

# PEER REVIEW REPORT SAN RAFAEL ROCK QUARRY RECLAMATION PLAN



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Feb 2, 2012

Prepared for the County of Marin

*Zitney*  
& Associates

ENVIRONMENTAL PLANNING

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# Peer Review Report for the San Rafael Rock Quarry Reclamation Plan

PREPARED FOR THE COUNTY OF MARIN

## INTRODUCTION

This report presents the results of a peer review of the Conforming Amended Reclamation Plan as revised in 2010 (aka CARP10) to incorporate conditions required as part of the approval of the mining and reclamation plan for San Rafael Rock Quarry in September of 2010. Throughout this report, use of the terms “reclamation plan” and “CARP10” mean the same thing and refer to the latest Conforming Amended Reclamation Plan available as of the date of this review. Also included in the scope was a review of the Financial Assurance Cost Estimate (FACE) and the geological/geotechnical data and reports supporting proposed site reclamation and post-reclamation end use of the quarry property. Following are the individuals and firms who completed the reviews, their expertise, and areas of review:

- **Greg Zitney, Zitney & Associates** (Project Management, SMARA Compliance — Reclamation Plan and FACE reviews)
- **Craig Herzog, Herzog Geotechnical** (Geotechnical Engineering — Geotechnical Engineering Studies and Reclamation Plan reviews)
- **Michael Dwyer** (Engineering Geology — Geological Studies and Reclamation Plan reviews)
- **David Cromb, Cromb Associates** (Construction Cost Estimating — FACE review)

The primary objective for reviewing the reclamation plan is to determine if it complies with content requirements and reclamation standards of California’s Surface Mining and Reclamation Act (SMARA) and associated regulations, Marin County’s Surface Mining and Reclamation Ordinance (Title 23, Chapter 23.06), and related conditions of approval for the project.

The FACE is the basis for determining the amount of financial assurance, which is essentially a “bond” that insures that funds would be available to the lead agency and state to complete reclamation of the property if the quarry operator should fail to do so for whatever reason (bankruptcy, abandonment, etc.). In order for the lead agency to be adequately protected financially, the FACE must be adequate and should be prepared following established guidelines, standards, and practices. The purpose of the FACE review is to determine if it is reasonable and followed accepted guidelines and practices. The scope of this review did not involve independently preparing a cost estimate for comparison purposes.

The objectives for reviewing the geological and geotechnical information were to assess the thoroughness of data and analyses prepared to date for the quarry operator, advise the County on whether additional information is warranted, and determine the adequacy of related monitoring programs.

The reviews were completed with the following general assumptions, limitations, and/or notations:

- In all reviews, we have taken an unbiased approach in making comments and recommendations. In particular, we have no opinions regarding the proposed end use of the property.
- In determining compliance with SMARA, a literal interpretation of the statutes and regulations was used in most cases. In some areas, review comments and recommendations are also based on professional experience and judgment.
- For purposes of this review, we assumed that the CARP10 document, including the supporting technical studies, constitutes “the reclamation plan” under review. The Environmental Impact Report (EIR), conditions of approval (COA), and other items that comprise the “administrative record” for approval of the permit and reclamation plan are regarded as supporting informational documents. In many cases, these supporting documents were used to determine compliance with SMARA where applicable.

The remainder of the main body of this report primarily addresses the reclamation plan and FACE, but also includes a brief summary of findings of the geotechnical and geologic review of the reclamation plan and supporting geotechnical studies. The detailed geotechnical and geologic review is included as an appendix to this report.

## CONFORMING AMENDED RECLAMATION PLAN

### Review of SMARA Content Requirements

In reviewing CARP10, we used the “Reclamation Plan Review Checklist” provided by the state Office of Mine Reclamation (OMR) as a guide to determine content completeness with respect to SMARA requirements. The checklist is presented below, with additional comments provided as footnotes where appropriate. Answers given in the checklist generally mean the following:

- “Yes” means the reclamation plan is in compliance with this requirement. Additional comments or recommendations are provided in some cases in the footnotes when deemed beneficial.
- “No” means the reclamation plan either does not or only partially complies with this requirement. All “No” answers have footnotes giving further explanation.
- “NA” means that this item is not applicable to the reclamation plan because of location, type of mining, etc.

Statute/Code Section	Answer	Statute/Code Topic Synopsis
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#### General Requirements

SMARA 2772(c)(1)(5), 2207(a)(2)	Yes	Name and address of the operator and any person designated by the operator as an agent for service of process (must reside in CA). Names and addresses of the owners of all surface interests and mineral interests in the land.
SMARA 2772(c)(2)	Yes	Estimated total quantity and type of minerals to be mined (see Annual Report Instructions, Exhibit B, for mineral types and units of measure).
SMARA 2772(c)(3)	Yes	Initiation and termination dates of mining (must be specific, e.g. December 31, 2030).
SMARA 2772(c)(4)	Yes	Maximum anticipated depth of mining, stated in relation to a verifiable benchmark such as Mean Sea Level.

SMARA 2772(c)(5)	Yes	Size and legal description of the mine property, including map(s) with boundaries, topography in sufficient detail to show any relevant features, locations of streams, stockpiles, existing and proposed roads, equipment storage, railroads, and any utilities or easements within or adjacent to the mine.
SMARA 2772(c)(5)	Yes	Describe the general geology of the area, and give a detailed description of the geology of the mine site.
SMARA 2772(c)(6)	Yes	A description of the mining methods and a time schedule that provides for completion of mining on each segment so that reclamation can be concurrent or phased ASAP.
SMARA 2772(c)(9)	Yes	Provide a statement regarding the impact of reclamation on future mining.
SMARA 2772(c)(7,8)	Yes	Include a description of the proposed subsequent use or potential use, and evidence that landowners have been notified of the proposed use. Reclamation measures must be adequate to achieve the proposed end use.
CCR 3502(b)(2)	No <sup>1</sup>	Any potential public health and safety concerns should be addressed.
CCR 3713(b)	NA	Show that any portals, shafts, tunnels, or openings will be gated or protected from public entry, and to preserve access for wildlife (e.g. bats).
CCR 3709(b)	Yes	Structures and equipment shown to be dismantled and removed at closure, except as demonstrated to be required for the proposed end use.
CCR 3713(a)	No <sup>2</sup>	Show that drill holes, water wells, monitoring wells will be completed or abandoned in accordance with laws, unless demonstrated necessary for the proposed end use.
SMARA 2772(c)(10)	Yes	Include a statement signed by the operator accepting responsibility for reclamation per the reclamation plan.
SMARA 2776	Yes	All areas disturbed by mining since 1/1/1976 are required to be reclaimed. Any areas disturbed prior to 1976 and not disturbed after that date may be excluded, but should be clearly shown on the maps.

### **Agricultural Land Reclamation**

CCR 3707(a)	NA	Return prime agricultural land to prime agricultural land, unless exempted.
CCR 3707(c)	NA	Productivity rates must be equal to pre-project condition or to a similar site for two consecutive years, for prime agricultural land. Productivity rates should be specified in the plan.
CCR 3708	NA	Non-prime land must be reclaimed to be capable of sustaining economically viable crops common to area.

<sup>1</sup> CCR 3502(b) states that the following shall be included in the reclamation plan: "The public health and safety, giving consideration to the degree and type of present and probable future exposure of the public to the site." This was mentioned in OMR's comments dated 2/25/2011. No discussion of public health and safety (especially for post-reclamation conditions) was found in CARP10.

<sup>2</sup> Usually addressed by other agency regulations, but retirement of monitoring wells onsite should be discussed in the reclamation plan per this standard.

**Geotechnical Requirements**

CCR 3502(b)(3)	No <sup>3</sup>	Final slopes: consider physical properties of materials, maximum water content, and landscaping. Stability analysis for final slopes that approach critical gradient.
CCR 3704(f)	No <sup>4</sup>	Final cut slopes have minimum factor of safety for end use and conform with surrounding topography or end use.
CCR 3502(b)(4)	No <sup>5</sup>	Source and disposition of fill materials considered. Foundation fills for end use in conformance with current engineering technology.
CCR 3704(a)	Yes	For urban use, fill compacted in accordance with UBC, local grading ordinance, or other methods approved by the lead agency.
CCR 3704(b)	Yes	For resource conservation, compact to standard for that end use.
CCR 3704(d)	Yes	Final reclamation fill slopes not exceed 2:1, except when allowed by site-specific engineering analysis, and can be revegetated.
CCR 3704(e)	Yes	At closure, all fill slopes conform with surrounding topography or end use.

**Hydrology and Water Quality**

SMARA 2770.5	NA	For operations within the 100-year flood plain (defined by FEMA) and within one mile up- or downstream of a state highway bridge, Caltrans must be notified and provided a 45-day review period.
CCR 3710(a)	Yes <sup>6</sup>	Surface and groundwater protected in accordance with Porter-Cologne and Clean Water Acts, and RWQCB/SWRCB requirements.
CCR 3706(b)	Yes	Water quality, recharge, and groundwater storage that is accessed by others shall not be diminished, except as allowed by plan.

- <sup>3</sup> Additional cut slope stability analyses are necessary (i.e., evaluation of the top of northwest and north pit walls, the south hill, and the proposed channel slopes), and additional fill material characterization is necessary (i.e., evaluation of shear strength of proposed pond fines mixture and determination of unsuitable oversize material). Requirement will be satisfied following implementation of geologic and geotechnical-related Conditions of Approval outlined in the *Marin County Surface Mining and Quarrying Permit, Permit # Q-72-03 Amendment #1*, and the recommendations presented in Comments 1.0 through 6.0 and 8.0 through 8.3 of the February 1, 2012 *Geotechnical and Geologic Review* by Herzog Geotechnical (see Appendix).
- <sup>4</sup> Additional cut slope stability analyses are necessary (i.e., evaluation of the top of northwest and north pit walls, the south hill, and the proposed channel slopes). Requirement will be satisfied following implementation of geologic and geotechnical-related Conditions of Approval outlined in the *Marin County Surface Mining and Quarrying Permit, Permit # Q-72-03 Amendment #1*, and the recommendations presented in Comments 8.0 through 8.3 of the February 1, 2012 *Geotechnical and Geologic Review* by Herzog Geotechnical (see Appendix).
- <sup>5</sup> Additional fill material characterization is necessary (i.e., evaluation of shear strength of proposed pond fines mixture and determination of unsuitable oversize material). Requirement will be satisfied following implementation of geologic and geotechnical-related Conditions of Approval outlined in the *Marin County Surface Mining and Quarrying Permit, Permit # Q-72-03 Amendment #1*, and the recommendations presented in Comments 8.0 through 8.3 of the February 1, 2012 *Geotechnical and Geologic Review* by Herzog Geotechnical (see Appendix).
- <sup>6</sup> Addressed in the Storm Water Management Plan (SWMP) and Storm Water Pollution Prevention Plan (SWPPP) incorporated by reference, as well as other erosion control measures described in the reclamation plan.

CCR 3503(b)(2)	Yes	Substantially prevent siltation of groundwater recharge areas.
SMARA 2773(a)	No <sup>7</sup>	Site-specific sediment and erosion control criteria for monitoring compliance with approved reclamation plan.
CCR 3503(a)(3)	Yes	Erosion control facilities constructed and maintained where necessary.
CCR 3503(b)(1)	Yes	Settling ponds used where they will provide significant benefit to water quality.

- <sup>7</sup> Site-specific criteria for monitoring erosion control measures are not included. To satisfy SMARA, this can be covered by including the following information in the reclamation plan's monitoring program:

*For inspection purposes, performance criteria for erosion control are as follows: Any area larger than 500 square feet on the site that receives an average evaluation score of Class 2 as stated in Table \_\_\_ (or higher) that persists for more than one year will be investigated. The investigator will determine the need for remedial measures. Areas receiving an average score of Class 3 or higher will receive treatment to correct the problem as set forth in the discussion or remedial measures (Table \_\_\_). Any observable reason for failure will be noted and the appropriate remedial measure stated as part of the annual monitoring report.*

Table \_\_\_: Qualitative Descriptions of Soil Surface Status

CLASS 1:	No soil loss or erosion; topsoil layer intact, vegetation established.
CLASS 2:	Soil movement slight and difficult to recognize; small deposits of soil in form of fans or cones at end of small gullies or fills, or as accumulations back of grass plugs.
CLASS 3:	Soil movement or loss more noticeable; topsoil loss evident, with some plants on pedestals or in hummocks; rill marks evident. Poorly dispersed litter and bare spots not protected by litter.
CLASS 4:	Soil movement and loss readily recognizable; topsoil remnants with vertical sides and exposed plant roots, roots frequently exposed, litter in relatively small amounts and washed into erosion protected patches.
CLASS 5:	Advanced erosion; active gullies and rills greater in cross section than 12 square inches exceeding 10 feet in length, steep sidewalls on active gullies; well-developed erosion pavement on gravelly soils, litter mostly washed away.

Table \_\_\_: Remedial Measures For Erosion Control

CLASS 1:	No action required. Continue observation.
CLASS 2:	Document and continue observation. Mulch limited critical areas with weed-free straw or rice mix @ 2000 lbs per acre on slopes less than a 3:1 gradient or at rate of 3000 lbs. per acre on 3:1 gradient slopes or steeper. Use straw bales, straw rolls, and erosion control blankets where necessary.
CLASS 3:	Mulch entire area with weed-free straw or rice mix @ 3000 lbs per acre. Use of straw bales, straw rolls, and erosion control blankets where necessary.
CLASS 4:	Regrade area to distribute and prevent concentration of surface flows. Direct runoff to established swales. Mulch intervening bare areas. Use straw bales, straw rolls, and erosion control blankets where necessary.
CLASS 5:	Regrade area to distribute and prevent concentration of surface flows. Direct runoff to established swales. Arrest gully development by placement of graded rock interceptors or straw bales to slow concentrated runoff within 1 week following any rainfall event. Mulch intervening bare areas and heavy equipment-impacted areas. Use straw bales, straw rolls, and erosion control blankets where necessary.

CCR 3503(e)	Yes	Grading and revegetation to minimize erosion and convey surface runoff to natural drainage courses or interior basins. Spillway protection.
CCR 3706(c)	Yes	Erosion and sedimentation controlled during all phases of construction, operation, reclamation, and closure of surface mining operation to minimize siltation of lakes and water courses per RWQCB/SWRCB.
CCR 3706(d)	Yes <sup>8</sup>	Surface runoff and drainage controlled to protect surrounding land and water resources. Erosion control methods designed for not less than 20 year/1 hour intensity storm event.
CCR 3706(e)	Yes	Altered drainages shall not cause increased erosion or sedimentation. Mitigation alternatives proposed in reclamation plan.
SMARA 2772(c)(8)(A)	Yes <sup>9</sup>	Description of contaminant control and mine waste disposal.
CCR 3503(d)	Yes	Disposal of mine waste and overburden shall be stable and not restrict natural drainage without suitable provisions for diversion.
CCR 3503(a)(2)	Yes <sup>10</sup>	Stockpiles managed to minimize water and wind erosion.
CCR 3712	Yes	Mine waste and tailings, and mine waste disposal units governed by SWRCB/IWMB (Article 1, Subchapter 1, Chapter 7, Title 27, CCR).

**In-Stream Mining**

CCR 3710(b)	NA	In-stream mining conducted in accordance with Fish and Game Code Section 1600 et seq, Section 404 of the Clean Water Act,, and Section 10 of the Rivers and Harbors Act of 1899.
SMARA 2772(c)(8)(B)	NA	Rehabilitation of stream banks/beds to minimize erosion.
CCR 3502(b)(6)	NA	Temporary stream and water diversions shown.
CCR 3710(c)	NA	In-stream mining controls impacts to structures, habitats, riparian vegetation, groundwater levels, and banks. In-stream channel elevations and bank erosion evaluated annually using extraction quantities, cross-sections, aerial photos.

<sup>8</sup> Erosion control is addressed; however, it is unclear if this standard (or any other) was used as a design criterion. No references were found to this or a higher intensity design standard.

<sup>9</sup> This is addressed indirectly and generally in the SWPPP and FEIR. CARP10 and related documents assume that most mining waste not used in reclamation would be placed into the quarry bowl. CARP10 covers in general terms by indicating that pond fines are stockpiled and would be mixed with overburden for use in reclamation. Quantities and ability for this approach to work as intended are uncertain and not well defined at this stage. (See *Geotechnical and Geologic Review* by Herzog Geotechnical in the Appendix for more information regarding pond fines.) It is recommended that CARP10 include a “description of mine waste management and contaminant control” section to address this requirement clearly and directly.

<sup>10</sup> Scattered references are made to stockpiles being hydroseeded and stabilized with Type I and Type V revegetation methods. References to doing this on topsoil stockpiles are made; however, it’s not clear what would be done on overburden stockpiles. We recommend including a “Stockpile Management” section to clearly describe in one place how stockpiles will be managed throughout the life of the project. Also, there is contradictory and confusing information presented on topsoil and whether or not it will be stockpiled and segregated from other material. (See footnote #12 below.)

CCR 3706(a)	NA	Mining and reclamation to protect downstream beneficial uses.
CCR 3706(f)(1)	NA	Stream diversions constructed in accordance with Fish and Game's stream and lake alteration agreement.
CCR 3706(f)(2)	NA	Stream diversions constructed in accordance with Federal Clean Water Act and Rivers and Harbors Act of 1899.
CCR 3706(g)	NA	All temporary stream diversions eventually removed and affected land reclaimed.

#### **Environmental Setting and Protection of Fish and Wildlife Habitat**

CCR 3502(b)(1)	Yes	Environmental setting and impact of reclamation on surrounding land uses. (Identify sensitive species, wildlife habitat, sensitive natural communities, e.g. wetlands, riparian zones, etc.)
CCR 3705(a)	No <sup>11</sup>	Vegetative cover, similar to surrounding habitats, self-sustaining. Baseline studies documenting cover, density and species richness.
CCR 3503(c)	Yes	Protection of fish and wildlife habitat (all reasonable measures).
CCR 3703(a)	Yes	Sensitive species conserved or mitigated.
CCR 3703(b)	Yes	Wildlife habitat at least as good as pre-project, unless approved end use precludes its use as wildlife habitat.
CCR 3703(c)	Yes	Wetlands avoided or mitigated at 1:1 minimum for both acreage and habitat value.
CCR 3704(g)	Yes	Piles or dumps not placed in wetlands without mitigation.
CCR 3710(d)	NA	In-stream mining not cause fish to be trapped in pools or off-channel pits, or restrict migratory or spawning activities.

#### **Resoiling**

CCR 3711(b)	No <sup>12</sup>	Topsoil resources mapped prior to stripping, location of stockpiles on map. Topsoil and other growth media in separate stockpiles.
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<sup>11</sup> Reclamation standards require that baseline studies documenting plant cover, density, and species richness be conducted onsite for naturally-occurring habitats to be reclaimed to what existed prior to disturbance from mining, or that baseline data from relevant reference areas be used where reclamation will be to habitats that were not present onsite prior to disturbance. CARP10 does not appear to include the collection of such baseline data.

<sup>12</sup> CARP10 contains contradictory statements regarding topsoil and stockpiling of topsoil. On page 2 it states: ". . . top soil [sic] will not be stockpiled during reclamation as originally anticipated in ARP 04." Later in the same paragraph it states that "The small area of topsoil from the west end of the south hill will be placed on the final contoured grading of the easterly end of the south hill immediately after it is stripped during phase IV." On page 9, the following is stated: "While it is not anticipated that much topsoil remains on the site, care will be taken to stockpile what soil exists over areas of overburden that have yet to be removed. The topsoil material will be stored in a soil stockpile and will be incorporated back into the site as reclamation grading and site work proceed." This is confusing and contradictory and needs to be clarified. CCR 3711(b) indicates that topsoil onsite should be mapped and stockpiled separately from overburden and other growth media. Topsoil is described as occurring in a small area on the west end of south hill, but this area is not shown on maps. Also, although stockpiles are shown on EXH-3 (Existing Conditions), the location of the topsoil stockpile referenced on page 9 is not shown. This information should be provided to meet SMARA standards described in CCR 3711(b).

CCR 3704(c)	Yes <sup>13</sup>	Mine waste stockpiled to facilitate phased reclamation and kept separate from topsoil or other growth media.
CCR 3711(a)	Yes <sup>14</sup>	All salvageable topsoil removed. Topsoil and vegetation removal not to precede mining by more than one year.
CCR 3503(a)(1)	Yes	Removal of vegetation and overburden preceding mining kept to a minimum.
CCR 3711(c)	Yes <sup>15</sup>	Soil salvage and phases set forth in plan, minimize disturbance, designed to achieve revegetation success.
CCR 3711(d)	No <sup>16</sup>	Topsoiling phased ASAP. Topsoil stockpiles not be disturbed until needed. Topsoil stockpiles clearly identified and planted with vegetation or otherwise protected.
CCR 3503(f)	Yes	Resoiling: use fine materials plus topsoil and/or mulches.
CCR 3711(e)	Yes	Topsoil redistributed in a manner resulting in a stable, consistent thickness.
CCR 3707(b)	NA	Segregate and replace topsoil by horizon in prime agricultural soils.
CCR 3705(e)	Yes	If soil is altered or other than native topsoil, requires soil analysis. Amend if necessary.
CCR 3707(d)	NA <sup>17</sup>	If fertilizers and amendments are applied, they do not contaminate water

**Revegetation**

SMARA 2773(a)	Yes	Revegetation plan specific to property. Monitoring plan.
CCR 3503(g)	Yes <sup>18</sup>	Use available research regarding revegetation and plant survival.

<sup>13</sup> However, see footnote #12 with respect to segregating topsoil from mining waste or other growth media.

<sup>14</sup> However, see footnote #12 with respect to clarifying when and if topsoil will be removed and/or stockpiled.

<sup>15</sup> However, see footnote #11 regarding baseline studies to establish revegetation goals, and footnote #19 regarding the use of test plots to help insure revegetation success.

<sup>16</sup> See footnote #12 regarding topsoil and stockpiling. With clarification and better description of topsoil handling and stockpiling, this standard will have been met.

<sup>17</sup> Cited standard applies to prime agricultural land.

<sup>18</sup> OMR provided earlier comments and suggestions for species composition; however, CARP10 does not appear to provide specific references or “available research” to support the likely success of the revegetation methods proposed. This information would assist in demonstrating that test plots (see footnote #19 below) are not required if the quarry operator proposes to have the County waive that requirement.

CCR 3705(b)	No <sup>19</sup>	Test plots.
CCR 3705(c)	Yes	Decompaction of site.
CCR 3705(d)	Yes	Roads stripped of roadbase materials, resoiled and revegetated, unless exempted.
CCR 3705(f)	NA	Temporary access not to disrupt soil surface on arid lands except where necessary for safe access. Barriers installed to keep unauthorized vehicles out.
CCR 3705(g)	Yes	Use native plant species, unless exotic species meet end use.
CCR 3705(h)	Yes	Plant during correct season.
CCR 3705(l)	Yes	Use soil stabilizing practices and irrigation, when necessary to establish vegetation.
CCR 3705(j)	No <sup>20</sup>	If irrigated, demonstrate self-sustaining without for two-year minimum.
CCR 3705(k)	Yes	Weeds managed.
CCR 3705(l)	Yes <sup>21</sup>	Plant protection measures, fencing, caging where needed for success.
CCR 3705(m)	No <sup>22</sup>	Success quantified by cover, density and species-richness. Standards proposed in plan. Sampling method set forth in plan and sample sizes provide 80 percent confidence level, as minimum.

<sup>19</sup> “Test plots” are proposed to be randomly located, one-meter square, and established at the beginning of each phase of reclamation (CARP10, page 18). From this description, it appears that these are actually “monitoring plots” and not test plots as described in CCR 3705(b), which states: “Test plots conducted simultaneously with mining shall be required to determine the most appropriate planting procedures to be followed to ensure successful implementation of the proposed revegetation plan.” The purpose of test plots is to assist in determining appropriate planting procedures and results (soil mixtures, amendments, seed mixes, irrigation regimes, plant vigor, success, need for protection, etc.) well before (5 years or more) revegetation is initiated, so that the probability of meeting success criteria is maximized. That’s why the standard specifies that they should be established “simultaneously with mining.” Test plots for this purpose are usually much larger in size (e.g., 25 x 25 ft or larger depending on a variety of factors), and multiple plots may be established to test and compare different revegetation methodologies. CARP10 should be revised to include true test plots and include more detailed specifications. Note, however, that CCR 3705(b) also states: “The lead agency may waive the requirement to conduct test plots when the success of the proposed revegetation plan can be documented from experience with similar species and conditions or by relying on competent professional advice based on experience with the species to be planted.” One approach or the other needs to be established and validated in order to meet this standard. (For a good discussion of test plots and their use, see Newton, Gail A. and Claassen, V. P., 2003, *Rehabilitation of Disturbed Lands in California: A Manual for Decision Making*, California Geological Survey Special Publication 123, 228 p. [available online]) Also see footnote #18 regarding using specific references and available research to support a waiver of the requirement for using test plots.

<sup>20</sup> Add a success criterion specifying that, for revegetated areas requiring irrigation, the vegetation must be shown to be self-sustaining without irrigation (or any other human intervention) for at least two years.

<sup>21</sup> Use of fencing, caging, etc. is not specifically mentioned, but it can reasonably be assumed it would be employed if found to be a problem (which would prevent attainment of success criteria). Test plots would be useful to determine if such protection would be necessary prior to implementing revegetation on a large scale.

<sup>22</sup> Success criteria for cover, density, and survivorship are provided for the proposed revegetation types; however, species richness is not included and should be added. Also, sampling specifications (e.g., using a sample size adequate for obtaining statistically valid results to a confidence of at least 80 percent) are not provided and should be included to meet this standard.

## Additional Reclamation Plan Review Comments

1. Page 5 under “For engineered fills”: It is noted that a geotechnical investigation and report will be prepared for the grading permit application for Phase 1 reclamation, and that the report will address suitability of using the pond fines for mixing with overburden, and at what ratio. This issue has also been discussed in some detail in the geotechnical review report in the Appendix. It should be noted that the final suitability and mixing ratio determination might substantially affect the reclamation plan, grading quantities, the need to import material for revegetation, etc. This, in turn, could affect adequacy of the FACE. The County should be aware of this and, if necessary, amend the reclamation plan and adjust the FACE and related financial assurance as appropriate.
2. Page 7 under “Topsoil”: It is indicated here that soil used for revegetation will be “amended overburden.” This may very well be feasible; however, it would be best to conduct appropriate testing of the overburden (and possibly the fines) very soon to determine its suitability for use in revegetation as a growth medium, and to determine specifications for amending the overburden to make it suitable. The proposed use of amended overburden also provides a good reason for establishing test plots as soon as possible to determine, well in advance of beginning revegetation, how successful it is likely to be. See the discussion of using test plots in the previous section.
3. Page 8 at the top: The approximate time periods for the four reclamation phases are shown. As a general note, an assessment of where phasing stands should be a part of each annual report provided by SRRQ. Then, as appropriate, “minor” amendments can be noted, collected, and then covered in an amendment to the reclamation plan if necessary sometime in the future.
4. Although monitoring of revegetation is proposed, specifications for monitoring and success criteria are incomplete and undefined. These specifications should include number and locations of monitoring plots (to achieve required statistically valid results), schedule for monitoring, all parameters to be measured, etc. This should not be deferred to a later annual report.
5. We reviewed conditions of approval (COA) for those that applied to a revised amended reclamation plan. We have comments on the following:
  - a. COA #131 states: “The Permittee shall submit a revised amended reclamation plan that includes standards for preventing polluted stormwater runoff from entering the Main Quarry Bowl after it is flooded.” This does not appear to have been included in the latest CARP10. We also note that the SWPPP and SWMP are both dated 8/11/2004 and are somewhat out of date (e.g., references are made to excavating the quarry bowl to -300 ft msl rather than the approved -350 ft.)
  - b. COA #134 states: “. . . Permittee shall revise the amended reclamation plan (ARPO4) to incorporate the State Office of Mine Reclamation (OMR) “Resoiling and Revegetation” comments contained in OMR’s December 14, 2009 comment letter to the County. The revisions shall be included in the Conforming Amended Reclamation Plan submitted to the County.” Most of OMR’s comments have been incorporated into CARP10, with the exception of comments pertaining to test plots, statistically valid sample sizes, etc. See earlier comments on these elements for more information.

## FINANCIAL ASSURANCE COST ESTIMATE (FACE)

There are several points that are important to understand about the Financial Assurance Cost Estimate (FACE) before presenting our review of the FACE for SRRQ:

- The FACE is used to determine the amount of financial assurance (FA) that a mine operator posts (in the form of a surety bond or other acceptable mechanism) to guarantee that funds will be available to the lead agency (and State) to reclaim the quarry site should the operator fail to do so for any reason.
- The FA must be adequate to reclaim the site in accordance with the approved reclamation plan.
- The State Mining and Geology Board (SMGB) has published *Financial Assurance Guidelines* to assist operators and lead agencies in complying with the FA and FACE requirements. The Guidelines contain the minimum requirements for compliance and provide cost estimating references and a recommended format for developing an adequate FACE.
- The FA in place at any given time must be in an amount adequate to reclaim (1) areas scheduled for disturbance in the next year, and (2) areas not yet successfully reclaimed pursuant to the lead agency approved reclamation plan. The FA mechanism can be in place for a minimum of a year (with annual renewals and no lapse in coverage) or for the life of the project.
- The FACE must be reviewed annually and the FA adjusted accordingly to insure that the FA will be adequate, at minimum, to meet the two criteria described in the previous bullet point. The annual recalculation may be as simple as adding a “cost of living” and other rate increases (labor and equipment), or more complex if based on factors such as areas deemed reclaimed, new areas to be mined in the coming year, etc. Pursuant to CCR 3804(c), the operator must submit an annual recalculation of the FACE for approval by the lead agency.
- The FACE must be based on: (1) an analysis of the physical activities necessary to implement the approved reclamation plan; (2) the lead agency's (or a third party contract) unit costs for each of the described physical activities; (3) the number of units required to perform each of the activities; (4) an amount to cover contingency costs, (not to exceed 10% of the above calculated reclamation cost) and, (5) actual lead agency administrative costs.

A common misconception is that the FACE must be based on the reclamation plan for the entire mining project and site when, as indicated in the fourth bullet point above, it does not. However, many operators and/or lead agencies, because of the specific characteristics of the property, operation, or end use, opt for a FA for the entire life-of-project reclamation plan. The FACE provided to us for review is based on the entire reclamation plan for SRRQ.

Our review was undertaken at two levels: (1) an assessment of basic assumptions, approaches, and methods for compliance with SMARA requirements and the *Financial Assurance Guidelines*, and (2) a review of the cost estimate items and calculations (quantities, labor and equipment rates, etc.) to determine their thoroughness (i.e., inclusion of all cost factors) and reasonableness (i.e., use of adequate quantities, labor and equipment rates, etc.) given the details provided in the FACE and approved reclamation plan. The latter review was performed by Mr. David Cromb of Cromb Associates, a professional construction cost estimator.

Overall, the FACE appears to be a good-faith effort to identify reclamation tasks and costs. We have, however, identified several issues including the proposed use of market values to offset other costs, overlooked cost items, and others. Many of these are relatively minor in terms of the bigger picture and are fairly easy to correct. We also have concerns about the accuracy of quantities and rates used to calculate several of the line item costs; these are identified in Mr. Cromb's review under the “Review of Cost Estimates” section below.

## General SMARA Compliance Review Comments

The FACE for SRRQ includes the following “Reclamation Cost Assumptions” identified in item 1.1. (Note that the FACE does not include page numbers):

*Reclamation is intended to be concurrent with ongoing operations. Costs have been derived based on work being done by outside contractors and include the following assumptions:*

- *Equipment production rates are based on the Caterpillar Performance Handbook, edition 38*
- *All scrap metal will be recycled; SIMS metal management will provide debris boxes and haul offsite at no cost*
- *Equipment rates were derived from The US Army Corps of Engineers EP 1110-18 Construction Equipment Ownership and Operating Expense Schedule, Volume 7*
- *Labor rates are obtained from the California Dept. of Industrial Relations and are current prevailing wage*
- *Dutra recycles tires at their Rio Vista facility, thus no cost is included for tire removal*
- *All equipment onsite owned by Dutra will be taken to another Dutra site*
- *All stockpiled materials left onsite will be used in the reclamation tasks*
- *The 2004 FEIR includes construction of the bowl jetties, thus no further environmental study is necessary for them.*

Although the first sentence above indicates that costs were based on use of outside contractors, the 2<sup>nd</sup>, 5<sup>th</sup>, and 6<sup>th</sup> bullet points assume that all scrap metal will be removed at no cost, that tires can be removed at no cost, and that all equipment owned by Dutra would be taken to another site at no cost. Under current circumstances, this is probably true; however, in keeping with SMARA requirements for FAs, the FACE must assume that the operator (and/or SIMS) may not be able/willing to do these at some point in the future. Therefore, the FACE must include costs for the County, as the lead agency, to hire an outside contractor to perform all of these tasks (remove scrap metal, tires, and equipment) in order to be fully compliant with FA requirements. This is a basic issue for the FACE and should be corrected.

Additional general review comments:

1. Table 2 (Cost Estimate for Task 1-2a): This table includes a “sale” value for the process plant of \$1.4 million and uses it as an offset for dismantling the process plants. The *Financial Assurance Guidelines* (page 3) specify that: “To establish the salvage value of the plant site an estimate, bid or cost calculation from an impartial company or contractor which provides industrial dismantling or equipment salvage services, or is in the business of buying and selling scrap metals or similar products, must be provided.” This is further explained on page 7 of the Guidelines: “In order to include net salvage value in the financial assurance calculation, the operator must provide a letter of agreement, signed contract, bid or quote from an independent company which provides industrial dismantling or equipment salvage services, or is in the business of buying and selling scrap metals or similar products.” To be in compliance with FA requirements, therefore, this offset cost should be supported by an estimate from a qualified and impartial company or individual.
2. Tables 3 and 4 (Cost Estimate for Task 1-2b and 1-2c): The net cost on these tables includes offsets of \$150,000 and \$60,000, respectively, for free debris boxes and sale of scrap metal. See earlier comments regarding the need to provide an impartial estimate for salvage value and including costs for the County to hire an outside contractor.

3. Table 18 (Cost Summary): All of the percentages for items under "Management" conform to the Financial Assurance Guidelines under the total costs provided. These percentages may need to be updated for future recalculations of the FACE.

## Review of Cost Estimates

### Basis of Peer Review

- San Rafael Rock Quarry Financial Assurance Cost Estimate (FACE) prepared by Dutra Materials, Inc., Updated June 6th, 2011.
- One visit to the project site to observe site conditions and constraints.
- Current construction market and bidding conditions.
- RSMeans Heavy Construction Cost Data 2011, 25<sup>th</sup> Annual Edition.
- State of California Department of Transportation, Equipment Rental Rates. Caltrans Effective April 1, 2011 through March 31, 2012.

### Areas Reviewed

- Scope: To validate if the FACE matches the scope of the defining documents (a cursory review).
- Quantities: To validate if the quantities in the FACE are reasonably in line with the defining documents. Major items were checked against the plans and drawings.
- Rates: To validate if pricing in the FACE is reasonable for the quality of work, current market conditions, working conditions and other special requirements of the project.
- Extensions: To check math in the FACE for accuracy in arriving at total costs for each division and in the summaries.
- Basis of Estimate: To review assumed market conditions, markups and other assumptions and qualifications contained in the FACE.

### Notes:

- This Peer Review Estimate should not be considered as an independent engineer's estimate (it is for checking purposes only).
- The information contained herein is based on professional judgment made by experts familiar with the construction industry. Due to the myriad of outside factors that may affect any construction cost, including the status of the economy and the number of interested bidders, Cromb Associates does not guarantee that the stated costs will not vary from those specified in this review.

### Summary of Findings:

After reviewing the submitted FACE, it is our opinion that the stated total of \$2,613,716.66 is not adequate to complete the reclamation and construction work required. The main areas of concern are:

- The pricing methodology shown is based on individual operators, while the typical estimating method would be by crews; this results in a lower labor cost than would normally be anticipated.
- The estimated production output was typically found to be far higher than the norm, resulting in lower labor and equipment hours than would be expected in a competitive bid.
- Although the production output was found to be high, the hourly rates for equipment did not match those of the large equipment that would be required.

- It does not appear that all elements of CARP10 have been included in the FACE.
- Costs for hazardous materials (abbreviated as “HAZMAT” in the table below) evaluations or “environmental site assessments,” testing, reports, etc. have not been included in the FACE, but could be significant because of past and current uses on the site, proposed end uses, and regulations requiring such assessments. We expect that one or more environmental site assessment(s) will be needed for various phases/activities. Reasonable estimates for the associated costs should be included in the FACE.
- There may be anticipated submittals expected in the future that are connected to implementation of the reclamation plan that have not been included in the FACE. For example, we understand that SRRQ has requested a one-year extension (to September 28, 2012) for submittal of the Marsh Restoration Plan required by COA #113 and the engineering and economic report required by COA #129. Such plans have significant costs associated with their development (consultants, agency meetings, etc.), and reasonable estimates for these and other plans/studies that site reclamation as proposed is dependent upon should be included in the FACE.

The following table elaborates on the above points, identifying aspects of the FACE that do not appear to be consistent with the FA Guidelines and/or typical construction estimating practices, additional cost elements that should be included, or errors that were noted.

FACE Area of work	Independent Review Comments	Recommended Action
<b>INTRODUCTION</b>		
<b>Reclamation Cost Assumptions</b>		
Scrap metal	No third party estimate for the work was received. It is stated that scrap metal will be removed at no cost by SIMS metal management.	Provide a third party estimate per FACE Guidelines or add a reasonable cost to remove the scrap metal to the FACE.
Equipment rates	The equipment type and size is not called out. The production is typically called out as the highest attainable, which appears to assume the largest available machine.	Call out equipment model. A more reasonable assumption would be for the equipment to be in the mid-range size.
Tire removal	Stated as being removed by Dutra at no cost; however part of FACE purpose is to cover all costs in the event of abandonment.	Add the cost of tire removal by a third party.
Equipment owned by Dutra	Stated as being removed by Dutra to other site at no cost; however, part of FACE purpose is to cover all costs in the event of abandonment. It is not known what equipment would be left or moved.	Add the cost of equipment removal by a third party.

FACE Area of work	Independent Review Comments	Recommended Action
<b>SECTION 1: PLANT STRUCTURES &amp; EQUIPMENT REMOVAL</b>		
<b>Summary of Reclamation Methods Used</b>		
Tanks	Stated as "To be taken to another Dutra Facility."	Per FACE Guidelines these costs should be added to FACE. Work to be done by outside contractor.
Fuel Tanks	Soil should be inspected for contamination.	Add cost of inspection and removal of contaminated soil if necessary.
PG&E Lines and poles	Assumed to be removed by PG&E at no cost.	While PG&E will remove the infrastructure, fees may be charged. Confirm with PG&E any charges, add to FACE if necessary.
Utilities	Stated as "capped near buildings"	Verify in the future (once final plans for the end land use in the locations of capped utilities are known) that leaving existing underground utilities in place is compatible. Until then, costs for removal should be included in FACE.
Non portable buildings	Demolition by crane and taken to landfill dump.	HAZMAT. Cost of report and removal should be added to FACE if necessary.
Portable buildings	Stated as "hailed to another Dutra site"	Per FACE Guidelines these costs should be added to FACE. Work to be done by outside contractor.
<b>Task 1-1:Remove Part of Barge Pier</b>		
Dumping	No mention of dumping debris	Add dump fees
Labor & Equipment	No mention of pulling piers below water line.	Add labor and equipment to remove.
	The Laborers cost should be calculated as a "crew cost" including a laborer foreman.	Add crew cost.
	Laborers 42 hours do not match the stated 2 men for 12 days. The total hours should be 192.	Correct arithmetic error.
Missing scope - work required but not shown in FACE.	Water protection. Protect bay from demolition pollution.	Add material and labor costs to protect bay.
	Inspector to confirm work complies with Environmental regulations.	Confirm if needed and add cost.

FACE Area of work	Independent Review Comments	Recommended Action
	As this work would typically be subcontracted out, the subcontractor's bid would include profit, overhead and general conditions added to the above direct cost of the work.	Add Subcontractor General Conditions, OH&P, insurance, bonds, etc.
<b>Task 1-2a: Dismantle Process Plants</b>		
Material	Sale of process plant. \$1.4 million.	Unable to confirm salvage value. Provide a quote from a third party salvage company or scrap dealer as specified in FACE Guidelines.
Labor	Crane Operator's 32 hours do not match the stated 8 days. The total hours should be 64.	Correct arithmetic error.
	Laborers 416 hours do not match the stated 14 men for 4.5 days. The total hours should be 504.	Correct arithmetic error.
	The Laborers cost should be calculated as a "crew cost" including a laborer foreman.	Add crew cost.
	The proposed cost for labor to breakdown plant works out at \$5.13 per lf. This production is higher than would be expected.	Add reasonable time for breakdown, loading, hauling and unloading.
Production	It's not known where the Plant would be delivered to; however the assumption that it would take a 3-hour trip is overly optimistic.	Increase trip hours and show anticipated distance.
Missing scope - work required but not shown in FACE.	Confirm OSHA requirements are being met.	Add cost to comply with OSHA, lifts, scaffolding, etc.
	Confirm no HAZMAT assessment needed on the Process Plant.	Add cost of report and remedial measures if any.
	As this work would typically be subcontracted out, the subcontractor's bid would include profit, overhead and general conditions added to the above direct cost of the work.	Add Subcontractor General Conditions, OH&P, insurance, bonds, etc.
<b>Task 1-2b: Remove Plant Support Structures</b>		

FACE Area of work	Independent Review Comments	Recommended Action
Scrap metal	No third party estimate for the work was provided. It is stated that scrap metal will be removed at no cost by SIMS metal management.	Provide a third party estimate per FACE Guidelines or add a reasonable cost to remove to the FACE
Quantity	500 tons of scrap steel.	Show how the 500 tons is calculated.
Missing scope - work required but not shown in FACE.	Concrete footings supporting plant.	Add cost to remove footings.
	Miscellaneous demolition.	Add cost of items not accepted by SIMS.
	As this work would typically be subcontracted out, the subcontractor's bid would include profit, overhead and general conditions added to the above direct cost of the work.	Add Subcontractor General Conditions, OH&P, insurance, bonds, etc.
<b>Task 1-2c: Remove Metal Pipe Tunnels</b>		
Scrap metal	No third party estimate for the work. It is stated that scrap metal will be removed at no cost by SIMS metal management.	Provide a third party estimate per FACE Guidelines or add a reasonable cost to remove to the FACE.
Quantity	200 tons of scrap steel.	Show how the 200 tons is calculated. This equates to 25lbs/sf, which seems high. Should confirm gauge of steel.
Missing scope - work required but not shown in FACE.	Trucking of soils or double handling to access the metal pipe.	Add cost to the FACE.
	Add subcontractor's mark up.	Add Subcontractor General Conditions, OH&P, insurance, bonds, etc.
<b>Task 1-2d: Remove Concrete Tunnels and Bunkers</b>		
Quantity	Quantity of 1,270 cy appears to match the pipe concrete quantity. Assumed the cost of bunkers and foundations is priced elsewhere. If they are included in this item then costs and quantities are low.	Confirm cost is for pipe only.
Production	30-min round trip allocated for dumping material.	Specify location of dumped material to confirm accuracy of estimate.

Missing scope - work required but not shown in FACE.	Bunkers and concrete structures	Add cost to demolish all bunkers and remaining structures. Show locations on plan.
	Add subcontractor's mark up.	Add Subcontractor General Conditions, OH&P, insurance, bonds, etc.
<b>Task 1-3: Remove On-site Buildings</b>		
Portables	States that they "will be towed to another Dutra Facility or sold at auction."	Per FACE requirements, provide third party cost for removal. Add cost to FACE.
Demolish buildings	Four buildings are to be demolished. It is assumed that the two large buildings at the pier are to be demolished.	Provide square footage and correlated cost.
	The quantity of demolition appears to only include the walls @ 300 cy of debris.	Add cost to completely remove building, footings, slabs, structure, roofing, safe off, etc.
	It appears the demolished buildings area is greater than 16,500 sf. If this is the case, the cost of \$2 per sf is low.	Confirm buildings to be demolished and square footage. Increase cost.
	No mention is made of any HAZMAT in the buildings.	Confirm buildings are free of hazardous materials. Add cost to remove if necessary.
	Dump Fees are not included.	Add dump fee costs.
Missing scope - work required but not shown in FACE.	Not all buildings on the site appear to be included in the demolition. An example is the house and barn structures at the Grassy Knoll. In addition the Existing Conditions Plan shows many more structures than the eleven mentioned in the FACE.	Confirm which buildings/structures are to be demolished and which are to remain. Adjust costs in the FACE accordingly.
	Add Subcontractor's mark up.	Add Subcontractor General Conditions, OH&P, insurance, bonds, etc.
<b>SECTION 2: GRADING AND SITE WORK</b>		
<b>Task 2.1: Re-Grade &amp; Re-Soil North Hill &amp; Brick Resource Areas</b>		
Quantity	Stated as "7 acres of vegetation clearing." The area called out on the plans scales at over 40 acres.	Confirm area to be cleared (7 versus 40+ acres) and adjust FACE accordingly.

	Level of vegetative clearing is not called out.	Specify degree of clearing (medium, heavy, trees, bushes, shrub, etc.) and adjust FACE accordingly.
Production	The 4 hours allotted for a bulldozer to clear 7 acres is inadequate. RSMMeans, for example, specifies 1.5 acres per day.	Increase hours for this work
	The front-end loader production of 375 cy per hour for loading of cleared vegetation is overly optimistic.	Reduce output to standard level (e.g., per RSMMeans data). Adjust FACE accordingly.
	The grading (cut and fill) at 1,600 cy per hour is excessive; production would be substantially less.	Reduce output to standard level (e.g., per RSMMeans data). Adjust FACE accordingly.
	The compacting at 2,200 cy per hour is overly optimistic; production would be substantially less.	Reduce output to standard level (e.g., per RSMMeans data). Adjust FACE accordingly.
	Ditch excavation. Unknown if the ditch is excavated in rock or soil. Also, depth is unknown.	Confirm excavation material and size of trench. Adjust FACE accordingly.
	Water truck - The water truck will be required for the duration of cut and fill operations.	Increase water truck time period at a minimum to match cut and fill duration. Add water charges.
Equipment	Caltrans cost per hour for a medium wheel dozer is \$194.68.	Increase stated \$124.37 cost per hour of bulldozer to Caltrans rate. Confirm size of dozer in FACE.
	Caltrans cost per hour for a 7.5 cy Loader is \$176.12, while a 15 cy Loader is \$261.91 up to \$427.34.	Increase stated \$138.37 cost per hour for Loader to Caltrans rate. Confirm size of loader in FACE.
	Dump truck. The stated 22 cy per truckload would require a 33 ton rated truck. Caltrans rate for a 32-40 ton capacity truck is \$140.68 per hour.	Increase stated \$46.66 cost per hour for truck to Caltrans rate.
	Backhoe. Caltrans cost per hour for a 420E Backhoe is \$42.05.	Increase stated \$20.92 cost per hour for backhoe to Caltrans rate.
	Pickup Truck. Caltrans cost per hour for a light truck is \$17.10.	Increase stated \$6.31 cost per hour for pickup to Caltrans rate.
Missing scope - work required but not shown in FACE.	Dump fees are not included.	Add dump fee costs.
	Foreman	Add a foreman to the labor cost estimate.

	Surveying	Add cost for stacking, surveying, etc.
	Subcontractor's mark up.	Add Subcontractor General Conditions, OH&P, insurance, bonds, etc.
<b>Task 2-2: Re-Soil Upper Pit Slope, Upper Quarry Benches &amp; Slope Between Elev. 82 &amp; Elev. 112</b>		
Production	The front-end loader production of 360 cy per hour to transport soil is overly optimistic.	Reduce output to standard level (e.g., per RSMMeans data). Adjust FACE accordingly.
	The bulldozer spreading of soil at 1,600 cy per hour is overly optimistic.	Reduce output to standard level (e.g., per RSMMeans data). Adjust FACE accordingly.
	The haul truck's production at 180 cy per hour is overly optimistic.	Reduce output to standard level (e.g., per RSMMeans data). Adjust FACE accordingly.
Equipment	Caltrans cost per hour for a medium wheel dozer is \$194.68.	Increase stated \$124.37 cost per hour of bulldozer to Caltrans rate. Confirm size of dozer in FACE.
	Caltrans cost per hour for a 7.5 cy Loader is \$176.12, while a 15 cy Loader is \$261.91 up to \$427.34.	Increase stated \$138.37 cost per hour for loader to Caltrans rate. Confirm size of loader in FACE.
Missing scope - work required but not shown in FACE.	Metal pipe to manage run off.	Add labor and material for 330' of 12" corrugated pipe.
	Foreman	Add a foreman to the labor cost estimate.
	SWPPP	Add cost to implement Storm Water Pollution Prevention Plan.
	Subcontractor's mark up.	Add Subcontractor General Conditions, OH&P, insurance, bonds, etc.
<b>Task 2-3: Remove Paving &amp; Transport Pit</b>		
Grand Total Cost	The proposed total cost of \$13,213 is inadequate to demolish 203,500 sf of 6" Asphalt. This calculates to a unit cost of \$0.06 per sf. RFMeans, for example, quotes \$1.00 per sf.	Increase equipment and labor costs using standard references per FACE Guidelines; include overhead, etc. See comments above for equipment rates and production output.
<b>Task 2-4: Re-Grade &amp; Re-Soil Quarry Floor &amp; Add Drainage</b>		
Production	The production of 4,000 cy/hour for a scraper is excessive	Reduce output to standard level (e.g., per RSMMeans data). Adjust FACE accordingly.

	The front-end loader production of 360 cy per hour for loading is excessive.	Reduce output to standard level (e.g., per RSMeans data). Adjust FACE accordingly.
	The grading by bulldozer at 1,600 cy & 2,400 cy per hour is excessive; production would be substantially less.	Reduce output to standard level (e.g., per RSMeans data). Adjust FACE accordingly.
	The haul truck's production at 120 cy per hour is excessive.	Reduce output to standard level (e.g., per RSMeans data). Adjust FACE accordingly.
	The compacting at 2,200 cy per hour is excessive; production would be substantially less.	Reduce output to standard level (e.g., per RSMeans data). Adjust FACE accordingly.
	Ditch excavation. Unknown if the ditch is excavated in rock or soil. Also, depth is unknown.	Confirm excavation material and size of trench.
	Water truck. The water truck will be required for the duration of cut and fill operations.	Increase water truck time period at a minimum to match cut and fill duration. Add water charges.
Equipment	Caltrans cost per hour for a medium wheel dozer is \$194.68.	Increase stated \$124.37 cost per hour of bulldozer to Caltrans rate. Confirm size of dozer in FACE.
	Caltrans cost per hour for a 7.5 cy Loader is \$176.12, while a 15cy Loader is \$261.91 up to \$427.34.	Increase stated \$138.37 cost per hour for loader to Caltrans rate. Confirm size of loader in FACE.
	Backhoe. Caltrans cost per hour for a 420E Backhoe is \$42.05.	Increase stated \$20.92 cost per hour for backhoe to Caltrans rate.
	Scraper. Caltrans rate for a 624 scraper is \$190.18 per hour.	Increase stated \$141.99 cost per hour for scraper to Caltrans rate. State scraper type.
Missing scope - work required but not shown in FACE.	Installation of storm piping and catch basins	Add specifications/quantities and installation costs.
	Foreman	Add a foreman to the labor cost estimate.
	Surveying	Add cost for stacking, surveying, etc.
	Subcontractor's mark up.	Add Subcontractor General Conditions, OH&P, insurance, bonds, etc.

<b>Task 2-5: Re-Grade &amp; Re-Soil Part of South Hill</b>		
Grand Total Cost	The proposed total cost of \$3,168 calculates to a unit cost of \$1.81 per cy.	Increase equipment cost using standard references per FACE Guidelines; include overhead, etc. See comments above for equipment rates and production output.
<b>Task 2-6: Construct Channel &amp; Jetties</b>		
Overall	The stated cost of \$2.59/cy to blast, remove, transport, build a jetty and a cofferdam is inadequate.	Increase stated \$2.59 cost to a standard amount (e.g., per RSMeans data). Adjust FACE accordingly.
Production	The front-end loader production of 720 cy per hour for loading is excessive.	Reduce output to standard level (e.g., per RSMeans data). Adjust FACE accordingly.
	The quantity of rock to be loaded (69,950 cy) does not match the 78,190 cy called out in the quantity section. In addition, 8,148 cy of soil should also be included.	Change production to match quantity takeoff.
	The excavation by bulldozer at 900 cy per hour is excessive; production would be substantially less.	Reduce output to standard level (e.g., per RSMeans data). Adjust FACE accordingly.
	The haul truck's production at 170 cy and 120 cy per hour is excessive.	Reduce output to standard level (e.g., per RSMeans data). Adjust FACE accordingly.
	The hauling of soil (8,148 cy) and jetties (8,250 cy) is not included.	Add soil and jetty hauling
	Crane with dragline bucket is listed. Question whether a dragline could remove the rock in a cofferdam. If possible, the 120 cy per hour is excessive.	Reduce output to standard level (e.g., per RSMeans data). Confirm proper choice of equipment. Adjust FACE accordingly.
	The hauling of the cofferdam rock has not been included.	Add cofferdam hauling.
	Water truck - The water truck will be required for the duration of operations.	Increase water truck time period to match work duration. Add water charges.
Equipment	Caltrans cost per hour for a medium wheel dozer is \$194.68.	Increase stated \$124.37 cost per hour of bulldozer to Caltrans rate. Confirm size of dozer in FACE.

	Caltrans cost per hour for a 7.5 cy Loader is \$176.12, while a 15 cy Loader is \$261.91 up to \$427.34.	Increase stated \$138.37 cost per hour for Loader to Caltrans rate. Confirm size of loader in FACE.
Material	Drill and blast subcontractor cost is inadequate.	Increase cost to a standard amount (e.g., per RSMeans data). Adjust FACE accordingly.
Missing scope - work required but not shown in FACE.	Hauling and dumping of cofferdam not included.	Add costs.
	Hauling and dumping of top 2 ft of soil not included.	Add costs.
	Foreman	Add a foreman to the labor cost estimate.
	Surveying	Add cost for stacking, surveying, etc.
	SWPPP	Add cost to design and implement Storm Water Pollution Prevention Plan.
	Subcontractor's mark up.	Add Subcontractor General Conditions, OH&P, insurance, bonds, etc.
<b>Task 2-7: Provide Basin Circulation</b>		
<b>Overall</b>	Per 9/29/2011 letter from Dutra Materials, preliminary cost estimate is revised to \$1.1 million with \$100K annual maint. cost.	Update FACE when more specific cost estimates are available (engineering & economic report).
<b>SECTION 3: REVEGETATION</b>		
<b>Task 3-1: Remove and Control Exotic Plants</b>		
	Level/degree of vegetative clearing is not called out.	Specify degree of clearing (medium, heavy, light - trees, brush, grass, etc.) and adjust FACE accordingly.
	Transportation of plants and dump fees are not included.	Add costs.
<b>Task 3-3: Hydroseed for Erosion Control</b>		
	Grand Total Cost appears to be appropriate.	None
<b>Task 3-4: Plant Woody Materials</b>		
Description	The quantity of 12 plants per acre does not conform to specifications in CARP10 (e.g., page 17).	Increase quantities to match plan.
Materials	The plants should be priced by type and size; an average of \$4.80 per plant is low.	Show plant type cost.

<b>Cost Summary (Table 18)</b>		
	The mathematical extensions under "MANAGEMENT" should be compounded.	Calculate the Supervision, Profit and Overhead on the base value that includes the Mobilization and Contingency, not merely the Task Subtotal. <sup>1</sup>
<b>Additional Items in CARP10 that do not appear to be in the FACE. (Reviewer's notes)<sup>2</sup></b>		
	<ul style="list-style-type: none"> <li>• Permits</li> <li>• Relocation of boarding house</li> <li>• Demolition of farmhouse and barn at grassy knoll</li> <li>• Work at McNear Brickyard</li> <li>• Diesel tank</li> <li>• Weigh station</li> <li>• Revegetation test plots</li> </ul>	Add costs for identified missing items. A more thorough review would be required to determine if other missing items are present.

<sup>1</sup> Note that the example cost estimation forms provided in the *Financial Assurance Guidelines* do not require this approach; however, it is our professional opinion that this is not consistent with standard construction cost bidding practice and, should third party construction bids ever have to be solicited by the County to implement the reclamation plan, those bids would most likely use the approach recommended here.

<sup>2</sup> These are items noted during the course of plan review and one field visit, and may not be complete.

## GEOTECHNICAL AND GEOLOGIC REVIEW

As mentioned previously, a detailed geotechnical engineering and engineering geologic review of the reclamation plan and supporting geotechnical studies is included in the appendix to this report. This section provides a summary of key findings and recommendations contained in that report.

### Summary of Findings

Based on the results of our review, we judge that the ENGEO reports characterize the geology of the quarry in a satisfactory manner, and that suitably conservative assumptions have been used to analyze the stability of the pit walls. However, we have identified the following geotechnical/geologic and other issues/concerns:

1. Excavated side slopes for the proposed channel connection to the bay will extend through undocumented fills, deep deposits of weak Bay Mud, and possibly loose beach sand deposits. Portions of these deposits may be subject to seismic lurching and/or liquefaction-induced lateral spreading. It will be necessary to evaluate the static and seismic stability of the proposed channel slopes to determine stable bank inclinations and to evaluate whether additional stabilization measures will be required to mitigate the risk of slope failure.
2. During the time that has elapsed since 2005, mining at South Hill has advanced and is now near or at completion. While these rock slopes appear stable, analyses have not yet been performed to verify stability. The long-term stability of these cuts is important because they will support second use improvements. It is therefore recommended that an engineering geologic evaluation be performed in the near-term to determine if these slopes require a stability analysis similar to that performed for the pit walls. If stability analyses are deemed necessary, they should be performed in the near term and incorporated into the second use (post mining) design phase. The stability report should contain whatever measures are necessary to adequately improve stability.
3. The top of the northwest and north pit walls are occupied by thick layers of overburden and stockpiles of asphaltic concrete overlying weathered to highly weathered weak rock (sandstone and shale/siltstone). All or most of these materials will eventually be removed as part of future reclamation or recycling (asphaltic concrete) activities. However, in their present location they appear to present an ongoing potential for slope failure into the quarry pit. This concern is highlighted by a large failure that recently occurred in these materials, and which resulted in pit closure by MSHA until the hazardous slope condition was corrected. It is recommended that an engineering geologic/geotechnical engineering surface evaluation be immediately performed of the overburden and stockpiles to better characterize the risk presented by these materials, and to develop recommendations as to where, to what degree, and how soon these materials should be laid back or benched to decrease the risk of future failure.
4. CARP10 describes and depicts several reclamation-grading tasks that will result in permanent, second use earthworks (see Sheets G-1 through G-4). These substantial earthworks, constructed of disturbed, heterogeneous undocumented fill materials (pond fines and overburden stockpiles) and underlying, uncharacterized natural soils and bedrock, will support the extensive post-mining residential/commercial improvements and their infrastructure. CARP10 indicates that geotechnical design work will be done and results submitted with each phase of the reclamation/grading plan. However, CARP 10 does not contain or make reference to any existing preliminary geotechnical investigative work performed to date and specifically undertaken to characterize these materials, to confirm the technical and economic approach of the proposed grading and development plan, and to provide initial design recommendations. There could be significant risk associated with committing to

major development grading without a preliminary geotechnical investigation because geotechnical conditions might be discovered later that could require major components of the second use grading plan to be modified, or that costs are far higher than expected due to the extent and/or characteristics of the fill materials. We therefore recommend that a preliminary geotechnical investigation be undertaken to characterize the above-described materials, to confirm the technical and economic approach of the shown second use reclamation/grading, and to provide preliminary design recommendations.

5. CARP10 notes finished slope inclinations of 2:1 (horizontal:vertical) or flatter, and 2:1 slope inclinations are depicted on the grading plans. The feasibility of finished 2:1 slopes will be dependent upon the strength characteristics of the pond fine/overburden mixture. Waiting until shortly before grading operations are to begin to develop design-level geotechnical information presents significant risk in the event that laboratory testing indicates that the proposed slope inclinations will not be adequately stable under static and/or seismic loading. A preliminary geotechnical investigation should therefore be undertaken to characterize the strength characteristics of the proposed pond fine/overburden mixture, and to verify the static and seismic stability of the proposed fill slopes.
6. The overburden contains substantial amounts of oversized material, which may make it unsuitable for reuse as engineered fill. The preliminary geotechnical investigation outlined above should address the suitability of the overburden material for use as fill, and provide criteria regarding acceptable gradations of the material. Provisions for dealing with any unsuitable portions of the overburden material should be addressed.
7. A surcharge fill up to 15 feet high will be placed over the soft Bay Mud within McNear Brick Yard as part of the Phase 2 grading. It will be necessary to place this fill in a controlled and scheduled manner in order to avoid overstressing and potentially failing the underlying soft Bay Mud. Depending upon the thickness, strength, and drainage characteristics of the Bay Mud, this may require placing the fill in incremental stages to allow the underlying Bay Mud to consolidate and gain necessary strength. A geotechnical engineer should evaluate the feasibility of the proposed surcharge placement depicted in CARP10, and determine whether staged placement of the surcharge will be required. Prior to placement of the surcharge, the geotechnical engineer should perform appropriate investigation and laboratory testing of the proposed surcharge area, and provide recommendations for staged fill placement and corresponding monitoring.
8. Piezometer installations were completed in 2006, and we have only been provided with readings from that year. We have not received monitoring results or interpretations for intervening years or an evaluation of the impact of the monitoring results on rock slope stability. The County should request that any monitoring data obtained subsequent to the 2006 readings be provided for review and comment and require its submittal from SRRQ on a quarterly basis.

Additional review comments and suggested modifications regarding future investigations, monitoring, and submittal requirements outlined in the project geotechnical reports and Conditions of Approval are presented in the full *Geotechnical and Geologic Review* report in the appendix to this report.

# APPENDIX

## **Geotechnical and Geologic Review**

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**HERZOG**  
**GEOTECHNICAL**  
**CONSULTING ENGINEERS**

February 1, 2012  
Project Number 2609-01-11

Zitney & Associates  
Attention: Greg Zitney  
7 Villa Vista Court  
Novato, California 94947

RE: Geotechnical and Geologic Review  
Conforming Amended Reclamation Plan  
San Rafael Rock Quarry  
San Rafael, California

Dear Mr. Zitney:

This report contains the results of our geotechnical engineering and engineering geologic review of the Conforming Amended Reclamation Plan and supporting geotechnical documentation in connection with the San Rafael Rock Quarry (SRRQ) at 1000 Point San Pedro Road, San Rafael, California. Our services have been provided according to the provisions of our subcontracts with Zitney & Associates dated February 16, 2011. The County of Marin, Department of Public Works retained Zitney and Associates to perform peer review and advisory services as outlined in the Request for Proposal (RFP) dated November 5, 2010.

The purpose of our review was to evaluate compliance with SRRQ's Surface Mining and Quarry Permit and its applicable conditions, and to review geotechnical data submitted to date by SRRQ. Our purpose also included evaluation for compliance with the State of California's Surface Mining and Reclamation Act and related regulatory requirements, to evaluate submittal completeness, to note any obvious factual errors, to check consistency of data with conclusions and standards of geotechnical engineering and engineering geologic practices, and to identify areas where the proposed geotechnical design could lead to future significant problems. Our primary objective is to serve the public and the public agency, and to preserve public safety. Our intention was not to directly participate in the design process, nor to undertake exhaustive and time-consuming duplication of the work reviewed.

## **SERVICES PERFORMED**

We reviewed the following documents pertaining to present mining, future reclamation, and second use development.

- CSW/Stuber-Stroeh Engineering Group, March 11, 2011, *San Rafael Rock Quarry, Conforming Amended Reclamation Plan 2010*, Prepared for San Rafael Rock Quarry, Inc.
- Department of Conservation, Office of Mine Reclamation, February 17, 2005, Letter and Attachment to Eric Steger, County of Marin.

- ENGEO, Inc., September 9, 2004, *Evaluation of Quarry Slope Stability and Preliminary Geotechnical Reconnaissance, San Rafael Rock Quarry, Marin County, California*, Submitted to Dutra Materials, San Rafael, California. Project No. 6261.1.001.02.
- ENGEO, Inc., April 11, 2005, *Supplemental Geotechnical Data Report, Proposed Changes to Mining Plan, San Rafael Rock Quarry, Marin County California, Volumes 1 and 2*, Submitted to Dutra Materials, San Rafael, California. Project No. 6261.1.003.01.
- ENGEO, Inc., November 23, 2010, *Letter Report, Review of Proposed Quarry Access Ramp* (Submitted to Mr. Josh Kirtley, Dutra Materials).
- ENGEO, Inc., November 29, 2010, *Pond Fines, COA #21C - Permit #Q-72-03 Amendment #1, San Rafael Rock Quarry, San Rafael, California*, Submitted to Dutra Materials, San Rafael, California. Project No. 6261.200.000.
- ENGEO, Inc., June 14, 2011, *Evaluation of Proposed Quarry North Pit Wall Modification* (Submitted to Mr. Josh Kirtley, Dutra Materials).
- ESA, January 2009, *San Rafael Rock Quarry, Amended Reclamation Plan and Amended Surface Mining and Quarrying Permit*, Prepared for Marin County Community Development Agency, Volumes 1-3.
- Marin County Surface Mining and Quarrying Permit, undated, EXHIBIT 2, Permit # Q-72-03, Amendment #1, Conditions of Approval, Including Amended Reclamation Plan, San Rafael Rock Quarry (CA Mine #91-21-0008).
- Moffatt & Nichol, October 1, 2004, *Letter Report, Harbor Feasibility at San Rafael rock Quarry, San Rafael rock Quarry Amended Reclamation Plan, 2004, M&N No.5487* (Submitted to Mr. Al Cornwell, CSW/Stuber-Stroeh Engineering Group, Inc.)
- Revey Associates, Inc., January 2007, *Assessment of Rock Blasting Practices and Impacts for Proposed Amendments to the Mining Permit at the San Rafael Rock quarry, Marin County, California- Contained in: San Rafael Rock Quarry Amended Reclamation Plan and Amended Surface Mining and Quarry Permit, Combined Final Environmental Impact Report (FEIR) - Volume 3: Appendices*. Prepared by ESA, January 2009.
- Seidelman Associates, Lafayette, California, February 20, 2007, *Geologic Issues Associated with the Enlargement and Eventual Reclamation of the San Rafael Rock Quarry, Point San Pedro, California - Contained in: San Rafael Rock Quarry Amended Reclamation Plan and Amended Surface Mining and Quarry Permit. Combined Final Environmental Impact Report (FEIR) - Volume 3: Appendices*. Prepared by ESA, January 2009.
- Wyllie & Norrish, Rock Engineers, December 30, 2006, *Data Report, Rock Coring and Piezometer Installations, San Rafael Rock Quarry*, Prepared for Dutra Materials, Marin County, California.
- Wyllie & Norrish, Rock Engineers, October 4, 2004, *Letter Report, Updated Mining Plan, San Rafael Rock Quarry, San Rafael, California*, Submitted to Mr. Brian Peer, Dutra Materials.

Four visits were made to SRRQ to visually confirm aspects of the information contained in the review documents. During the visits, verbal information on the mining operation and reclamation

was obtained from SRRQ personnel. Consultations were periodically held with the review team to clarify and deliberate issues and to request additional information from the County to assist in the review process. As requested by the County, confirmatory site visits were not made following submittal to us on September 22, 2011 of the ENGEO report dated June 14, 2011. Following completion of the described services, this report was prepared, which contains our review comments and recommendations.

## **SITE CHARACTERIZATION**

A principal task of geologic review is to provide a professional opinion on the adequacy of the engineering geologic characterization of the site, as developed by the applicant, and to describe detectible errors or omissions in the characterization, or in the conclusions and recommendations drawn from it. To objectively develop this opinion, a definition of engineering geologic site characterization is required. The following definition of Tepel (The Engineering Geology Site Characterization as the Core Function of Engineering Geology Practice, 2004) is utilized herein: *“Engineering Geology Site Characterization is a geologic investigative and evaluative process that produces substantiated and scientifically valid geologic and related data upon which the geologist bases conclusions, recommendations, and expert opinion, either general or project-specific, regarding the geologic conditions and processes that effect the design, construction, or utilization of a project (fixed work) or the utilization of a site or region, taking into account both natural and human-induced conditions in the geologic environment.”* Such characterization typically involves a number of investigative tasks, which include: literature research, assessment of the regional geology and seismicity within which the site is located, general field mapping or study (including aerial photo interpretation) of the area peripheral to the site, and more detailed site-specific investigation, whose scope is controlled by the type of project, it's geology/seismicity, and it's potential to impact the health, safety, and welfare of humankind and property.

Geotechnical engineering is the evaluation of earth materials including soil, rock, groundwater and man-made materials and their interaction with earth retention systems, structural foundations and other civil engineering works. This practice involves the utilization of the geologic site characterization to develop recommendations for slopes, grading, drainage, and other civil engineering improvements. The objective of the geotechnical review is to evaluate the design assumptions and analysis methodology in order to determine conformance with applicable standards of geotechnical engineering geologic practice.

## **GEOTECHNICAL & GEOLOGIC REVIEW COMMENTS**

This section contains comments and recommendations for reports reviewed. Of these reports, the geotechnical report by ENGEO (2005), the Conforming Amended Reclamation Plan (CSW/ Stuber-Stroeh Engineering Group, Inc., 2011), and the Marin County Surface Mining and Quarry Permit #Q -72-03 contain the most important information for review and comment. Other contributing geotechnical reports include the SRRQ EIR (ESA, 2009), Seidelman Associates (2007), and reports by Wyllie & Norrish (2004, 2006). Other reports reviewed provided supporting and clarifying information.

**ENGEO, Inc., April 11, 2005, Supplemental Geotechnical Data Report, Proposed Changes to Mining Plan, San Rafael Rock Quarry, Marin County California, Volumes 1 and 2.**

**ENGEO, Inc., June 14, 2011, Evaluation of Proposed Quarry North Pit Wall Modification (Submitted to Mr. Josh Kirtley, Dutra Materials).**

The 2005 report contains much of the basis for geologic characterization of the SRRQ. It is very similar to and contains much the same geologic and geotechnical information as the 2004 ENGEO, Inc. report. However, the 2005 report contains supplemental information requested by the Office of Mine Reclamation (February 17, 2005) and by the County of Marin. The principal purpose of this additional information was to evaluate the stability of a pit configuration that was somewhat modified just prior to submittal of 2004 report, and to further explore the conclusions of the 2004 report. The 2011 report is much briefer and focuses on evaluating the potential for planar rock failures on the north pit walls. We focused on the 2005 and 2011 reports for review purposes.

ENGEO's geologic characterization is based on literature review, review of previous geotechnical reports, aerial photo interpretation, description of regional geology/seismicity, site and pit wall geologic mapping, groundwater assessment, additional subsurface exploration, and the acquisition of representative intact rock strength parameters. The reports included the development of rock mass characteristics, stability evaluations, and recommendations for further work as mining progresses and is completed.

### **Engineering Geologic Characterization of Quarry**

**Comment 1.0:** We judge that the ENGEO reports characterize the geology of the quarry in a satisfactory manner, and that suitably conservative assumptions have been used to calculate the factors of safety (FOS) for the pit walls. However, additional slope stability evaluation is warranted. The necessity for some of this evaluation is due to rock slopes that have been developed by quarrying since submittal of 2005 report.

**Recommendations:** We recommend that additional slope stability evaluations be made as specified in the following subsection on Slope Stability.

The numerous recommendations in the 2005 ENGEO report should be implemented. However, the recommendations require more detail regarding scope and scheduling. This is discussed in the subsection titled Ongoing and Future Inspections and Investigations and in Comment 12.0. Recommendations in the 2011 report are those also contained in the 2005 report.

### **Slope Stability**

**Comment 2.0:** Geologic observations made during our brief reconnaissance of the current pit walls generally support the geologic mapping, geologic description, and rock mass discontinuity

data accumulated for stability assessment by ENGEO in the 2004 and 2005 reports. Our observations of the pit did not reveal obvious signs of incipient, massive rock failure of large segments of the pit walls (many thousands of cubic yards), referred to by ENGEO as “global” stability. However, at the time of the reconnaissance, we noted some potential for localized planar failures within the northeast mine quadrant and nearby parts of the southeast quadrant. These locations are characterized by uniform areas of relatively flat, joint-bounded sections of rock whose inclinations are parallel or sub-parallel to the pit walls. Following our initial review, we received the 2011 report. This report focuses on evaluation of the potential for “global” planar failures. The report concludes that the jointed rock evaluated will not adversely impact the global stability of the pit face. The accompanying stability analyses support that conclusion. Neither the 2005 or 2011 reports discuss the potential for topples, another mode of rock failure in addition to wedge and planar failures. Overall, our review and observations indicate that, during the remaining planned life of mining (2024), a nominal number of moderate size (a few tens of cubic yards to possibly several hundred cubic yards) wedge and/or planar rock failures should be anticipated. Based on our review of the ENGEO work, these should be inter-bench failures, not multi-bench (global) failures. The actual number and volume of future failures will be dependent upon mining methods employed and rock conditions encountered as mining progresses. The number and volume of failures stated above should not be considered highly unusual for a moderate-sized or smaller open pit mine with such rock conditions. The better blasting practices reportedly now employed (ENGEO, 2005, page 30) should reduce the number or size of failures.

**Recommendations:** The recommendations pertaining to inspections, observations, and future investigations of the pit outlined on pages 77 through 80 of the 2005 ENGEO report should be implemented as required in the Permit.

**Comment 3.0:** Excavated side slopes for the proposed channel connection to the bay will extend through undocumented fills, deep deposits of weak Bay Mud, and possibly loose beach sand deposits. Portions of these deposits may be subject to seismic lurching and/or liquefaction-induced lateral spreading. It will be necessary to evaluate the static and seismic stability of the proposed channel slopes to determine stable bank inclinations and to evaluate whether additional stabilization measures will be required to mitigate the risk of slope failure.

**Recommendations:** Static and seismic stability analyses of the proposed channel slopes should be performed. If the slopes are found to not be sufficiently stable as determined by the geotechnical engineer, a remedial plan should be developed to increase the stability to acceptable long-term levels. The stability analysis and any remedial plan developed should be subject to review and approval by the County.

**Comment 4.0:** As mentioned above, neither the ENGEO 2005 nor 2011 reports provide a discussion of the potential for rock topples. If ENGEO found this potential to be low, some discussion of this should be provided.

**Recommendations:** Evaluation of the potential for rock toppling should be provided by ENGEO and the results submitted to the County for review and comment.

**Comment 5.0:** During the time that has elapsed since 2005, mining at South Hill has advanced and is now near or at completion. While these rock slopes appear stable, analyses have not yet

been performed to verify stability. The long-term stability of these cuts is important because they will support second use improvements.

**Recommendations:** We recommend that an engineering geologic evaluation be performed to determine if these slopes require a stability analysis similar to that performed for the pit walls. This evaluation should be undertaken in the near term. If stability analyses are deemed necessary, they should be performed in the near term and incorporated into the second use (post mining) design phase. The stability report should contain whatever measures are necessary to adequately improve stability. The report should be submitted for review by the County.

**Comment 6.0:** The top of the northwest and north pit walls are occupied by thick layers of overburden and stockpiles of asphaltic concrete overlying weathered to highly weathered weak rock (sandstone and shale/siltstone). We understand all or most of these materials will eventually be removed as part of future reclamation. However, in their present location they appear to present an ongoing potential for slope failure into the quarry pit. This concern is highlighted by a large failure that recently occurred in these materials, and which resulted in pit closure by MSHA until the hazardous slope condition was corrected.

**Recommendations:** We recommend that an engineering geologic/geotechnical engineering surface evaluation be immediately performed of the overburden and stockpiles to better characterize the risk presented by these materials, and to develop recommendations as to where, to what degree, and how soon these materials should be laid back or benched to decrease the risk of future failure. The report should be submitted to the County for review and approval.

### **Ongoing and Future Inspections and Investigations**

**Comment 7.0:** Pages 77 through 80 of the 2005 ENGEO report contain recommendations for ongoing and future inspections, observations, and investigations. These recommendations also appear as conditions of approval in the SRRQ permit (# Q-72-03) on which we provide comment below. We concur with these recommendations. However, a number of them require more detail regarding scheduling and scope.

**Recommendations:** The numerous above-described recommendations should be better organized so their purpose, method, scope, and timing are more clearly defined, and a procedure is in place for the County to track and review the results and provide comment. More detail is provided on method of organization later in this report (see Comment 12.0).

**CSW/Stuber-Stroeh Engineering Group, November 29, 2010 (resubmitted March 11, 2011), Conforming Amended Reclamation Plan 2010 (CARP 10)**

**Comment 8.0:** CARP10 describes and depicts several reclamation-grading tasks that will result in permanent, second use earthworks (see Sheet G-1 through G-4). These substantial earthworks, constructed of disturbed, heterogeneous undocumented fill materials (pond fines and overburden stockpiles), and underlying, uncharacterized natural soils and bedrock, will support the extensive post-mining residential/commercial improvements and their infrastructure. CARP10 indicates that

geotechnical design work will be done and results submitted with each phase of the reclamation/grading plan. However, CARP 10 does not contain or make reference to any existing preliminary geotechnical investigative work to date specifically undertaken to characterize these materials, to confirm the technical and economic approach of the proposed grading and development plan, and to provide initial design recommendations. There could be significant risk associated with committing to major development grading without a preliminary geotechnical investigation because geotechnical conditions might be discovered later that could require major components of the second use grading plan to be modified, or that costs are far higher than expected due to the extent and/or characteristics of the fill materials.

**Recommendations:** A preliminary geotechnical investigation should be undertaken to characterize the above-described materials, to confirm the technical and economic approach of the shown second use reclamation/grading, and to provide preliminary design recommendations. The amount of subsurface exploration and testing should reflect the heterogeneous nature and complexity of the stockpiled overburden and pond spoils, and the variability of the underlying surficial and bedrock geology. This preliminary geotechnical investigation should be completed prior to submittal/approval of Phase 1 grading plans in order to confirm the feasibility of all phases of grading anticipated in CARP10. This recommended investigation is in keeping with the intent of SMARA Regulations (CCR § 3502(b)(3) and (4), CCR§ 3704(a), and CCR § 3704.1(d)).

**Comment 8.1:** Item 5 on page 3 notes finished slope inclinations of 2:1 (horizontal:vertical) or flatter, and 2:1 slope inclinations are depicted on the grading plans. The feasibility of 2:1 slopes will be dependent upon the strength characteristics of the pond fines/overburden mixture. CSW/Stuber-Stroeh Engineering Group has indicated that the originally proposed 4:1 ratio of pond fines to overburden has been revised to a 2:1 ratio because the fines were determined to be dryer than originally expected. The feasibility of finished 2:1 slopes will be dependent upon the strength characteristics of the pond fine/overburden mixture. Waiting until shortly before grading operations are to begin to develop design-level geotechnical information presents significant risk in the event that laboratory testing indicates that the proposed slope geometries will not be adequately stable under static and/or seismic loading.

**Recommendations:** A preliminary geotechnical investigation should be undertaken to characterize the strength characteristics of the proposed pond fine/overburden mixture, and to verify the static and seismic stability of the proposed fill slopes. The amount of subsurface exploration and testing should reflect the heterogeneous nature and complexity of the stockpiled overburden and pond spoils. This investigation should be combined with the preliminary geotechnical design investigation recommended under Comment 8.0.

**Comment 8.2:** The overburden contains substantial amounts of oversize material, which may make it unsuitable for reuse as engineered fill.

**Recommendations:** The preliminary geotechnical investigation outlined in Comments 8.0 and 8.1 should address the suitability of the overburden material for use as fill, and provide criteria regarding acceptable gradations of the material. Provisions for dealing with any unsuitable portions of the overburden material should be addressed.

**Comment 8.3:** A surcharge fill up to 15 feet high will be placed over the soft Bay Mud within McNear Brick Yard as part of the Phase 2 grading. It will be necessary to place this fill in a controlled and scheduled manner in order to avoid overstressing and potentially failing the underlying soft Bay Mud. Depending upon the thickness, strength, and drainage characteristics of the Bay Mud, this may require placing the fill in incremental stages to allow the underlying Bay Mud to consolidate and gain necessary strength.

**Recommendations:** A geotechnical engineer should evaluate the feasibility of the proposed surcharge placement depicted in CARP10, and determine whether staged placement of the surcharge will be required. Prior to placement of the surcharge, the geotechnical engineer should perform appropriate investigation and laboratory testing of the proposed surcharge area, and provide recommendations for staged fill placement. Recommendations should also be provided for settlement and piezometer monitoring to evaluate consolidation rates and surcharge stability, and to verify the effectiveness of the surcharge in mitigating future settlements. This investigative work could be combined with the preliminary geotechnical design investigation recommended under Comment 8.0.

**Comment 8.4:** Sheet G-3 notes the pit elevation as -250 MSL instead of -350 MSL.

**Recommendations:** The pit elevation on Sheet G-3 should be corrected.

**Marin County Surface Mining and Quarrying Permit, Permit # Q-72-03, Amendment #1, Conditions of Approval, Including Amended Reclamation Plan, San Rafael Rock Quarry (CA Mine #91-0008)**

The Permit includes 173 Conditions of Approval. In the Permit there are several conditions that specify geotechnical performance. These are predominantly based on the recommendations found in the 2005 ENGEO report (pages 77 through 80) as commented on above. Comment is provided on these and other geotechnical conditions identified by us. For each condition commented on, the complete text has been provided followed by our comments and recommendations.

Condition #21, Grading Permit: For each phase of reclamation, Permittee shall submit an application for Excavation, Grading or Filling, with plans, to the Department of Public Works prior to each phase of reclamation and which will be subject to review and approval by the Director of Public Works.

**Comment 9.0:** We concur with the condition.

**Recommendations:** None

Condition #21c: The Permittee shall provide a geotechnical evaluation and report on the pond fine to soil mixing ratio needed to comply with the California Surface Mining and Reclamation Act (SMARA) reclamation performance standards. Further, the geotechnical evaluation shall also examine the most efficient method and location to reclaim the pond fines which further reduces potential impacts to the environment and minimizes the amount of material imported into the NE

Quadrant. The evaluation is subject to the Public Works Director's review and approval. The Permittee shall also fund an independent geotechnical review and site assessment (peer review) by the County on the submitted report.

**Comment 10.0:** We concur with this condition and note it is similar to our Comment 8.1. However, it appears this investigation has not yet been completed. CARP 10 states (timeline following page 50) that the Phase 1 Grading Plan is to commence preparation April 15, 2011 and review is to be made by the County on September 30, 2011. The information in the referenced geotechnical report is required for the grading plan. For this reason, the geotechnical evaluation and report described in Condition 21c should be undertaken as soon as possible.

**Recommendations:** Complete the geotechnical evaluation and report required by Condition #21c as soon as possible and combine with the report recommended in 8.0 and 8.1. The strength characteristics and the stability of proposed slopes containing pond fine/overburden mixtures should be evaluated as outlined in Comment 8.1 above. The geotechnical report should be submitted to the County for review and approval.

**Condition #26:** All final slopes on approved reclamation plan shall meet the following criteria, unless subsequent geotechnical analysis indicate modifications are required to maintain slope integrity:

- a. Within the quarry pit, the average (toe to top) slope inclination shall not exceed 60 degrees for a maximum vertical height of 350 feet, as depicted on Figure 15 of the ENGeo Supplemental Geotechnical Data Report, Proposed Changes to Mining Plan, San Rafael Rock Quarry, Marin County California, April 11, 2005 (ENGeo Supplemental Report).
- b. Minimum 30-foot-wide safety benches shall be constructed at a maximum of 90-foot vertical intervals.
- c. In general, the inclination of inter-bench faces should be maintained at less than 75 degrees where possible. The recommended safety bench spacing and width are depicted in ENGeo Supplemental Report Figure 15. Locally, inter-bench face inclinations will be influenced by splitting along pre-existing rock discontinuities, but overhanging faces should be avoided whenever possible.

**Comment 11.0:** Based on our review of the 2005 ENGeo report, we concur with these conditions.

**Recommendations:** None.

**Condition #114:** The Permittee shall include the recommendations made in the Supplemental Geotechnical Data Report Proposed Changes to Mining Plan by ENGeo, Incorporated dated April 11, 2005 as part of the quarry design and submittal of the Conforming Amended Reclamation Plan. These recommendations include conducting supplemental geotechnical pit observations, groundwater monitoring, and slope monitoring which shall be conducted by a California Certified Engineering Geologist or Registered Professional Geotechnical Engineer with oversight by the State Office of Mine Reclamation. In addition, the average slope inclination (toe top) shall not exceed 60 degrees for a maximum vertical height of 350 feet, a minimum of 30-

foot-wide benches shall be constructed at maximum 90-foot intervals, and inter-bench face inclinations shall not exceed 75 degrees. (Mitigation Measure R4.4-1 & R4.4-3b)

**Comment 12.0:** We concur with this condition. However, the numerous recommendations referred to in this condition should be organized and possibly consolidated to be uniform with regard to the details of scope, scheduling, and the degree to which the County wishes to be involved in the process of their implementation. The organization could take the form of a spreadsheet that provides the title of the recommendation, details on scope, scheduling, and the nature of the County's involvement to ensure the intent of the recommendations are met.

**Recommendations:** The various recommendations referred to in Condition 114 should be organized in the manner discussed above.

**Condition #115:** The quarry access ramp placement required to deepen the quarry shall be configured to minimize excavation at the south face and create a buttressing effect to the slopes at the south side of the quarry.

**Comment 13.0:** We concur with this condition. It is a recommendation in the 2005 ENGEO report (F. Slope Stability Mitigation Options for Mining, the last bulleted item on page 80, with details shown on Figure 14). Since the timing of needed geotechnical investigation for design of the ramp is not indicated, we assume the design and ramp construction are likely a function of the rate of mining, which, in turn, depends on market demands. However, this assumption should be confirmed.

**Recommendations:** The above assumption should be confirmed by SRRQ. We suggest that a rough approximation of when construction is to take place be made, so the County will know when to inquire about the timing of necessary design investigations.

**Condition #116:** Quarry pit design shall consider the potential effect of large-scale horizontal curvature of pit walls on slope stability. In general, convex-inward horizontal curves in quarry slopes should be avoided. Concave inward-sloped offer some degree of increased confinement by "arching" of the rock mass between discontinuities, and effectively decrease the area of free face available for kinematically possible failure geometries. Convex-inward slopes can actually contribute to potential instability, since lateral confinement is reduced and the area of the kinematically-available free face is effectively increased.

**Comment 14.0:** We concur with the condition, but note that it might be difficult to achieve this shape through blasting, considering the complexity of the bedrock discontinuities that characterize the rock mass.

**Recommendations:** None

**Condition #117:** Mine quarry highwalls and the South Hill cut slope shall be periodically observed, mapped, and evaluated by a qualified engineering geologist and/or geotechnical engineer to determine if there are any rock structures or conditions that adversely impact or otherwise contradict the assumptions of the slope stability analyses provided with the 2004 Amended Reclamation Plan. In addition, the observations during mining would be to identify

possible adverse rock structure as excavations proceed, so that the quarry operations can avoid undesirable slope failures in critical improvements such as access ramps or quarry brow improvements. At least annually, as part of the required SMARA mine inspection, the mine highwalls and South Hill cut slope shall be evaluated by a qualified engineering geologist and/or geotechnical engineer. If an adverse condition occurs, additional geotechnical studies shall be undertaken and slope modifications made to ensure stability of the final mine slopes. Copies of all evaluation reports shall be provided to the Department of Public Works as part of the Annual Report.

**Comment 15.0:** We concur with various provisions of this condition. As pointed out in our comments to Condition #114, more organization, scope, and timing detail are required to eliminate redundancies and to ensure that the intent of the recommendations are met. Inspections described in the condition should also be made following seismic events affecting the general area, following large storms, and/or following reported (SRRQ) slope performance problems stemming from blasting or ongoing mining.

The last part of this Condition discusses steps to be taken if adverse slope conditions are encountered. While this is appropriate, it should be noted that as mining approaches completion and quarry walls are near their final configuration (maximum allowable steepness), the option to correct slope stability problems by flattening slopes will no longer exist because the location of the top of slope will be fixed at the stipulated +10 MSL boundary. Under this scenario, only relatively expensive remedial stabilization options would be available.

**Recommendations:** Implement the recommendations for Condition #114. Include inspections following seismic events, large storms, and/or problems reported by SRRQ.

**Condition# 118:** Piezometers shall be installed within a year following approval of the Permit around the margins of the quarry pit to allow periodic monitoring of ground water elevations to demonstrate that the assumptions in the slope stability analysis about pore water pressures are valid. The actual configuration of the piezometer array should be determined based on the final proposed pit configuration and on proposed planning of quarry operations to allow optimum placement of instruments and to avoid conflicts with future operations. Ground water level monitoring shall be done at least quarterly. Copies of all monitoring data and reports shall be provided to the Department of Public Works at least annually.

**Comment 16.0:** We concur with this condition. The piezometer installations (see Comment 30.0) were completed in 2006, and we have only been provided with readings from that year. We have not received monitoring results or interpretations for intervening years or an evaluation of the impact of the monitoring results on rock slope stability.

**Recommendations:** See recommendations under Comment 30.0.

**Condition #119:** A network of survey monitoring points shall be established around the quarry pit and on benches to allow for measurement of any movement in the highwalls. These monitoring points shall be surveyed initially at a monthly interval. The Quarry geotechnical engineer shall periodically evaluate whether additional survey points are necessary, and determine if more or less frequent survey monitoring is needed (reference page 77, ENGEO Supplemental Report).

Results of this survey monitoring shall be reported to the Department of Public Works as part of the Annual Report.

**Comment 17.0:** We concur with this condition. We have not seen any plans or survey monitoring results with respect to this condition.

**Recommendations:** The monitoring plan should immediately be prepared and submitted for review and comment. Following installation, base line readings should then be taken and reported to the County as soon as possible. The report should include any initial indications on slope performance.

**Condition #120:** The south face quarry access ramp shall be constructed to provide for a buttressing effect on the Wedge 1 failure area and any similarly unstable areas. Additional remedial grading and placement of engineered fill materials may be necessary to provide this buttressing effect. Any fill placed for structural support shall be designed, inspected, and tested by a qualified geotechnical or soils engineer. An engineer's report on placement and compaction of any engineered soils shall be provided to the Department of Public Works for review.

**Comment 18.0:** We concur with this condition. It is similar to Condition #115, except it provides additional requirements for geotechnical design, construction testing, and reporting to the County.

**Recommendations:** Same as for Condition #115.

**Condition #121:** The periodic geotechnical inspections recommended above shall include evaluation of mining faces for potentially unstable blocks. Localized face failures are an expected part of surface mining, and the location and potential size of unstable blocks can be evaluated during periodic inspections as mining proceeds. If it appears that a critical facility such as the access ramp could be threatened by a potential block failure, the geotechnical engineer shall recommend appropriate correction action such as the installation of rock bolts, or local modification of mining excavations to increase stability.

**Comment 19.0:** We concur with this condition. However, this condition is similar to those of Conditions #114 and #117 and should be organized and consolidated as recommended in Comment 12.0.

**Recommendations:** Implement the same recommendation presented for Condition 114.

**Condition #122:** The large-scale stability of the quarry walls shall be periodically evaluated by the geotechnical engineer based on the results of monitoring of slope performance, groundwater levels, and geotechnical inspection of mining exposures. If unacceptable slope performance is detected, it will be possible to implement several possible mitigation measures as described below. The actual recommended mitigation measures shall be based on site-specific evaluations:

- a. Mitigation measures shall be employed if adverse groundwater conditions are encountered (unacceptably high pore pressures or excessive seepage, etc.) Mitigation measures could include horizontal drains, extraction wells, slurry walls, etc.

- b. If unacceptable levels of mining-concurrent slope deformation are encountered, mining activities shall be modified to improve stability. At the quarry brow, stockpiles of products, quarry waste piles or areas of overburden can be excavated and moved to reduce driving forces. In the pit, bench configurations can be modified by “stepping out” or increasing bench width, effectively flattening the mining slope angle.

**Comment 20.0:** While we concur with this condition, our comments are similar to those for Conditions #114, #117, and #121. The mitigations in #122(a) are not feasible for rock that is to be later mined because the mining process physically destroys the mitigation measures installed. Therefore, #122(a) is only feasible for areas that will not be further mined. For #122(b), we recommend evaluation and possible laying back of non-fresh rock materials present along the north brow of the pit (see Comment 5.0). Also, as noted earlier in this report, as mining approaches completion and quarry walls are near their final configuration (maximum allowable steepness), the option to correct slope stability problems by flattening slopes will no longer exist.

**Recommendations:** Implement the same recommendation presented for Condition #114.

**Condition #123:** At the south quarry brow, it is anticipated that the final slopes will locally expose quarry fills and areas of native soils and weathered rock. The anticipated extent of soils and weaker materials in the proposed face is presented in Figure 13 of the ENGEO Supplemental Report. ENGEO Supplemental Report Figure 14 presents options for mitigation, including construction of a sheet pile wall or an engineered fill buttress. Both options would allow the quarry limits depicted in the Quarry’s mining plan to be preserved. The Quarry shall select an appropriate method based on conditions actually encountered at the time of construction. The Quarry shall provide the engineering evaluation and method chosen to the Department of Public Works for review prior to implementation.

**Comment 21.0:** While the corrective engineering measures described in this Condition may be feasible, there is insufficient geotechnical information to confirm their feasibility or provide design parameters. We disagree that the most appropriate corrective measures should be based on conditions encountered at the time of construction. These conditions should be evaluated beforehand based on appropriate subsurface investigation and laboratory testing, and the most appropriate corrective measures should be selected. As stated in this condition, the results of this geotechnical work should be submitted to the County for review prior to construction.

**Recommendations:** Prior to commencing grading at the south quarry brow, the geotechnical work described above should be completed and submitted to the County. This should be done prior to any construction at the location(s) along the south quarry brow.

**Condition #124:** A thorough re-evaluation of excavated slopes shall be performed near the conclusion of the mining operations, but no later than three years from mining cessation, so that the proposed post-reclamation conversion to secondary uses can be re-evaluated based on revealed conditions with a comprehensive re-evaluation of quarry slope stability based on the results of on-site geotechnical pit observations made during mining, groundwater monitoring, slope monitoring, and a program of laboratory testing of on-site materials. An appropriate testing program shall, as a minimum, include unconfined compressions tests, triaxial testing, and direct shear tests of joint surfaces. The re-evaluation shall be provided to the Department of Public Works.

**Comment 22.0:** We concur with undertaking a thorough re-evaluation of the excavated slopes near the conclusion of mining. We concur that the evaluations should include information revealed from ongoing observations and monitoring. It is not clear why this work should be undertaken “no more than three years” from the cessation of mining. If done later, it would likely provide a better opportunity to observe the final slopes and better determine the investigative/corrective work necessary to minimize the limitations they might impose on the proposed second use. We also concur that the work should include an appropriate testing program that, at the least, should include the methods described in the condition, and that the results should be submitted to the County for review.

**Recommendations:** We recommend that the scope of this later work, including the testing program, be developed closer to the time mining is actually completed, when the condition of the final rock slopes can best be observed and evaluated.

**Condition #125:** The additional studies recommended in the condition above and the ENGEO Supplemental Report will include a study to determine how the site may be developed following reclamation in order to avoid or mitigate to less than significant impacts related to soil and slope stability. At the time the study is prepared, there will be a greater understanding of the bedrock stability and the properties and performance of the Quarry walls. A comprehensive re-evaluation of slope stability shall be performed based on results from geotechnical observations throughout the mining period, groundwater monitoring, slope monitoring, and laboratory testing of on-site materials which would include compression tests and shear tests of joint surfaces.

- a. The design-level, site-specific geotechnical investigation shall be prepared by a California licensed Geotechnical Engineer or Certified Engineering Geologist and include review of the supplemental geotechnical evaluations and monitoring conducted throughout the history of mining activities. The investigation shall include final grading recommendations, mitigation of any identified compressible or liquefiable soils, slope stability analyses, calculation of factors of safety, and structural foundation recommendations to ensure that post-reclamation development will be in accordance with the then-current requirements of the California Building Code and the Marin County Building and Safety Division or City of San Rafael Building Code. These recommendations shall be incorporated into the final design plans for post-reclamation development. (*Mitigation Measure R4.4-3c*)
- b. A qualified Geotechnical Engineer or Certified Engineering Geologist shall prepare a revised geologic map of the Quarry Pit and South Hill, and provide supplemental recommendations, if any, for implementation of the proposed reclamation plan. The study shall confirm that the final mine slopes are stable and suitable for the proposed post-reclamation land use. As necessary, the study shall provide recommendations for any geotechnical investigation and/or analysis needed to demonstrate the stability of the slopes is suitable for any proposed post-reclamation end land use(s). The study shall be provided to the County. If determined by the County or engineering geologist, supplemental rock slope engineering recommendations shall be provided to maintain acceptable factors of safety for proposed adjacent land uses.
- c. If the design-level, site-specific geotechnical investigation determines that achievement of factors of safety adequate for the intended post-reclamation uses are infeasible in some

or all of the reclaimed Quarry, the report shall specify appropriate alternative post-reclamation uses or limitations on the planned use. An amended reclamation plan shall be submitted to the County as required under State law and/or the Marin County Code. (*Mitigation Measure R4.4-3d*)

- d. The location of secondary use structures and critical facilities such as lifeline roads and utilities with respect to the top finished pit reclamation slopes shall be based on the results of the recommended detailed post-mining studies.

**Comment 22.0:** We concur with opening paragraph of this condition. However, it is our opinion, as stated in Comment 8.0 and its related recommendations, that a Preliminary Geotechnical Investigation should be initiated in the near future to characterize the above-described materials, to confirm the technical and economic approach of the anticipated second use reclamation grading, and to provide preliminary design recommendations. The information from this investigation is needed at this point in time as described in Comment 8.0. We also concur that a comprehensive re-evaluation of slope stability should be done utilizing all information developed from observation and monitoring during the period of mining. This should include some or all of the testing included in the condition, plus other geotechnical work contained the investigative scope to be prepared just prior to undertaking the re-evaluation.

**Recommendations:** The above investigations should be undertaken as described and submitted to the County for review.

**Comment 23.0:** We concur with Condition #125(a). However, the investigation should be undertaken by both a California Certified Engineering Geologist and California licensed Geotechnical Engineer. The scope of the investigation should include evaluation of the various soil/rock characteristics described and the scope should refer to and be guided by the results of the recommended preliminary geotechnical investigation.

**Recommendations:** The investigation should be undertaken as described and submitted to the County for review.

**Comment 24.0:** We concur with Condition #125(b). However, the geologic map should be prepared by a California Certified Engineering Geologist. The mapping must include measuring a statistically adequate number and type of bedrock discontinuity properties to adequately characterize the rock mass characteristics of the slopes and to provide the basis for stability calculations to develop FOS values. As found necessary, a California licensed Geotechnical Engineer should calculate the FOS values and provide an opinion on the adequacy of the slopes to support the second use improvements. As discussed in Comment 5.0, the stability evaluation of South Hill slopes should be undertaken sooner.

**Recommendations:** The above investigations should be undertaken as described and commented on.

**Comment 25.0:** We concur with Condition #125(c).

**Recommendations:** None.

**Comment 26.0:** We concur with Condition #125(d).

**Recommendations:** None.

**Condition #126:** The Permittee shall incorporate into the reclamation grading and construction specifications provisions requiring that all phases of reclamation construction implement best management practices (BMPs) to reduce and eliminate soil erosion and loss of topsoil. The Permittee shall implement these BMPs, and the Permittee shall be responsible for the inspection and maintenance of the BMPs through all phases of reclamation. (Mitigation Measure R4.4-2b)

**Comment 27.0:** This is not directly a geotechnical condition. However, we noted during our review that a discussion of BMPs for quarries is contained in Volume 3, Appendix O of the Combined FEIR on SRRQ (ESA, 2009). This information might assist in preparation of BMPs for the SRRQ.

**Recommendations:** None.

**San Rafael Rock Quarry Amended Reclamation Plan and Amended Surface Mining and Quarry Permit. Combined Final Environmental Impact Report (FEIR) - Volume 1: Revisions to the Draft EIR Text. Prepared by ESA, January, 2009.**

**Comment 28.0:** The geologic setting, impacts and mitigation sections of the EIR do not contain any new geotechnical information or recommendations beyond those contained in the reports reviewed above.

**Recommendations:** None.

**Seidelman Associates, Lafayette, California, February 20, 2007, *Geologic Issues Associated with the Enlargement and Eventual Reclamation of the San Rafael Rock Quarry, Point San Pedro, California*, Contained in: San Rafael Rock Quarry Amended Reclamation Plan and Amended Surface Mining and Quarry Permit. Combined Final Environmental Impact Report (FEIR)-Volume 3: Appendices. Prepared by ESA, January, 2009.**

**Comment 29.0:** The Seidelman report was prepared for ESA to assist them in the preparation of the geologic section of the SRRQ EIR. This included review of the 2004 and 2005 ENGEO reports. The Seidelman report largely focuses on project-related seismic shaking issues affecting stability, and makes comments and recommendations to further characterize and reduce their potential impacts on mining and second use slope performance. In our review of the geology section of the EIR, we did not identify any direct response to the shaking or stability issues raised by Seidelman. These issues are rooted in Seidelman's concern that the ENGEO reports did not select seismic parameters representative of an "extreme earthquake event" and, as a result, may have underestimated the seismic effects on the quarry cut slopes. They further state the site's future

exposure to earthquake shaking during mining is far shorter than will be experienced by the second use development, and that the mining and second use almost certainly require different earthquake parameters, which ENGEO did not submit. Based on our review, we conclude that the seismic parameters utilized in the 2005 ENGEO report are reasonable, and that separate seismic parameters are not warranted for the evaluation of proposed second use grading improvements shown in CARP10. Seismic design criteria for second use structures and other improvements will need to be developed as part of future geotechnical investigations, and will be subject to the requirements of the California Building Code.

**Recommendations:** None.

***Wyllie & Norrish, Rock Engineers, December 30, 2006, Data Report, Rock Coring and Piezometer Installations, San Rafael Rock Quarry, Prepared for Dutra Materials, Marin County, California.***

**Comment 30.0:** This report describes the results of a drilling project to meet two separate objectives. The first, and the subject of our comments, describes the drilling and installation methodology of four permanent piezometer borings to provide long-term (life of quarry) water pressure monitoring in the pit walls of the quarry for future slope stability evaluations. The second objective was the drilling, logging, sampling, and testing of two boreholes on South Hill for rock resource quantity and quality purposes.

Detailed information is provided regarding the methodology of the piezometer installations and it appears that the instruments were carefully and correctly installed. However, the report would have been more helpful for our review and comment if the bases for selecting the number, locations, and depths of the boring were discussed along with bases for selecting the number and depth intervals for the installation of the individual piezometer instruments. While the installations were made at the end of 2006, we have not received monitoring results or interpretations for intervening years or an evaluation of the impact of the monitoring results on rock slope stability.

**Recommendations:** The County should request that any monitoring data obtained subsequent to the 2006 readings be provided for review and comment and require its submittal from SRRQ on a quarterly basis.

## **LIMITATIONS**

Services performed by Herzog Geotechnical have been conducted in a manner consistent with that level of care and skill ordinarily exercised by members of the profession practicing in the same locality under similar conditions at the time the services were provided. No other representation, expressed or implied, and no warranty or guarantee is included or intended in this report or in any opinion, documented or otherwise. Our services were limited to reviewing data developed by the project design professionals, and did not include independent subsurface exploration or analyses. Our review does not in any way relieve or modify the project engineer's responsibility as the project Soils Engineer of Record.

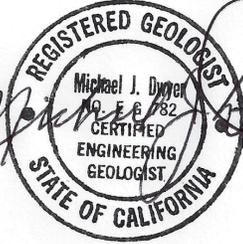
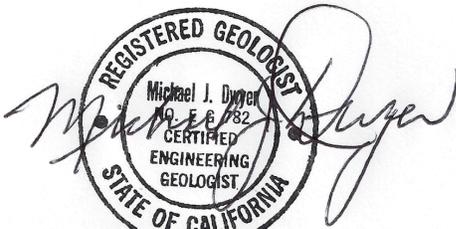
We trust this provides the information required at this time. If you should have further questions, please do not hesitate to call.

Sincerely,

HERZOG GEOTECHNICAL



Craig Herzog, G.E. #2383  
Principal Engineer



Michael J. Dwyer, C.E.G. 782  
Certified Engineering Geologist  
(Expires 3/31/2013)