AMENDED
PLAN OF OPERATIONS
AND
RECLAMATION PLAN

FOR

OMYA CALIFORNIA
BUTTERFIELD AND SENTINEL QUARRIES

CA MINE ID# 91-36-0052

Submitted to:

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
SAN BERNARDINO NATIONAL FOREST
602 S. Tippecanoe Avenue
San Bernardino, CA 92408

and

COUNTY OF SAN BERNARDINO
Land Use Services Department
Planning Division
385 N. Arrowhead Avenue
San Bernardino, CA 92415

Prepared by:

OMYA CALIFORNIA
7225 Crystal Creek Road
Lucerne Valley, CA 92356

September 2012

TABLE OF CONTENTS

COUNTY OF SAN BERNARDINO AMENDED RECLAMATION PLAN

Section Page

LIST OF FIGURES

Figure Page

LIST OF TABLES

APPENDICES (Under Separate Hard Cover; included on CD)

APPENDICES (continued)

MAP SHEETS (attached)

OMYA CALIFORNIA
AMENDED PLAN OF OPERATIONS AND RECLAMATION PLAN FOR THE BUTTERFIELD AND SENTINEL QUARRIES

EXECUTIVE SUMMARY

Omya California (Omya) is submitting to the San Bernardino National Forest (SBNF) and San Bernardino County (County) an Amended Plan of Operations, a Conditional Use Permit (CUP), and a Reclamation Plan for the proposed expansion of the existing Butterfield and Sentinel Limestone Quarries. (This document includes the three submittals and is described as the "Amended Plan" or "Plan".) The project site is located approximately 7.5 miles south of the community of Lucerne Valley and 5 miles north of Big Bear Lake within the SBNF in San Bernardino County, California (see Figures 1 and 2 in the text of the Plan). This Amended Plan combines the existing and permitted mining activities with the Proposed Project expansion. Because these two quarries are adjacent to each other; utilize the same crushing plant; and share overburden stockpiles, haul and access roads; the operations and reclamation for these two quarries are being combined into one Amended Plan of Operations and Reclamation Plan. The Proposed Project includes quarry and overburden expansions, increased operational years and production, additional haul road area, and minor adjustments to existing disturbance and permitted boundaries. The total existing permitted operational area is approximately 137.5 acres. This Amended Plan will add approximately 77.3 acres for a total project area of approximately 214.8 acres.

The Butterfield and Sentinel Quarries are located entirely within portions of approximately 954 acres of unpatented placer claims controlled by Omya located on public land administered by SBNF. Permitting will require compliance with both United States Forest Service Minerals Regulations under the jurisdiction of the SBNF and the California Surface Mining and Reclamation Act (SMARA) implemented by the County. Therefore, in consultation with both the SBNF and the County, Omya is submitting an Amended Plan of Operations for Mining Activities on National Forest System Lands, as well as a CUP and an Amended Reclamation Plan per Chapter 88.03 of the County's Development Code and the County's Mine and Reclamation Plan Information and Application form. Obtaining the necessary SBNF and County approvals will require compliance with both the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA) and a joint Environmental Impact Report/Environmental Impact Statement (EIR/EIS) will be prepared.

The Forest Service approved the previous Omya Umbrella Plan of Operations and Reclamation Plan on January 11, 1988 which included the Sentinel, Butterfield, Cloudy, and Claudia quarries and associated haul roads (see Sheet 1 and Figure 3 in the text of the Plan). The existing SMARA approved Plan of Operations and Reclamation Plan (94M-02) was approved by the Forest Service, and was approved by the SMARA lead agency, San Bernardino County in 1994. The site is designated with CA Mine ID# 91-36-0052.

Omya received approval of the Sentinel Quarry Area Expansion Plan of Operations and Reclamation Plan from the Forest Service and County in 2002/2003. This approved Plan of Operations and Reclamation Plan includes mining and reclamation of the current Sentinel and Butterfield Quarries. All other aspects of the Omya operations on SBNF lands including other quarries, overburden sites, and haul roads are covered in the 1994 approved plans and are not changed or further discussed in this document with the exception of extending the years of use of the Crystal Creek Haul Road by 10 years from 2046 to 2055.

The Sentinel Quarry is permitted to operate through the year 2035 and the Butterfield Quarry through 2015. Known resources will accommodate an increase to approximately 27 million tons of ore to the plant for a proposed additional 40 years of operations for Butterfield (2016 through 2055) and a proposed additional 20 years for the Sentinel Quarry (2036 through 2055). Depending on market demand, average ore production rates to the processing plant in Lucerne Valley will increase to approximately 680,000 tons of ore to the plant per year compared to the approved plans of an average of 450,000 tons of ore to the plant per year.

The Butterfield Quarry proposed expansion consists of 28.6 acres and includes expansion of the existing quarry approximately 900 feet to the west and 200 feet to the south and north incorporating those areas previously defined as Butterfield 2, Butterfield 3, and the previously mined and reclaimed Butterfield 4, and the partial filling of the quarry with overburden. These areas will all be included into the overall Butterfield Quarry footprint for a total disturbance area of approximately 50.4 acres.

The Sentinel Quarry Area revisions consist of an additional 48.7 acres of disturbance and include expansion of the quarry (10.8 acres), the Butterfield 5 overburden pad (B5 Pad – 22.7 acres), and the Central Area with overburden fill pads, growth media storage, and additional haul road areas (15.2 acres). These areas will all be included into the overall Sentinel Quarry Area footprint for a total disturbance area of approximately 164.4 acres.

These changes allow for substantial optimization of the Quarry's operational activities. This Amended Plan will add approximately 77.3 acres for a total project area of approximately 214.8 acres (see Table ES1).

Quarry and overburden stockpile development and expansion will be phased. Included in the phased expansion and reclamation is concurrent quarry development and reclamation of equipment-accessible mined out portions of the quarries. Once the final outer limit and bottom of the ore is reached, the quarries will be partly backfilled as the remainder of the quarries is mined out. The Amended Plan allows for substantial backfill to be placed in the mined out portions of the quarries, and also allows an efficient mining plan, minimum disturbance of new ground, phased incremental disturbance of new ground, and concurrent reclamation of the quarries and overburden stockpiles.

The previously approved SMARA 2003 reclamation plan includes a site-specific approved revegetation plan that identifies growth media salvage, organics placement, seeding and revegetation, seed collection and propagation, irrigation, site cleanup, public safety, rock and fill

slope stability, drainage and erosion controls, a monitoring and maintenance plan, and bond release criteria. No changes in the approved revegetation plans for the Butterfield and Sentinel quarries are proposed other than increased acreage and timing changes as discussed in detail in Section 2.5.

Table ES1
Existing and Planned Operational Areas
Butterfield and Sentinel Quarries

Quarry or Area	Existing Approved Areas (acres)	Proposed New Areas (acres)	Total New Project Areas (acres)
Butterfield Quarry	21.8	28.6	50.4
Sentinel Quarry	59.6	10.8	70.3
Butterfield 5 Overburden Pad	23.4	22.7	46.1
Central Area	28.3	15.2	43.5
Sentinel North Pad (reclaimed)	4.5	0	4.5
Totals	**137.5**	**77.3**	**214.8**

Note: Areas rounded to nearest tenth of an acre. Totals may be slightly different due to rounding.

There are no new quarries proposed in this Amended Plan, only the phased logical progression of quarry and overburden stockpile development and ultimate reclamation of the Butterfield and Sentinel Quarries. Inherent project design features and mitigation measures are intended to avoid and reduce potential environmental issues including potential impacts to federally listed endangered and threatened carbonate plants species, and visual resources.

In summary, this Amended Plan requests the following overall changes:

1. an increase of 28.6 acres at the Butterfield Quarry;
2. an increase of 10.8 acres at the Sentinel Quarry (mostly in-fill);
3. an increase in Sentinel Quarry depth by 150 feet;
4. an increase of 22.7 acres at the B5 Pad;
5. modifications to existing and planned overburden stockpile areas and haul roads in the Central Area on approximately 15.2 acres;
6. an increase in average production from 450,000 tons/year to 680,000 tons/year (ore to plant);
7. an increase in the length of operations of 40 years at Butterfield (2016 to 2055);
8. an increase in the length of operations of 20 years at Sentinel (2036 to 2055); and
9. an increase in the length of use of the Crystal Creek Haul road of 10 years until 2065 followed by 10 years of reclamation.

The carbonate soils, including limestone, in the northern San Bernardino Mountains, provide a unique habitat and there are five federally listed threatened or endangered plant species endemic to carbonate soils. An intensive collaborative effort led to the development of the Carbonate Habitat Management Strategy (CHMS) in 2003. The strategy is designed to provide long-term protection for the carbonate endemic plants and also provide for long-term continued mining in the San Bernardino Mountains. Portions of the carbonate habitat are protected from mining impacts in perpetuity within the carbonate habitat reserves dedicated and managed as described in the CHMS. A Memorandum of Understandings and Agreement was signed in 2003 by Omya, the SBNF, Bureau of Land Management (BLM), San Bernardino County, Specialty Minerals, Mitsubishi Cement Company, California Native Plant Society, and the Cushenbury Mine Trust stipulating that the signatories will implement the CHMS for the dual purpose of conserving threatened and endangered carbonate plants and streamlining the permitting of mining operations.

The listed carbonate-endemic plants are managed by the SBNF, San Bernardino County, and other public agencies under the CHMS. "Take" of listed carbonate-endemic plants is permitted under the strategy, and mitigated by permanently relinquishing unpatented mining claims or transferring private property into the public domain, and by management of off-site plant occurrences as outlined in the CHMS.

Several botanical surveys by both SBNF and Omya-contracted botanists have been conducted in the mine expansion area during the past 30 years and have identified onsite populations of Cushenbury oxytheca, one of the five federally listed endangered plant onsite in the CHMS. No occurrences of the other four listed carbonate endemic plant species have been recorded on or adjacent to the site. In consultation with the SBNF, Omya has provided the SBNF a mitigation land proposal consistent with the CHMS that would relinquish 300 acres of unpatented claims for carbonate plant mitigation (see Appendix 11A and Figure 3).

Numerous project designs, conditions of approval and mitigation measures from the existing approved permitted plans listed below have already been or will be incorporated into the existing Butterfield and Sentinel Quarry operations and will reduce potential environmental impacts. This Amended Plan includes the following avoidance/minimization and environmental protection measures:

1. Quit claim to the SBNF 300 acres of unpatented mining claims held within the SBNF which are known to have occupied endangered species habitat agreed upon by the SBNF and consistent with the CHMS.

2. Design future overburden to be placed or backfilled into existing overburden areas and completed quarries as much as feasible to avoid possible impacts to existing Cushenbury oxytheca populations;

3. Submit additional reclamation bond to cover the new disturbance in the expansion areas prior to starting the development work.

4. Implement a Dust Management Plan (DMP) for the quarry expansion areas which will emphasize:
   A. Methods and means to reduce mining related dust.
   B. Periodical use of dust control measures (water and/or chemical suppressant) on the haul roads and the mining areas.
   C. Limiting amount of exposed disturbed sites at any one time.
   D. On windy days, employ water sprays in working areas in order to reduce the volume of dust blowing from disposal areas toward the sensitive plant habitat.

5. Implement an Employee Awareness Plan that will provide information, training, and protection measures on the following:
   A. Mining within Critical Habitat for listed plant species in cooperation with United States Fish and Wildlife Service (USFWS) and SBNF.
   B. Mining in proximity to an area of SBNF land segregated from mineral entry and location in cooperation with BLM and SBNF (CHMS designated refugia).
   C. Awareness and protection measures about Bighorn sheep in cooperation with USFWS, California Department of Fish and Game (CDFG), and SBNF.
   D. Benefits of preserving heritage resources in cooperation with the SBNF.

6. Continue maintaining the water guzzler for Bighorn sheep near the north end of the Sentinel Quarry.

7. Continue support of CDFG Bighorn sheep studies during the mining project.

8. Dispose of sediment from runoff control basins to pre-approved sites rather than side cast.

9. As areas become available, implement concurrent reclamation/revegetation of completed quarries and overburden stockpiles to reduce visual impacts through backfilling, recontouring and slope reduction, growth media and habitat log placement, revegetation with native plant species, and colorization as applicable.

10. Any unexpected or unforeseen events will result in immediate notification to the SBNF. If conditions are encountered that vary significantly from the assumptions used in this analysis, Omya will coordinate with the SBNF to determine required actions.

11. Monitoring as described below is incorporated to be part of the approved Plan of Operations:

    Forest Mine Administrator, Certified Mineral Examiner or other qualified specialists will document and assure the avoidance/minimization and environmental protection measures incorporated into the Plan of Operations and the Decision Notice are being followed and that they are effective in protecting the environment. Inspections will occur during the life of the project at least once a year to document the site conditions and to assure the Plan of

Operations is being followed. If it is determined that a particular environmental protection measure is not adequately protecting surface resources, the Plan of Operations will be modified to correct the situation. Significant changes may require additional analysis and documentation in compliance with the National Environmental Policy Act.

USDA, Forest Service

PLAN OF OPERATIONS FOR MINING ACTIVITIES ON NATIONAL FOREST SYSTEM LANDS

FS-2800-5
OMB NO.
0596-0022

USE OF THIS FORM IS OPTIONAL! **1st TIME USERS SHOULD DIRECT QUESTIONS REGARDING THIS FORM OR REGULATIONS (36 CFR 228A) TO THE FOREST SERVICE DISTRICT OFFICE NEAREST YOUR AREA OF INTEREST.**

Submitted by: _____ **Plant Manager** _____

Signature | Title | Date *(mm/dd/yy)*

_____ _____ _____

Plan Received by: _____ _____ _____

Signature | Title | Date *(mm/dd/yy)*

I. GENERAL INFORMATION

A. Name of Mine/Project: **Omya California / Amended Plan of Operations for the Butterfield and Sentinel Quarries**

B. Type of Operation: **Mining on placer claims**
(lode, placer, mill, exploration, development, production, other)

C. Is this a (☐new/☒continuing) operation? (check one). If continuing a previous operation, this plan (☐replaces/☒modifies/☐supplements) a previous plan of operations. (check one)

D. Proposed start-up date *(mm/dd/yy)* of operation: **Ongoing Permit to 01/01/2016**

E. Expected total duration of this operation: **40 years of operations from 2016 through 2055 followed by 10 years of reclamation activities through 2065; 10 additional years for Crystal Creek Road through 2075.**

F. If seasonal, expected date *(mm/dd/yy)* of annual reclamation/stabilization close out: **N/A**

G Expected date *(mm/dd/yy)* for completion of all required reclamation: **12/31/2075**

II. PRINCIPALS

A. Name, address and phone number of operator:
Omya California
7225 Crystal Creek Road
Lucerne Valley, CA 92356
Peter Sutherland, Plant Manager (760) 248-5233

B. Name, address, and phone number of authorized field representative (if other than the operator). Attach authorization to act on behalf of operator. Same as A above.

C. Name, address and phone number of owners of the claims (if different than the operator):

See Table below. King Claim, Slope North: Sentinel Mining Co.; P.O. Box 6141; San Bernardino, CA 92412

Crystal Creek Claims: Floyd Butterfield c/o Martha Spalding; 934 Osos Way; Paso Robles, CA 93447

D. Name, address and phone number of any other lessees, assigns, agents, etc., and briefly describe their involvement with the operation, if applicable:

Not Applicable

III. PROPERTY OR AREA

Name of claim, if applicable, and the legal land description where the operation will be located.

Project is within portions of the following claims:

Claim Name – Area (approx. acres)	***Section***	***Township***	***Range***
Crystal Creek 1 – 160 acres	23	3N	1W
Crystal Creek 2 - 160 acres	23	3N	1W
Crystal Creek 13 – 160 acres	24	3N	1W
Crystal Creek 14 – 160 acres	25	3N	1W
King 3 – 160 acres	24	3N	1W
Crystal Creek 4 -80 acres	23	3N	1W
Slope North – 74 acres	23	3N	1W

IV. DESCRIPTION OF THE OPERATION

A. **Access.** Show on a map (USGS quadrangle map or a National Forest map, for example) the claim boundaries, if applicable, and all access needs such as roads and trails, on and off the claim. Specify which Forest Service roads will be used, where maintenance or reconstruction is proposed, and where new construction is necessary. For new construction, include construction specifications such as widths, grades, etc., location and size of culverts, describe maintenance plans, and the type and size of vehicles and equipment that will use the access routes.

Please refer to Figure 1 – Vicinity Map; Figure 2 – Location Map; and Figure 3 – Existing Operations (including claims boundaries). Access and haul roads are shown on the Amended Mine and Reclamation Plan Sheets 1 through 4.

During the planned mining operations through 2055 and for the 10-year period of active reclamation through 2065, the existing vested Crystal Creek Road will continue to be utilized for the transport of limestone ore from the quarries to the Omya process plant in Lucerne Valley and for reclamation purposes, respectively. This road will be reclaimed after completion of quarry reclamation in the time period from 2066 through 2075 per the approved 1994 Reclamation Plan (94M-02) as detailed on Sheet 11 of the 1994 Reclamation Plan. No other offsite roads will be constructed.

B. **Map, Sketch or Drawing.** Show location and layout of the area of operation. Identify any streams, creeks or springs if known. Show the size and kind of all surface disturbances such as trenches, pits, settling ponds, stream channels and run-off diversions, waste dumps, drill pads, timber disposal or clearance, etc. Include sizes, capacities, acreage, amounts, locations, materials involved, etc.

Please refer to attached Amended Plan of Operations and Reclamation Plan Sheets 1 through 4.

C. **Project Description.** Describe all aspects of the operation including mining, milling, and exploration methods, materials, equipment, workforce, construction and operation schedule, power requirements, how clearing will be accomplished, topsoil stockpile, waste rock placement, tailings disposal, proposed number of drill holes and depth, depth of proposed suction dredging, and how gravels will be replaced, etc. Calculate production rates of ore. Include justification and calculations for settling pond capacities, and the size of runoff diversion channels.

A complete Project Description is included in Section 1.0 Mine Plan of this Amended Plan. The amended Plan is the logical expansion of existing approved mining and crushing operations that will provide sized limestone ore to Omya's Lucerne Valley Plant. The expansion of existing quarries planned including the area, production, phasing, slopes, and depth are discussed in Section 1.1. Proposed production, rates, and limestone resources are listed in Table NF1 below. The Amended Plan requests the following overall changes:

1. An increase of 28.6 acres at the Butterfield Quarry;
2. An increase of 10.8 acres at the Sentinel Quarry (mostly in-fill);
3. An increase in Sentinel Quarry depth by 150 feet;
4. An increase of 22.7 acres at the B5 Pad;
5. Modifications to existing and planned overburden stockpile areas and haul roads in the Central Area (15.2 acres);
6. An increase in average production from 450,000 tons/year to 680,000 tons/year (ore to plant);
7. An increase in the length of operations of 40 years at Butterfield Quarry (2016 to 2055);
8. An increase in the length of operations of 20 years at Sentinel Quarry (2036 to 2055); and
9. An increase in the length of use of the Crystal Creek Haul road of 10 years until 2065 followed by 10 years for reclamation.

The total existing permitted operational area is approximately 137.5 acres. This Amended Plan will add approximately 77.3 acres for a total project area of approximately 214.8 acres (refer to Table ES1 above).

Mining activities vary through the year, and may occur 24 hours/day, 7 days/week depending on operational requirements. Blasting is restricted to daylight hours. The existing operational hours are not changing with this Amendment. Winter snowfall and ore production requirements are the major determining factors for scheduling of ore and waste rock mining. Other factors such as market conditions and maintenance requirements also may vary this schedule.

The quarries are multi-bench open pit mines. Several working levels are operated at any one time to supply the quota of ore needed to meet production demands. The multi-working level concept allows for greater selectivity and blending of rock qualities to meet stringent quality standards of customers, and allows maximum utilization of the resource. Five grades of ore are selectively mined. The ore is drilled and blasted, loaded into haul trucks and hauled to the crusher currently located just southwest of the Sentinel Quarry. Crushed ore is loaded into off-road haul trucks and transported eight miles on the vested Crystal Creek Haul Road to the existing processing plant in Lucerne Valley.

As operations progress, alternate equipment may be required to optimize operations. The alternate equipment would not substantively change the process described above. Required permits would be obtained prior to placing alternative equipment into operation.

Waste rock, defined as limestone and other rock not suitable for the manufacture of Omya-produced limestone products will be stockpiled within the planned overburden stockpiles and/or backfilled within the quarries' footprints to reduce the size of separate stockpiles, thereby reducing surface disturbance and potential impacts to wildlife habitat, sensitive vegetation, and visual resources.

There will be no operational settling ponds onsite and no new runoff diversion channels required. No change in the number of blasts are expected which is approximately one per week at each quarry.

Table NF1
Planned Quarries' Production and Operational Areas
Butterfield and Sentinel Quarries

Quarry or Area	Total Area (acres)	Ore Limestone Resources (millions of tons)	Annual Average Excavated (tons)	Annual Average Production (ore to plant) (tons)	Annual Average Waste – including crusher fines[1] (tons)	Waste – including crusher fines[1] (millions of tons)	Max. Depth (feet above ground surface)
Butterfield	50.4	7.6	356,500	162,500	194,000	7.8	200
Sentinel	70.3	24.4	1,131,000	517,500	613,500	24.5[2]	600
B5 OB Pad	46.1	---	---	---	---	---	---
Central Area	43.5	---	---	---	---	---	---
Sentinel North Pad (inactive)	4.5	---	---	---	---	---	---
Totals	**214.8**	**32**	**1,487,500**	**680,000**	**807,500**	**32.3[2]**	**---**

Notes:
Volumes are estimated based on drilling data and computer modeling.
Area rounded to nearest tenth of an acre. Totals may be slightly different due to rounding.
In-situ or in-place limestone rock weight to volume ratio estimated at 2 tons per cubic yard.
Waste rock (interburden and overburden) excavated will vary annually depending on area being excavated.
1 – Fines produced from primary onsite crushing estimated at 15% of ore crushed.
2 – Includes relocation of some existing waste rock to allow western and southern expansion of Sentinel Quarry.

D. **Equipment and Vehicles.** Describe that which is proposed for use in your operation (Examples: drill, dozer, wash plant, mill, etc.). Include: sizes, capacity, frequency of use, etc.

The typical equipment list is included as Table NF2 below. As operations progress, alternate equipment may be required to optimize operations and these are listed in the table below. The alternate equipment would not substantively change the process described above. Required compliance with air quality regulations and permits would be obtained prior to placing equipment into operation.

Table NF2
Typical Quarry Equipment
Butterfield and Sentinel Quarries

Equipment	Typical Number	Net Increase of Additional Equipment	Purpose
Dozer	1	0	Removal of topsoil and waste rock. Construction and maintenance of the haul road, and quarry bench grading
Off-Road Haul Trucks	8 50 to100 ton trucks	2	Transportation of excavated material to the primary crusher and to overburden stockpiles onsite and transportation of crushed sized ore to the Lucerne Valley Plant.
Drill Rig	1	0	Drill holes for placement of explosives.
Water Truck	1	0	Water spray haul roads, active quarry areas, overburden stockpiles, and general dust control onsite.
Front-End Loaders	2	1	Loading of excavated materials into haul trucks at the quarry and at the primary crusher.
Mobile Crusher/Screening System	---	1	Potential future replacement for existing stationary crusher
Surface Miner	---	1	Potential future replacement to be used in place of crusher
Excavator	---	1	Currently limited use for special projects and boulder breaking. Potential future replacement to be used in place of front-end loader
35 to 45-Ton Haul Trucks	Varies	Varies	Limited use for special projects
Ancillary Equipment	Varies	Varies	Maintenance vehicles, bobcats, backhoe, pick-ups, etc

Note that similar equipment may be used during the life of the project.

E. **Structures.** Include information about fixed or portable structures or facilities planned for the operation. Show locations on the map. Include such things as living quarters, storage sheds, mill buildings, thickener tanks, fuel storage, powder magazines, pipelines, water diversions, trailers, sanitation facilities including sewage disposal, etc. Include engineering design and geotechnical information for Proposed Project facilities, justification and calculations for sizing of tanks, pipelines and water diversions, etc.

There are no new structures proposed to be constructed onsite. The existing or new primary crusher would be moved to a pad on the top of completed overburden storage areas approximately 1,000 feet south of its present location to facilitate the southward expansion of the Sentinel Quarry. Alternatively, the existing stationary crusher may be replaced with a mobile crushing/screening system. The onsite structures and facilities currently include the following:

- Truck dump hopper and vibrating feeder
- Primary screen
- Jaw crusher
- Belt conveyors and radial stacker
- One 40' van trailer and one 50' railroad boxcar containing electrical switchgear, spare parts, tools, and lunchroom
- Two metal buildings
- Portable toilets
- One 10,000 gallon diesel fuel tank (double-walled) for mobile equipment
- One 10,000 gallon skid mounted non-potable water tank

Geotechnical assessment prepared by CHJ for the slope stability is included in Appendix 8.
Sewage disposal is handled by portable sanitation facilities.

V. ENVIRONMENTAL PROTECTION MEASURES (SEE 36 CFR 228.8)

A. **Air Quality.** Describe measures proposed to minimize impacts on air quality such as obtaining a burning permit for slash disposal or dust abatement on roads.

The existing crusher plant has approved permits to operate from the Mojave Desert Air Quality Management District (MDAQMD). (See Appendix 3A for current permits.) The permits outline specific conditions which must be met to maintain air quality standards and limits on daily and hourly production rates. Existing dust controls in the crusher and quarry area include a bag house and foam/fog sprays at the crusher and the use of magnesium chloride and water for dust suppression on haul roads, quarry roads and ramps. The bag house removes >95-98% of the PM_{10} emissions. Monitoring requirements are also outlined.

Haul trucks and diesel equipment meet requirements of the California Air Resources Board's off-road diesel vehicles regulations to reduce diesel pollutants. Operations are required to comply with MDAQMD Rules 401 (limiting visible emissions from exhaust); 402 (avoid nuisance emissions); 403 prohibits visible dust from crossing property lines); and 403.2 (requires requirements for controlling fugitive dust). An air quality assessment will be conducted as part of the EIR/EIS.

B. **Water Quality.** State how applicable state and federal water quality standards will be met. Describe measures or management practices to be used to minimize water quality impacts and meet applicable standards.

1. State whether water is to be used in the operation, and describe the quantity, source, methods and design of diversions, storage, use, disposal, and treatment facilities. Include assumptions for sizing water conveyance or storage facilities.

2. Describe methods to control erosion and surface water runoff from all disturbed areas, including waste and tailings dumps.

3. Describe proposed surface water and groundwater quality monitoring, if required, to demonstrate compliance with federal or state water quality standards.

4. Describe the measures to be used to minimize potential water quality impacts during seasonal closures, or for a temporary cessation of operations.

5. If land application is proposed for waste water disposal, the location and operation of the land application system must be described. Also describe how vegetation, soil, and surface and groundwater quality will be protected if land application is used.

1. No processing chemicals are used and no wastewater is produced from the mining and crushing operations. Water is used for dust suppression at the quarries, overburden placement areas, haul roads, and primary crusher site. Water is also used for irrigation at reclamation sites. The only increase in water use will be to maintain adequate dust control. In the past years, approximately 1.3 acre-feet per year were used for the project area. With increased production and area, water usage is expected to double to about 3 acre-feet/year.

   Water used to control dust is obtained from two previously permitted sources, a well located at the plant site in Lucerne Valley, and a well located in Crystal Creek Canyon near Turn 5 on the Crystal Creek Haul Road. No surface water is used in the operation. There are no planned additional diversions or storage for water supply. No treatment facilities will be needed. Water will be hauled in a water truck and sprayed on the haul roads and active mining and overburden areas to minimize fugitive dust. The water truck will work during active quarry operations as needed to control visible dust. This water will evaporate and therefore, the project will not produce any run-off to surface waters or recharge of groundwaters.

   It should be noted that the use of magnesium chloride for dust suppression one to three times per year depending on the seasonal rainfall and mine production, has greatly reduced water use. Prior to using magnesium chloride, water use for dust suppression was more than double the present consumption and was less effective.

Both existing wells are permitted by the State of California Water Resources Control Board, and County of San Bernardino Department of Environmental Health Services (Permit #06259026). The plant well has been assigned recordation number 36011 by the California State Water Resources Control Board (see Appendix 4).

The Mojave Water Agency (MWA) is a State Water Project contractor, a regional groundwater management agency, and serves as Watermaster for the adjudicated Mojave Basin in which Omya's wells are located. Omya has a verified base annual production allocation of 23 acre-feet (af)/year for its two wells and water production over the past 5 years (2007 through 2011) has been 19, 14, 14, 14, and 14 af/year, respectively (18th Annual Report, MWA 2012). The expected increase of water usage for the Proposed Project of 1.5 af/year will not exceed Omya's base allocation even during its higher production year in 2007 of 19 af/year.

2. Methods to control erosion are discussed in Section 1.5.

3 & 4. Omya has a storm water discharge plan which has been approved by the California State Water Resources Control Board, and will continue to have one until mining ceases. The storm water plan permits include: specific prohibitions, effluent limitations, storm water pollution prevention plans, including source identification, practices to reduce pollutants, assessment of pollutant sources, materials inventory, preventative maintenance program, spill prevention and response procedures, general storm water management practices, training, record keeping, sampling procedures and monitoring program.

All operations on-site comply with a National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges associated with industrial activities and employ storm water Best Management Practices (BMPs) during construction, operations, and temporary cessation of operations. NPDES goals are to eliminate unauthorized non-storm water discharges and to monitor storm water discharges requirements. Any surface water monitoring would be through this requirement as needed. See Appendix 10 for the cover sheet of Omya's current SWPPP.

5. Not applicable.

C. **Solid Wastes.** Describe the quantity and the physical and chemical characteristics of solid waste produced by the operation. Describe how the wastes will be disposed of including location and design of facilities, or treated so as to minimize adverse impacts.

No solid waste will be produced by the operations. Waste rock, defined as limestone and other rock not suitable for the manufacture of Omya produced limestone products, will be stockpiled within the planned stockpile areas or backfilled within the quarries' footprint to reduce the size of offsite stockpiles, thereby reducing surface disturbance and potential habitat and visual impacts. Reclamation of the waste rock stockpiles will include slope grading and revegetation.

D. **Scenic Values.** Describe protection of scenic values such as screening, slash disposal, or timely reclamation.

The quarries and overburden expansions will be designed to reduce exposure and phased to limit exposed areas and to aid in concurrent reclamation. Waste rock will be deposited within the quarries as feasible and both the Butterfield Quarry and the Sentinel Quarry will be excavated below ridgeline. Reclamation and revegetation will be implemented concurrent with mining including use of dark material as available and permeon (colorization as feasible), and reducing form lines where equipment accessible to reduce visual impacts. The development of internal waste rock stockpiles within quarries will reduce the area of disturbance outside the quarries and existing overburden stockpiles, reducing potential new visual impacts of the waste rock piles.

The Proposed Project site lies within the northern boundaries of the SBNF within the Desert Rim Place. The existing views of the project area are currently affected by two existing limestone mines (Claudia and Cloudy mines), the existing Butterfield and Sentinel Quarries, and associated overburden stockpiles. The Proposed Project is the expansion of those existing quarries and stockpiles utilizing the existing processing equipment and haul road for site access over a 40-year period through the year 2055. Two inactive limestone mines, Claudia and Cloudy, are located to the south of the Proposed Project, connected by haul roads. These closed quarries are undergoing revegetation monitoring and remediation. The connecting haul roads will also be reclaimed in the near future. Therefore, the Proposed Project will not introduce a new use or create a substantial new alteration to the landscape of the area.

The project area is and will be visible only from elevated areas to the south and southeast within the SBNF based on topographic mapping. The forest use areas that would be able to view the site include potions of Holcomb Valley (private land not accessible to the public), the Pacific Crest Trail, Castle Rocks, and the top of Snow Summit. The distances from the project site to the latter two viewpoints are over 7 miles and at these distances, the Proposed Project is a minimal alteration to the overall view. From more distant ridgelines such as Onyx Summit, one may be able to see the site, but when placed into the context of a panoramic viewshed from these various distant viewpoints, the existing and future mine occupies a very small portion of the viewshed with respect to the overall view and becomes nearly indiscernible.

The project will not be visible from any developed/ populated areas surrounding Big Bear Lake (and from the lake itself) including Fawnskin, the City of Big Bear Lake, and Big Bear City due to the intervening ridges located north of the lake and the relatively lower elevations of the lake itself. The existing and proposed mine expansion are located on the south side of the range crest and are not visible from Lucerne Valley.

Visual resources including project design measures to reduce impacts are discussed in Section 2.2 of this Amended Plan and potential impacts to scenic values will be assessed in the EIR/EIS.

E. **Fish and Wildlife.** Describe measures to maintain and protect fisheries and wildlife, and their habitat (includes threatened, endangered, and sensitive species) affected by the operations.

Several botanical surveys by both SBNF and Omya contracted botanists have been conducted in the expansion areas during the past years and have identified populations of Cushenbury oxytheca, a federally listed endangered plant onsite and to the west and south of the Butterfield Quarry. No populations of listed plant species are present at the Sentinel Quarry area expansion. No occurrences of the other four listed carbonate endemic plant species have been recorded on or adjacent to the site. In consultation with the SBNF, Omya has provided the SBNF a mitigation land proposal consistent with the CHMS that would permanently relinquish 300 acres of unpatented claims for carbonate plant mitigation (see Appendix 11A).

Wildlife surveys completed during the last 30 years in the project area have not noted any animals which are listed or proposed for listing as threatened or endangered by either Federal or State agencies. Special status species including Nelsons Bighorn sheep, Golden eagle, California spotted owl, and Grey vireo are known to occur in the general area. Based on available information, Big horn sheep are known to occur in the Sentinel Quarry area and the proposed Plan is not expected to adversely impact the sheep. The quarry benching and reclamation are expected to create favorable bighorn sheep habitat.

Omya has cooperated with and participated in several projects which yield additional information or are believed to enhance the habitat of the Bighorn sheep. Omya's participation will continue for the life of this Plan. These projects include providing: funds to the Bighorn Sheep Society for construction of drinkers; information on bighorn sightings, population migrations, and census; site access for capture, tagging, drinker installation and setup of a motion detection camera project at the north end of Sentinel Quarry.

No adverse impacts to any threatened, endangered, or sensitive species have been identified and none are expected as a result of the Proposed Project.

The environmental document will assess potential plant and wildlife impacts from the Amended Plan and recommend mitigation measures as needed.

F. **Cultural Resources.** Describe measures for protecting known historic and archeological values, or new sites in the Proposed Project area.

Cultural resource surveys were conducted by the SBNF (see Appendix 9) and the environmental document will assess potential impacts and recommend mitigation measures if needed. No cultural sites have been identified within or adjacent to the proposed Butterfield or Sentinel expansion areas.

G. **Hazardous Substances.**

1. Identify the type and volume of all hazardous materials and toxic substances which will be used or generated in the operations including cyanide, solvents, petroleum products, mill, process and laboratory reagents.

No hazardous materials will be used or generated in the proposed operations except for the use of diesel fuel and lubricants for the primary crusher and mine equipment. Best Management Practices (BMPs) are applied during re-fueling and maintenance of the mine equipment which will be undertaken by mobile maintenance trucks and fuel trucks. The equipment will typically be moved to the main plant area in Lucerne Valley for scheduled maintenance or repairs. Minor or emergency repairs may be conducted at the quarry. A 10,000 gallon double-walled diesel fuel tank with dispenser is located onsite.

2. For each material or substance, describe the methods, volume, and frequency of transport (include type of containers and vehicles), procedures for use of materials or substances, methods, volume, and containers for disposal of materials and substances, security (fencing), identification (signing/labeling), or other special operations requirements necessary to conduct the proposed operations.

   Diesel fuel and lubricants will be transported to the site by maintenance and fuel trucks that will be in compliance with applicable federal, state and local regulations related to the transport and transferring of fuels.

3. Describe the measures to be taken for release of a reportable quantity of a hazardous material or the release of a toxic substance. This includes plans for spill prevention, containment, notification, and cleanup.

The Hazardous Materials Division of the San Bernardino County Fire Department is designated as the Certified Unified Program Agency or "CUPA" for the County of San Bernardino in order to focus the management of specific environmental programs at the local government level. Omya will update its current Business Emergency/ Contingency Plan to include any changes in operations as needed. The Business Plan includes a hazardous materials inventory and Spill Prevention Control and Countermeasure Plan (SPCC). The cover sheets of these plans are included in Appendix 13.

H. **Reclamation.** Describe the annual and final reclamation standards based on the anticipated schedule for construction, operations, and Project closure. Include such items as the removal of structures and facilities including bridges and culverts, a revegetation plan, permanent containment of mine tailings, waste, or sludge which pose a threat of a release into the environment, closing ponds and eliminating standing water, a final surface shaping plan, and post operations monitoring and maintenance plans.

Reclamation and revegetation are discussed in detail in Sections 2.5 and 2.6 for this Amended Plan for Butterfield and Sentinel Quarries. Omya's "Revegetation Plan: Mining Operations on USDA Forest Service Land San Bernardino National Forest" was approved by the SBNF and San Bernardino County in November 1996 and is included in Appendix 5. There are no changes to the overall reclamation and revegetation plan, only site specific reclamation for the expansion areas and the timing are changed due the increased life of the quarries.

VI. FOREST SERVICE EVALUATION OF PLAN OF OPERATIONS

A. Required changes/modifications/special mitigation for plan of operations:

B. **Bond.** Reclamation of all disturbances connected with this plan of operations is covered by Reclamation Performance Bond No. , dated *(mm/dd/yy)* , signed by (Principal) and (Surety), for the penal sum of . This Reclamation Performance Bond is a guarantee of faithful performance with the terms and conditions listed below, and with the reclamation requirements agreed upon in the plan of operations. This Reclamation Performance Bond also extends to and includes any unauthorized activities conducted in connection with this operation.

The bond amount for this Reclamation Performance Bond was based on the SMARA bond calculation worksheet and approved by the County and the State of California Dept. of Conservation, Office of Mine Reclamation (OMR). The bond amount may be adjusted during the term of this proposed plan of operations in response to changes in the operations or to changes in the economy. Both the Reclamation Performance Bond and the bond calculation worksheet are attached to and made part of this plan of operations.

Acceptable bond securities (subject to change) include:

1. Negotiable Treasury bills and notes which are unconditionally guaranteed as to both principle and interest in an amount equal at their par value to the penal sum of the bond; or

2. Certified or cashier's check, bank draft, Post Office money order, cash, assigned certificate of deposit, assigned savings account, blanket bond, or an irrevocable letter of credit equal to the penal sum of the bond.

VII. TERMS AND CONDITIONS

A. If a bond is required, it must be furnished before approval of the plan of operations.

B. Information provided with this plan marked confidential will be treated in accordance with the agency's laws, rules, and regulations.

C. Approval of this plan does not constitute certification of ownership to any person named herein and/or recognition of the validity of any mining claim named herein.

D. Approval of this plan does not relieve me of my responsibility to comply with other applicable state or federal laws, rules, or regulations.

E. If previously undiscovered cultural resources (historic or prehistoric objects, artifacts, or sites) are exposed as a result of operations, those operations will not proceed until notification is received from the Authorized Officer that provisions for mitigating unforeseen impacts as required by 36 CFR 228.4(e) and 36 CFR 800 have been complied with.

F. This plan of operations has been approved for a period of or until *(mm/dd/yy)* . A new or revised plan must be submitted in accordance with 36 CFR part 228, subpart A, if operations are to be continued after that time period.

VIII. OPERATING PLAN ACCEPTANCE

☐I/☐We have reviewed and agreed to comply with all conditions in this plan of operations including the required changes, modifications, special mitigation, and reclamation requirements.

☐I/☐We understand that the bond will not be released until the Authorized Officer in charge gives written approval.

☐Operator (or ☐Authorized Representative)	(Date) *(mm/dd/yy)*

IX. OPERATING PLAN APPROVAL

(Name)	(Title)
(Authorized Officer)	(Date) *(mm/dd/yy)*

"According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB number. The valid OMB number for this information collection is 0596-0022. The time required to complete this information collection is estimated to average 8 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information."

OMYA CALIFORNIA
AMENDED PLAN OF OPERATIONS AND RECLAMATION PLAN FOR THE BUTTERFIELD AND SENTINEL QUARRIES

1.0 MINE PLAN

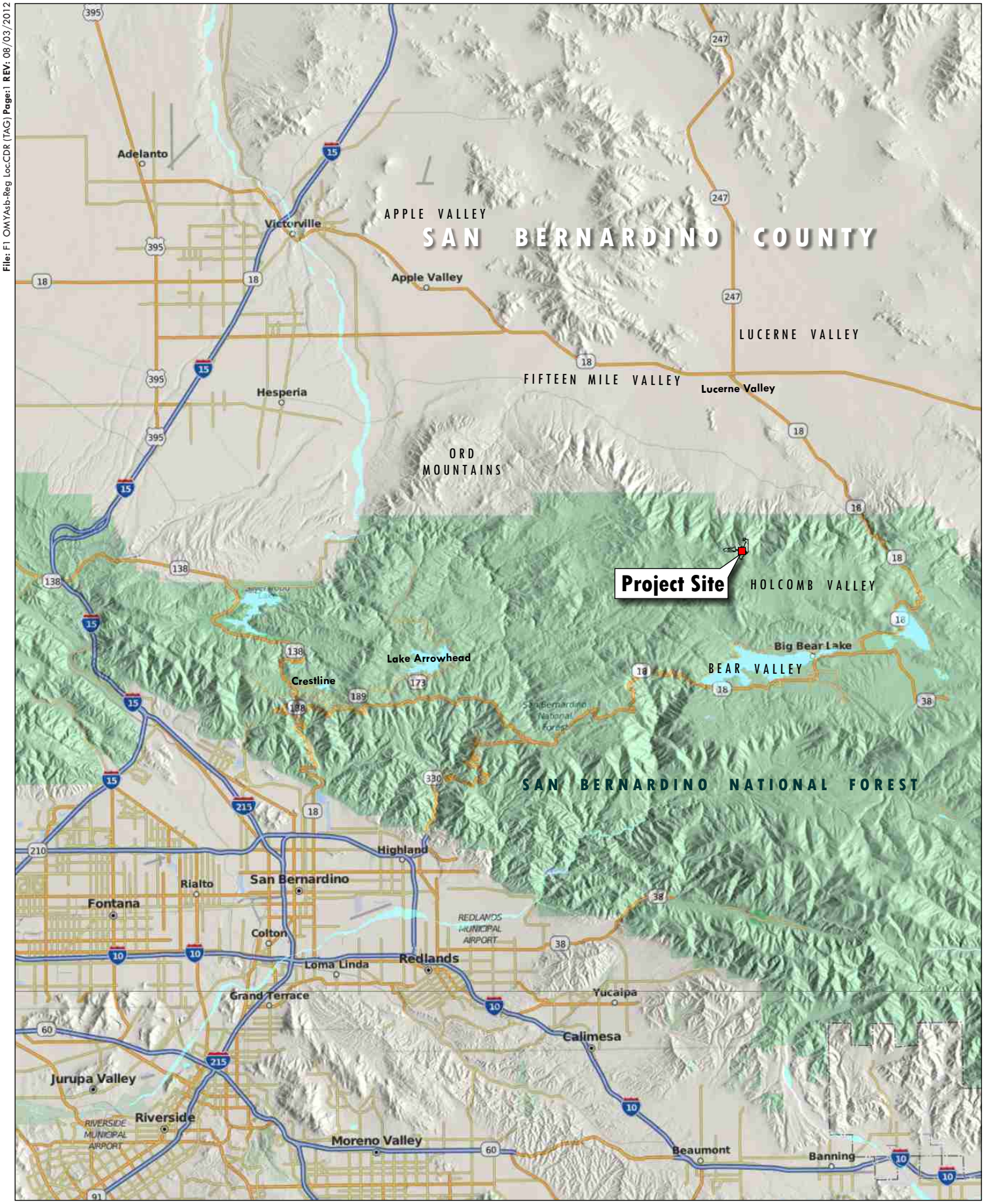
Introduction

Omya is submitting to the San Bernardino National Forest (SBNF) and San Bernardino County (County), an Amended Plan of Operations, a CUP and Reclamation Plan for the proposed expansion of the existing Butterfield and Sentinel Limestone Quarries. The project site is located approximately 7.5 miles south of the community of Lucerne Valley and 5 miles north of Big Bear Lake within the SBNF in San Bernardino County, California (see Figures 1 and 2). The project area is within portions of Sections 23, 24, and 25 Township 3 North, Range 1 West, SBBM. This Amended Plan combines the existing and permitted mining activities with the Proposed Project expansion. Because these two quarries are adjacent to each other and utilize the same crushing plant and share overburden stockpiles and haul and access roads, the operations and reclamation for these two sites are being combined into one amended Plan of Operations and Reclamation Plan. The Proposed Project includes quarry and overburden expansions, increased operational years and production, additional haul road area, and minor adjustments to existing disturbance and permitted boundaries. The total existing permitted operational area is approximately 137.5 acres. This amended Plan will add approximately 77.3 acres for a total project area of approximately 214.8 acres (refer to Table ES1).

The Butterfield and Sentinel Quarries are located entirely within portions of approximately 954 acres of unpatented placer claims controlled by Omya Inc. located on public land administered by the SBNF. These claims include Crystal Creek 1, 2, 4, 13 and 14, Slope North and King 3 (see Figure 3 and Sheet 1). Permitting will require compliance with both United States Forest Service Minerals Regulations under the jurisdiction of the SBNF (36 CFR 228, Subpart A) and the California Surface Mining and Reclamation Act (SMARA) implemented by the County (Development Code, Chapter 88.03). Therefore, in consultation with both the SBNF and the County, Omya is submitting an Amended Plan of Operations for Mining Activities on National Forest System Lands, and a CUP and an Amended Reclamation Plan to the County. The application forms and text are combined in this document with attached mine and reclamation plan sheets and cross-sections.

Obtaining the necessary SBNF and County approvals will require compliance with both the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA) and a joint Environmental Impact Report/Environmental Impact Statement (EIR/EIS) will be prepared.

File: F1 OMYAsb-Reg LocCDR (TAG) Page:1 REV: 08/03/2012



0 5.25
Mile
Source: World Topo Map, 2012

LILBURN CORPORATION

LEGEND

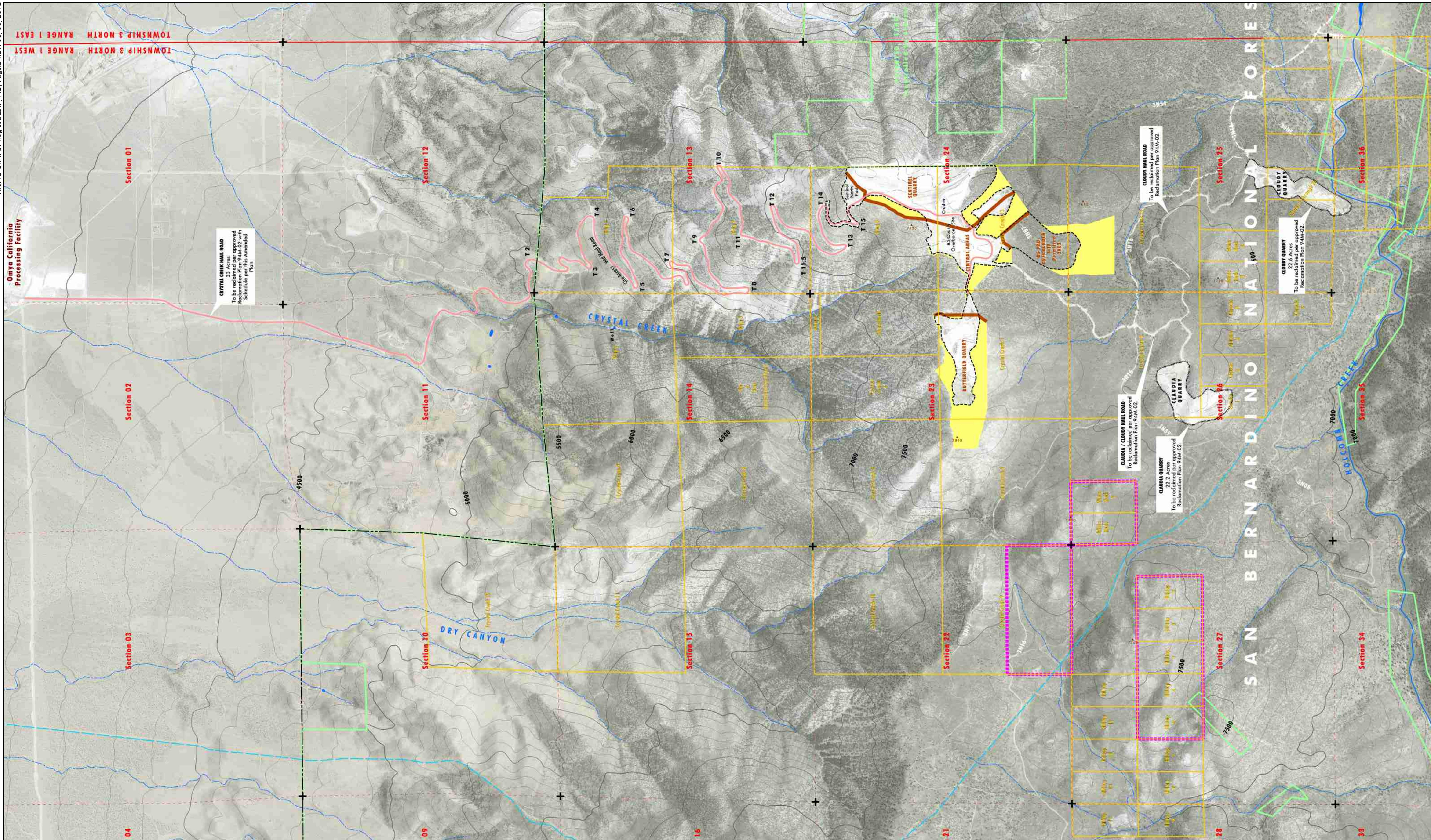
- **Project Site Location** (Geographic Location)
  California Zone 5 (FIPS 405): 6881064.78 1943854.58
  Lat/Lon: 34° 19' 45.0165" N, 116° 56' 31.3945" W

REGIONAL LOCATION

BUTTERFIELD and SENTINEL QUARRIES
Amended Plan of Operations and Reclamation Plan
Omya California, San Bernardino National Forest, California

FIGURE 1

File: F2 OMYAsb-Reg Loc.CDR (TAG) Page:2 REV: 08/03/2012



LEGEND

- Existing Operating Area
- Amended Operations
- Claims
- T 12 Crystal Creek Turn-out
- Proposed Carbonate Mitigation
- Patented land Owned by Others
- Major Contour
- Minor Contour
- 7500 Peak or Ridgeline Elevation
- SBNFS Boundary
- USGS Township
- USGS Section
- Streams
- Drainage
- Water Body
- Pipeline (not a part of project)

0 1800
FEET

Source: LILBURN CORP., 2012

LILBURN CORPORATION

PROJECT VICINITY

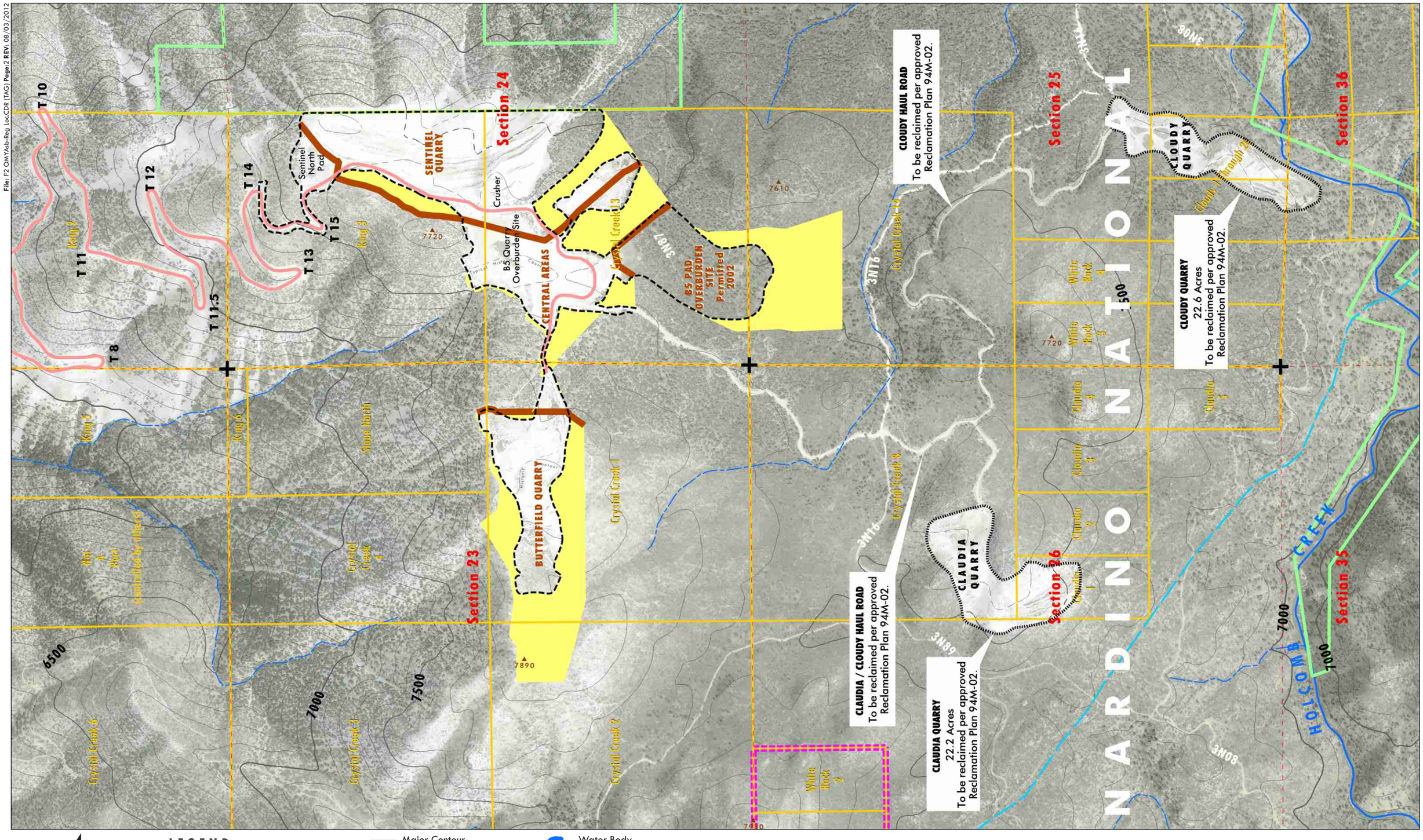
BUTTERFIELD and SENTINEL QUARRIES

Amended Plan of Operations and Reclamation Plan

Omya California, San Bernardino National Forest, California

FIGURE 2

File: F2 OMYAsb-Reg Loc.CDR (TAG) Page:2 REV: 08/03/2012



0 900
FEET
Source: LILBURN CORP., 2012
LILBURN CORPORATION

LEGEND

- Existing Operating Area
- Amended Operations
- Claims
- T 12 Crystal Creek Turn-out
- Proposed Carbonate Mitigation
- Patented land Owned by Others
- Major Contour
- Minor Contour
- 7500 Peak or Ridgeline Elevation
- SBNFS Boundary
- USGS Township
- USGS Section
- Streams
- Drainage
- Water Body
- Pipeline (not a part of project)

EXISTING QUARRIES and PLANNED OPERATIONS

BUTTERFIELD and SENTINEL QUARRIES
Amended Plan of Operations and Reclamation Plan
Omya California, San Bernardino National Forest, California

FIGURE 3

Existing Approved Plan of Operations and Reclamation Plan

The Forest Service approved the previous Omya Umbrella Plan of Operations and Reclamation Plan on January 11, 1988 which included the Sentinel, Butterfield, Cloudy, and Claudia quarries and associated haul roads. The existing SMARA 2003 Plan of Operations and Reclamation Plan was approved by the Forest Service, and was approved by the SMARA lead agency, San Bernardino County in 1994. The site is designated with CA Mine ID# 91-36-0052.

Omya received approval of the Sentinel Quarry Area Expansion Plan of Operations and Reclamation Plan from the Forest Service and County in 2002/2003. This approved Plan of Operations and Reclamation Plan includes mining and reclamation of the current Sentinel and Butterfield Quarries. All other aspects of the Omya operations on SBNF lands including the reclamation of other quarries, overburden sites, and haul roads are covered in the approved plans and are not changed or further discussed in this document with the exception of extending the years of use of the Crystal Creek Haul Road by 10 years from 2046 to 2055 followed by 10 years of reclamation.

Proposed Amended Plan of Operations and Reclamation Plan

(Please refer to Figure 4 and Sheet 2.) The Sentinel Quarry is currently permitted to operate through the year 2035 and the Butterfield Quarry through 2015. Known limestone resources will accommodate an increase to approximately 27 million tons of ore to the plant for a proposed additional 40 years of operations for Butterfield (2016 through 2055) and a proposed additional 20 years for the Sentinel Quarry (2036 through 2055). Depending on market demand, the combined Butterfield/Sentinel Quarries average ore production rates will increase to approximately 680,000 tons of ore to the plant per year compared to the existing approved plans of an average of 450,000 tons of ore to the plant per year.

The Butterfield Quarry proposed expansion consists of 28.6 acres and includes expansion of the existing quarry approximately 900 feet to the west and about 200 feet south and north, incorporating those areas previously defined as Butterfield 2, Butterfield 3, and the previously mined and reclaimed Butterfield 4 and the partial filling of the quarry with overburden. These areas will all be included into the overall Butterfield Quarry footprint for a total disturbance area of approximately 50.4 acres.

The Sentinel Quarry Area revisions consist of an additional 48.7 acres of disturbance and include expansion of the quarry (10.8 acres), the B5 Pad (22.7 acres), and the Central Area with overburden fill pads, growth media storage, and additional haul road areas (15.2 acres). These areas will all be included into the overall Sentinel Quarry Area footprint for a total disturbance area of approximately 164.4 acres.

These changes allow for substantial optimization of the quarry's operational activities. This Amended Plan will add approximately 77.3 acres for a total project area of approximately 214.8 acres.

File: F2 OMYAsb-Amended Mine Plan.CDR (TAG) Page:1 REV: 08/03/2012

CRYSTAL CREEK HAUL ROAD
To be reinstated per approved Reclamation Plan VAM-02 with Schedule per this Amended Plan

1 Sentinel North Pad (previously revegetated)
Big Horn Sheep Corridor

SAN BERNARDINO NATIONAL FOREST

B 4

F 4

D5 4 Typical Haul Quarry Road

C 4

SENTINEL QUARRY
2

D1 4 Typical Quarry Design (Maximum 1:1 Slopes)

Floor Elevation 7,000 Feet AMSL

PATENTED LAND (owned by others)

D3 4 Typical Boulder Rolldown Prevention Berm

E 4

D 4

D2 4 Typical Quarry Design (Maximum 1:1 Slopes)

A 4

BUTTERFIELD QUARRY
5

West Floor Elevation 7,700 Feet AMSL

East Floor Elevation 7,825 Feet AMSL

Material/Growth Media Storage Area

Quarry Road

B5 Quarry Overburden Site
Maximum Height 7,725 Feet AMSL

CENTRAL AREA
3

Material/Growth Media Storage Area

Cut/Fill Pad for Ancillary Facilities

Material/Growth Media Storage Area

Cut/Fill Pad for Ancillary Facilities

Cloudy / Claudia Haul Road

Typical B5 Pad Sediment Control Development D4 4

23 24 26 25 USGS Section Corner

4
B5 PAD
Maximum Height 7,700 Feet AMSL

SAN BERNARDINO NATIONAL FOREST

MINE PLAN NOTES

1. Name:
Butterfield and Sentinel Quarries

2. Mineral Mined:
Limestone

3. Mine Operator:
Omya California
7225 Crystal Creek Road
Lucerne Valley, CA 92356
Peter Sutherland, Plant Manager
(760) 248-5233

4. Land Owner:
Unpatented Claims leased by Omya on Federal lands under jurisdiction of:
USDA Forest Service
San Bernardino National Forest
602 S. Tippecanoe Avenue
San Bernardino, CA 92408
909-382-2898

5. Applicant:
Same as (3)

6. Representative:
Lilburn Corporation
1905 Business Center Drive
San Bernardino, CA 92408
(909) 890-1818

7. Owner of Mineral Rights:
Omya California leases the following claims from:
Floyd Butterfield (Crystal Creek claims)
c/o Martha Spalding
934 Oaos Way
Paso Robles, CA 93447

Sentinel Mining Co. (King and Slope North claims)
P.O. Box 6141
San Bernardino, CA 92412

Claim Name	Area (approx. acres)	Section	Township	Range
Crystal Creek 1	160 acres	23	3N	1W
Crystal Creek 2	160 acres	23	3N	1W
Crystal Creek 13	160 acres	24	3N	1W
Crystal Creek 14	160 acres	25	3N	1W
King 3	160 acres	24	3N	1W
Crystal Creek 4	80 acres	23	3N	1W
Slope North	74 acres	23	3N	1W

8. Geologists:
CHJ Consultants
1355 E. Cooley Drive, Suite C
Colton, CA 92324
(909) 824-7311

9. Map Preparers:
Omya California
Lilburn Corporation

10. Source of Existing Topography:
Digital Mapping, Inc. June 2008; USGS

11. Date of Map Preparation:
July 2012

12. Assessor's Parcel Numbers:
Portions of 446-121-004, 006, and 17
Portions of Sections 23, 24, and 25, T3N, R1W, SBBM.
For Claim Numbers See Table Above.

13. Utilities:
Electricity: SCE
Gas: Not applicable
Water: Omya well system
Sewer: Portable sanitation stations
Telephone: Cellular

14. Area To Be Disturbed:
77.3 acres per this Amendment
Area To Be Reclaimed:
214.8 acres total with this Amendment and prior approvals

15. Reclaimed End Uses:
Open space habitat for native wildlife and plants

16. County Land Use District:
Resource Conservation (RC)

17. Plant and Tree Protection:
No protected or endangered trees exist onsite. Specific plant and tree species including pinyon pine, juniper, white fir, Jeffrey pine and canyon live oak will be managed per SBNF requirements and County Native Plant Protection policy.

18. Plant Protection:
Carbonate plants mitigated per CHMS and USFS.

EXISTING and PLANNED OPERATIONAL AREAS
Butterfield and Sentinel Quarries

	Quarry or Area	Existing Approved Areas (acres)	Proposed New Areas (acres)	Total New Project Areas (acres)
1	Sentinel North Pad (inactive)	4.5	0	4.5
2	Sentinel Quarry	59.6	10.8	70.3
3	Central Area	28.3	15.2	43.5
4	Butterfield 5 Overburden Pad	23.4	22.7	46.1
5	Butterfield Quarry	21.8	28.6	50.4
	TOTALS	137.5	77.3	214.8

Note: Areas rounded to nearest tenth of an acre. Totals may be slightly different due to rounding.

LEGEND

- Amended Operations Limits of Disturbance
- Existing Permitted Operating Area
- Proposed Expansion
- Operating Major Contour
- Operating Minor Contour
- Haul Road
- Slope Indicator
  - Top of slope
  - Toe of slope
- Boulder Barrier
- RipRap
- Design Drainage
- Sump
- Storm Water Control Berm
- Existing Major Contour
- Existing Minor Contour
- Existing Drainages

N

0 550
FEET

Source: LILBURN CORP., 2012

LILBURN CORPORATION

AMENDED MINE PLAN

BUTTERFIELD and SENTINEL QUARRIES
Amended Plan of Operations and Reclamation Plan
Omya California, San Bernardino National Forest, California

OMYA **FIGURE 4**

In consultation with the SBNF, Omya has provided the SBNF a mitigation land proposal consistent with the CHMS that would relinquish 300 acres of unpatented claims for carbonate plant mitigation (see Appendix 11A).

Quarry and overburden stockpile development and expansion will be phased. Included in the phasing is concurrent quarry development and reclamation of equipment-accessible mined out portions of the quarries.

The quarries are multi-bench open pit mines. Several working levels are operated at any one time within both quarries to supply the quota of ore needed to meet production demands. The multi working level concept allows for greater selectivity and blending of rock qualities to meet stringent quality standards of customers, and allow maximum utilization of the resource. Five grades of ore are selectively mined. The ore is drilled and blasted, loaded into haul trucks and hauled to the crusher currently located just southwest of the Sentinel Quarry. Crushed ore is loaded into off-road haul trucks and transported eight miles on the vested Crystal Creek Haul Road to the existing processing plant in Lucerne Valley.

The Amended Plan proposes excavations to be developed in the Butterfield Quarry to a maximum depth of 7,650 feet above mean sea level (amsl) or approximately 200 feet below the quarry rim on the north and 75 feet deeper than currently permitted (see Figure 4). The Sentinel Quarry will be excavated to a maximum depth of 7,000 feet amsl or approximately 600 feet below the quarry rim on the north and west and approximately 150 deeper than currently permitted.

Once the final outer limit and bottom of the ore is reached, the quarries will be partly backfilled as the remainder of the quarries are mined out. The Plan allows for substantial backfill to be placed in the mined out portions of the quarries, and also allows for an efficient mining plan, minimum disturbance of new ground, phased incremental disturbance of new ground, and concurrent reclamation of the quarries and overburden stockpiles.

The previously approved SMARA reclamation plan includes a site specific approved reclamation and revegetation plan, including growth media salvage, organics placement, seeding and revegetation, seed collection and propagation, irrigation, site cleanup, public safety, rock and fill slope stability, drainage and erosion controls, monitoring and maintenance plan and bond release criteria. At the conclusion of excavations, ten years of active reclamation and revegetation will be implemented followed by monitoring and remediation until revegetation goals are achieved. No changes in the approved revegetation plan are proposed other than increased acres and timing.

Project Objectives

The phased mining, overburden development, and reclamation with cross-sections, slopes and contours are depicted on the attached Mine Reclamation Plan sheets. The amended Plan was developed with the following objectives:

1. To continue the mining and recovery of a unique high calcium limestone resource to supply the Lucerne Valley Plant for the production of a wide range of calcium carbonate products;
2. To minimize additional land disturbance through the expansion of contiguous existing quarries and minimal expansion of existing overburden stockpiles and haul roads;
3. To develop internal waste rock stockpiles within completed portions of the quarries to limit the area of disturbance outside the quarries to reduce impacts to sensitive plant habitat and viewshed;
4. To meet the SBNF regulations to cause no undue and unnecessary degradation;
5. To meet the State's and County's SMARA requirements;
6. To relinquish claims to mitigate for impacts to carbonate plants consistent with the Carbonate Habitat Management Strategy;
7. To minimize impacts to sensitive plants and wildlife including Bighorn sheep through quarry design and ongoing Bighorn sheep programs;
8. To reclaim the site for post-mining uses which will include open space habitat;
9. To contour mining features and revegetate disturbed areas to minimize aesthetic and erosion impacts; and
10. To reclaim and maintain the site as necessary to eliminate hazards to public safety.

Project Information Summary

Operator: Omya California - Peter Sutherland, Plant Manager
7225 Crystal Creek Road
Lucerne Valley, CA 92356

Representative: Lilburn Corporation
1905 Business Center Drive
San Bernardino, California 92408

Location: Approximately 7.5 miles south of the community of Lucerne Valley and 5 miles north of Big Bear Lake within the SBNF in San Bernardino County, CA. The project area is within portions of Sections 23, 24, and 25 Township 3 North, Range 1 West, SBBM

County General Plan Designation: Resource Conservation

Estimated Operating Life: 40 years from existing permit for Butterfield and 20 years from existing permit for Sentinel (January 1, 2016 through December 31, 2055)

Planned Production: Average combined Butterfield and Sentinel Quarries 680,000 tons/year of limestone ore hauled to plant; overburden or waste rock and crusher fines average of 807,500 tons/year.

Estimated Mining Termination Date: December 31, 2055

Estimated Reclamation Completion: December 31, 2065 for quarries and overburden stockpiles; December 31, 2075 for Crystal Creek Haul Road

Reclaimed End Use: Open space habitat with native vegetation

Project Need

Omya's Lucerne Valley Plant operations require high brightness, high purity limestone ore (calcium carbonate) of specific quantities and qualities to produce fine ground calcium carbonate for numerous consumer and industrial products discussed below. To meet current and future product demand, Omya requires reliable and economic resources of high quality limestone ore. This has been achieved through the development of three unique limestone deposits, the White Knob Quarry to the west of the plant, and the Butterfield and Sentinel quarries located to the south, and the subject of this Amendment. This Amended Plan will assure Omya that its Lucerne Valley Plant will have the raw limestone resources needed to not only continue producing existing products, but also to be able to respond to future product demand and to invest in future expansion of its plant as necessary to meet this future demand.

Calcium Carbonate (Limestone) Resources

Limestone is one of the fundamental building blocks of our society. Carbonate rocks are a major mineral commodity used in the construction, cement, metallurgical, chemical, paper, and plastics industries. Limestone is utilized in thousands of consumer products which are encountered every day.

Within the United States, productive deposits of white, high purity limestone are restricted to only a few areas. The San Bernardino Mountains and Lucerne Valley area of southern California is one of the major producing areas in North America. Existing limestone resources at the Butterfield and Sentinel quarries are adequate for over 40 years. The Butterfield and Sentinel limestone deposits are among the best whiting grade crystalline limestone deposits in the San Bernardino Mountains.

The Omya deposits are one of the few producing sources of high calcium limestone in the western United States that can be used as whiting. Whiting is used in the form of nontoxic fillers and extenders in a large number of products ranging from paper products to environmental cleanup, carpet backing, plastics, PVC, paint, paper, and other building products. Limestone mining provides numerous environmental benefits including fewer trees harvested for paper making, less petroleum products utilized, and less greenhouse gasses produced. Other environmental impacts may be reduced by utilizing limestone as a substitute for other components in industrial processes and the manufacture of consumer products.

Products Made from Limestone Mined by Omya

Some of the most common consumer products which are made from Omya limestone mined from the San Bernardino Mountains are shown on Table 1.

Table 1
Common Consumer Products
Made from Limestone Mined by Omya California

ENVIRONMENTAL	CONSTRUCTION	CONSUMER PRODUCTS	SOME OTHER USES
Water filtration	Dry wall mud	Crayons	Athletic field line marker
Acid water neutralization	Paint	Glue	Wire coating insulation
Acid sewage neutralization	Plastics	Fabrics	Carpet backing
Acid rain neutralization	Stucco	Polyester	Sugar refining
Air emission control	Roofing paper	Latex compounds	Vinyl floor covering
Acid soil treatment	Synthetic marble	Household cleanser	Linoleum floor covering
	Caulking compound	PVC pipe	Glass
	Tile grout	Shoe polish	Fiberglass
	Roofing shingles		
	Highway paint		

Economic Benefits

Long-term cumulative economic benefits of limestone mining along the north range front of the San Bernardino Mountains have added to the County economy for decades including tax payments and jobs. The limestone mining industry provides stable high paying jobs and professional careers for many people. The proposed Butterfield and Sentinel expansion will allow continued (up to 40 years) mining of the resource and provide long-term employment for many employees.

Omya helps support federal, State and local governments and schools through payment of property taxes, excise, fuel and other taxes for the long term. Omya supports local economies through direct purchases of equipment, materials, supplies, and services, and indirect turnover of these expenditures in the economy. Omya also supports local communities through charitable contributions, and employee involvement in various community affairs.

Land Holdings

Omya owns or leases several claim blocks in the immediate vicinity of the Butterfield and Sentinel Quarries (refer to Figure 3 and Sheet 1). Sentinel Quarry and facilities are located on the Sentinel King #3 Claim and the Crystal Creek #13 and #14 claims. Butterfield Quarry is located on the Slope North Claim and the Crystal Creek #1 #2, and #4 claims. Table 2 shows the claim holdings, including name, number of claims, location and owners of the claims.

Table 2
Omya Land Holdings – Butterfield & Sentinel Quarries

CLAIM BLOCK	NO. of CLAIMS/ TOTAL ACRES	LOCATION SECTION, T., R.	LEASED FROM
King Claims Slope North Claim	6 / 680 ac	Sections 13, 14, 23, 24 T3N, R1W, SBBM	Sentinel Mining Co. P.O. Box 6141 San Bernardino, CA 92412
Crystal Creek Claims	13 / 2000 ac	Sections 10, 14, 15, 22 – 26, T3N, R1W, SBBM	Floyd Butterfield c/o Martha Spalding 934 Osos Way Paso Robles, CA 93447

Mineral Resource Zoning

Omya has petitioned and received from the California Division of Mines and Geology (CDMG) Mineral Resource Zone 2 status (MRZ-2) for the limestone deposits on the Omya claims. Core drilling, detailed geologic mapping and assay data prove the deposits are significant mineral resources (MRZ-2) and exceeded the MRZ-2 criteria established by the California Department of Conservation Division of Mines and Geology (Joseph, 1984). Figure 5 shows the MRZ zoning of the Omya claim area.

The Butterfield and Sentinel Quarries limestone deposit is given MRZ-2 rating, which indicates it is recognized as a valuable proven mineral resource. MRZ-2 status is significant as it recognizes the significance and importance of mineral resources and mining in land use planning. For proven mineral resources, mining may be the best land use.

1.1 MINING OPERATIONS

History

Mining on the properties now controlled by Omya began by the Sentinel Mining Company during the late 1950s and has been, more or less, continuous since 1958. Mining of the Sentinel deposit began by La Habra Products during the early 1970's. The Crystal Creek Haul Road was started in 1958 and was extended to the top of the mountain at that time, and several quarries were developed to extract white limestone. The Sentinel Quarry was originally opened in 1970-1971.

The Crystal Creek mining claims were staked during the mid-1950s, and mining of the Butterfield deposit began by Pluess-Staufer (later renamed Omya) during the late 1970's. Omya acquired the mining and processing operation in 1976 introducing extensive geologic exploration and quarry development programs. Geologic mapping, sampling and core drilling continue to the present day, and have substantially increased limestone resources. The Butterfield and Sentinel resources are adequate to allow mining to continue until 2055 at present and projected rates of mining.

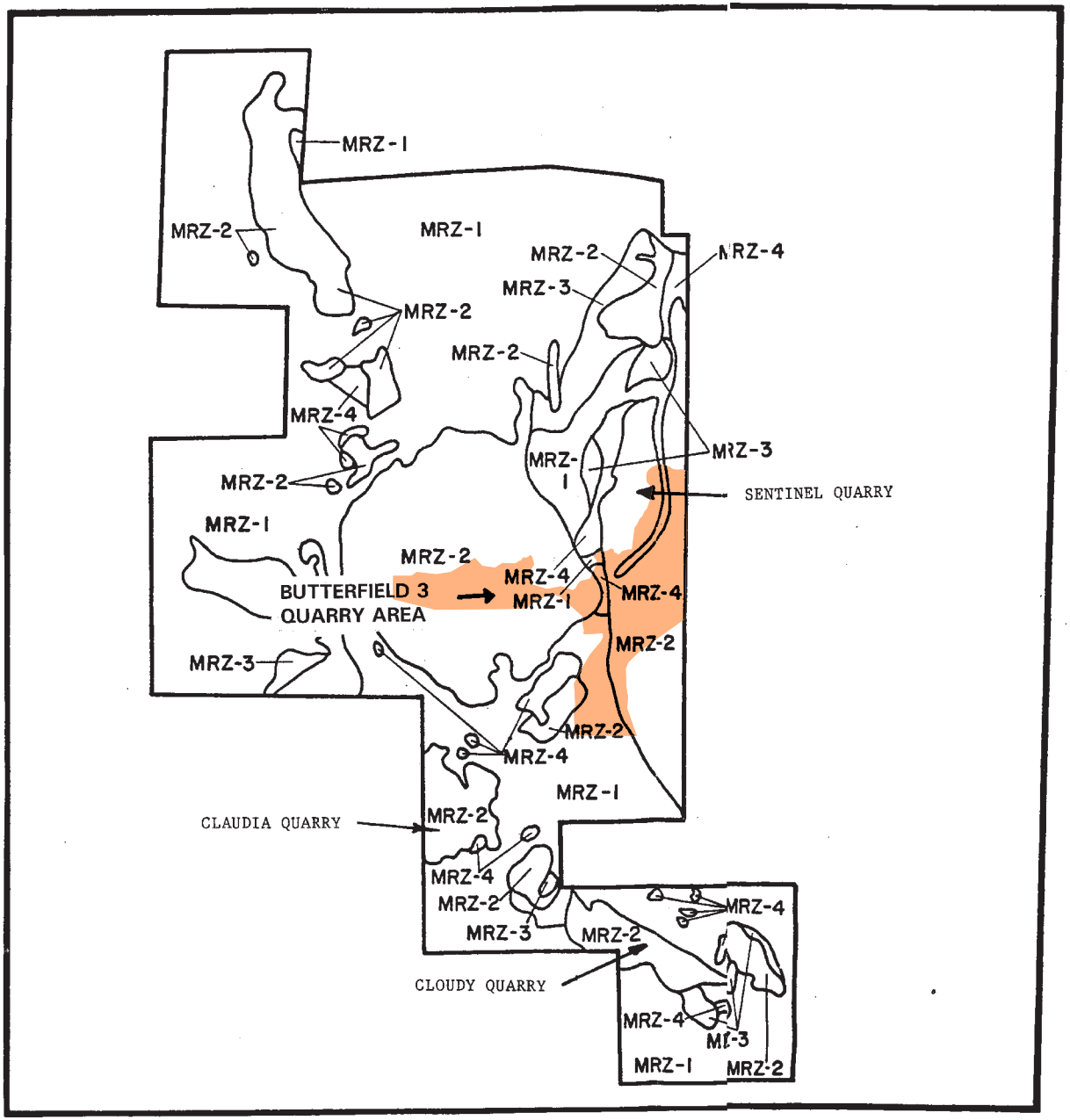


Figure 5.

MINERAL LAND CLASSIFICATION MAP
of
LANDS PETITIONED BY PLUESS-STAUFER, INC.
LIMESTONE RESOURCES ONLY
SAN BERNARDINO COUNTY
by Stephen E. Joseph
1984

OFR 84-21 LA
(PLATE 1A, REVISED 1984)

EXPLANATION

MINERAL RESOURCE ZONE BOUNDARIES

MRZ-1 Areas where adequate information indicates that no significant mineral deposits are present, or where it is judged that little likelihood exists for their presence.

MRZ-2 Areas where adequate information indicates that significant mineral deposits are present, or where it is judged that a high likelihood for their presence exists.

MRZ-3 Areas containing mineral deposits the significance of which cannot be evaluated from available data.

MRZ-4 Areas where available information is inadequate for assignment to any other MRZ zone.

PREPARED IN COMPLIANCE WITH THE SURFACE MINING AND RECLAMATION ACT OF 1975, ARTICLE 4, SECTION 2761

STATE GEOLOGIST

NORTH

SCALE (MILES)
0 .5 1

MINERAL LAND CLASSIFICATION

BUTTERFIELD and SENTINEL QUARRIES
Amended Plan of Operations and Reclamation Plan
Omya California, San Bernardino National Forest, California

FIGURE 5

LEGEND

Amended Plan of Operations

Existing and Planned Quarry Operations

Pre-Mining Activities of Undisturbed Lands

The following activities will be conducted prior to mining and overburden and waste rock stockpile development in order to limit disturbed areas to the mine plan boundaries and to facilitate ongoing and future reclamation and revegetation:

- Excavation and development limits will be located and marked in the field;
- Specified plants that can tolerate transplant will be salvaged to the degree possible and stored in a nursery and will be replanted on reclaimed land as areas become available for revegetation;
- To the degree possible, seeds of specified plants will be collected and either used for revegetation or stored appropriately for maximum future viability; and
- Salvageable soils and/or growth media will be placed in separate identified stockpiles for use as a seed bank and seedbed during reclamation. Soil stockpiles will be clearly marked and managed to limit wind and water erosion.

Quarry Operations

The Butterfield and Sentinel Quarries are multi bench open pit mines. Several working levels are operated at any one time at each quarry to supply the quota of ore needed to meet production demands. The multi working level concept allows for greater selectivity and blending of rock qualities to meet stringent quality standards of customers, and allows maximum utilization of the resource.

Five grades of ore are selectively mined from the quarries. The ore is drilled and blasted about once per week for each quarry, loaded into haul trucks and hauled to the crusher southwest of the Sentinel Quarry. Crushed ore is loaded into haul trucks and transported 8 miles on the vested Crystal Creek Haul Road to the existing Omya processing plant in Lucerne Valley.

The two quarries have been mined continuously by Omya since 1977. The Sentinel Quarry is permitted to operate through the year 2035 and the Butterfield Quarry through 2015. Known resources will accommodate an increase to approximately 27 million tons of ore to the plant for a proposed additional 40 years (2016 through 2055) of operations for Butterfield and a proposed additional 20 years for the Sentinel Quarry (2036 through 2055). Depending on market demand, average ore production rates will increase to approximately 680,000 tons of ore to the plant per year compared to the existing approved plans of an average of 450,000 tons of ore to the plant per year (see Table 3).

The Butterfield Quarry expansion consists of 28.6 acres and includes expansion of the existing quarry approximately 900 feet to the west and 200 feet to the north and south, incorporating those areas previously defined as Butterfield 2, Butterfield 3, and the previously mined and reclaimed Butterfield 4, and the partial filling of the quarry with overburden. These areas will all be included into the overall Butterfield Quarry footprint for a total disturbance area of approximately 50.4 acres and limestone resources of 7.6 million tons.

Table 3
Planned Production and Operational Areas
Butterfield and Sentinel Quarries

Quarry or Area	Area (acres)	Ore Limestone Resources (millions of tons)	Annual Average Excavated (tons)	Annual Average Production (ore to plant) (tons)	Annual Average Waste – including crusher fines[1] (tons)	Waste – including crusher fines[1] (millions of tons)	Max. Depth (feet)
Butterfield Quarry	50.4	7.6	356,500	162,500	194,000	7.8	200
Sentinel Quarry	70.3	24.4	1,131,000	517,500	613,500	24.5[2]	600
B5 Pad	46.1	---	---	---	---	---	---
Central Area	43.5	---	---	---	---	---	---
Sentinel North Pad (reclaimed)	4.5	---	---	---	---	---	---
Totals	**214.8**	**32**	**1,487,500**	**680,000**	**807,500**	**32.3[2]**	**---**

Notes:
Volumes are estimated based on drilling data and computer modeling.
Area rounded to nearest tenth of an acre. Totals may be slightly different due to rounding.
In-situ or in-place limestone rock weight to volume ratio estimated at 2 tons per cubic yard.
Waste rock (interburden and overburden) excavated will vary annually depending on area being excavated.
1 – Fines produced from primary onsite crushing estimated at 15% of ore crushed.
2 – Includes relocation of some existing waste rock to allow western and southern expansion of Sentinel Quarry.

The Sentinel Quarry revisions consist of an additional 59.6 acres of disturbance and include expansion of the quarry (10.8 acres), the B5 Pad (22.7 acres), and the Central Area with overburden fill pads, growth media storage, and additional haul road areas (15.2 acres). These areas will all be included into the overall Sentinel Quarry footprint for a total disturbance area of approximately 164.4 acres and limestone resources of 24.4 million tons. These changes allow for substantial optimization of the quarry's operational activities.

The quarries operate year round. Overburden removal and quarry development typically occur during winter months. Winter snowfall (mine elevations are 7,600 to 7,900 feet amsl) and ore production requirements are the major determining factor for scheduling of ore and waste mining phases.

Phased Future Quarry Development

Although mining is more or less continuous, the development of the quarries is linked to operational parameters and product demands. Estimated phasing is described in Table 4. Mining operations may experience unscheduled phasing changes due to various market/economic demands and variation in material quality since the natural deposit is not of uniform quality. The

SBNF and the County will be updated in the annual monitoring report on the status of operational phases.

Table 4
Butterfield and Sentinel Quarries
Phased Development Schedule

Phase No.	LOCATIONS	Years	Duration (years)	Cumulative Years
1	Sentinel Quarry – Mine approx. 200 feet into southwest expansion area and west into the B5 Quarry fill. Relocation of waste rock to overburden pads. Butterfield Quarry - Mine east half to approx. 7,750-foot elevation. Central Pads – Slope B5 Quarry fill with Sentinel Quarry pushback. Utilize overburden for road and pad fills. B5 Pad – Phased expansion with placement of material from quarries. Crusher - Put new crushing system into service when available.	2016-2025	10	1-10
2	Sentinel Quarry – Mine approx. 200 feet into southwest expansion area and initiate backfilling on north slope. Butterfield Quarry- Mine east half to approximate final quarry floor depth of 7,650 feet. Initiate mining in western half of quarry. Central Pads - Complete filling and sloping of old B5 Quarry area; initiate reclamation & revegetation. B5 Pad - Phased expansion with placement of material from quarries.	2026–2035	10	11 - 20
3	Sentinel Quarry – Mine approx. 200 feet into southwest expansion area; continue backfilling on north slopes. Butterfield Quarry- Complete eastern half to 7,650-foot depth. Continue mining in western half and initiate placement of overburden in completed east half. Central Pads - B5 Quarry fill completed; ongoing revegetation/monitoring/remediation as needed. B5 Pad - Phased expansion with placement of material from quarries.	2036-2045	10	21 -30
4	Sentinel Quarry – Mine approx. 200 feet into southwest expansion area; complete backfilling on north slopes and initiate slope reduction to 2H:1V. Butterfield Quarry - Complete mining on west half to 7,700 feet. Complete backfilling of eastern half to approximate original contour. Central Pad - B5 Quarry fill; Reclamation completed. B5 Pad - Stockpile completed; initiate reclamation and revegetation.	2046-2055	10	31 -40

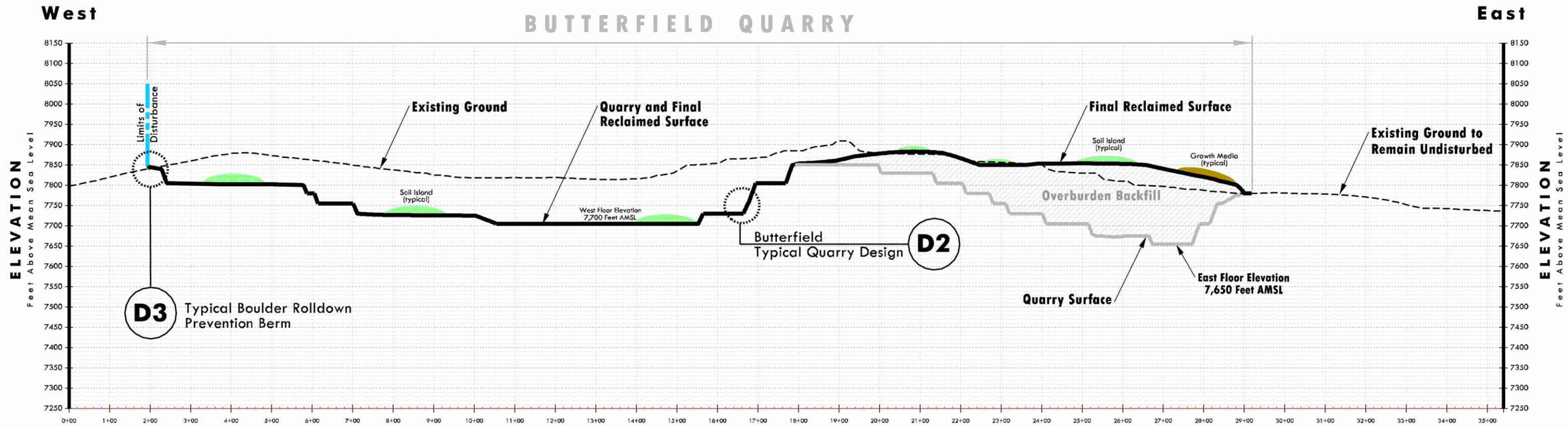
Phase No.	LOCATIONS	Years	Duration (years)	Cumulative Years
5	**Final Reclamation** Remove crusher and other plant equipment (within one year after completion of mining). Sentinel Quarry – Finish sloping of backfill to 2H:1V; revegetate per Plan; maintain erosion control; monitor revegetation progress; and conduct remediation as necessary until success criteria achieved. Butterfield Quarry- Finish sloping of quarry and backfill; revegetate; maintain erosion control; monitor revegetation progress; and conduct remediation as necessary until success criteria achieved. Central Pads - Finish sloping of backfill; revegetate; maintain erosion control; monitor revegetation progress; and conduct remediation as necessary until success criteria achieved. B5 Pad - Ongoing revegetation monitoring & remediation as needed. Crystal Creek Haul Road – Maintained for reclamation and monitoring access to Butterfield – Sentinel Quarries.	2056-2065	10	41-50
5A	Crystal Creek Haul Road – Reclaim per approved 1994 Reclamation Plan. Remove outside berm, place at toe of cut, install erosion controls, and revegetate (year 2066). Maintain erosion control; monitor revegetation progress; and conduct remediation as necessary years 2067 to 2075.	2066-2075	10	51-60

Notes: All elevations are above mean sea level (amsl).
Phasing and development of the quarries are dependent on operational parameters and product demand needs. Mining operations may experience unscheduled phasing changes due to various market/economic demands and variation in material quality since the natural deposit is not of uniform quality. The SBNF and the County will be updated in the annual monitoring report on the status of operational phases.

Butterfield Quarry

The Butterfield Quarry is generally mined in 25-foot cuts with a 25-foot horizontal safety bench every 50 vertical feet. Generally, bench width is ½ wall height. Face angle averages 70 degrees. Bench heights and widths will vary with deposit geometry and have been determined as a result of detailed studies of the geologic structure, over 30 years of mining experience at this specific mine site, and consultations with various experts including government and private sector (see Figure 6 for Butterfield Quarry Cross Sections).

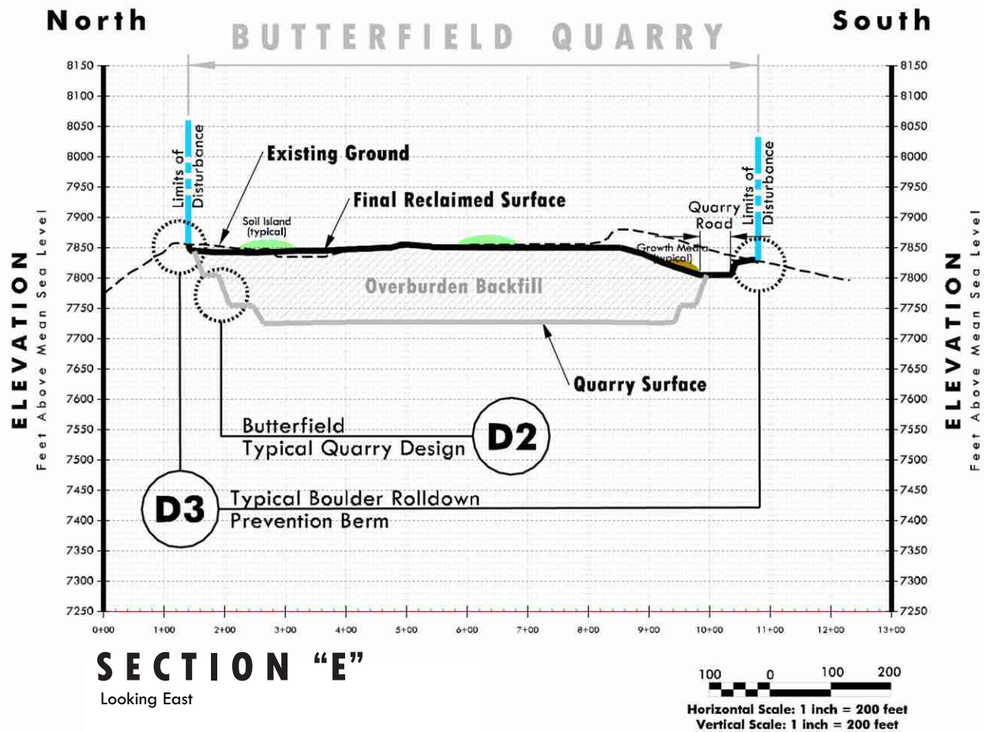
Pit ramps are 30 to 50 feet wide and grade is 12 to 15% depending on conditions. The operating plan is designed with overall pit slopes of about 45 to 50 degrees (about 1:1 overall slope). The highest level of the Butterfield Quarry is approximately 7,900 feet amsl and mining will ultimately reach the 7,650-foot level in the eastern half and 7,700 feet amsl in the western half. The quarry will have up to eight benches. The estimated limestone resources are 7.6 million tons of ore with approximately 7.7 million tons of waste rock to be stockpiled within the central pad area, B5 Pad, or the eastern half of the quarry as backfill.



SECTION "A"

Looking North

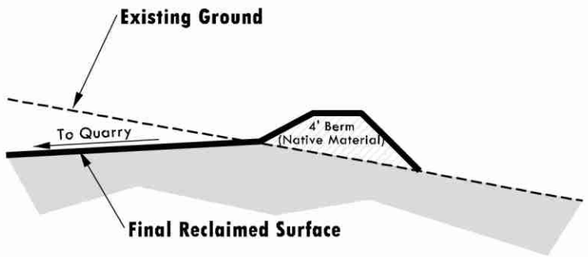
Horizontal Scale: 1 inch = 200 feet
Vertical Scale: 1 inch = 200 feet



SECTION "E"

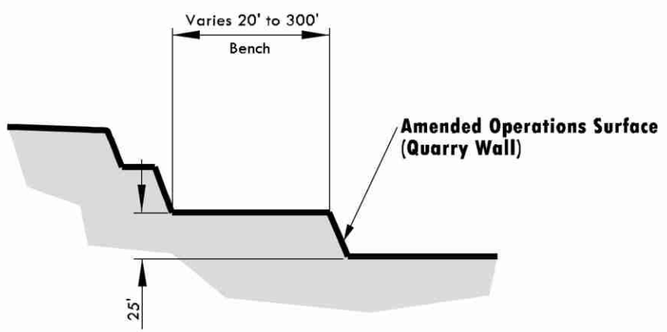
Looking East

Horizontal Scale: 1 inch = 200 feet
Vertical Scale: 1 inch = 200 feet



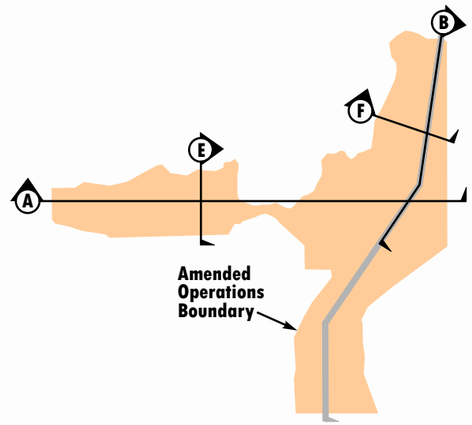
DETAIL 3

Typical Boulder Rolldown Prevention Berm
(not to scale)



DETAIL 2

Typical Butterfield Quarry Design
(not to scale)



Cross Section Index Map

See "Amended Plan of Operations" Sheet 4 of 4 for More Detail
Not to Scale

BUTTERFIELD QUARRY CROSS SECTIONS

BUTTERFIELD and SENTINEL QUARRIES
Amended Plan of Operations and Reclamation Plan
Omya California, San Bernardino National Forest, California

LILBURN CORPORATION

FIGURE 6

A "Slope Stability Investigation" was prepared by CHJ Consultants in July 2012 (see Appendix 8 and Section 2.9 below). CHJ concluded that the proposed mine excavation and reclamation (backfilling) of the quarries are suitably stable against gross failure for the anticipated long–term conditions including the effects of seismic shaking, and meet the factor of safety criteria for static and seismic conditions. CHJ recommended measures to be implemented during mining and these are listed in Section 2.9.

Although mining is more or less continuous, the development of the quarry is phased. The proposed expansion includes phases or pushbacks starting in the year 2015 and described in 10-year intervals for a total of 5 phases including a 10-year Phase 5 for reclamation. Mining will occur on several levels within the Butterfield Quarry. During Phases 1 and 2, the eastern half of the quarry (approximately 16 acres) will be progressively developed to the south, west, and north to planned boundary limits.

During Phase 3, mining will be initiated in the western portion of the Butterfield Quarry. Excavations will continue until the end of Phase 4 to the planned floor depth of 7,700 feet amsl or approximately 200 feet below the northern rim. Note that an area in the center of the quarry will only be excavated to a depth of 7,850 feet amsl due to deposit geometry.

During mining of the western half of the Butterfield Quarry, concurrent backfilling of the eastern quarry area will occur. Ultimately the eastern portion will be completely backfilled to approximate original contours as shown in Figure 6 in Section 2 and on Sheet 4. The overburden will be progressively placed in the eastern portion of the Butterfield Quarry, but only after those portions of the quarry have reached their final outer limit and the ore has been mined out.

The quarry will be mined from east to west. Backfill will progressively follow mining as the limits of the ore are reached. When backfill areas are not available, alternate overburden sites will be utilized.

This Plan allows for substantial backfill to be placed in the mined out portion of the Butterfield Quarry, and also provides for an efficient mining plan, consistent mining costs, better selectivity, even royalty payment distribution to claim owners, and the most flexibility in overburden placement. Furthermore it allows concurrent reclamation of the quarry and overburden site, minimum disturbance of new ground, and phased incremental disturbance of new ground only as necessary for both quarry and overburden sites.

Sentinel Quarry

The Sentinel deposit is mined in a generally uniform manner in 30-foot cuts with a 30 to 35-foot horizontal safety bench every 60 vertical feet. Generally, bench width is ½ wall height. Face angle averages 70°. Bench heights will vary with material encountered and have been determined as a result of detailed studies of the geologic structure, over 30 years of mining experience in this specific mine site, and consultations with various experts including government and private sector.

Pit ramps are 30 to 50 feet wide and grade is 10 to 15% depending on conditions. The operating plan is designed with overall pit slopes of about 45° to 50° (about 1H:1V overall slope). The highest level of the Sentinel Quarry is 7,600 feet amsl. Mining will ultimately reach the 7,000-foot elevation amsl, and the quarry will have 11 benches or more on the north, west, and south (see Figure 7 for Sentinel Quarry Cross Sections).

A "Slope Stability Investigation" was prepared by CHJ Consultants in July 2012 (see Appendix 8 and Section 2.9 below). CHJ concluded that the proposed mine excavation and reclamation (backfilling) of the quarries are suitably stable against gross failure for the anticipated long –term conditions including the effects of seismic shaking and meet the factor of safety criteria for static and seismic conditions. CHJ recommended measures to be implemented during mining and these are listed in Section 2.9.

Although mining is more or less continuous, the development of the quarry is phased. The quarry will be progressively developed (pushed back) to the south, west, and east property line, and eventually deepened to the footwall to reach the final depth of 7,000 feet amsl.

Several mining and development mining phases have been previously approved in the existing mine and reclamation plans. The proposed expansion includes five new additional phases or pushbacks starting in the year 2016 and described in 10-year intervals for a total of 5 phases including a 10-year Phase 5 for reclamation.

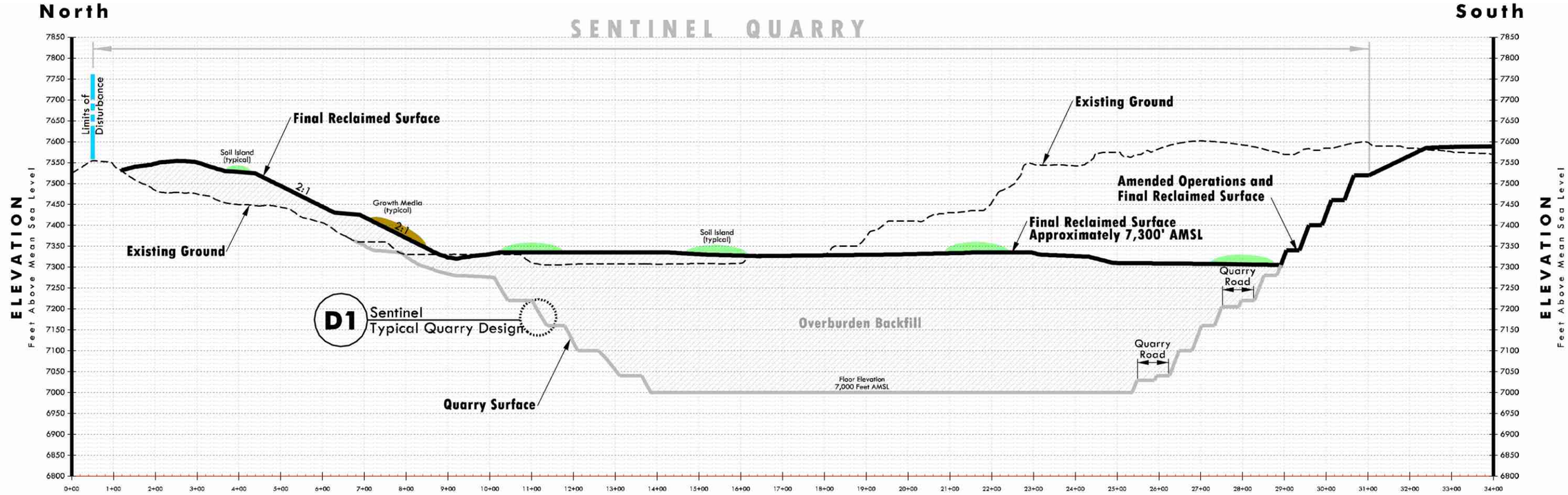
Phases 1 and 2 will progressively develop (push back) the quarry wall to the western and proposed southern limits, and eastward to the property line. During Phase 1, a new stationary or mobile crusher will be put into service. During Phases 3 and 4, the Sentinel Quarry will be mined in incremental pushbacks to the lateral extent and final depth of 7,000 feet. Waste material will be backfilled starting on the northern wall and gradually filling the quarry to an estimated elevation of 7,550 feet on the north slope and to approximately 7,300 to 7,325 feet on the quarry floor. Backfill slopes will be reduced to 2H:1V during final reclamation. The final backfilled floor will be graded to drain towards the high wall on the south and west and will have capacity to retain all quarry run-off for a 100-year precipitation event.

Equipment Used

The major equipment listed in Table 5 is currently used in mining of the Butterfield and Sentinel quarries. As operations progress, alternate equipment may be required to optimize operations and these are listed in the table below. The alternate equipment would not substantively change the process described above. Required compliance with air quality regulations and permits would be obtained prior to placing equipment into operation.

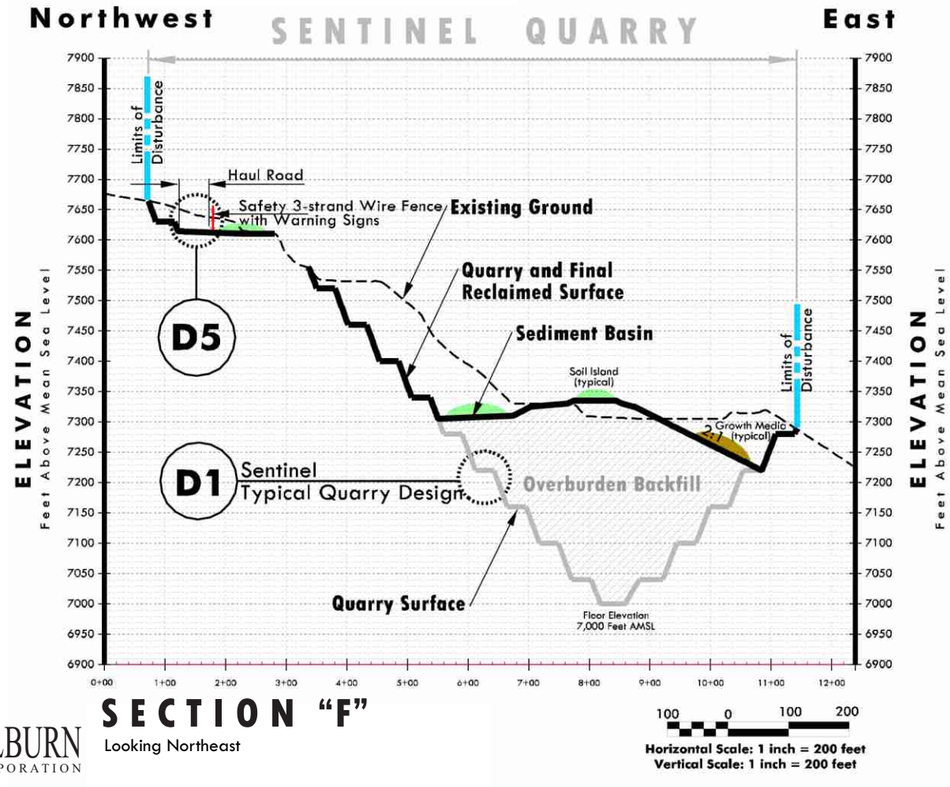
Sanitation

Portable toilets are supplied for use by employees and are located at the crusher site.



SECTION "B"

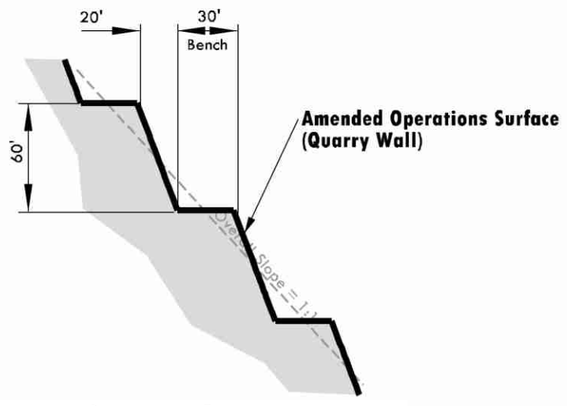
Looking East



SECTION "F"

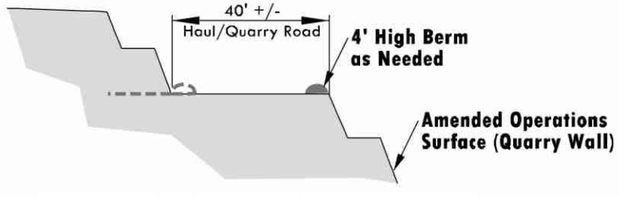
Looking Northeast

Horizontal Scale: 1 inch = 200 feet
Vertical Scale: 1 inch = 200 feet



DETAIL 1

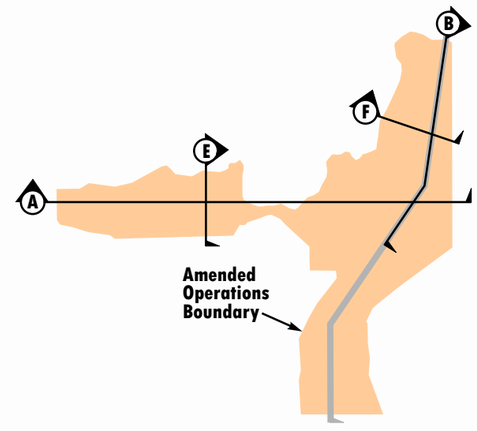
Typical Sentinel Quarry Design
(not to scale)



DETAIL 5

Typical Haul / Quarry Road
(not to scale)

Horizontal Scale: 1 inch = 200 feet
Vertical Scale: 1 inch = 200 feet



Cross Section Index Map

See "Amended Plan of Operations" Sheet 4 of 4 for More Detail
Not to Scale

SENTINEL QUARRY CROSS SECTIONS

BUTTERFIELD and SENTINEL QUARRIES
Amended Plan of Operations and Reclamation Plan
Omya California, San Bernardino National Forest, California

LILBURN CORPORATION

FIGURE 7

Table 5
Typical Quarry Equipment
Butterfield and Sentinel Quarries

Equipment	Typical Number	Net Increase of Additional Equipment	Purpose
Dozer	1	0	Removal of topsoil and waste rock. Construction and maintenance of the haul road , and quarry bench grading
Off-Road Haul Trucks	8 50 to100 ton trucks	2	Transportation of excavated material to the primary crusher and to overburden stockpiles onsite and transportation of crushed sized ore to the Lucerne Valley Plant.
Drill Rig	1	0	Drill holes for placement of explosives.
Water Truck	1	0	Water spray haul roads, active quarry areas, overburden stockpiles, and general dust control onsite.
Front-End Loaders	2	1	Loading of excavated materials into haul trucks at quarry and at the primary crusher.
Mobile Crusher/Screening System	---	1	Potential future replacement for existing stationary crusher
Surface Miner	---	1	Potential future replacement to be used in place of crusher
Excavator	---	1	Currently limited use for special projects, and boulder breaking. Potential future replacement to be used in place of front-end loader
35 to 45-Ton Haul Trucks	Varies	Varies	Limited use for special projects
Ancillary Equipment	Varies	Varies	Maintenance vehicles, bobcats, backhoe, pick-ups, etc

Note that similar equipment may be used during the life of the project.

Public Access and Safety

Access to the Butterfield – Sentinel quarries (and any other portion of the Omya California operation) is limited to employees and authorized personnel. Access is controlled during the workweek by operating personnel. During off hours, access is restricted by warning signs and fences, and all legal access roads have locked gates and signs informing the public the roads are closed to public access. Warning signs notify the public that the mining area has restricted access and that the roads are not public access roads. During non-operating hours the gates are closed and locked.

1.2 OVERBURDEN AND WASTE ROCK

Overburden and waste rock at the Butterfield and Sentinel Quarries are composed of off-color and/or impure limestone and dolomite, and a very small (less than 1%) amount of altered intrusive dike and clay material. Overburden and waste rock are nontoxic, naturally occurring rock material, but which are of insufficient quality (purity and brightness) to process for ore. A

Dust Management Plan is in place to minimize dust emissions. Acid mine drainage refers to the outflow of acidic water from metal mines or coal mines; typically those that are abandoned. Limestone waste rock/overburden does not have the chemical composition to create acid mine drainage.

Overburden or Waste Rock Stockpile Areas/Pads

Currently overburden, interburden, and fines are deposited into the old Butterfield 5 Quarry site, central pads' area, and the B5 Pad. Material placed into these areas includes both waste rock and material stockpiled for potential future use. Material stockpiling will continue throughout the life of the operation. Waste rock is also planned to be backfilled into the Butterfield and Sentinel Quarries as areas are mined out. This Amendment proposes the revisions shown in Table 6 to handle the estimated overburden from the planned expansion of mining.

Table 6
Planned Overburden Areas and Storage Capacities
Butterfield and Sentinel Quarries

Storage Area	Existing Area (acres)	Planned Expansion Area (acres)	Total Area (acres)	Estimated Overburden Quantity (mt)
B5 Overburden Pad	23.4	22.7	46.1	11.67
Central Pads	28.3	15.2	43.5	1.45
Sentinel Quarry Backfill[1]	59.6	10.8	70.3	14.4
Butterfield Quarry Backfill[1]	21.8	28.6	50.4	4.8
Sentinel Quarry North	4.5	0	4.5	Reclaimed
Totals	**137.5**	**77.3**	**214.8**	**32.32**

Notes:
mt – millions of tons based on loose or swelled cubic yards.
Areas rounded to nearest tenth of an acre. Totals may be slightly different due to rounding.
Waste rock (interburden & overburden) excavated will vary annually depending on area being excavated and includes fines produced from onsite crushing estimated at 15% of ore crushed and relocation of existing waste rock to allow western and southern expansion of Sentinel Quarry.
1 – Backfill will be within the quarry footprint.

<u>B5 Pad (Overburden Stockpile)</u>

The existing approved B5 Pad of approximately 23.4 acres will be progressively extended to the south with overburden from the Butterfield and Sentinel Quarries when backfilling areas of the these quarries are not available. As overburden removal progresses during Phases 1-4 the pad will be incrementally built out southward to its planned height of 7,700 feet. Capacity of the B5 Pad is estimated at up to 11.67 million tons and is expected to reach capacity by the end of Phase 4. Reclamation in the form of sloping to 2H:1V and revegetation will occur concurrently

where operationally feasible. Slope reduction of remaining slopes will begin during Phase 4, and be completed during Phase 5 (see Figure 8 for B5 Pad and Central Area Cross Sections).

The extended B5 Pad is largely underlain by noncarbonate rock and is thus non-habitat for the endangered carbonate plant species. The majority of the overburden placed at the site is carbonate rock and thus the expansion of the B5 Pad will create habitat for endangered species, and will also form continuous habitat where the natural habitat is segmented.

Central Area - B5 Quarry Backfill Site

During Phase 1 (years 1 - 10), overburden and waste rock will continue to be placed at the B5 Quarry overburden site to the existing height of 7,775 feet. In order to expand the Sentinel Quarry to the west, a portion of the B5 Quarry fill will be removed and the waste rock will be relocated to an alternate overburden location. It is planned to backfill the B5 Quarry as shown on the mining and reclamation plans (see Figures 4 and 12). Reclamation of this area will occur concurrently where operationally feasible and continue when backfilling is completed during Phase 3. Slopes will be contoured at 2H:1V and revegetated.

Central Area for Future Crusher Site, Growth Media Storage, and Haul Roads

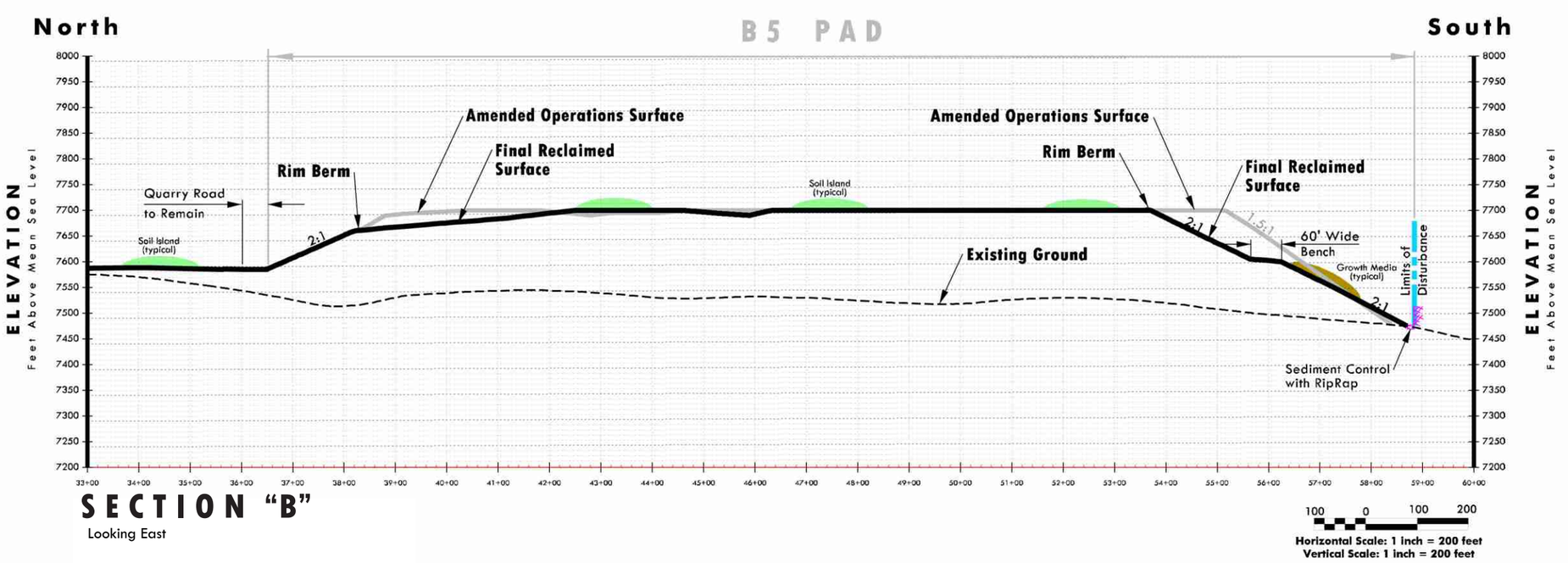
In order to expand the Sentinel Quarry southward, the waste rock to the south of the Sentinel Quarry will be incrementally excavated as part of the quarry pushbacks as described in the phased development and placed at the following available overburden or infrastructure sites:

- Pads for ancillary uses and the future crusher site to the south;
- B5 Pad;
- Fill for haul road development; and
- Sentinel Quarry backfill on its north slopes.

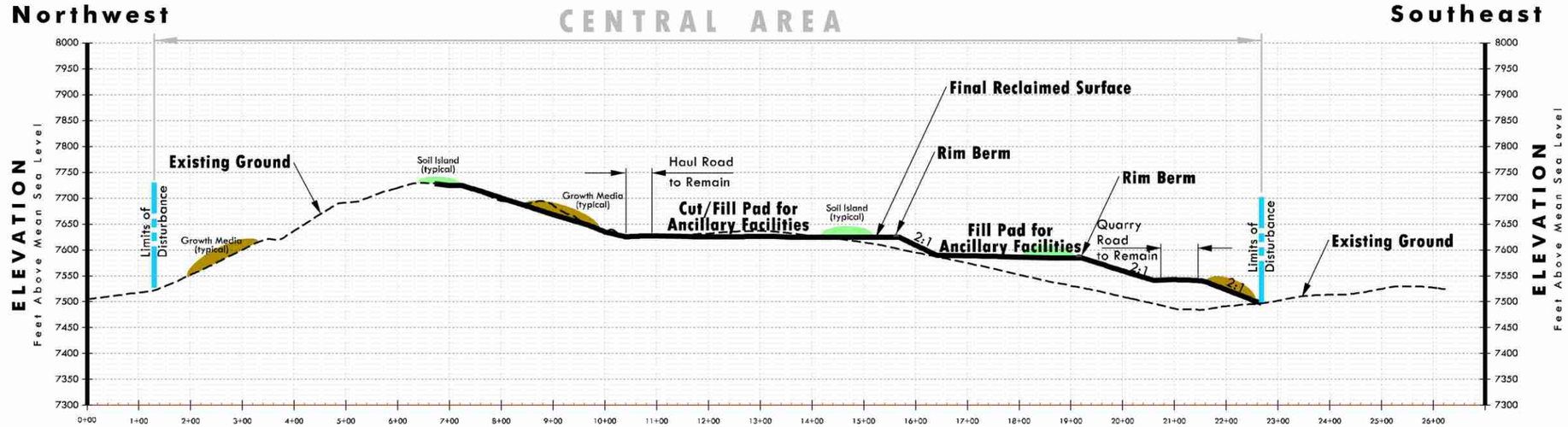
Two pads will be developed southwest of the Sentinel Quarry with waste material. The upper pad will be built using cut and fill methods. The lower pad will be constructed using waste material as fill. The lower pad will be about 2.75 acres with an elevation of 7,625 amsl and the upper pad will be approximately 2 acres. These pads will be used for ancillary uses and the potential crusher facility relocation from within the Sentinel Quarry likely by the end of Phase 1. Slopes will be 2H:1V and run-off control berms will be constructed around the rims of the pad.

Sentinel Quarry Backfill

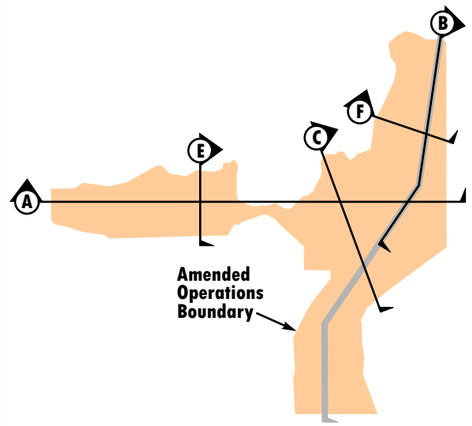
The approved plan calls for the backfilling of portions of the Sentinel Quarry from the north to the south as the quarry is mined out. This Amended Plan will expand the quarry southward, allowing the quarry depth to be deepened by 150 feet to elevation 7,000 feet. Omya will backfill the Sentinel Quarry as mining is completed from north to south. Up to 14.4 million tons of waste material will be placed as backfill, up to an approximate elevation of 7,550 at the north end of the quarry and 7,300-ft at the southern end of the quarry. The final reclaimed quarry floor including its planned backfill, will be designed to gently slope towards the western and southern



SECTION "B"
Looking East



SECTION "C"
Looking Northeast



Cross Section Index Map
See "Amended Plan of Operations" Sheet 4 of 4 for More Detail
Not to Scale

B5 PAD and CENTRAL AREA CROSS SECTIONS

BUTTERFIELD and SENTINEL QUARRIES
Amended Plan of Operations and Reclamation Plan
Omya California, San Bernardino National Forest, California

LILBURN CORPORATION

FIGURE 8

highwall and to create a retention basin with sufficient capacity to handle potential run-off for a 24-hour, 100-year precipitation event.

The backfilling will also eliminate the excavated step-benches on the north and the lower levels of the quarry and will be more favorable for revegetation. Backfilling greatly reduces the size of potential new overburden sites limiting additional impacts to undisturbed lands and to biological and visual resources.

Butterfield Quarry Backfill

Extensive use of the Butterfield Quarry for backfilling is also planned. The Butterfield Quarry will be generally mined east to west. The overburden from the western half of the quarry will utilize the existing overburden stockpiles during Phases 1 and 2 while the ore in the eastern part is still being mined. As mining is completed in the east and initiated in the western area of the Quarry during Phase 3, backfilling of the eastern half of the Butterfield pit would occur. The eastern half of the quarry will be backfilled to approximate original contours of 7,850 to 7,875 feet. This plan will allow up to 4.8 million tons of backfill to be placed in the Butterfield Quarry concurrent with mining. Reclamation of the backfill will be undertaken during Phase 5.

1.3 ORE CRUSHING

Ore from the Butterfield and Sentinel Quarries is hauled to the primary crusher and screens for size reduction, screening, and sorting of ore grades and then is transported to the processing plant in Lucerne Valley. Stockpiles of ore, separated as to grade, are made by the radial stacker at the crusher. From these stockpiles, haul trucks are loaded and transport the crushed ore to the processing plant in Lucerne Valley.

The primary crushing area is currently located immediately south of the Sentinel Quarry. In the future, a stationary–type crusher would be relocated to the constructed pad south of the expanded Sentinel Quarry as shown on Figure 4 and Sheet 2. The following discussion applies to both locations, as no changes in the crushing process is planned, only moving the crusher to another previously disturbed site.

The crusher area accommodates the crusher and support facilities. Commercial high voltage power lines and transformers are available for power. The existing crusher plant has approved permits to operate which are renewed annually by MDAQMD. (See Appendix 3A for copies of current permits.) The permits outline specific conditions which must be met to maintain air quality standards and limits on daily and hourly production rates. The existing permits allow for a maximum of 5,000 tons per day and 600 tons/hour of ore processed which is sufficient to accommodate the increased excavation rate proposed in this Amended Plan. Therefore, no change in the existing crusher air quality permits will be necessary.

Existing dust controls in the crusher and quarry area include a bag house and foam and fog sprays at the crusher and the use of magnesium chloride and water for dust suppression on haulage roads, quarry roads and ramps. The bag house removes >95-98% of the PM_{10} emissions. Monitoring requirements are also outlined.

The following is a listing of the equipment and support facilities for the ore crushing system:

- Truck dump hopper and vibrating feeder
- Primary screen
- Jaw crusher
- Belt conveyors and radial stacker
- One 40' van trailer and one 50' railroad boxcar containing electrical switchgear, spare parts, tools, and lunchroom
- Two metal buildings
- Portable toilets
- One 10,000 gallon diesel fuel tank (double-walled) for mobile equipment
- One 10,000 gallon skid mounted non-potable water tank

Existing dust control measures are in compliance with MDAQMD Rules 401 (limiting visible emissions from exhaust); 402 (avoid nuisance emissions to people or businesses or property); 403 (prohibits visible dust from crossing property lines); and 403.2 (requirements for controlling fugitive dust) and meet the required air quality standards. The dust control measures are required to be in place and operative and regular monitoring by agency personnel insures that the regulatory standards are met.

Haul trucks and diesel equipment meet all requirements of the California Air Resources Board's (CARB) off-road diesel vehicles regulation to reduce diesel pollutants.

Fuel for mobile equipment is stored at the crusher site in an approved double-walled tank with a spill control berm. Mine equipment is fueled at the crusher site. Scheduled equipment maintenance occurs at the main plant site. Minor or emergency repairs may be conducted at the quarry. Any waste oil generated at the mine site is collected and transported for offsite disposal by approved methods and by properly trained and licensed personnel.

As operations progress, alternate equipment may be required to optimize operations and these were previously listed in Table 5. These may include the utilization of a mobile crusher which would be capable of being set up near the face of the quarry to reduce handling of the ore. A mobile crusher could also be moved from quarry to quarry as needed. The alternate equipment would not substantively change the process described above. Required compliance with air quality regulations and permits would be obtained prior to placing equipment into operation.

1.4 PRODUCTION WATER

A relatively small amount of water is used in the Butterfield and Sentinel quarries operations. Approximately one acre-foot of water is used annually for dust suppression at the quarries, overburden placement areas, haul roads, and at the crusher. Water (approximately 0.4 acre-feet) is also used for irrigation at reclamation sites. With the increase in production, water usage is expected to double to approximately three acre-feet per year. No substantial changes are proposed and adequate dust control will be maintained. Note that the use of magnesium chloride on roads and other active mine areas, the addition of a baghouse on the crusher screens, and the

occurrence of typically wet winter weather can all contribute to reducing the amount of water needed to control dust.

Water used to control dust is obtained from two previously permitted sources, a well located at the plant site in Lucerne Valley, and a well located in Crystal Creek Canyon near Turnout 5 on the Crystal Creek Haul Road (refer to Figure 2). No substantial changes in overall water use are proposed. Both existing wells are permitted by the State of California Water Resources Control Board and County of San Bernardino Department of Environmental Health Services (Permit #06259026). The plant well has been assigned recordation number 36011 by the California State Water Resources Control Board (see Appendix 4 for copies of permits). Bottled drinking water for employees at the mining area is brought to the site as necessary. No surface water is used in the operation. There will be no added diversions or storage for water supply.

No treatment facilities will be needed. Water will continue to be hauled in a water truck and sprayed on the haul roads and active mining and overburden areas to minimize fugitive dust. The water truck will work during active quarry operations as needed to control visible dust. This water will evaporate and therefore, the project will not produce any wastewater or run-off.

The Mojave Water Agency (MWA) is a State Water Project contractor, a regional groundwater management agency, and serves as Watermaster for the adjudicated Mojave Basin in which Omya's wells are located. Omya has a verified base annual production allocation of 23 acre-feet (af)/year for its two wells and water production over the past 5 years (2007 through 2011) has been 19, 14, 14, 14, and 14 af/year, respectively (18th Annual Report, MWA 2012). The expected increase of water usage for the Proposed Project of 1.5 af/year will not exceed Omya's base allocation even during its higher production year in 2007 of 19 af/year.

1.5 EROSION AND SEDIMENTATION CONTROL

The objective of drainage control measures is to limit runoff to minimize or prevent erosion and to promote settling of suspended solids before the runoff leaves the site. Numerous erosion and sedimentation controls have been implemented as needed in the mining and stockpile areas to control, minimize or prevent off site sedimentation. Runoff is directed into quarry pits, and many culverts, dips, or drains direct water off roads. A large number of energy dissipaters, sediment catchment basins or sumps, rip rap, berms, and/or hay bales rap sediment and minimize the potential for off-site transport. Operations also limit surface disturbance to minimum areas and concurrent reclamation and revegetation will stabilize disturbed pads and slopes.

Omya has continuously worked with the Forest Service in the design and implementation of drainage controls along roads and other facilities. Existing erosion and sedimentation controls are inspected and approved by both Forest Service and Omya personnel. The site will be visually inspected after major precipitation events to determine if any substantial erosion is evident such as sheet, rill or gully erosion or any surficial instability. Appropriate erosion control measures will be maintained as necessary and additional controls implemented where new erosion is observed. Existing and/or proposed erosion controls are adequate for prevailing climatic conditions. The existing approved Forest Service operation/reclamation plan contains

requirements for erosion and sedimentation controls. The following discusses sedimentation and erosion controls specific to each area of the mine (also see Section 2.12).

Sentinel Quarry

Existing and future mining activities at Sentinel Quarry area will deepen the pit and push it back to the south. Current and future runoff down slopes, benches, roads and ramps and any sediment is directed into the pit, and does not now have nor will it have any adverse effect on downstream property.

Butterfield Quarry

Existing and future mining activities at Butterfield Quarry area will deepen the pit and push it back to the south, west and north. Future runoff down slopes, benches, roads and ramps and any sediment will be directed into the mined out portion of the quarry, or into sediment sumps located down the road in the vicinity of the overburden site. The drainage controls will minimize the potential for off-site transport and will eliminate any potential adverse effect on downstream property.

Central Areas and Overburden Sites

The Central Areas and the B5 Pad will be constructed with berms near the crest of the fill pads to prevent runoff over the fill slope. Drainage will be directed away from the rims. Rip rap, catchment basins, and various energy dissipaters have been or will be placed along the toe of fills and in the drainage below the fill slope to trap sediment and minimize the potential for off-site transport. These drainage controls are and will be periodically inspected and maintained as necessary.

Storm Water Pollution Prevention Plan (SWPPP)

Omya has a storm water discharge plan which has been approved by the California State Water Resources Control Board, and will continue to have one until mining ceases. The storm water plan permits include: specific prohibitions, effluent limitations, storm water pollution prevention plans, including source identification, practice to reduce pollutants, assessment of pollutant sources, materials inventory, preventative maintenance program, spill prevention and response procedures, general storm water management practices, training, record keeping, sampling procedures and monitoring program.

All operations on-site comply with a National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges associated with industrial activities and employ storm water BMPs during construction, operations, and temporary cessation of operations. NPDES goals are to eliminate unauthorized non-storm water discharges and to monitor storm water discharges requirements. Any surface water monitoring would be through this requirement as needed. See Appendix 10 for the cover sheets of Omya's current drainage control and SWPPP plans.

1.6 BLASTING

Drilling and blasting operations will be conducted by licensed individuals in such a manner as to meet or exceed Federal Mine Safety and Health Administration (MSHA) and California Occupational Safety and Health Administration (Cal-OSHA) requirements. Blasting will typically be conducted about once each week at each quarry during daylight hours. Blasting operations will involve drilling, placement of charges, and detonation of the charges by a blaster with all required licenses and permits for handling explosives. All explosives and detonators shall be transported, handled, and stored in accordance with all federal, State, and local regulations.

The current blasting agent ammonium nitrate and fuel oil (ANFO) explosives used at the quarries are currently stored separately in magazines located at designated locations at Omya's Lucerne Valley operations per all federal, State, and local regulations. The explosives are only transported to the quarry site by a licensed contractor as necessary.

Blasts in the Omya quarries are relatively small to maximize selectivity. The active quarries are located near the Range Crest in the central portion of the mountain range. There are no residences for over 2 miles in any direction from the quarry, and one or more major mountain ridges are present in between quarries and residences. Blasting has occurred in these quarries for over 35 years with no adverse impact on people, structures, or wildlife. The blasts cannot be seen, heard or felt in any residential areas

2.0 RECLAMATION PLAN

2.1 LAND USE

The site is located in the San Bernardino Mountains south of Lucerne Valley in southwestern San Bernardino County. The Butterfield and Sentinel Quarries are located entirely within portions of 954 acres of unpatented placer claims controlled by Omya on public land administered by the SBNF (refer to Figure 3). The existing mine and planned expansions are bounded on the south, west, and north by mountainous undeveloped Forest Lands and to the east by patented open space with an active limestone mine called Furnace Canyon Quarry about 0.75 to 1 mile to the northeast. Other than mining, which has historically been active in the area since the 19th century, land use in the rugged mountainous area has been limited to occasional use by hikers and hunters. OHV use and fuel wood cutting have increased as more access roads were built.

The "Land Management Plan, Part 2 San Bernardino National Forest Strategy" (USDA September 2005) defines the project area as the "Desert Rim." The Desert Rim is described as "a high desert, remote, rugged landscape formed by complex geological faulting. Today, the majority of the land is valued in the production of large quantities of high quality, limestone mineral deposits used in the production of pharmaceuticals and cement. These carbonate deposits are also valuable habitat supporting four species of threatened and endangered plants found nowhere else in the world." An intensive collaborative effort led to the development of the CHMS in 2003. The strategy is designed to provide long-term protection for the carbonate endemic plants and also provide for continued long-term mining. Portions of the carbonate habitats are protected from mining impacts in perpetuity within the carbonate habitat reserves dedicated and managed as described in the CHMS.

The Desert Rim Place is maintained as a modified to natural appearing landscape that functions as a sanctuary for the aforementioned federally listed native plants and a highly valued area for limestone production. SBNF management is expected to center on implementation of the CHMS and to continue mining while preserving and managing habitat for federally listed plants that occur in this area.

The County land use designation for the site is RC – Resource Conservation.

2.2 VISIBILITY

The Proposed Project site lies within the northern boundaries of the SBNF within the Desert Rim Place as described above. The existing views of the project area are currently affected by two existing mines, the Butterfield Quarry and the Sentinel Quarry, and associated overburden stockpiles. The Proposed Project is the expansion of the existing quarries and stockpiles utilizing the existing processing equipment and haul road for site access over a 40-year period through the year 2055. Two inactive mines, Claudia and Cloudy, are located to the south of the Proposed Project, connected by haul roads. These closed quarries are undergoing revegetation monitoring and remediation. The connecting haul roads will also be reclaimed in the near future. Therefore,

the Proposed Project will not introduce a new use or create a substantial new alteration to the landscape of the area.

The project area is and will be visible only from elevated areas to the south and southeast within the SBNF based on topographic mapping. The forest use areas that would be able to view the site include potions of Holcomb Valley (private land, not accessible to the public), the Pacific Crest Trail, Castle Rocks, and the top of Snow Summit. Note that the distances from the project site to the latter two viewpoints are over 7 miles and at these distances, the Proposed Project starts to become a minimal alteration to the overall view. From more distant ridgelines such as Onyx Summit, one may be able to see the site, but when placed into the context of a panoramic viewshed from these various distant viewpoints, the existing and future mine occupies a very small portion of the viewshed with respect to the overall view and becomes nearly indiscernible.

The project will not be visible from any developed/ populated areas surrounding Big Bear Lake (and from the lake itself) including Fawnskin, the City of Big Bear Lake, and Big Bear City due to the intervening ridges located north of the lake and the relatively lower elevations of the lake itself. The existing and proposed mine expansion are located on the south side of the range crest and are not visible from Lucerne Valley.

The existing landscape character of the project area consists of mountain slopes, ridges, and canyons with vegetation characterized as pinyon-juniper-mountain mahogany woodland. Vegetation tends to be denser on north slopes and gullies, and more open on south slopes and along ridges. However, most of the project site and areas south and west of the site were burned in wildfires in 2007 and appear sparsely vegetated to barren with distance.

Visual anomalies from within SBNF lands looking northwest from the Pacific Crest Trail east of FS Road 2N09 (Poligue Canyon Road) at a distance of 3.75 miles include the existing active Butterfield and Sentinel quarries and two inactive mines south of the Proposed Project. These anomalies consist of altered disturbed open areas with a lighter color that contrasts with the existing natural areas. From viewpoints more distant (Castle Rocks, 7 miles south, and the top of Snow Summit, 8.25 miles southeast), the existing mine areas are less evident as the altered areas make-up a very small portion of the panoramic views.

The proposed Butterfield Quarry expansion is essentially a pit along the existing ridgeline; as such the south quarry rim is only slightly lower (average of about 25 feet lower) than the north rim. Thus the views from the viewpoints to the south with slightly lower elevations than the quarry and at substantial distances may only see the upper bench of the north side quarry wall. In addition, the south quarry boundary has two natural elevated knolls up to 7,875 feet which further reduce quarry views and break up the lines and color contrast of the quarry area. The expansion of the Sentinel Quarry and the B5 Pad will increase views of impacted areas. Omya will implement the following Project Design features to reduce visual impacts:

- Deposit waste rock within the quarry footprint to the degree feasible, as described in this Plan to reduce the area of disturbance and visual impact outside the quarries;

- Implement reclamation and revegetation per Plan on completed equipment accessible quarry benches and on overburden stockpiles concurrent with mining where feasible;
- Utilize approved color-staining product to darken the visible quarry slopes where not subject to raveling;
- Deposit darker waste rock on overburden sites where available to reduce color contrast;
- Cut or roughen upper slopes that may be visible from southern viewpoints to reduce straight lines and visual impacts as benches completed;
- Design adequate erosion control features along the haul and access roads and quarry to limit erosion;
- Construct catchment berms at foot of stockpiles to reduce rock rolldown;
- Limit surface disturbances to areas identified in the Plan; and
- Implement appropriate dust controls to reduce visible dust.

Potential impacts to scenic values will be fully assessed in a Scenic Report to be prepared as a part of the EIR/EIS.

2.3 VEGETATION

Several biological studies on the Omya claims have been completed during the past three decades that have evaluated the biological resources on the claims and in the mining areas. Psomas and Associates (1997) completed a biological survey of the 2001 Sentinel expansion and B-5 overburden expansion site and a plant survey in June 1998. Site specific biological surveys of the Butterfield Quarry area were undertaken in 2008 and 2009 by Scott White Biological Consulting. See Appendix 6 for these biological surveys. In addition, the USFS has also completed biological studies in the area.

For the Sentinel expansion in 2001, a Biological Assessment (BA) was prepared by the Forest Service (see Appendix 6B) and an informal Section 7 consultation with the USFWS was completed (see Appendix 6A), at which time the USFWS concurred that the Sentinel expansion may affect but not likely to adversely impact endangered plant and wildlife species. The BA and the Plan of Operations approved by the Forest Service in 2002 included a number of conditions and measures to reduce and limit potential impacts to listed plant species as well as for sensitive wildlife species (mainly bighorn sheep). These included avoidance as feasible of existing and potential habitat, reducing dust deposition, and land compensation by relinquishment of 80 acres of placer claims adjacent to the Bighorn Wilderness Area. (The 80-acres were relinquished in 2003 and included 60-acres of carbonate rock with known oxytheca populations and potential habitat for Cushenbury buckwheat and milk-vetch, pinyon-juniper woodland at a greater density than the project site, and high potential for bighorn sheep use.)

The measures below, mainly related to reducing dust, have been implemented by Omya over the past 10 years and will continue to be utilized:

- Phase development of the quarries to minimize exposure of newly disturbed ground;
- Conduct most excavation of overburden during the winter months when possible when conditions are wetter and less dust produced;.
- Minimize excavation of overburden during oxytheca flowering season (summer months) when possible;
- Minimize the number of roads and exposed surfaces in the quarry site area;
- Use dust suppression and water on heavily utilized roads and exposed active quarry areas;
- Restrict excavation of overburden from the Butterfield site when possible in dry weather when the wind is blowing toward the endangered species populations to the south and west; and
- Implement concurrent reclamation and revegetation of the quarry site as possible.

The EIR/EIS document that will be prepared by the Forest Service and the County for this Amended Plan will assess biological resources, potential impacts, application of the CHMS, and the adequacy of Omya's proposed mitigation per the CHMS guidelines.

General Vegetation Description

The expansion areas south of the existing Sentinel Quarry can be characterized as a pinyon-juniper-mountain mahogany-rabbit brush woodland. The dominant tree species are singleleaf pinyon (*Pinus monophylla*), western juniper (*Juniperus occidentalis*), and curlleaf mountain mahogany (*Cerocarpus ledifolius*). Igneous derived (non-carbonate) soils are especially prevalent adjacent to the B5 Pad and white fir (*Abies concolor*) and Jeffrey pine *(Pinus jeffreyi*) are present. Overstory canopy cover is generally less than 50%, almost the entire area having been harvested for timber at some time in the last century. Vegetative material removed during quarry and overburden site development will be salvaged and saved for reclamation. Phased development in the Sentinel Quarry area and Central Area will result in disturbance of approximately 26 acres of pinyon-juniper woodland. All other aspects of the expansion will occur on previously disturbed sites. There is no riparian vegetation onsite.

The Butterfield Quarry site area can be characterized as a pinyon-juniper-mountain mahogany woodland with thin carbonate soils over the carbonate bedrock. In this area, serviceberry (*Amelanchier utahensis*) and Great basin sagebrush (*Artemisia tridentate*) are common associates. Natural overstory canopy cover is generally less than 50%, almost the entire area having been harvested for timber at some time in the last century. Virtually the entire proposed expansion area was burned in recent fires (Willow Fire and Butler Fire in 2007), and descriptions refer to vegetation and habitat prior to the fires.

The Butterfield Quarry area expansion may result in minimal impacts to the listed endangered species adjacent to the site as discussed below. Vegetative material removed during quarry and overburden site development will be salvaged to the degree feasible and saved for reclamation. Phased development of the proposed Butterfield Quarry area will result in disturbance of approximately 28.6 acres of pinyon-juniper woodland.

The expansion of the B5 Pad southward will disturb an additional 22.7 acres of pinyon–juniper woodland.

Threatened, Endangered and Sensitive Plant Species

The carbonate soils provide a unique habitat and there are five federally listed threatened or endangered plant species endemic to carbonate soils. The Proposed Project site is partially within designated critical habitat for these carbonate-endemic plants (USDI Fish and Wildlife Service 2002). An intensive collaborative effort led to the development of the CHMS in 2003. The strategy is designed to provide long-term protection for the carbonate endemic plants and also provide for continued long-term mining in the San Bernardino Mountains.

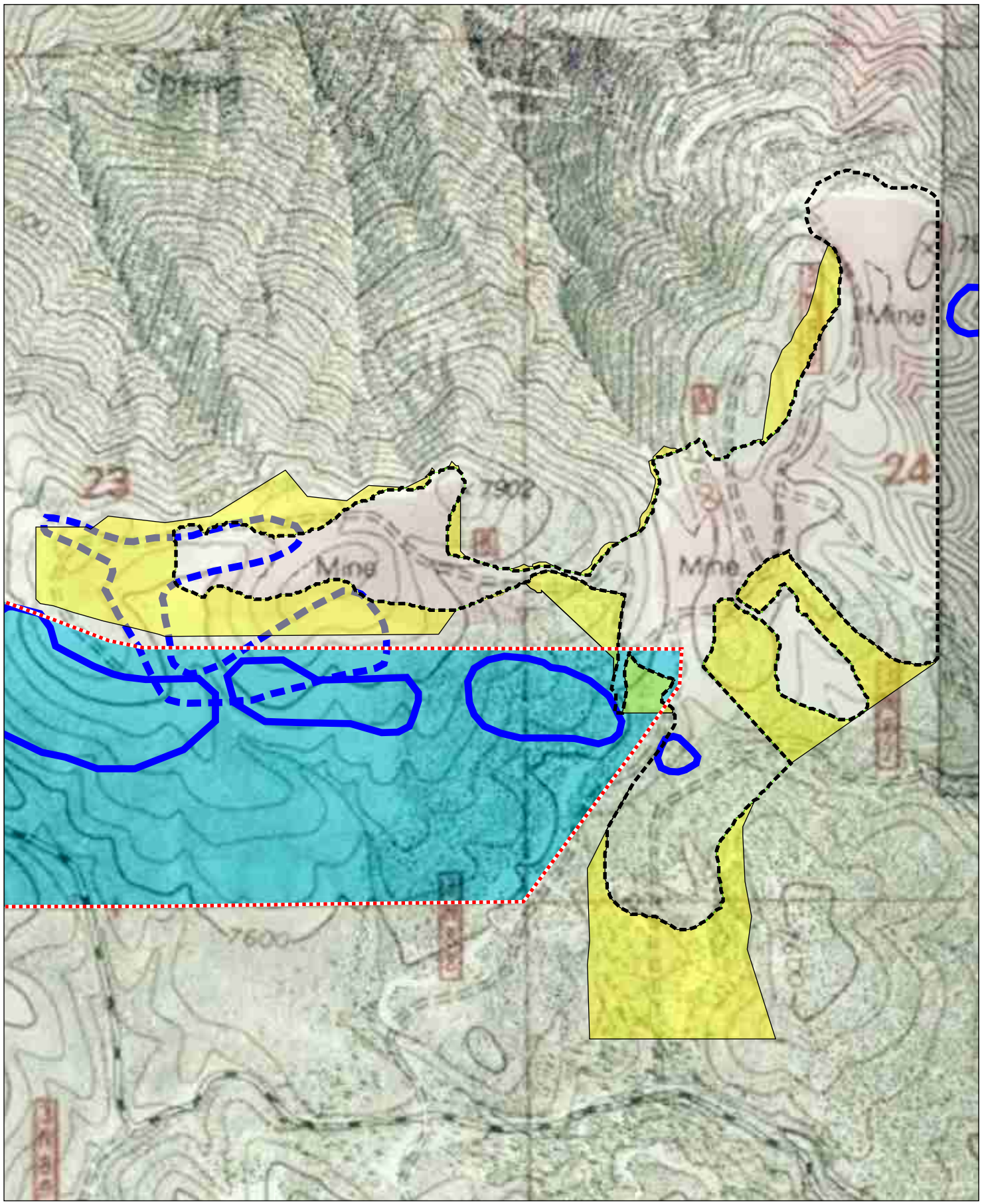
A portion of the carbonate habitats are protected from mining impacts in perpetuity within the carbonate habitat reserves dedicated and managed as described in the CHMS. A Memorandum of Understandings and Agreement was signed in 2003 by Omya, the SBNF, BLM, San Bernardino County, California Native Plant Society, and adjacent mining companies stipulating that the signatories will implement the CHMS for the dual purpose of conserving threatened and endangered carbonate plants and streamlining the permitting of mining operations.

These listed carbonate-endemic plants are managed by the SBNF, San Bernardino County, and other public agencies under the CHMS. "Take" of listed carbonate-endemic plants is permitted under the strategy, and mitigated by permanent mining claim or private property set-aside and through management of off-site plant occurrences as outlined in the CHMS.

Several botanical surveys by both SBNF and Omya-contracted botanists have been conducted in the Sentinel/Butterfield expansion area during the past 30 years. Four of these listed species, San Bernardino Mountains bladderpod (*Lesquerella kingii* subsp. *bernardina*), which occurs on limestone outcrops around Big Bear Lake to the south, Cushenbury milk-vetch (*Astragalus albens*), Cushenbury buckwheat (*Erogonum ovalifoliun var. nudum),* and the Parish's daisy (*Erigeron parishii*) do not occur in this area and were not found on or adjacent to the expansion sites.

The surveys have identified populations of Cushenbury oxytheca, a federally listed endangered plant onsite and to the west and south of the Butterfield Quarry, while none of the species have ever been identified in the Sentinel Quarry area (see Figure 9). The plants occur in relatively open places away from formerly shaded pinyon-juniper woodland, on relatively deep fine sandy carbonate derived soils, generally in scattered patches.

Omya intends to be consistent with the CHMS and has proposed to mitigate impacts to these listed species through permanent conservation easements on unpatented mining claims. In consultation with the SBNF, Omya has provided the SBNF a mitigation land proposal consistent



N

0 800

FEET

Source: SBNFS 2012; LILBURN CORP., 2012

LILBURN CORPORATION

LEGEND

- Existing Approved Facilities
- Amended Plan of Operations
- CHMS Critical Habitat
- CHMS *Oxytheca parishii* known Occurences
- Estimated boundary of *Oxytheca parishii* Occurences per Scott White Biological Consulting Dec. 2008

LISTED PLANT LOCATIONS

BUTTERFIELD and SENTINEL QUARRIES

Amended Plan of Operations and Reclamation Plan

Omya California, San Bernardino National Forest, California

OMYA

FIGURE 9

with the CHMS that would relinquish 300 acres of unpatented claims for carbonate plant mitigation (see Appendix 11A and Figure 3). Biological evaluation of the unpatented claims by USFS personnel has indicated they contain significant populations of oxytheca and are adequate mitigation. The adequacy of this mitigation land proposal will be assessed in the Forest Service's Biological Assessment (BA) to be submitted to the USFWS as part of a Section 7 consultation and addressed in the EIR/EIS.

Critical habitat for the plants was also designated by the USFWS. The critical habitat boundary buffer zone extends approximately 300 feet north of the known plant populations. The proposed Butterfield Quarry expansion extends into the critical habitat buffer zone, but does not extend south to the location of the previously identified plant populations within the critical habitat. The proposed Butterfield Quarry expansion does not extend into the CHMS refugia. The BA and Section 7 consultation will also evaluate the impact and proposed mitigation on critical habitat through the CHMS guidelines.

Four other sensitive plant species were also noted in surveys. Parish's rock cress (*Arabis Parishii*) was scarce on a ridgetop, Bear Valley Wollypod (*Astragalus leucolobus*) was scarce, Big Bear Valley Milkvetch (*Astragalus lentiginosus var. sierra*) was also scarce, and Heckard's paintbrush (*Castilleja applegatti in part*) was noted in a burned area. None of the plants are listed as threatened or endangered, but are managed as sensitive species, or are on the SBNF "watch list". Many of them share similar habitat requirements with the listed carbonate-endemic species and would likely be mitigated through the mitigation land proposal.

2.4 WILDLIFE

Several biological studies on the Omya claims have been completed during the past 30 years decades. Psomas and Associates (1997) completed a biological survey of the 2001 Sentinel expansion and B-5 overburden expansion site in June 1998. Site specific biological surveys of the Butterfield Quarry area were undertaken in 2008 and 2009 by Scott White Biological Consulting. See Appendix 6 for these biological surveys.

For the Sentinel expansion in 2001, a BA was prepared by the Forest Service (see Appendix 6B) and an informal Section 7 consultation with the USFWS was completed (see Appendix 6A), at which time the USFWS concurred that the Sentinel Expansion may affect but not likely to adversely impact endangered wildlife species.

The EIR/EIS document prepared by the Forest Service and the County will assess biological resources, potential impacts, and the mitigation land proposal for the conservation of carbonate plant species but which will also have value for wildlife usage.

The following discussion summarizes the wildlife resources in the expansion areas based on the above reports and the Forest Service. Descriptions are based on the habitat that existed prior to large forest fires in the immediate area. Wildlife utilization patterns may have changed since the fires. No wildlife species currently listed on the Federal List of Threatened or Endangered species are known to inhabit the expansion areas.

The arid woodland in the project area provides suitable habitat for several sensitive species including Nelson's Bighorn Sheep (*Ovis canadensis nelson),* Mountain lions (*Felis concolor*), mule deer (*Odocoileus hemionus*), American badger (*Taxidea taxus*), sagebrush lizard (*Sceloporus graciosus vanderbergianus*), gray vireo (*Vireo vicinior),* and mountain quail (*Oreotyx pictus).* Various raptor and bat species may utilize the area for foraging but this may be minimal due to the existing mining operations. There have been no raptor nests found onsite and there are no abandoned tunnels or shafts for use as bat roosts. There are no seasonal or perennial water sources on the Proposed Project site which could serve as breeding habitat for frogs or toads or create riparian habitat.

Mountain lions are known to inhabit the less populated areas of the San Bernardino Mountains, but because of their enormous home ranges and reclusive habits, it is extremely difficult to obtain reliable data on their population ecology. It is unlikely that anything more than occasional transient occupancy by a solitary lion occurs within the area. No observations of lions or lion signs were made during the field surveys.

Nelson's Bighorn Sheep

Nelson's bighorn sheep (*Ovis canadensis nelsoni*) is one of three bighorn subspecies occurring in California. The others are California bighorn (*O. c. californiana*) of the Sierra Nevada and Peninsular bighorn (*O. c. cremnobates*), of the Santa Rosa Mountains, scattered ranges in San Diego County, and northern Baja California. The California and Peninsular subspecies are both listed as threatened or endangered by both state and federal agencies, but Nelson's bighorn occurs in substantial numbers in several mountain ranges and is not listed, proposed for listing, or a candidate for listing as threatened or endangered. It is managed as a Special Status species by the Forest Service and as a protected species by the CDFG.

Nelson's bighorn sheep are known to occur in the vicinity of the Sentinel Quarry, but sightings in the Butterfield Quarry area are rare. During the past years, only a few sightings in the Butterfield area have occurred. The herd does not appear to migrate very far to the west of the Butterfield 5 Pad or utilize the Butterfield expansion area further west. The northern end of Sentinel appears to be a favored location because it offers unobstructed views, escape paths, shade and vegetation which are to their liking for browsing, and the wildlife guzzler established by Omya with consultation with the CDFG and the Bighorn Sheep Society in 1998 is also located in this area.

The herd (up to 15) has been in the general area for many years and is apparently stable. The Forest Service, CDFG, and BLM have tagged, tracked and monitored the migration paths of the sheep for many years. The sheep appear unaffected by the mining activities, and have been seen along the highwalls alongside mining activities at several of the existing quarries in the region. BLM data and other observations thus far indicate that the mining activities do not adversely impact the sheep. The CDFG and the Forest Service are continuing to study the Bighorn sheep in the area through tagging and tracking.

Omya has cooperated with and participated in several projects which yield additional information or are believed to enhance the habitat of the Bighorn sheep. This will continue in the

future. These projects include providing funds to the Bighorn Sheep Society for construction of drinkers, providing information on Bighorn sightings, providing access for capture and tagging, and the installation of the drinker and motion detection camera project at the north end of Sentinel, in which Omya provided critical aspects of the project. As part of ongoing cooperation with the agencies, CDFG has recommended and the Forest Service has determined that Omya should delay backfilling of the Sentinel Quarry as feasible to reduce disturbance to Bighorn sheep and their habitat in the area of the guzzler at the north end of the quarry.

As discussed above, a BA and the approved Plan of Operations for the Sentinel Quarry expansion approved by the Forest Service in 2002 included a number of conditions and measures to reduce and limit potential impacts to listed plant species as well as for sensitive wildlife species (mainly bighorn sheep). These included avoidance as feasible of existing and potential habitat, reducing dust deposition, and land compensation by relinquishment of 80 acres of placer claims adjacent to the Bighorn Wilderness Area. The 80 acres were relinquished in 2003 and the area has a high potential for bighorn sheep use.

Spotted Owls

California (subspecies) spotted owl is not on the Federal list of Threatened and Endangered species, but is considered by the Forest Service to be a sensitive species. In 1987, a pair of California spotted owls established a nesting site in the west fork of Crystal Creek nearly 1 mile north of the proposed Butterfield Quarry expansion area. Between 1987 and 2000, the territory was occupied by a pair of owls in all but one year. Part of the habitat burned in the Willow fire in 1999, but the territory continued to be occupied by a pair in 2000. A single female was located in 2002, and the territory was not monitored in 2003-04. Since 2005, the territory has been vacant but could be reoccupied in the future (see Appendix 6E, SBNF correspondence 2009).

A spotted owl management plan for the Crystal Creek pair was prepared and approved by SBNF in 1989. The management plans include specific mitigations to reduce or eliminate potential adverse impacts that have been implemented by Omya.

The SBNF uses a restriction of activities (Limited Operating Period or LOP) within ¼ mile of known nests between February 1 and August 15 to limit disturbance to breeding birds. The LOP is well away from the proposed expansion area. The existing quarry is about 0.4 miles away from the outer limit of the ¼ mile LOP circle and the proposed expansion will be no closer to the LOP. The Forest Service has indicated that since the quarry is outside of the LOP no noise impacts would be expected, and as proposed, the quarry expansion would not result in impacts to mapped spotted owl habitat.

In addition, the nest and core territory includes dense canyon live oak and incense cedar, which is surrounded by dry pinyon-juniper and iron wood which is not suitable habitat. The Proposed Project is pinyon-juniper woodland and is not considered suitable habitat.

Migratory Birds

State and federal law prohibits take of native birds under the federal Migratory Bird Treaty Act (MBTA) and California Fish and Game Code. Golden eagles are fully protected by California law and have special federal protection under the Bald and Golden Eagle Protection Act. To avoid incidental killing of birds protected under the MBTA, two measures would be implemented: (1) Complete all vegetation removal or initial grading outside the breeding season (*i.e.*, do not remove potential nesting habitat from February 1 through August 31, or appropriate dates based on on-site nesting phenology determined by a qualified biologist), or (2) confirm prior to beginning vegetation removal but after survey flagging is in place showing the limits of grading, that no birds are nesting in areas to be disturbed.

The environmental document will provide biological data and assess biological resources, potential impacts, application of the CHMS, and mitigation for potential impacts to wildlife resources.

2.5 RECLAMATION

The Forest Service approved the previous Omya Umbrella Plan of Operations and Reclamation Plan in 1988 and the SMARA Reclamation Plan (94M-02) was approved by the Forest Service and the County in 1994. The Forest Service approved the existing Plan of Operations and Reclamation Plan for Butterfield and Sentinel Quarries in 2002, following completion of an environmental assessment and evaluation of the plan of operations. The SMARA Reclamation Plan was amended and approved by the County in 2003.

The Butterfield and Sentinel Quarries' operations discussed in this Plan are approved mines consisting of the quarries, overburden placement sites, haul roads, and a primary crusher. All other aspects of the operations including other quarries and haul roads are covered in the existing approved plans and are not discussed or proposed for change in this document.

As noted, the 2003 Reclamation Plan has been previously approved by the Forest Service and the County, the SMARA lead agency. The approved plan includes a detailed revegetation plan reviewed and approved by the agencies. No changes to the approved reclamation and revegetation methods are proposed for this expansion plan. As such, many portions of the following discussions are unchanged from the previously approved SMARA Reclamation plan. No changes are proposed for conceptual reclamation of the Butterfield and Sentinel Quarries and stockpiles. The timing and some specific details of reclamation are affected by the expansion and will be discussed in detail.

Article 9, Section 3700 of SMARA states the following: "Reclamation of mined lands shall be implemented in conformance with standards in this Article (Reclamation Standards). The standards shall apply to each surface mining operation to the extent that:

(1) they are consistent with required mitigation identified in conformance with CEQA; and
(2) they are consistent with the planned or actual subsequent use or uses of the mining site."

Omya proposes to reclaim the site to meet both Forest Service Minerals Regulations (36 CFR 228, Subpart A) under the jurisdiction of the SBNF and SMARA implemented by the County that will minimize impacts to the surrounding environment. The objectives of this Reclamation Plan are to:

- Eliminate or reduce environmental impacts from mining operations;
- Reclaim in a usable condition for post-mining end uses which will include open space/habitat;
- Reshape mining features and revegetate disturbed areas to return biological productivity and to minimize aesthetic impacts; and
- Reclaim the site as necessary to eliminate hazards to public health and safety.

Because of the phased nature of the mining development, reclamation concurrent with mining only can occur to a limited degree for safety and logistical reasons. Concurrent reclamation starts with the initiation of mining and includes the following:

- Salvaging and stockpiling of grubbed organics, soils, growth media, seeds, and re-locatable plants and cuttings for propagation and direct deposition and/or re-planting to available reclamation areas during clearing of areas to be developed;
- Ongoing seed collection onsite and/or adjacent to the site and propagation of seeds, salvaged plants and cuttings at local nursery by a contracted revegetation contractor;
- Backfilling of the eastern half of the Butterfield Quarry and portions of the Sentinel Quarry as feasible;
- Sloping and grading of completed quarry and stockpile slopes for safety, slope stability, and erosion control;
- Placement of darker materials, as available, on outside of more visible slopes and colorization if shown successful for slopes not susceptible to raveling to reduce color contrast;
- Ripping of compacted areas prior to revegetation;
- Covering approximately 30% of equipment accessible horizontal areas with salvaged soil, growth media and organics utilizing the island concept;
- Reclamation of onsite roads after reclamation of quarries and pads certified complete as determined by Forest Service in order to allow access to all reclamation areas;
- Revegetation – hand seeding and direct seeding followed by imprinting, seedling planting, and hydroseeding will be utilized as deemed most effective;
- Irrigation may be conducted for 2 years to maximize establishment; and
- Monitoring and remediation until success criteria achieved.

Although mining is more or less continuous, the development of the quarries and their ultimate timing for reclamation are linked to operational parameters and product demand needs. Mining operations may experience unscheduled phasing changes due to various market/economic demands and variation in material quality since the natural deposit is not of uniform quality. The

SBNF and the County will be updated in the annual monitoring report on the status of operational and reclamation phases.

The Reclamation Plot Plan is included as Figure 10 and attached as Sheet 3 of 4. Reclamation will consist of sloping excavated cuts and benches that will not be backfilled to meet the designed approximate 1H:1V overall slope. The individual benches will be approximately 60 feet vertical at 70° and 30 to 35 feet wide at Sentinel; and 50 feet vertical at 70° and at least 25 feet wide at Butterfield as mapped on Sheet 2. Slopes may be flatter where backfilled with waste rock. Bench heights also will vary with material encountered and have been determined as a result of detailed studies of the geologic structure, over 30 years of mining experience in this specific mine site, and consultations with various experts including government and private sector. A summary of the general phased reclamation is listed in Table 7.

Table 7
Reclamation Phasing
Butterfield and Sentinel Quarries

PHASE	YEARS OF OPERATION (estimated*)	PLANNED RECLAMATION ACTIVITIES
1	1 - 10	Newly developed areas - Salvage and stockpile plants and cuttings, organics, seeds, and soil. Central Area – Initiate sloping of B5 Quarry fill to 2H:1V and for erosion control.
2	11 - 20	Newly developed areas - Salvage and stockpile plants and cuttings, organics, seeds, and soil. Sentinel Quarry - Initiate backfilling on mined north slopes as become available. Central Area – Complete filling and sloping of B5 Quarry; initiate revegetation. Butterfield Quarry- Salvage and stockpile plants and cuttings, organics, seeds, and soil from western area as mining develops. B5 Pad - Initiate sloping to 2H:1V where feasible and for erosion control.
3	21 -30	Sentinel Quarry – Continue backfilling from north as mined slopes become available. Central Pads – B5 Quarry reclamation complete; revegetation, monitoring, and remediation as needed. Butterfield Quarry - Salvage and stockpile plants and cuttings, organics, seeds, and soil from western area as mining develops. Initiate placement of overburden in completed east half as available. B5 Pad – Stockpile completed; initiate reclamation and revegetation.
4 (Final Mining Phase)	31 - 40	Sentinel Quarry – Complete north slope backfilling and initiate sloping to 2H:1V and for erosion control; revegetation on completed backfill areas. Central Area – B5 Quarry reclamation complete; Revegetation, monitoring, & remediation as needed. Butterfield Quarry - Complete backfilling of eastern half to approximate original contour of approx. 7,850 to 7,875 feet. B5 Pad - Ongoing revegetation monitoring and remediation as needed.

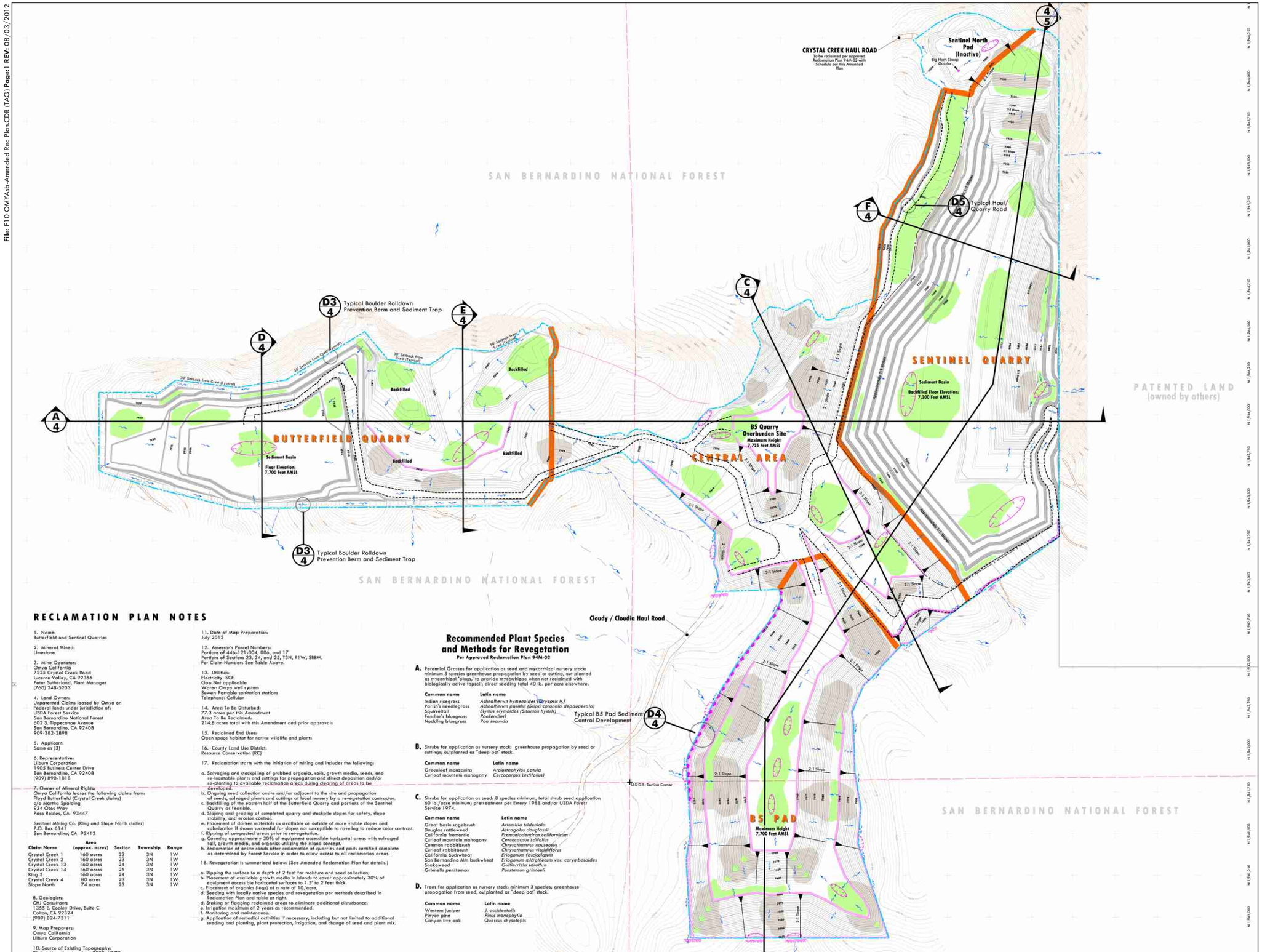
PHASE	YEARS OF OPERATION (estimated*)	PLANNED RECLAMATION ACTIVITIES
5 Final Reclamation	41 - 50	Remove crusher and other plant equipment (within one year after completion of mining). Sentinel Quarry – Finish sloping of backfill to 2H:1V; revegetate all areas not previously revegetated; maintain erosion control; monitor revegetation progress and conduct remediation as necessary until success criteria achieved. Butterfield Quarry- Finish sloping of quarry and backfill; revegetate; maintain erosion control; monitor revegetation progress and conduct remediation as necessary until success criteria achieved. Central Area - Finish sloping of backfill; revegetate; maintain erosion control; monitor revegetation progress; and conduct remediation as necessary until success criteria achieved. B5 Pad – Ongoing revegetation monitoring and remediation as necessary until success criteria achieved. Onsite Roads - Reclaimed after reclamation of quarries and pads certified complete as determined by Forest Service in order to allow access to all reclamation areas. Crystal Creek Haul Road – Maintained for reclamation and monitoring access to Butterfield – Sentinel Quarries.
5A Crystal Creek Road	51 - 60	Crystal Creek Haul Road – Reclaim per approved 1994 Reclamation Plan. Remove outside berm to toe of cut, install erosion controls, and revegetate (year 2066). Maintain erosion control; monitor revegetation progress; and conduct remediation as necessary years 2067 to 2075.

Final Reclamation

Final reclamation will take place within the 10 years after termination of mining. All remaining equipment, stockpiles, and internal roads not needed for site access, reclamation, and revegetation and general site monitoring will be reclaimed. Final sloping of quarry walls, backfilled areas, and overburden stockpiles; erosion control; and revegetation of any unreclaimed areas and waste rock stockpiles will be conducted. Some haul roads may be left onsite for use in the revegetation and monitoring activities and for overall site public safety. Ongoing maintenance of fencing, signs, and erosion control will be conducted. Roads not needed for site and quarry access will be ripped, covered with available growth media, and revegetated. Other onsite roads needed for quarry and pad access will be reclaimed after reclamation of quarries and pads are certified complete as determined by Forest Service in order to allow access to all reclamation areas.

The Crystal Creek Haul Road is needed for access from Lucerne Valley to the quarries during the mining and reclamation phases. After receiving certification from the Forest Service and County that reclamation and revegetation of the quarries have achieved success criteria, this road will be reclaimed per the approved 1994 Reclamation Plan as summarized in Table 7 above unless requested by the Forest Service to leave the road in place.

File: F10 OMYAsb-Amended Rec Plan.CDR (TAG) Page: 1 REV: 08/03/2012



RECLAMATION PLAN NOTES

1. Name:
Butterfield and Sentinel Quarries

2. Mineral Mined:
Limestone

3. Mine Operator:
Omya California
7225 Crystal Creek Road
Lucerne Valley, CA 92356
Peter Sutherland, Plant Manager
(760) 248-5233

4. Land Owner:
Unpatented Claims leased by Omya on Federal lands under jurisdiction of:
USDA Forest Service
San Bernardino National Forest
602 S. Tippeconoe Avenue
San Bernardino, CA 92408
909-382-2898

5. Applicant:
Same as (3)

6. Representative:
Lilburn Corporation
1905 Business Center Drive
San Bernardino, CA 92408
(909) 890-1818

7. Owner of Mineral Rights:
Omya California leases the following claims from:
Floyd Butterfield (Crystal Creek claims)
c/o Martha Spalding
934 Oaks Way
Paso Robles, CA 93447

Sentinel Mining Co. (King and Slope North claims)
P.O. Box 6141
San Bernardino, CA 92412

Claim Name	Area (approx. acres)	Section	Township	Range
Crystal Creek 1	160 acres	23	3N	1W
Crystal Creek 2	160 acres	23	3N	1W
Crystal Creek 13	160 acres	24	3N	1W
Crystal Creek 14	160 acres	25	3N	1W
King 3	160 acres	24	3N	1W
Crystal Creek 4	80 acres	23	3N	1W
Slope North	74 acres	23	3N	1W

8. Geologists:
CHJ Consultants
1355 E. Cooley Drive, Suite C
Colton, CA 92324
(909) 824-7311

9. Map Preparers:
Omya California
Lilburn Corporation

10. Source of Existing Topography:
Digital Mapping, Inc. June 2008; USGS

11. Date of Map Preparation:
July 2012

12. Assessor's Parcel Numbers:
Portions of 446-121-004, 006, and 17
Portions of Sections 23, 24, and 25, T3N, R1W, SBBM.
For Claim Numbers See Table Above.

13. Utilities:
Electricity: SCE
Gas: Not applicable
Water: Omya well system
Sewer: Portable sanitation stations
Telephone: Cellular

14. Area To Be Disturbed:
77.3 acres per this Amendment
Area To Be Reclaimed:
214.8 acres total with this Amendment and prior approvals

15. Reclaimed End Uses:
Open space habitat for native wildlife and plants

16. County Land Use District:
Resource Conservation (RC)

17. Reclamation starts with the initiation of mining and includes the following:

a. Salvaging and stockpiling of grubbed organics, soils, growth media, seeds, and re-locatable plants and cuttings for propagation and direct deposition and/or re-planting to available reclamation areas during clearing of areas to be developed.
b. Ongoing seed collection onsite and/or adjacent to the site and propagation of seeds, salvaged plants and cuttings at local nursery by a revegetation contractor.
c. Backfilling of the eastern half of the Butterfield Quarry and portions of the Sentinel Quarry as feasible.
d. Sloping and grading of completed quarry and stockpile slopes for safety, slope stability, and erosion control.
e. Placement of darker materials as available on outside of more visible slopes and colorization if shown successful for slopes not susceptible to raveling to reduce color contrast.
f. Ripping of compacted areas prior to revegetation.
g. Covering approximately 30% of equipment accessible horizontal areas with salvaged soil, growth media, and organics utilizing the island concept.
h. Reclamation of onsite roads after reclamation of quarries and pads certified complete as determined by Forest Service in order to allow access to all reclamation areas.

18. Revegetation is summarized below: (See Amended Reclamation Plan for details.)

a. Ripping the surface to a depth of 2 feet for moisture and seed collection;
b. Placement of available growth media in islands to cover approximately 30% of equipment accessible horizontal surfaces to 1.5' to 2 feet thick.
c. Placement of organics (logs) at a rate of 10/acre.
d. Seeding with locally native species and revegetation per methods described in Reclamation Plan and table at right.
e. Staking or flagging reclaimed areas to eliminate additional disturbance.
f. Irrigation maximum of 2 years as recommended.
f. Monitoring and maintenance.
g. Application of remedial activities if necessary, including but not limited to additional seeding and planting, plant protection, irrigation, and change of seed and plant mix.

Recommended Plant Species and Methods for Revegetation

Per Approved Reclamation Plan 94M-02

A. Perennial Grasses for application as seed and mycorrhizal nursery stock: minimum 5 species greenhouse propagation by seed or cutting, out planted as mycorrhizal 'plugs,' to provide mycorrhizae when not reclaimed with biologically active topsoil; direct seeding total 40 lb. per acre elsewhere.

Common name	Latin name
Indian ricegrass	*Achnatherum hymenoides (Oryzopsis h.)*
Parish's needlegrass	*Achnatherum parishii (Stipa coronata depauperata)*
Squirreltail	*Elymus elymoides (Sitanion hystrix)*
Fendler's bluegrass	*Poafendleri*
Nodding bluegrass	*Poa secunda*

B. Shrubs for application as nursery stock: greenhouse propagation by seed or cuttings; outplanted as "deep pot" stock.

Common name	Latin name
Greenleaf manzanita	*Arclostaphylos patula*
Curleaf mountain mahogany	*Cercocarpus ledifolius)*

C. Shrubs for application as seed: 8 species minimum, total shrub seed application 60 lb./acre minimum; pretreatment per Emery 1988 and/or USDA Forest Service 1974.

Common name	Latin name
Great basin sagebrush	*Artemisia tridentata*
Douglas rattleweed	*Astragalus douglasii*
California fremontia	*Fremontodendron californicum*
Curleaf mountain mahogany	*Cercocarpus Ledifolius*
Common rabbitbrush	*Chrysothamnus nauseosus*
Curleaf rabbitbrush	*Chrysothamnus viscidiflorus*
California buckwheat	*Eriogonum fasciculatum*
San Bernardino Mtn buckwheat	*Eriogonum microthecum var. corymbosoides*
Snakeweed	*Guitierrizia sarothre*
Grinnells penstemon	*Penstemon grinnelli*

D. Trees for application as nursery stock: minimum 3 species; greenhouse propagation from seed, outplanted as "deep pot" stock.

Common name	Latin name
Western juniper	*J. occidentalis*
Pinyon pine	*Pinus monophylla*
Canyan live oak	*Quercus chrysolepis*

LEGEND

- Amended Operations Limits of Disturbance
- Reclaimed Major Contour
- Reclaimed Minor Contour
- Roads to Remain
- Slope Indicator
  - Top of slope
  - Toe of slope
- Existing Major Contour
- Existing Minor Contour
- Existing Drainages
- Boulder Barrier
- RipRap
- Design Drainage
- Sump (typical)
- Existing Natural Sump
- Storm Water Control Berm
- Sediment Control
- Berm as Necessary
- 3-strand Wire Fence (typical)
- Soil Islands for
- Growth Media (typical)

NT

0 550

FEET

Source: LILBURN CORP., 2012

LILBURN CORPORATION

AMENDED RECLAMATION PLAN

BUTTERFIELD and SENTINEL QUARRIES

Amended Plan of Operations and Reclamation Plan

Omya California, San Bernardino National Forest, California

FIGURE 10

Backfilling of Sentinel Quarry

During mining of the Sentinel Quarry, concurrent backfilling of the pit will also occur but only after those portions of the pit have reached their final outer limit and the ore has been mined. During Phases 3 and 4, the Sentinel Quarry will be mined in incremental pushbacks to the lateral extent and final depth of 7,000 feet. Waste material will be backfilled starting at the northern end and gradually filling the quarry to an estimated elevation of 7,550 feet on the north slope and to approximately 7,300 to 7,325 feet on the quarry floor. Backfill slopes will be reduced to 2H:1V during final reclamation. The final backfilled floor will be graded to drain towards the high wall on the south and west and will have capacity to retain all quarry run-off for a 100-year precipitation event. The Amended Plan will allow up to 14.4 million tons of back fill to be placed in the pit.

Once various portions of the pit are backfilled to completion, concurrent revegetation can also begin on the completed portion of backfill during Phase 4 and then completed during Phase 5. This Plan allows for substantial backfill to be placed in the mined out portion of Sentinel, and also allows for an efficient mining plan, consistent mining costs, better selectivity, more even royalty payment distribution, and the most flexibility in overburden placement, in addition to concurrent reclamation, and minimum disturbance of new ground.

Backfilling of Butterfield Quarry

During Phase 3, mining will be initiated in the western portion of the Butterfield Quarry. Excavations will continue until the end of Phase 4 to the planned floor depth of 7,700 feet amsl or approximately 200 feet below the northern rim. During mining of the western half of the Butterfield Quarry, concurrent backfilling of the eastern quarry area will occur. Ultimately the eastern portion will be completely backfilled to its approximate original contours as shown in Figure 12 and on Sheet 3. The overburden will be progressively placed in the eastern Butterfield Quarry, but only after those portions of the quarry have reached their final outer limit and the ore has been mined out.

This Plan allows for substantial backfill to be placed in the mined out portion of Butterfield Quarry, and also provides for an efficient mining plan, consistent mining costs, better selectivity, even royalty payment distribution to claim owners, and the most flexibility in overburden placement. Furthermore it allows concurrent reclamation of the quarry and overburden site, minimum disturbance of new ground, and phased incremental disturbance of new ground only as necessary for both quarry and overburden sites. The existing plan will allow up to 4.8 million tons of backfill to be placed in the pit.

2.6 REVEGETATION

A detailed revegetation plan for the entire Omya operations located on Forest Service lands including the Butterfield and Sentinel Quarries was prepared and approved by both the Forest Service and San Bernardino County in 1996. This Revegetation Plan is included as Appendix 5. There are no substantive changes to the approved revegetation plan, only the timing and number

of acres have been updated. Therefore this section includes only a summary of the approved plan.

Reclamation of the disturbed areas will include site cleanup and removal of any buildings or equipment, recontouring of slopes as necessary, backfilling, and construction and maintenance of drainage controls. Revegetation will include ripping, placement of growth media and organics (logs), and revegetation during the fall planting season. The island concept will be utilized and will cover approximately 30% of the equipment-accessible horizontal surface in a manner which will allow maximum visual enhancement and revegetation success. The islands will trap windblown seeds and attract wildlife to aid in seed dispersal. Irrigation will occur for 2 years as needed, followed by monitoring for 10 years or until success criteria are met.

Growth Media Salvage and Storage

Despite rocky outcrops and paucity of soil, much of the soil, growth media and vegetative material are salvaged prior to mining. The following methods have been successful onsite in the past years:

- Timber cutting and removal to storage site;
- Clearing and grubbing with stumps and remaining vegetation removed to storage site; and
- Soil salvaging of available growth media stockpiled separately from overburden and clearly identified.

Growth media has been and will continue to be salvaged from quarry and overburden site development activities. Soils are poorly developed in the rocky and rugged mountain terrain (see Section 2.11 below). Growth media includes top soil which is rarely more than 1-foot thick and decomposed granite and limestone regolith with tree stumps and roots. Most soil and growth media salvaged from expanded operations will be from the west half of the Butterfield Quarry, the expansion of the B5 Pad, and the southern expansion of the Sentinel Quarry. Salvaged topsoil, growth media and vegetation will only be collected in phases as new areas are opened up for development.

Salvaged soil, growth media and organic material may be distributed directly to active reclamation sites in order to minimize the storage period and reduce seed mortality, which is preferred. Growth media has been and will be stored in three areas labeled Material/Growth Media Storage Areas generally located east of Butterfield and northwest of the B5 Pad (see Sheet 2). Salvaged material may also be temporarily stored on available areas on the overburden stockpile areas during the course of operations. Permanent and temporary material/growth media stockpiles will be stockpiled separate from overburden and clearly identified. Existing soil and growth media piles have berms around the perimeter to retain growth media and prevent soil loss and downstream sedimentation. Seasonal rain and snow provide some dampening, and spontaneous revegetation by contained and windblown seeds provides stability and reduces erosion of the existing piles. In addition, wetting and drying will produce a crust which minimizes wind erosion.

Total current and projected future growth media inventory indicates there is not enough to cover 100% of the surface area to a viable depth. Based on previous experience, 1.5 to 2 feet of soil and growth media cover is deposited over the ripped surface to allow root penetration to sustain growth. Therefore the island concept is utilized in which islands of growth media of adequate thickness are placed to allow root development and penetration during revegetation. The island concept is in fact close to reality, as some areas of the mine site are sparsely vegetated while others are more densely vegetated. The island concept will allow growth media coverage of about thirty percent (30%) of the equipment-accessible horizontal surface to be reclaimed. Table 8 shows existing projected and proposed volumes of growth media available and to be used for revegetation.

Table 8
Estimated Growth Media Available

Site Name	Growth Media Volume (CY)
Approx. Existing Stored Material	32,200
Volume (cy) estimated to be salvaged during future 40-year development (based in 1-foot depth per undisturbed acre)	
Sentinel Quarry (10.8 ac – southern expansion)	17,500
Butterfield Quarry (28.6 ac)	46,000
B-5 Pad expansion (approx. 40 ac) (includes approved areas not previously cleared)	64,500
Central Areas (15.2 ac)	24,500
Total Existing and Future Projected Growth Media Available (cy)	**184,700**
Estimated reclaimed acres covered by salvaged growth media (Goal 30% of equipment accessible horizontal areas) (Total project area disturbed 214 acres; 30% = 64 acres)	@ 2-foot depth - 57 acres @ 1.75-foot depth – 65 acres @1.5-foot depth = 76 acres

Note: Quantities are rounded estimates only and will vary with area to be cleared.
Source: Omya, Lilburn 2012

The existing woodlands onsite are characterized by slow-growing tree species (pinyon pine, juniper, and Jeffrey pine). The revegetation plan objective is to establish "islands" with salvaged topsoil and organics to create conditions favorable for the early-successional plants such as perennial grasses, rabbit brush, fremontia, and sage brush. Nursery-grown pinyon pine, canyon live oak, western juniper, manzanita, and curl-leaf mountain mahogany will be planted when the sites are deemed favorable for planting and seeding of "climax" trees and shrubs. Revegetation is summarized below:

1. Ripping the surface to a depth of 2 feet for moisture and seed collection;
2. Placement of available growth media utilizing the island concept to cover approximately 30% of equipment accessible horizontal surfaces, 1.5' to 2' thick;

3. Placement of organics (logs) at a rate of 10/acre;
4. Seeding with locally native species and revegetation per methods described and as listed in Table 10;
5. Staking or flagging reclaimed areas to eliminate additional disturbance;
6. Irrigation maximum of 2 years as recommended;
7. Monitoring and maintenance; and
8. Application of remedial activities, if necessary, including but not limited to additional seeding and planting, plant protection, irrigation, and change of seed and plant mix,.

Existing Vegetation Data

Within the site's elevation and geographic area, the northern San Bernardino Mountains support a mosaic of Pinyon – Juniper woodlands, dominated by singleleaf pinyon and shrubby canyon live oak, often with high cover of curlleaf mountain mahogany. Southeastern portions of the site also include white fir and Jeffrey pine.

The woodlands portion of the project site is described as pinyon woodland generally in relatively open stands, characterized by scattered pinyon pines and Utah junipers growing with montane shrubs. This composition is characteristic of early successional pinyon woodlands (Wangler and Minnich 1995; Neel 2000) and also is typical of woodlands on carbonate soils, which tend to be less productive than other soil types. The woodland generally matches Neel's (2000) descriptions of vegetation in the region, based on her extensive sampling on limestone soils throughout the northern San Bernardino Mountains. Neel's previous work is directly applicable to the local vegetation, soils, and flora, and provides even more detailed vegetation descriptions than recommended in SMARA guidelines for project site data collection. In Neel's (2000) description, Singleleaf Pinyon Series is dominated in the overstory by singleleaf pinyon pine and several characteristic shrub species, including Great Basin sagebrush (*Artemisia tridentata*), green ephedra (*Ephedra viridis*), narrowleaf goldenbush (*Ericameria linearifolia*), and antelope brush. Average overstory (tree canopy) cover was about 25% and average shrub cover was about 49%, which is comparable to the pinyon woodlands on the proposed sites (see Table 9).

Table 9
Vegetation Characteristics of Pinyon Woodlands
on Limestone Soils in the Northern San Bernardino Mountains

Vegetation Type	Tree Cover	Shrub Cover	Shrub & Tree Cover	Shrub & Tree Species Richness	Tree Density
Pinyon woodland (including mixed stands w/ Utah juniper or Canyon live oak and early-successional shrub-dominated stands)	25%	49%	74%	10 spp. / 0.1 acre plot	84 / acre

Source: (From M. C. Neel 2000)

These data are used to establish the cover and diversity of each species per unit area per SMARA guidelines and to determine success criteria for future revegetation. Estimates of plant cover based on these plots are percent, density is plants/acre, and species richness or diversity is number of different species per 0.1-acre plot.

Plant Salvage

Where possible, perennial grasses and other shrubs likely to survive transplantation should be salvaged for storage and propagation at the nursery. For grasses, whole plants can be salvaged and then can be cut into multiple clumps rather than the taking of cuttings. Cuttings from manzanita and other shrubs as recommended should be collected.

Seed Collection

Effective revegetation requires a dependable seed supply. Omya has arranged for ongoing collection and storage of species utilized in revegetation, and other additional species as they become available. Some seed is used for nursery propagation, but most is sown onto revegetation sites to maximize cover and diversity of native species. Seed originates from on or near the site where it is planted. Many species included in this revegetation plan occur commonly throughout the project area (e.g., pines, junipers, fremontia, and mountain mahogany). Others are especially common in disturbed areas. Seed will be collected directly from areas prior to development and from other adjacent sources.

Seed are collected, cleaned, and stored by various techniques. Available seed will vary from year to year, and collecting adequate quantities will necessitate regular monitoring throughout summer to identify sites where various species are in seed. Records of seed sources, including substrate (carbonate or granitic) and elevation, are maintained so that seed will be reintroduced into appropriate environments. Omya has also propagated native plants in a nursery through its revegetation contractor.

At planting, seed is either mixed or raked into the top layer of replaced soil, or applied during surface imprinting or use of a sheep's foot attachment. In some cases, application is tripled and cages placed to allow for loss to granivores.

Plant Propagation

On-site collection of seed and cuttings is also recommended because of their availability and the likelihood of local ecotypes adapted to elevation and soils. The revegetation plan recommended that revegetation rely on a combination of greenhouse-grown stock, seeding, natural seed banks, and natural dispersal. Additional seeding will be used as a remedial measure if monitoring indicates that diversity is insufficient to meet SBNF success criteria. Seed collection has been ongoing at the Omya sites since 1995.

Omya has contracted with local restoration specialists (JJ Restoration Service, Lucerne Valley, CA) to store and propagate plant materials. Plants are grown with minimal fertilization and watering, in containers designed to maximize root/shoot ratios. All nursery-grown plants

destined for out planting onto carbonate soil are raised in similar soil. Planting is coordinated with revegetation planning to assure an adequate supply of the necessary species as they are needed for planting.

Shrubs and grasses are propagated in advance and outplanted as established stock. They provide (1) vertical structure, including shade and shelter from elements, and (2) a source of mycorrhizae for seeds germinating on the site. A mix of shrubs and native perennial grasses is used. Nursery stock is inoculated with mycorrhizae suitable to the area.

Site Preparation

The site will be sloped per the reclamation plan and graded for slope stability and erosion control. Compacted areas will be ripped to depth of 2-feet if feasible due to the rock material to relieve compaction and to create an uneven surface. This will aid in collecting wind borne seeds and moisture and create more favorable microhabitats.

After final grading and contouring, salvaged growth media will be placed to a depth of 1.5 to 2 feet on areas to be revegetated in islands totaling approximately 30% of equipment accessible, horizontal disturbed areas to create an uneven surface. Soil will be slightly compacted to reduce erosion.

Growth media 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. In addition to growth media, organics (trees and logs salvaged) will be spread on the site at a rate of approximately 10 logs per acre based on observations of the area. The logs serve a useful purpose as they provide shade and animal habitat, but also ultimately decompose adding organic matter and thus enrich the soil.

Slash salvaged from vegetation removal will also be utilized in reclamation. The slash material adds organic matter to the revegetation sites. The mulch decays more quickly than the logs, and thus organic material will be added to the soil in both short and long term time frame.

Existing mining law (1872) allows timber to be available to the mining company if it is utilized for mining activities. Omya has and will continue to utilize the timber salvaged for reclamation purposes. The wood is not utilized as fire wood. The wood is stored behind locked gates in an area with no vegetation around the perimeter and is not available to the public or employees.

Seeding

Broadcast seeding, direct seeding, seedling planting and/or hydroseeding will be utilized and usually occurs during the fall season. Irrigation, if recommended, will continue for a maximum of two years. At planting, seed is either mixed or raked into the top layer of replaced soil, or applied during surface imprinting or use of a sheep's foot attachment to increase seed germination, moisture infiltration and reduce erosion. In some cases, application is tripled and cages placed to allow for loss to granivores.

The specific seed mixture and revegetation methods are detailed in the revegetation plan (see Appendix 5) and are listed in Table 10.

Table 10
Recommended Plant Species for Revegetation

Perennial Grasses for application as seed and mycorrhizal nursery stock: minimum 5 species greenhouse propagation by seed or cutting, outplanted as mycorrhizal 'plugs,' to provide mycorrhizae when not reclaimed with biologically active topsoil; direct seeding total 40 lb. per acre elsewhere.

Common name	Latin name
Indian ricegrass	*Achnalherwn hymenoides (Oryzpsis h,)*
Parish's needlegrass	*Achnalherum parishii (Sripa coronala depauperala)*
Squirreltail	*Elymus elymoides (Sitanion hystrlr)*
Fendler's bluegrass	*Poafendleri*
Nodding bluegrass	*Poa secunda*

Shrubs for application as nursery stock: greenhouse propagation by seed or cuttings; outplanted as "deep pot' stock.

Common name	Latin name
Greenleaf manzanita	*Arclostaphylos patula*
Curleaf mountain mahogany	*Cercocarpus Ledifolius*)

Shrubs for application as seed: 8 species minimum, total shrub seed application 60 lb./acre minimum; pretreatment *per* Emery 1988 and/or USDA Forest Service 1974.

Common Name	Latin name
Great basin sagebrush	*Artemisia trideniala*
Douglas rattleweed	*Astragalus douglassii*
California fremontia	*Fremoniodendron californicum*
Curleaf mountain mahogony	*Cercocarpus Ldifolius*
Common rabbitbrush	*Chrysothamnus nauseosus*
Curleaf rabbitbrush	*Chrysothamnus viscidiflorus*
California buckwheat	*Eriogonum fasciculatum*
San Bernardino Mtn buckwheat	*Eriogonum microthecum var. corymbosoides*
Snakeweed	*Guitierrizia sarothre*
Grinnells penstemon	*Penstemon grinneuii*

Trees for application as nursery stock: minimum 3 species; greenhouse propagation from seed, outplanted as "deep pot' stock.

Common name	Latin name
Western juniper	*J. occidentalis*
Pinyon pine	*Pinus monophylla*
Canyon live oak	*Quercus chysolepis*

Source: "Revegetation Plan" Omya Mining Operations on USDA Forest Service Land San Bernardino National Forest," Tierra Madre Consultants 1996

Irrigation

Irrigation will be conducted as needed (up to 2 years) to allow the revegetated areas to receive adequate moisture to become established but to not create a dependence on artificial irrigation.

Weed Control

The purpose of the weed control plan is to reduce or eliminate the occurrence of non-native invasive plant species deemed harmful by the Forest Service that may invade the site where mining activities have removed the native plant cover and where active and natural revegetation is taking place. Non-native invasive species (weeds) can compete with native plant species for available moisture and nutrients and consequently interfere with revegetation of the site.

The occurrence of weeds on-site shall be monitored by visual inspection. The goal is to prevent weeds from becoming established and depositing seeds in areas to be revegetated at a later date. No areas will be allowed to have more than 10 percent of the ground cover provided by non-native invasive plant species. If inspections reveal that non-native invasive weeds are becoming or have established on-site, then removal will be initiated under Forest Service direction. Inspections shall be made in conjunction with revegetation monitoring.

Weed removal will be accomplished through manual, mechanical or chemical methods depending on the specific circumstances. For example, solitary or limited numbers of tree and tree-like species will be manually removed (chopped) and the stumps sprayed with an approved weed killer such as Round-Up. Smaller plants (wild oats and bromes) that cover more area may be sprayed, scraped with a tractor, or chopped by hand, depending upon the size of the area of infestation and the number of desired native plants in proximity or mixed in with the weeds.

Reports of inspections and weed control implementation shall be part of the annual monitoring report and kept on file by the operator.

Herbivore Exclusion

Deer, sheep, burros and rabbits all can do serious damage to revegetation areas. If a problem develops on revegetation sites, Tubex, TreePees and hardware cloth cages can be placed around individual plants to allow them to establish.

Success Criteria

The following monitoring plan and success criteria have been previously approved by both the Forest Service and San Bernardino County, and meets both Federal and State requirements. No changes are proposed. SMARA requires that reclaimed sites provide wildlife habitat "at least as good as that which existed before ... mining," and that reclaimed sites must be "similar to naturally occurring habitats in the surrounding area." SMARA also requires the operator to demonstrate that vegetation on reclaimed sites has been self-sustaining without irrigation, fertilization, or weeding for a minimum of two years prior to release of performance bond. The Big Bear Ranger District requires that revegetated sites reach 50% of pre-disturbance vegetation

cover and 15% of pre-disturbance species richness by the end of a ten-year monitoring period for release of the performance bond.

Based on these guidelines, the following quantitative success criteria for revegetation sites at Omya operations on the National Forest are in effect (the plan has been approved). Criteria 1, 2, and 3 are intended to meet National Forest requirements; Criterion 3 will gauge wildlife habitat quality. Criteria 4 and 5 will assure that revegetated sites are similar to nearby undisturbed habitat.

1. Average total native plant cover on revegetation sites will be at least 50% of the average total native plant cover on undisturbed natural vegetation within the Omya mining area.
2. Species richness (diversity) of locally indigenous plants on revegetation sites will reach at least 15% of average species richness of locally native plants on equal acreage of undisturbed natural vegetation within the Omya mining area.
3. Species richness and density of native bird species occurring in revegetated areas during the breeding season will equal or exceed average species richness and density of native bird species occurring in equal acreage of undisturbed natural vegetation within the Omya mining area during the breeding season.
4. Total native shrub cover at revegetated sites will reach 50% of the average total native shrub cover occurring in equal acreage of undisturbed natural vegetation within the Omya mining area.
5. Density (number of trees per acre) of native tree seedlings and saplings (all species combined) in revegetated sites will be at least 50 % of the average density of mature trees in equal acreage of undisturbed natural vegetation within the Omya mining area.

Success criteria are based on the overall quality of the revegetation results compared to recorded baseline vegetation data. From completion of the revegetation for a specific area, the surviving perennial plant species shall be evaluated annually by the consulting botanist. The first 2 – 3 years will measure survivor of planted stock, need for weeding, and successful establishment of seeded native plants. In later years monitoring will focus on the site's resemblance to undisturbed vegetation in terms of the criteria above.

Individual specimens or areas shall receive appropriate remedial attention as necessary. Remedial actions may include removing invasive weed species, reseeding, supplemental planting, and protection from herbivory. The above procedure will be repeated annually.

Monitoring

The Annual Reclamation Report will be prepared to summarize revegetation and monitoring efforts over the past year and to assess the results of revegetation on the disturbed areas of the site. Monitoring will be conducted annually to monitor and assess completed revegetated areas and areas where revegetation is being planned or just beginning and the need for remediation. JJ Restoration Service has been preparing the Annual Reclamation Report for all the Omya sites for the past 5 years. The 2011 report is included as Appendix 12. Revegetated areas will be assessed utilizing success criteria with successful methods being implemented for future revegetation.

Revegetation efforts will be monitored annually for ten years after seeding and planting or until success criteria are met and vegetation is self-sustaining. 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. This schedule may be revised depending on the results of the revegetation effort and the meeting of the success criteria. Monitoring data will be reviewed and verified by the Forest Service and County.

2.7 CLEANUP

All clean-up operations will be conducted within one year of the termination of mining. Scrap material, refuse, residual equipment, and surplus materials will be removed, recycled, and/or disposed of at an appropriate landfill site. Excess material piles and disturbed areas will be regraded for positive drainage, scarified, and revegetated. Any spillage of fuel, oil, grease, or hazardous materials will be cleaned up in a proper and legally acceptable manner.

2.8 POST RECLAMATION AND FUTURE MINING

The planned land use subsequent to mining is open space and wildlife habitat compatible with SBNF management plan directives. The quarry excavation and reclamation will result in a series of reclaimed benches 30 to 35 feet wide and 60 feet high within the Sentinel Quarry and at least 25 feet wide and 50 feet high in the Butterfield Quarry. The eastern portion of the Butterfield Quarry and the lower portion of the Sentinel Quarry will be backfilled with waste rock with 2H:1V slopes and revegetated. The overburden sites will be contoured with 2H:1V slopes and revegetated on up to 30% of its area.

The project area is surrounded by SBNF lands on the west, south, and north and by the privately held land to the east (patented open space with an active limestone mine). The area is known to have additional limestone resources and mining could be undertaken in the vicinity of the site in the future with additional entitlements.

2.9 SLOPE AND SLOPE TREATMENT

A “Slope Stability Investigation” was prepared by CHJ Consultants in July 2012 (see Appendix 8). CHJ concluded that the proposed mine excavation and reclamation (backfilling) of the quarries are suitably stable against gross failure for the anticipated long–term conditions including the effects of seismic shaking and meet the factor of safety criteria for static and seismic conditions.

As shown in Tables 11 and 12, sufficient static factors of safety in excess of 1.5 and seismic factors of safety in excess of 1.1 were indicated for the proposed slope configurations and satisfy San Bernardino County guidelines.

Table 11
Summary of Slope Stability Results
Bedrock Mine Slopes

Cross Section	Material	Slope Configuration	Static F.S.	Seismic F.S. (k=0.2)
Section A - Sentinel	Bullion	Native-over-cut	2.63	1.97
Section C - Sentinel	Bullion	Overburden-over-cut	2.72	2.19
Section E – Butterfield	Bird Spring	Native-over-cut	5.72	4.84

Source: CHJ 2012

Table 12
Summary of Slope Stability Results
Overburden Stockpile Study

Slope Configuration		Static F.S.	Seismic F.S. (k=0.2)
continuous slope at 2:1	26.6° overall H = 250 feet	1.52	1.17
continuous slope at 2:1	26.6° overall H = 400 feet	1.48	1.13
4 segments at 26.6° 3 benches at 50-foot width	23.8° overall H = 560 feet	1.53	1.16

Source: CHJ 2012

CHJ recommended measures to be implemented during mining and these are listed below.

- Overall final cut slopes in the rock materials shall be no steeper than approximately 1H:1V up to a maximum height of approximately 625 feet.
- Large, unstable rounded boulders on slopes steeper than approximately 2H:1V should be removed or stabilized where accessible. Areas below loose rock shall be restricted and indicated by means of signage or fencing.
- Geotechnical evaluation and design, management of mine bench geometry based on encountered conditions, or use of mechanical support systems shall be implemented as necessary.
- Continued inspection and monitoring of mine benches and slope conditions for indications of potential instability and failure warming signs shall be implemented.

- Final reclaimed fill slopes composed of overburden materials should be no steeper than 2H:1V to the maximum proposed heights.
- Slopes should be protected with berms and/or levees as necessary to prevent slope erosion in the areas where natural slopes drain onto the reclaimed slopes.

A final slope stability assessment report will be prepared for the SBNF and County to assess the final slopes as part of the site closure.

2.10 PONDS, WASTE STOCKPILES

No operational ponds, reservoirs or tailings are utilized or produced at the project site. Mine waste and/or overburden have been and will be deposited in overburden placement sites

The backfilling of portions of the two quarries will limit the areas disturbed outside the quarries reducing potential visual and biological impacts. Overburden placement areas will be reclaimed with 2H:1V slopes and revegetated as discussed under Sections 2.6 and 2.7 above.

2.11 SOILS

Due to the rugged mountainous nature of the area and arid climate, limestone, which is the most resistant of rock types, often forms rocky ridges devoid of soil, or with only a thin rocky regolith developed. Generally, soil or growth medium is rarely more than 6 to 12 inches thick. Tree roots may extend only several feet down into fractures in the bedrock. Soil may be 2 feet thick or more near or within ravines.

Forest Service studies (USFS EA 1988) have determined that much of the soil found in the limestone mining area is classified as low to very low in productivity. The soils are predominantly shallow, moderate to excessively drained coarse textured with low moisture holding capacity. Bedrock outcroppings and substantial rock fragments are present throughout the soil. Vegetation response on these soils varies greatly due to low moisture conditions.

Soil is salvaged and will be stored in areas labeled Material/Growth Media Storage Areas generally located east of Butterfield and northwest of the B5 Overburden Site. Salvaged material may also be temporarily stored on available portions of the overburden stockpile areas during the course of operations. Permanent and temporary material/growth media stockpiles will be stockpiled separately from overburden, fines and waste rock and clearly identified.

The soil that is salvaged contains a high organic content due to vegetative matter, and is thus equal in quality to the native soil cover. In addition many plant seeds are incorporated, and soil storage areas have been found to spontaneously revegetate. Therefore, slow release fertilizer applied during the planting phase is sufficient to encourage plant growth.

The chemical composition of soils developed from Paleozoic limestone formations on the Omya California claims was analyzed by Burke (1981), and found to be ph neutral ranging from 7.2 to 7.8. Chemical analysis is shown on Table 13 is similar to the soils in the project areas. Several

samples of the various growth media piles have also been analyzed. Soil ph of less than 8.3 is not considered to represent an overly alkaline condition for most native plant species of the arid southwest and the reclamation sites will not require chemical treatments to control ph.

Table 13
Soil Properties from Samples from the Burk Experimental Revegetation Plots in the Butterfield Quarry Area

Soil Property	Mean	Standard Deviation
Ph	7.5	0.2
Electrical Conductance (x 1,000)	0.4	0.1
Nitrate Nitrogen	3.6	1.2
Sulfate Sulphur	5.0	---
Potassium	109.5	64.3
Phosphate Phosphorus	6.1	1.9
Iron	6.1	3.1
Zinc	4.4	1.2
Copper	1.4	0.4
Manganese	5.9	3.4
Sodium*	7.6	10.1
Calcium*	111.3	77.4
Magnesium	15.0	4.7

Mean = Nutrient values are in parts per million air dry soil or (*) saturation extract. Source: Burk 1981

2.12 DRAINAGE AND EROSION CONTROLS

Please also refer to Section 1.5 above. The project site is located along a ridge at the top of the San Bernardino Mountains and thus drainage is generally away from the mining site. Nevertheless, considerable effort has been placed on achieving positive drainage, reduction of sediment transport, and minimal adverse impact on adjacent property.

The existing approved U.S. Forest Service Operation/Reclamation Plan contains requirements for numerous erosion and sedimentation controls. Omya has continuously worked with the SBNF in the design and implementation of drainage controls along roads and other facilities. Existing controls have been inspected and approved by both SBNF and Omya personnel and maintained as necessary. Existing and/or proposed drainage controls are adequate for existing climatic/hydrologic conditions.

Numerous erosion and sedimentation controls have been implemented in the mining and stockpile areas to control, minimize or prevent off site sedimentation. Runoff is directed into the quarries, sediment catchment basins and many culverts, dips, or drains direct water off roads. A large number of energy dissipaters, sediment catchment basins or sumps, rip rap, and/or hay bales trap sediment and minimizes the potential for off-site transport. Long-term stabilization or

reclamation will generally involve grading or reshaping disturbed areas, establishing effective drainage, placement of plant growth media, and revegetation. Following reclamation, the majority of surface runoff from quarry areas will be retained in the quarry limits where it will either infiltrate or evaporate.

Erosion and Sedimentation Control for Quarries

Existing and future mining activities at Sentinel Quarry area will deepen the pit and push back to the south. The Butterfield Quarry will expand the quarry to the south, west and north, and deepen the pit up to 200 feet deep. In quarry areas, drainage control is generally not a significant concern since essentially all disturbed area drainage is retained within the basin created by the quarry excavation. Current and future runoff is channeled along roads and ramps, and any sediment is directed into sumps or into the quarry pits. Storm water runoff is currently managed so that there is no adverse effect on downstream property. The final reclaimed Sentinel Quarry including its planned backfill, will be designed to create at a minimum a sized basin or grading towards the west highwall with 100 AF of capacity for storm water retention.

Erosion and Sedimentation Controls for Overburden Stockpiles

Catchment basins, berms, and sediment traps have been, or will be erected at the toe of the fill slopes to reduce downstream sediment transport. The berms at the toe of the active 1.5H:1V slope and along the disturbance boundary will be a minimum of 4 feet in height. During reclamation the slope will be reduced to a 2H:1V slope to ensure long term stability. Small berms will be placed at the crest of the fill and the surface will be sloped away from the crest to prevent water from running over the fill slope. Available darker material will be dumped over the slope to give a dark color to the material and armor the underlying materials from erosion.

Erosion and Sedimentation Controls for Central Areas

The current crusher site is near the center of the Sentinel Quarry mining area and is located on a shallow fill pad. Most runoff in the area is directed away from the site into the Sentinel Quarry. Much of the crusher site is fairly flat and water spreads and dissipates on the surface. Berms near the crest of the fill pads prevent runoff over the fill slope. Rip rap, catchment basins, and energy dissipaters have been or will be placed along the toe of fill and in the drainage below the fill slope to trap sediment and minimize the potential for off-site transport. These drainage controls are periodically inspected and maintained as necessary. Crusher fines are disposed into available overburden sites. The fines are damp from the dust control system and are not a dust problem.

The crushing facility will be relocated onto the two fill pads to be developed south of the Sentinel Quarry likely during Phase 2 (11 to 20 year timespan). The crusher site will be fairly level and water will spread and dissipate on the surface. Berms near the crest of the fill pad will prevent runoff over the fill slope. Rip rap and energy dissipaters will be placed along the toe of fill and in the drainage below the fill slope to trap sediment and minimize the potential for off-site transport. These drainage controls will be periodically inspected and maintained as necessary.

Existing and/or planned drainage controls are adequate to contain sedimentation from the site particularly within the context of regular long-term inspection and maintenance.

2.13 PUBLIC SAFETY

To reduce the risk of injury to the general public and employees, several safety measures have been incorporated and will be ongoing as part of mining and reclamation activities.

Vehicular access to the mining area is provided only on restricted access/haul roads. The roads have multiple highly visible warning signs directing the public away from the active mining area. In addition, the haul roads are watched by company personnel during operating hours. During non-operating times, locked steel gates are installed on all haul roads accessing both active and inactive quarries to restrict vehicle access. Safety berms are placed on jeep and ORV trails to restrict ORV access and will be maintained as necessary.

Signs are located around the perimeter of the mining area directing vehicles or foot traffic away from the mining or reclamation areas.

Active mining areas comply with all federal (MSHA) and state (Cal-OSHA) mine safety regulations. Workers, including contractor labor, are trained in mine safety and first aid. Elevated roads have safety berms, quarries have safety benches with berms and inactive ramps and roads in mining areas are blocked to prevent access.

Prior to blasting activities, employees working in the area are notified, and a visual search of the area is done prior to blasts to verify that no one is present in the area. Standard horn signals are used to notify personnel before and after blasts (all clear). No smoking signs are placed on all storage containers which contain flammable materials. Storage containers are labeled indicating contents, and hazardous or poisonous materials are identified. Buildings or storage facilities are locked.

Once mining has been completed, the quarry rims will have a fence or other type of access restriction erected along dangerous highwalls with warning signs to prevent anyone from entering into the pit area. Typical warning signs will be at least 18" by 18" with contrasting background lettering every 250 feet and shall read in English and Spanish "Danger" "Open Pit Mine" or "Steep Slope."

2.14 MONITORING AND MAINTENANCE

SMARA requires annual reporting of Mining and Reclamation activities. The reports are filed with the State Division of Mining and Geology, the SBNF, and the County. Revegetated areas will be monitored over a 10-year period or until success criteria is achieved following initial seeding and/or 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.

Monitoring and maintenance of reclamation is an ongoing responsibility of Omya. The project site will be inspected as needed, at least annually, by the County and by the SBNF. As reclamation efforts increase through establishment of out-planted native species, the frequency of monitoring by Omya will increase commensurate with the activities being conducted. The individual monitor(s) shall be qualified revegetation specialists approved by the SBNF and the County.

In addition, CEQA requires adoption of a reporting and monitoring program for the conditions of approval of a project that are intended to mitigate or avoid adverse environmental effects. The Lead Agency-adopted program is intended to ensure compliance with mitigation measures throughout the life of the approved Project. The program will identify the conditions of approval that act as impact mitigation measures and for each measure, outline who is responsible for implementation and verification of the measure.

2.15 RECLAMATION ASSURANCE

Omya will post an updated reclamation assurance annually in an amount sufficient to pay for the cost of reclamation for existing disturbance as outlined in this amended Plan and incorporating required reclamation costs per the approved Reclamation Plan (94M-02). As the Proposed Project is within Forest Service lands, the SBNF and the County will annually review the updated reclamation financial assurance cost estimate (FACE); as annual updates are required by SMARA. San Bernardino County is the lead agency for SMARA, which also requires the reclamation assurance to be reviewed and approved by the California Office of Mine Reclamation (OMR).

Omya most recently submitted its annually updated FACE to the County in June 2012. As of July 2012, Omya currently has a Financial Assurance Mechanism in the form of a letter of credit on file payable to the County, Forest Service, and DOC-OMR.

STATEMENT OF RESPONSIBILITY

The statement of responsibility for the reclamation of the site (below) will be signed by Omya's representative and will be included as a separate form.

I, the undersigned, hereby agree to accept full responsibility for reclamation of all mined lands as described and submitted herein and in conformance with the applicable requirements of Articles 1 and 9 (commencing with Sections 3500 et. seq. and 3700 et. seq., respectively) of Chapter 8 of Division 2 of Title 14 of the California Code of Regulations, the Surface Mining and Reclamation Act commencing with Section 2710 et. seq., and with any modifications requested by the administering agency as conditions of approval.

Signed this_____ day of _____, 20___ by:

Signature: _____Title: _____

Printed Name: _____

3.0 GEOLOGY

3.1 GEOLOGIC SETTING OF THE SAN BERNARDINO MOUNTAINS

The San Bernardino Mountains are one of the major ranges in the east-west-trending Transverse Ranges province of southern California (see Figure 11). The north slope of the range rises abruptly from the desert floor in Lucerne Valley, with elevations along the north range crest reaching 8400 feet.

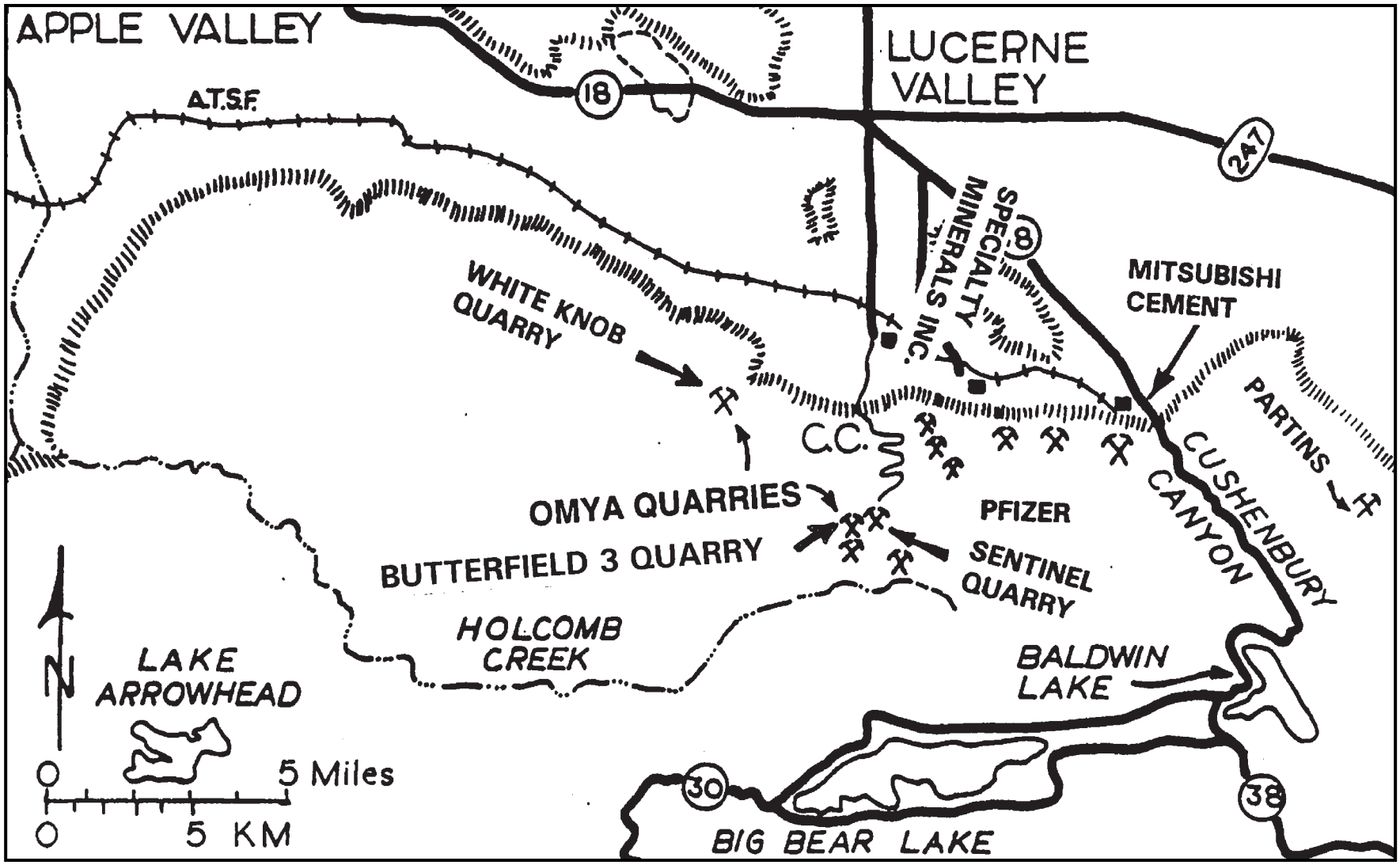
Although the northern range front forms the southern boundary of the Mojave Desert geomorphic province, rocks in the San Bernardino Mountains have a close affinity to rocks in the Mojave Desert region, and they have shared a complex geologic history. Roof pendants within the extensive Mesozoic batholithic terrane of the southern Cordillera include numerous exposures of deformed and metamorphosed Paleozoic strata.

Rocks exposed in the San Bernardino Mountains range from Precambrian to Quaternary in age and include igneous, sedimentary and metamorphic rocks. Extensive exposures of pre-Mesozoic metasedimentary rocks unconformably overlie Precambrian basement in the San Bernardino Mountains. The lower part of the section is clastic dominated, the middle part is dolomite-dominated, and the upper part is limestone dominated. The section is generally of shallow-water affinity, and the rocks are identical to and correlative with strata of the Cordilleran miogeocline exposed in many ranges in the Mojave region (see Figure 12). Because of the economic importance of the Paleozoic rocks, and the role Mesozoic intrusive rocks, metamorphism and geologic structure have played in the formation of economic limestone deposits, they will be discussed in some detail.

3.2 SAN BERNARDINO MOUNTAINS STRATIGRAPHY

Unconformable overlying basement gneiss are Late Precambrian and Paleozoic metasedimentary rocks. The pre-Mesozoic strata are exposed as several large rook pendants (see Figure 13), and exposures are deformed and metamorphosed. Reconnaissance work by Richmond (1960) and Dibblee (1964) led to the division of the sedimentary rocks into three formations; the Saragosa and Chicopee Quartzites of pre-Carboniferous age, and the overlying Furnace Limestone of Carboniferous age. Subsequent detailed mapping, however, has demonstrated that the rocks can be further subdivided into several formations and correlated with late Precambrian through Permian strata of the Cordilleran miogeocline (Stewart and Poole, 1975; Brown, 1984a,b). These detailed studies suggest that the use of the older nomenclature should be discontinued.

Correlations are based on stratigraphic positions as well as lithologic and chemical similarities to Paleozoic strata exposed in other ranges. Limited but very useful paleontologic data also are available.



LUCERNE VALLEY LIMESTONE DISTRICT

BUTTERFIELD and SENTINEL QUARRIES

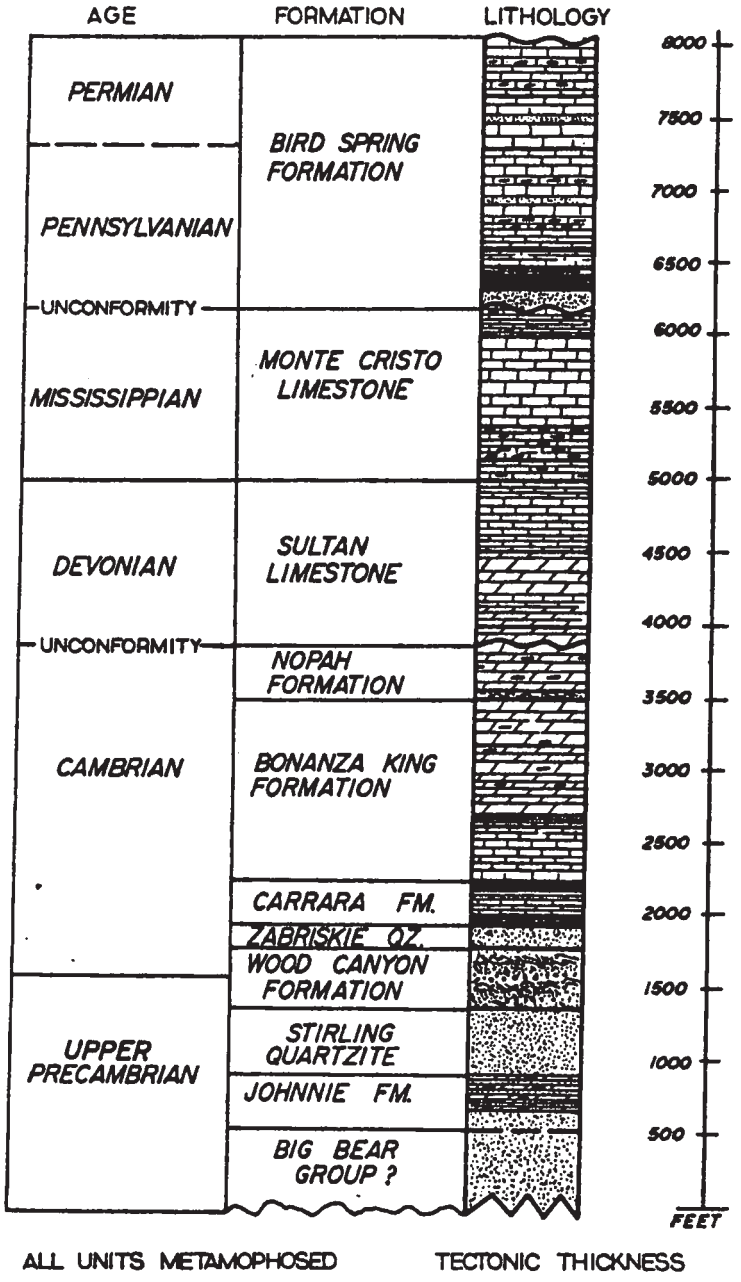
Amended Plan of Operations and Reclamation Plan

Omya California, San Bernardino National Forest, California

FIGURE 11

LILBURN CORPORATION

COMPOSITE STRATIGRAPHIC COLUMN
PALEOZOIC ROCKS
WESTERN SAN BERNARDINO MOUNTAINS

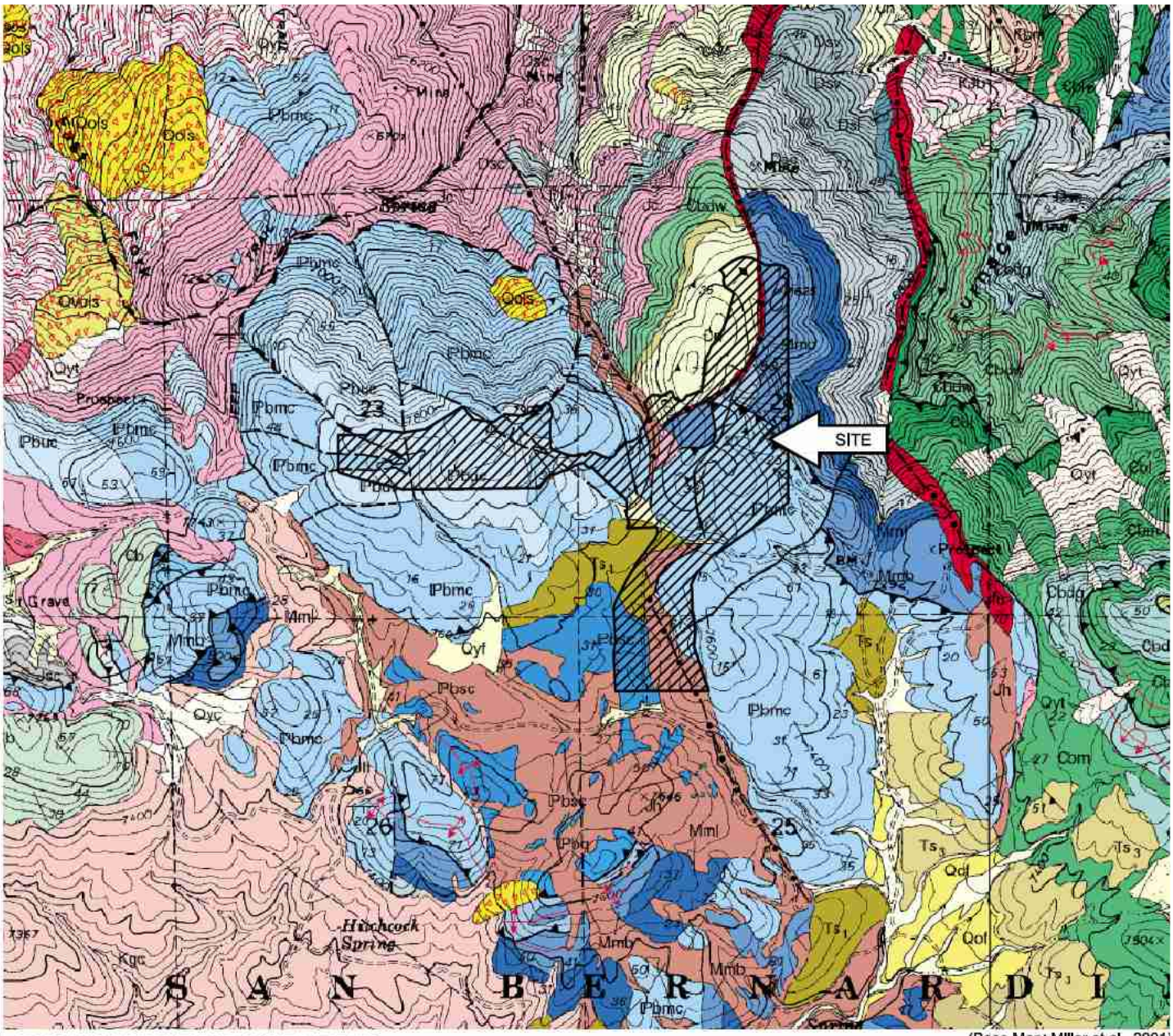


STRATIGRAPHIC COLUMN PALEOZOIC ROCKS

BUTTERFIELD and SENTINEL QUARRIES
Amended Plan of Operations and Reclamation Plan
Omya California, San Bernardino National Forest, California

LILBURN CORPORATION

FIGURE 12



(Base Map: Miller et al., 2001)

GEOLOGIC UNITS IN MINE AREAS:

Qyt - talus deposits
Ts - sedimentary rocks of Holcomb Valley
Jc - quartz monzonite
Pbuc, Pbmc, Pblc, Pbsc - carbonate members of Bird Spring Formation
Mmy, Mmb, Mml - carbonate members of Monte Cristo Limestone
Dsc, Dsv, Dsl - members of Sultan Limestone
ϵn - Nopah Formation
ϵn - Dunderburg Shale
ϵbdw, ϵbdg - Bonanza King Formation

geologic contact
thrust fault
fault - intruded
fault - high angle
61 strike and dip of bedding
36 strike and dip of foliation

-N-

SCALE: 1" = 2000'

GEOLOGIC MAP
NORTHERN SAN BERNARDINO MOUNTAINS

BUTTERFIELD and SENTINEL QUARRIES
Amended Plan of Operations and Reclamation Plan
Omya California, San Bernardino National Forest, California

LILBURN CORPORATION

OMYA **FIGURE 13**

Late Precambrian and Lower Paleozoic Strata

In the Big Bear area, a thick section of quartzite, phyllite, and impure marble unconformably overlies Precambrian basement, and has been assigned a late Precambrian age (Cameron, 1982). Numerous structural complexities are present, however, and the sequence probably includes Paleozoic rocks. Quartzites correlative with the late Precambrian Johnnie Formation and Stirling Quartzites are present as are younger late Precambrian and Lower Cambrian metasedimentary rocks that include cross-bedded, pebbly quartzite; phyllite and schist of the Wood Canyon Formation; white vitreous quartzite of the Zabriskie Quartzite; and a heterogeneous sequence of calc-silicate rock, schist, hornfels, and dark grey, laminated, fossiliferous (gastropods Girvanella), siliceous marble correlative with the Lower-Middle Cambrian Carrara Formation (Stewart and Poole, 1975; Brown, 1984a.

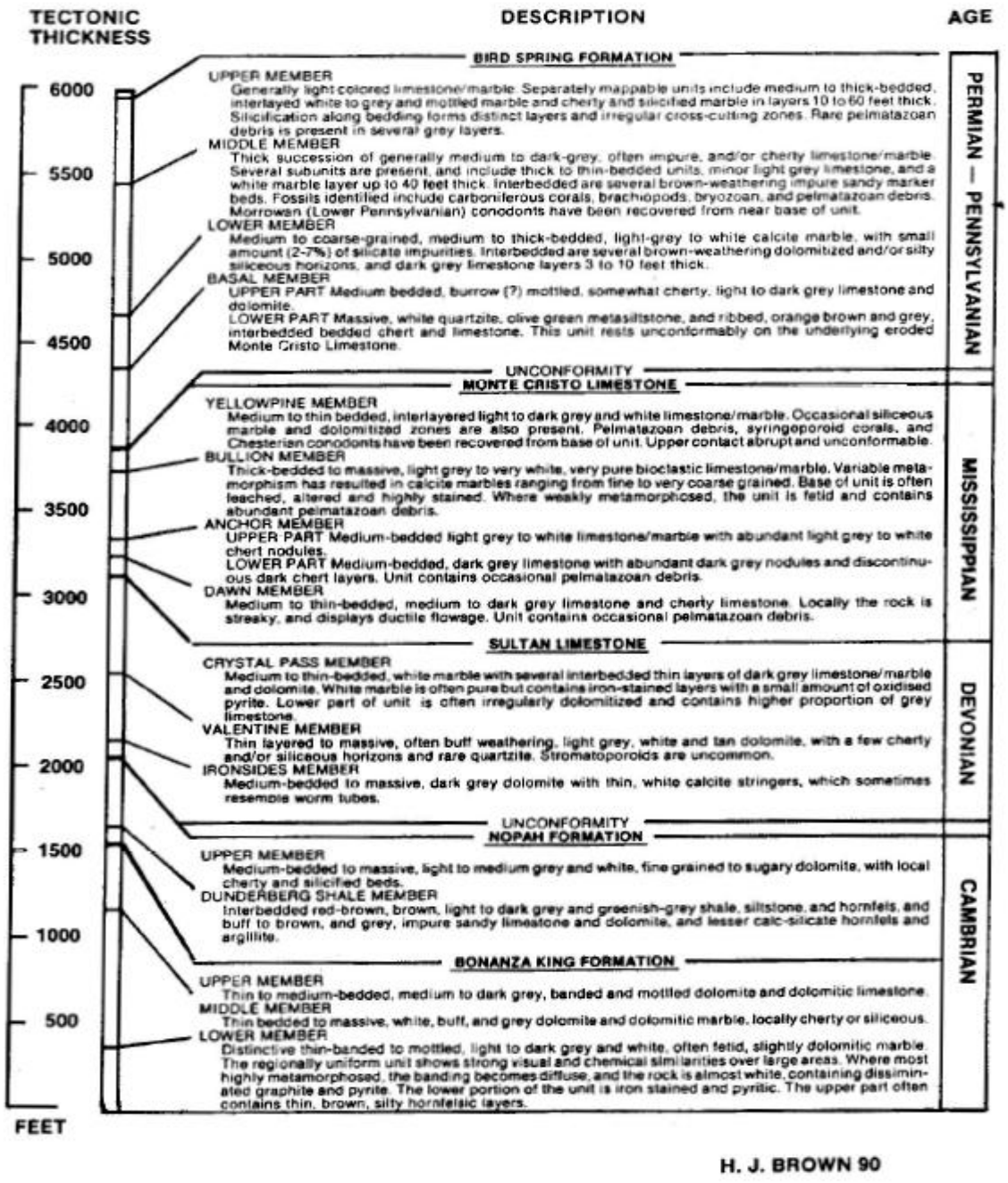
Middle to Upper Cambrian and Devonian Strata

Middle to Upper Cambrian and Devonian strata are widely exposed and form a distinctive dolomite-dominated sequence. Visually and chemically distinctive, thin-banded to mottled, light to dark grey, slightly dolomitic marble of the Lower Member of the Bonanza King Formation, is overlain by a thick sequence of light brown, light to dark grey, and white dolomite (Brown, 1982a, 1984c). Recognition of distinctive, regionally persistent hornfels and calc-silicate marker beds allow subdivision of the thick dolomite-dominated sequence into several formations and members including Cambrian Bonanza King Formation (three members), Cambrian Nopah Formation (Dunderberg Shale Member and Upper member). Above a regional unconformity, the Devonian Sultan Limestone (Ironsides Member and Middle member) (Brown, 1984a) has been recognized. Characteristic stromatoporoids have been noted from the lower part of the Sultan Limestone. Rocks of Ordovician and Silurian age have not been recognized in the San Bernardino Mountains.

Upper Paleozoic Strata

Upper Paleozoic rocks are abundantly exposed, and comprise shallow-water carbonate-platform sequences dominated by limestone and calcite marble (Brown, 1984a) (see Table 14). Detailed mapping (Brown, 1984a) has allowed recognition of several formations and members including Devonian Sultan Limestone (Crystal Pass Member), Mississippian Monte Cristo Limestone (Dawn, Anchor, Bullion, and Yellowpine Members), and the unconformably overlying Pennsylvania-Permian Bird Spring Formation (several informal members). In some places metamorphism is weak and several localities have yielded fossils. Chesterian conodonts and syringoporoid corals have been recovered from samples of the Yellowpine Member of the Monte Cristo Limestone. Fossils recovered from the Bird Spring Formation include Morrowan Conodonts (Bruce Wardlaw, written communi., Ozanich, 1982) and Carboniferous solitary corals, bryozoans, brachiopods and pelmatazoan debris. Fusulinids also have been reported (Pete Sadler, personal communication).

Table 14
Description of Paleozoic Carbonate Rocks



3.3 MESOZOIC INTRUSIVE ROCKS

A large variety of intrusive rocks are exposed in the San Bernardino Mountains, but only the most common will be noted. A widely exposed hornblende monzonite, the Fawnskin monzonite of Permian-Triassic age, is the oldest intrusive body. This intrusion, which has yielded minimum

ages of 215 million years utilizing the 40Ar/39Ar dating method (Miller and Cameron, 1982), intrudes previously deformed strata. Granitic cataclasite of possible Permian-Triassic are is prominently exposed along the north range front near Crystal Creek. Hornblende gabbro/diorite dikes and sills, thought to be Late Jurassic (Miller and Cameron 1982), are exposed in several areas. Shallow level quartz latite porphyry intrusive bodies and dikes are present in the Holcomb Creek area. These rocks also are thought to be of Jurassic age, and it is possible that they are correlative with the Sidewinder volcanics exposed near Victorville (Smith, 1983).

During Cretaceous time the region was intruded by several large biotite quartz monzonite plutons which are exposed over several hundred square kilometers in the San Bernardino Mountains and adjacent ranges in the Mojave Desert. Many of the plutonic rocks have yielded K-Ar dating method ages of 70-80 million years (Late Cretaceous) (Miller and Morton, 1980).

Migmatized rocks, a mixture of older pre-Late Cretaceous igneous and metamorphic rocks and younger Late Cretaceous quartz monzonite, are widely exposed in the granitic terrain along the north range front of the San Bernardino Mountains. Mylonite is exposed in the vicinity of Greenland Mine and in Silver Creek near the range front. The mylonite zone is up to 200 feet thick and dips 30 to 50 degrees to the south. Richmond (1960) indicated the mylonite to be of Mesozoic age and related to the intrusion of plutonic rocks. Several different rock types are involved however, and the mylonite may represent a major tectonic feature unrelated to intrusion of igneous rocks.

The youngest intrusive rocks are west-trending, steeply dipping, light grey felsite dikes. The dikes displaying folded and flow-foliated, spherulitic, chilled border zones, clearly cut other intrusives rocks, and could be of Tertiary (?) age.

3.4 METAMORPHISM

Pre-Mesozoic sedimentary rocks in the San Bernardino Mountains have been altered by both regional and contact metamorphism. The earliest metamorphism and deformation pre-dates, but also may be associated with, the Permian-Triassic intrusive event (Brown, 1984a; Sadler, 1982). Geochronologic work by Miller and Morton (1980) demonstrated a younger, regionally widespread thermal event that culminated in Late Cretaceous time (70-80 million years). The thermal disturbance may have been associated with emplacement of the regionally widespread batholithic rocks.

Pre-Mesozoic sedimentary rocks exposed in the range show abundant evidence of metamorphism. Richmond (1960) described epidote-amphibolite facies assemblages in the Big Bear area, and McColl (1964) reported upper amphibolite and granulite facies rocks in the Juniper Flats and White Mountain areas. Conodont color alteration index measurements indicate that the least metamorphosed rocks have reached temperatures of 400 to 500°C (Bruce Wardlaw, written communication). Garnet-pyroxene granulites at White Mountain suggest that metamorphic temperatures may have exceeded 650°C, and local anatexis is suggested at some outcrops. Contact metamorphic effects are reflected in the development of local skarn deposits, recrystallization, and bleaching adjacent to some intrusive contacts.

3.5 STRUCTURE

Structure in the San Bernardino Mountains area is exceedingly complex, and only recently have the complexities been recognized. Reconnaissance work by Richmond (1960) and Dibblee (1964) recognized several structures, but many of the more subtle deformational features were overlooked. Detailed mapping documents extensive and complex multiphase Mesozoic deformation with superimposed complex Late Cenozoic deformation (Miller and Cameron, 1982; Sadler and Reeder, 1983; Brown, 1984a).

Multiphase Mesozoic deformational features are well exposed in highly metamorphoised Late Precambrian and Paleozoic strata along the north range front. The rocks were subjected to multiphase folding and thrusting prior to, or in conjunction with the Permian-Triassic intrusive and metamorphic events. The first phase formed large ductile recumbent fold and thrust nappes. Several conspicuous, northwest-trending, northeast-verging, overturned, sheared isoclinal folds are present at White Mountain. Stratigraphic correlations and detailed mapping indicate that the folds are inverted, and are second generation (F_2) structures that have been superimposed on the overturned limb of a major (F_1) early phase fold nappe. The second generation folds were then intruded by the Permian-Triassic monzonite.

The range front in the Lucerne Valley area is a precipitous 3000 to 4000 foot topographic edge, thought to have formed in late Cenozoic time. A myriad of Cenozoic low- and high-angle faults of several orientations and generation is present. The regional setting, orientation of compressional structures, and sedimentological studies led Sadler and Reeder (1983) to conclude that the mountains are a product of repeated transpressional movement. Uplift is thought to have occurred on numerous northwest-trending high-angle wrench faults, and thrust faults that flatten up-dip, forming mushroom-shaped uplifts (Sadler, 1982). Core drilling, however, suggests that some of the structures may flatten with depth.

In the Crystal Creek area along the range crest, northward thrusting of carbonate rocks on south-dipping low-angle faults reached the surface, and near the range crest some of the contacts can be seen to roll over and form north-sipping gravity slides along the range front. The slides are composed of cataclastic marble breccia. In places remnant stratigraphy is preserved, and the slides can be traced back to their source along the range crest.

Subsequent low-angle faulting near the base of the range has placed granite cataclastic, and the overlying slide klippen, over older fan gravels. The Crystal Creek thrust placed Mesozoic granite cataclastic over the late Pliocene Old Woman Sandstone. This structure has been traced for several miles along the range front. In the foothills, several ridges of older alluvium also are interpreted to have been involved in young thrusting.

Younger late Cenozoic deformation includes many northeast, northwest, and west-northwest trending high-angle faults, some of which have juxtaposed alluvium against Mesozoic intrusive rocks. Still younger landslides postdate and cover the trace of the northwest-trending faults.

Uplift of the present range occurred in late Cenozoic time. Concordant highland summits and old quartzite-bearing gravels in highland valleys suggest an older period of uplift and erosion of possible Miocene age. Uplift of the present rugged mountain range occurred in

Pliocene-Pleistocene time. The emergence of a local San Bernardino Mountains source terrain is recorded at the top of the late Pliocene Old Woman Sandstone by the abrupt deposition of nearly monolithologic carbonate conglomerate (Sadler, 1982). Fossils indicate a late Pliocene age of 2.0 to 3.0 million years for the lower part of the Old Woman Sandstone (May and Repenning, 1982); thus uplift of the Paleozoic carbonate terrain began in post-late Pliocene time.

3.6 ECONOMIC GEOLOGY OF LIMESTONE DEPOSITS FORMATION OF WHITE HIGH PURITY LIMESTONE DEPOSITS

Carbonate rocks are found extensively on all continents, but high purity, high brightness (white) limestone deposits are relatively uncommon in nature because their formation is dependent on the superposition of several independent geologic processes, acting over a long period of time (Brown, 1987).

Among the processes are:

1) Deposition of originally pure limestone in high energy agitated, shallow marine environment.
2) Metamorphism and/or magmatic processes to bleach and recrystallize the rock and disperse any impurities which may have been present.
3) Folding, faulting and orogenic processes to place the rocks in desirable structural settings.
4) Uplift and erosion.
5) Preservation thru geologic time.

Because all the geologic processes are required, deposits of premium quality limestone are relatively uncommon in nature, and are vastly different from common limestone.

Deposits of high brightness, high purity limestones are restricted in their occurrence. Currently the major producing areas in the United States are located in Vermont, Alabama, Georgia, and Lucerne Valley, California. The Lucerne Valley area is the premier producing district in western North America.

Economic Significance of the Paleozoic Rocks

The San Bernardino Mountains area contains immense resources of limestone, magnesium limestone, and dolomite. Limestone and dolomite from several formations have been or are currently mined. White dolomite correlative with the Cambrian Nopah Formation, and the lower part of the Devonian Sultan Limestone has been mined in the past from several quarries, and utilized for roofing granules and terrazo chips. Quarries on the Omya claims have produced pure limestone and marble from the Crystal Pass Member of the Sultan Limestone, of Upper Devonian age, the Bullion Member of the Monte Cristo Limestone of Mississippian age, and the upper part of the Bird Spring Formation of Pennsylvanian-Permain age.

At the present time, the Sentinel deposit, which is being mined is formed from the Bullion Member of the Monte Cristo limestone of Mississippian age. White, calcium carbonate is produced at Sentinel Quarry from the Bullion Member of the Monte Cristo Limestone. Rocks of the Bullion Member of the Monte Cristo Limestone formed in type 5, high energy shallow marine environment which winnowed out fines and silt, resulting in pure bioclastic limestone.

White calcium carbonate at the Butterfield Quarry is mined from the upper part of the Bird Spring Formation and formed in a similar depositional environment to the Monte Cristo noted above. Mesozoic metamorphism has recrystallized and bleached the rock to form white, high purity calcium carbonate marble. Superimposed folding and faulting have resulted in several major deposits of high purity, high brightness calcium carbonate marble, which are suitable for all high quality applications.

3.7 GEOLOGY - SENTINEL QUARRY

Sentinel Quarry is located at the north range crest at an elevation of about 7600 feet, and is reached by the vested Crystal Creek Haul Road. Topography in the quarry area is rugged and steep. Rocks in the quarry area include metamorphosed Paleozoic sedimentary rocks and Mesozoic intrusive rocks.

Paleozoic Rocks

Paleozoic rocks exposed in the quarry area include Cambrian Nopah formation, Mississippian Monte Cristo limestone, Bullion Member, and Pennsylvanian Bird Spring Formation. Cambrian Nopah Formation is exposed along the west side of the quarry and is in reverse fault contact with upper Paleozoic rocks in the quarry. The moderate to steeply dipping Nopah Formation is composed of white to grey Dolomite marble of variable purity. For mining purposes, all Dolomite is waste rock.

Mississippian Monte Cristo Limestone Bullion member is exposed in the quarry area and forms the orebody. The gently dipping Bullion member is up to 350 feet thick, 2,500 feet long and up to 500 feet wide and is composed of exceedingly pure, variably light grey to white calcium carbonate marble. Originally fossil rich bioclastic limestone, variable metamorphism has bleached the rock into light grey to white fine grained calcite marble, of very high purity, typically > 99.5% CaCO3.

Pennsylvanian Bird Spring Formation exposed in the southern portion of the quarry area, is in thrust fault contact with the Mississippian Monte Cristo limestone and forms the hanging wall (overburden) above the orebody. Bird Spring Formation in the quarry area is dark grey to black impure limestone and dips gently toward the south.

Mesozoic Rocks

Mesozoic rocks in the quarry area include an altered porphyry dike which has intruded into the west dipping reverse fault which has juxtaposed Cambrian Dolomite against upper Paleozoic rocks. The dike is generally less than 8 feet thick dips steeply to the west and is highly altered to clay minerals.

Metamorphism

Paleozoic rocks in the area have been regionally metamorphosed to green- schist grade. Conodont color index measurements indicate metamorphic temperatures of over 430 degrees C. Metamorphism of the Bullion member of the Monte Cristo limestone has formed variable white to light grey, very pure Calcite Marble which forms the ore body.

Structure

Rocks in the quarry area have been both folded and faulted. Folds seen during mining are F2 folds and are upright and open undulations in the shallow dipping upper Paleozoic rocks.

Faults are common in the quarry and have several major trends. Numerous NE trending high angle faults are present in the north part of the quarry. The faults progressively down drop the footwall to the south, and are generally marked by iron oxide stain zones. A major north trending west dipping reverse fault has juxtaposed Cambrian Dolomite against upper Paleozoic limestones and forms the west boundary of the ore. Several other smaller north trending faults of smaller magnitude are also present.

The Bird Spring Formation has been juxtaposed over the Monte Cristo Limestone on a south dipping thrust fault. Several hundred feet of Bird Spring Formation have been removed along the fault. Other minor low angle shears are also present in the area. Most of the faults are of Cenozoic Age and some may be related to the uplift of the range.

Formation of Limestone Ore Deposit

As noted, the ore deposit is formed from the pure limestone of the Bullion Member of the Monte Cristo limestone of Mississippian Age. Green-schist grade metamorphism has bleached the rock variably white resulting in Calcium Carbonate of exceptionally uniform and high purity and moderate to high brightness. The orebody on the Omya claims is triangular in plain view, 2500 feet long, up to 500 feet wide and up to 350 feet thick.

3.7.1 Adverse Geologic Conditions Sentinel Quarry

No adverse geological conditions have been identified in the Sentinel Quarry area which would have a significant adverse impact on existing and future Sentinel Quarry operations. Upper Paleozoic limestones in the Sentinel Quarry area are shallow dipping and are natural cliff formers. Several generations of high angle faults are present. Steeply dipping Lower Paleozoic Dolomites have been juxtaposed against the limestones on a high angle reverse fault. Most faults are perpendicular to the long axis of the quarry (cross faults).

Bedding of the upper Paleozoic limestones is shallow dipping ranging from 10 to 30 degrees. Although joints and fractures are present, they are generally tight. There are no micaeous, or shaley interbeds or as joint or fracture filling within the Upper Paleozoic limestone ore. Most prominent joints are discontinuous and parallel major fault trends. Spacing ranges from 6 inches to 3 feet. Bedding in the Lower Paleozoic dolomites ranges from moderate to steeply east dipping.

The quarry was opened in the 1970's. Walls are designed to be 60 feet high with 30-foot wide safety benches. Face angle is 70 degrees. Overall existing and ultimate planned pit slope is 45 to 50 degrees (maximum). Ultimate overall slope height is up to 600 feet (maximum depth). As noted in previous discussions, the slopes are completely dry. Hoek (1971) has shown that critical slope height (Hc) for geological conditions similar to those at Sentinel Quarry is far in excess of the ultimate planned excavation even with dip angles greater than any of the ore displays in the mine area.

A "Slope Stability Investigation" was prepared by CHJ Consultants in July 2012 (see Appendix 8 and Section 2.9 above). CHJ concluded that the proposed mine excavation and reclamation (backfilling) of the quarries are suitably stable against gross failure for the anticipated long–term conditions including the effects of seismic shaking and meet the factor of safety criteria for static and seismic conditions.

3.7.2 Adverse Geologic Conditions Butterfield 5 Pad

No adverse geological conditions have been identified which would have an adverse impact on the Butterfield 5 Pad Overburden site. CHJ concluded that the proposed reclaimed overburden slopes are suitably stable against gross failure for the anticipated long –term conditions including the effects of seismic shaking and meet the factor of safety criteria for static and seismic conditions (see Appendix 8 and Section 2.9 above).

The stockpile is free draining and the ground water table at least 300 feet below the base of the stockpile. Overburden materials (limestone and Dolomite) are not subject to liquefaction earth flows or landslides. During reclamation the slope of the overburden stockpile will be reduced to 2H:1V. This will insure long term stability. Recontouring and drainage controls will insure that erosion and off site sedimentation are minimized.

3.7.3 Potential Impacts on Furnace Canyon

The Sentinel Quarry reclamation includes a significant portion of backfilling of the Sentinel Quarry with a mixture of overburden and crusher fines. Once mining is completed the final slope of the backfill will be reduced to a 2H:1V slope. Slope reduction to 2H:1V assures the stability of the fill material against failure. Fill slopes at 2H:1V meet the stability requirements for Federal and State agencies.

The backfill will be composed of overburden and waste rock composed of bedrock limestone and dolomite, and intrusive rocks in sizes ranging from 6-foot boulders to silt size material. When the final slope of the backfill is lowered, additional mixing and homogenization will occur. The final mixture will be thoroughly mixed. There will be no possibility of fines forming a potential slide plane on which failure could occur.

The backfill will not completely fill the pit. The south wall and part of the west and east walls of the quarry will not be backfilled (due to lack of material). A portion of the pit will remain which is not backfilled. The portion of the pit which is not backfilled will be almost 300 feet deep. The available volume of space in the unfilled portion of the quarry would contain any failure which could occur under the existing climatic and or seismic conditions.

3.8 GEOLOGY - BUTTERFIELD QUARRY

Butterfield Quarry is located within the Crystal Creek #1 placer claim, at the north range crest at an elevation of about 7800 feet, and is reached by the vested Crystal Creek Haul Road. Topography in the quarry area is generally rugged and steep, although once the range crest is reached, topography becomes more gentle.

Paleozoic Rocks

Paleozoic rocks exposed in the quarry area include Pennsylvanian Bird Spring Formation. The Bird Spring Formation is a regionally widespread thick, and variable carbonate dominated sequence. In the quarry area, the formation is over 1000 feet thick. However the sequence of interest in the quarry is about 120 feet thick, 2,500 feet long and up to 800 feet wide and occurs at the top of the exposed section. The layers dip gently to the east, and are composed of interbedded layers of white and light grey marble, with individual color layers up to 40 feet thick. Below the white layers the carbonate rock sequence becomes increasingly grey and impure with increased silica. Originally fossil rich bioclastic limestone, variable metamorphism has bleached the rock into light grey to white fine to medium grained calcite marble, of high purity. Metamorphism has largely destroyed any fossil remains.

Mesozoic Rocks

Mesozoic rocks in the quarry area include several altered porphyry dikes which have intruded into the Pennsylvanian carbonate rocks. The dikes are generally less than 10 feet thick and dip steeply to vertical. The dikes are highly altered and composed almost entirely of clay minerals, although some remnant igneous textures are still present in a few areas.

Metamorphism

Paleozoic rocks in the area have been regionally metamorphosed to greenschist grade. Conodont color index measurements in nearby rocks indicate metamorphic temperatures of over 430 degrees C. Metamorphism of susecptible rocks within the Bird Spring formation limestone has formed variable white to light grey, calcite marble which forms the ore body.

Structure

Rocks in the quarry area have been both folded and faulted. Visible folds are F2 folds and are upright, open undulations in the shallow dipping upper Paleozoic rocks. The rocks dip gently to the east and rocks in the quarry are on the east limb of an anitform to the west. Faults are common in the quarry and have several major trends. Several high angle faults are present in the quarry. The faults cut the carbonate rock, and the altered intrusive appears to be involved in faulting as well. Several faults and or fractured have rocks have been silicified by hydrothermal fluids and formed Alunite veins. Other low angle shears are also present in the area some of which are also occupied by thin alunite layers. Most of the faults are probably of Cenozoic Age and some may be related to the uplift of the range.

Formation of Butterfield Limestone Ore Deposit

As noted, the ore deposit is formed from depositionally pure limestone layers within the thick Bird spring Formation of Pennsylvanian-Permain age. Greenschist grade metamorphism has bleached the rock variably white resulting in Calcium Carbonate of exceptionally uniform and high purity and moderate to high brightness. Uplift and erosion have removed the overlying rocks to leave a significant deposit of pure white marble well suited for mining with very little overburden. Limestone resources are adequate for 40 years mining at present and projected future mining rate.

3.8.1 Adverse Geologic Conditions Butterfield Quarry

No geologic conditions have been identified which would adversely affect the Butterfield Quarry mining operation. The area has also been mapped in detail (Brown, various references) and no adverse geologic conditions have been identified.

Upper Paleozoic limestones in the Butterfield Quarry area are shallow dipping and are natural cliff formers. Cliffy topography exists along the range front. Several generations of high angle faults are present. Most faults are perpendicular to the long axis of the quarry (cross faults). Joint spacing is wide and the rock is blocky and solid. High walls are stable.

Bedding of the upper Paleozoic limestones is shallow dipping ranging from 10 to 30 degrees toward the east. Although joints and fractures are present, they are generally tight and pretty wide spaced. There are no micaeous, or shale interbeds or as joint or fracture filling. Most prominent joints are discontinuous and parallel major fault trends. Spacing ranges from 6 inches to 3 feet.

The quarry was opened in the 1970's. Walls are designed to 50 feet high with minimum 25 feet wide safety benches but vary based on geological and limestone quality. Face angle is 70 degrees. Overall existing and ultimate planned pit slope is about 45 degrees. Ultimate overall slope height will be about 200 feet. As noted in previous discussions, the slopes are completely dry. Hoek (1971) has shown that critical slope height (Hc) for geological conditions similar to those at Butterfield Quarry is far in excess of the ultimate planned excavation even with dip angles greater than any of the ore displays in the mine area.

A “Slope Stability Investigation” was prepared by CHJ Consultants in July 2012 (see Appendix 8 and Section 2.9 below). CHJ concluded that the proposed mine excavation and reclamation (backfilling) of the quarries are suitably stable against gross failure for the anticipated long –term conditions including the effects of seismic shaking and meet the factor of safety criteria for static and seismic conditions.

3.9 GEOLOGIC REFERENCES CITED

Brown, H., 1984a, Summary of the geology of the north range front of the San Bernardino Mountains, Lucerne Valley, California: in Kupfermann, S., McIver, D., and Morton, P., eds., Major limestone producers of the western Mojave Desert, California: Field Trip Guidebook, American Institute of Mining Engineers, 112TH annual meeting, Los Angeles, p. 12-29.

___, 1984b, Paleozoic carbonate stratigraphy of the San Bernardino Mountains, southern California: Geological Society of America Abstracts with Programs, v. 16, p. 456.

___, 1984c, Correlation of metamorphosed Paleozoic strata of the southeastern Mojave Desert region, California and Arizona, Discussion and Reply: Geological Society of America Bulletin, v. 95, p. 1482-1486.

___, 1987, Geological setting of the Lucerne Valley limestone mining district, and overview of the Pluess-Staufer mining operation, Lucerne Valley, California, in Pierce, W., ed., 21st Annual Industrial Minerals Conference Proceedings: Arizona Bureau of Mines Special Report 4, p. 44-54.

___, 1991a, Stratigraphy and Paleogeographic setting of Paleozoic rocks in the San Bernardino Mountains, California; in, Cooper, J.D., and Stevens, C. H., eds., 1991, Paleozoic Paleogeography of the Western United States II: Pacific Section SEPM, Vol. 67, p. 193-207.

___, 1991b, Detailed geologic maps of the San Bernardino Mountains, Transverse Ranges Province, Southern California; Geol. Society of America, Abs. w. prog. V. 23 No. 5, p. 478. Cameron, C.S., 1982, Stratigraphy and significance of the Upper Precambrian Big Bear Group: in Cooper, J., Troxel, B., and Wright, L., eds., Geology of selected areas of the San Bernardino Mountains and western Mojave Desert, and southern Great Basin of California: Los Angeles, Cordilleran Section, Geological Society of America, p. 5-20.

Dibblee, T.W., 1964, Geologic map of the Lucerne Valley Quadrangle, San Bernardino County, California: U.S. Geological Survey Miscellaneous Investigations Map I-426, scale 1:62500.

McColl, R. S., 1964, Structural geology of the Rattlesnake Mountain Pluton, San Bernardino Mountains, California: Geological Society of America Bulletin v. 75, p. 805-822.

May, S. R., and Repenning, C. A., 1982, New evidence for the age of the Old Woman Sandstone, Mojave Desert California, in Late Cenozoic stratigraphy and structure of the San Bernardino Mountains: Geological Society of America Field Trip, Cordilleran Section, 78th Annual Meeting, Anaheim, California, April 19-21, 1982, p. 93-96.

Miller, E. L., and Cameron, C.S., 1982, Late Precambrian to Late Cretaceous evolution of the southwestern Mojave Desert, California, in Cooper, J. D., and others, eds., Geology of selected areas in the San Bernardino Mountains, western Mojave Desert, and southern Great

Basin: Geological Society of America Field Trip Number 9, Cordilleran Section, 78th Annual Meeting, Anaheim, California, April 19-21, 1982, p. 21-34.

Miller, F. K., and Morton, D. M., 1980, Potassium-argon Geochronology of the eastern Transverse Ranges and southern Mojave Desert southern California: U.S. Geological Survey Professional Paper 1152, p. 30.

Richmond, J.F., 1960, Geology of the San Bernardino Mountains north of Big Bear Lake, California: California Division of Mines and Geology Special Report 65, 68 p.

Sadler, P.M., 1982, Geology of the Fawnskin and Big Bear City 7-1/2' Quadrangles, California: California Division of Mines and Geology Open-File Report 82-18.

_____, and Reeder, W. S., 1983, Upper Cenozoic, quartzite bearing gravels of the San Bernardino Mountains, southern California: recycling and mixing as a result of transpressional uplift, in Anderson, D. W., and Rymer, M.J., eds., Tectonics and sedimentation along faults of the San Andreas system, Los Angeles Society of Economic Paleontologists and Mineralogists, p. 45-57.

Smith, D. K., 1983, Mesozoic alkaline and calc-alkaline igneous rocks, north-central San Bernardino Mountains,

California: Geological Society of America Abstracts with programs, v. 15, no. 5, p. 281.

Stewart, J.H., 1970, Upper Precambrian and Lower Cambrian strata in the southern Great Basin, California and Nevada: U.S. Geological Survey Professional Paper 620, 206 p.

____, and Poole, F.G., 1975, Extension of the Cordilleran miogeosynclinal belt to the San Andreas fault, southern California: Geological Society of America Bulletin, v. 86, p. 205-212.

4.0 HYDROLOGY

4.1 CLIMATE CONDITIONS

The mining area is located along the rugged semi-arid north range crest of the San Bernardino Mountains and extends south to the Holcomb Valley area. Elevations in the mining area range from 7,200 to 7,900 feet.

Climate in the project area is characterized by warm summers and cold winters. Precipitation averages approximately 5-15 inches annually, mostly in the form of winter snows, and localized summer thunder showers. High summer temperatures average about 73 degrees F, with average lows about 41 degrees F. Winter average maximum and minimum temperatures are 43 degrees F and 18 degrees F respectively. Wind patterns are typically mild (less than 6-10 miles per hour), westerly to southwesterly during the day with milder easterly to northeasterly winds during the night. Occasional strong northeast winds known as "Santa Anas" blow for periods of a few days at a time during fall and winter months. Additional discussion of climate is in Appendix 3C.

4.2 DRAINAGE PATTERNS

The mining area is located at the top of the range crest of the San Bernardino Mountains and thus drainage is generally away from the mining area rather than into it.

Geomorphology indicates the steep “V” shaped canyons are youthful and related to rapid uplift and rapid erosion of the geologically young mountain range. Major drainages have very steep gradients. Drainage patterns are in part related to underlying geologic structure and/or lithology, and in places locations reflect lithologic or fault contacts.

Furnace Canyon is located east of the Sentinel Quarry. The north trending canyon is steep and rugged. The natural mountain slopes contain abundant talus, which washes into the canyon naturally. Several existing idle limestone quarries (not controlled by Omya) are present in Furnace Canyon. No blue line drainages or perennial streams are located within the project area. The headwaters of Furnace Canyon are located near the Sentinel Quarry and off of the Omya controlled claims. All drainages in the Sentinel Quarry area are dry.

Efforts are made to minimize sediment from the Sentinel mining area from entering Furnace Canyon. Roads are sloped to direct runoff into Sentinel Quarry, and rip rap, berms, hay bales, or other energy dissipaters have been or will be placed at the toe of fill pads or overburden placement areas to minimize the potential for sediment to enter Furnace Canyon. Other than to reduce sediment entering the drainage, mining at Sentinel has not and will not in the future alter drainage patterns into Furnace Canyon.

Numerous culverts, dips, over-side drains or other structures have been constructed along the quarry roads to allow minimum impact on existing drainage patterns and reduce sediment transport. These structures are regularly inspected and maintained as necessary. Drainage patterns of minor dry drainages in the mining area crossed by haul roads have not been altered.

Drainage to the north of the Butterfield Quarry is over the steep range front and into unnamed intermittent drainages that eventually feed into Crystal Creek. To the south of Butterfield Quarry, the unnamed intermittent drainages eventually feed into Holcomb Creek. There are no blue line drainages or perennial streams within the limits of the proposed expanded Butterfield Quarry. All drainages in the Butterfield Quarry area are dry.

4.3 GENERAL METHODS FOR POSITIVE DRAINAGE

Please refer to Section 2.12 above.

4.4 RECOGNIZED FLOODWAYS, 100-YEAR FLOOD PLAIN

The Project Site is not within a recognized floodway, a 100-year flood plain or an area subject to flash flooding. The project does not include habitable structures or hard surface covering (paving) of the site.

4.5 GROUNDWATER, PERMEABILITY, FAULT BARRIERS

There is no groundwater in the area of the Butterfield and Sentinel Quarries. Core drilling 100 feet below the final pit floor has not penetrated any water sources or aquifers.

The limestone formations in the quarry area are over 1,000 to 2,000 feet thick and generally highly fractured and permeable. The limestone is underlain by granitic intrusive rocks at depth. Over 100 core holes have been drilled and most have lost circulation indicating fractured permeable ground. No groundwater or springs are located near the quarries.

4.6 EXISTING WATER SOURCES AND USES

Presently water used in the active quarry mining areas amounts to about 1.5 acre feet per year, and comes from 2 wells which are pumping groundwater. The plant well (at the plant in Lucerne Valley) is about 1100 feet deep and pumps groundwater from alluvium. The Crystal Creek well located in Crystal Creek Canyon is about 200 feet deep and pumps groundwater from fractured granitic basement rocks. These sources were permitted many years ago and documents related to the wells and production are included in Appendix 4. No changes are proposed to the water sources. The amount of water use is expected to double to about 3 acre-feet/year which is not expected to affect the local groundwater. Section 1.4 above discusses water production allowance under the Mojave Basin Area Adjudication.

4.7 GENERAL USE OF TOXIC SUBSTANCES

The mining and processing operations do not use or introduce any toxic substances into storm water runoff generated at the site.Ore mined is nontoxic calcium carbonate, which is present in natural waters. Carbonate rocks are widely present at the surface throughout the San Bernardino Mountains and dissolution of limestone (calcium carbonate) occurs naturally in the area.

During the mining no reagents (organic compounds) are utilized. The only nonfuel chemicals used are dust control agents (MgCl2) used on the haul roads, and foam spray dust control at the

crusher. There are therefore, no sources of introduced chemical contamination to surface or groundwater at this operation.

4.8 STREAM GAUGING STATIONS

There are no stream gauging stations within the mining area.

REFERENCES, ACRONYMS, and GLOSSARY

REFERENCES

"Annual Reclamation Report 2011 Omya California", JJ Restoration Service, 2012.

"Carbonate Habitat Management Strategy (CHMS)", San Bernardino National Forest Association, April 2003.

"Land Management Plan, Part 2 San Bernardino National Forest Strategy" (USDA September 2005)

"Omya Umbrella Plan of Operations and Reclamation Plan", Omya 1987 (which includes the Sentinel, Butterfield, Cloudy, and Claudia quarries and associated haul roads). *Approved by the Forest Service, January 1988 and by San Bernardino County in 1994.*

"Plan of Operations and Reclamation Plan Sentinel Quarry Expansion", Omya (California) Inc., September 15, 2002. *Approved by San Bernardino National Forest, April 2002 and by San Bernardino County, July 2003.*

"Revegetation Plan Omya California Mining Operations on USDA Forest Service Land San Bernardino National Forest, San Bernardino County California", Tierra Madre Consultants 1996. *Approved by San Bernardino National Forest and San Bernardino County in 1996.*

"Rules and Regulations," Mojave Desert Air Quality Management District, 2012.

"San Bernardino County General Plan," San Bernardino County (with updates).

"Slope Stability Investigation Proposed Sentinel and Butterfield Quarries", C.H.J. Consultants, July 2012.

"Surface Mining and Reclamation Act (SMARA)," California Department of Conservation, Office of Mine Reclamation, 2012.

ACRONYMS

af	acre-feet
amsl	above mean sea level
ANFO	ammonium nitrate and fuel oil
AQMP	Air Quality Management Plan
B-5	Butterfield 5
BA	Biological Assessment
BATF&E	Bureau of Alcohol, Tobacco, Firearms and Explosives (federal agency)
BLM	Bureau of Land Management
BMP	Best Management Practices
Cal-OSHA	California Occupational Safety and Health Administration
CARB	California Air Resources Board
CCR	California Code of Regulations
CDFG	California Department of Fish and Game
CESA	California Endangered Species Act
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CHMS	Carbonate Habitat Management Strategy
CNPS	California Native Plant Society
CUP	Conditional use permit
CUPA	Certified Unified Program Agency (Hazardous Materials Division of the San Bernardino County Fire Department is designated as the "CUPA.")
CY	Cubic yards
DOC	Department of Conservation
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
FESA	Federal Endangered Species Act
H:V	horizontal to vertical; typically in feet (slope inclination)
MBTA	Migratory Bird Treaty Act
MCY	million cubic yards
MSHA	Mining Safety and Health Administration
MT	million tons
MDAQMD	Mojave Desert Air Quality Management District
MWA	Mojave Water Agency
NEPA	National Environmental Policy Act
NF	National Forest
NPDES	National Pollutant Discharge Elimination System
OMR	Office of Mine Reclamation
PM_{10}	10-micron or less particulate matter
RWQCB	Regional Water Quality Control Board
SBNF	San Bernardino National Forest
SMARA	Surface Mining and Reclamation Act
SPCC	Spill Prevention, Control, and Counter-measure
SWPPP	Storm Water Pollution Prevention Program
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

GLOSSARY OF TERMS

BACT: Best Available Control Technology – Air quality term used to describe air pollutant control equipment for equipment and facilities that produce air emissions.

Bedrock: The solid rock that underlies soil and unconsolidated material.

Bench: Terrace or leveled area breaking the continuity of a slope. For the South Quarry, the bench will be 25 feet wide every 45 feet vertical feet.

Berm: An elongated earthen structure which acts as a barrier; e.g., to make it difficult for a vehicle or ORV to cross, or to redirect the flow of water.

California Endangered Species Act (CESA): California state legislation enacted in 1984, with the intent to protect floral (plant) and faunal (animal) species by listing them as "rare," "threatened" "endangered," or "candidate." The Act also provides a consultation process for the determination and resolution of potential adverse impacts to the species.

California Environmental Quality Act (CEQA): Policies enacted in 1970, and subsequently amended, the intent of which is the maintenance of a quality environment for the people of California now and in the future.

Carbonate Habitat Management Strategy (CHMS): An intensive collaborative effort led to the development of the Carbonate Habitat Management Strategy (CHMS) in 2003. The strategy is designed to provide long-term protection for the carbonate endemic plants and also provide for continued long-term mining. Some carbonate habitats are protected from mining impacts in perpetuity within the carbonate habitat reserves dedicated and managed as described in the CHMS. A Memorandum of Understanding and agreement was signed in 2003 by the USDA Forest Service, SBNF, Bureau of Land Management (BLM), San Bernardino County, Omya, Specialty Minerals, MCC, California Native Plant Society, and the Cushenbury Mine Trust stipulating that the signatories will implement the CHMS for the dual purpose of conserving threatened and endangered carbonate plants and streamlining mining operations.

Endangered species: A species whose prospects of survival and reproduction in the wild are in immediate jeopardy from one or more causes.

Environmental Impact Report (EIR): "Detailed statement or report prepared under CEQA describing and analyzing the significant effects of a project and discussing ways to mitigate or avoid the effects" (CEQA Guidelines §15362).

Environmental Impact Statement (EIS): Document required by the National Environmental Policy Act (NEPA) for certain actions "significantly affecting the quality of the human environment". An EIS is a tool for decision making. It describes the positive and negative environmental effects of a proposed action, and it usually also lists one or more alternative actions that may be chosen instead of the action described in the EIS.

Factor of safety: Ratio of forces resisting slope or foundation failure over forces driving slope or foundation failure.

Fine Particulate Matter: Extremely small air pollutants less than 2.5 microns in diameter and that form primarily from engine combustion sources, not from fugitive dust sources ($PM_{2.5}$).

Growth media: Surface material which contains nutrients, micro flora, and plant seeds.

Hazardous material: Substance, which may cause injury to persons or damage to property because of its potential for corrosivity, toxicity, ignitability, chemical reactivity, or explosiveness.

Haul road: A road used by haul trucks to haul ore and waste rock from the open pit to other locations usually to the crusher feed or to the waste rock stockpiles.

Hazardous material: Substance which, because of its potential for corrosivity, toxicity, ignitability, chemical reactivity, or explosiveness, may cause injury to persons or damage to property.

Hazardous waste: Defined in Section 1004(5) of the federal Resource Conservation and Recovery Act (RCRA) as, "…a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may: (a) cause, or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or (b) pose a substantial present or potential hazard to human health or the environmental when improperly treated, stored, transported, or disposed of, or otherwise managed."

Hydrogeology: The study of surface and subsurface water.

National Environmental Policy Act (NEPA) of 1969: The purposes of this Act are: To declare a national policy which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nation; and to establish a Council on Environmental Quality. Sec. 2 [42 USC § 4321].

Ore body: A generally continuous mass of ore distinct from the surrounding rock.

Phasing: Planned stages of project development.

Rare species: A species, which, although not presently threatened with extinction, is in such small numbers throughout its range that it may become endangered if its present environment worsens.

Reclamation: The combined process of land treatment that minimizes water degradation, air pollution, damage to aquatic or wildlife habitat, flooding, erosion, and other adverse effects from surface mining operations (SMARA 2007).

Reclamation Plan: A restoration plan for the stabilization and recovery of a mine site after cessation of mining operations for another use; generally open space or other low intensity use.

Regolith: a layer of loose, heterogeneous material covering solid rock. It includes dust, soil, broken rock, and other related materials.

Revegetation: Establishment of native vegetation on lands that have been disturbed.

Regional Water Quality Control Board (RWQCB): Agency which administers the requirements of the California Administrative Code, Title 23, Division 3, Chapter 15 (Section 2595,g,7) to ensure the highest possible water quality consistent with all demands.

Sensitive species: A plant or animal species, which is recognized by the government or by a conservation group, as being depleted, rare, threatened, or endangered.

Threatened species: Species, which, although not presently threatened with extinction, are likely to become endangered in the foreseeable future in the absence of special protection and management efforts.

Waste rock: Limestone which does not meet quality specifications and other rock types encountered during excavations which will be hauled directly to waste rock stockpiles.

Water table: The upper water level of a body of groundwater.