ORIGINAL

Grace Pacific
CORPORATION
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May 23, 2008

Mr. Henry Eng, FAICP, Director
Department of Planning and Permitting
City and County of Honolulu
650 South King Street, 7th Floor
Honolulu, Hawaii 96813

Attn: Mr. Raymond Young

Dear Mr. Eng:

Additional Information for
Application to Amend Special Use Permit File No. 72/SUP-1
Makakilo Quarry: Grace Pacific Corporation
Tax Map Keys 9-1-16: 4; 9-2-2: 6; and 9-2-3: 74 and 82

At our meeting on April 24, 2008 with Mr. Raymond Young of your staff, Grace Pacific agreed to provide the following additional information:

1) revised Final Grading Plan reflecting slopes of 1.5 to 1 (horizontal to vertical) or greater for the quarry faces;

2) proposed relocation of the primary crushing plant, finish crushing plant, hot-mix asphalt plant, and maintenance shop from the lower processing site to the upper quarry;

3) metes and bounds description of the expanded upper quarry area and landscape grading area;

4) exhibit showing visual evidence that slopes of 1.5 to 1 can sustain long-term vegetation; and

5) document providing support for the combining of the primary plant cost with the finish plant cost.

Please find the following items enclosed with this letter:

a) Revised Figure 4 "Overall Site Plan (Closure Grading Plan)" in Exhibit K "Engineering Report Amendment," Appendix B of the SUP Application. Figure 4 is presented in full size (30" x 40") and reduced (8.5" x 11") formats. The area marked as "Primary, Finish and Hot Mix Operations Area" includes Shop and Office use.

- The acreages for the Proposed Quarry and Proposed Landscape Grading are included in this figure. Please note that the earlier 33-acre area that was shown for the proposed expansion used the toe (edge of the quarry floor) of the face on the side facing Makakilo, and the top of the face on the mauka and Kunia sides.

EXHIBIT 21

- The revised Figure 4 uses the toe of the quarry face on all three sides, as outlined in green, to identify the Quarry Area. The blue line delineates the extent of the landscape grading, with the area between the blue and green lines characterized as the Landscape Grading Area. The increase in total acres is due largely to the increased landscape grading. The following table compares the total under the April 2007 and May 2008 quarry and landscaping plans:

	Quarry	Landscape Grading	Total
Expansion Area (parcel 74)			
April 2007 application	33.5 acres	14.7 acres	48.2 acres
May 2008 revision	21.0 acres	43.6 acres	64.6 acres
Existing Area (parcel 82)			
April 2007 application	94.0 acres	13.0 acres	107.0 acres
May 2008 revision	85.6 acres	34.0 acres	119.6 acres

b) New Exhibits 1, 2, 3, and 4 for Appendix B in Exhibit K "Engineering Report Amendment" of the SUP Application. These exhibits provide the metes and bounds descriptions for the Quarry Areas and Landscape Grading Areas of Parcels 82 and 74 respectively.

c) Revised Figure 5a "Closure Grading Plan with Cross Section Index" in Appendix B of Exhibit K "Engineering Report Amendment" of the Application.

d) Revised Figure 5b1 - Bb9 "Cross Sections AA through II"', accompanying revised Figure 5a.

e) New Figure 5c "Slope Ratio to Percent" table for reference purposes.

f) New Figures 5d "Planting Slope Index", 5e "Aerial Photo with Planting Slope Index", and 5f "Planting Slope Cross Sections AA through HH" depicting the slopes above the Anuhea Subdivision and the ability of vegetation to establish itself. Note that the image in Figure 5e is also used in Exhibit 2-9 of Appendix E in the Engineering Report Amendment.

g) Supplemental information for our April 21, 2008 response to Department of Planning and Permitting's April 3, 2008 Request for Information: March 28, 2008 Letter from Gail Mize of Astec Industries to Jay Obrey of Grace Pacific quoting the construction cost of a new primary crushing plant, finish crushing plant and a hot mix asphalt plant.

The following sections of the "Engineering Report Amendment", Exhibit K, to the Application have been changed to reflect the gentler slopes under the May 2008 Revised Grading Plan. A red-line and clean copy of the changes are enclosed.

1.1 Purpose
2.1 Grading
2.3 Bench Reclamation
4.1 Purpose of the Plan

Thank you for the opportunity to provide you with additional information on this project. Should you have any questions regarding the information provided herein, please do not hesitate to call me at 674-5201.

Sincerely yours,

Robert Creps

Robert Creps
Grace Pacific Corporation

cc: Lee Sichter, Belt Collins

Attachments

Slope Ratio to Percent

Horz.	:	Vert.	Percent			Horz.	:	Vert.	Percent
Feet		Feet	Slope			Feet		Feet	Slope
400	:	1	0.25%			4	:	1	25.00%
300	:	1	0.33%			3.5	:	1	28.57%
200	:	1	0.50%			3	:	1	33.33%
100	:	1	1.00%			2.5	:	1	40.00%
90	:	1	1.11%			2	:	1	50.00%
80	:	1	1.25%			1.9	:	1	52.63%
70	:	1	1.43%			1.8	:	1	55.56%
60	:	1	1.67%			1.7	:	1	58.82%
50	:	1	2.00%			1.6	:	1	62.50%
40	:	1	2.50%			1.5	:	1	66.67%
30	:	1	3.33%			1.4	:	1	71.43%
25	:	1	4.00%			1.3	:	1	76.92%
20	:	1	5.00%			1.2	:	1	83.33%
15	:	1	6.67%			1.1	:	1	90.91%
10	:	1	10.00%			1	:	1	100.00%
9	:	1	11.11%			0.9	:	1	111.11%
8.5	:	1	11.76%			0.8	:	1	125.00%
8	:	1	12.50%			0.7	:	1	142.86%
7	:	1	14.29%			0.6	:	1	166.67%
6.666	:	1	15.00%			0.5	:	1	200.00%
6	:	1	16.67%			0.4	:	1	250.00%
5.5	:	1	18.18%			0.3	:	1	333.33%
5	:	1	20.00%			0.2	:	1	500.00%
4.5	:	1	22.22%			0.1	:	1	1000.00%

Figure 5c

March 28, 2008

Mr. Nathan (Jay) Obrey
Grace Pacific Corporation
P. O. Box 78
Honolulu, HI 96810

Dear Jay:

The following are the discounted equipment prices and installation costs now of the new quarry equipment and the new Hot Mix Facility. A shipping guess is not included.

New Makakilo Crushing System (In upper quarry)

1 – 800 TPH Primary, Secondary and Tertiary Crushing plant. This unit has complete modular structures with as much electrical wiring in conduit, hydraulic piping and air piping installed into the structures as possible. The units are designed to set on customer supplied concrete footing. These modular structures are pre-erected in our factory to insure proper fit up on the job. All control is soft PLC by Siemens with Siemens MCC's with smart bucket technology. This plant represents the same equipment list, flow and layout that we were using before we went to the fractionated crushing plant. Attached find a flow Diagram.

Total Equipment Price	$11,018,196.00
Controls, Switchgear, cable trays and wiring	2,164,500.00
Installation of Plant $5,280,000.00	
Miscellaneous costs Engineering	180,667.00
Total for Crushing plant	**$18,643,363.00**

New Makakilo Hot Mix Facility (in upper quarry)

1 - 450 TPH Double Barrel asphalt plant identical in equipment to 06CC0327 quoted in May of 2006 except at today's pricing:

Equipment Price	$4,180,000.00
Installation Price	599,760.00
Total for Hot Mix Plant	**$4,779,760.00**

I am sorry for the delay in getting this to you. Couldn't seem to round up enough troops.

Jay, I am sure that there will probably be deletions and/or additions to the equipment that can make these prices vary. There is also a major problem of steel pricing on the horizon. The steel companies say that structural steel could go up 40% and that plate could go up 50% before the first of June. In addition to this, they also indicate a shortage of steel is also on the horizon. Usually, when steel takes a leap, copper and other metal products follow there lead. I know I don't need to remind you that our equipment by weight is mostly all steel.

At this point I see no reason to panic, but one would assume a possible substantial increase before your project would be ready to ship.

Thanks for considering Astec.

Regards,

E. Gail Mize
Vice President – National Accounts

P.S. Suggest we bring Warren Ozaki out of retirement to round up the best shipping prices when we really get ready to light the fire on the front burner.

E. Gail Mize
Astec Industries, Inc.
4101 Jerome Avenue
Chattanooga, TN 37407

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Email Office	gmize@astecindustries.com
Email on the road	keystone@chattanooga.net

MAKAKILO QUARRY
(Tax Map Key 9-2-3: 82)
CONDITIONAL USE PERMIT NO. 72/CUP-15
ENGINEERING REPORT AMENDMENT

Prepared for:

GRACE PACIFIC CORPORATION
P.O. Box 78
Honolulu, Hawaii 96810

Prepared by:

BELT COLLINS HAWAII, LTD.
2153 North King Street, Suite 200
Honolulu, Hawaii 96819

April 2007
and Amended May 2008

This work was prepared by me or under my supervision.
April 30, 2008
Expiration Date of the License

ENGINEERING REPORT AMENDMENT

TABLE OF CONTENTS

APPENDICES

1. INTRODUCTION

1.1 PURPOSE

This Makakilo Quarry Engineering Report, dated April 2007 and amended May 2008 (the "April 2007 Report"), is prepared to assist Grace Pacific Corporation in its application for a modification to use permits 72/CUP-15 and 73/SUP-147, to allow the relocation and continuation of quarrying activities at Pu'u Makakilo (the "Application").

The original Makakilo Quarry Engineering Report was approved by the City and County of Honolulu Department of Planning and Permitting on October 19, 1998 (the "1998 Report"). The 1998 Report was prepared to satisfy Condition no. 2 of City Council resolution 95. An amendment was made to the 1998 Report in March of 2004 (the "2004 Report"). The 2004 Report dealt largely with the retention of run-off within the property, visual mitigation and landscaping.

While this report is written to be a free-standing document, a review of the 1998 Report and the 2004 Report is of value in understanding the current operations. These reports are included as Exhibit J of the Application.

1.2 SITE DESCRIPTION

The James Campbell Company owns the land under the Makakilo Quarry (Tax Map Key 9-2-3:82), and licenses it to Grace Pacific Corporation for quarry operations. The license agreement expires in the year 2017. Subject to the approval of the Application, Grace Pacific has negotiated with Campbell for an extension of the license to 2032.

The quarry is situated on the slopes of Pu'u Makakilo. The west bound lanes of the H-1 Freeway front the southeast side of the property. The area makai of the H-1 Freeway is used as a processing site for quarry, but its operations are not included in this report.

Pu'u Makakilo Inc., a subsidiary of Grace Pacific Corporation, owns the property surrounding the existing quarry. The land is characterized as dry-range land with poor, scrub-type vegetation on greater than 10 percent slopes.

2. GRADING PLAN

2.1 GRADING

The attached grading plan (Figure 4, Appendix B) shows the proposed final grades prior to reclamation of the quarry in the year 2032. The plan maximizes the excavation of the known basalt reserve while minimizing visual and environmental impacts to the surrounding community.

The southeast boundary of the quarry, which consists of undisturbed ridges and gullies, parallels the H-1 freeway. This area serves as a buffer and will remain undisturbed,

providing a noise and visual barrier from the freeway. The quarry sides and mauka face will utilize slopes averaging flatter than 1.5 (horizontal) to 1 (vertical)~~staggered benches~~ and undulating faces to minimize the appearance of a man-made landform. The existing quarry floor will gently slope from the back and sides to the front at approximately a 2% grade. The floor of the proposed mauka quarry area will be steeper, at 15% to 25%, matching the gradients of the existing Pu'u formation.

Restoration grading recommendations prepared by a geotechnical engineer are attached as Appendix A. Several key methods are recommended to provide an adequate foundation for access roads, residential and light loaded commercial development. Excess stockpile material, 1 inch minus, may be used for landscape restoration provided the material contains or is amended with proper portions of organics, sand and silts.

The proposed relocation of the quarry extends up the Pu'u from existing~~lower~~ lower elevations between 500 feet to 550 feet to an upper elevation of 700 feet. An access road running across~~long~~ the 350 foot~~500~~ elevation of Parcel 82~~ excavated contour~~ will be constructed to allow vehicle access from the southwest portion of the 312 acre parcel (TMK 9-2-3-74) to the northeast portion of the parcel~~, skirting the foot of the Puu~~.

As part of this proposal, two~~hree~~ drainage basins will be constructed within the lower active pit for runoff retention. There is only minimal additional run-on arising from this proposal, representing runoff from the southwestern portion of the berm that is to be constructed on the northeast boundary. Today, approximately one-half of the runoff in the vicinity of the proposed berm finds its way into the Kaloi Gulch watershed.

Two new landforms will be created from the 475 foot to 700~~675~~ foot elevations in conjunction with the relocation of quarrying activities. On the southwest boundary, the ridgeline of the Puu will be cut and graded by up to 50 feet to reduce the visual impact of the quarrying, as seen from the H-1 freeway on the approach to Kapolei. For the same reason, Grace Pacific will construct a ridge-like berm extending from the northeastern ridge of the Puu. This berm will range in height from 15 feet to 100 feet above the existing ground. The berm will be constructed with flatter than~~a~~ 2:1 horizontal to vertical slopes. In addition, the bowl of the Puu, in the 700 foot to 800 foot elevation, will be restored to its pre-golf, gullied appearance. ~~, and with 10 foot wide benches at each interval of 30 feet in height.~~

The quarry sides and mauka face will consist of slopes of averaging greater than a 1.5 to 1 horizontal to vertical proportion~~utilize vertical cuts and horizontal benches~~ to reach the desired depths of approximately 200 feet~~ to 250 feet~~ below the existing ground surface~~.~~. Quarrying to such slopes arguably leaves good material in the ground, but success in achieving visual mitigation in the land forming and revegetation processes is deemed a greater benefit. Over-excavation on the quarry floor will be necessary in some areas to follow rock deposits. Such over-excavation will be filled and compacted to achieve the desired final grades. ~~Typical benches will be 25 feet wide and 50 feet tall. The uppermost benches, particularly on the southwest and mauka faces will utilize 1:1, 1:1.5 and 2:1 horizontal to vertical slopes to facilitate revegetation efforts and visual mitigation.~~ See Figures 4, 5a and

5b of Appendix B for a detailed look at the slopes~~, vertical cuts and benches~~ along the sides and mauka face of the proposed quarry area.

2.2 ALTERNATIVE FLOOR RECLAMATION

If post-closure development plans deem it desirable, the quarry can be indirectly reclaimed to increase infiltration. After the quarry has been shaped to match the grading plan, the pit floor can be regraded to produce a rough, irregular surface. This method will increase water infiltration and slow erosion by keying the replaced soil into the substrate. This can be achieved by either blasting or ripping the pit floor. Since this quarry is hard rock quarry, blasting is the appropriate method to fracture the pit floor so that water can drain slowly and roots can penetrate. A good technique is to blast an extra 10 feet during the last production round and leave some of the fractured material in place.

2.3 BENCH RECLAMATION

Under the May 2008 Revised Grading Plan several areas of the existing quarry will be left with traditional 25 foot wide benches and 50 foot high faces. In these cases~~Typically~~, the ~~25 foot wide~~ benches will be sloped toward the high wall to help trap moisture and soil. Topsoil will be placed on the benches and planted. ~~However, since the quarry is located in an arid area, the linear features of the benches will probably not be obscured by significant vegetation. Therefore, o~~Other methods may be used~~necessary~~ to break up ~~some of~~ the linear features including performing post-production blasting to form staggered benches. Strategic blasting can create chutes, spurs, and rough vertical cliff faces can be created. The desired effect depends on the rock type, structural geology, and blasting agent from a choice of blast patterns, delays, and stemming depths. The appropriate methods will be chosen only when final quarry grades are achieved and rock faces can be evaluated.

~~The quarry reclamation will use a combination of vegetative benches along with staggered benches to create a more natural appearance.~~ Appendix E presents the current revegetation plan for screening and restoration of the quarry.

3. DRAINAGE PLAN

3.1 DRAINAGE PLAN

3.1.1 METHOD

The intent of the Makakilo Quarry drainage plan is to reduce the amount of stormwater run-on and minimize the impacts of run-off on the quarry as well as downstream. Elements of the drainage plan are detailed in Appendix C.

The method used in this report to calculate required storage uses the total rainfall depth from the design storm. This number is multiplied by the drainage area to yield the total required storage. See Appendices C-1 through C-4 for rainfall storage calculations.

The depth of recorded rainfall for a 100-year storm with a 24-hour duration was extracted from the State Hawaii Department of Land and Natural Resources, Division of Water Land Development, "Rainfall Frequency Study for Oahu, Report R-73", 1984. The applicable page from this reference is included in Appendix B, as figure 1.

3.1.2 EXISTING DRAINAGE

The existing upper quarry covers 94 acres of the Makakilo Pu'u. The slopes of Pu'u Makakilo generate approximately 148 acres of rainfall into the existing quarry area. Figure 2 of Appendix B shows the extent of the existing drainage area.

Two~~hree~~ existing drainage basins located near the bottom elevation of the quarry create the necessary storage capacity for a design 100-year 24-hour storm. They are DB#1 and~~,~~ DB#2~~, and DB#3~~. The required storage was calculated to be 151.9 ac-ft. See Appendix C-1 for required storage calculations. The volume capacity of the three drain basins is 175 ac-ft.

3.1.3 QUARRY DRAINAGE WITH RELOCATION OF QUARRY

The relocated quarry extends mauka within the northeast and southwest trending ridges of Pu'u Makakilo. See Figure 4 of Appendix B for the proposed relocation of quarrying activities. The total proposed area plus the offsite area contribution totals 170.0 acres. This includes the rainfall from the southwestern face of the new berm. See Figure 3 of Appendix B for the developed drainage arising from the proposed relocation of the quarry. On-site storage capacity of 174.3 ac-ft is needed for the increased runoff surface. Free board at this rainfall capacity will be 2 feet. See Appendix C-2 for calculations.

The limit of grading runs along the outer ridge of the Pu'u on the southwest side of the quarry. Runoff generated outside the limit of grade will fall away naturally from the quarry. On the northeast, a new berm will be constructed. As a result, no measures are necessary to divert offsite runoff from the northeast and southwest limits of the relocated quarry. Subsequently, run-on generated from the northwestern edge of the relocated quarry will be handled by the three drainage basins.

The flow off of the northeastern berm face is 18.33 cfs and will continue to flow along the existing flow patterns.

3.1.4 CONCLUSION

The intent of the Makakilo quarry drainage plan is to reduce the amount of storm water entering the site and fully retain all the storm water runoff within the upper quarry.

The two~~hree~~ existing basins (DB#1 and~~,~~ DB#2~~, and DB#3~~) with capacity of 175 ac-ft sufficiently store the 174.3 ac-ft (100-yr storm) of required by the expansion. A 100-yr storm at 174.3 ac-ft of rainfall will reach hydrological water levels of 253 ft. The surrounding berm height at the 96" culvert is at elevation 255 ft. This results in 2' of freeboard. The existing

slopes along the southwestern edge of the quarry will convey runoff away along its natural existing flow pattern preventing offsite runoff from entering the site.

The berm on the northeastern edge of the proposed quarry will serve as an offsite runoff diversion. The southwestern face of the berm will produce approximately 18.33 cfs of runoff and will follow existing flow patterns. The existing area (under the site of the proposed berm) generates approximately 18.33 cfs, therefore there is no net increase in runoff generated by the construction of the berm. The direction of flow of this 18.33 cfs of runoff will continue along the same direction as the existing flows.

Overall, no additional flows will be added to outside drainage patterns. Runoff will be contained within the quarry limits. The quarry relocation project will have no adverse impact on adjacent properties or existing downstream drainage systems.

3.2. EROSION CONTROL PLAN

Minimizing or eliminating water-quality problems by mechanical or operational means is generally described as a *best management practice* (BMP). BMPs can be classified as either short- or long-term with considerable overlap existing between the two. Also, erosion controls at a site will likely change over time as the configuration of the site changes. The best strategy for stormwater control is to divert stormwater around the quarry and into an existing drainage. However, in the absence of such diversion, once stormwater has entered a quarry, a very effective control technique during ongoing operations is to develop numerous sumps or low areas to disperse stormwater. These low areas collect sediments and allow stormwater to infiltrate into the ground.

The runoff created within the Makakilo quarry expansion will be retained, therefore no soil loss is expected within the quarry expansion.

Proper erosion control measures will be implemented during the construction of the new berm. The northeastern face of the berm measures to be approximately 5.7 acres. Flow generated during a 10-year storm for this area would be 18.33 cfs.

~~In order to sustain and manage soil loss, a number of measures will be taken. The height of the berm will require it to be constructed with 10' wide benches at 30' height intervals. These benches will serve as a slope stabilization measure as well as an erosion control measure to lower the velocity of runoff flows and retain sediments because of the benches' level surface.~~

~~To further control sediment runoff, s~~Silt fences will be installed along the toe of the berm slope down stream of drainage pattern flow. Geotextile fabrics will be installed along the berm slopes, in order to stabilize the bare slopes while the grassing is being established. Other methods include mulching, straw bales, silt fences, jute matting, and plastic coverings. Mulching, matting, and plastic covering are good methods to reduce rain drop erosion especially on slopes; while straw bales and silt fences are designed to prevent fully or rill erosion of long overland areas such as swales.

The quarry is exempted from complying with the *City and County of Honolulu, Soil Erosion Standards and Guidelines, November 1975. (Chapter 23. Grading, Soil Erosion and Sediment Control).* However, Grace Pacific. will use the guidelines, as appropriate, in its erosion control activities at the site.

3.3. WATER QUALITY

No discharge is expected from the quarry. The site has been designed to fully contain runoff for a 100-year storm event.

The newly constructed berm will produce runoff that will flow towards Kaloi Gulch but the quantity of flow will not be in excess of what was already conveyed in the same area. Industrial activity will not take place within the berm area.

4. 2007 REVEGETATION PLAN

4.1 PURPOSE OF THE PLAN

The purpose of the Plan is to address the visual mitigation and revegetation of the areas affected by the proposed relocated quarry while operating (2007-2032), and the post-closure revegetation efforts beginning in 2032.

The Plan assumes the final landforms described in the Grading Plan section of this report. See Figures 4, 5a, 5b, and 6 of Appendix B.

The tools of the Plan are landforms and re-naturalization (or "revegetation"). The key elements of the Plan are:

1) the use of the existing ridges and man-made berms as effective visual screens of quarry activities and quarry faces;

2) for quarried faces not able to be screened, minimizing the man-made appearance of the final contours is preferable from a visual standpoint; and

3) the re-naturalization of man-made berms and quarried faces with drought tolerant vegetation, mixed and placed to blend with that existing on the Puu, is the most water-efficient and effective approach to long term landscape management.

The Proposed Use affords an opportunity an opportunity to improve upon several aspects of the 2004 Revegetation Plan. The existing excavation area is completely screened from view from the Kapolei Regional Park towards Ko Olina by a ridge on the southwest boundary. This aspect will be retained. A ridge and berm along the H-1 freeway at the 275 foot elevation screens the close-in views from Farrington Highway in the vicinity of Kapolei Knolls around to Palehua Road. This aspect will also be retained.

The intermediate and distant views from the Villages of Kapolei and Kalaeloa (formerly BPNAS) presently are that of a 2,400 foot wide active quarry face with a visible height of 250 feet (from elevation at 275 feet to 525 feet). The proposed excavation activity

will quarry upslope through this quarry face and leave a bowl-shaped landform 700 feet further mauka, complementing the existing bowl of the Puu. The exposed face of the bowl (prior to revegetation) will be 200 feet in height (from elevation at 500 feet to 700 feet). The top of the Pu'u is at an elevation of 980 feet. What is presently the quarry face will become the quarry floor (from elevation at 275 feet to 500 feet), which as a landform, will be readily revegetated.

The intermediate and distant views from Ewa and Waipahu, while not viewing the existing active face head-on, will benefit from the move mauka and the bowl-shaped final landform.

The weak ridge on the northeast boundary of the proposed excavation area will expose the southwest quarry face on the approach to Kapolei on the H-1 Freeway from Kunia Road to the vicinity of the proposed North South Road Interchange. To mitigate this visual impact, Grace Pacific is proposing to lower the southwest ridgeline by approximately 50 feet in elevation and to build a berm on the northeast ridgeline of approximately 75 feet in height. The net effect of these actions will be to leave no more than 100 feet of the southwest face unscreened. Further, it is planned to grade the unscreened face with slopes averaging flatter than~~ranging from~~ 1.5~~:1~~ to ~~2:~~1 (horizontal to vertical slope) to facilitate the revegetation effort.

4.2 GOALS AND OBJECTIVES

Minimize or eliminate the visual recognition of the quarry from off-site locations. Through the re-establishment of plant material and careful excavation of exposed rock areas, it is the intent of this Plan to either screen or "visually blend" wherever possible exposed areas of the site. "Visual blending" is based on the use of appropriate plant material and grow-in procedures.

Screen the quarry machinery and equipment from public view. Placing the quarry machinery and equipment on the Quarry floor effectively screens it from the public view. The quarry floor will be at a 245-foot elevation, which will be at least 70 feet below the quarry rim.

Minimize the long-term use of irrigation water. Although all plant materials require water for establishment and to survive, this plan recommends a minimum of water consumption through the use of drought-tolerant species and growth in procedures that are designed to acclimate plants to dry conditions.

Minimize long-term maintenance in the re-naturalized areas. On the same basis in which irrigation water use is being minimized, recommendations are geared towards the long term, low maintenance requirements of the quarry environment. Plant materials will be selected based on ability to survive with minimal maintenance for the two-year establishment period. These plants ultimately will naturalize into the existing vegetation and survive without regular maintenance. See Exhibits 3 of Appendix E for the

Recommended Plant Palette. See Exhibits 4 and 5 of Appendix E for the Revegetation Matrix and Revegetation Phasing Plan arising from the Proposed Use.

Avoid an "engineered appearance" to the completed project. In regards to the arrangement and appearance of the plant materials and rock walls, it is the intent of this plan to convey the importance of using irregular forms wherever possible. No straight row plantings will occur anywhere within the site or at the site boundary, including the benches. Clusters of plant materials and benches of varying shapes, orientation and dimension will be used to create a more natural appearance.

Quickly establish a re-naturalized appearance. Plant materials that are currently surviving on the site without irrigation provide a guide to those plants that will survive in the hot, windy and dry climate of the site and should be considered for use. Plant materials with a fast growth rate and hardy nature will be used so that screening and slope stabilization can occur as quickly and effectively as possible. Plant materials that have strong colors and textures and would not visually blend in with the naturally occurring grasses and lightly textured and colored trees found in neighboring areas will not be used. See Exhibit 3 of Appendix E for recommended Plant Palette.

Activities will not disturb protected areas of the site. All areas, which are not intended for quarry development, will be left undisturbed. These areas will serve as the benchmark and guide for the appearance of the quarry re-naturalized areas when that work is done. See Exhibit 1 of Appendix E for photos of undisturbed lands on the surrounding Puu Makakilo slopes.

Minimize costs associated with the re-naturalization efforts. The plan strives to minimize short and long-term costs associated with the re-naturalization. Seed or seedlings of many of the plant materials recommended can be propagated directly on-site and most are considered easy to grow. Many of the plant materials used will reseed themselves and spread on their own eliminating the potential need for periodic follow-up plantings. Typically smaller container size trees will be planted because they more readily adapt to site conditions and because they are available at a relatively low cost. The irrigation system contemplated for use will require an initial cost and some on-going costs for maintenance but will lower the potential long-term costs of replanting during extremely dry periods. Test plots will be used on-site to test varying seed mixes and maintenance practices to improve the chances of success and to fine tune a cost effective planting and low maintenance approach.

4.3 Site Opportunities and Constraints

Site opportunities and constraints are summarized below:

Natural ridgelines screen views. The ridge on the Makakilo side of the quarry completely screens distant, intermediate and close-up views of the quarry from the Makakilo residential neighborhood (Exhibits 2-1 and 2-2 of Appendix E) to the Kapolei Regional Park; The ridge on the Waipahu side of the quarry screens intermediate

and close-up views of the quarry face, as seen from the intersection of Farrington Hwy and the old Palehua Road (Exhibit 2-3 of Appendix E). The western quarry face is visible from the distant view at the H-1/Kunia intersection (Exhibit 2-4 of Appendix E). The lowering of the elevation of the southwest ridge and construction of a berm on the northeast ridge will mitigate the effects of the proposed excavation area on this distant view. See Exhibit 2-0 of Appendix E for a map of screening zones and photograph vantage points.

Berm above H-1 freeway screens views into Upper Quarry. The existing H-1 freeway cut faces and the intervening gullies of Puu Makakilo serve to screen close-up views of the quarry from the H-1 and Farrington Hwy (Exhibit 2-5 of Appendix E). The quarry face is visible from intermediate views such as Kapolei Golf Course (Exhibit 2-6 of Appendix E) and the Villages of Kapolei (Exhibit 2-7 of Appendix E) and from distant views, such as the Ewa Golf Course (Exhibit 2-8 of Appendix E). See Exhibit 2-0 of Appendix E for a map of screening zones and photograph vantage points.

Puu Makakilo screens views from Upper Makakilo. Puu Makakilo completely screens views of the quarry from the residents of upper Makakilo (Exhibit 2-9 of Appendix E).

The variation of colors of the quarry face rock and surrounding natural vegetation. Distant views of the quarry are indistinct due to moving cloud shadows and the mottled appearance of the quarry rock and cinder. Much of the existing quarry face rock and surrounding vegetation has an uneven gray-brown to blue color from a distance. This unevenness helps to break up the line of the quarry faces and benches.

Color/Texture. During the dry season, the surrounding area vegetation is brown to yellow in color. During the rainy season, the plants are grayish-green with occasion splashes of yellow. Textures vary among the vegetation found on site, but generally smaller, finer textured plants appear to predominate visually rather than broad-leafed ones. Brightly colored plants, such as Bougainvillea, should be avoided, as they attract attention, rather than diffuse it.

Types of plants. The plants existing on site have volunteered naturally. These plants include a wide variety of shrubs, groundcovers, and grasses. None of the established plants on site receive any permanent irrigation. Therefore, only the hardiest and drought tolerant plants tend to survive. All proposed plants should be extremely drought-tolerant, and require minimal water after establishment. See Plant Palette, Exhibit 3 of Appendix E.

Volunteer/Natives. Many volunteered or native plants are very drought tolerant and hardy. Many are considered "weeds" in ornamental landscapes, but on this site they cover the ground and minimize erosion. However, there are a few noxious weeds and toxic plants that should be eliminated. An example of this is the Tree Tobacco (Nicotiana glauca), which is poisonous to man and to livestock.

Source of irrigation water. Grace Pacific Corporation has a well at its Processing Site with an allocation of 168,000 GPD. Water from this well is pumped to the Upper Quarry and stored in tanks near the primary crusher. Portable water tanks may be located on the upper benches and supplied by water wagons.

The Revegetation Matrix and Revegetation Phasing Plan (Exhibits 4 and 5 of Appendix E) assume the availability of approximately .200 mgd of water for all quarry purposes (Processing Site well plus Board of Water Farrington Hwy meters). Of this amount, the Revegetation Plan targets .050 mgd or less for revegetation purposes. This limitation on supply serves as a constraint on the speed by which quarried land and land graded for visual mitigation purposes may be revegetated.

Climate. Rainfall is historically less than 20 inches per year, and usually occurs between the months of December and February. Prevailing trade winds are from the northeast and can be quite strong. Temperatures are very high, with summer average highs in the mid to high 90's and winter average highs in the lower 80's. The average annual humidity ranges from 65% in the summer to 75% in the winter.

Agricultural soils analysis. Soil tests on quarry benches and the slopes surrounding the quarry suggest that existing site soils are high in sodium and magnesium, and low in calcium, phosphorous, iron and zinc. With proper amendments re-naturalization can occur readily given the soils present on-site. Toxic concentrations of boron and magnesium have been found in certain areas of the site. These areas will require the addition of Gypsum to bind the toxic materials in the soil.

4.4 LANDSCAPE DEVELOPMENT PLAN

Quarry Floor. The quarry floor will encompass an area of approximately 1072~~8~~ acres. This area makes up the lower ground plane or base of the quarry. It is understood that this base area of the quarry may be developed in the future, however until the specific development plan has been determined, the area will be planted with grasses and ground covers to control dust and erosion. The floor of the quarry with elevations below 300 feet will be hidden from view and will have no visual impact from off-site locations.

Upon removal of Grace Pacific's plant and equipment in 2032, the first priority will be to establish a natural appearing grass/ground cover mix. The species already growing on site provide a good indication of species that will tolerate the harsh site conditions occurring in Makakilo. A carefully selected combination of grass/ground cover species that are fast growing, drought tolerant and will reseed or otherwise spread is recommended. Species will be combined to ensure that plants will establish within all of varying microclimates present on-site. The quarry floor soil materials may also need to be amended to provide nutrients and drainage. The ultimate planting plan for the quarry floor will depend upon the final land use determined by the James Campbell Company and Grace Pacific. For this reason no large landscape materials will be introduced within the quarry floor area.

Irrigation will be required to establish grasses and ground covers in the quarry floor area. Rotary impact heads will be used to establish the plantings for a period of approximately two years. Irrigation lines will be buried in shallow 4" trenches to protect then from UV and other damage and lengthen the usable life of the system. The irrigation system will be turned on periodically in times of drought to minimize potential fire hazards.

Mauka Quarry Faces. The most visible aspect of the quarry at its completion will be the ~~vertical~~ faces above the 400 foot elevation up to the ~~along the~~ mauka perimeter. To mitigate the appearance of these faces, an undulating landform and a slope averaging flatter than 1.5 to 1 but allowing for significant variation~~eries of random benches of various heights and lengths~~ will be created to render a more natural appearance than straight benches and slopes. ~~A technique termed "restoration blasting" will be used to create gullies and talus slopes on the quarry faces. Although the random benching and restoration blasting of the quarry faces will greatly mitigate the appearance of the quarry faces, landscape re-naturalization of these faces will be necessary for effective visual blending. The upper-most 100 feet of the quarry faces are most visible from off-site locations, and this is where the major planting effort will be made~~.

Because of the high exposed elevations~~face walls~~ that will be exposed, it not the intent of the revegetation plan to screen the entire face with trees but rather to soften the exposed surfaces~~rock face itself~~ with grasses and shrubs. This treatment will create the illusion that these faces are naturally formed and aged. The excavation pattern for the quarry will emphasize the uppermost benches first. It will be very important to complete landscape work in conjunction with the quarrying process~~as soon as possible after the excavation of each bench~~ to ensure the landscape installation is not hindered due to conflicts with mining procedures. Soil and amendments will ~~also~~ be added to the ~~horizontal~~ surfaces ~~of the benches~~ immediately after completion, as it may be difficult to add any soil later. Soils used in the work will come from on-site stockpiles where possible. If imported soils are used, they will be matched with the structure and characteristics of on-site soils and will be inspected to prevent the introduction of noxious weeds and insects.

The plant materials used would be fast growing, drought tolerant and self-spreading varieties. Random placement of tree and shrub groupings will be under the direction of a Landscape Architect to select appropriate variation and density of clusters. Clusters of larger plants such as Kiawe and Opiuma will be planted in specific areas. Large tree or shrub plantings will not be planted along the entire length of benches to avoid reinforcing unnatural horizontal lines.

Irrigation is required to establish plant material on the faces. It will be particularly critical that a sturdy system is in place (even though considered of temporary quality) because of the potential future access problems. A PVC line system is recommended with lower trajectory and narrower coverage area impact heads due to the strong prevailing winds. Where adjacent benches occur within 25' of elevation change of each other, it is possible that one row on the upper bench could irrigate both

levels. This would be determined on a case-by-case analysis in the field. Irrigation will be implemented for a two-year grow-in period. Irrigation mainlines will be buried in shallow 4" trenches to protect from UV and lengthen the usable life of the system. The irrigation system will be turned on periodically in times of drought to minimize potential fire hazards. As field stock materials will be used on the benches, no drip irrigation will be required. See Exhibits 4 and 5 of Appendix E for the re-naturalization schedule.

Access Road. From the existing Quarry, the access road skirts the lower edge of the adjacent Puu Makakilo property, and then turns into Old Palehua Road, crossing under the H-1 and terminating at Farrington Highway. The visibility of the access road varies depending on where it is being viewed from and the particular segment of the road being viewed. Wherever possible undulating re-naturalized berms of 6 feet in height planted with grasses, groundcovers, trees and shrubs will be maintained to screen the access road from view. Earth mounds and rock material laid in natural patterns should be used in certain areas where highest visibility exists. A continuous landscape treatment along the road is not desirable (such as a row of trees or a long berm) and would serve to draw more attention to the roadway. A limited number of field stock trees are recommended to soften the most critical areas immediately. The irrigation system provided will consist of a rotor head system, which will remain in place for the duration of the use of the access road use to revitalize plant materials, which are affected, by heavy vehicle use. A temporary drip irrigation system will be used to establish the field stock materials for an approximate 12-month period.

Existing Buffer at H-1, the "Adjacent Area". The portions of the existing Quarry parcel flanking the quarry, but not used for quarrying, are termed the "Adjacent Area" in the license agreement with the James Campbell Company. The Adjacent Area for the most part is untouched and has a natural appearance with kiawe, hauole koa and naturally occurring grasses. It is the intent of this Plan to maintain this area in its entirety as it currently exists and to a substantial degree emulate this "look" as much as possible in the surrounding areas to be naturalized.

APPENDIX A

APPENDIX B

APPENDIX C

APPENDIX E

APPENDIX F

EXHIBIT 1

Metes and Bounds Description
Parcel 82 – Quarry Area

CLOSURE REPORT

Coordinate values shown are computed based on the rounded bearing and distance,
or chord bearing and chord lengths as indicated herein.
Boundary Name: PARCEL 82 - QUARRY AREA

Point Number	Description	Sta	Northing	Easting	Elevation
	Bearing	Distance			
0		79+06.52	-5498.9741	1156.8383	
	25°15'00"	1909.31 ft			
0		98+15.83	-7225.8594	342.3863	
	314°59'31"	375.64 ft			
0		101+91.47	-7491.4396	608.0412	
	339°46'56"	137.94 ft			
0		103+29.41	-7620.8806	655.7118	
	353°59'06"	183.88 ft			
0		105+13.29	-7803.7482	674.9804	
	343°07'50"	71.05 ft			
0		105+84.34	-7871.7408	695.5985	
	348°09'41"	401.18 ft			
0		109+85.52	-8264.3875	777.9029	
	52°32'34"	61.31 ft			
0		110+46.83	-8301.6743	729.2345	
	305°49'17"	339.88 ft			
0		113+86.71	-8500.5926	1004.8247	
	288°01'23"	169.64 ft			
0		115+56.35	-8553.0792	1166.1408	
	253°07'13"	118.56 ft			
0		116+74.92	-8518.6537	1279.5928	
	245°28'52"	384.89 ft			
0		120+59.80	-8358.9269	1629.7752	
	226°48'20"	187.45 ft			
0		122+47.25	-8230.6218	1766.4328	
	221°14'46"	247.44 ft			
0		124+94.68	-8044.5755	1929.5687	
	212°46'44"	184.77 ft			
0		126+79.46	-7889.2272	2029.6029	
	198°41'14"	368.27 ft			
0		130+47.72	-7540.3717	2147.5972	
	183°29'29"	381.89 ft			
0		134+29.61	-7159.1905	2170.8538	
	176°02'01"	203.39 ft			
0		136+33.00	-6956.2877	2156.7850	
	191°21'34"	203.16 ft			
0		138+36.16	-6757.1074	2196.8001	
	162°47'16"	168.70 ft			
0		140+04.86	-6595.9626	2146.8798	
	148°19'38"	211.87 ft			

0		142+16.73	-6415.6484	2035.6338
152°34'54"	115.89 ft			
0		143+32.62	-6312.7765	1982.2683
164°58'21"	143.57 ft			
0		144+76.19	-6174.1164	1945.0431
192°06'16"	144.36 ft			
0		146+20.55	-6032.9660	1975.3146
136°04'27"	332.92 ft			
0		149+53.47	-5793.1842	1744.3591
124°49'54"	104.55 ft			
0		150+58.02	-5733.4686	1658.5409
132°14'20"	183.39 ft			
0		152+41.40	-5610.1896	1522.7684
113°42'21"	160.08 ft			
0		154+01.48	-5545.8309	1376.1957
106°01'02"	159.16 ft			
0		155+60.65	-5501.9145	1223.2145
92°32'59"	66.44 ft			
0		156+27.09	-5498.9588	1156.8403

Closing latitude	= 0.01534
Closing departure	= 0.00199
Closing bearing	= 7°23'34"
Closing distance	= 0.01547
Total traverse length	= 7720.58 (7720.57)
Total error of closure	= 1/499178
Error of closure in latitude	= 1/503362
Error of closure in departure	= 1/3879506
Area	= 3730582.74 Sq. Ft.
Area	**= 85.6424 Acres**

EXHIBIT 2

Metes and Bounds Description
Parcel 82 – Landscape Grading Area

CLOSURE REPORT

Coordinate values shown are computed based on the rounded bearing and distance,
or chord bearing and chord lengths as indicated herein.

Boundary Name: PARCEL 82 - LANDSCAPE GRADING AREA

Point Number	Description	Sta	Northing	Easting	Elevation
	Bearing	Distance			
0		98+15.94	-7225.9599	342.3389	
	25°15'00"	580.35 ft			
0		103+96.29	-7750.8604	94.7798	
	14°50'28"	170.28 ft			
0		105+66.57	-7915.4599	51.1643	
	19°16'53"	58.95 ft			
0		106+25.52	-7971.1032	31.6986	
	311°17'38"	334.74 ft			
0		109+60.25	-8192.0054	283.2003	
	235°56'09"	288.87 ft			
0		112+49.12	-8030.2032	522.5033	
	342°08'30"	351.85 ft			
0		116+00.97	-8365.1003	630.4032	
	323°38'40"	275.20 ft			
0		118+76.18	-8586.7337	793.5402	
	302°09'30"	226.51 ft			
0		121+02.69	-8707.2960	985.2992	
	296°49'06"	120.52 ft			
0		122+23.21	-8761.6702	1092.8562	
	247°12'51"	242.90 ft			
0		124+66.11	-8667.5981	1316.8001	
	284°37'16"	71.90 ft			
0		125+38.01	-8685.7475	1386.3717	
	242°24'40"	112.00 ft			
0		126+50.02	-8633.8776	1485.6365	
	234°34'08"	396.94 ft			
0		130+46.95	-8403.7620	1809.0685	
	227°06'15"	259.25 ft			
0		133+06.21	-8227.2990	1998.9930	
	199°53'54"	688.65 ft			
0		139+94.85	-7579.7627	2233.3766	
	263°07'11"	89.73 ft			
0		140+84.58	-7569.0135	2322.4604	
	201°00'35"	359.62 ft			
0		144+44.21	-7233.3012	2451.3936	
	181°21'03"	220.56 ft			
0		146+64.77	-7012.8025	2456.5932	
	115°35'31"	176.41 ft			
0		148+41.17	-6936.6006	2297.4902	
	179°01'44"	206.53 ft			

0		150+47.70	-6730.1003	2293.9899
163°29'41"	198.17 ft			
0		152+45.87	-6540.0962	2237.6891
137°47'53"	128.92 ft			
0		153+74.79	-6444.5946	2151.0876
154°57'45"	219.75 ft			
0		155+94.54	-6245.4943	2058.0869
172°08'41"	103.17 ft			
0		156+97.71	-6143.2924	2043.9865
220°43'16"	108.99 ft			
0		158+06.69	-6060.6895	2115.0892
203°08'34"	212.32 ft			
0		160+19.01	-5865.4552	2198.5360
179°51'26"	254.93 ft			
0		162+73.94	-5610.5260	2197.9007
53°18'21"	218.46 ft			
0		164+92.40	-5741.0654	2022.7315
109°23'37"	65.88 ft			
0		165+58.28	-5719.1895	1960.5895
167°40'58"	143.34 ft			
0		167+01.62	-5579.1490	1930.0117
163°14'39"	92.04 ft			
0		167+93.66	-5491.0169	1903.4771
133°50'15"	231.23 ft			
0		170+24.90	-5330.8634	1736.6893
151°50'44"	382.53 ft			
0		174+07.43	-4993.5948	1556.1925
167°37'46"	126.23 ft			
0		175+33.66	-4870.2955	1529.1499
87°53'06"	77.22 ft			
0		176+10.87	-4873.1453	1451.9825
25°15'00"	691.82 ft			
0		183+02.70	-5498.8655	1156.8737
272°32'59"	66.41 ft			
0		183+69.11	-5501.8198	1223.2179
286°01'02"	159.18 ft			
0		185+28.29	-5545.7418	1376.2184
293°42'21"	160.10 ft			
0		186+88.40	-5610.1085	1522.8094
312°14'20"	183.40 ft			
0		188+71.79	-5733.3943	1658.5893
304°49'54"	104.56 ft			
0		189+76.35	-5793.1155	1744.4157
316°04'27"	332.98 ft			
0		193+09.33	-6032.9405	1975.4128
12°06'16"	144.39 ft			
0		194+53.72	-6174.1203	1945.1350
344°58'21"	143.53 ft			
0		195+97.25	-6312.7418	1982.3498
332°34'54"	115.87 ft			
0		197+13.12	-6415.5959	2035.7061
328°19'38"	211.88 ft			
0		199+25.00	-6595.9186	2146.9574
342°47'16"	168.74 ft			
0		200+93.74	-6757.1016	2196.8895
11°21'34"	203.17 ft			
0		202+96.92	-6956.2917	2156.8725

356°02'01"	203.38 ft			
0		205+00.29	-7159.1846	2170.9405
3°29'29"	381.91 ft			
0		208+82.20	-7540.3857	2147.6828
18°41'14"	368.29 ft			
0		212+50.50	-7889.2601	2029.6820
32°46'44"	184.79 ft			
0		214+35.29	-8044.6253	1929.6370
41°14'46"	247.45 ft			
0		216+82.74	-8230.6791	1766.4945
46°48'20"	187.47 ft			
0		218+70.21	-8358.9979	1629.8223
65°28'52"	384.91 ft			
0		222+55.11	-8518.7330	1279.6218
73°07'13"	118.60 ft			
0		223+73.72	-8553.1701	1166.1315
108°01'23"	169.69 ft			
0		225+43.41	-8500.6681	1004.7678
125°49'17"	340.03 ft			
0		228+83.44	-8301.6620	729.0561
232°32'34"	61.38 ft			
0		229+44.82	-8264.3326	777.7800
168°09'41"	401.12 ft			
0		233+45.93	-7871.7446	695.4879
163°07'50"	71.05 ft			
0		234+16.99	-7803.7520	674.8698
173°59'06"	183.87 ft			
0		236+00.86	-7620.8943	655.6023
159°46'56"	137.91 ft			
0		237+38.77	-7491.4815	607.9420
134°59'31"	375.58 ft			
0		241+14.35	-7225.9437	342.3295

Closing latitude = 0.01617
Closing departure = -0.00938
Closing bearing = 329°52'36"
Closing distance = 0.01869
Total traverse length = 14298.40 (14298.41)
Total error of closure = 1/764942
Error of closure in latitude = 1/884381
Error of closure in departure = 1/1524198

Area = 1479733.07 Sq. Ft.
Area = 33.9700 Acres

EXHIBIT 3

Metes and Bounds Description
Parcel 74 – Quarry Area

CLOSURE REPORT

Coordinate values shown are computed based on the rounded bearing and distance,
or chord bearing and chord lengths as indicated herein.

Boundary Name: PARCEL 74 - QUARRY AREA

Point Number	Description	Sta	Northing	Easting	Elevation
	Bearing	Distance			
0		0+00.00	-7214.9526	347.5303	
	158°02'16"	273.84 ft			
0		2+73.84	-6960.9850	245.1154	
	96°33'13"	33.48 ft			
0		3+07.32	-6957.1639	211.8542	
	157°24'41"	135.97 ft			
0		4+43.29	-6831.6246	159.6265	
	142°30'06"	75.06 ft			
0		5+18.35	-6772.0742	113.9346	
	163°33'13"	43.02 ft			
0		5+61.37	-6730.8143	101.7549	
	195°18'03"	103.15 ft			
0		6+64.53	-6631.3206	128.9748	
	164°24'33"	110.54 ft			
0		7+75.07	-6524.8479	99.2655	
	214°37'26"	140.21 ft			
0		9+15.28	-6409.4691	178.9310	
	195°02'03"	52.17 ft			
0		9+67.45	-6359.0848	192.4636	
	207°30'16"	115.51 ft			
0		10+82.96	-6256.6303	245.8081	
	234°31'56"	51.21 ft			
0		11+34.17	-6226.9160	287.5157	

203°01'06" 76.27 ft
0 12+10.44 -6156.7186
317.3392
175°28'44" 25.53 ft
0 12+35.97 -6131.2681
315.3268
158°32'39" 124.93 ft
0 13+60.89 -6014.9957
269.6294
152°22'57" 120.46 ft
0 14+81.36 -5908.2607
213.7882
119°29'16" 153.17 ft
0 16+34.52 -5832.8646
80.4597
198°12'51" 51.27 ft
0 16+85.80 -5784.1635
96.4851
271°30'09" 46.97 ft
0 17+32.76 -5785.3951
143.4390
251°26'11" 60.82 ft
0 17+93.58 -5766.0326
201.0946
259°37'57" 98.95 ft
0 18+92.53 -5748.2255
298.4291
239°07'30" 83.92 ft
0 19+76.45 -5705.1605
370.4567
175°24'16" 53.65 ft
0 20+30.10 -5651.6830
366.1582
241°34'26" 34.87 ft
0 20+64.97 -5635.0840
396.8240
181°15'54" 89.21 ft
0 21+54.19 -5545.8957
398.7934
190°08'16" 94.97 ft
0 22+49.16 -5452.4085
415.5096
237°03'49" 42.63 ft
0 22+91.78 -5429.2302
451.2879
261°06'24" 64.99 ft
0 23+56.77 -5419.1831
515.4966
289°42'21" 49.09 ft
0 24+05.86 -5435.7358
561.7117
269°50'53" 100.20 ft

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       0                          25+06.06   -5435.4700
661.9114
        296°31'11"      69.75 ft
       0                          25+75.81   -5466.6138
724.3223
        287°44'19"      58.40 ft
       0                          26+34.21   -5484.4068
779.9458
        277°27'11"     151.80 ft
       0                          27+86.01   -5504.0974
930.4633
        263°05'58"     100.69 ft
       0                          28+86.71   -5491.9999
1030.4239
        273°29'04"     126.32 ft
       0                          30+13.02   -5499.6773
1156.5104
         25°15'00"    1896.48 ft
       0                          49+09.51   -7214.9584
347.5313

-------------------------------------------------------------------
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Closing latitude                = -0.00573
Closing departure               = 0.00101
Closing bearing                 = 169°58'38"
Closing distance                = 0.00582
Total traverse length           = 4909.50  (4909.51)
Total error of closure          = 1/843562
Error of closure in latitude    = 1/856635
Error of closure in departure   = 1/4846893

Area                            = 914569.55 Sq. Ft.
Area                              = 20.9956 Acres
```

EXHIBIT 4

Metes and Bounds Description
Parcel 74 – Landscape Grading Area

CLOSURE REPORT

Coordinate values shown are computed based on the rounded bearing and distance, or chord bearing and chord lengths as indicated herein.

Boundary Name: **PARCEL 74 - LANDSCAPE GRADING AREA**

Point Number	Description	Sta	Northing	Easting	Elevation
	Bearing Distance				
0		0+00.00	-7750.8577	94.7810	0.00
	193ø58'58" 294.54 ft				
0		2+94.54	-7465.0454	165.9508	0.00
	149ø36'12" 260.52 ft				
0		5+55.07	-7240.3357	34.1319	0.00
	166ø53'01" 78.74 ft				
0		6+33.80	-7163.6499	16.2635	0.00
	157ø39'31" 70.91 ft				
0		7+04.71	-7098.0628	-10.6911	0.00
	155ø11'14" 55.68 ft				
0		7+60.39	-7047.5229	-34.0575	0.00
	140ø22'45" 98.71 ft				
0		8+59.10	-6971.4885	-97.0053	0.00
	163ø12'44" 164.52 ft				
0		10+23.62	-6813.9801	-144.5232	0.00
	144ø27'30" 172.08 ft				
0		11+95.69	-6673.9598	-244.5524	0.00
	162ø31'23" 76.19 ft				
0		12+71.88	-6601.2869	-267.4339	0.00
	178ø31'10" 167.48 ft				
0		14+39.36	-6433.8628	-271.7612	0.00
	217ø11'45" 268.72 ft				
0		17+08.08	-6219.8075	-109.3089	0.00
	176ø18'55" 228.26 ft				
0		19+36.34	-5992.0194	-123.9783	0.00
	136ø20'45" 168.28 ft				
0		21+04.63	-5870.2655	-240.1427	0.00
	88ø13'54" 265.60 ft				
0		23+70.22	-5878.4615	-505.6162	0.00
	129ø55'40" 114.57 ft				
0		24+84.79	-5804.9280	-593.4747	0.00
	171ø29'56" 257.61 ft				
0		27+42.40	-5550.1483	-631.5568	0.00
	179ø55'35" 156.37 ft				
0		28+98.77	-5393.7785	-631.7577	0.00
	251ø39'39" 176.99 ft				
0		30+75.76	-5338.0901	-463.7569	0.00
	270ø00'00" 34.05 ft				
0		31+09.80	-5338.0901	-429.7069	0.00
	290ø08'02" 140.92 ft				
0		32+50.72	-5386.5969	-297.3984	0.00
	214ø15'35" 66.60 ft				
0		33+17.32	-5331.5523	-259.9062	0.00
	265ø20'00" 52.06 ft				
0		33+69.39	-5327.3168	-208.0188	0.00
	284ø51'48" 55.34 ft				
0		34+24.72	-5341.5123	-154.5305	0.00
	258ø41'49" 150.25 ft				
0		35+74.97	-5312.0635	-7.1947	0.00
	253ø47'33" 143.91 ft				
0		37+18.89	-5271.8958	130.9959	0.00

200ø39'16"	151.11 ft			
0		38+69.99	-5130.4985	184.2971	0.00
188ø47'46"	86.32 ft			
0		39+56.32	-5045.1937	197.4970	0.00
154ø14'09"	197.46 ft			
0		41+53.78	-4867.3630	111.6675	0.00
148ø10'35"	42.80 ft			
0		41+96.58	-4830.9969	89.0988	0.00
195ø35'28"	103.63 ft			
0		43+00.21	-4731.1801	116.9515	0.00
190ø25'38"	144.47 ft			
0		44+44.68	-4589.0959	143.0986	0.00
303ø08'12"	91.11 ft			
0		45+35.79	-4638.9001	219.3913	0.00
267ø14'41"	77.09 ft			
0		46+12.89	-4635.1944	296.3922	0.00
278ø37'56"	43.12 ft			
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255ø18'16"	140.54 ft			
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262ø14'38"	94.52 ft			
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319ø09'37"	183.30 ft			
0		50+74.37	-4731.9317	688.4897	0.00
321ø51'50"	123.59 ft			
0		51+97.96	-4829.1410	764.8105	0.00
321ø55'34"	72.38 ft			
0		52+70.34	-4886.1197	809.4456	0.00
219ø00'40"	104.92 ft			
0		53+75.26	-4804.5943	875.4897	0.00
240ø11'00"	32.60 ft			
0		54+07.86	-4788.3847	903.7741	0.00
274ø16'05"	111.05 ft			
0		55+18.91	-4796.6494	1014.5162	0.00
312ø24'59"	31.08 ft			
0		55+49.99	-4817.6133	1037.4614	0.00
225ø00'16"	79.09 ft			
0		56+29.08	-4761.6925	1093.3908	0.00
244ø05'34"	21.20 ft			
0		56+50.28	-4752.4299	1112.4602	0.00
238ø42'43"	87.20 ft			
0		57+37.48	-4707.1434	1186.9785	0.00
256ø43'07"	19.89 ft			
0		57+57.37	-4702.5740	1206.3365	0.00
334ø45'29"	117.23 ft			
0		58+74.60	-4808.6103	1256.3282	0.00
304ø36'11"	108.84 ft			
0		59+83.44	-4870.4192	1345.9151	0.00
309ø14'11"	66.17 ft			
0		60+49.62	-4912.2731	1397.1666	0.00
225ø50'58"	63.58 ft			
0		61+13.19	-4867.9867	1442.7860	0.00
299ø15'58"	10.54 ft			
0		61+23.73	-4873.1394	1451.9807	0.00
25ø15'00"	692.59 ft			
0		68+16.33	-5499.5560	1156.5434	0.00
93ø29'04"	126.37 ft			
0		69+42.70	-5491.8755	1030.4071	0.00
83ø05'58"	100.69 ft			
0		70+43.39	-5503.9731	930.4464	0.00
97ø27'11"	151.78 ft			

0		71+95.17	-5484.2851	779.9487	0.00
107ø44'19"	58.38 ft				
0		72+53.55	-5466.4982	724.3443	0.00
116ø31'11"	69.77 ft				
0		73+23.32	-5435.3455	661.9155	0.00
89ø50'53"	100.20 ft				
0		74+23.52	-5435.6112	561.7158	0.00
109ø42'21"	49.10 ft				
0		74+72.62	-5419.0551	515.4913	0.00
81ø06'24"	65.04 ft				
0		75+37.65	-5429.1100	451.2332	0.00
57ø03'49"	42.69 ft				
0		75+80.34	-5452.3209	415.4046	0.00
10ø08'16"	95.02 ft				
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1ø15'54"	89.16 ft				
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61ø34'26"	34.88 ft				
0		77+99.41	-5651.5994	366.0367	0.00
355ø24'16"	53.65 ft				
0		78+53.06	-5705.0769	370.3352	0.00
59ø07'30"	83.84 ft				
0		79+36.90	-5748.1008	298.3762	0.00
79ø37'57"	98.94 ft				
0		80+35.84	-5765.9061	201.0516	0.00
71ø26'11"	60.81 ft				
0		80+96.65	-5785.2655	143.4055	0.00
91ø30'09"	47.02 ft				
0		81+43.67	-5784.0326	96.4016	0.00
18ø12'51"	51.43 ft				
0		81+95.10	-5832.8857	80.3262	0.00
299ø29'16"	153.22 ft				
0		83+48.32	-5908.3063	213.6982	0.00
332ø22'57"	120.43 ft				
0		84+68.75	-6015.0148	269.5255	0.00
338ø32'39"	124.91 ft				
0		85+93.66	-6131.2685	315.2156	0.00
355ø28'44"	25.49 ft				
0		86+19.15	-6156.6792	317.2248	0.00
23ø01'06"	76.22 ft				
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54ø31'56"	51.20 ft				
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27ø30'16"	115.54 ft				
0		88+62.11	-6359.0202	192.3631	0.00
15ø02'03"	52.16 ft				
0		89+14.28	-6409.3948	178.8330	0.00
34ø37'26"	140.24 ft				
0		90+54.52	-6524.7982	99.1505	0.00
344ø24'33"	110.56 ft				
0		91+65.08	-6631.2902	128.8652	0.00
15ø18'03"	103.15 ft				
0		92+68.23	-6730.7840	101.6453	0.00
343ø33'13"	43.07 ft				
0		93+11.30	-6772.0917	113.8392	0.00
322ø30'06"	75.06 ft				
0		93+86.36	-6831.6422	159.5311	0.00
337ø24'41"	136.02 ft				
0		95+22.38	-6957.2276	211.7779	0.00
276ø33'13"	33.48 ft				
0		95+55.86	-6961.0488	245.0392	0.00

	338ø02'16"	273.87 ft			
0			98+29.73	-7215.0442	347.4652	0.00
	25ø15'00"	592.38 ft			
0			104+22.11	-7750.8254	94.7744	0.00

Closing latitude = 0.03238
Closing departure = -0.00657
Closing bearing = 348ø31'22"
Closing distance = 0.03304
Total traverse length = 10422.09 (10422.11)
Total error of closure = 1/315408
Error of closure in latitude = 1/321843
Error of closure in departure = 1/1585155

Area = 1898303.20 Sq. Ft.
Area = 43.5790 Acres

MAKAKILO QUARRY
(Tax Map Key 9-2-3: 82)
CONDITIONAL USE PERMIT NO. 72/CUP-15
ENGINEERING REPORT AMENDMENT

Prepared for:

GRACE PACIFIC CORPORATION
P.O. Box 78
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Prepared by:

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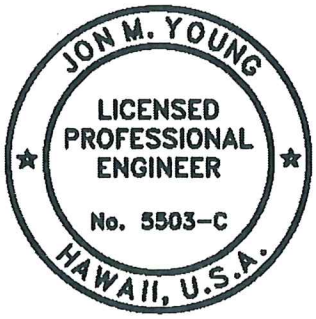
April 2007
and Amended May 2008



This work was prepared by me or under my supervision.
April 30, 2008
Expiration Date of the License

ENGINEERING REPORT AMENDMENT

TABLE OF CONTENTS

APPENDICES

1. INTRODUCTION

1.1 PURPOSE

This Makakilo Quarry Engineering Report, dated April 2007 and amended May 2008 (the "April 2007 Report"), is prepared to assist Grace Pacific Corporation in its application for a modification to use permits 72/CUP-15 and 73/SUP-147, to allow the relocation and continuation of quarrying activities at Pu'u Makakilo (the "Application").

The original Makakilo Quarry Engineering Report was approved by the City and County of Honolulu Department of Planning and Permitting on October 19, 1998 (the "1998 Report"). The 1998 Report was prepared to satisfy Condition no. 2 of City Council resolution 95. An amendment was made to the 1998 Report in March of 2004 (the "2004 Report"). The 2004 Report dealt largely with the retention of run-off within the property, visual mitigation and landscaping.

While this report is written to be a free-standing document, a review of the 1998 Report and the 2004 Report is of value in understanding the current operations. These reports are included as Exhibit J of the Application.

1.2 SITE DESCRIPTION

The James Campbell Company owns the land under the Makakilo Quarry (Tax Map Key 9-2-3:82), and licenses it to Grace Pacific Corporation for quarry operations. The license agreement expires in the year 2017. Subject to the approval of the Application, Grace Pacific has negotiated with Campbell for an extension of the license to 2032.

The quarry is situated on the slopes of Pu'u Makakilo. The west bound lanes of the H-1 Freeway front the southeast side of the property. The area makai of the H-1 Freeway is used as a processing site for quarry, but its operations are not included in this report.

Pu'u Makakilo Inc., a subsidiary of Grace Pacific Corporation, owns the property surrounding the existing quarry. The land is characterized as dry-range land with poor, scrub-type vegetation on greater than 10 percent slopes.

2. GRADING PLAN

2.1 GRADING

The attached grading plan (Figure 4, Appendix B) shows the proposed final grades prior to reclamation of the quarry in the year 2032. The plan maximizes the excavation of the known basalt reserve while minimizing visual and environmental impacts to the surrounding community.

The southeast boundary of the quarry, which consists of undisturbed ridges and gullies, parallels the H-1 freeway. This area serves as a buffer and will remain undisturbed,

providing a noise and visual barrier from the freeway. The quarry sides and mauka face will utilize slopes averaging flatter than 1.5 (horizontal) to 1 (vertical) and undulating faces to minimize the appearance of a man-made landform. The existing quarry floor will gently slope from the back and sides to the front at approximately a 2% grade. The floor of the proposed mauka quarry area will be steeper, at 15% to 25%, matching the gradients of the existing Pu'u formation.

Restoration grading recommendations prepared by a geotechnical engineer are attached as Appendix A. Several key methods are recommended to provide an adequate foundation for access roads, residential and light loaded commercial development. Excess stockpile material, 1 inch minus, may be used for landscape restoration provided the material contains or is amended with proper portions of organics, sand and silts.

The proposed relocation of the quarry extends up the Pu'u from existing lower elevations between 500 feet to 550 feet to an upper elevation of 700 feet. An access road running across the 350 foot elevation of Parcel 82 will be constructed to allow vehicle access from the southwest portion of the 312 acre parcel (TMK 9-2-3-74) to the northeast portion of the parcel.

As part of this proposal, two drainage basins will be constructed within the lower active pit for runoff retention. There is only minimal additional run-on arising from this proposal, representing runoff from the southwestern portion of the berm that is to be constructed on the northeast boundary. Today, approximately one-half of the runoff in the vicinity of the proposed berm finds its way into the Kaloi Gulch watershed.

Two new landforms will be created from the 475 foot to 700 foot elevations in conjunction with the relocation of quarrying activities. On the southwest boundary, the ridgeline of the Puu will be cut and graded by up to 50 feet to reduce the visual impact of the quarrying, as seen from the H-1 freeway on the approach to Kapolei. For the same reason, Grace Pacific will construct a ridge-like berm extending from the northeastern ridge of the Puu. This berm will range in height from 15 feet to 100 feet above the existing ground. The berm will be constructed with flatter than 2:1 horizontal to vertical slopes. In addition, the bowl of the Puu, in the 700 foot to 800 foot elevation, will be restored to its pre-golf, gullied appearance.

The quarry sides and mauka face will consist of slopes of averaging greater than a 1.5 to 1 horizontal to vertical proportion to reach the desired depths of approximately 200 feet below the existing ground surface. Quarrying to such slopes arguably leaves good material in the ground, but success in achieving visual mitigation in the land forming and revegetation processes is deemed a greater benefit. Over-excavation on the quarry floor will be necessary in some areas to follow rock deposits. Such over-excavation will be filled and compacted to achieve the desired final grades. See Figures 4, 5a and 5b of Appendix B for a detailed look at the slopes along the sides and mauka face of the proposed quarry area.

2.2 ALTERNATIVE FLOOR RECLAMATION

If post-closure development plans deem it desirable, the quarry can be indirectly reclaimed to increase infiltration. After the quarry has been shaped to match the grading plan, the pit floor can be regraded to produce a rough, irregular surface. This method will increase water infiltration and slow erosion by keying the replaced soil into the substrate. This can be achieved by either blasting or ripping the pit floor. Since this quarry is hard rock quarry, blasting is the appropriate method to fracture the pit floor so that water can drain slowly and roots can penetrate. A good technique is to blast an extra 10 feet during the last production round and leave some of the fractured material in place.

2.3 BENCH RECLAMATION

Under the May 2008 Revised Grading Plan several areas of the existing quarry will be left with traditional 25 foot wide benches and 50 foot high faces. In these cases, the benches will be sloped toward the high wall to help trap moisture and soil. Topsoil will be placed on the benches and planted. Other methods may be used to break up the linear features including performing post-production blasting to form staggered benches. Strategic blasting can create chutes, spurs, and rough vertical cliff faces can be created. The desired effect depends on the rock type, structural geology, and blasting agent from a choice of blast patterns, delays, and stemming depths. The appropriate methods will be chosen only when final quarry grades are achieved and rock faces can be evaluated. Appendix E presents the current revegetation plan for screening and restoration of the quarry.

3. DRAINAGE PLAN

3.1 DRAINAGE PLAN

3.1.1 METHOD

The intent of the Makakilo Quarry drainage plan is to reduce the amount of stormwater run-on and minimize the impacts of run-off on the quarry as well as downstream. Elements of the drainage plan are detailed in Appendix C.

The method used in this report to calculate required storage uses the total rainfall depth from the design storm. This number is multiplied by the drainage area to yield the total required storage. See Appendices C-1 through C-4 for rainfall storage calculations.

The depth of recorded rainfall for a 100-year storm with a 24-hour duration was extracted from the State Hawaii Department of Land and Natural Resources, Division of Water Land Development, "Rainfall Frequency Study for Oahu, Report R-73", 1984. The applicable page from this reference is included in Appendix B, as figure 1.

3.1.2 EXISTING DRAINAGE

The existing upper quarry covers 94 acres of the Makakilo Pu'u. The slopes of Pu'u Makakilo generate approximately 148 acres of rainfall into the existing quarry area. Figure 2 of Appendix B shows the extent of the existing drainage area.

Twoe existing drainage basins located near the bottom elevation of the quarry create the necessary storage capacity for a design 100-year 24-hour storm. They are DB#1 and DB#2. The required storage was calculated to be 151.9 ac-ft. See Appendix C-1 for required storage calculations. The volume capacity of the three drain basins is 175 ac-ft.

3.1.3 Quarry Drainage with Relocation of Quarry

The relocated quarry extends mauka within the northeast and southwest trending ridges of Pu'u Makakilo. See Figure 4 of Appendix B for the proposed relocation of quarrying activities. The total proposed area plus the offsite area contribution totals 170.0 acres. This includes the rainfall from the southwestern face of the new berm. See Figure 3 of Appendix B for the developed drainage arising from the proposed relocation of the quarry. On-site storage capacity of 174.3 ac-ft is needed for the increased runoff surface. Free board at this rainfall capacity will be 2 feet. See Appendix C-2 for calculations.

The limit of grading runs along the outer ridge of the Pu'u on the southwest side of the quarry. Runoff generated outside the limit of grade will fall away naturally from the quarry. On the northeast, a new berm will be constructed. As a result, no measures are necessary to divert offsite runoff from the northeast and southwest limits of the relocated quarry. Subsequently, run-on generated from the northwestern edge of the relocated quarry will be handled by the three drainage basins.

The flow off of the northeastern berm face is 18.33 cfs and will continue to flow along the existing flow patterns.

3.1.4 Conclusion

The intent of the Makakilo quarry drainage plan is to reduce the amount of storm water entering the site and fully retain all the storm water runoff within the upper quarry.

The two existing basins (DB#1 and DB#2) with capacity of 175 ac-ft sufficiently store the 174.3 ac-ft (100-yr storm) of required by the expansion. A 100-yr storm at 174.3 ac-ft of rainfall will reach hydrological water levels of 253 ft. The surrounding berm height at the 96" culvert is at elevation 255 ft. This results in 2' of freeboard. The existing slopes along the southwestern edge of the quarry will convey runoff away along its natural existing flow pattern preventing offsite runoff from entering the site.

The berm on the northeastern edge of the proposed quarry will serve as an offsite runoff diversion. The southwestern face of the berm will produce approximately 18.33 cfs of runoff and will follow existing flow patterns. The existing area (under the site of the proposed berm) generates approximately 18.33 cfs, therefore there is no net increase in runoff generated by the construction of the berm. The direction of flow of this 18.33 cfs of runoff will continue along the same direction as the existing flows.

Overall, no additional flows will be added to outside drainage patterns. Runoff will be contained within the quarry limits. The quarry relocation project will have no adverse impact on adjacent properties or existing downstream drainage systems.

3.2. EROSION CONTROL PLAN

Minimizing or eliminating water-quality problems by mechanical or operational means is generally described as a *best management practice* (BMP). BMPs can be classified as either short- or long-term with considerable overlap existing between the two. Also, erosion controls at a site will likely change over time as the configuration of the site changes. The best strategy for stormwater control is to divert stormwater around the quarry and into an existing drainage. However, in the absence of such diversion, once stormwater has entered a quarry, a very effective control technique during ongoing operations is to develop numerous sumps or low areas to disperse stormwater. These low areas collect sediments and allow stormwater to infiltrate into the ground.

The runoff created within the Makakilo quarry expansion will be retained, therefore no soil loss is expected within the quarry expansion.

Proper erosion control measures will be implemented during the construction of the new berm. The northeastern face of the berm measures to be approximately 5.7 acres. Flow generated during a 10-year storm for this area would be 18.33 cfs.

Silt fences will be installed along the toe of the berm slope down stream of drainage pattern flow. Geotextile fabrics will be installed along the berm slopes, in order to stabilize the bare slopes while the grassing is being established. Other methods include mulching, straw bales, silt fences, jute matting, and plastic coverings. Mulching, matting, and plastic covering are good methods to reduce rain drop erosion especially on slopes; while straw bales and silt fences are designed to prevent fully or rill erosion of long overland areas such as swales.

The quarry is exempted from complying with the *City and County of Honolulu, Soil Erosion Standards and Guidelines, November 1975. (Chapter 23. Grading, Soil Erosion and Sediment Control).* However, Grace Pacific. will use the guidelines, as appropriate, in its erosion control activities at the site.

3.3. WATER QUALITY

No discharge is expected from the quarry. The site has been designed to fully contain runoff for a 100-year storm event.

The newly constructed berm will produce runoff that will flow towards Kaloi Gulch but the quantity of flow will not be in excess of what was already conveyed in the same area. Industrial activity will not take place within the berm area.

4. 2007 REVEGETATION PLAN

4.1 PURPOSE OF THE PLAN

The purpose of the Plan is to address the visual mitigation and revegetation of the areas affected by the proposed relocated quarry while operating (2007-2032), and the post-closure revegetation efforts beginning in 2032.

The Plan assumes the final landforms described in the Grading Plan section of this report. See Figures 4, 5a, 5b, and 6 of Appendix B.

The tools of the Plan are landforms and re-naturalization (or "revegetation"). The key elements of the Plan are:

1) the use of the existing ridges and man-made berms as effective visual screens of quarry activities and quarry faces;

2) for quarried faces not able to be screened, minimizing the man-made appearance of the final contours is preferable from a visual standpoint; and

3) the re-naturalization of man-made berms and quarried faces with drought tolerant vegetation, mixed and placed to blend with that existing on the Puu, is the most water-efficient and effective approach to long term landscape management.

The Proposed Use affords an opportunity an opportunity to improve upon several aspects of the 2004 Revegetation Plan. The existing excavation area is completely screened from view from the Kapolei Regional Park towards Ko Olina by a ridge on the southwest boundary. This aspect will be retained. A ridge and berm along the H-1 freeway at the 275 foot elevation screens the close-in views from Farrington Highway in the vicinity of Kapolei Knolls around to Palehua Road. This aspect will also be retained.

The intermediate and distant views from the Villages of Kapolei and Kalaeloa (formerly BPNAS) presently are that of a 2,400 foot wide active quarry face with a visible height of 250 feet (from elevation at 275 feet to 525 feet). The proposed excavation activity will quarry upslope through this quarry face and leave a bowl-shaped landform 700 feet further mauka, complementing the existing bowl of the Puu. The exposed face of the bowl (prior to revegetation) will be 200 feet in height (from elevation at 500 feet to 700 feet). The top of the Pu'u is at an elevation of 980 feet. What is presently the quarry face will become the quarry floor (from elevation at 275 feet to 500 feet), which as a landform, will be readily revegetated.

The intermediate and distant views from Ewa and Waipahu, while not viewing the existing active face head-on, will benefit from the move mauka and the bowl-shaped final landform.

The weak ridge on the northeast boundary of the proposed excavation area will expose the southwest quarry face on the approach to Kapolei on the H-1 Freeway from Kunia Road to the vicinity of the proposed North South Road Interchange. To mitigate this visual impact, Grace Pacific is proposing to lower the southwest ridgeline by approximately 50 feet

in elevation and to build a berm on the northeast ridgeline of approximately 75 feet in height. The net effect of these actions will be to leave no more than 100 feet of the southwest face unscreened. Further, it is planned to grade the unscreened face with slopes averaging flatter than 1.5 to 1 (horizontal to vertical slope) to facilitate the revegetation effort.

4.2 GOALS AND OBJECTIVES

Minimize or eliminate the visual recognition of the quarry from off-site locations. Through the re-establishment of plant material and careful excavation of exposed rock areas, it is the intent of this Plan to either screen or "visually blend" wherever possible exposed areas of the site. "Visual blending" is based on the use of appropriate plant material and grow-in procedures.

Screen the quarry machinery and equipment from public view. Placing the quarry machinery and equipment on the Quarry floor effectively screens it from the public view. The quarry floor will be at a 245-foot elevation, which will be at least 70 feet below the quarry rim.

Minimize the long-term use of irrigation water. Although all plant materials require water for establishment and to survive, this plan recommends a minimum of water consumption through the use of drought-tolerant species and growth in procedures that are designed to acclimate plants to dry conditions.

Minimize long-term maintenance in the re-naturalized areas. On the same basis in which irrigation water use is being minimized, recommendations are geared towards the long term, low maintenance requirements of the quarry environment. Plant materials will be selected based on ability to survive with minimal maintenance for the two-year establishment period. These plants ultimately will naturalize into the existing vegetation and survive without regular maintenance. See Exhibits 3 of Appendix E for the Recommended Plant Palette. See Exhibits 4 and 5 of Appendix E for the Revegetation Matrix and Revegetation Phasing Plan arising from the Proposed Use.

Avoid an "engineered appearance" to the completed project. In regards to the arrangement and appearance of the plant materials and rock walls, it is the intent of this plan to convey the importance of using irregular forms wherever possible. No straight row plantings will occur anywhere within the site or at the site boundary, including the benches. Clusters of plant materials and benches of varying shapes, orientation and dimension will be used to create a more natural appearance.

Quickly establish a re-naturalized appearance. Plant materials that are currently surviving on the site without irrigation provide a guide to those plants that will survive in the hot, windy and dry climate of the site and should be considered for use. Plant materials with a fast growth rate and hardy nature will be used so that screening and slope stabilization can occur as quickly and effectively as possible. Plant materials that have strong colors and textures and would not visually blend in with the

naturally occurring grasses and lightly textured and colored trees found in neighboring areas will not be used. See Exhibit 3 of Appendix E for recommended Plant Palette.

Activities will not disturb protected areas of the site. All areas, which are not intended for quarry development, will be left undisturbed. These areas will serve as the benchmark and guide for the appearance of the quarry re-naturalized areas when that work is done. See Exhibit 1 of Appendix E for photos of undisturbed lands on the surrounding Puu Makakilo slopes.

Minimize costs associated with the re-naturalization efforts. The plan strives to minimize short and long-term costs associated with the re-naturalization. Seed or seedlings of many of the plant materials recommended can be propagated directly on-site and most are considered easy to grow. Many of the plant materials used will reseed themselves and spread on their own eliminating the potential need for periodic follow-up plantings. Typically smaller container size trees will be planted because they more readily adapt to site conditions and because they are available at a relatively low cost. The irrigation system contemplated for use will require an initial cost and some on-going costs for maintenance but will lower the potential long-term costs of replanting during extremely dry periods. Test plots will be used on-site to test varying seed mixes and maintenance practices to improve the chances of success and to fine tune a cost effective planting and low maintenance approach.

4.3 Site Opportunities and Constraints

Site opportunities and constraints are summarized below:

Natural ridgelines screen views. The ridge on the Makakilo side of the quarry completely screens distant, intermediate and close-up views of the quarry from the Makakilo residential neighborhood (Exhibits 2-1 and 2-2 of Appendix E) to the Kapolei Regional Park; The ridge on the Waipahu side of the quarry screens intermediate and close-up views of the quarry face, as seen from the intersection of Farrington Hwy and the old Palehua Road (Exhibit 2-3 of Appendix E). The western quarry face is visible from the distant view at the H-1/Kunia intersection (Exhibit 2-4 of Appendix E). The lowering of the elevation of the southwest ridge and construction of a berm on the northeast ridge will mitigate the effects of the proposed excavation area on this distant view. See Exhibit 2-0 of Appendix E for a map of screening zones and photograph vantage points.

Berm above H-1 freeway screens views into Upper Quarry. The existing H-1 freeway cut faces and the intervening gullies of Puu Makakilo serve to screen close-up views of the quarry from the H-1 and Farrington Hwy (Exhibit 2-5 of Appendix E). The quarry face is visible from intermediate views such as Kapolei Golf Course (Exhibit 2-6 of Appendix E) and the Villages of Kapolei (Exhibit 2-7 of Appendix E) and from distant views, such as the Ewa Golf Course (Exhibit 2-8 of Appendix E). See Exhibit 2-0 of Appendix E for a map of screening zones and photograph vantage points.

Puu Makakilo screens views from Upper Makakilo. Puu Makakilo completely screens views of the quarry from the residents of upper Makakilo (Exhibit 2-9 of Appendix E).

The variation of colors of the quarry face rock and surrounding natural vegetation. Distant views of the quarry are indistinct due to moving cloud shadows and the mottled appearance of the quarry rock and cinder. Much of the existing quarry face rock and surrounding vegetation has an uneven gray-brown to blue color from a distance. This unevenness helps to break up the line of the quarry faces and benches.

Color/Texture. During the dry season, the surrounding area vegetation is brown to yellow in color. During the rainy season, the plants are grayish-green with occasion splashes of yellow. Textures vary among the vegetation found on site, but generally smaller, finer textured plants appear to predominate visually rather than broad-leafed ones. Brightly colored plants, such as Bougainvillea, should be avoided, as they attract attention, rather than diffuse it.

Types of plants. The plants existing on site have volunteered naturally. These plants include a wide variety of shrubs, groundcovers, and grasses. None of the established plants on site receive any permanent irrigation. Therefore, only the hardiest and drought tolerant plants tend to survive. All proposed plants should be extremely drought-tolerant, and require minimal water after establishment. See Plant Palette, Exhibit 3 of Appendix E.

Volunteer/Natives. Many volunteered or native plants are very drought tolerant and hardy. Many are considered "weeds" in ornamental landscapes, but on this site they cover the ground and minimize erosion. However, there are a few noxious weeds and toxic plants that should be eliminated. An example of this is the Tree Tobacco (Nicotiana glauca), which is poisonous to man and to livestock.

Source of irrigation water. Grace Pacific Corporation has a well at its Processing Site with an allocation of 168,000 GPD. Water from this well is pumped to the Upper Quarry and stored in tanks near the primary crusher. Portable water tanks may be located on the upper benches and supplied by water wagons.

The Revegetation Matrix and Revegetation Phasing Plan (Exhibits 4 and 5 of Appendix E) assume the availability of approximately .200 mgd of water for all quarry purposes (Processing Site well plus Board of Water Farrington Hwy meters). Of this amount, the Revegetation Plan targets .050 mgd or less for revegetation purposes. This limitation on supply serves as a constraint on the speed by which quarried land and land graded for visual mitigation purposes may be revegetated.

Climate. Rainfall is historically less than 20 inches per year, and usually occurs between the months of December and February. Prevailing trade winds are from the northeast and can be quite strong. Temperatures are very high, with summer

average highs in the mid to high 90's and winter average highs in the lower 80's. The average annual humidity ranges from 65% in the summer to 75% in the winter.

Agricultural soils analysis. Soil tests on quarry benches and the slopes surrounding the quarry suggest that existing site soils are high in sodium and magnesium, and low in calcium, phosphorous, iron and zinc. With proper amendments re-naturalization can occur readily given the soils present on-site. Toxic concentrations of boron and magnesium have been found in certain areas of the site. These areas will require the addition of Gypsum to bind the toxic materials in the soil.

4.4 LANDSCAPE DEVELOPMENT PLAN

Quarry Floor. The quarry floor will encompass an area of approximately 107 acres. This area makes up the lower ground plane or base of the quarry. It is understood that this base area of the quarry may be developed in the future, however until the specific development plan has been determined, the area will be planted with grasses and ground covers to control dust and erosion. The floor of the quarry with elevations below 300 feet will be hidden from view and will have no visual impact from off-site locations.

Upon removal of Grace Pacific's plant and equipment in 2032, the first priority will be to establish a natural appearing grass/ground cover mix. The species already growing on site provide a good indication of species that will tolerate the harsh site conditions occurring in Makakilo. A carefully selected combination of grass/ground cover species that are fast growing, drought tolerant and will reseed or otherwise spread is recommended. Species will be combined to ensure that plants will establish within all of varying microclimates present on-site. The quarry floor soil materials may also need to be amended to provide nutrients and drainage. The ultimate planting plan for the quarry floor will depend upon the final land use determined by the James Campbell Company and Grace Pacific. For this reason no large landscape materials will be introduced within the quarry floor area.

Irrigation will be required to establish grasses and ground covers in the quarry floor area. Rotary impact heads will be used to establish the plantings for a period of approximately two years. Irrigation lines will be buried in shallow 4" trenches to protect then from UV and other damage and lengthen the usable life of the system. The irrigation system will be turned on periodically in times of drought to minimize potential fire hazards.

Mauka Quarry Faces. The most visible aspect of the quarry at its completion will be the faces above the 400 foot elevation up to the mauka perimeter. To mitigate the appearance of these faces, an undulating landform and a slope averaging flatter than 1.5 to 1 but allowing for significant variation will be created to render a more natural appearance than straight benches and slopes..

Because of the high exposed elevations that will be exposed, it not the intent of the revegetation plan to screen the entire face with trees but rather to soften the

exposed surfaces with grasses and shrubs. This treatment will create the illusion that these faces are naturally formed and aged. The excavation pattern for the quarry will emphasize the uppermost benches first. It will be very important to complete landscape work in conjunction with the quarrying process to ensure the landscape installation is not hindered due to conflicts with mining procedures. Soil and amendments will be added to the surfaces immediately after completion, as it may be difficult to add any soil later. Soils used in the work will come from on-site stockpiles where possible. If imported soils are used, they will be matched with the structure and characteristics of on-site soils and will be inspected to prevent the introduction of noxious weeds and insects.

The plant materials used would be fast growing, drought tolerant and self-spreading varieties. Random placement of tree and shrub groupings will be under the direction of a Landscape Architect to select appropriate variation and density of clusters. Clusters of larger plants such as Kiawe and Opiuma will be planted in specific areas. Large tree or shrub plantings will not be planted along the entire length of benches to avoid reinforcing unnatural horizontal lines.

Irrigation is required to establish plant material on the faces. It will be particularly critical that a sturdy system is in place (even though considered of temporary quality) because of the potential future access problems. A PVC line system is recommended with lower trajectory and narrower coverage area impact heads due to the strong prevailing winds. Where adjacent benches occur within 25' of elevation change of each other, it is possible that one row on the upper bench could irrigate both levels. This would be determined on a case-by-case analysis in the field. Irrigation will be implemented for a two-year grow-in period. Irrigation mainlines will be buried in shallow 4" trenches to protect from UV and lengthen the usable life of the system. The irrigation system will be turned on periodically in times of drought to minimize potential fire hazards. As field stock materials will be used on the benches, no drip irrigation will be required. See Exhibits 4 and 5 of Appendix E for the re-naturalization schedule.

Access Road. From the existing Quarry, the access road skirts the lower edge of the adjacent Puu Makakilo property, and then turns into Old Palehua Road, crossing under the H-1 and terminating at Farrington Highway. The visibility of the access road varies depending on where it is being viewed from and the particular segment of the road being viewed. Wherever possible undulating re-naturalized berms of 6 feet in height planted with grasses, groundcovers, trees and shrubs will be maintained to screen the access road from view. Earth mounds and rock material laid in natural patterns should be used in certain areas where highest visibility exists. A continuous landscape treatment along the road is not desirable (such as a row of trees or a long berm) and would serve to draw more attention to the roadway. A limited number of field stock trees are recommended to soften the most critical areas immediately. The irrigation system provided will consist of a rotor head system, which will remain in place for the duration of the use of the access road use to revitalize plant materials, which are affected, by heavy vehicle use. A temporary drip irrigation system will be used to establish the field stock materials for an approximate 12-month period.

Existing Buffer at H-1, the "Adjacent Area". The portions of the existing Quarry parcel flanking the quarry, but not used for quarrying, are termed the "Adjacent Area" in the license agreement with the James Campbell Company. The Adjacent Area for the most part is untouched and has a natural appearance with kiawe, hauole koa and naturally occurring grasses. It is the intent of this Plan to maintain this area in its entirety as it currently exists and to a substantial degree emulate this "look" as much as possible in the surrounding areas to be naturalized.

APPENDIX A

APPENDIX B

APPENDIX C

APPENDIX D

APPENDIX F

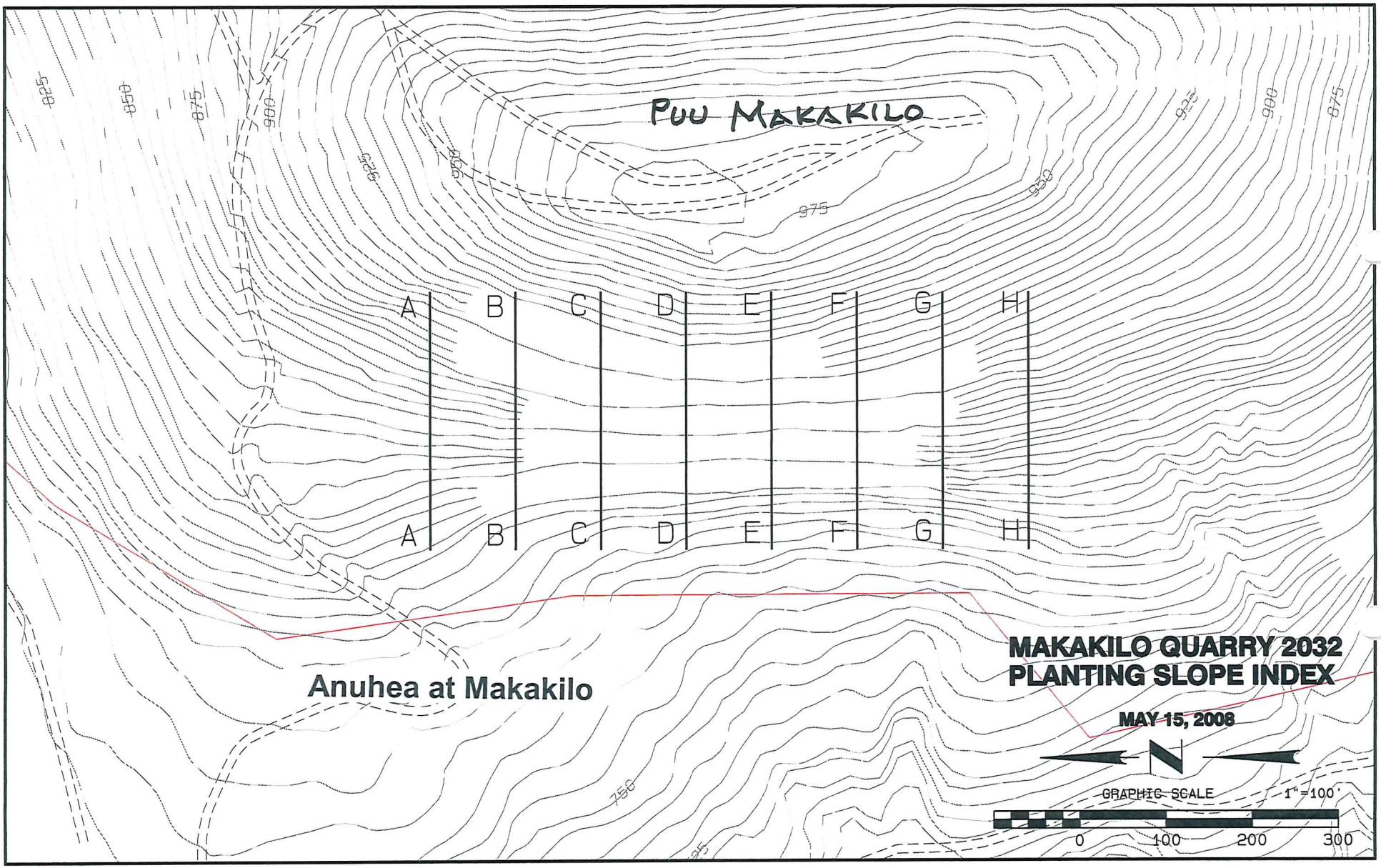
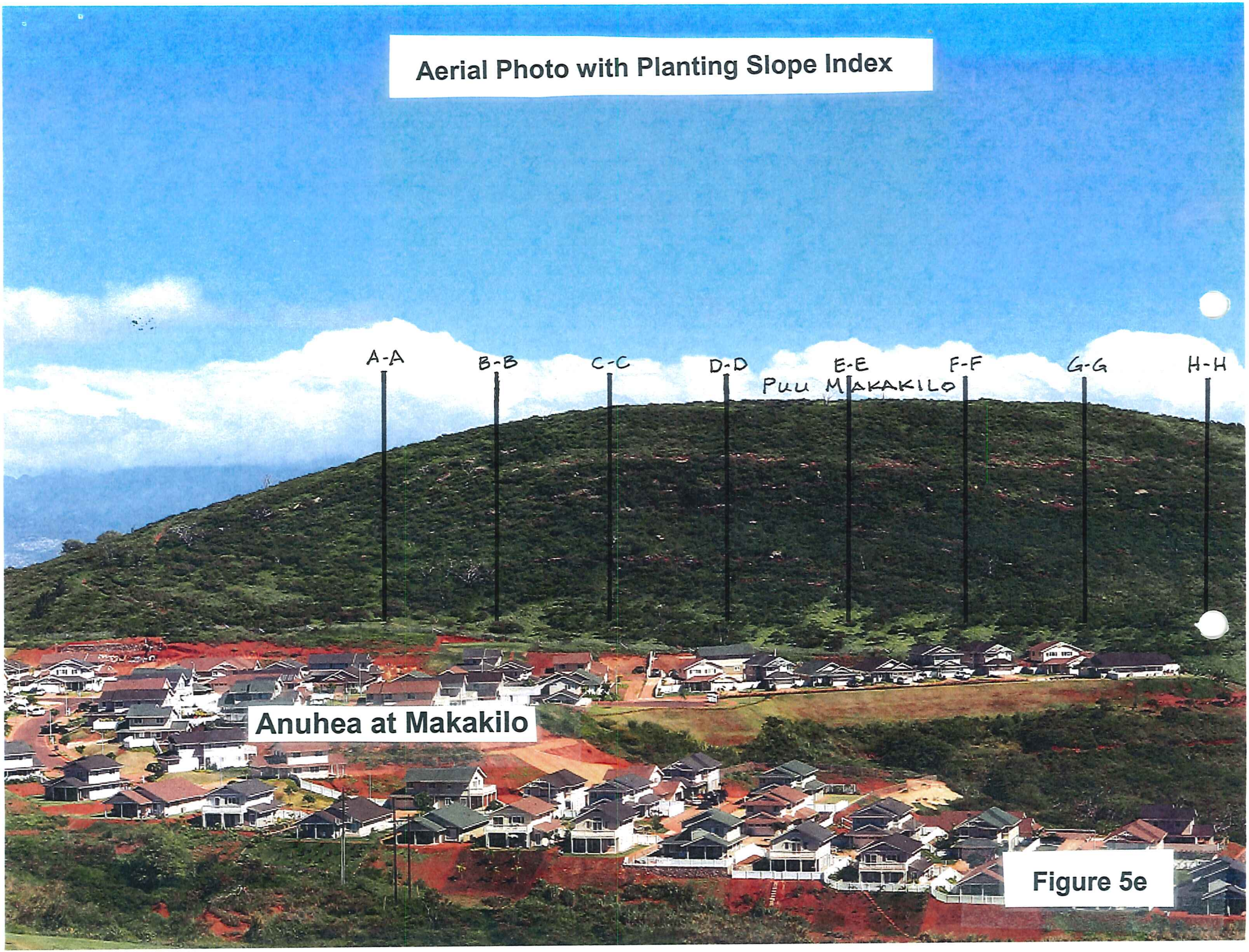
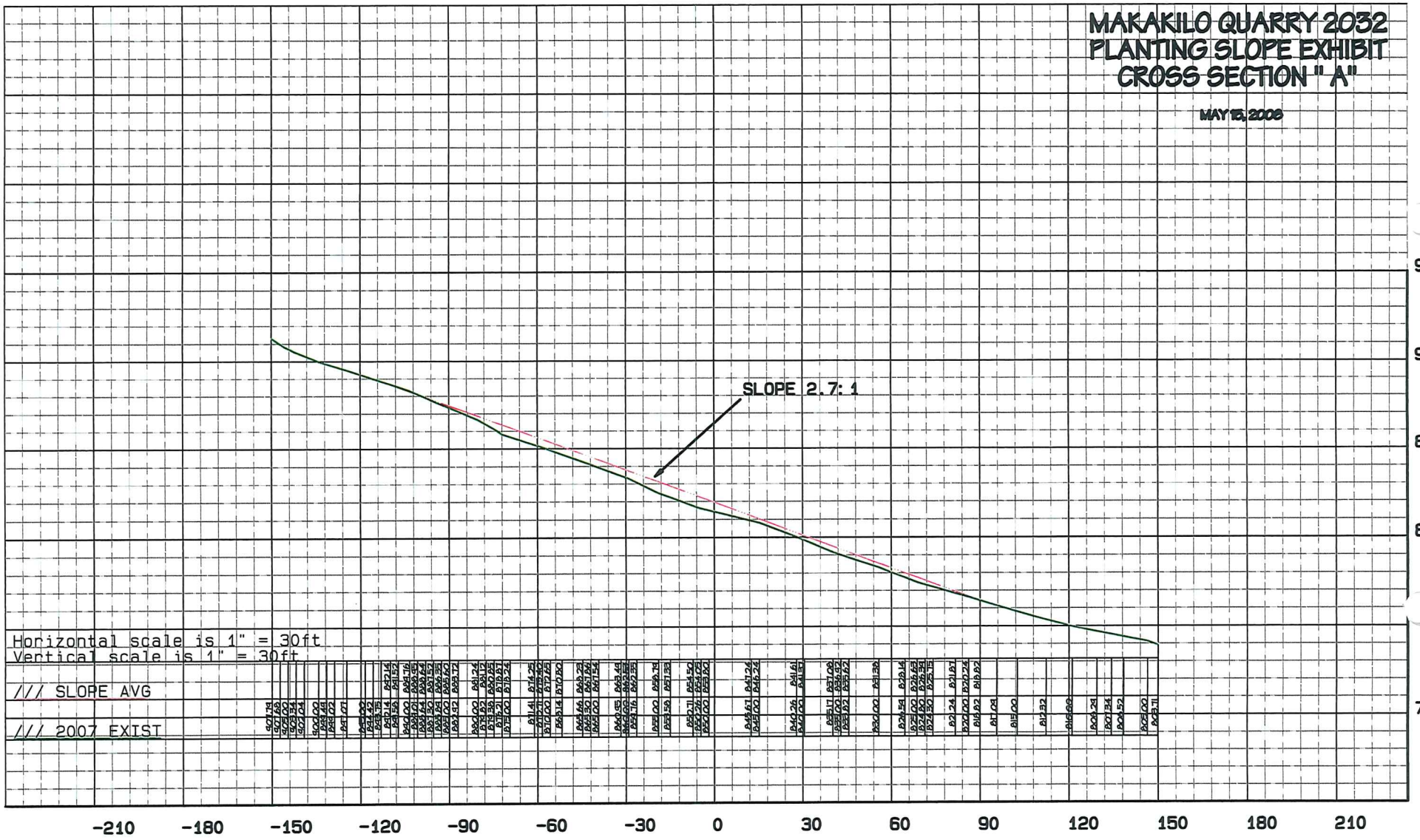

PUU MAKAKILO
A
B
C
D
E
F
G
H
Anuhea at Makakilo
MAKAKILO QUARRY 2032
PLANTING SLOPE INDEX
MAY 15, 2008
GRAPHIC SCALE
1" = 100'
0
100
200
300

Figure 5d


Aerial Photo with Planting Slope Index
A-A
B-B
C-C
D-D
E-E
F-F
G-G
H-H
Puu Makakilo
Anuhea at Makakilo
Figure 5e



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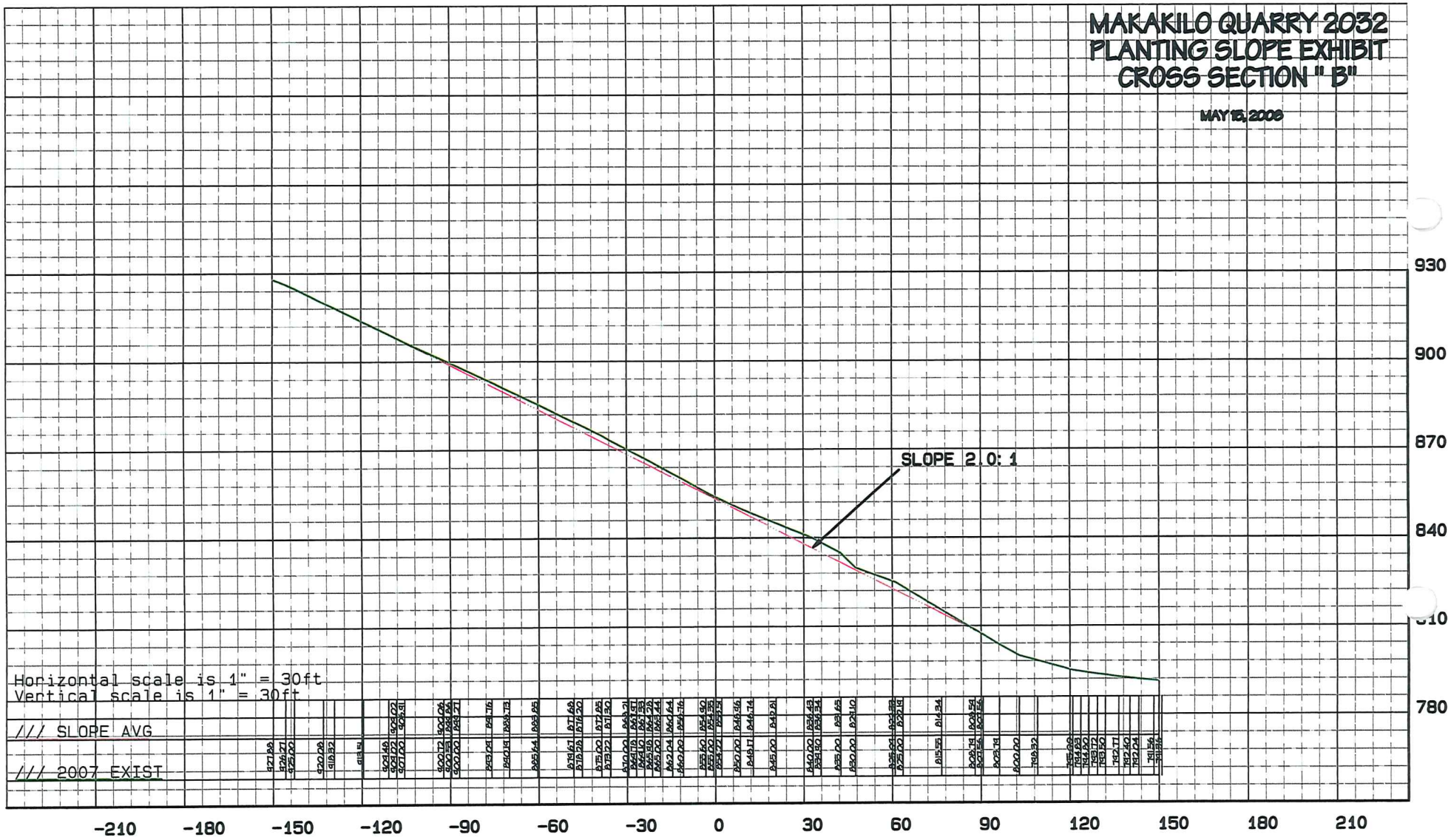

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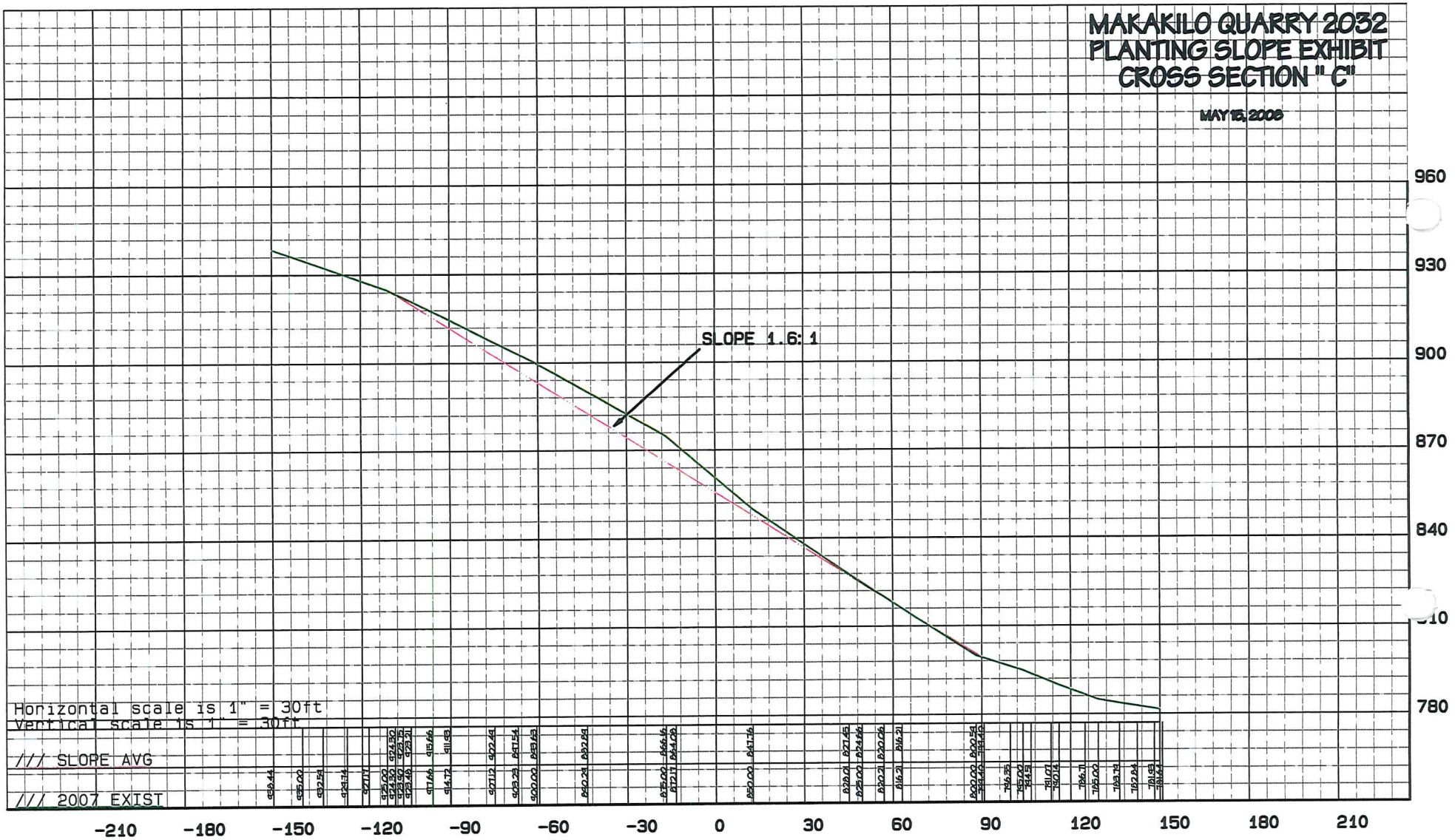

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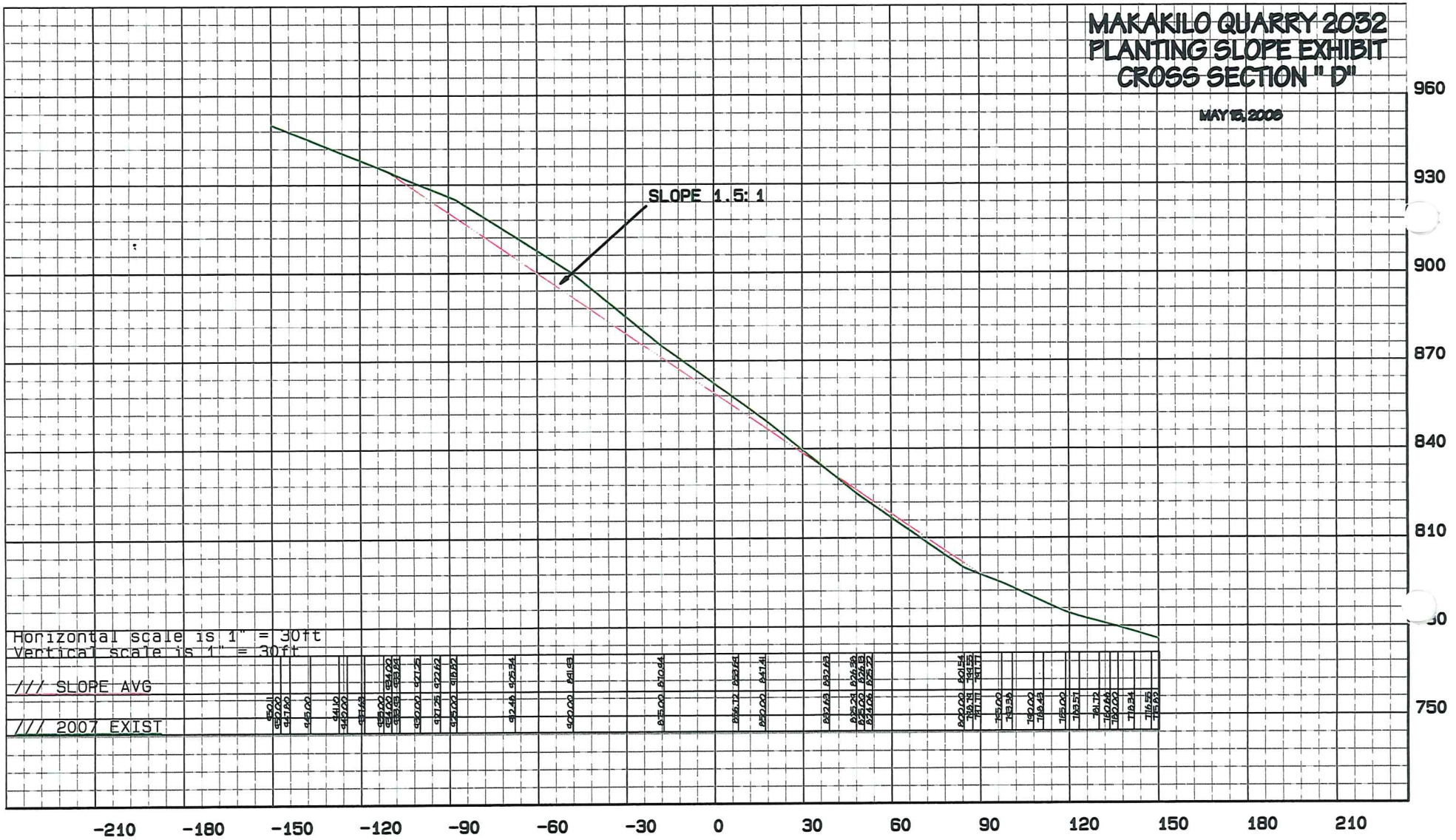

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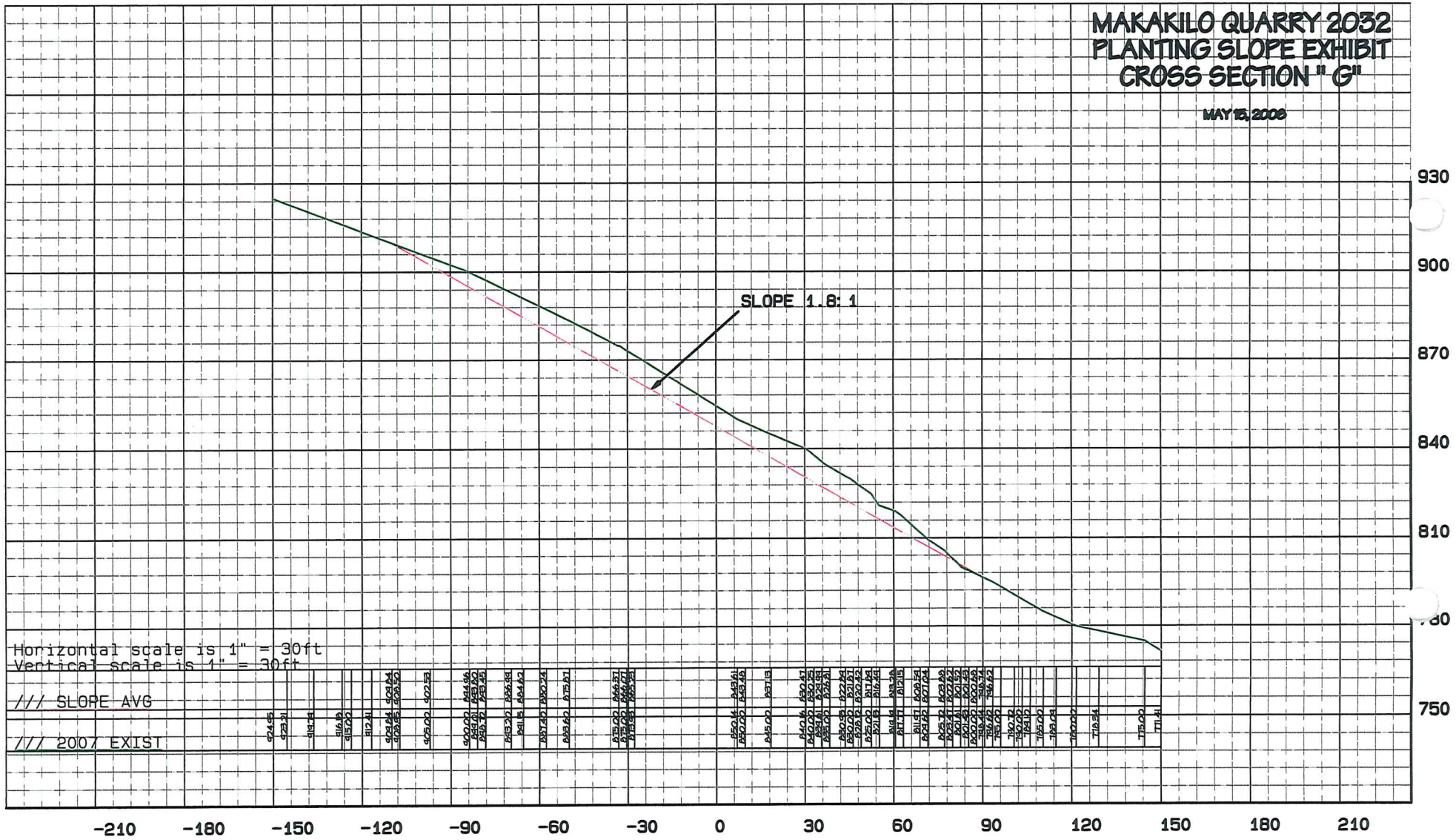
Figure 5f (part 5 of 8)

Figure 5f (part 6 of 8)



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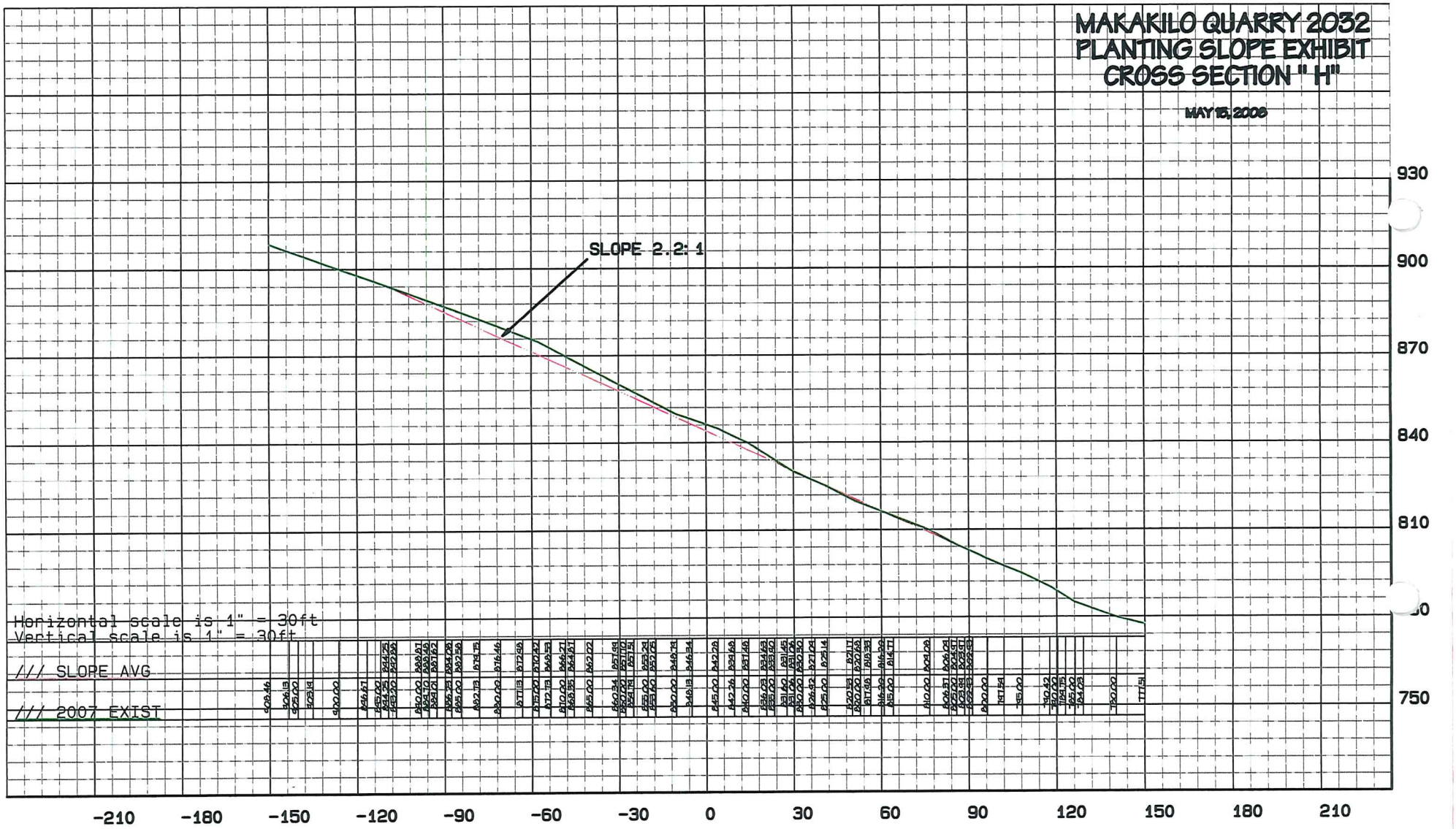

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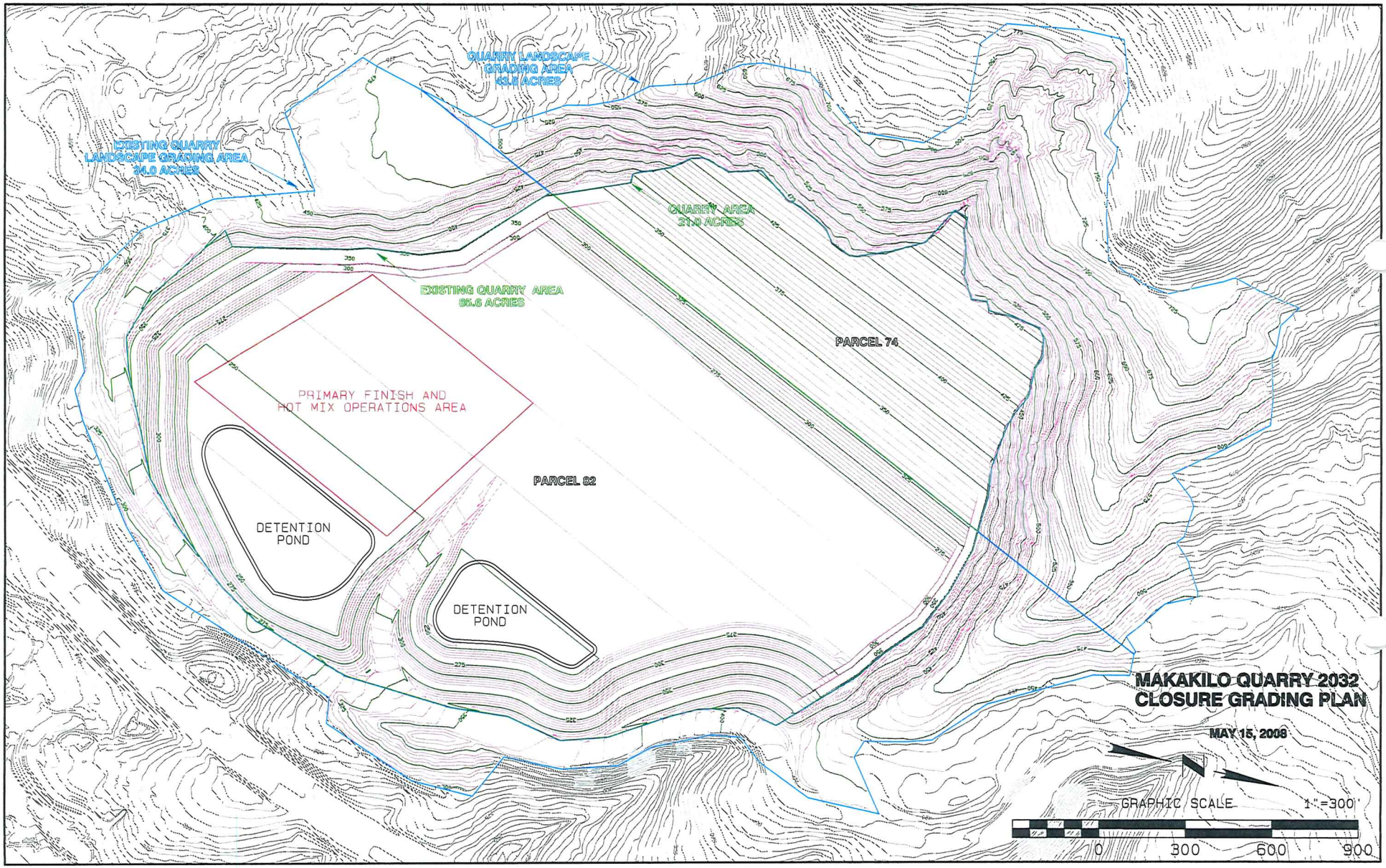
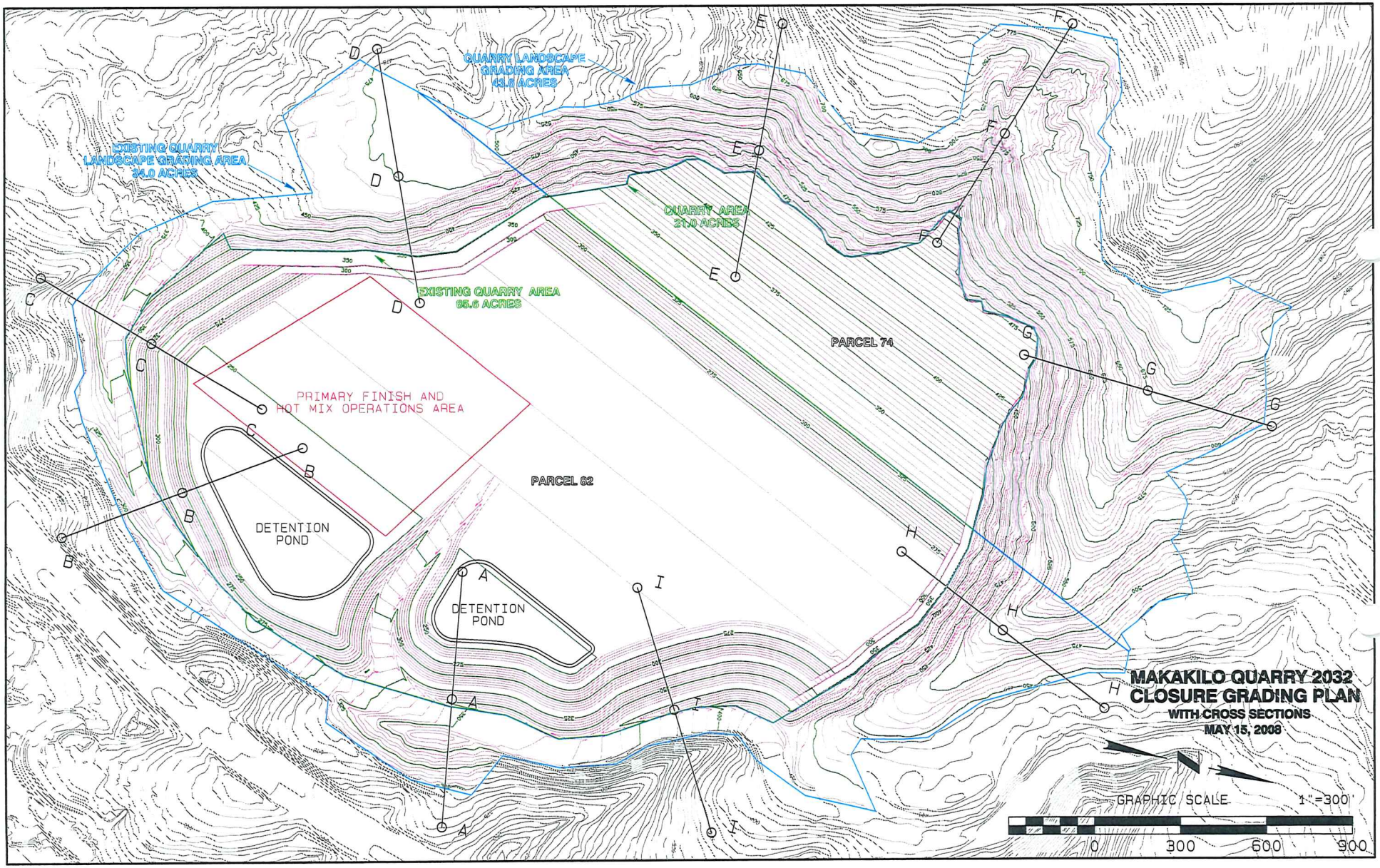

QUARRY LANDSCAPE GRADING AREA 43.8 ACRES
EXISTING QUARRY LANDSCAPE GRADING AREA 34.0 ACRES
QUARRY AREA 21.0 ACRES
EXISTING QUARRY AREA 85.6 ACRES
PARCEL 74
PRIMARY FINISH AND HOT MIX OPERATIONS AREA
PARCEL 62
DETENTION POND
DETENTION POND
MAKAKILO QUARRY 2032
CLOSURE GRADING PLAN
MAY 15, 2008
GRAPHIC SCALE 1"=300'
0
300
600
900

Figure 4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EXISTING QUARRY LANDSCAPE GRADING AREA 34.0 ACRES
QUARRY AREA 21.0 ACRES
EXISTING QUARRY AREA 86.6 ACRES
PRIMARY FINISH AND HOT MIX OPERATIONS AREA
PARCEL 74
PARCEL 82
DETENTION POND
DETENTION POND
MAKAKILO QUARRY 2032
CLOSURE GRADING PLAN
WITH CROSS SECTIONS
MAY 15, 2008
GRAPHIC SCALE 1" =300'
0 300 600 900

Figure 5a

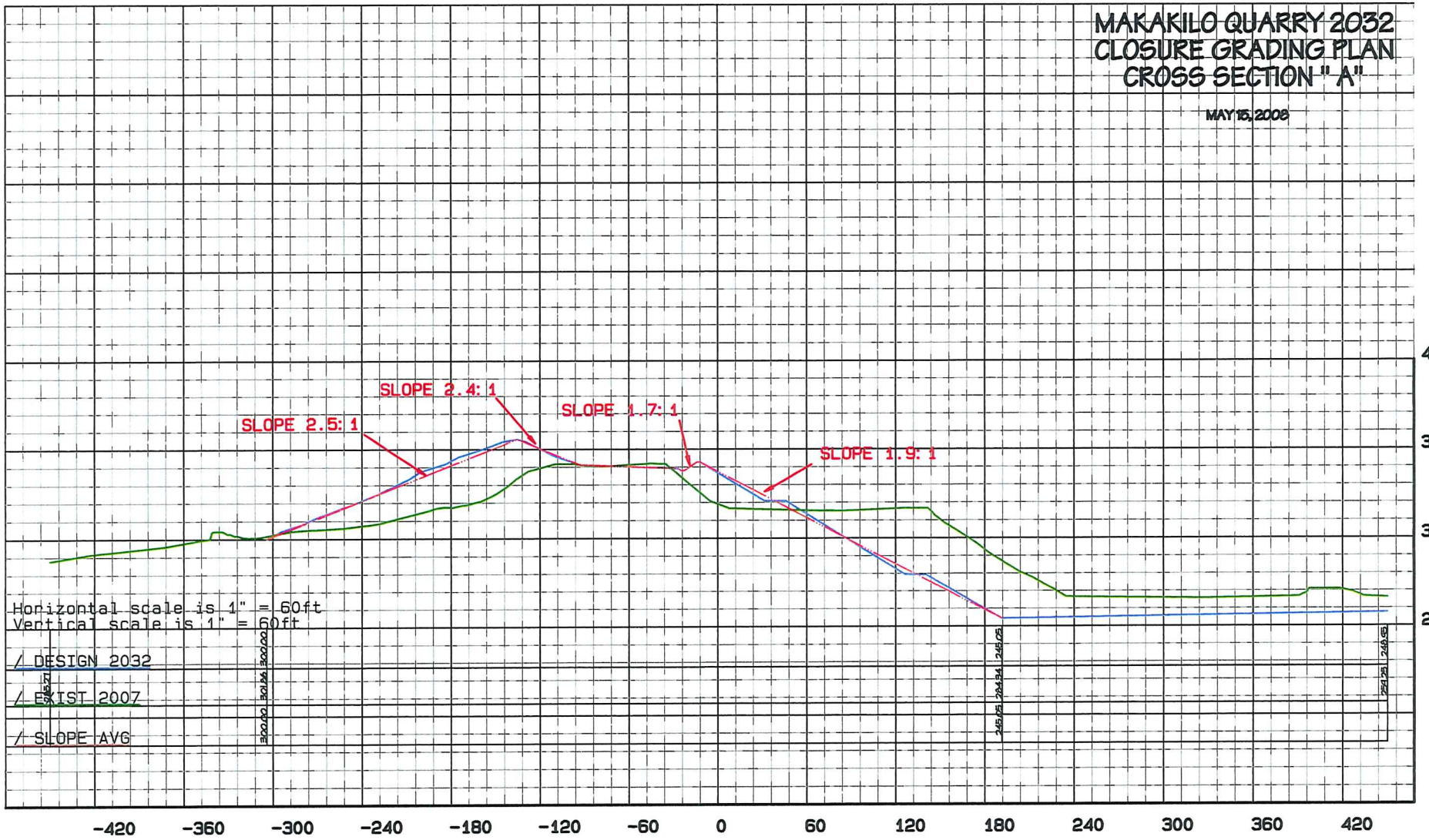
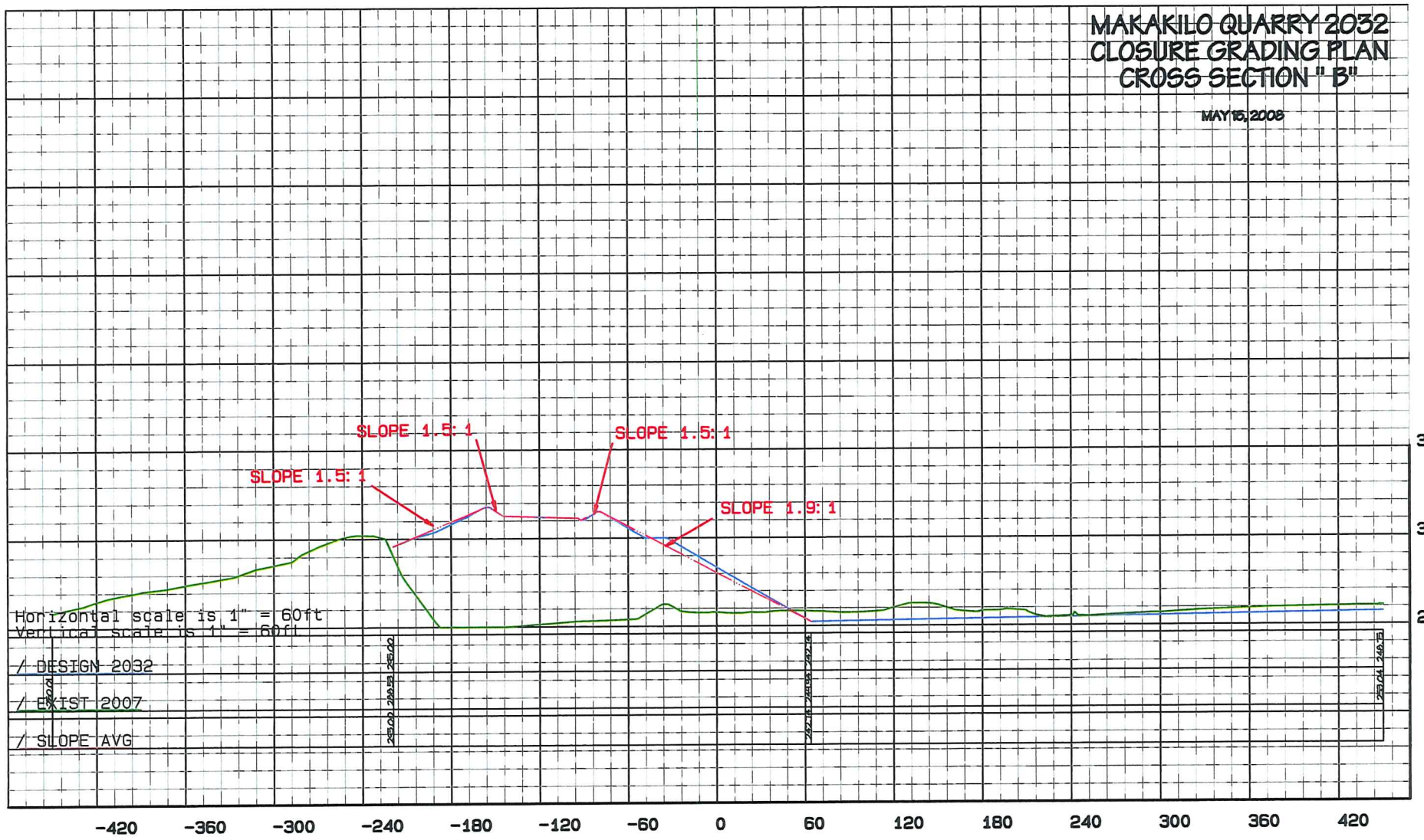


Figure 5b (part 1 of 9)



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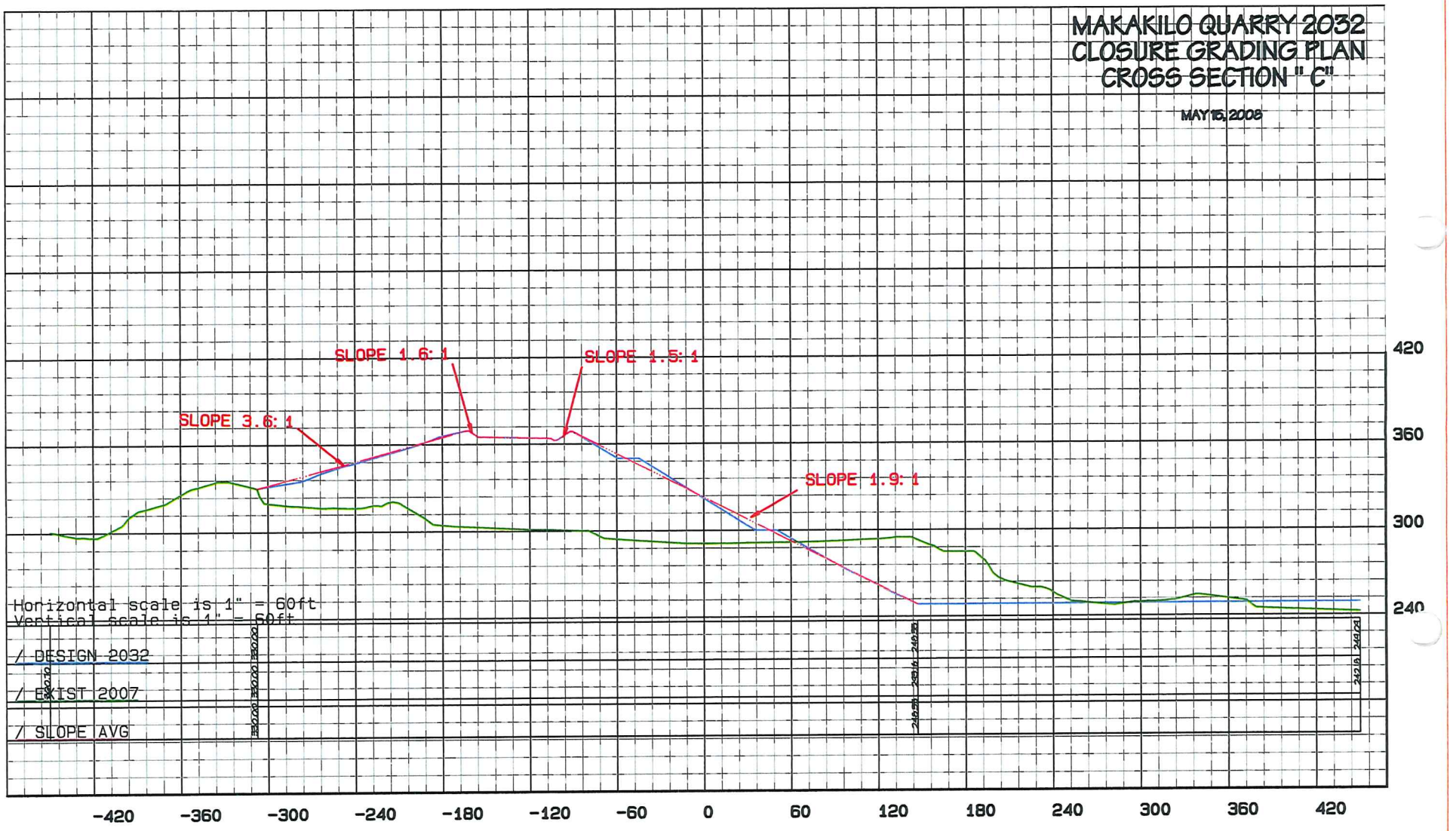

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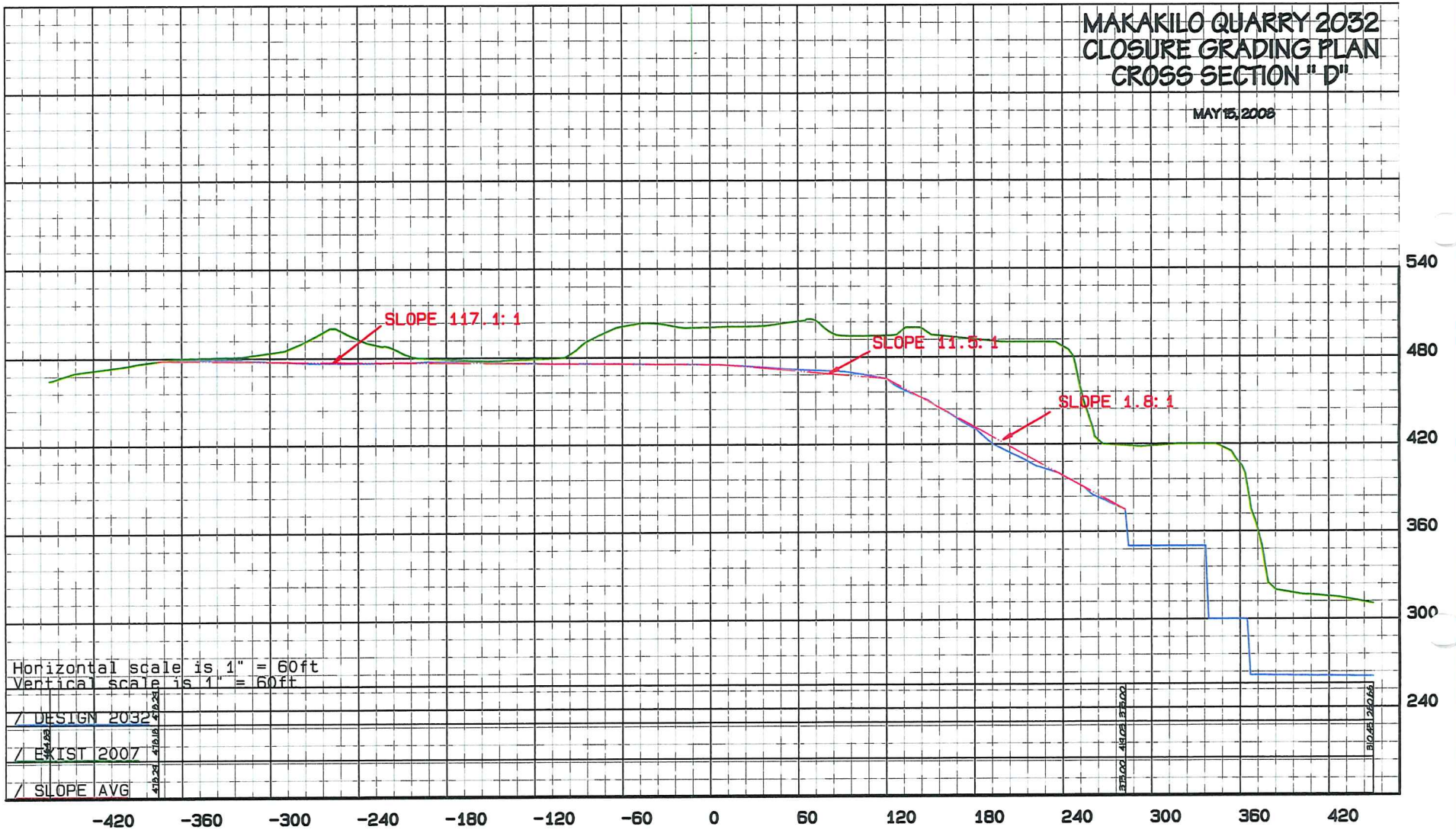

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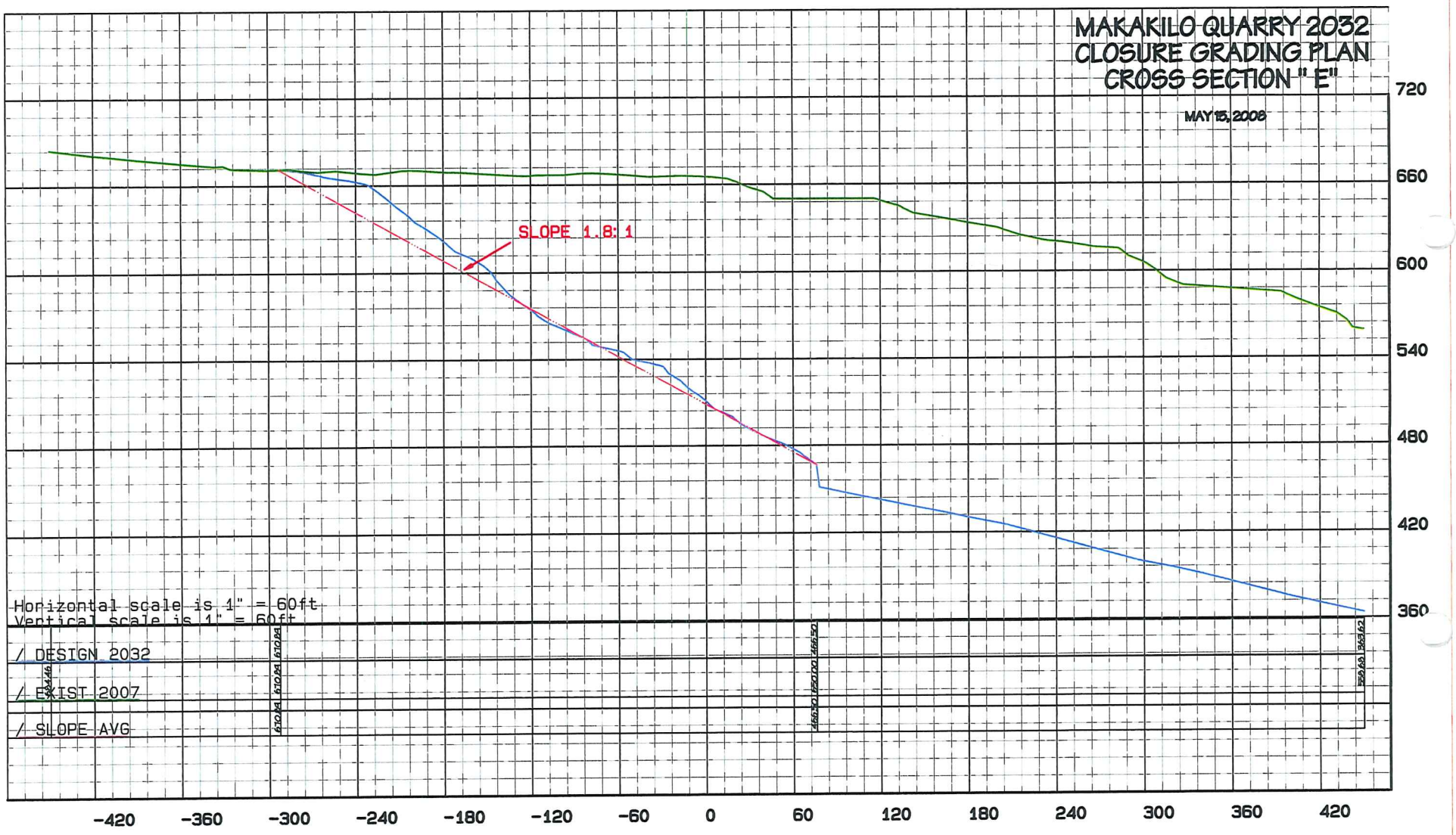

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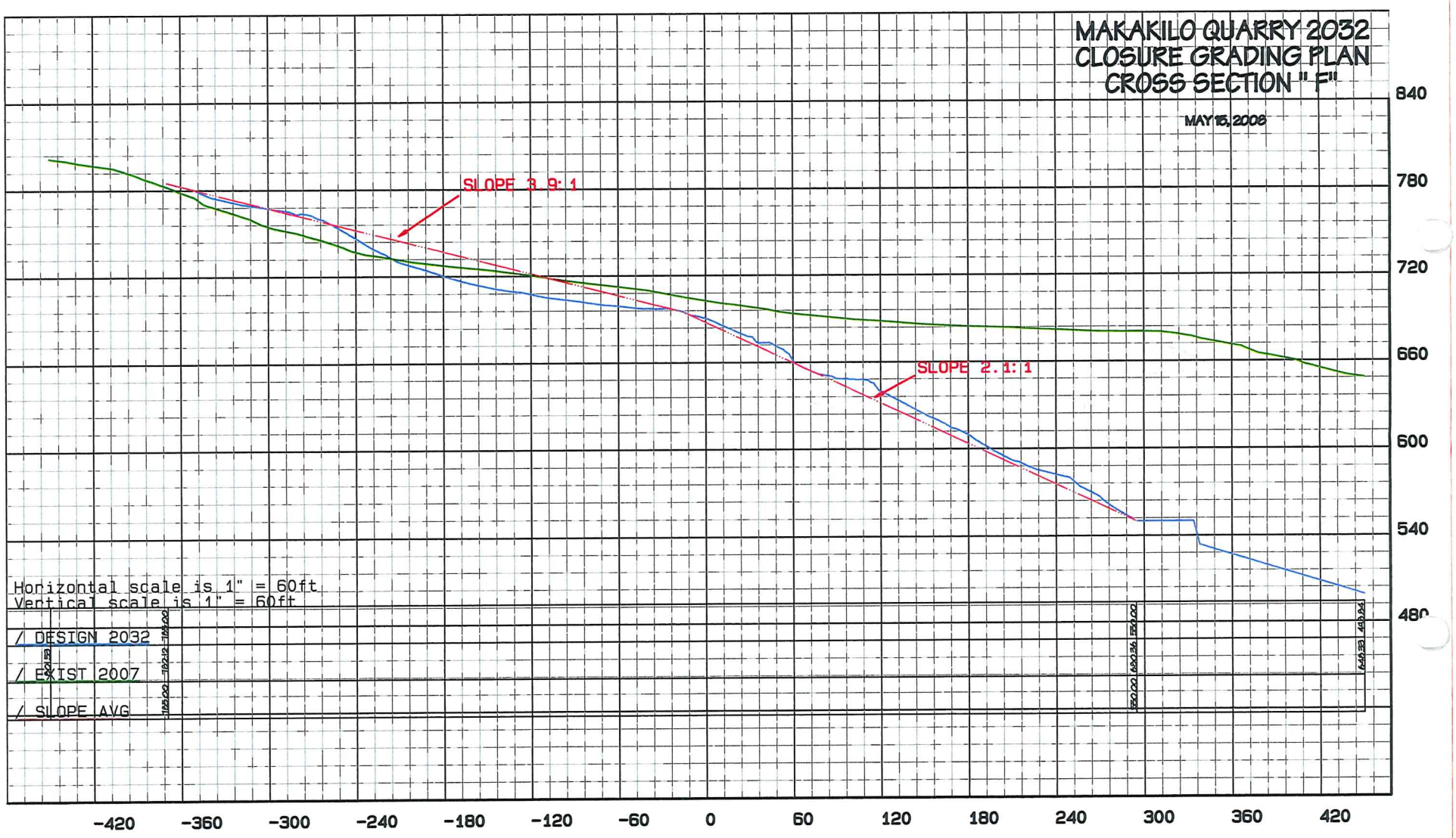

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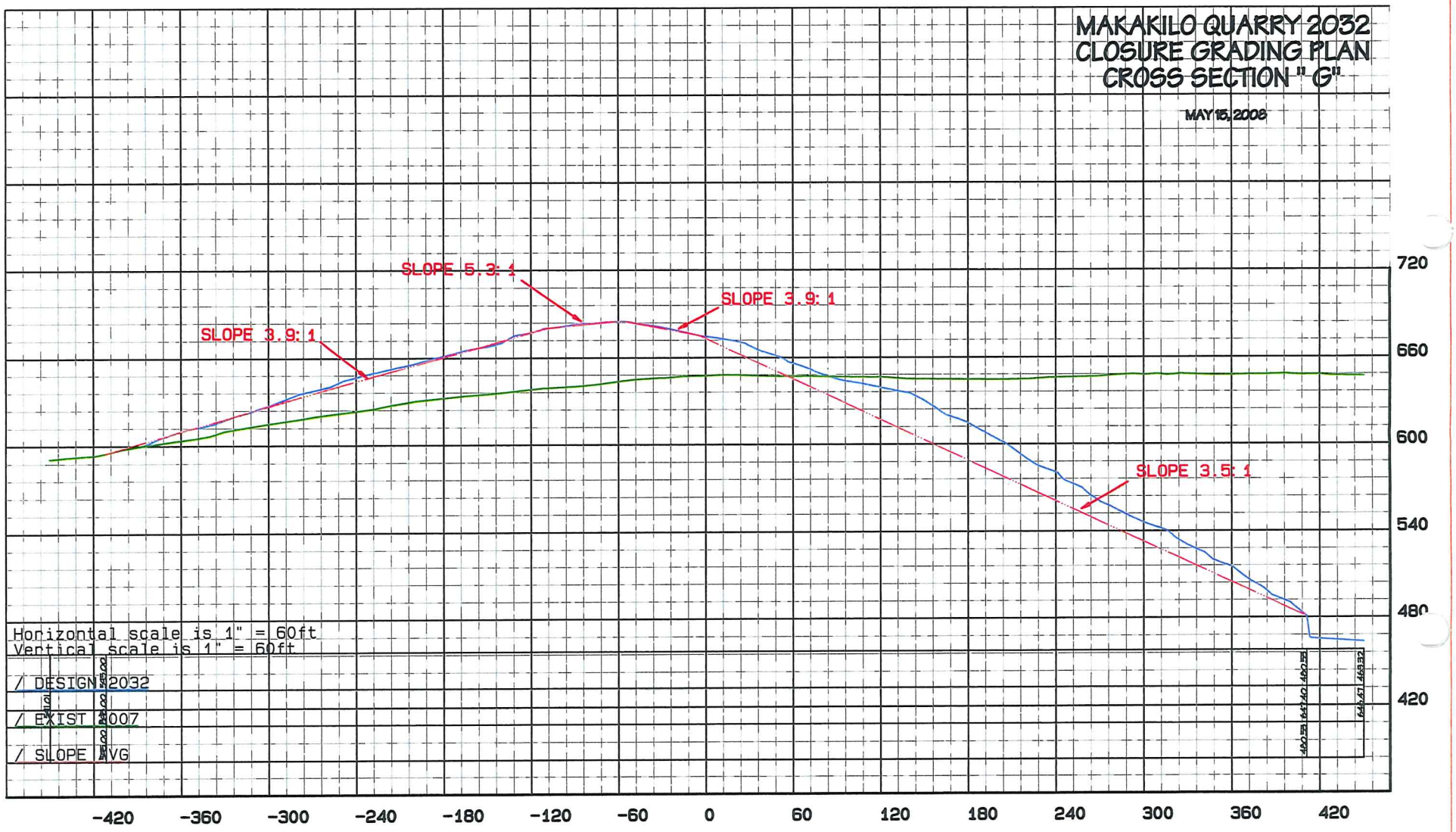

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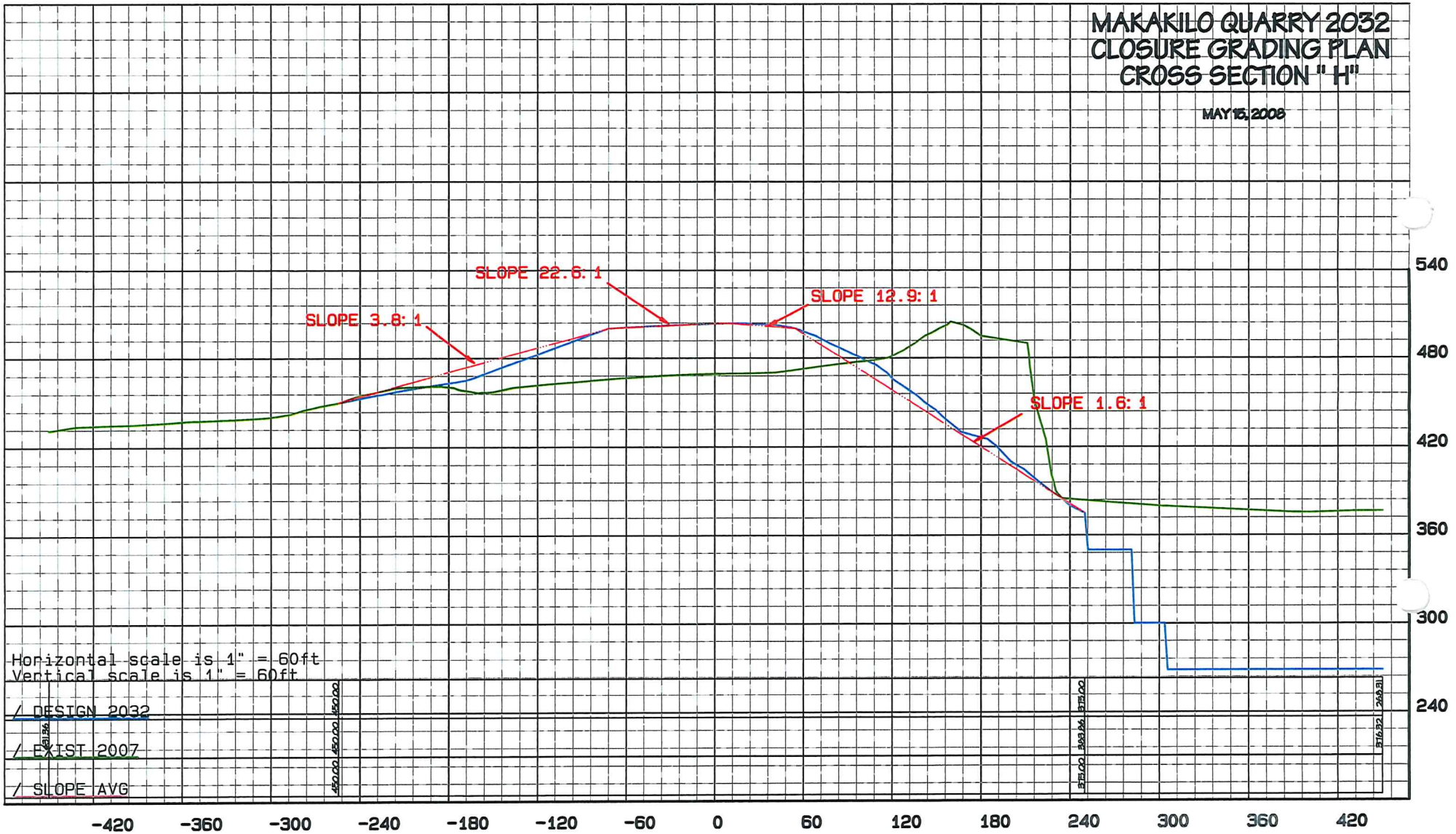

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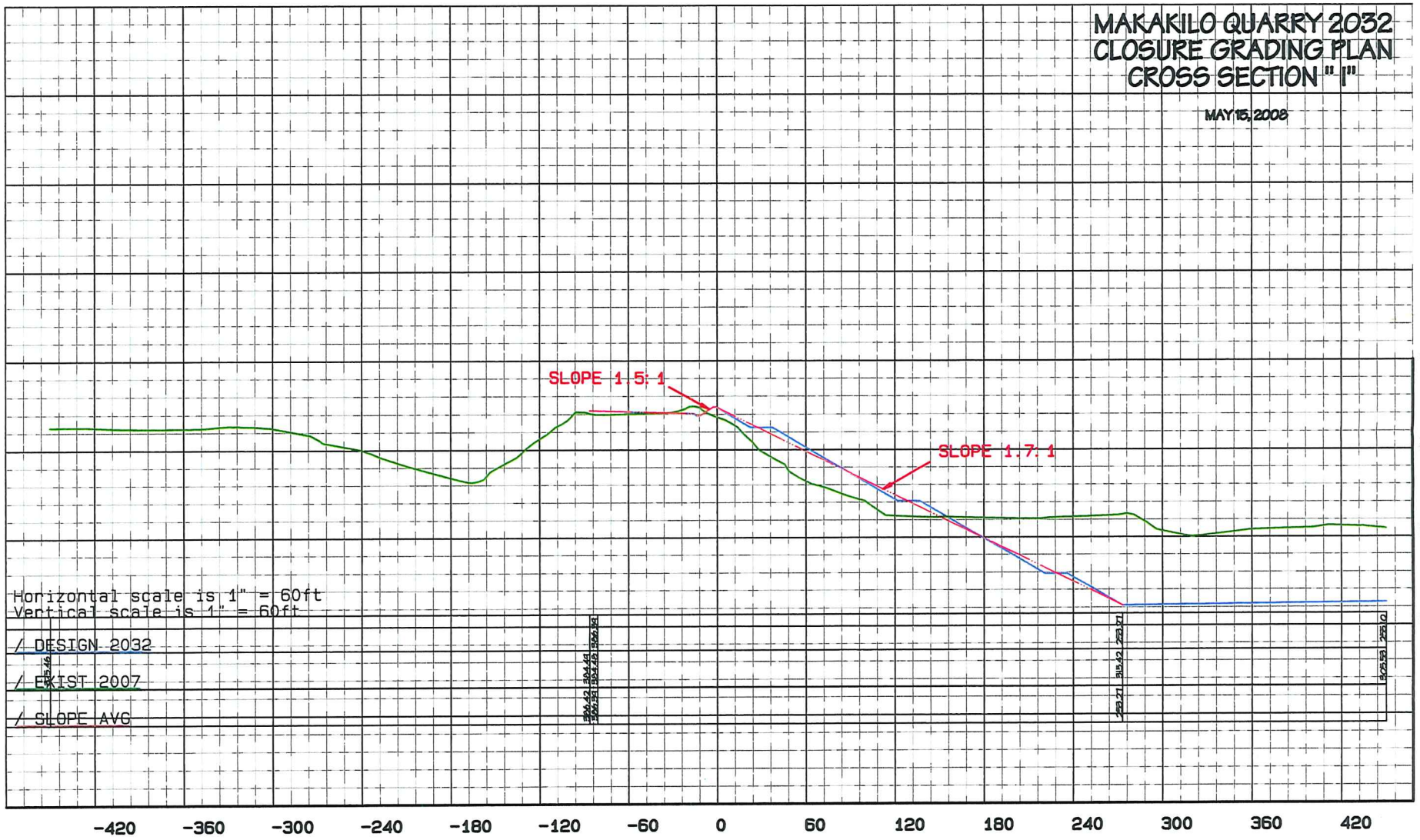

Figure 5b (part 9 of 9)