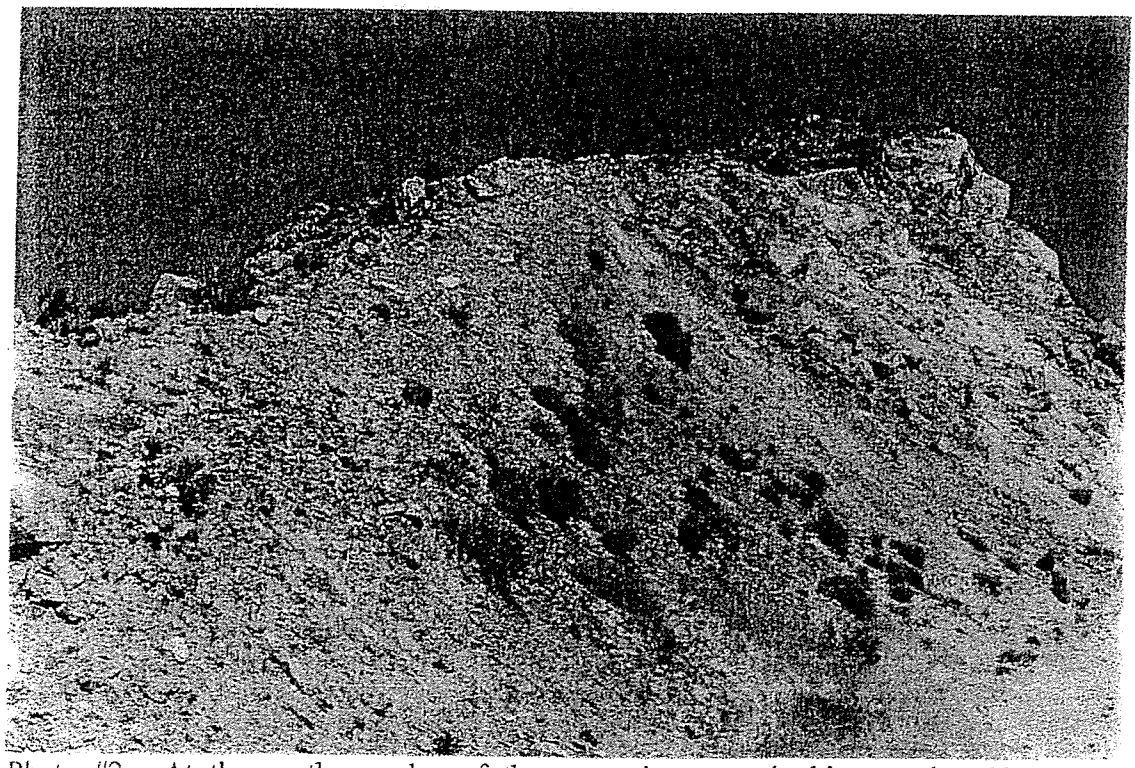

Photo #2: At the southern edge of the expansion area, looking north. Shows the steepness of the existing east slope and the sparseness of the vegetation.

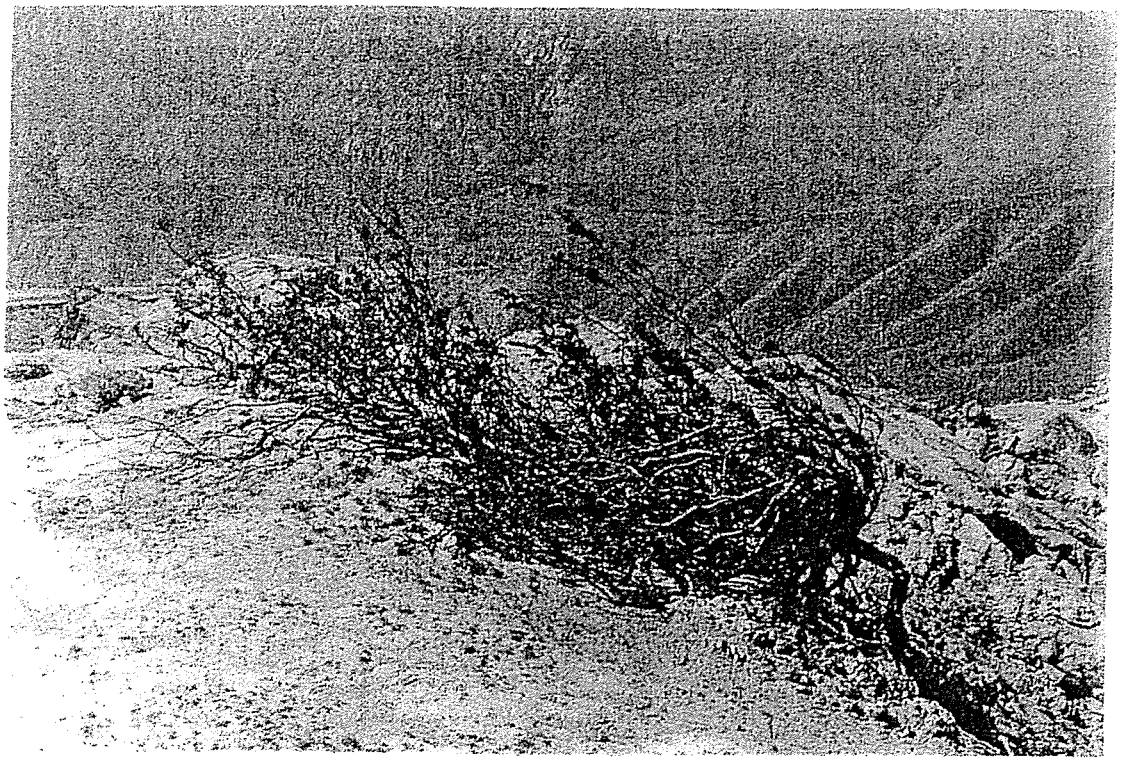

Photo #3: On top of the ridge, looking south. Shows the wind-swept condition of a creosote bush on the ridge and the Snow Creek Canyon in the distance.

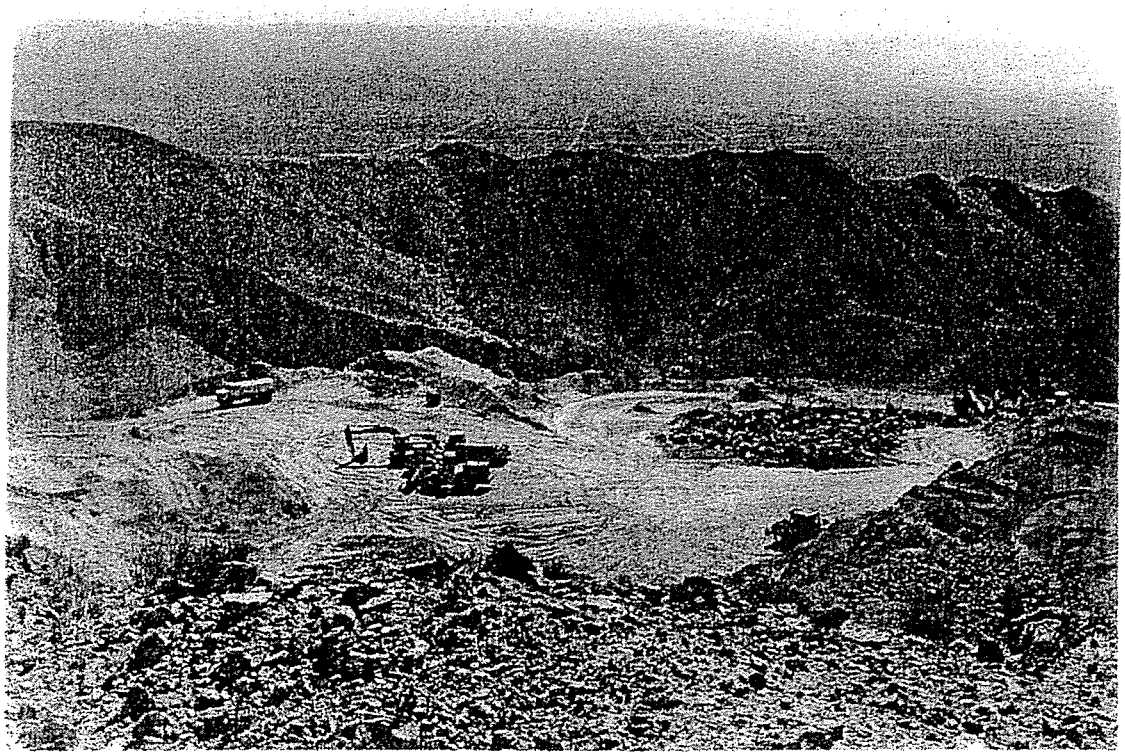

Photo #4: On the eastern edge of the proposed expansion area, looking east. Shows the existing quarry area, the hills and Desert Hot Springs beyond.