APPENDIX B

REVISED
FINAL GRADING PLAN

EXHIBIT J

APPENDIX C

STORM DRAINAGE CALCULATIONS

EXHIBIT J

Parametrix, Inc.

PROJECT Makakilo Quarry JOB NO SS-1657-05

BY SZ DATE 6/29/98 CHECKED [illegible] DATE 7/1/98 SHEET 1 OF

SURFACE WATER CALCULATIONS:

DETERMINE FLOWS FOR QUARRY USING RATIONAL METHOD AND A RECURRENCE INTERVAL OF 10 YEARS FOR DRAINAGE AREAS THAT ARE LESS THAN 100 ACRES PER "DEPARTMENT OF PUBLIC WORKS, CITY AND COUNTY OF HONOLULU, STORM DRAINAGE STANDARDS, 1988."

$Q = C \cdot I \cdot A$

Q = FLOW RATE (cfs)

C = RUNOFF COEFFICIENT FOR T_C = 10 min

I = RAINFALL INTENSITY (inches/hour)

A = DRAINAGE AREA (acres)

ASSUME THE PROPOSED GOLF COURSE FOR THE BUFFER AREA SURROUNDING THE QUARRY IS NOT INSTALLED, I.E., NO IMPROVEMENTS

FROM GRADING PLAN, AREA 16

A = 198 ACRES

FROM STORM DRAINAGE STANDARDS, PLATE 1, PAGE 14

T_R = 10 YEARS

$I_R \approx 1.9$ inches

THEN CORRECTION FACTOR FOR CONVERTING RAINFALL TO RAINFALL INTENSITY FROM PLATE 4, PAGE 18 @ T_C = 10 min

CF = 2.24

EXHIBIT J

Parametrix, Inc.

PROJECT MAKAKILO QUARRY JOB NO SS-1657-05

BY SE DATE 6/29/98 CHECKED [illegible] DATE 7/13/98 SHEET 2 OF 2

$I = I_R * CF$

$I = 1.9 * 2.24 = 4.29$ in/hr

From TABLE 1, PAGE 14

COEFFICIENT OF RUNOFF, C.

$C = 2/3$ (BARE)

$C \approx 2/3$ (0.55 to 0.80)

$C \approx 0.75$

SOLVE FOR Q:

$Q = (0.75)(4.29)(19.8)$

$Q = 63.8$ cfs

* SEE ATTACHED MAKAKILO QUARRY STORM DRAINAGE SUMMARY CALCULATIONS *

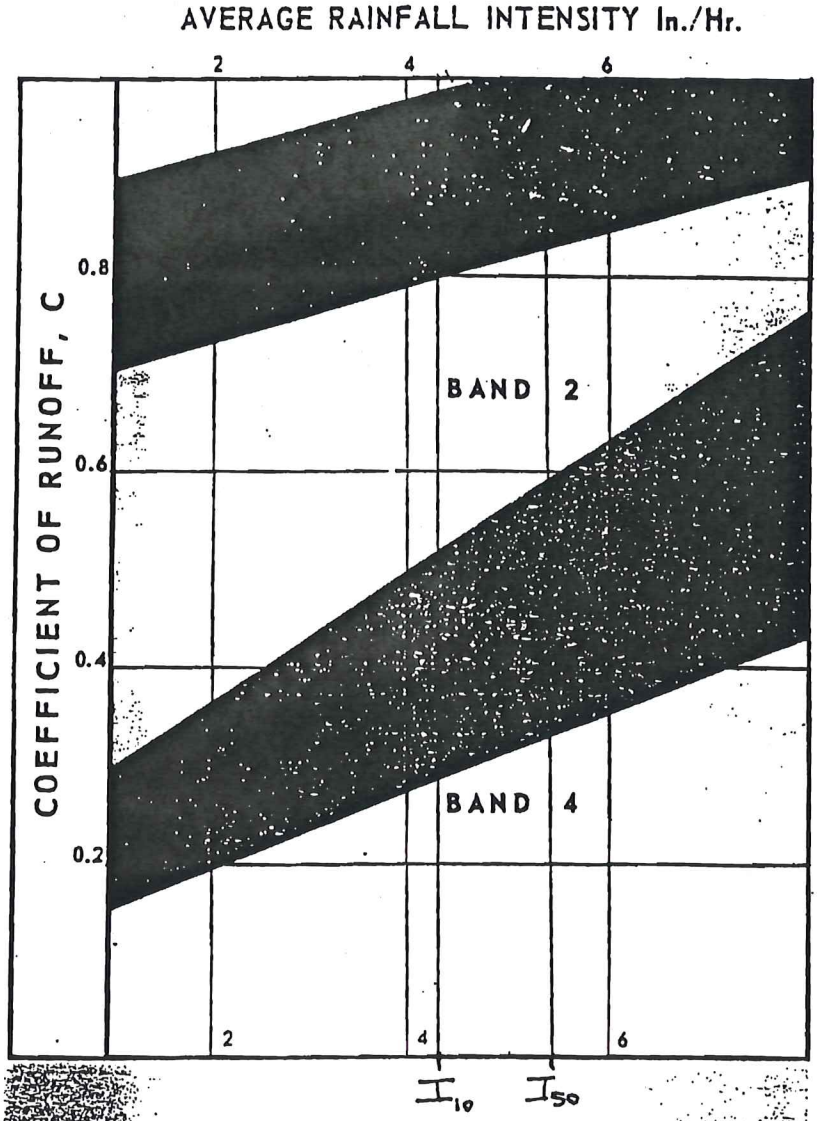
EXHIBIT J

Table 1

RUNOFF COEFFICIENT FOR AGRICULTURAL AND OPEN AREAS

I_{10} = 0.55 to 0.80
Assume 2/3 of Band
≈ 0.75

I_{50} = 0.60 to 0.82
Assume 2/3 of Band
≈ 0.80



BAND 1	Steep, barren, impervious surfaces
BAND 2	Rolling barren in upper band values, flat barren in lower part of band, steep forested and steep grass meadows
BAND 3	Timber lands of moderate to steep slopes, mountainous, farming
BAND 4	Flat pervious surface, flat farmlands, wooded areas and meadows

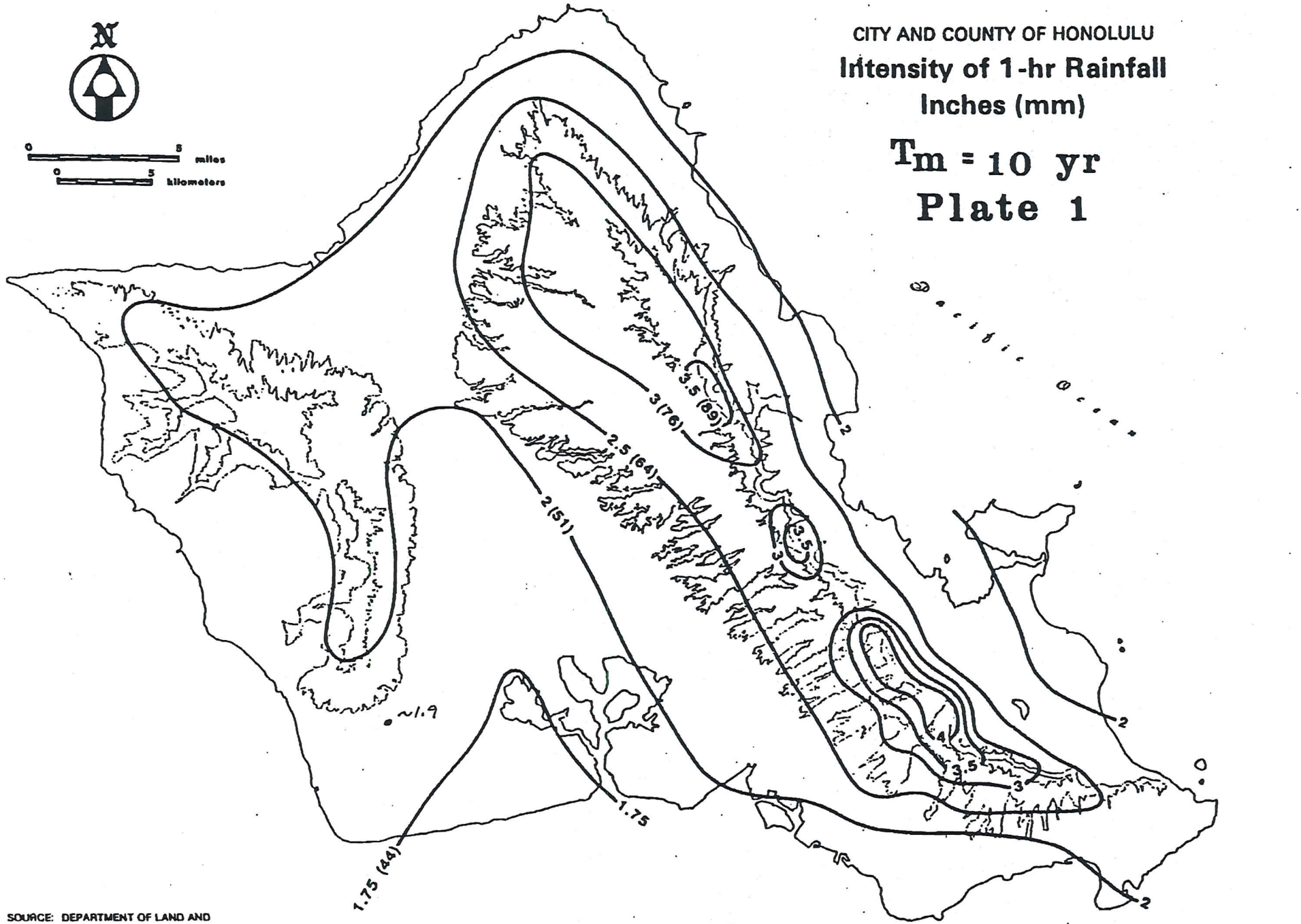
EXHIBIT J

CITY AND COUNTY OF HONOLULU

Intensity of 1-hr Rainfall Inches (mm)

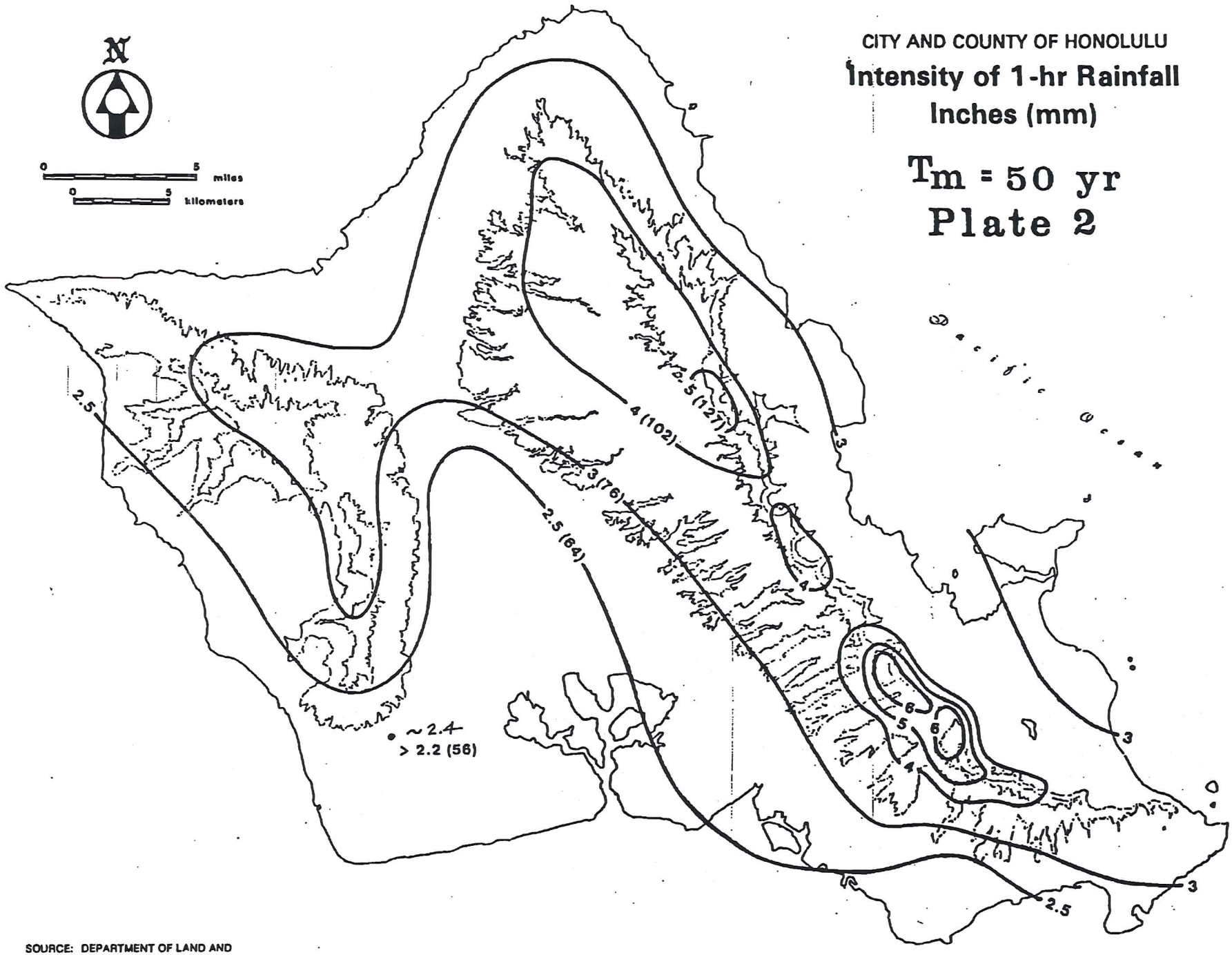
T_m = 10 yr

Plate 1



SOURCE: DEPARTMENT OF LAND AND NATURAL RESOURCES STATE OF HAWAII

EXHIBIT J

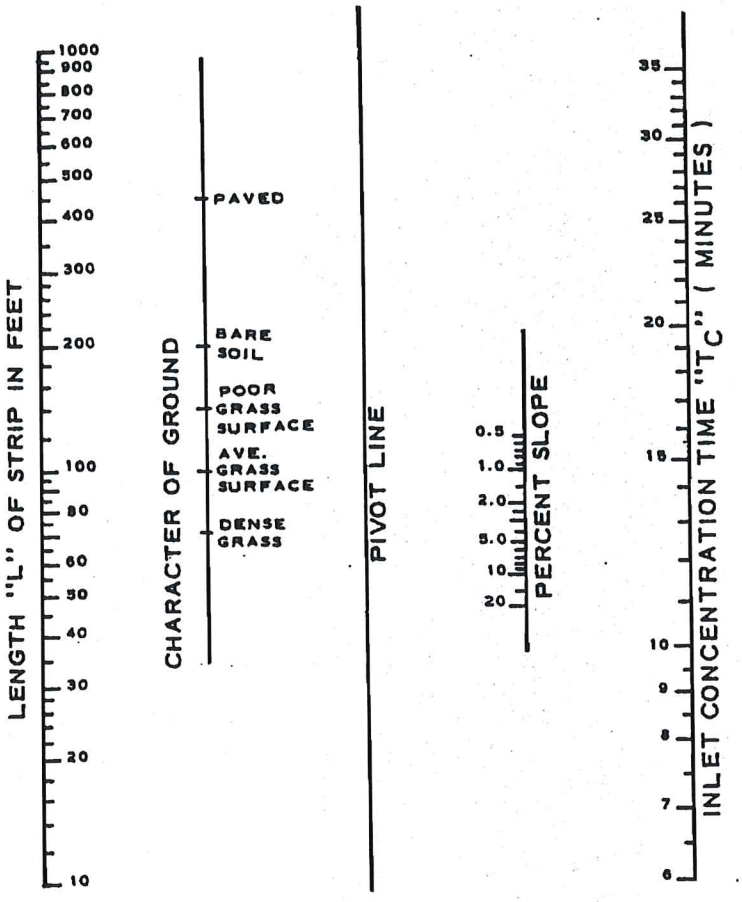


SOURCE: DEPARTMENT OF LAND AND NATURAL RESOURCES STATE OF HAWAII

EXHIBIT J

Plate 3

Overland Flow Chart



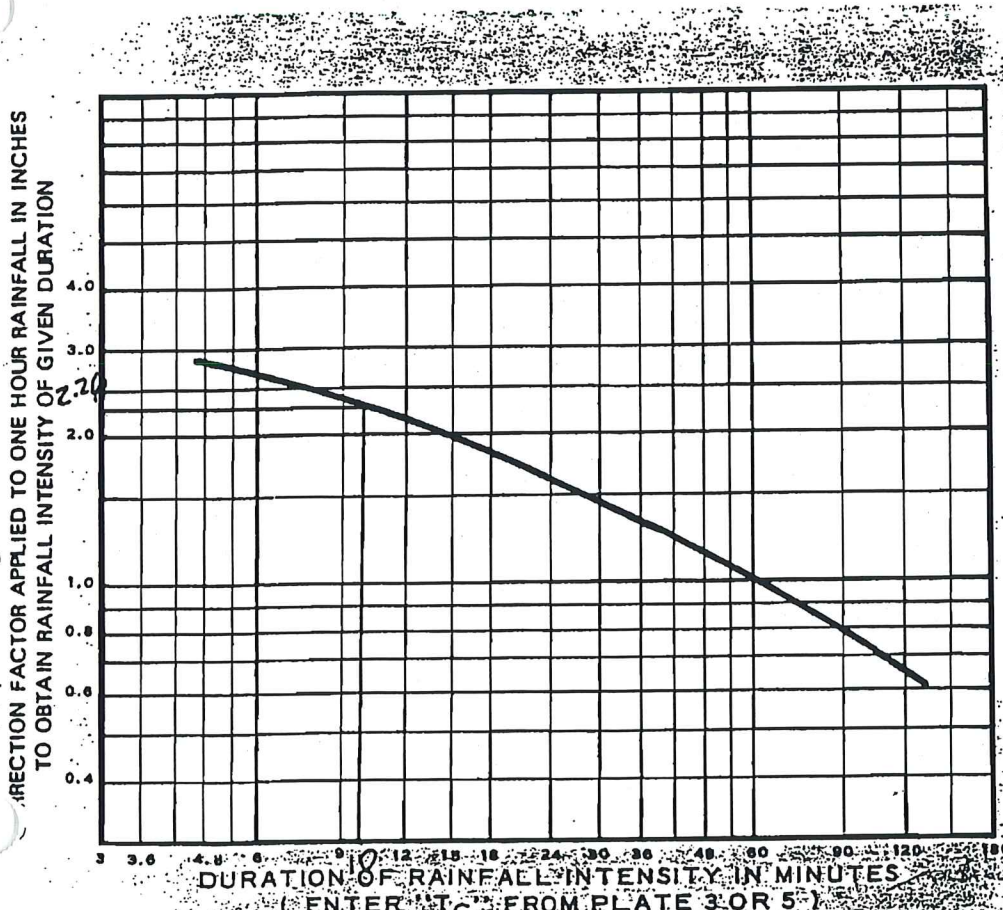


Plate 4

CORRECTION FACTOR

FOR CONVERTING 1 HR. RAINFALL TO RAINFALL INTENSITY OF VARIOUS DURATIONS

TO BE USED FOR AREA LESS THAN 100 ACRES

(See Plate 6 on page 20 for area more than 100 acres)

EXHIBIT J

Parametrix, Inc.

PROJECT _____ JOB NO _____

BY _____ DATE _____ CHECKED _____ DATE _____ SHEET _____ OF _____

SURFACE WATER CALCULATIONS:

DETERMINE DRAINAGES AREAS FOR QUARRY

FOR DRAINAGE AREAS UPSLOPE OF QUARRY, SEE "MAKAKILO GOLF COURSE DRAINAGE REPORT, FEB 1989".

SUMMARY OF AREAS: (ACRES)

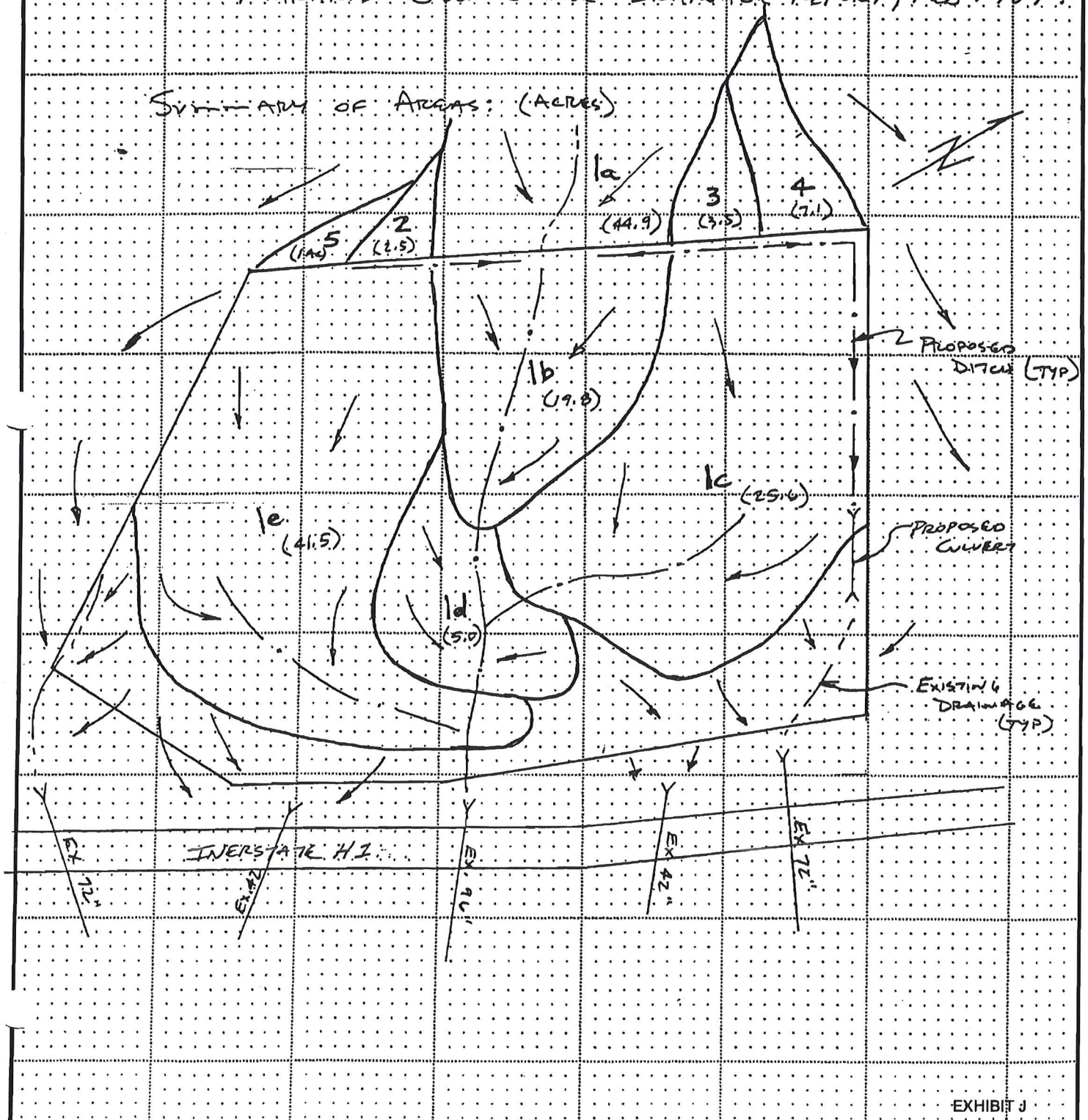


EXHIBIT J

MAKAKILO QUARRY
STORM DRAINAGE SUMMARY

Determine design flow using Rational Method and a recurrence interval of 10 years for drainage areas that are less than 100 acres per "Department of Public Works, City and County of Honolulu, Storm Drainage Standards, 1988".

[1] DRAINAGE UNIT NO.	[2] DRAINAGE AREA (ACRES)	[3] LENGTH OF RUN (FT)	[4] ELEV. DIFF. (FT)	[5] SLOPE (FT/FT)	[6] K	[7] Tc (MIN)	[8] I10 (IN)	[9] I50 (IN)	[10] INTENSITY CORR FACTOR	[11] I10 (FT)	[12] I50 (FT)	[13] C10	[14] C50	[15] Q10 DESIGN (CFS)	[16] Q50 DESIGN (CFS)
1a	44.9	2150	480	0.22	4550.3	10.00	1.90	2.40	2.26	4.29	5.42	0.75	0.80	144.6	194.8
1b	19.8	1100	23	0.02	7607.2	10.00	1.90	2.40	2.26	4.29	5.42	0.75	0.80	63.8	85.9
1c	25.6	1430	26	0.02	10605.2	10.00	1.90	2.40	2.26	4.29	5.42	0.75	0.80	82.4	111.1
1d	5.0	840	21	0.03	5312.6	10.00	1.90	2.40	2.26	4.29	5.42	0.75	0.80	16.1	21.7
1e	41.5	1950	30	0.02	15721.4	10.00	1.90	2.40	2.26	4.29	5.42	0.75	0.80	133.6	180.0
2	2.5	730	130	0.18	1729.9	10.00	1.90	2.40	2.26	4.29	5.42	0.75	0.80	8.1	10.8
3	3.5	670	100	0.15	1734.3	10.00	1.90	2.40	2.26	4.29	5.42	0.75	0.80	11.3	15.2
4	7.1	1320	270	0.20	2918.6	10.00	1.90	2.40	2.26	4.29	5.42	0.75	0.80	22.9	30.8
5	1.0	630	140	0.22	1336.4	10.00	1.90	2.40	2.26	4.29	5.42	0.75	0.80	3.2	4.3

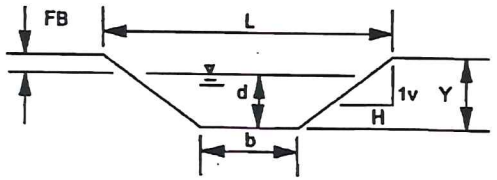
Notes:

- [1] Drainage area.
- [2] Drainage area size in acres as determined from the "Makakilo Golf Course Drainage Report" and Engineering Report Drawings.
- [3] Drainage area length in feet between the most remote point and outlet.
- [4] Difference in elevation between the most remote point and outlet.
- [5] Slope = [4] / [3] (ft/ft).
- [6] For areas with little or no cover, K=([3]^3 / [4])^0.5.
- [7] Minimum time of concentration (Tc) of 10 minutes was used.
- [8] & [9] 1-hour rainfall intensity selected from Plate 1 and 2 (Storm Drainage Standards) for design recurrence interval.
- [10] Correction factor for converting 1-hour rainfall to rainfall intensity from Plate 3 (Storm Drainage Standards).
- [11] Rainfall intensity for a 10-year storm recurrence interval, [11] = [8] x [10].
- [12] Rainfall intensity for a 50-year storm recurrence interval, [12] = [9] x [10].
- [13] Runoff coefficient for a 10-year storm as determined from Table 1 (Storm Drainage Standards) for open areas.
- [14] Runoff coefficient for a 50-year storm as determined from Table 1 (Storm Drainage Standards) for open areas.
- [15] Computed design flow for a 10-year storm in cubic feet per second, [15] = [2] x [11] x [13].
- [16] Computed design flow for a 50-year storm in cubic feet per second, [16] = [2] x [12] x [14].

EXHIBIT J

AKILO QUARRY
STORM DRAINAGE SUMMARY

SWAT[illegible]S



Manning solution for trapezoid channels:
Solves for flow (Q) and velocity (V), and a ditch width (L)
Given a ditch base (b) and depth (d) and sideslope (H:1v) dimensions
for a given manning roughness coefficient (n) and slope (s)
Design Freeboard (FB) = 2.0 + 0.025[V(d^0.333)]

A = Area; Wp = Wetted perimeter; R = Hydralic radius

Location	Ditch	Q10 Design	b (ft)	d (ft)	Q (cfs)	V (fps)	FB (ft)	Y (ft)	L (ft)	H:1v	n	s (ft/ft)	A (ft2)	Wp (ft)	R (ft)
Drainage Unit #1:															
1a, 2, & 3	A	164.00													
			3.00	3.00	316.2	11.7	2.42	5.42	24.69	2.0	0.025	0.020	27.00	16.42	1.64
Ditch w/l 1b		→	4.00	2.50	245.9	10.9	2.37	4.87	23.48	2.0	0.025	0.020	22.50	15.18	1.48
		Full Flow	4.00	4.50	887.6	15.2	0.00	4.87	23.48	2.0	0.025	0.020	58.50	24.12	2.42
1a-d	B	306.90													
			1.00	4.00	465.2	12.9	2.51	6.51	27.05	2.0	0.025	0.020	36.00	18.89	1.91
Ditch from 1b to		→	4.00	3.00	362.4	12.1	2.44	5.44	25.74	2.0	0.025	0.020	30.00	17.42	1.72
outlet		Full Flow	4.00	5.00	1128.4	16.1	0.00	5.44	25.76	2.0	0.025	0.020	70.00	26.36	2.66
1c	C	82.40													
			0.00	2.50	113.2	9.1	2.31	4.81	19.23	2.0	0.025	0.020	12.50	11.18	1.12
		→	1.00	2.00	84.4	8.4	2.27	4.27	18.06	2.0	0.025	0.020	10.00	9.94	1.01
		Full Flow	1.00	4.00	465.2	12.9	0.00	4.27	18.08	2.0	0.025	0.020	36.00	18.89	1.91
1e	D	133.60													
			5.00	2.00	179.4	10.0	2.31	4.31	22.26	2.0	0.025	0.020	18.00	13.94	1.29
		→	1.00	2.50	144.9	9.7	2.33	4.83	20.31	2.0	0.025	0.020	15.00	12.18	1.23
		Full Flow	1.00	4.50	626.3	13.9	0.00	4.83	20.32	2.0	0.025	0.020	45.00	21.12	2.13
2		8.10													
Last 350 ft	E	→	0.00	1.00	8.5	4.2	2.11	3.11	12.42	2.0	0.035	0.029	2.00	4.47	0.45
		Full Flow	0.00	3.00	158.3	8.8	0.00	3.11	12.42	2.0	0.035	0.029	18.00	13.42	1.34
First 120 ft	F	→	0.00	1.00	19.3	9.7	2.24	3.24	12.97	2.0	0.045	0.250	2.00	4.47	0.45
		Full Flow	0.00	3.00	361.5	20.1	0.00	3.24	12.97	2.0	0.045	0.250	18.00	13.42	1.34
3	G	11.30													
		→	0.00	1.00	13.9	7.0	2.17	3.17	12.70	2.0	0.045	0.130	2.00	4.47	0.45
		Full Flow	0.00	3.00	260.7	14.5	0.00	3.17	12.70	2.0	0.045	0.130	18.00	13.42	1.34
4	H	22.90													
		→	0.00	1.50	35.6	7.9	2.23	3.73	14.91	2.0	0.045	0.098	4.50	6.71	0.67
		Full Flow	0.00	3.50	341.4	13.9	0.00	3.73	14.91	2.0	0.045	0.098	24.50	15.65	1.57
5		3.20													
		→	0.00	1.00	10.0	5.0	2.12	3.12	12.50	2.0	0.045	0.067	2.00	4.47	0.45
		Full Flow	0.00	3.00	187.2	10.4	0.00	3.12	12.50	2.0	0.045	0.067	18.00	13.42	1.34

EXHIBIT J

Parametrix, Inc.

PROJECT MAKAKILO JOB NO 55-1657-05

BY SE DATE 7/7/98 CHECKED _____ DATE _____ SHEET _____ OF _____

SURFACE WATER CALCULATIONS

DETERMINE FLOW FROM QUARRY TO ENTER EXISTING 96" CULVERT AND SIZE AN DETENTION POND TO HANDLE THE FLOW AND COLLECT SEDIMENTS. FOR DRAINAGE AREAS 1, 2, & 3.

QUARRY DESIGN FLOW FOR 10 YEAR - 1 HR STORM EVENT IS $Q_{10} = 459.9$ cfs, AT $T_c = 10$ min

$V = Q \cdot T_c = 459.9 \text{ cfs} * 60 \text{s/min} * 10 \text{ min}$

$V = 275,940$ cf / 10 yr event

* SEE POND DIMENSION FROM SPREADSHEET, "MAKAKILO QUARRY, DETENTION POND".

DETERMINE DISCHARGE OF POND

ASSUME 50-YEAR FOR $T_c = 30$ min

$V = 619.5 \text{ cfs} * 60 \text{s/min} * 30 \text{ min/event}$

$= 1,115,100$ cf OR

$\Delta V = 821,475$ cf OR 456 cfs

EXHIBIT J

MAKAKILO QUARRY
STORM DRAINAGE SUMMARY
DETENTION POND

Determine Detention Pond to handle an 10-year storm event of approximately 280,000 cubic feet of water.

Scenario	Length Top	Length Bottom	Width Top	Width Bottom	Depth	Sideslope	Volume	Volume
No.	(ft)	(ft)	(ft)	(ft)	(ft)	(XH:1V)	(cf)	(Gal.)
1	600	576	100	76	4	3	206,976	1,548,180
2	600	576	150	126	4	3	324,576	2,427,828
3	500	470	150	120	5	3	327,375	2,448,765
4	475	445	150	120	5	3	310,500	2,322,540
→ **5**	**450**	**420**	**150**	**120**	**5**	**3**	**293,625**	**2,196,315**
6	450	420	125	95	5	3	239,250	1,789,590
7	425	395	150	120	5	3	276,750	2,070,090

For a 50-year storm — 1,115,100 cf = 8,340,948 gal

EXHIBIT J

Table
Rating Table for Circular Channel

Project Description	
Project File	untitled
Worksheet	Hawaii quarry
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Capacity

Constant Data	
Mannings Coefficient	0.024
Diameter	8.00 ft

Input Data

	Minimum	Maximum	Increment
Channel Slope	0.010000	0.100000	0.010000 ft/ft

Rating Table

Channel Slope (ft/ft)	Depth (ft)	Discharge (ft³/s)	
0.010000	8.00	494.02	> EST. Q_{10} = 459.9 cfs
0.020000	8.00	698.64	> EST. Q_{50} = 619.5 cfs
0.030000	8.00	855.66	
0.040000	8.00	988.03	
0.050000	8.00	1104.65	
0.060000	8.00	1210.09	
0.070000	8.00	1307.04	
0.080000	8.00	1397.29	
0.090000	8.00	1482.05	
0.100000	8.00	1562.21	

Table
Rating Table for Circular Channel

CULVERT FOR DITCH H.

Project Description	
Project File	untitled
Worksheet	Hawaii quarry
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Capacity

Constant Data	
Mannings Coefficient	0.024

Input Data	Minimum	Maximum	Increment	
Channel Slope	0.010000	0.100000	0.010000	ft/ft
Diameter	1.00	5.00	0.50	ft

Rating Table

Diameter (ft)	Channel Slope (ft/ft)	Depth (ft)	Discharge (ft^3/s)
1.00	0.010000	1.00	1.93
1.00	0.020000	1.00	2.73
1.00	0.030000	1.00	3.34
1.00	0.040000	1.00	3.86
1.00	0.050000	1.00	4.32
1.00	0.060000	1.00	4.73
1.00	0.070000	1.00	5.11
1.00	0.080000	1.00	5.46
1.00	0.090000	1.00	5.79
1.00	0.100000	1.00	6.10
1.50	0.010000	1.50	5.69
1.50	0.020000	1.50	8.05
1.50	0.030000	1.50	9.85
1.50	0.040000	1.50	11.38
1.50	0.050000	1.50	12.72
1.50	0.060000	1.50	13.94
1.50	0.070000	1.50	15.05
1.50	0.080000	1.50	16.09
1.50	0.090000	1.50	17.07
1.50	0.100000	1.50	17.99
2.00	0.010000	2.00	12.25
2.00	0.020000	2.00	17.33
2.00	0.030000	2.00	21.22
2.00	0.040000	2.00	24.51
2.00	0.050000	2.00	27.40
2.00	0.060000	2.00	30.01

Table
Rating Table for Circular Channel

Rating Table

Diameter (ft)	Channel Slope (ft/ft)	Depth (ft)	Discharge (ft^3/s)
2.00	0.070000	2.00	32.42
2.00	0.080000	2.00	34.66
2.00	0.090000	2.00	36.76
2.00	0.100000	2.00	38.75
2.50	0.010000	2.50	22.22
2.50	0.020000	2.50	31.42
2.50	0.030000	2.50	38.48
2.50	0.040000	2.50	44.43
2.50	0.050000	2.50	49.68
2.50	0.060000	2.50	54.42
2.50	0.070000	2.50	58.78
2.50	0.080000	2.50	62.84
2.50	0.090000	2.50	66.65
2.50	0.100000	2.50	70.25
3.00	0.010000	3.00	36.13
3.00	0.020000	3.00	51.09
3.00	0.030000	3.00	62.57
3.00	0.040000	3.00	72.25
3.00	0.050000	3.00	80.78
3.00	0.060000	3.00	88.49
3.00	0.070000	3.00	95.58
3.00	0.080000	3.00	102.18
3.00	0.090000	3.00	108.38
3.00	0.100000	3.00	114.24
3.50	0.010000	3.50	54.49
3.50	0.020000	3.50	77.07
3.50	0.030000	3.50	94.39
3.50	0.040000	3.50	108.99
3.50	0.050000	3.50	121.85
3.50	0.060000	3.50	133.48
3.50	0.070000	3.50	144.18
3.50	0.080000	3.50	154.13
3.50	0.090000	3.50	163.48
3.50	0.100000	3.50	172.33
4.00	0.010000	4.00	77.80
4.00	0.020000	4.00	110.03
4.00	0.030000	4.00	134.76
4.00	0.040000	4.00	155.61
4.00	0.050000	4.00	173.97
4.00	0.060000	4.00	190.58
4.00	0.070000	4.00	205.85
4.00	0.080000	4.00	220.06
4.00	0.090000	4.00	233.41
4.00	0.100000	4.00	246.03
4.50	0.010000	4.50	106.51

$Q_{50} = 30.8 cfs$

APPENDIX D

WATER QUALITY PERMIT COMPLIANCE

EXHIBIT J

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

LAWRENCE MIKE
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P.O. BOX 3378
HONOLULU, HAWAII 96801-3378

In reply, please refer to:
EMD/CWB

November 12, 1997

Mr. Robert Singlehurst
Vice President
Grace Pacific Corporation
91-920 Farrington Highway
Kapolei, Hawaii 96707

Dear Mr. Singlehurst:

Subject: **Notice of General Permit Coverage (NGPC)**
Grace Pacific Corporation Makakilo Quarry
91-920 Farrington Highway
Kapolei, Oahu, Hawaii 96707
TMK: (1)9-1-16:4 and (1)9-2-3:82
File No. HI R32A707

In compliance with the provisions of the Clean Water Act, as amended, (33 U.S.C. § 1251 et seq.; the "Act") and Chapter 342D, Hawaii Revised Statutes, and Chapters 11-54 and 11-55, Hawaii Administrative Rules ("HAR"), Department of Health, State of Hawaii,

GRACE PACIFIC CORPORATION

(hereinafter "PERMITTEE")

is authorized to discharge storm water runoff associated with industrial activity from its facility located at 91-920 Farrington Highway, Kapolei, Oahu, Hawaii 96707, TMK: (1)9-1-16:4 and (1)9-2-3:82, to an unnamed gulch near the upper quarry, at coordinates latitude 21°21'30"N, longitude 158°04'09"W, and another unnamed gulch near the lower quarry, at coordinates latitude 21°21'18"N, longitude 158°04'03".

This Notice of General Permit Coverage (NGPC) is subject to compliance with the following regulations and conditions:

1. HAR Chapter 11-55, Appendix B, NPDES General Permit Authorizing Discharges of Storm Water Associated With Industrial Activities;

EXHIBIT J

DRAFT NPDES

2. HAR Chapter 11-55, Appendix A, Department of Health Standard General Permit Conditions;

3. HAR Sections 11-55-34.04(a), 11-55-34.07, 11-55-34.11, 11-55-34.12, and any other applicable sections of HAR Chapter 11-55;

4. Plans, reports, specifications and other related materials submitted in and with the Notice of Intent (NOI) dated September 19, 1997, and/or later amendments to the NOI;

5. A copy of this NGPC and its enclosures; and plans, reports, specifications and other related materials submitted in and with the NOI dated September 19, 1997, and/or later amendments to the NOI shall be kept at the facility until termination of subject activities;

6. Discharge quality data as required by NOI Form A shall be collected during the next representative rainfall event and submitted within 30 days of such sampling. Data shall include all parameters listed under Item 2.a and parameters listed under Item 2.b believed to be present in the discharge;

7. In accordance with HAR Chapter 11-55, Appendix B, Table 34.1, the discharge shall be limited and monitored by the Permittee as follows:

Parameter	Discharge Limitation	Cutoff Concentration	Units	Measurement Frequency	Type of Sample
Flow	N/L	N/A	MGD	Annually[1]	Calculated or Estimated
Biochemical Oxygen Demand (5-Day)	N/L	N/A	mg/l	Annually[1]	Composite or Grab
Chemical Oxygen Demand	N/L	N/A	mg/l	Annually[1]	Composite or Grab
Total Suspended Solids	N/L	N/A	mg/l	Annually[1]	Composite or Grab
Total Phosphorus	N/L	N/A	mg/l	Annually[1]	Composite or Grab
Total Nitrogen	N/L	N/A	mg/l	Annually[1]	Composite or Grab
Nitrate + Nitrite Nitrogen	N/L	N/A	mg/l	Annually[1]	Composite or Grab

page 2 sent NGP

Parameter	Discharge Limitation	Cutoff Concentration	Units	Measurement Frequency	Type of Sample
Oil and Grease	15	N/A	mg/l	Annually[1]	Grab
pH Range	5.5 to 8.0	N/A	Standard Units	Annually[1]	Grab

N/L No Limitation at this time. Only monitoring and reporting required.
N/A Not Applicable.
MGD Million gallons per day
mg/l Milligrams per liter
[1] The monitoring year shall start on the effective date of this NGPC.

8. Reporting of monitoring results shall be in accordance with HAR Chapter 11-55, Appendix B, Section 9;

9. The Director may specify additional monitoring requirements and limitations, in addition to the monitoring requirements specified in Item 7 of this NGPC;

10. The Permittee shall revise their SWPCP should any discharge limitation be exceeded. The revisions shall include measures to reduce the amount of pollutants found to be in exceedance from entering storm water runoff;

11. The Permittee shall notify the Department of Health upon termination of the subject activities; and

12. The Permittee shall be responsible for ensuring that anyone working under this NGPC understands the NGPC's terms and conditions.

This NGPC will take effect on the date of this notice. This NGPC will expire at midnight, September 21, 2002, or when amendments to HAR Chapter 11-55, Appendix B are adopted, whichever occurs first.

EXHIBIT J

PAGE 2 of NGPC

Should you have any questions regarding this NGPC, please contact Ms. Kris Poentis, Engineering Section of the Clean Water Branch, at (808)586-4309.

Sincerely,

THOMAS E. ARIZUMI, P.E., CHIEF
Environmental Management Division

KP\cr

Enclosures:
1. HAR Chapter 11-55, Section 34, Appendices A and B
2. Discharge Monitoring Report Form
3. Title 40, Code of Federal Regulations Citations as referenced in Chapter 11-55, Appendix A

c: Alex Ho, Department of Public Works, City and County of Honolulu (w/o encls.)

EXHIBIT J

Page 4 SOH NGPC

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

December 1, 1997

Robert P. Singlehurst
Grace Pacific Corporation
Makakilo Facility
91-920 Farrington Highway
Kapolei, HI 96707

Re: SPCC Case No.: 97-510
Notice of Compliance
Inspection Date: 3/17/97
Inspectors: Peter Reich, SAIC

Dear Mr. Singlehurst:

The EPA has reviewed Grace Pacific Corporation's addendums to the Final Spill Prevention Control and Countermeasure Plan dated July 14, 1997, which was submitted to the Agency on August 21, 1997.

Based upon review of the addendums a determination has been made that your facility is in compliance with requirements of 40 CFR Part 112.

This letter does not, in any way, relieve the Grace Pacific Corporation from any responsibility or liability should it experience an oil spill at the facility in the future.

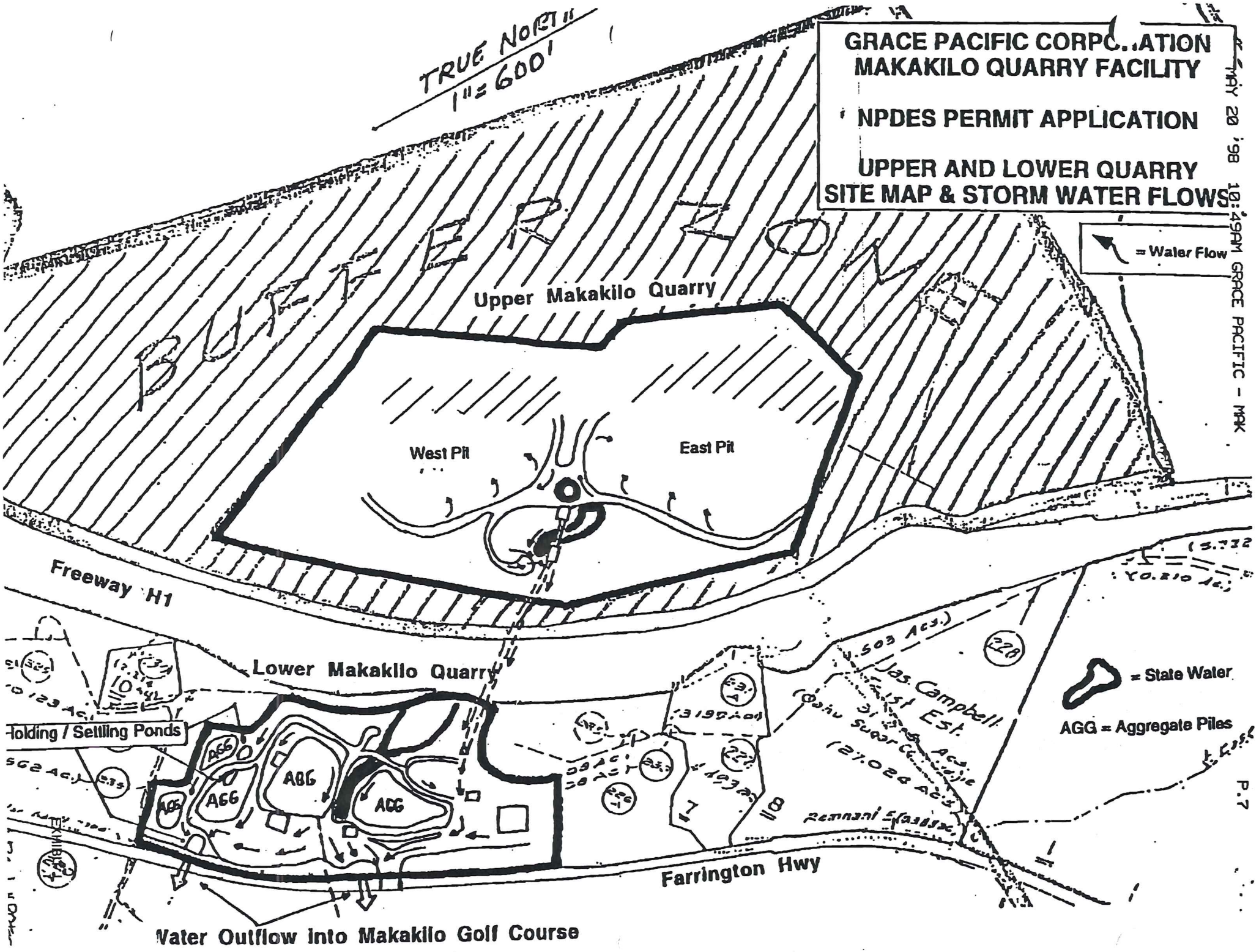
If you have any questions regarding this matter, please contact me at (415) 744-2327.

Sincerely,

Steve Calanog
Oil Team

cc: Elizabeth Galvez
Hawaii Dept. of Health
HEER Office
919 Ala Moana Boulevard
Honolulu, HI 96814-4912

EXHIBIT J


GRACE PACIFIC CORPORATION
MAKAKILO QUARRY FACILITY
NPDES PERMIT APPLICATION
UPPER AND LOWER QUARRY
SITE MAP & STORM WATER FLOWS
= Water Flow
TRUE NORTH
1" = 600'
Upper Makakilo Quarry
West Pit
East Pit
Freeway H1
Lower Makakilo Quarry
Holding / Settling Ponds
= State Water
AGG = Aggregate Piles
Jas. Campbell Est.
Farrington Hwy
Water Outflow into Makakilo Golf Course
MAY 20 '98 10:49AM GRACE PACIFIC - MAK
P.7

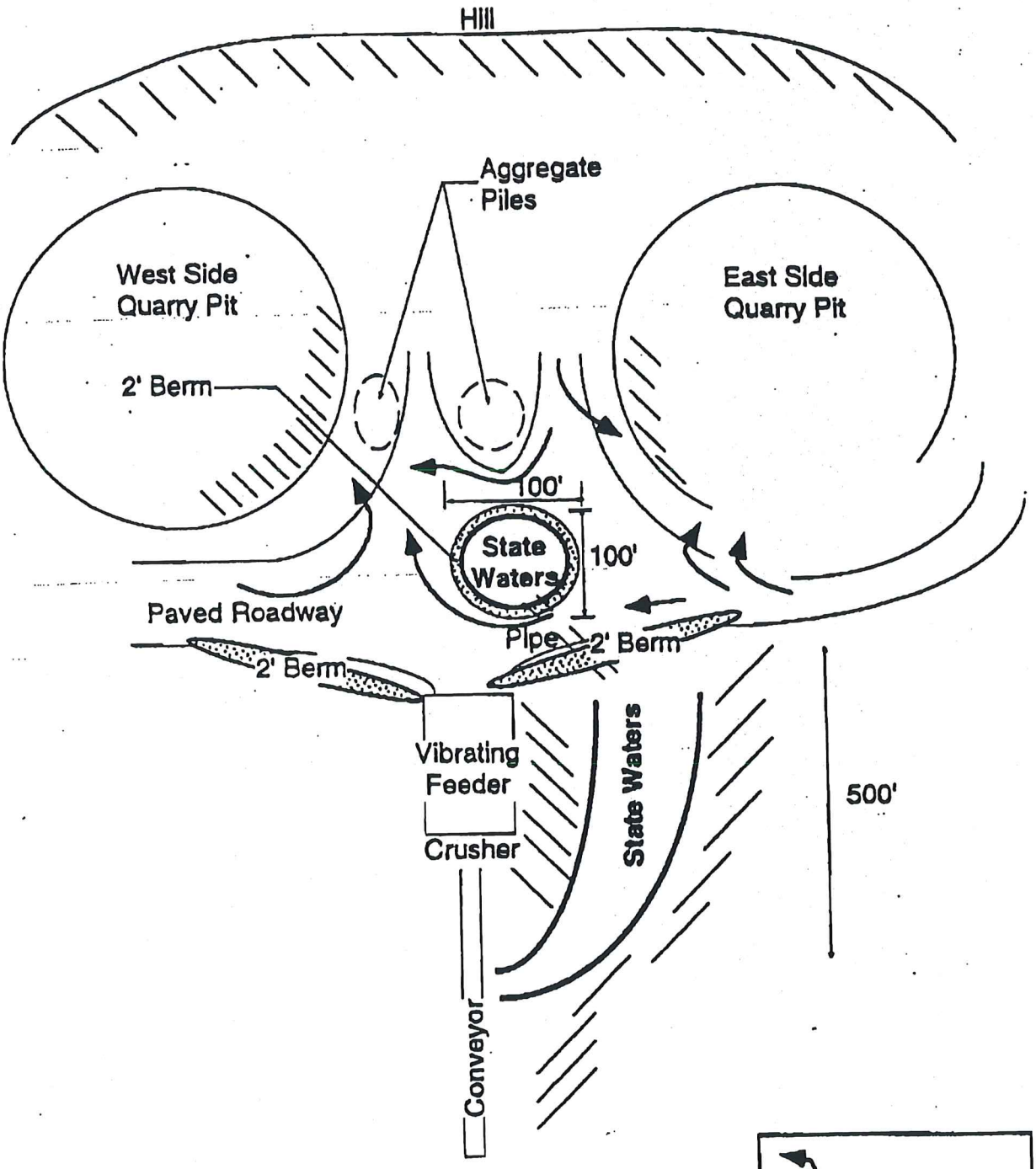
GRACE PACIFIC CORPORATION
MAKAKILO QUARRY FACILITY

NPDES PERMIT APPLICATION

LOCATION OF STATE WATERS WITHIN UPPER QUARRY

Not to Scale

Page 1



Continuation on page 2

EXHIBIT J

GRACE PACIFIC CORPORATION
MAKAKILO QUARRY FACILITY

NPDES PERMIT APPLICATION

LOCATION OF STATE WATERS WITHIN UPPER QUARRY

Not to Scale

Page 2

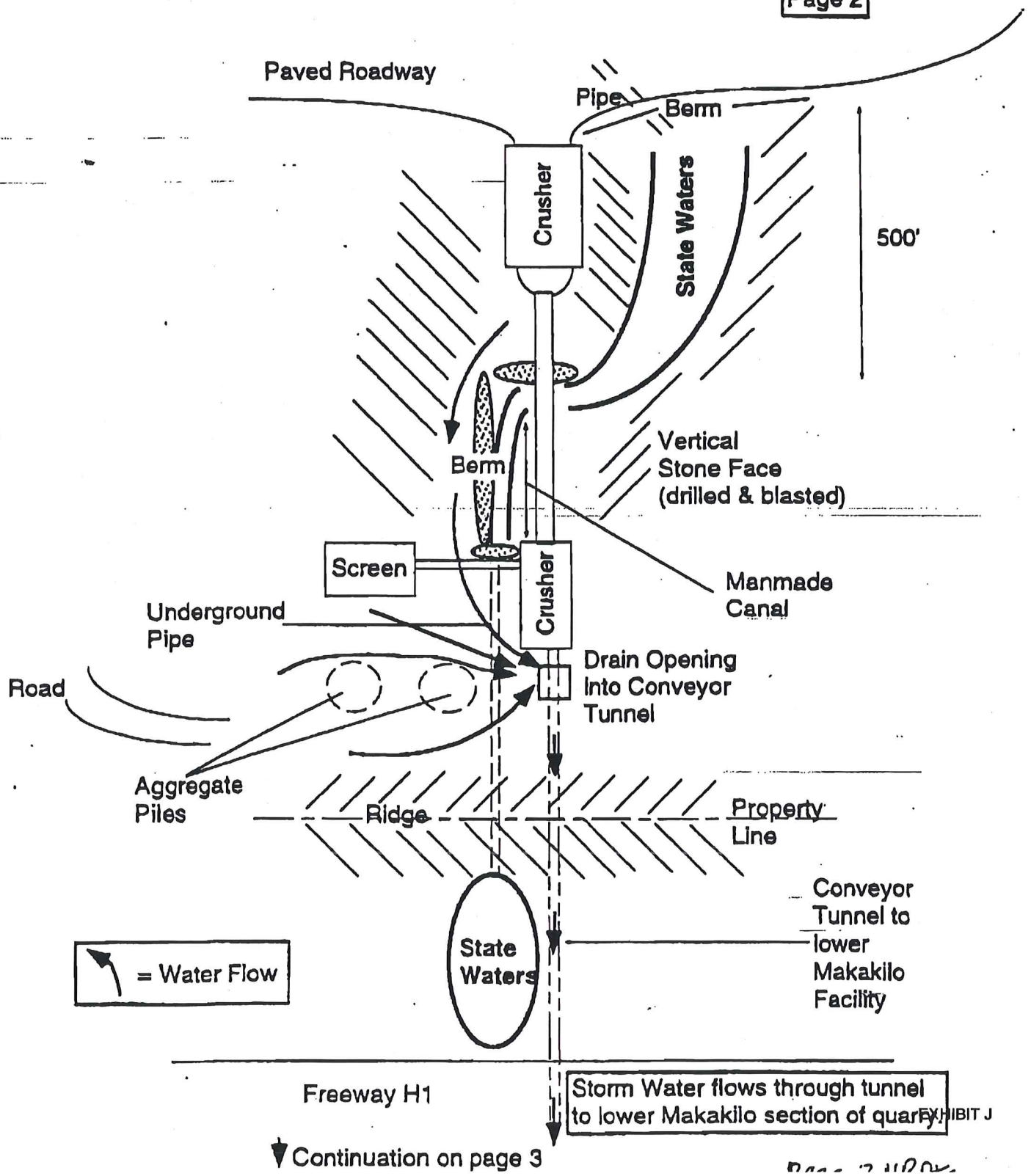


EXHIBIT J

Continuation on page 3

GRACE PACIFIC CORPORATION
MAKAKILO QUARRY FACILITY

NPDES PERMIT APPLICATION

LOCATION OF STATE WATERS WITHIN LOWER QUARRY

Not to Scale

Page 3

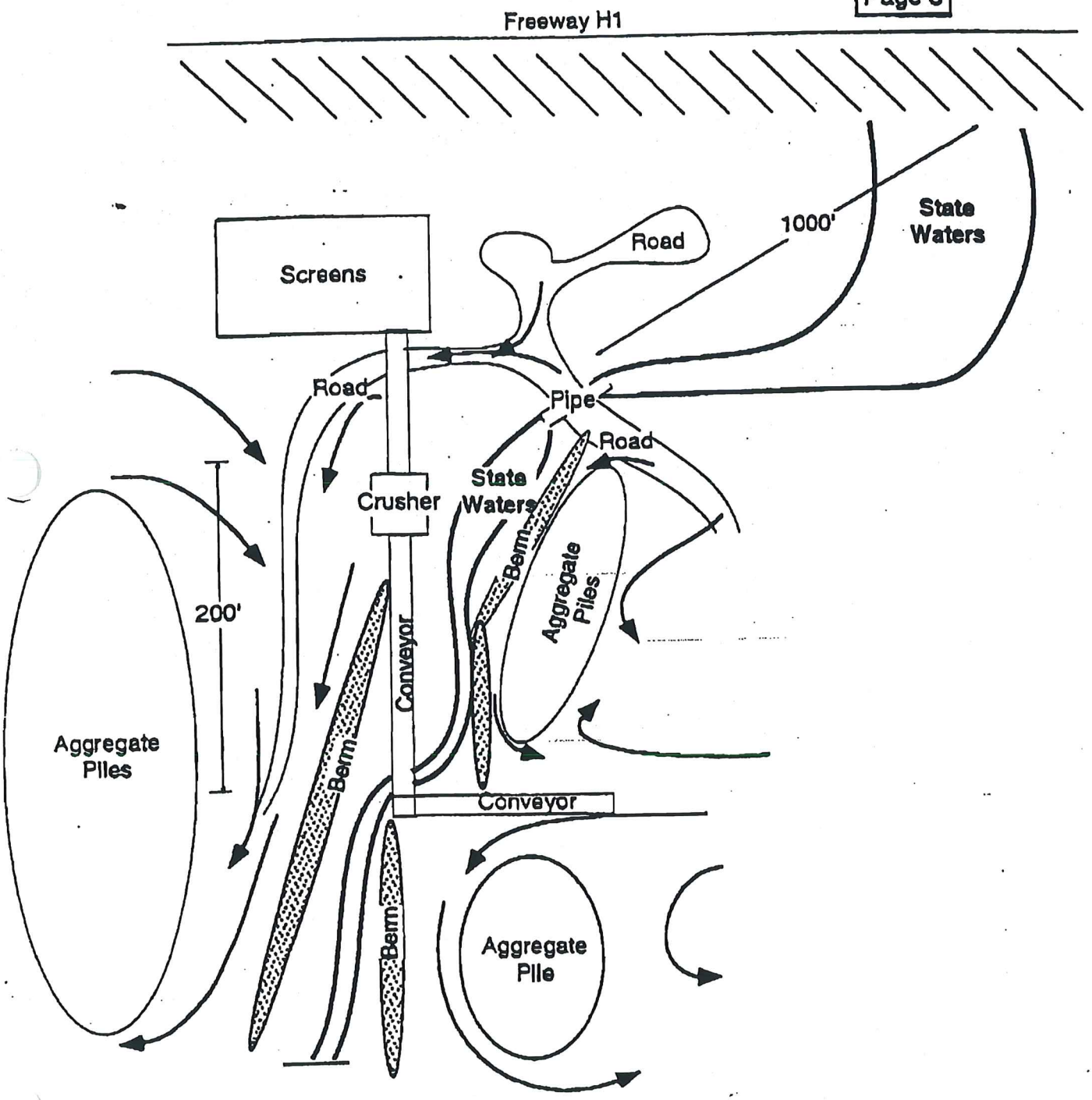


EXHIBIT J

Page 11 NPDES

APPENDIX E

REVEGETATION RECOMMENDATION

EXHIBIT J

EXPIRATION DATE 4/17/83

MEMORANDUM TO FILE

Lee Sichter
Reviewed By

Makakilo Quarry - Farrington Hgwy
Address

File No: 72/CUP-15

Tax Map Key : 9-1-6:por6; 9-2-3:por12; 9-1-16:por4; 9-2-3:por2

Applicant/Owner: Pacific Concrete & Rock Company

Approval Date: April 17, 1973

Issued By: City Council Res. 94 & 95 (Resolution, letter dated)

Amended: ----------

By: ----------

A. REVIEW OF FILE, indicates: Date: 8/31/82

___ All conditions are met

___ The following conditions have not been met: (List)

Comments:

Review of file in response to receipt of Status Report # 13 from Pacific Concrete and Rock Co. on May 3, 1982. Letter indicates that no dust complaints have been received and that replanting to present date has been successful with no new replanting scheduled.

B. INSPECTION OF THE PREMISES, reveals: (Attach photos)

X All conditions are met

___ The following conditions have not been met: (List)

Comments:

Site check on Aug. 31, 1982 indicates that plants are indeed thriving and that despite normal quarry operations dust levels appear to be minimal

Date(s) of inspection: 8/31/82

C. ACTION: (Revoke, terminate, grant extension of time, etc.)

X No action necessary schedule next monitoring for April, 83

___ Letter to Applicant

___ Letter to Council

REMARKS: (Attach additional sheets if necessary)

see photos attached

EXHIBIT J

LU 5/83

PACIFIC CONCRETE
AND ROCK COMPANY, LIMITED
2344 PAHOUNUI DRIVE / HONOLULU, HAWAII 96819
TELEPHONE (808) 845-6441

May 5, 1983

1983 MAY 11 PM 12:42
DEPT. OF LAND UTILIZATION
CITY & COUNTY OF HONOLULU

Department of Land Utilization
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Gentlemen:

Conditional Use Permit
Puu Makakilo Quarry
Reference No. 72/CUP-15

This letter is Pacific Concrete's Status Report No. 15 on dust and replanting activities at our Puu Makakilo Facility for the past six months.

We received one complaint about dust at lower Makakilo on April 14, 1983. Complainant called after lunch about observing dust early in the morning. Visited the site during the late afternoon and noted that the wind was very strong. However, increased watering on the ground and conveyors was controlling the dust. We had no further complaint from this incident.

In regard to replanting activities, all planted areas are being maintained satisfactorily. Indigenous plant growth have also flourished over previously bare soil areas.

Very truly yours,

Frederick K. Sekiya

Frederick K. Sekiya
Technical Services Director

cc: Samuel L. Keala, Jr.
The Estate of James Campbell

MAY 23 1983

LU5/83-21
72/CUP-15
72/SUP-1

Mr. Frederick K. Sekiya
Technical Services Director
Pacific Concrete and Rock
Company, Limited
2344 Pahounui Drive
Honolulu, Hawaii 96819

Dear Mr. Sekiya:

Conditional Use Permit (72/CUP-15)
Status Report No. 15 - Puu Makakilo Quarry
Tax Map Key 9-2-03

Your status report of May 5, 1983 has been received and accepted. Our staff will continue to make periodic checks on the site.

Your next status report is due in November 1983, pursuant to Condition No. 5 of City Council Resolution No. 95.

Your efforts on the landscaping and maintenance of the planted areas are acknowledged, and also the affirmative action taken on the complaint about the dust situation at lower Makakilo on April 14, 1983.

When writing to the department regarding this permit, please refer to the reference number (72/CUP-15) indicated above.

We appreciate your cooperation in this matter. Should you have any questions, please contact Allan Kuramoto of my staff at 527-5379.

Very truly yours,

MICHAEL M. McELROY
Director of Land Utilization

MMM:jt

cc: CCA

EXHIBIT 4

File

DEPARTMENT OF LAND UTILIZATION

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813 • (808) 523-4432

EILEEN R. ANDERSON
MAYOR

MICHAEL M. McELROY
DIRECTOR

ROBERT B. JONES
DEPUTY DIRECTOR

NOV 23 1983

72/CUP-15(EY)
LU11/83-6376

Mr. Frederick K. Sekiya
Technical Services Director
Pacific Concrete and Rock
Company, Limited
2344 Pahounui Drive
Honolulu, Hawaii 96819

9-1-16:4
9-2-03:12

Dear Mr. Sekiya:

Status Report No. 16
Conditional Use Permit (72/CUP-15)
Puu Makakilo Quarry
Tax Map Key 9-2-03: Portion of 2
and 9-1-06: Portion of 4

This is to acknowledge receipt and review of your Status Report No. 16 required by Condition No. 5 of City Council Resolution No. 95 (dated April 17, 1973) on the quarry operation.

Your report has been accepted and we are pleased to note your immediate response to complaints received as cited in your report. All planted areas shall be satisfactorily maintained.

Your next scheduled report will be due in May 1984.

Very truly yours,

for MICHAEL M. McELROY
Director of Land Utilization

MMM:jt

EXHIBIT J

LU/88-105

Grace Pacific
Corporation

[illegible]

January 6, 1988

Department of Land Utilization
City & County of Honolulu
650 South King Street
Honolulu, HI 96813

Subject: Conditional Use Permit, Pu'u Makakilo Quarry, 72/CUP-15

Gentlemen:

This is Grace Pacific's status report on dust and replanting activities at our Puu Makakilo facility for the past eight months.

We received four complaints about dust at our lower Makakilo area during this time period, two from local residents and two from freeway users. They complained about dust blowing across the freeway. On three occasions we notified the plant supervisor and he was already aware of the dust problems and was containing it through the use of our waterwagon spraying heavier amounts of water.

On one occasion during our plant start-up the wind picked up and blew dust into the air but our plant supervisor mentioned that the dust was very minimal and contained through our water spraying system.

No further replanting activities took place, however, all recently planted areas continue to grow. 3½" x 5" colored photos of our site and planted areas will be forwarded shortly.

Very truly yours,

The Rock Division

Ronald L. Obrey
Vice President-Operations

'88 JAN 7 PM 3 30

DEPARTMENT OF LAND UTILIZATION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET

72/CUP-15(WE)

January 11, 1988

Mr. Ronald L. Obrey
Grace Pacific Corporation
P.O. Box 78
Honolulu, Hawaii 96810

Dear Mr. Obrey,

Conditional Use Permit, Pu'u Makakilo Quarry, 72/CUP-15

This is to acknowledge receipt and review of your Status Report as required by Condition No. 5 of City Council Resolution No. 95 (dated April 17, 1973) on the quarry operation.

Your report has been accepted and based on our records, your next schedule report No. 26 is due in May 1988.

Very truly yours,

JOHN P. WILLEN
Director of Land Utilization

JPW:an
0137N

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

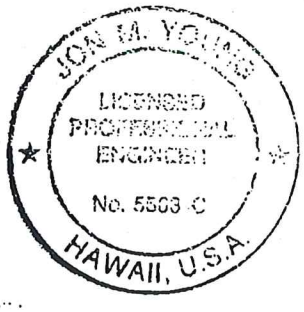
Prepared for:

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

March 2004



This work was prepared by me or under my supervision.

ENGINEERING REPORT AMENDMENT
TABLE OF CONTENTS

1. INTRODUCTION

1.1 PURPOSE

This is an amendment to *Makakilo Quarry Conditional Permit No. 72/Cup-15 Engineering Report* prepared by Parametrix, Inc. in July 1998, hereafter referred to as the "Original Report". The Original Report was approved by the City and County of Honolulu Department of Planning and Permitting on October 19, 1998. Please refer to the Table of Contents of this Amendment which show the specific subsections and appendices of the Original Report that remain unchanged.

Section 1, INTRODUCTION, is rewritten for this Amendment.

Section 2, GRADING PLAN, was revised to incorporate visual mitigation measures to enhance the natural look of the quarry from offsite locations. Section 2.2 has not changed, and is not included in this report.

Section 3, DRAINAGE PLAN general concepts were used from the original plan. For instance, the basin floor is still graded at 2% and the same quantity of offsite runoff is still redirected around the quarry. There are, however, some differences. Namely, there are now three drain basins, instead of the one proposed in the original engineering report. These basins were designed such that there will be increased surface area for percolation. The three basins combined will completely retain a 100-year storm event.

There will be no recurring discharge into the 96" culvert which underpasses the H-1 freeway and discharges into the Lower Quarry area. The elimination of such discharge removes the need for annual testing as delineated in the November 1997 Notice of General Permit Coverage (NGPC) included in Appendix D.

Section 4, REVEGETATION PLAN is revised to incorporate additional revegetation and visual mitigation measures. A new Revegetation/Mitigation Plan prepared by Belt Collins Hawaii in August 2003 replaces Appendix E of the Original Report.

1.2 SITE DESCRIPTION

The Estate of James Campbell owns the Makakilo Quarry land (Tax Map Key 9-2-3: 82), and leases it to Grace Pacific Corporation for quarry operations. The lease contract expires in the year 2017. The quarry is situated on the slopes of Pu'u Makakilo. The West Bound lanes of the H-1 Freeway front the east side of the property.

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

The area on the opposite side of the H-1 Freeway is also part of the Makakilo Quarry operations, however, is not included in this report.

2. GRADING PLAN

2.1 GRADING

The attached revised grading plan (Appendix B) shows the final grades prior to reclamation of the quarry in the year 2017. The plan maximizes quarry operations while minimizing the visual and environmental impacts to the surrounding areas.

Most of the design criteria are from the approved grading plan of Original Report. For instance, the basin floor is still graded at 2%, the same offsite drainage area enters the quarry, and the same drainage area is directed around the site. There are, however, some differences. Namely, there are now three drain basins, instead of the one proposed in the Original Report. These basins were designed such that storm events up to a 100-year storm intensity will be completely retained within the quarry. A more detailed explanation of the site drainage is provided in the next section, Drainage Plan.

The following is a description of the grading plan highlighting the similarities and differences with the original grading plan. The grading plan summary starts with the east side of the property and continues clockwise around the rim of the basin, and ending with the quarry floor.

2.1.1 EAST (MAKAI) RIM

The front of the quarry parallels the H-1 Freeway. Screening is presently provided by a row of banyan trees at the 275-foot elevation. An additional feature proposed with this grading plan raises the berm to 310 feet to provide a noise and sight barrier from the freeway. The foot on the east side of the berm ties into the existing 225-foot elevation where there is a gully between the berm and the H-1 Freeway. This gully discharges runoff into multiple concrete pipe culverts, which convey storm water under the freeway. The roadway of the H-1 Freeway is between 245 and 250-foot elevation along the quarry property. The difference of 60 to 65 feet between the roadway elevation and the raised berm will ensure that any equipment in the quarry will remain unseen.

2.1.2 SOUTHWEST RIM

The limits of grading shall be restricted to within the hedge/tree row along the south property line. The existing vegetation is growing on a naturally formed berm and provides a barrier for unwanted off-site runoff. An exception to this rule is the last 300 feet along the access road at the SW property corner near the entrance of the proposed storage bunker. This area already has positive drainage away from the site, so the vegetation is not needed to deflect any runoff.

Adjacent to this tree preservation area will be a 40-foot wide roadway generally graded to a slope of 12 to 15%. From the edge of the road a 2:1 slope is necessary to maximize success in re-naturalizing this face, which is presently visible from the approach to Kapolei on the H-1 Freeway. There will also be two benches at the foot of this 2:1 face; one at elevation 350 and the other at elevation 300. Each will have a vehicle access road connecting to the 40' road at the southern most ends.

2.1.3 NORTHWEST (MAUKA) RIM

The 310-foot long hedge/tree row outside of the northwest property corner boundary shall also be preserved just as the row on the southwest side was. This hedgerow is located just uphill of the proposed storage bunker facility and 25' wide access road. The preservation of this hedge/tree row is essential in diverting off-site runoff.

The 25-foot access road will run along the northwest property line. In the midpoint along the side it will meander offsite for about 200-linear feet to circumvent a natural channel, which drops approximately 150 vertical feet into the quarry. The last 500-feet of the access road at the north property corner shall be sloped away from the quarry and toward the high side at a cross-slope of 5%

As proposed with the original grading plan, the quarry will utilize staggered benches which will help provide a better visual effect yet maximize quarry operations. The grading plan shows benches uniform in height and widths. Actual heights and widths will vary depending upon the material encountered. Varying dimensions will also minimize the engineered appearance and help create a more natural-looking hillside.

2.1.4 NORTHEAST RIM

The northeast rim will have benches and two access roads. The access road along the property line should also slope away from the quarry to direct offsite runoff. The lower access road, which leads to the quarry floor, should also slope toward the higher benches and away from the center of the quarry. This is provided simply for the additional safety of the vehicles traversing down the 10% slope. Both of these roads will have a cross-slope of 4%.

The existing quarry entrance at Old Cane Haul Road, about midpoint along this side will continue to be used.

2.1.5 QUARRY FLOOR

As per the original grading plan, the pit floor will generally slope from the back and sides to the front at an approximately 2% grade. For the Quarry Floor, a tolerance of plus or minus two feet is considered acceptable as long as there is positive drainage toward the retention basins.

An additional measure proposed with this Amendment is the construction of an energy dissipation basin. The basin is to be located on the quarry floor at the midpoint of the northwest rim. An area 90 feet by 120 feet should be excavated to a depth of 10 feet below the quarry floor. This basin will reduce the erosive velocities of the incoming off-site runoff.

The lowest area of the quarry floor shall be developed with three drainage basins. The drain basins will have bottom elevations of 240-feet with 2:1 side slopes and top of berm elevation of 245 feet. Above the elevation of 245, the available storage is combined between the three basins. The top of the berm surrounding the existing 96" culvert shall be at elevation 255-feet.

2.3 BENCH RECLAMATION

Typically, the benches are 25 feet wide and 50 feet high with the horizontal surfaces being flat. To mitigate the engineered appearance of these faces, a series of random benches of various heights and lengths will created to vary the appearance of the sides of the quarry providing 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. Topsoil will be placed on the benches and planted.

3. DRAINAGE PLAN

3.1 DRAINAGE PLAN

The intent of the Makakilo Quarry drainage plan is to reduce the amount of storm water entering the site and fully retain all storm water runoff within the Upper Quarry boundary. The site will contain three drainage basins. Drainage Basins (DB) #1 and #2 at the southeast property corner are connected via a 48" corrugated metal pipe. The pipe will allow flow to transfer from DB#1 to DB#2 starting at pipe invert elevation 245-feet. DB#3 is located on the northeast area of the property. The design of these basins is presented in Appendix C-1 and C-2.

3.1.1 RAINFALL STORAGE

The basins were designed to completely retain storm runoff. Storm water storage requirements based on a 100-year storm as required by the City and County of Honolulu, *Rules Relating to Storm Drainage Standards,* January 2000. The maximum 24-hour duration storm was used to calculate the required basin storage.

"Design Curves for Peak Discharge vs. Drainage Area" (Plate 6) from the above referenced standard was not used in these calculations. Plate 6 gives only the peak discharge based on the size of the drainage area. As is notated on the figure, the use of these curves are limited to "stream channels and drainage structures." The runoff volume cannot be readily deduced from the peak discharge.

Graphically speaking, the peak discharge is only one point on the runoff hydrograph. All values of runoff/time curve are needed, not just one, since the planimetric area under this curve would give the volume of storm water runoff.

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 Appendix C-1 for Rainfall Storage Calculations.

Depth of recorded rainfall for a 100-yr storm with 24-hour duration was extracted from the State of Hawaii Department of Land and Natural Resources Division of Water and Land Development, *"Rainfall Frequency Study for Oahu, Report R-73"*, 1984. Applicable page from this reference is included with the calculations in Appendix C-1.

Multiplying the total quarry drainage area of 148 acres by 12.3 inches of rainfall, gave the total required storage capacity of 151.7 AC-ft. The total impoundment of the quarry is set at the overflow point at the top of the berm surrounding the existing 96" culvert. The berm is at elevation 255-feet. Designing for a freeboard of 2 feet, the available storage at elevation 253-feet is 175 AC-feet as tabulated in Appendix C-2. Therefore, the

storage capacity is adequate. The elevation correlating to the required storage volume of 151.7 AC-ft is at 251.9-feet. It should be noted that although the 100-year storm will be completely retained, the existing 96" culvert should not be removed or plugged.

High percolation rates of approximately 10 minutes per inch have been observed, but not formally analyzed by an engineer. Since no accurate data is available, no percolation discharge is deducted from the enclosed volume calculations. Observations within the last several years show that percolation rates have been adequate to discharge all storm water within a few hours. Additional fracturing of detention pond bottom 10 feet below grade as mentioned in the Original Report seems unnecessary.

The drain basins and quarry floor should be visually checked after each storm event to ensure adequate release of storm water through percolation. Should be basins or quarry floor develop high silt content, measures need to be taken to restore adequate percolation rates.

3.1.2 DIVERSION OF OFFSITE RUNOFF

It is necessary to divert as much offsite runoff around the quarry as feasible. This will minimize erosion of soils and damage to current revegetation efforts. The same offsite drainage areas are being diverted as they were in the Original Report. The existing drainage culverts which transport the storm water under the H-1 Freeway have already been sized to take these drainage areas.

As described in the Section 2.1.2 and 2.1.3, the existing hedge/tree line located at the northwest and southwest property lines should be maintained. These preservation areas will naturally divert offsite storm water runoff around the south side of the property.

The access road at the north property corner will have a 5% cross-slope sloping away from the quarry. This will prevent offsite runoff from entering the quarry at the north corner. Once transported past the corner, that flow will enter existing offsite swales. The remainder of the sloped roadway along the northeast property line will divert a minimal amount of runoff. This sloped roadway will start at the bench high point of 545-feet and continue around to the northeast property line to the main entrance at Old Cane Haul Road.

Since the drainage area to the sloped access road is less than 100 acres, the rational formula method is used to determine the flow quantity. See Appendix C-3 for Surface Water flow calculations. A minimum time of concentration (Tc) of 10 minutes for a 10-yr storm were used. The roadway with a 5% cross-slope was analyzed as a V-ditch using the Chezy-Manning Equation to find the depth and spread of the flow over the road. It was determined that the maximum depth would be 4" and the spread would only reach 6.4-feet of the 25-foot wide road. Calculations are in Appendix C-4 Diversion Ditch Analysis.

3.2.1 EROSION CONTROL MEASURES

An Energy Dissipation Basin should be installed at the highest point of the quarry floor where off-site runoff enters the site. A 10-yr storm will produce approximately 150 cfs of runoff at that entry point as calculated in Appendix C-3. An area 90 feet wide centered on the low point of the bench above and 120 feet long paralleling the berm on the quarry floor should be over-excavated to a depth at least 10 feet below floor elevation (elevation 260-feet). Use heavy-duty geotextile material and large (min. 3' diameter) boulders to line the basin. The large volume of the basin will detain the waters for approximately 9 minutes to dissipate the erosive energy. The lower edge of the basin will then act as a weir to further reduce the velocity.

Check dams will be installed on the perimeter access road at the north corner at approximately every 150-feet to trap sediments and lower velocities. Use rocks with minimum diameter of 12". Minimum dimension of check dams are 2' high x 12' wide x 6' long. Length of the check dams may be increased to maintain vehicle accessibility.

3.3 QUALITY

No discharge is expected from the quarry. The site has been designed to fully contain runoff for a 100-year storm event, therefore, the *Notice of General Permit Coverage (NGPC) (File No. HI R32A707)* previously included in Appendix D of the Original Report is removed and is no longer be applicable.

The Lower Quarry currently takes the storm water discharge from the 96" culvert from the Upper Quarry. This discharge did not feed into any wet ponds or any other feature which rely on active flow. The elimination of said discharge, therefore, will cause no negative effect.

4. REVEGETATION PLAN

4.1 INTRODUCTION

The Revegetation Plan included in Appendix E of the Original Report was written by Belt Collins and Associates in January 1990. A new Mitigation/Revegetation Plan prepared by Belt Collins Hawaii in August 2003 is incorporated into this Amendment.

The improvements of this Plan over its predecessor are:

1) the existing gullies of Puu Makakilo along the H-1 freeway will not be excavated to the elevation of the freeway, which would expose the quarry operations to passing traffic;
2) the height of the existing berm along the H-1 Freeway will be increased by 35 feet and be re-naturalized for screening purposes; and
3) the western corner of the quarry will be sculpted with a 2:1 slope above the 350 foot elevation and re-naturalized to enhance the view on the H-1 approach to Kapolei.

The revised Mitigation/Revegetation Plan lists specific measures to:

1) Minimize or eliminate the visual recognition of the quarry from off-site locations.
2) Screen the quarry machinery and equipment from public view.
3) Minimize (and essentially eliminate) the long-term use of irrigation water.
4) Minimize long-term maintenance in the re-naturalized areas.
5) Avoid an "engineered appearance" to the completed project.
6) Quickly establish a re-naturalized appearance.
7) Protect existing vegetation surrounding the site from quarry activities.
8) Minimize costs associated with the re-naturalization efforts.

4.2 STRATEGIES

Generally the revegetation recommendations stated in the Original Report are still valid and are still included in this Amendment. For example, it is emphasized that native plant species in the surrounding landscape should be used as they will be more apt to survive in the arid climate.

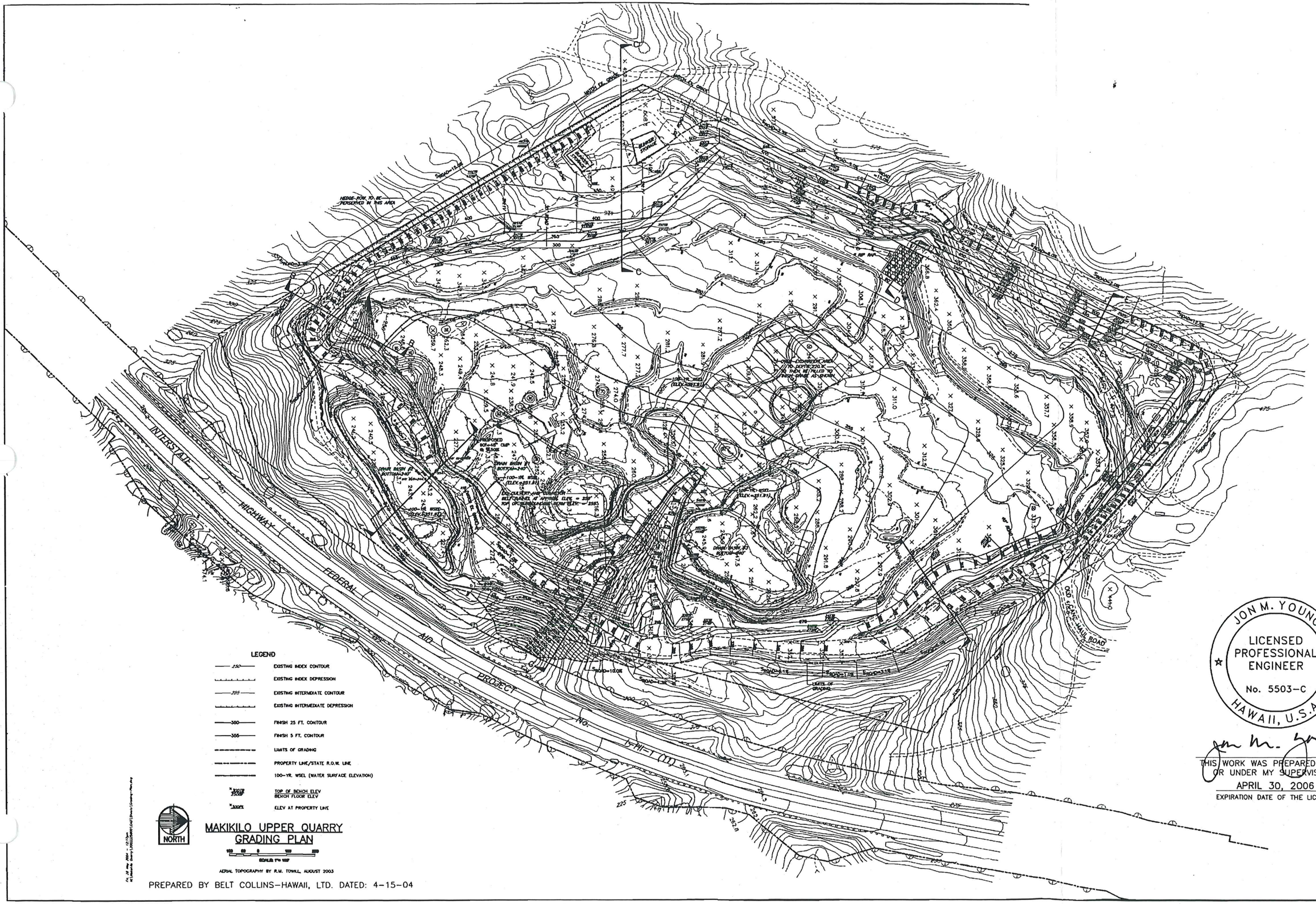
For full description of specific recommendations, see Appendix E Mitigation/Revegetation plan prepared by landscape architects from Belt Collins Hawaii in August 2003.

APPENDIX B

GRADING PLAN

AND

SECTIONS



MAKIKILO UPPER QUARRY GRADING PLAN

SCALE: 1"= 100'

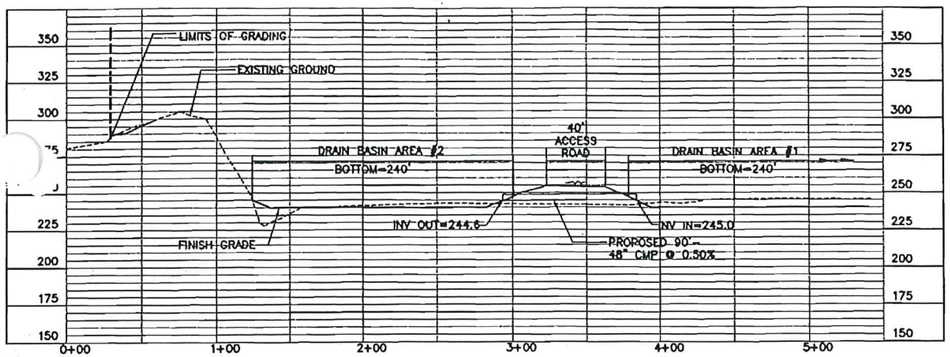
AERIAL TOPOGRAPHY BY R.M. TOWILL, AUGUST 2003

PREPARED BY BELT COLLINS–HAWAII, LTD. DATED: 4-15-04

JON M. YOUNG
LICENSED PROFESSIONAL ENGINEER
No. 5503-C
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION

APRIL 30, 2006
EXPIRATION DATE OF THE LICENSE



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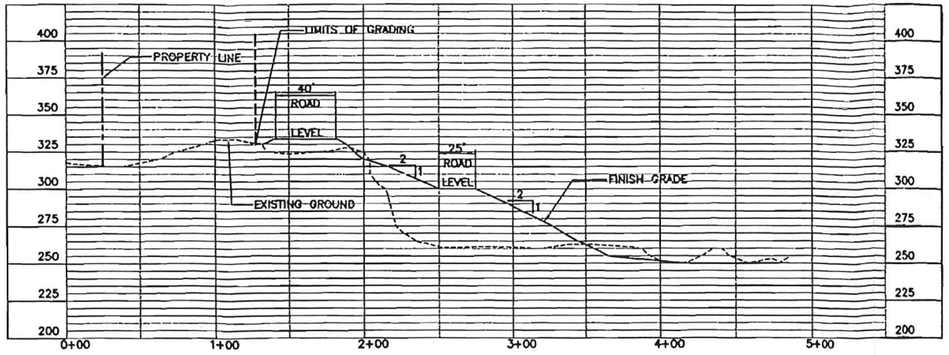

SECTION–BB
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No. 5503-C
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APRIL 30, 2006
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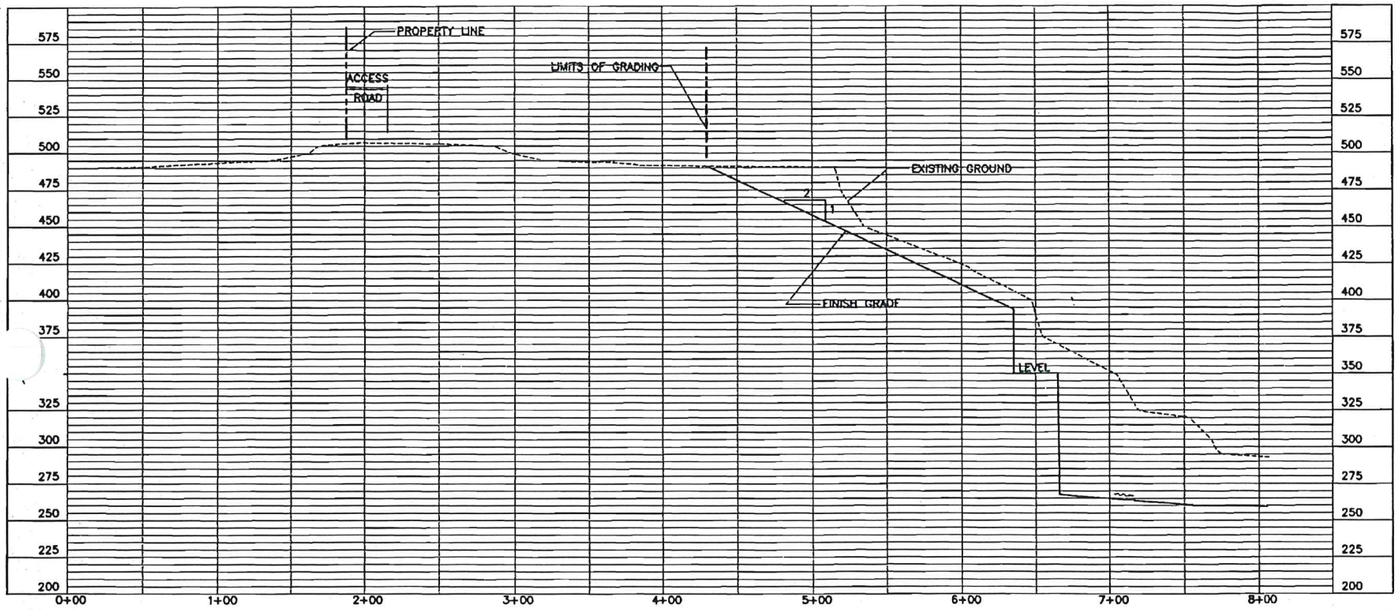

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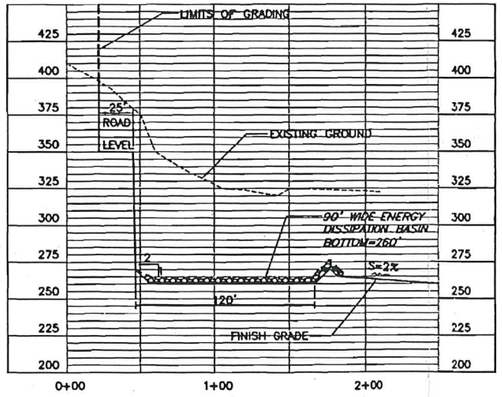

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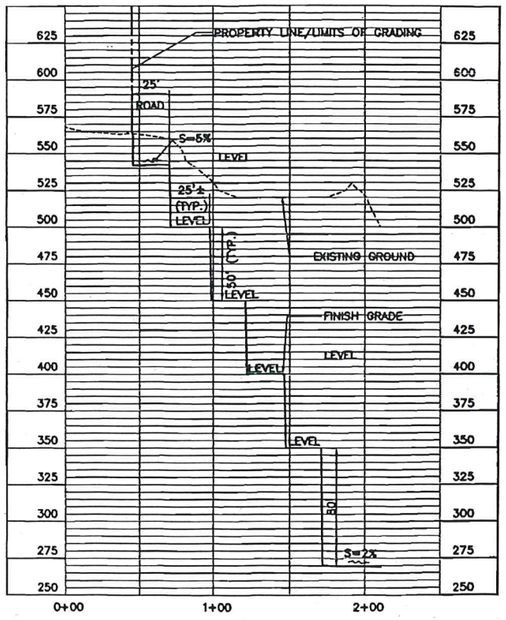

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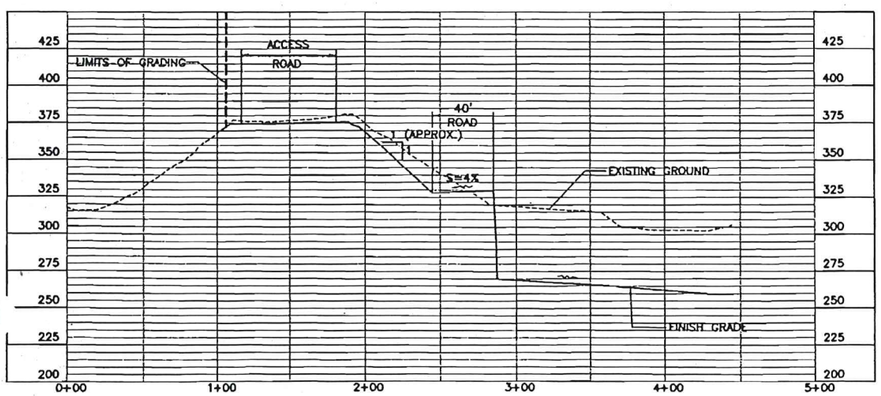

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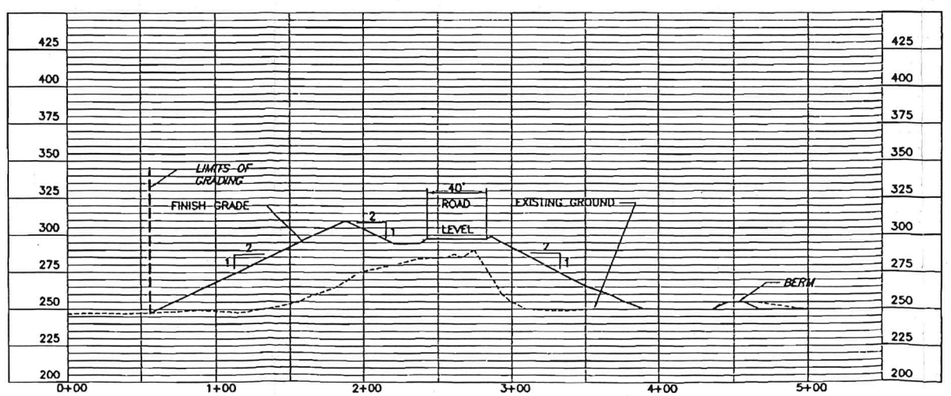

SECTION–GG
SCALE: 1"=50'

MAKIKILO UPPER QUARRY
SECTION PLAN

50 25 0 50 100
SCALE: 1"= 50'

PREPARED BY BELT COLLINS–HAWAII, LTD. DATED: 3–19–04

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APPENDIX C

STORM DRAINAGE CALCULATIONS

APPENDIX C-1
RAINFALL STORAGE CALCULATIONS

Find: Required retention basin volume to fully contain a 100-yr, 24-hour storm.

Given:

(1) Total drainage area to the Makakilo Quarry is 148 acres.

(2) There are three smaller drainage basins that will act as one above the elevation of 245 feet. Total available storage is approximately 175 AC-ft as tabulated in Appendix C-2, Storage Elevation Tables.

Assumptions:

High percolation rates have been observed, but not formally analyzed by an engineer. Since no accurate data is available, no percolation discharge is deducted from the following volume calculations.

Ref: State of Hawaii Department of Land and Natural Resources Division of Water and Land Development, *"Rainfall Frequency Study for Oahu, Report R-73"*, 1984.

Solution:
Attached exhibit from the above reference shows 100-Year, 24-Hour storm rainfall atlas.
Rainfall in Makakilo area = 12.3 inches

Required Basin Volume
= 12.3 in * (1 ft/12 in) * 148 acres
= **151.7 AC-ft**

The available storage of 175 AC-ft is **ADEQUATE** to hold a 100-yr, 24-hr. storm.

Note: The adequacy of the retention basin storage is further reinforced by the fact that no percolation discharge rate was used to reduce the required volume. In reality relatively high percolation rates have been observed in the order of 10 minutes per inch.

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APRIL 30, 2006
EXPIRATION DATE OF THE LICENSE

MAKIKILO UPPER QUARRY DRAINAGE MAP

100 80 0 100 200
SCALE: 1"= 100'

PREPARED BY BELT COLLINS-HAWAII, LTD. DATED: 03-02-04

28 May 2004 - 11:57pm
Kaloko Quarry\2003335800\CAD\Sheets\Drainage

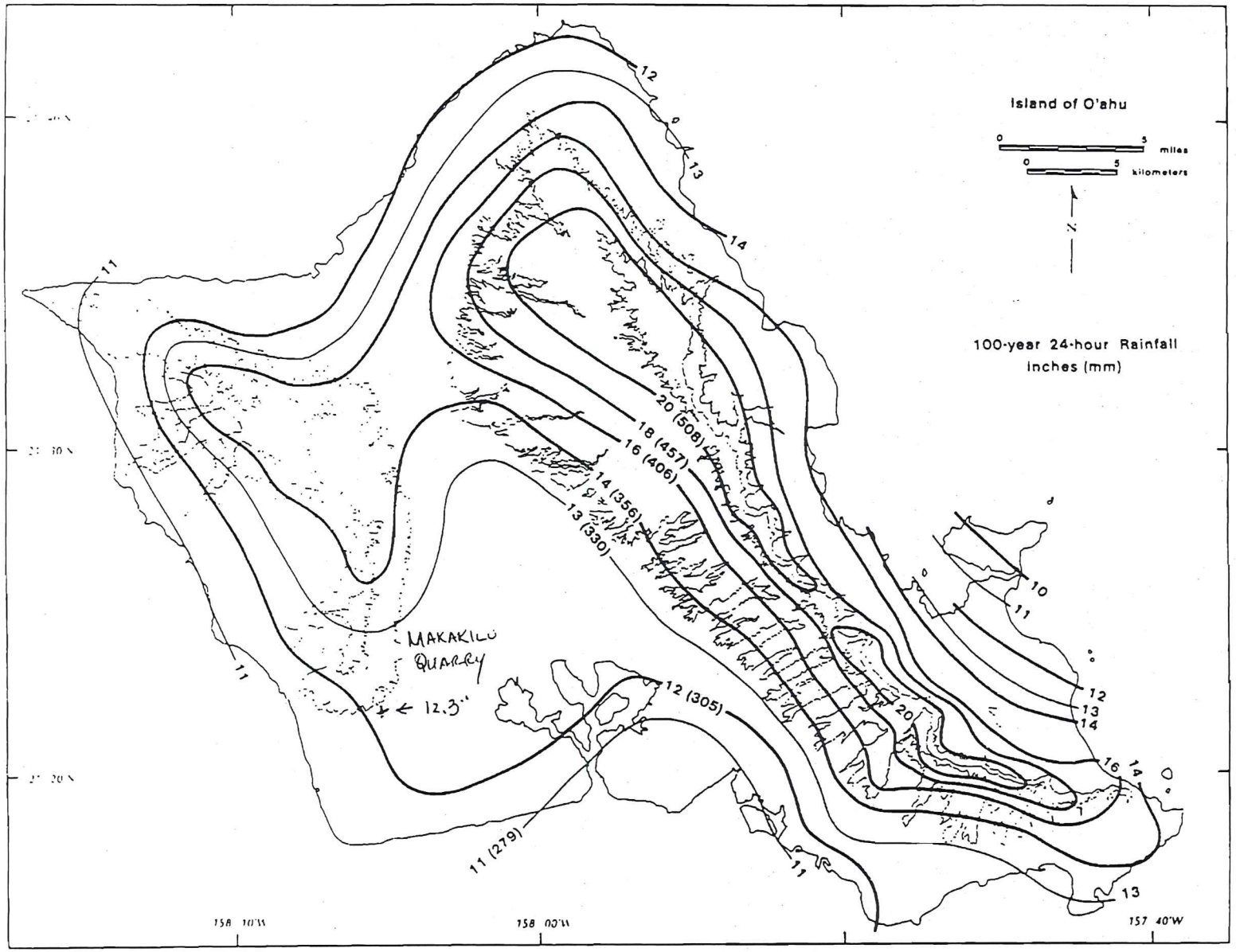


Figure 18. Map of 100-yr 24-hr rainfall, O'ahu, Hawai'i

APPENDIX C-2
STORAGE-ELEVATION TABLES
FOR DRAIN BASINS (DB)

DB#1

Elev (ft)	Area (sf)	Incr Vol (cf)	Accum Vol (cf)	Storage (AC-ft)
240	140,000	0	0	0
245	152,500	731,250	731,250	16.8

DB#2

Elev (ft)	Area (sf)	Incr Vol (cf)	Accum Vol (cf)	Storage (AC-ft)
240	102,000	0	0	0
245	112,000	535,000	535,000	12.3

DB#3

Elev (ft)	Area (sf)	Incr Vol (cf)	Accum Vol (cf)	Storage (AC-ft)
240	112,800	0	0	0
245	124,800	475,200	475,200	10.9

Combined storage above elevation 245-feet:
DB#1 + DB#2+DB#3

Elev (ft)	Area (sf)	Incr Vol (cf)	Accum Vol (cf)	Storage (AC-ft)
245	389,300	0	1,741,450	40.0
250	762,200	2,878,750	4,620,000	106.1
253	1,218,300	2,970,750	7,590,750	**174.3**
255	1,338,900	5,252,750	9,872,750	226.6

Available storage volume = approx. **175 AC-ft.**
Required volume < Available volume
151.7 < 175 Adequate storage provided.

Elevation at Required Volume of 151.7 AC-ft = 251.9 ft.

Freeboard at berm surrounding 96" culvert = 255 -251.9
= **3.1 ft.**

APPENDIX C-3
SURFACE WATER CALCULATIONS

Find: Flows for Quarry using Rational Method and a recurrence interval of 10-years.

Ref: City and County of Honolulu, *"Rules Relating to Storm Drainage Standards"*, January 2000

Solution:

$Q = CIA$

Q = Design flow rate (cfs)
C = Runoff coefficient
I = Rainfall intensity (inches/hr)
A = Drainage area (acres)

From Plate 2,

$T_m = 10$ years
$I_R = 1.9$ inches

Correction Factor (CF) from Plate 4 for Tc= 10 min.

$CF = 2.26$

Therefore, $I = I_R * CF = 1.9 * 2.26 = 4.29$ in/hr

From Table 1, Coefficient of Runoff, C

C = 2/3 band
C = 2/3 (0.55 to 0.80)
C = 0.75

Drainage Areas (A)

See enclosed Drainage Map for delineation of drainage areas.

Offsite DA4, A = 7.1 acres
Offsite DA2, A = 46.8 acres

Solve for Q:

Div. Ditch= 0.75 * 4.29 in/hr * 7.1 acres = 22.8 cfs
Offsite DA2 = 0.75 * 4.29 in/hr * 46.8 acres = 150.6 cfs

APPENDIX C-4
DIVERSION DITCH ANALYSIS

Find: The following characteristics of the diverted runoff on the road with cross slope of 5%.

(a) Depth
(b) Spread
(c) Velocity

Ref: City and County of Honolulu, *"Rules Relating to Storm Drainage Standards"*, January 2000

Using the Chezy-Manning Equation

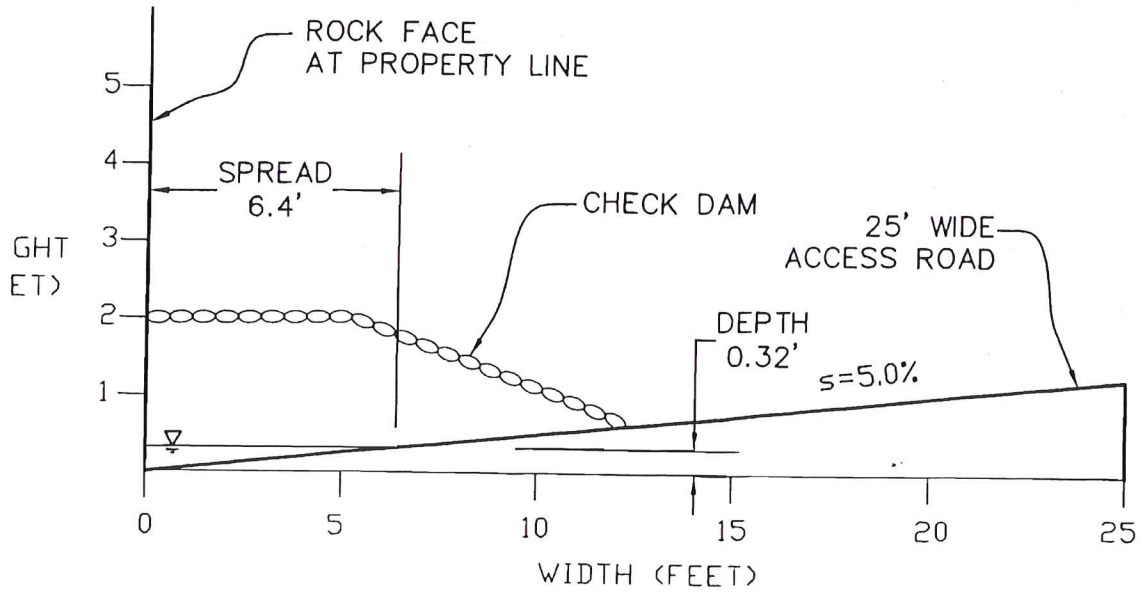
$$Q = 1.49/\eta \; A \; (R_h)^{2/3} * s^{1/2}$$

$$R_h = A/WP$$

Where Q = Quantity of 10-yr storm flow, cfs
η = Manning's roughness coefficient
A = Cross sectional area of the flow, sf
R_h = Hydraulic radius, ft
s = Channel slope, ft/ft
WP = Wetted Perimeter, ft

Given: Q = 22.8 cfs (see previous sheet)
η = 0.030, Rock
s = 12.5%

Sketch of cross-section (not to scale)



DIVERSION DITCH ANALYSIS, pg. 2

Solution:

R_h = A/WP
= (½*(d/0.05)*d)/(d+d/005)
= $10d^2/21d$
= 0.48d

Note: Long on the road of the wetted perimeter will approximately equal the spread, d/0.05.

Q = 1.49/η A (R_h)^2/3 * s^1/2
22.8 = 1.49/0.030 * (½*(d/0.05)*d) * (0.48d)^2/3 * (0.125)^1/2
22.8 = 49.7*10d^2*0.61d^2/3*0.35
0.21 = d^4/3
d = 0.32 ft.

Answer for (a) Runoff Depth = 0.32 feet

Spread = d/0.05
= 0.32/0.05
= 6.4 ft.

Answer for (b) Runoff Spread = 6.4 feet

V = Q/A
= 22.8/(½*6.4*0.32)
= 22.3 fps

Answer for (c) Runoff Velocity = 22.3 feet*

*Runoff must be controlled with check dams to reduce the erosive velocities of the flow. Recommend installation every 150 feet.

APPENDIX E

MITIGATION/REVEGETATION PLAN

MITIGATION/REVEGETATION PLAN

Purpose of the Plan

The purpose of the Plan is to address the visual mitigation of the Upper Quarry while actively processing aggregates, 2003-2017, and at closure, in 2017.

The Mitigation/Revegetation Plan (the "Plan") has been prepared as an exhibit to the Contract to Sell Rock in Place between the Estate of James Campbell and Grace Pacific Corporation, to be dated September 2003 (the "Contract"). The Plan sets forth Grace Pacific's visual mitigation obligations under the Contract and 1972 Conditional Use Permit. The Plan assumes the final landforms described in the Grading Plan section of this report.

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

1) the existing ridges and man-made berms are effective as 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 significant improvements of this Plan over its predecessor are:

1) the existing gullies of Puu Makakilo along the H-1 freeway will not be excavated to the elevation of the freeway, which would expose the quarry operations to passing traffic;

2) the height of the existing berm along the H-1 Freeway will be increased by 35 feet and be re-naturalized for screening purposes; and

3) the western corner of the quarry will be sculpted with a 2:1 slope above the 350 foot elevation and re-naturalized to enhance the view on the H-1 approach to Kapolei.

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 Upper 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. The June 2003 move of the B grade operations from the Lower Quarry to the Upper Quarry is a further step in this direction.

- 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.

- 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 UM-4 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 UM-1 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.

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 (Exhibit UM-2-1) to the Kapolei Regional Park (UM-2-2). 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 UM-2-3). The western quarry face is visible from the distant view at the H-1/Kunia intersection (Exhibit UM-2-4). Re-naturalization of this corner of the quarry will mitigate this distant view. See Exhibit UM-3 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 UM-2-5). The quarry face is visible from intermediate views such as Kapolei Golf Course (exhibit UM-2-6) and the Villages of Kapolei (exhibit UM2-7); and from distant views, such as the Ewa Golf Course (Exhibit UM-2-8). Raising the berm, now planted with banyan trees, will extend the screen from the close-up into the intermediate views. See Exhibit UM-3 for a map of screening zones and photographic vantage points.

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

- 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 UM-4.

- 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 Lower Quarry with an allocation of 124,000 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.

- 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.

Landscape Development Plan

Quarry Floor. The quarry floor will encompass an area of approximately 100 acres (not including benches). This area makes up the lower ground plane or base of the quarry, with the Grading Plan calling for grading at a downward average slope of approximately 2% towards the southeast. 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 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 2017, the first priority will be to establish a natural appearing grass/ground cover mix. The species will not necessarily be naturally occurring in Makakilo however materials already growing on site provide a good indication of species that will tolerate the harsh site conditions. 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 Estate of James Campbell. 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 face along the mauka perimeter. To mitigate the appearance of these faces, a series of random benches of various heights and lengths will be created to vary the appearance of the sides of the quarry providing 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. Quarry faces between elevations 350 and 525 fall within the area that is most visible from off-site locations, and will be where the major planting effort is made.

Because of the high face walls that will be exposed, it not the intent of the design to screen the entire face with trees but rather to soften the 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 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 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 Exhibit UM-5 for the re-naturalization schedule.

Western Corner. At the west corner of the quarry, approximately 6 acres will be left un-quarried, and graded to 2(H) to 1(V) slope above the 350-foot bench elevation. This slope will be created to maximize the establishment of grasses and groundcovers. The objective is to mitigate the distant view from the H-1 Freeway approaching Kapolei.

Access Road. From the Upper Quarry, the existing access road skirts the lower edge of the adjacent Makakilo golf course property, connects to the main entrance at Old Cane Haul Road and then turns into the old Palehua Road, crossing under the H-1 and terminating at Farrington Highway. Exhibit UM-6 shows the present location of this road. The solid section of the red line indicates the area needing attention. 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 created 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 Upper Quarry parcel flanking the quarry, but not used for quarrying, are termed the "Adjacent Area" in the Contract. 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.

H-1 Screening Berm. Immediately down slope of the active upper quarry and adjacent to the H-1 Freeway is a low ridge at about the +275 MSL elevation, currently planted with Banyan trees, that functions as a visual screen to the interior of the quarry. The Plan calls for removing the Banyans, which through their size and dark green color call attention to the area, and raise the berm by approximately 35 feet over a 600-foot length of the freeway frontage. Re-naturalization of the raised berm will begin immediately after grading operations. As this area is the closest area of the site to the public, it is important that a natural appearance be created there.

To further capitalize on the height of the berm to screen the upper quarry faces, trees will be planted on the highest areas of the berm. As with other areas mentioned in this Plan, straight rows of trees will not be created in favor of natural clustering. A combination of field stock trees with the smaller container stock will be used to provide a more immediate effect, with kiawe being the dominant species. Following tree planting, a fast growing, drought-tolerant, and self-spreading re-naturalization mix will be planted. Irrigation will be required to establish plant

material in this area. An irrigation system with rotary impact heads will be used to establish the plantings over a period of approximately two years. Irrigation lines will be buried in shallow 4" trenches to protect against UV and other damage to lengthen the usable life of the system. The irrigation system will be left in place and used during times of drought to minimize potential fire hazards.

Other Areas. Quarry faces and slopes not requiring visual mitigation will be planted with grasses as necessary to minimize erosion.

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BeltCollins

Typical Pu'u Landscape

Upper Mitigation Plan 03

Makakilo Quarry - Grace Pacific Corporation

July 22, 2003

Exhibit: UM-1

633.1300 UM2.1

Lower Makakilo Drive Viewpoint

Upper Mitigation Plan 03

Makakilo Quarry - Grace Pacific Corporation

July 22, 2003

Exhibit: UM-2-1

BelteCollins

Kapolei Regional Park Viewpoint

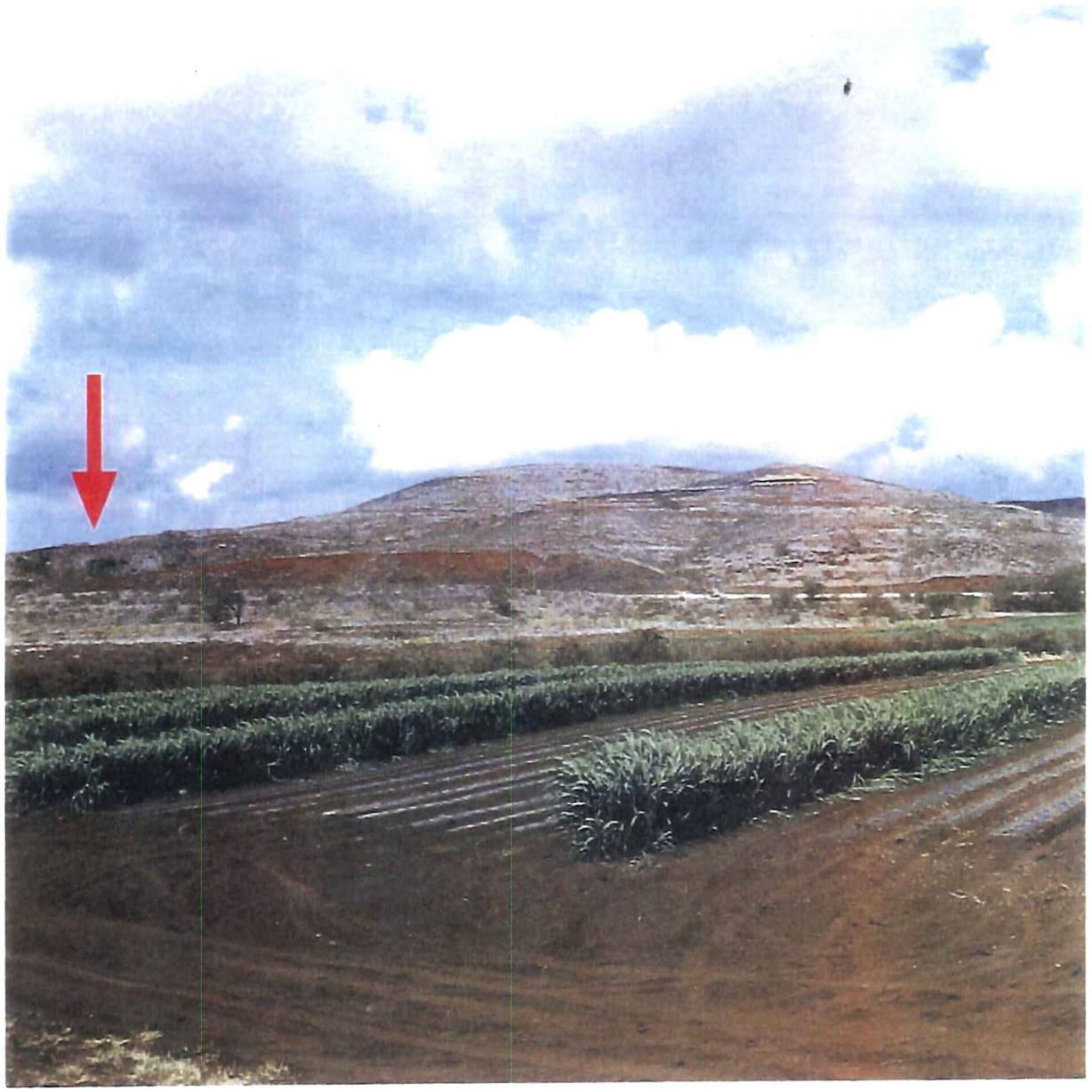
Upper Mitigation Plan 03

Makakilo Quarry - Grace Pacific Corporation

July 22, 2003

Exhibit: UM-2-2

BeltCollins



Farrington and Old Palehua Viewpoint

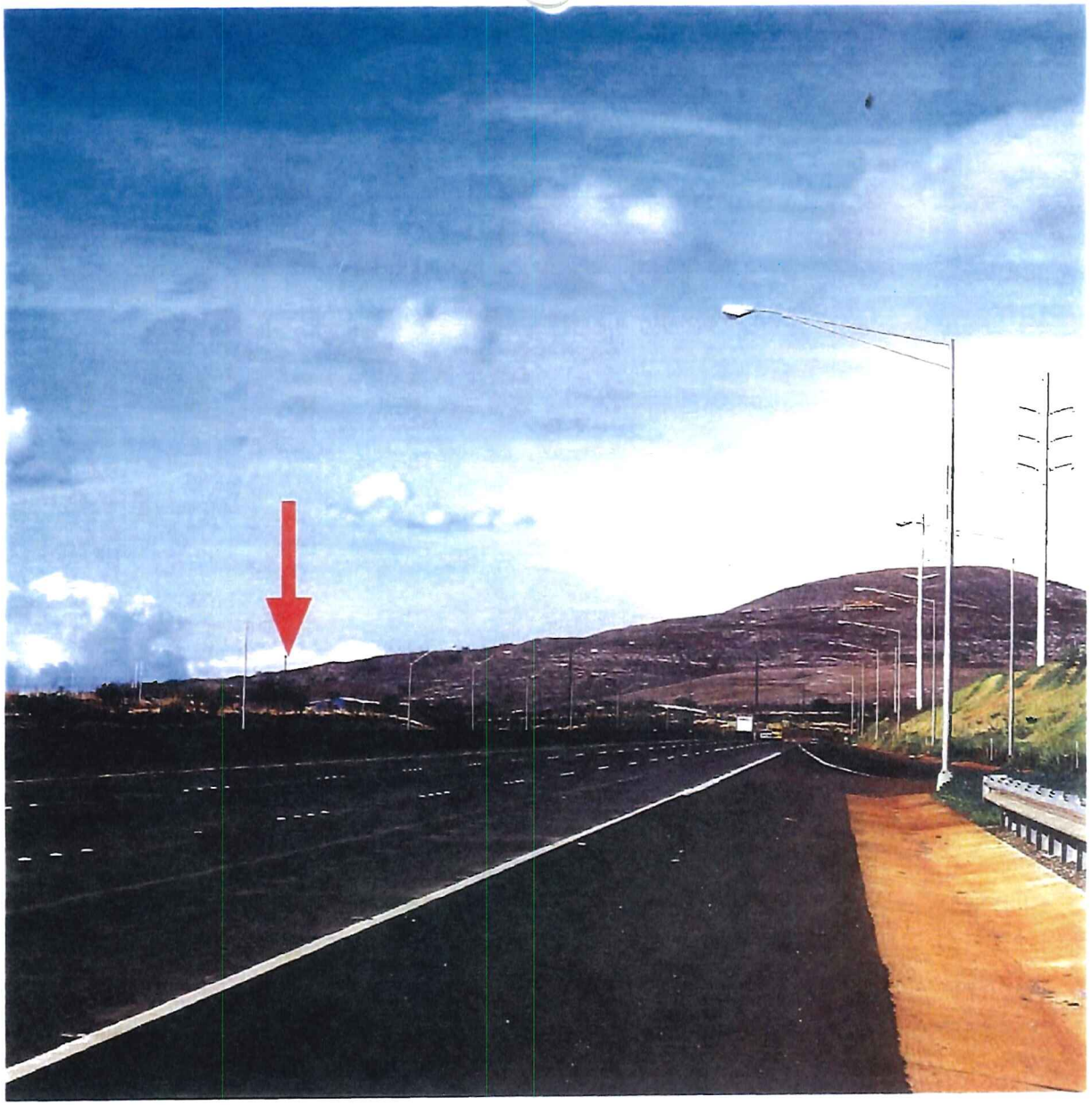
Upper Mitigation Plan 03

Makakilo Quarry - Grace Pacific Corporation

July 22, 2003

Exhibit: UM-2-3

BeltCollins



Kunia Approach Viewpoint

Upper Mitigation Plan 03

Makakilo Quarry - Grace Pacific Corporation

July 22, 2003

Exhibit: UM-2-4

BeltCollins

633,1300 UM2.5

H-1 Close-in Viewpoint

Upper Mitigation Plan 03

Makakilo Quarry - Grace Pacific Corporation

July 22, 2003

Exhibit: UM-2-5

BelteCollins

Kapolei Golf Course Viewpoint

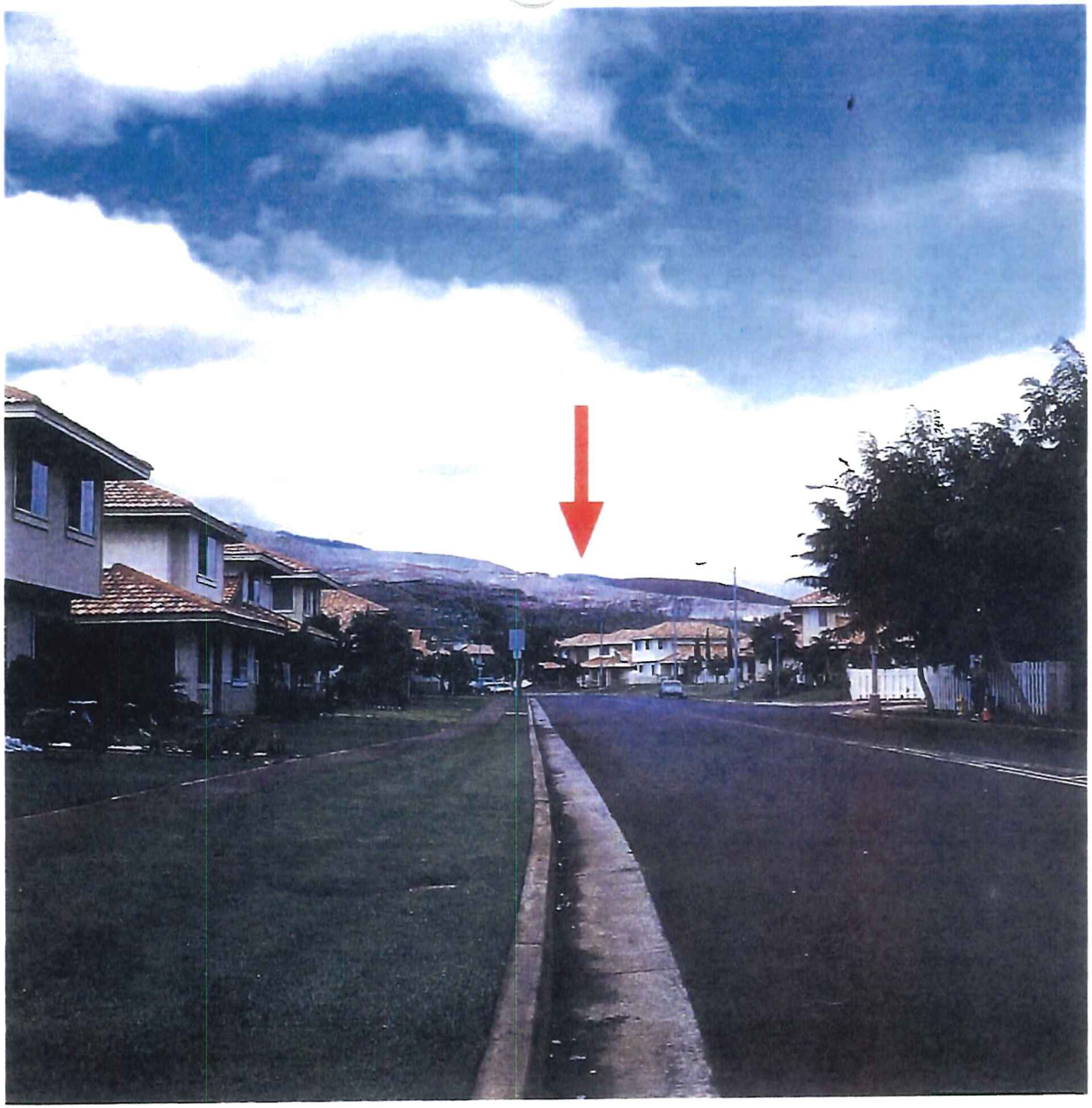
Upper Mitigation Plan 03

Makakilo Quarry - Grace Pacific Corporation

July 22, 2003

Exhibit: UM 2-6

BelteCollins



Villages of Kapolei Viewpoint

Upper Mitigation Plan 03

Makakilo Quarry - Grace Pacific Corporation

July 22, 2003

Exhibit: UM 2-7

BelteCollins

Ewa Golf Course Viewpoint

Upper Mitigation Plan 03

Makakilo Quarry - Grace Pacific Corporation

July 22, 2003

Exhibit: UM 2-8

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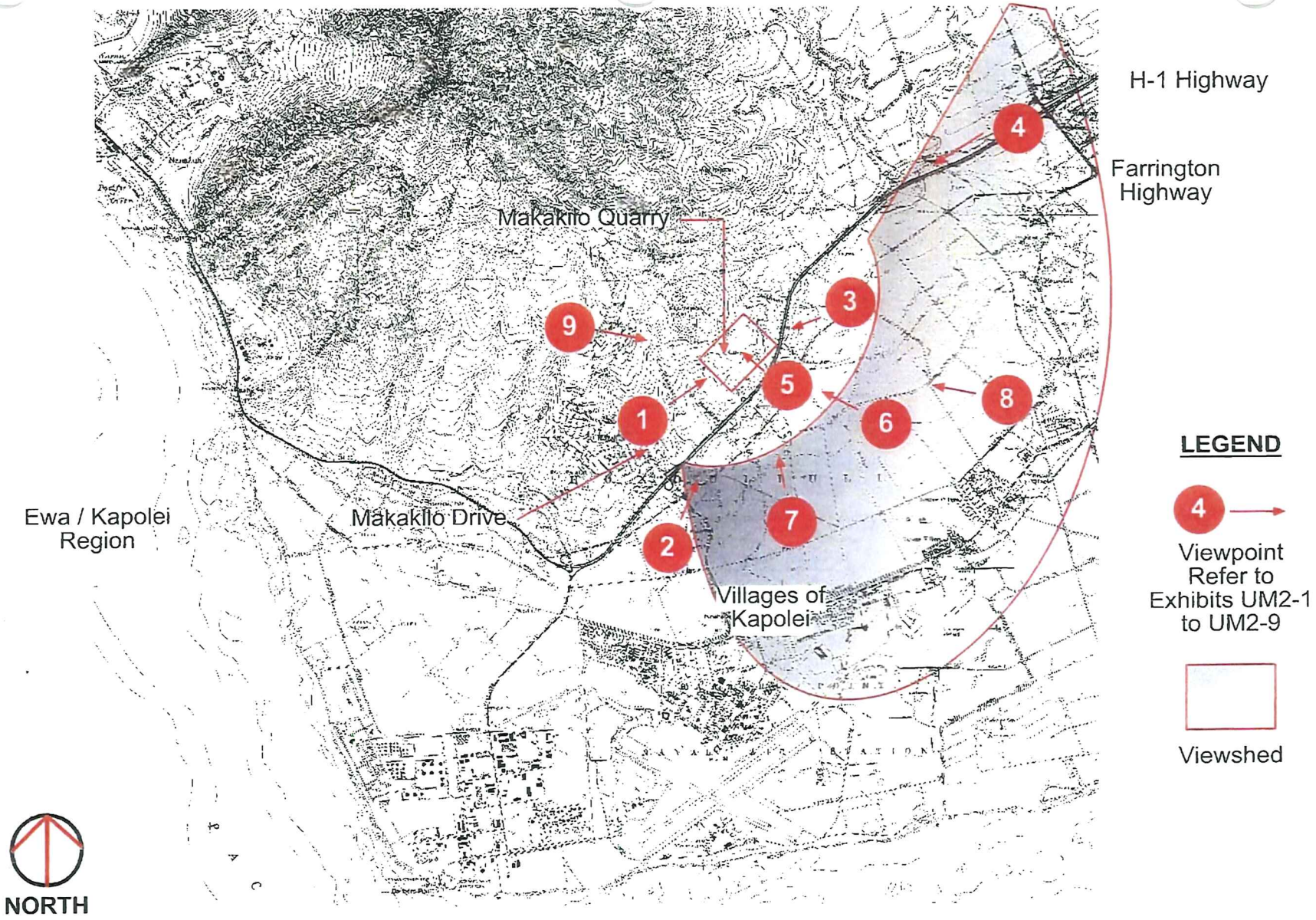

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Map with Viewpoints

Upper Mitigation Plan 03

Makakilo Quarry - Grace Pacific Corporation

July 22, 2003

Exhibit: UM-3

633.1300_UM4.ai

Buffel Grass

Buffel Grass

Buffel Grass

Sun Hemp

Redtop Grass

Opiuma

A'alii

Kiawe

Wili-Wili

BeltCollins

Plant Palette

Upper Mitigation Plan 03

Makakilo Quarry - Grace Pacific Corporation

July 22, 2003

Exhibit: UM-4

633.1300_UM5.ab.08.01.03

LANDSCAPE MATRIX

Area	Schedule: Excavation Complete	Schedule: 2 yr. Grow-In Complete	Grassing (sq. ft.)	Grassing Unit Cost	Grassing Sub-Total Cost	Trees	Trees Unit Cost	Trees Sub-Total Cost	Shrubs	Shrubs Unit Cost	Shrubs Sub-Total Cost	Irrigation System (sq. ft.)	Irrigation Unit Cost	Irrigation Sub-Total Cost	Total Cost Planting Materials	Irrigation Water Usage (average): Source	Water Use Year 1 (gal/day)	Water Use Year 2 (gal/day)
Upper Quarry																		
Mauka Face																		
500+	2003	2005	44,000	$ 0.10	$4,400							44,000	$ 0.05	$ 2,200	$ 6,600	tank-gravity	6,857	3,428
450+	2007	2009	54,400	$ 0.10	$5,440							54,400	$ 0.05	$ 2,720	$ 8,160	tank-gravity	8,477	4,239
400+	2009	2011	61,000	$ 0.10	$6,100							61,000	$ 0.05	$ 3,050	$ 9,150	tank-gravity	9,506	4,753
350+	2012	2014	65,500	$ 0.10	$6,550							65,500	$ 0.05	$ 3,275	$ 9,825	tank-gravity	10,207	5,104
West Corner																		
500+	2003	2005	59,300	$ 0.10	$5,930				50	$12.00	$600.00	59,300	$ 0.05	$ 2,965	$ 9,495			
450+	2004	2006	81,700	$ 0.10	$8,170				50	$12.00	$600.00	81,700	$ 0.05	$ 4,085	$ 12,855	tank-gravity	12,732	6,366
400+	2005	2007	62,000	$ 0.10	$6,200				50	$12.00	$600.00	62,000	$ 0.05	$ 3,100	$ 9,900	tank-gravity	9,662	4,831
350+	2006	2008	34,000	$ 0.10	$3,400				50	$12.00	$600.00	34,000	$ 0.05	$ 1,700	$ 5,700	tank-gravity	5,298	2,649
Freeway Berm																		
315+	2004	2006	152,000	$ 0.10	$15,200	100	$ 75	$ 7,500	200	$ 12.00	$ 2,400	152,000	$ 0.05	$ 7,600	$ 32,700	pressurized	23,687	11,843
Quarry Floor	2017	2019	3,360,000	$ 0.10	$336,000							3,360,000	$ 0.05	$ 168,000	$ 504,000	pressurized	523,600	261,800
															$ 608,385			

GROW-IN WATER USAGE (GPD)

year	Mauka Face	West Corner	Freeway Berm	Quarry Floor	total GPD
2003					
2004	6,857				6,857
2005	3,428	12,732	23,687		39,847
2006		16,027	11,843		27,871
2007		10,129			10,129
2008	8,477	2,649			11,127
2009	4,239				4,239
2010	9,506				9,506
2011	4,753				4,753
2012					-
2013	10,207				10,207
2014	5,104				5,104
2015				130,900	130,900
2016				196,350	196,350
2017				196,350	196,350
2018				196,350	196,350
2019				65,450	65,450

EXCAVATION PLAN IN TONS (000'S)

year	Mauka Face - A	Mauka Face - B	West Corner - A	West Corner - B	Floor - A	Floor - B	total A	total B	total A + B
2003	296	106	22	47	82	307	400	460	860
2004	244	89	131	286			375	375	750
2005	170	50	205	385			375	435	810
2006	159	50	216	405			375	455	830
2007	107	82			268	153	375	235	610
2008	375	150				225	375	375	750
2009	307	126			68	249	375	375	750
2010	375	170				205	375	375	750
2011	375	170				205	375	375	750
2012	60	48			315	327	375	375	750
2013			237	360	138	15	375	375	750
2014	345	137			30	238	375	375	750
2015			72	81	303	294	375	375	750
2016					375	375	375	375	750
2017					375	375	375	375	750
Recap by Elevation									Recap Totals
500	296	106	22	47					471
450	680	271	131	286					1,368
400	682	276	205	385					1,548
350	810	388	216	405					1,819
300	345	137	237	360	733	1,139			2,951
250			72	81	1,221	1,829	total A	total B	3,203
	2,813	1,178	883	1,564	1,954	2,968	5,650	5,710	11,360

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Landscape Matrix

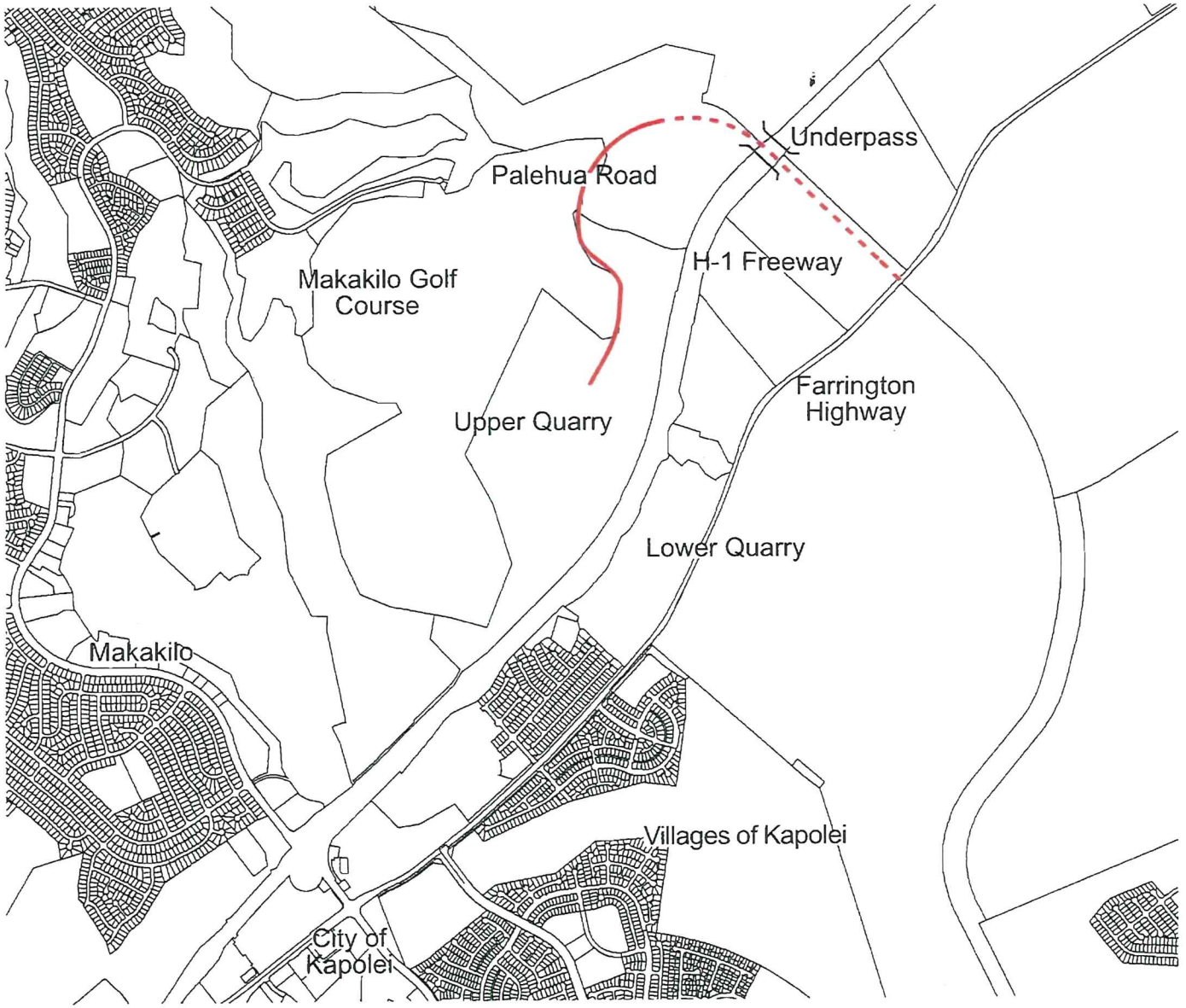
Upper Quarry Mitigation

Makakilo Quarry - Grace Pacific Corporation

July 22, 2003

Exhibit: UM-5

633.1300 UM6



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Access Road Map

Upper Mitigation Plan 03

Makakilo Quarry - Grace Pacific Corporation

July 22, 2003

Exhibit: UM-6

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:

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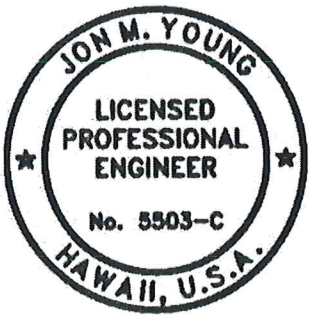
April 2007



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

Exhibit K

ENGINEERING REPORT AMENDMENT

TABLE OF CONTENTS

APPENDICES

1. INTRODUCTION

1.1 PURPOSE

This Makakilo Quarry Engineering Report, dated April 2007 (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 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 lower elevations between 500 feet to 550 feet to an upper elevation of 700 feet. An access road running along the 500 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, three 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 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 a 2:1 horizontal to vertical slope, and with 10 foot wide benches at each interval of 30 feet in height.

The quarry sides and mauka face will utilize vertical cuts and horizontal benches to reach the desired depths of approximately 200 feet to 250 feet below the existing surface. 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 Figure 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

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, other methods may be 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, figures 1, 2 and 3.

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.

Three 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, 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 three existing basins (DB#1, 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, 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 ranging from 1:1 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. See Exhibits 4 and 5 of Appendix E for the Revegetation Matrix and Revegetation Phasing Plan arising from the Proposed Use. These figures assume the availability of approximately .200 mgd of water for all quarry purposes. Of this amount, the Revegetation Plan targets .100 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. Grace Pacific is in the process of requesting that its current allocation of Waiahole Ditch water of .750 mgd be reduced and allowed for use in revegating existing and future landscaping needs on the Puu Makakilo parcel.

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 Exhibits 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 Exhibits 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 (Exhibits 2-3 of Appendix E). The western quarry face is visible from the distant view at the H-1/Kunia intersection (Exhibits 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.

As noted above in the section above on Minimize the long-term use of irrigation water, this plan assumes 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 .100 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. Grace Pacific is in the process of requesting that its current allocation of Waiahole Ditch water of .750 mgd be reduced and allowed for use in revegating existing and future landscaping needs on the Puu Makakilo parcel.

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 128 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 face along the mauka perimeter. To mitigate the appearance of these faces, an undulating landform and a series 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 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 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 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 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 created 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

AGRA Earth & Environmental
ENGINEERING GLOBAL SOLUTIONS

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2 June 1998
8-91M-12295-0

Parametrix, Inc.
5808 Lake Washington Boulevard NE
Kirkland, Washington 98033

Attention: Mr. Dwight Miller, P.E.

Subject: Recommendations for Restoration Grading
Makakilo Quarry
Oahu, Hawaii

Dear Mr. Miller:

This letter presents our recommendations for restoration grading on the above referenced project. We understand that the Makakilo Quarry has been operated as a hard rock mine for production of aggregate since 1974. As part of mining operations on the property, the topsoil and other soil overburden has been removed and stockpiled. The stockpile also includes softer portions of the excavated rock, including ash layers, cinder, and other residual soil (weathered bedrock) materials.

In its current configuration, the back slope of the quarry is approximately 150 feet in height and near vertical, with intermediate benching. The area in front of the slope is to be developed for possible residential, commercial, or industrial purposes. We have assumed that future site use would generally involve lightly loaded foundations. We understand that a grading and drainage plan for the floor of the pit would be provided by others. We have been requested to provide recommendations for subgrade preparation and filling in conjunction with the site grading and drainage plan, so that the subgrade would generally be appropriate for the proposed future use. Our recommendations are as follows:

- The base of the quarry should be rough graded to remove any highly irregular topography, such as large rock exposures which would act as "hard spots" during subsequent filling.

- Any thick deposits of uncontrolled fill, include possible soft silts from washing operations, should also be removed prior to filling, or be identified as areas not having engineered fill.

- Any accumulated water, originating from either groundwater or surface water, will also need to be controlled prior to filling. If it is not possible to remove all water by

pumping, an initial lift of crushed quarry rock may need to be placed to raise grades above static water levels.

- Once subgrade has been established by rough grading and water control, the resulting surface should be proof rolled. Proof rolling consists of driving a loaded dump truck, wheel to wheel, across the entire subgrade surface to disclose any soft spots. Any soft spots disclosed by proof rolling should be over excavated, and replaced with crushed quarry rock or "structural fill", as described below.

- Structural fill should consist of a granular soil which is free of organics, with no individual rocks larger than 6 inches in diameter. The structural fill should contain no logs, stumps, brush, rubbish or other deleterious materials. Other such unsatisfactory materials would include soils containing vegetation, roots, peat, organic clays and silts, sod, mulch, and any soils which are excessively fine or moist so as not to allow adequate compaction, as defined below.

- Structural fill should be placed in level lifts not exceeding 8 inches in thickness, with each lift compacted to at least 90 percent density, using the ASTM: D 1557 Modified Proctor. Moisture content of the fill soils should be maintained within plus or minus 3 percent of optimum moisture content.

- Structural fill should be tied into any subgrade areas sloping at greater than 5H:1V (Horizontal: Vertical). This should be accomplished by cutting level benches back into the slope; individual benches should be no more than 2 feet in vertical height.

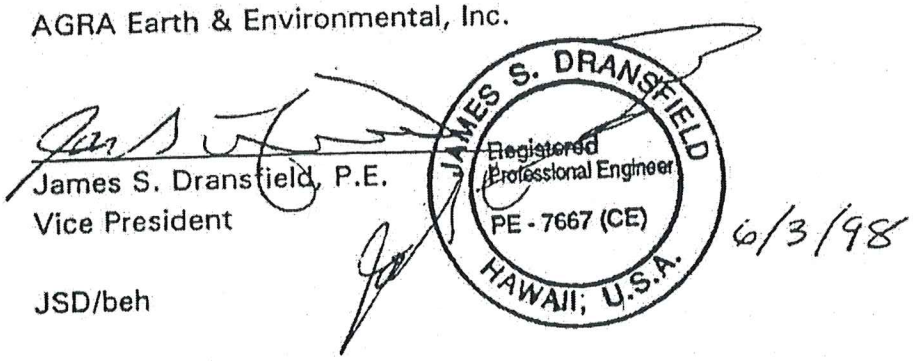
- The subgrade preparation and filling should be monitored by a qualified geotechnical engineer or their representative. Density tests should be performed on a regular basis throughout the filling process to provide confirmation and documentation of the quality of the engineered fill. This documentation can then be provided to the designer of future development at the site.

- Other portions of the stockpiled material could be used for topsoil in landscaping areas. Typically, topsoil would consist of a mixture of organics, sand and silt which is free from lumps, large amounts of clay, toxic substances, sticks, debris, vegetation, and stones larger than 1 inch in diameter.

As discussed, this method of subgrade preparation and filling would provide adequate foundation for typical roads, as well as residential and lightly loaded commercial or industrial development. If heavier foundation loading is required, more restrictive earthwork recommendations could be provided. Otherwise, the engineered fill documents could be provided to the future site developer, who could make their own determination of the need for more extensive foundation preparation.

Respectfully submitted,

AGRA Earth & Environmental, Inc.



James S. Dransfield, P.E.
Vice President

6/3/98

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