APPENDIX G
Noise Study

ACOUSTIC STUDY FOR THE PUUNENE HEAVY INDUSTRIAL SUBDIVISION PUUNENE, MAUI, HAWAII

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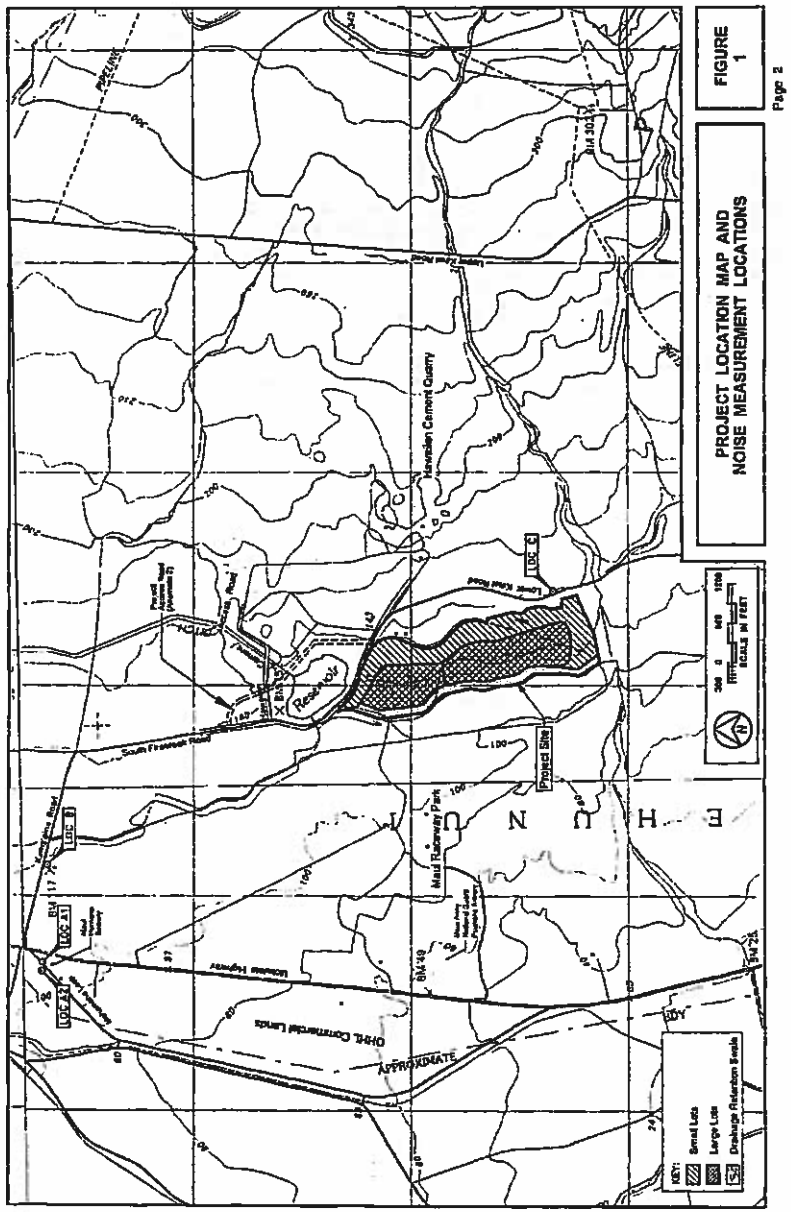
CHAPTER I. SUMMARY

The existing and future traffic noise levels in the vicinity of the proposed Puunene Heavy Industrial Subdivision in Puunene, Maui were evaluated for their potential impacts and their relationship to current FHA/HUD noise standards. The traffic noise level increases along the roadways servicing the project site (see Figure 1) were calculated. No significant increases in traffic noise levels are predicted to occur along Mokulele Highway as a result of project traffic following project build-out by CY 2015. Large increases of 6.4 DNL are expected to occur along the roadways used by project traffic between the project site and Mokulele Highway.

Along Mokulele Highway in the vicinity of the project site, traffic noise levels are expected to increase by approximately 1.3 to 1.4 DNL by CY 2015 as a result of project and non-project traffic. Of this increase, a 1.0 DNL increase is expected to occur from non-project traffic by CY 2015. Project traffic will account for approximately 0.3 to 0.4 DNL units of noise increase along Mokulele Highway in the immediate vicinity of the project. Along Kamaaina Road and South Firebreak Road between Mokulele Highway and the project site, traffic noise levels are expected to increase by 6.4 DNL by CY 2015 as a result of project traffic. This level of traffic noise increase resulting from project generated traffic along Kamaaina Road and South Firebreak Road are considered to be large. The 6.4 DNL predicted increase in project generated traffic noise levels are limited to the roadways used by project traffic between Mokulele Highway and the project site, and are not expected to generate adverse noise impacts by CY 2015 due to the absence of noise sensitive developments along these roadways.

The project site is located near an existing quarry, with large buffer distances to the closest residential developments. The closest neighboring developments include a rock quarry, the Maui Humane Society, a motorsport raceway, an industrial subdivision, and military office facilities. Predicted worst case noise emissions from operating equipment within the proposed Puunene Heavy Industrial Subdivision are not expected to exceed noise impact thresholds at the nearest noise sensitive developments. Compliance with State Department of Health noise regulations for fixed on-site equipment are recommended to minimize adverse noise impacts on adjacent and distant properties.

Adverse noise impacts are not expected to occur during construction of the proposed project due to the relatively large buffer distances to the nearest developed properties and due to the non-noise sensitive nature of the neighboring properties. Because construction activities may be audible within the project site and at nearby properties, the quality of the acoustic environment may be degraded to unacceptable levels during periods of construction. Mitigation measures to reduce construction noise to inaudible levels will not be practical in all cases, but the use of quiet equipment and compliance with State Department of Health construction noise regulations are recommended as standard mitigation measures.



CHAPTER II. PURPOSE

The primary objective of this study was to describe the existing and future traffic noise environment in the environs of the proposed Puunene Heavy Industrial Subdivision in Puunene on the island of Maui. Traffic forecasts for 2015 were used. Traffic noise level increases and impacts associated with the proposed project were to be determined within the project site as well as along the public roadways which are expected to service the project traffic. A specific objective was to determine future traffic noise level increases associated with both project and non-project traffic, and the potential noise impacts associated with these increases.

Noise impacts from on-site activities and short term construction noise at the project site were also included as noise study objectives. Recommendations for minimizing identified noise impacts were also to be provided as required.

CHAPTER III. NOISE DESCRIPTORS AND THEIR RELATIONSHIP TO LAND USE COMPATIBILITY

The noise descriptor currently used by federal agencies (such as FHA/HUD) to assess environmental noise is the Day-Night Average Sound Level (DNL). This descriptor incorporates a 24-hour average of instantaneous A-Weighted Sound Levels as read on a standard Sound Level Meter. By definition, the minimum averaging period for the DNL descriptor is 24 hours. Additionally, sound levels which occur during the nighttime hours of 10:00 PM to 7:00 AM are increased by 10 decibels (dB) prior to computing the 24-hour average by the DNL descriptor. A more complete list of noise descriptors is provided in Appendix B to this report.

Table 1, derived from Reference 1, presents current federal noise standards and acceptability criteria for residential land uses. Table 2, also extracted from Reference 1, presents the general effects of noise on people in residential use situations. Land use compatibility guidelines for various levels of environmental noise as measured by the DNL descriptor system are shown in Figure 2 (from Reference 2). As a general rule, noise levels of 55 DNL or less occur in rural areas, or in areas which are removed from high volume roadways. In urbanized areas which are shielded from high volume streets, DNL levels generally range from 55 to 65 DNL, and are usually controlled by motor vehicle traffic noise. Residences which front major roadways are generally exposed to levels of 65 DNL, and as high as 75 DNL when the roadway is a high speed freeway. In the project area, traffic noise levels associated with Mokulele Highway are typically greater than 65 DNL along the Right-of-Way due to the relatively large volume of traffic and high vehicle speeds on this thoroughfare.

For purposes of determining noise acceptability for funding assistance from federal agencies (FHA/HUD and VA), an exterior noise level of 65 DNL or less is considered acceptable for residences. This standard is applied nationally (Reference 3), including Hawaii. Because of our open-living conditions, the predominant use of naturally ventilated dwellings, and the relatively low exterior-to-interior sound attenuation afforded by these naturally ventilated structures, an exterior noise level of 65 DNL does not eliminate all risks of noise impacts. Because of these factors, and as recommended in Reference 4, a lower level of 55 DNL is considered as the "Unconditionally Acceptable" (or "Near-Zero Risk") level of exterior noise. However, after considering the cost and feasibility of applying the lower level of 55 DNL, government agencies such as FHA/HUD and VA have selected 65 DNL as a more appropriate regulatory standard.

For commercial, industrial, and other non-noise sensitive land uses, exterior noise levels as high as 75 DNL are generally considered acceptable. Exceptions to this occur when naturally ventilated office and other commercial establishments are exposed to exterior levels which exceed 65 DNL.

On the island of Maui, the State Department of Health (DOH) regulates noise from construction activities through the issuance of permits for allowing excessive

TABLE 1

EXTERIOR NOISE EXPOSURE CLASSIFICATION (RESIDENTIAL LAND USE)

NOISE EXPOSURE CLASS	DAY–NIGHT SOUND LEVEL	EQUIVALENT SOUND LEVEL	FEDERAL (1) STANDARD
Minimal Exposure	Not Exceeding 55 DNL	Not Exceeding 55 Leq	Unconditionally Acceptable
Moderate Exposure	Above 55 DNL But Not Above 65 DNL	Above 55 Leq But Not Above 65 Leq	Acceptable(2)
Significant Exposure	Above 65 DNL But Not Above 75 DNL	Above 65 Leq But Not Above 75 Leq	Normally Unacceptable
Severe Exposure	Above 75 DNL	Above 75 Leq	Unacceptable

Notes: (1) Federal Housing Administration, Veterans Administration, Department of Defense, and Department of Transportation.

(2) FHWA uses the Leq instead of the Ldn descriptor. For planning purposes, both are equivalent if: (a) heavy trucks do not exceed 10 percent of total traffic flow in vehicles per 24 hours, and (b) traffic between 10:00 PM and 7:00 AM does not exceed 15 percent of average daily traffic flow in vehicles per 24 hours. The noise mitigation threshold used by FHWA for residences is 67 Leq.

TABLE 2

EFFECTS OF NOISE ON PEOPLE (Residential Land Uses Only)

DAY-NIGHT AVERAGE SOUND LEVEL IN DECIBELS / EFFECTS[1]	Hearing Loss: Qualitative Description	Speech Interference: Indoor: %Sentence Intelligibility	Speech Interference: Outdoor: Distance in Meters for 95% Sentence Intelligibility	Annoyance[2]: % of Population[3] Highly Annoyed	Average Community Reaction[4]	General Community Attitude Towards Area
75 and above	May Begin to Occur	96%	0.5	37%	Very Severe	Noise is likely to be the most important of all adverse aspects of the community environment.
70	Will Not Likely Occur	99%	0.8	25%	Severe	Noise is one of the most important adverse aspects of the community environment.
65	Will Not Occur	100%	1.5	15%	Significant	Noise is one of the important adverse aspects of the community environment.
60	Will Not Occur	100%	2.0	9%	Moderate to Slight	Noise may be considered an adverse aspect of the community environment.
55 and below	Will Not Occur	100%	3.5	4%		Noise considered no more important than various other environmental factors.

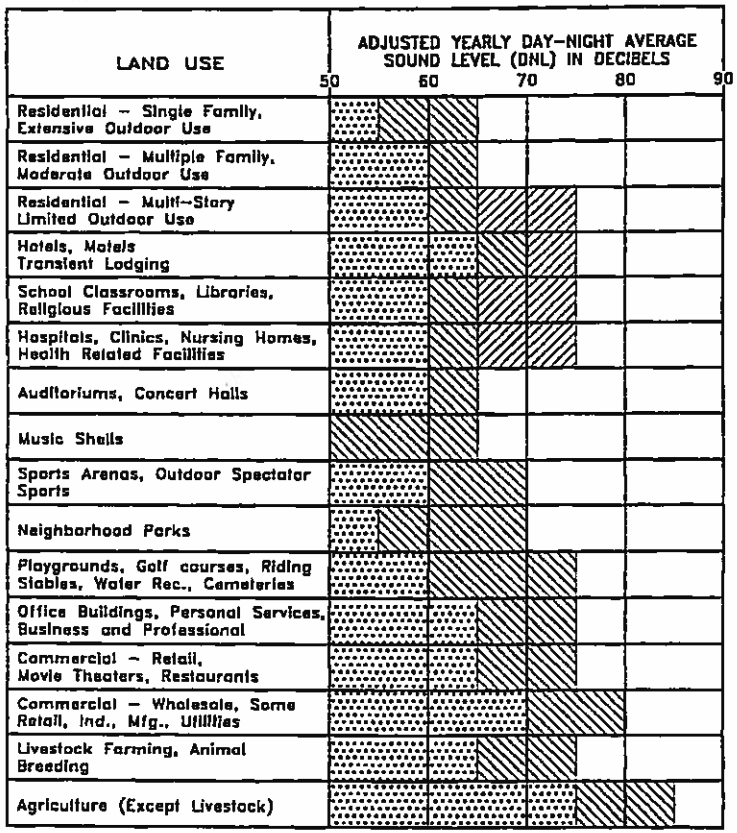
1. "Speech Interference" data are drawn from the following tables in EPA's "Levels Document"; Table 3, Fig. D-1, Fig. D-2, Fig. D-3. All other data from National Academy of Science 1977 report "Guidelines for Preparing Environmental Impact Statements on Noise; Report of Working Group 69 on Evaluation of Environmental Impact of Noise."

2. Depends on attitudes and other factors.

3. The percentages of people reporting annoyance to lesser extents are higher in each case. An unknown small percentage of people will report being "highly annoyed" even in the quietest surroundings. One reason is the difficulty all people have in integrating annoyance over a very long time.

4. Attitudes or other non-acoustic factors can modify this. Noise at low levels can still be an important problem, particularly when it intrudes into a quiet environment.

NOTE: Research implicates noise as a factor producing stress-related health effects such as heart disease, high-blood pressure and stroke, ulcers and other digestive disorders. The relationships between noise and these effects, however, have not as yet been quantified.



LAND USE COMPATIBILITY WITH YEARLY AVERAGE DAY–NIGHT AVERAGE SOUND LEVEL (DNL) AT A SITE FOR BUILDINGS AS COMMONLY CONSTRUCTED.
(Source: American National Standards Institute S12.9–1998/Part 5)

FIGURE 2

noise during limited time periods. State DOH noise regulations are expressed in maximum allowable property line noise limits rather than DNL (see Reference 5). Although they are not directly comparable to noise criteria expressed in DNL, State DOH noise limits for residential, commercial, and industrial lands equate to approximately 55, 60, and 76 DNL, respectively.

CHAPTER IV. GENERAL STUDY METHODOLOGY

Existing traffic noise levels were measured at four locations (A1, A2, B, and C) in the project environs to provide a basis for developing the project's traffic noise contributions along the roadways which will service the proposed development. The locations of the measurement sites are shown in Figure 1. Noise measurements were performed during the month of October 2011. The results of the traffic noise measurements were compared with calculations of existing traffic noise levels to validate the computer model used. The traffic noise measurement results, and their comparisons with computer model predictions of existing traffic noise levels are summarized in Table 3.

Traffic noise calculations for the existing conditions as well as noise predictions for the Year 2015 were performed using the Federal Highway Administration (FHWA) Traffic Noise Model (Reference 6). Traffic data entered into the noise prediction model were: roadway and receiver locations; hourly traffic volumes; average vehicle speeds; estimates of traffic mix; and "Lawn and Loose Soil" propagation loss factors. The traffic data and forecasts for the project (Reference 7), plus the spot traffic counts obtained during the noise measurement periods were the primary sources of data inputs to the model. Appendix C summarizes the AM and PM peak hour traffic volumes for CY 2011 and 2015 which were used to model existing and future traffic noise along the roadways in the vicinity of the project site. For existing and future traffic along the roadways in the vicinity of the project site, it was assumed that the the 24-hour DNL along those roadways were equal to the average noise levels, or Leq(h), during the AM peak traffic hour plus 1 dB. This assumption was based on computations of both the hourly Leq and the 24-hour DNL of traffic noise on Mokulele Highway (see Figure 3) using State of Hawaii hourly traffic counts from Reference 8.

Traffic noise calculations for both the existing and future conditions in the project environs were developed for ground level receptors with and without the benefit of shielding from natural terrain features or man made obstructions. Traffic noise levels were also calculated for future conditions with and without the proposed project. The forecasted changes in traffic noise levels over existing levels were calculated with and without the project, and noise impact risks evaluated. The relative contributions of non-project and project traffic to the total noise levels were also calculated, and an evaluation of possible traffic noise impacts was made.

Evaluations of potential noise impacts from on site noise sources were performed by predicting the noise levels from on site noise sources at the closest residential developments in Kihei (2.3 miles), Pukalani (6.4 miles), and Kahului (4.0 miles). These predictions assumed that each of the small and large lots of the industrial subdivision emitted the maximum sound level of 70 dBA as allowed for industrial properties by the State DOH noise regulations (Reference 5). A total of 28 subdivision lots, each with 70 dBA noise emitters located within each lot (for a total of 28 continuous noise sources), was assumed for these noise modeling purposes. The

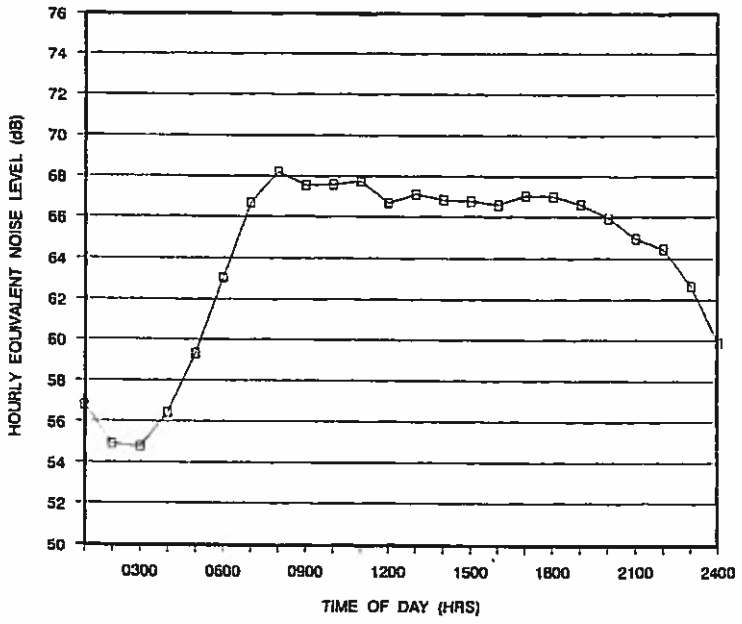
TABLE 3

TRAFFIC AND BACKGROUND NOISE MEASUREMENT RESULTS

	LOCATION	Time of Day (HRS)	Ave. Speed (MPH)	Hourly Traffic Volume AUTO	M.TRUCK	H.TRUCK	Measured Leq (dB)	Predicted Leq (dB)
A1.	96 FT from the centerline of Mokulele Hwy. (10/24/11)	0656 TO 0756	55	2,123	38	27	69.9	69.9
A2.	196 FT from the centerline of Mokulele Hwy. (10/24/11)	0656 TO 0756	55	2,123	38	27	61.9	62.0
B.	50 FT from the centerline of Kamaaina Rd (10/24/11)	0821 TO 1021	35	58	7	32	58.9	58.9
C.	44 FT from the centerline of Firebreak Rd (10/24/11)	1035 TO 1135	35	3	9	10	60.1	60.1
A1.	96 FT from the centerline of Mokulele Hwy. (10/24/11)	1539 TO 1639	50	2,384	14	7	66.6	66.9
A2	196 FT from the centerline of Mokulele Hwy. (10/24/11)	1539 TO 1639	50	2,384	14	7	56.9	58.7

FIGURE 3

HOURLY VARIATIONS OF TRAFFIC NOISE AT 96 FT SETBACK DISTANCE FROM THE CENTERLINE OF MOKULELE HIGHWAY NEAR MAUI RACEWAY PARK (STA. B74031100336; MAY 13, 2009)



worst case sound levels at the closest residential developments in Kihei, Pukalani, and Kahului resulting from this noise modeling assumption were then compared to existing background noise levels and noise impact criteria.

Calculations of average exterior and interior noise levels from construction activities were performed for typical naturally ventilated and air conditioned buildings. Predicted noise levels were compared with existing background ambient noise levels, and the potential for noise impacts was assessed.

V. EXISTING ACOUSTICAL ENVIRONMENT

The existing background ambient noise levels within the project site are relatively low and less than 50 dBA, except during passbys of heavy motor vehicles on the cane field service roads or during flybys of aircraft operating at Kahului Airport. Traffic along Mokulele Highway does not control the background noise levels at the project site due to the very large (approximately 1 mile) buffer distance between the project site and Mokulele Highway. The loudest noise sources at the project site are probably agricultural machines and heavy trucks during planting or harvesting seasons on the project site.

Traffic and background ambient noise measurements were obtained in October 2011 at four locations (A1, A2, B, and C) in the project environs. These locations are shown in Figure 1. The results of the traffic and background ambient noise measurements are summarized in Table 3, with measurement locations identified in Figure 1. The measurement locations were located at ground level. As shown in Table 3, correlation between measured and predicted traffic noise levels was satisfactory. The Traffic Noise Model's "Loose Soil" and "Lawn" propagation loss factors were used to obtain the good correlation.

Calculations of existing traffic noise levels during the AM and PM peak traffic hours are presented in Table 4. The hourly Leq (or Equivalent Sound Level) contribution from each roadway section in the project environs was calculated for comparison with forecasted traffic noise levels with and without the project. In Table 4, the AM peak hour Leq values were assumed to be approximately 1 dB lower than the DNL values for the roadways shown. The existing setback distances from the roadways' centerlines to their associated 65 and 70 DNL contours were also calculated as shown in Table 5. The contour line setback distances do not take into account noise shielding effects or the additive contributions of traffic noise from intersecting street sections.

The existing traffic noise levels in the project environs along the Mokulele Highway Rights-of-Way are in the "Significant Exposure, Normally Unacceptable" category for residences, and at or greater than 65 DNL along the highway's Rights-of-Way. The existing traffic noise levels in the project environs along Mokulele Highway's Rights-of-Way are approximately 70 to 71 DNL. Existing traffic noise levels at the Maui Humane Society building closest to Mokulele Highway are approximately 65 to 66 DNL, which is considered to be acceptable for office buildings. Existing traffic noise levels at the Maui Army National Guard Puunene Armory is approximately 56 DNL, which is also considered to be acceptable for office buildings. Existing traffic noise levels at the industrial subdivision south of Waihee Road intersection with Mokulele Highway range from approximately 55 DNL to 71 DNL, which is also considered to be acceptable for industrial land uses.

TABLE 4

EXISTING (CY 2011) TRAFFIC VOLUMES AND NOISE LEVELS
ALONG ROADWAYS IN PROJECT AREA
(AM OR PM PEAK HOUR)

LOCATION	SPEED (MPH)	TOTAL VPH	***** VOLUMES (VPH) ***** AUTOS	M.TRUCKS	H.TRUCKS	50' Leq	100' Leq	200' Leq
Mokulele Hwy. North of Kamaaina Rd. (AM)	55	2,197	2,129	37	31	76.5	69.6	62.6
Mokulele Hwy. North of Kamaaina Rd. (PM)	50	2,390	2,370	14	6	73.2	66.2	59.1
Mokulele Hwy. South of Kamaaina Rd. (AM)	55	2,147	2,085	36	26	76.3	69.4	62.5
Mokulele Hwy. South of Kamaaina Rd. (PM)	50	2,373	2,352	14	7	73.1	66.2	59.1
Kamaaina Rd. At Mokulele Hwy. (AM)	35	57	27	5	25	60.8	55.6	51.1
Kamaaina Rd. At Mokulele Hwy. (PM)	35	36	20	3	13	58.2	52.9	48.3
Mehameha Lp. At Mokulele Hwy. (AM)	25	35	35	0	0	44.3	38.0	32.0
Mehameha Lp. At Mokulele Hwy. (PM)	25	41	41	0	0	45.0	38.7	32.7
Under Project Access Alternative 1:								
South Firebreak Rd. N. of Quarry Access Rd. (AM)	35	57	27	5	25	60.8	55.6	51.1
South Firebreak Rd. N. of Quarry Access Rd. (PM)	35	36	20	3	13	58.2	52.9	48.3
Quarry Access Rd. At South Firebreak Rd. (AM)	35	57	27	5	25	60.8	55.6	51.1
Quarry Access Rd. At South Firebreak Rd. (PM)	35	36	20	3	13	58.2	52.9	48.3
South Firebreak Rd. S. of Quarry Access Rd (AM)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
South Firebreak Rd. S. of Quarry Access Rd (PM)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Under Project Access Alternative 2:								
South Firebreak Rd. N. of Project Access Rd. (AM)	35	57	27	5	25	60.8	55.6	51.1
South Firebreak Rd. N. of Project Access Rd (PM)	35	36	20	3	13	58.2	52.9	48.3
South Firebreak Rd. S. of Project Access Rd (AM)	35	57	27	5	25	60.8	55.6	51.1
South Firebreak Rd. S. of Project Access Rd (PM)	35	36	20	3	13	58.2	52.9	48.3
Quarry Access Rd. At South Firebreak Rd. (AM)	35	57	27	5	25	60.8	55.6	51.1
Quarry Access Rd. At South Firebreak Rd. (PM)	35	36	20	3	13	58.2	52.9	48.3
Project Access Rd. At South Firebreak Rd (AM)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Project Access Rd. At South Firebreak Rd. (PM)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

TABLE 5

EXISTING AND CY 2015 DISTANCES TO 65 AND 70 DNL CONTOURS

STREET SECTION	65 DNL SETBACK (FT) EXISTING	65 DNL SETBACK (FT) CY 2015	70 DNL SETBACK (FT) EXISTING	70 DNL SETBACK (FT) CY 2015
Mokulele Hwy. North of Kamaaina Rd.	174	202	106	122
Mokulele Hwy. South of Kamaaina Rd.	172	194	104	118
Kamaaina Rd. At Mokulele Hwy.	33	67	17	44
Mehameha Lp. At Mokulele Hwy.	6	6	3	3
Under Project Access Alternative 1:				
South Firebreak Rd. N. of Quarry Access Rd.	33	78	17	41
Quarry Access Rd. At South Firebreak Rd.	33	33	17	17
South Firebreak Rd. S. of Quarry Access Rd.	N/A	68	N/A	36
Under Project Access Alternative 2:				
South Firebreak Rd. N. of Project Access Rd.	33	78	17	41
South Firebreak Rd. S. of Project Access Rd.	33	33	17	17
Quarry Access Rd. At South Firebreak Rd.	33	33	17	17
Project Access Rd. At South Firebreak Rd.	N/A	68	N/A	36

Notes:

(1) All setback distances are from the roadways' centerlines.
(2) See TABLES 4 and 6 for traffic volume, speed, and mix assumptions.
(3) Setback distances are for ground level receptors.

CHAPTER VI. FUTURE NOISE ENVIRONMENT

Predictions of future traffic noise levels were made using the traffic volume assignments of Reference 7 for CY 2015 with the proposed project. Estimates of CY 2015 traffic volumes with and without the project were contained in Reference 7. The future projections of project plus non-project traffic noise levels on the roadways which would service the project are shown in Table 6 for the AM and PM peak hours of traffic, under the Build Alternative. Predicted increases in the setback distances to the 65 and 70 DNL contours are shown in Table 5. The separate non-project and project traffic noise contributions for the Build Alternative are shown in Table 7.

Very small changes in traffic noise levels (0.3 to 0.4 DNL) are expected along Mokulele Highway in the project environs between CY 2011 and 2015 as a result of project traffic. The growth in non-project traffic by CY 2015 is predicted to result in a traffic noise level increase of 1.0 DNL along Mokulele Highway. By CY 2015, traffic noise levels in the project area along Mokulele Highway are expected to increase primarily due to the anticipated growth in non-project traffic, and it will be difficult to determine the increases in future traffic noise associated with the project traffic.

Along the project access roads between Mokulele Highway and the project site, existing traffic noise levels are expected to increase by 3.7 to 6.4 DNL solely as a result of project traffic. No changes in non-project traffic noise levels are expected along the access roads between the project site and Mokulele Highway. The increases in traffic noise levels due to project traffic are relatively high, but these increases are expected to occur in currently undeveloped, agricultural lands.

The dominant traffic noise sources in the project environs will continue to be traffic along Mokulele Highway, with the increases in future traffic noise levels being relatively small along these two roadways and primarily associated with non-project traffic.

Future traffic noise levels on the proposed project site will continue to be unaffected by traffic noise along Mokulele Highway due to the large buffer distance to the highway. Future traffic noise levels on the project site will be controlled by project traffic moving within the industrial subdivision and moving to and from the industrial subdivision. These future traffic noise levels within the industrial subdivision are not expected to exceed 70 DNL, and should be acceptable for the planned industrial land uses.

TABLE 6

FUTURE (CY 2015) TRAFFIC VOLUMES AND NOISE LEVELS ALONG ROADWAYS IN PROJECT AREA (AM OR PM PEAK HOUR, BUILD)

LOCATION	SPEED (MPH)	TOTAL VPH	AUTOS	M.TRUCKS	H.TRUCKS	50' Leq	100' Leq	200' Leq
			****** VOLUMES (VPH) ********					
Mokulele Hwy. North of Kamaaina Rd. (AM)	55	3,035	2,941	52	42	77.9	71.0	64.1
Mokulele Hwy. North of Kamaaina Rd. (PM)	50	3,397	3,369	20	8	74.7	67.7	60.6
Mokulele Hwy. South of Kamaaina Rd. (AM)	55	2,873	2,790	49	34	77.6	70.7	63.7
Mokulele Hwy. South of Kamaaina Rd. (PM)	50	3,266	3,236	20	10	74.5	67.6	60.5
Kamaaina Rd. At Mokulele Hwy. (AM)	35	529	381	64	84	67.5	59.3	57.2
Kamaaina Rd. At Mokulele Hwy. (PM)	35	508	374	62	72	67.1	58.8	56.7
Mehameha Lp. At Mokulele Hwy. (AM)	25	35	35	0	0	44.3	38.0	32.0
Mehameha Lp. At Mokulele Hwy. (PM)	25	41	41	0	0	45.0	38.7	32.7
Under Project Access Alternative 1:								
South Firebreak Rd. N. of Quarry Access Rd. (AM)	35	529	381	64	84	67.5	62.0	57.2
South Firebreak Rd. N. of Quarry Access Rd. (PM)	35	508	374	62	72	67.1	61.6	56.7
Quarry Access Rd. At South Firebreak Rd. (AM)	35	57	27	5	25	60.8	55.6	51.1
Quarry Access Rd. At South Firebreak Rd. (PM)	35	36	28	1	7	55.9	50.5	45.8
South Firebreak Rd. S. of Quarry Access Rd. (AM)	35	472	354	59	59	66.4	60.9	56.0
South Firebreak Rd. S. of Quarry Access Rd. (PM)	35	472	352	60	60	66.5	61.0	56.1
Under Project Access Alternative 2:								
South Firebreak Rd. N. of Project Access Rd. (AM)	35	529	381	64	84	67.5	62.0	57.2
South Firebreak Rd. N. of Project Access Rd. (PM)	35	508	374	62	72	67.1	61.6	56.7
South Firebreak Rd. S. of Project Access Rd. (AM)	35	57	27	5	25	60.8	55.6	51.1
South Firebreak Rd. S. of Project Access Rd. (PM)	35	36	28	1	7	55.9	50.5	45.8
Quarry Access Rd. At South Firebreak Rd. (AM)	35	57	27	5	25	60.8	55.6	51.1
Quarry Access Rd. At South Firebreak Rd. (PM)	35	36	28	1	7	55.9	50.5	45.8
Project Access Rd. At South Firebreak Rd. (AM)	35	472	354	59	59	66.4	60.9	56.0
Project Access Rd. At South Firebreak Rd. (PM)	35	472	352	60	60	66.5	61.0	56.1

TABLE 7

CALCULATIONS OF PROJECT AND NON-PROJECT TRAFFIC NOISE CONTRIBUTIONS (CY 2015) (DNL)

STREET SECTION	NOISE LEVEL INCREASE DUE TO: NON-PROJECT TRAFFIC	PROJECT TRAFFIC
Mokulele Hwy. North of Kamaaina Rd.	1.0	0.4
Mokulele Hwy. South of Kamaaina Rd.	1.0	0.3
Kamaaina Rd. At Mokulele Hwy.	0.0	3.7
Mehameha Lp. At Mokulele Hwy.	0.0	0.0
Under Project Access Alternative 1:		
South Firebreak Rd. N. of Quarry Access Rd.	0.0	6.4
Quarry Access Rd. At South Firebreak Rd.	0.0	0.0
South Firebreak Rd. S. of Quarry Access Rd.	N/A *	60.9
Under Project Access Alternative 2:		
South Firebreak Rd. N. of Project Access Rd.	0.0	6.4
South Firebreak Rd. S. of Project Access Rd.	0.0	0.0
Quarry Access Rd. At South Firebreak Rd.	0.0	0.0
Project Access Rd. At South Firebreak Rd.	N/A *	60.9

Note:
* Existing noise levels from agricultural equipment are not inlcuded.

CHAPTER VII. DISCUSSION OF PROJECT-RELATED NOISE IMPACTS AND POSSIBLE MITIGATION MEASURES

Traffic Noise. Existing traffic noise levels along Mokulele Highway are relatively high, and are expected to remain so through CY 2015. Risks of future traffic noise impacts along the highway should continue to be low due to the absence of noise sensitive receptors along the highway in the project environs.

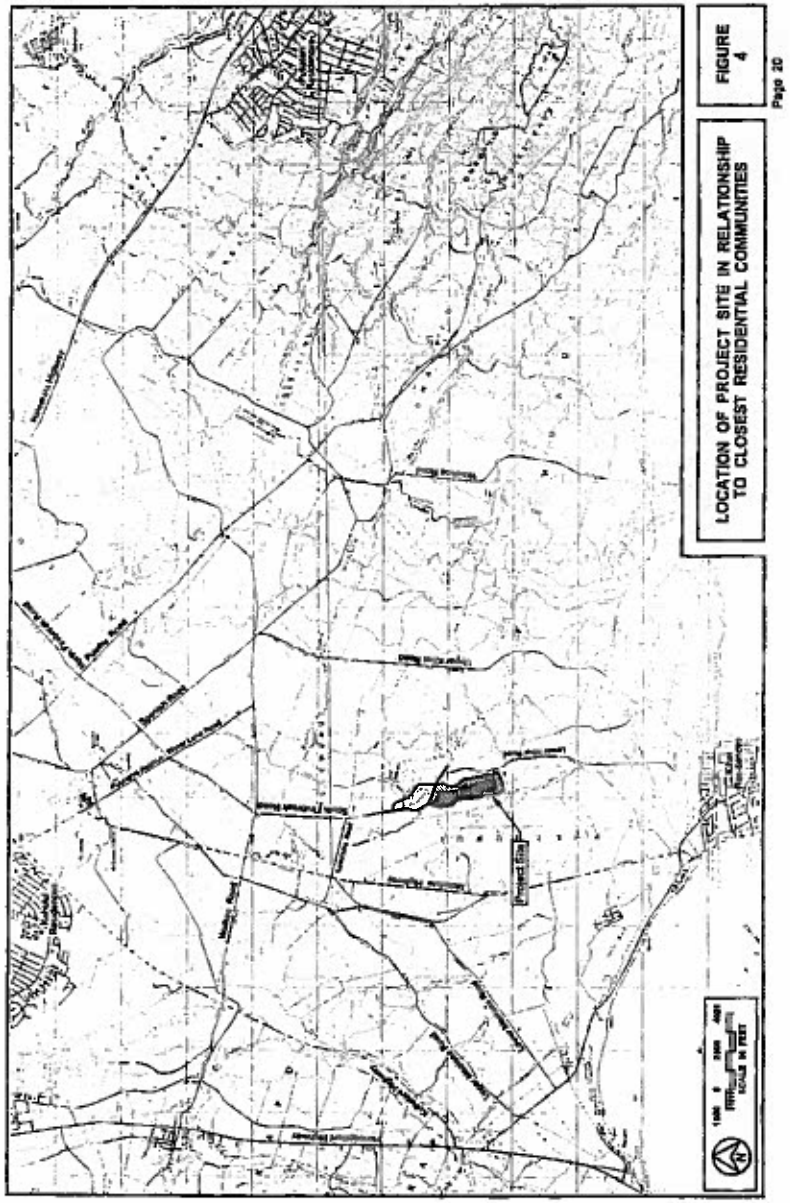
Project related traffic along Mokulele Highway is not expected to cause measurable increases in future traffic noise levels. The predicted increases of 0.3 to 0.4 DNL in project related traffic noise are small compared to the 1.0 DNL increase expected from non-project traffic. For these reasons, traffic noise mitigation measures should not be required.

On-Site Noise Sources. By existing State Department of Health regulations, fixed machinery on industrial lots may emit sound levels continuously during the day and night, as long as their sound levels do not exceed 70 dBA at the lots' property boundaries. Therefore, using the industrial subdivision plan shown in Figure 1, it was assumed that there could be 4 large lots and 24 small lots within the subdivision. A total of 28 noise sources, each emitting sound levels of 70 dBA at their respective lot boundary lines, was assumed for modeling the potential sound level emissions from on-site sources within the proposed industrial subdivision. Under these hypothetical worst case conditions, the combined sound level from the 28 lots of the industrial subdivision would be approximately 45 dBA at 4,900 feet (0.93 mile) distance from the center of the subdivision. A continuous outdoor sound level of 45 dBA is considered to be acceptable by the State DOH and by all federal agencies for single family residences. Because there are no noise sensitive developments within 4,900 feet of the proposed heavy industrial subdivision (see Figure 4), risks of adverse noise impacts from on site noise sources are considered to be minimal.

Predicted noise levels under the hypothetical worst case condition described above were developed at the closest residential developments. These hypothetical worst case levels were: 29 dBA in Kihei at Kaiolohia Street; 3 dBA in Pukalani at Opalipali Place; 19 dBA at Puunene near the Sugar Museum; and 17 dBA in Kahului at Makalii Street. These worst case levels are very low, and will be below existing nighttime background noise levels in these communities.

Noise mitigation measures which limit the noise from fixed mechanical equipment to those allowed by the State Department of Health (Reference 5) should be required of all tenants within the industrial subdivision.

General Construction Noise. Audible construction noise will probably be unavoidable during the entire project construction period. The total time period for construction is unknown, but it is anticipated that the actual work will be moving from one location on the project site to another during that period. Actual length of exposure



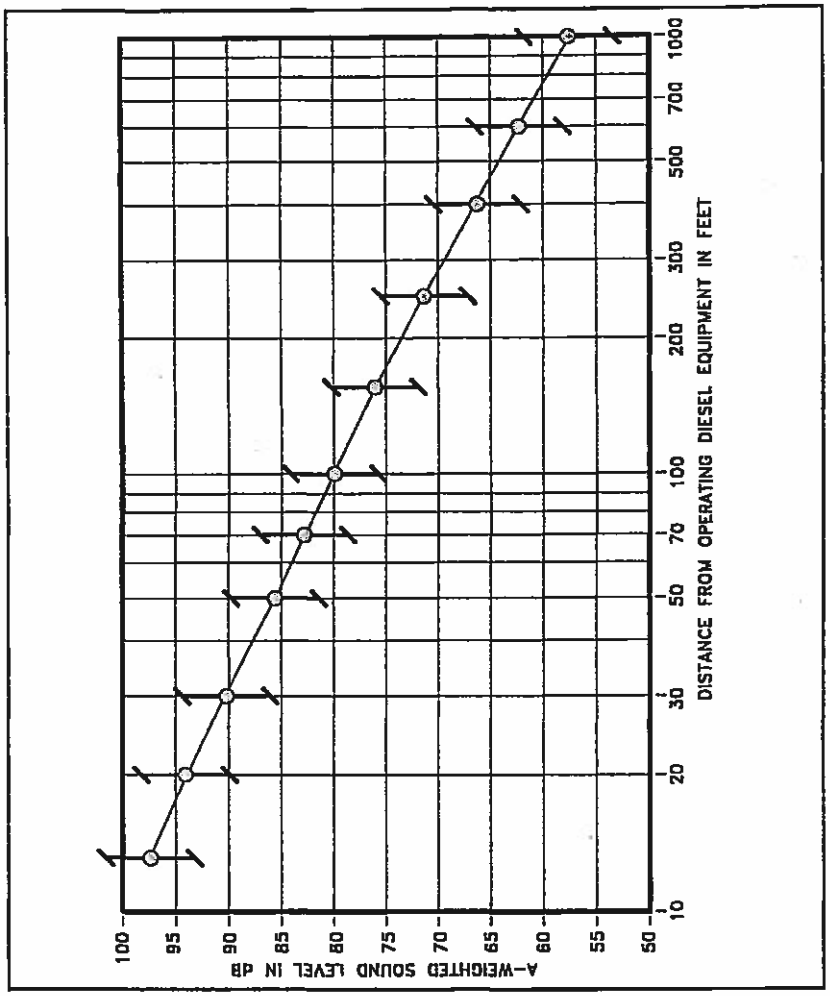
to construction noise at any receptor location will probably be less than the total construction period for the entire project. Typical levels of exterior noise from construction activity (excluding pile driving activity) at various distances from the job site are shown in Figure 5. The impulsive noise levels of impact pile drivers are approximately 15 dB higher than the levels shown in Figure 5, while the intermittent noise levels of vibratory pile drivers are at the upper end of the noise level ranges depicted in the figure. Typical levels of construction noise inside naturally ventilated and air conditioned structures are approximately 10 and 20 dB less, respectively, than the levels shown in Figure 5.

The closest residences to the project site are well beyond the 1,000 feet separation distance shown in Figure 5, and for this reason, risks of adverse noise impacts from construction activity on the project site are expected to be very low. The noise from construction activities will decrease and be masked by traffic noise from Mokulele Highway at the Maui Humane Society and National Guard facilities.

Peak airborne noise levels from pile diving may be as much as 15 dBA greater than noise levels shown in Figure 5 for non-impulsive (steady) construction noise sources. Although the pile driving can produce more intense noise levels, each pulse is of short individual duration (less than one second). Therefore, its impact on speech communication is not as severe as that of a steady source of the same noise level.

Adverse noise impacts are more likely to occur following completion of initial site preparation and infrastructure construction activities and at the initial subdivision tenants who are exposed to building construction noise from neighboring or nearby lots of the same subdivision. Adverse noise impacts are not expected to occur inside air conditioned structures which are beyond 200 FT of a building construction site. Inside naturally ventilated structures, interior noise levels (with windows or doors opened) are estimated to range between 65 to 53 dBA at 200 FT to 600 FT distances from the building construction site. Closure of all doors and windows facing the building construction site would generally reduce interior noise levels by an additional 5 to 10 dBA.

The use of properly muffled construction equipment should be required on all job sites. The incorporation of State Department of Health construction noise limits and curfew times, which are applicable throughout the State of Hawaii (Reference 5), is another noise mitigation measure which is normally applied to construction activities. Figure 6 depicts the normally permitted hours of construction. Noisy construction activities are not allowed on Sundays and holidays, during the early morning, and during the late evening and nighttime periods under the DOH permit procedures.



ANTICIPATED RANGE OF CONSTRUCTION NOISE LEVELS VS. DISTANCE

FIGURE 5

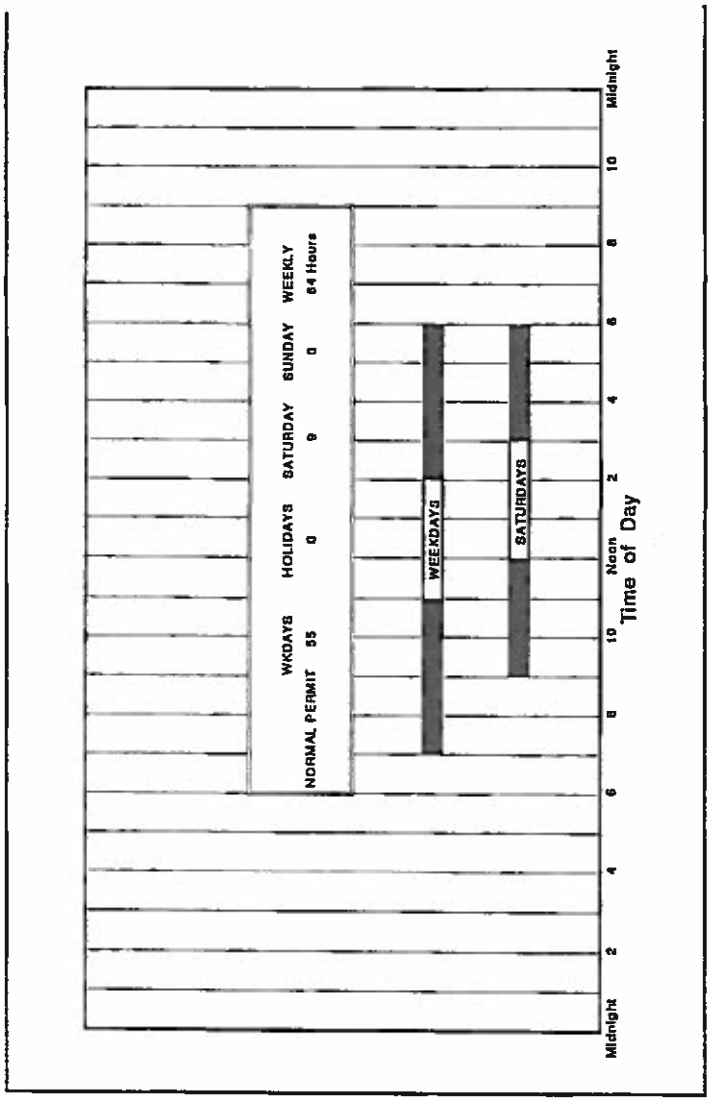


FIGURE 6

AVAILABLE WORK HOURS UNDER DOH PERMIT PROCEDURES FOR CONSTRUCTION NOISE

APPENDIX A. REFERENCES

(1) "Guidelines for Considering Noise in Land Use Planning and Control;" Federal Interagency Committee on Urban Noise; June 1980.

(2) American National Standard, "Sound Level Descriptors for Determination of Compatible Land Use." ANSI S12.9-1998/ Part 5; Acoustical Society of America.

(3) "Environmental Criteria and Standards, Noise Abatement and Control, 24 CFR, Part 51, Subpart B;" U.S. Department of Housing and Urban Development; July 12, 1979.

(4) "Information on Levels of Environmental Noise Requisite to Protect the Public Health and Welfare with an Adequate Margin of Safety;" U.S. Environmental Protection Agency; EPA 550/9-74- 004; March 1974.

(5) "Title 11, Administrative Rules, Chapter 46, Community Noise Control;" Hawaii State Department of Health; September 23, 1996.

(6) "FHWA Highway Traffic Noise Model User's Guide;" FHWA-PD-96-009, Federal Highway Administration; Washington, D.C.; January 1998 and Version 2.5 Upgrade (April 14, 2004).

(7) "Traffic Impact Analysis Report for Puunene Heavy Industrial Subdivison;" Phillip Rowell and Associates; September 26, 2011.

(8) Hourly Traffic Counts At Station B74031100336, Mokulele Highway Near Maui Raceway Park; Hawaii State Department of Transportation; May 13, 2009.

APPENDIX B

EXCERPTS FROM EPA'S ACOUSTIC TERMINOLOGY GUIDE

Descriptor Symbol Usage

The recommended symbols for the commonly used acoustic descriptors based on A-weighting are contained in Table I. As most acoustic criteria and standards used by EPA are derived from the A-weighted sound level, almost all descriptor symbol usage guidance is contained in Table I.

Since acoustic nomenclature includes weighting networks other than "A" and measurements other than pressure, an expansion of Table I was developed (Table II). The group adopted the ANSI descriptor-symbol scheme which is structured into three stages. The first stage indicates that the descriptor is a level (i.e., based upon the logarithm of a ratio), the second stage indicates the type of quantity (power, pressure, or sound exposure), and the third stage indicates the weighting network (A, B, C, D, E.....). If no weighting network is specified, "A" weighting is understood. Exceptions are the A-weighted sound level and the A-weighted peak sound level which require that the "A" be specified. For convenience in those situations in which an A-weighted descriptor is being compared to that of another weighting, the alternative column in Table II permits the inclusion of the "A". For example, a report on blast noise might wish to contrast the LCdn with the LAdn.

Although not included in the tables, it is also recommended that "Lpn" and "LepN" be used as symbols for perceived noise levels and effective perceived noise levels, respectively.

It is recommended that in their initial use within a report, such terms be written in full, rather than abbreviated. An example of preferred usage is as follows:

The A-weighted sound level (LA) was measured before and after the installation of acoustical treatment. The measured LA values were 85 and 75 dB respectively.

Descriptor Nomenclature

With regard to energy averaging over time, the term "average" should be discouraged in favor of the term "equivalent". Hence, Leq, is designated the "equivalent sound level". For Ld, Ln, and Ldn, "equivalent" need not be stated since the concept of day, night, or day-night averaging is by definition understood. Therefore, the designations are "day sound level", "night sound level", and "day-night sound level", respectively.

The peak sound level is the logarithmic ratio of peak sound pressure to a reference pressure and not the maximum root mean square pressure. While the latter is the maximum sound pressure level, it is often incorrectly labelled peak. In that sound level meters have "peak" settings, this distinction is most important.

"Background ambient" should be used in lieu of "background", "ambient", "residual", or "indigenous" to describe the level characteristics of the general background noise due to the contribution of many unidentifiable noise sources near and far.

With regard to units, it is recommended that the unit decibel (abbreviated dB) be used without modification. Hence, DBA, PNdB, and EPNdB are not to be used. Examples of this preferred usage are: the Perceived Noise Level (Lpn was found to be 75 dB. Lpn = 75 dB). This decision was based upon the recommendation of the National Bureau of Standards, and the policies of ANSI and the Acoustical Society of America, all of which disallow any modification of bel except for prefixes indicating its multiples or submultiples (e.g., decl).

Noise Impact

In discussing noise impact, it is recommended that "Level Weighted Population" (LWP) replace "Equivalent Noise Impact" (ENI). The term "Relative Change of Impact" (RCI) shall be used for comparing the relative differences in LWP between two alternatives.

Further, when appropriate, "Noise Impact Index" (NII) and "Population Weighed Loss of Hearing" (PHL) shall be used consistent with CHABA Working Group 69 Report Guidelines for Preparing Environmental Impact Statements (1977).

APPENDIX B (CONTINUED)

TABLE I

A-WEIGHTED RECOMMENDED DESCRIPTOR LIST

	TERM	SYMBOL
1.	A-Weighted Sound Level	L_A
2.	A-Weighted Sound Power Level	L_{WA}
3.	Maximum A-Weighted Sound Level	L_{max}
4.	Peak A-Weighted Sound Level	L_{Apk}
5.	Level Exceeded x% of the Time	L_x
6.	Equivalent Sound Level	L_{eq}
7.	Equivalent Sound Level over Time (T) (1)	$L_{eq(T)}$
8.	Day Sound Level	L_d
9.	Night Sound Level	L_n
10.	Day-Night Sound Level	L_{dn}
11.	Yearly Day-Night Sound Level	$L_{dn(Y)}$
12.	Sound Exposure Level	L_{SE}

(1) Unless otherwise specified, time is in hours (e.g. the hourly equivalent level is $L_{eq(1)}$). Time may be specified in non-quantitative terms (e.g., could be specified a $L_{eq(WASH)}$ to mean the washing cycle noise for a washing machine).

SOURCE: EPA ACOUSTIC TERMINOLOGY GUIDE, BNA 8-14-78,

APPENDIX B (CONTINUED)

TABLE II

RECOMMENDED DESCRIPTOR LIST

	TERM	A-WEIGHTING	ALTERNATIVE[1] A-WEIGHTING	OTHER[2] WEIGHTING	UNWEIGHTED
1.	Sound (Pressure)[3] Level	L_A	L_{pA}	L_B, L_{pB}	L_p
2.	Sound Power Level	L_{WA}		L_{WB}	L_W
3.	Max. Sound Level	L_{max}	L_{Amax}	L_{Bmax}	L_{pmax}
4.	Peak Sound (Pressure) Level	L_{Apk}		L_{Bpk}	L_{pk}
5.	Level Exceeded x% of the Time	L_x	L_{Ax}	L_{Bx}	L_{px}
6.	Equivalent Sound Level	L_{eq}	L_{Aeq}	L_{Beq}	L_{peq}
7.	Equivalent Sound Level[4] Over Time(T)	$L_{eq(T)}$	$L_{Aeq(T)}$	$L_{Beq(T)}$	$L_{peq(T)}$
8.	Day Sound Level	L_d	L_{Ad}	L_{Bd}	L_{pd}
9.	Night Sound Level	L_n	L_{An}	L_{Bn}	L_{pn}
10.	Day-Night Sound Level	L_{dn}	L_{Adn}	L_{Bdn}	L_{pdn}
11.	Yearly Day-Night Sound Level	$L_{dn(Y)}$	$L_{Adn(Y)}$	$L_{Bdn(Y)}$	$L_{pdn(Y)}$
12.	Sound Exposure Level	L_S	L_{SA}	L_{SB}	L_{Sp}
13.	Energy Average Value Over (Non-Time Domain) Set of Observations	$L_{eq(e)}$	$L_{Aeq(e)}$	$L_{Beq(e)}$	$L_{peq(e)}$
14.	Level Exceeded x% of the Total Set of (Non-Time Domain) Observations	$L_{x(e)}$	$L_{Ax(e)}$	$L_{Bx(e)}$	$L_{px(e)}$
15.	Average L_x Value	L_x	L_{Ax}	L_{Bx}	L_{px}

(1) "Alternative" symbols may be used to assure clarity or consistency.

(2) Only B-weighting shown. Applies also to C,D,E,....weighting.

(3) The term "pressure" is used only for the unweighted level.

(4) Unless otherwise specified, time is in hours (e.g., the hourly equivalent level is Leq(1). Time may be specified in non-quantitative terms (e.g., could be specified as Leq(WASH) to mean the washing cycle noise for a washing machine.

APPENDIX C

SUMMARY OF BASE YEAR AND YEAR 2015 TRAFFIC VOLUMES

ROADWAY LANES	**** CY 2011 ***** AM VPH	PM VPH	CY 2015 (NO BUILD) AM VPH	PM VPH	CY 2015 (BUILD) AM VPH	PM VPH
Mokulele Hwy. N. of Kamaaina Rd. (NB)	1,104	1,218	1,389	1,557	1,439	1,788
Mokulele Hwy. N. of Kamaaina Rd. (SB)	1,093	1,172	1,354	1,547	1,597	1,609
Two-Way	2,197	2,390	2,743	3,104	3,035	3,397
Mokulele Hwy. S. of Kamaaina Rd. (NB)	1,101	1,190	1,386	1,529	1,535	1,567
Mokulele Hwy. S. of Kamaaina Rd. (SB)	1,046	1,183	1,307	1,558	1,338	1,699
Two-Way	2,147	2,373	2,693	3,087	2,873	3,266
Kamaaina Rd. At Mokulele Hwy. (EB)	37	8	37	8	429	108
Kamaaina Rd. At Mokulele Hwy. (WB)	20	28	20	28	100	400
Two-Way	57	36	57	36	529	508
Mehameha Lp. At Mokulele Hwy. (EB)	4	30	4	30	4	30
Mehameha Lp. At Mokulele Hwy. (WB)	31	11	31	11	31	11
Two-Way	35	41	35	41	35	41
South Firebreak Rd. N. of Quarry Access Rd.(NB) Alt. 1	20	28	20	28	100	400
South Firebreak Rd. N. of Quarry Access Rd.(SB) Alt. 1	37	8	37	8	429	108
Two-Way	57	36	57	36	529	508
Quarry Access Rd. At S. Firebreak Rd. (EB) Alt 1	37	8	37	8	37	8
Quarry Access Rd. At S. Firebreak Rd. (WB) Alt 1	20	28	20	28	20	28
Two-Way	57	36	57	36	57	36
South Firebreak Rd. S. of Quarry Access Rd.(NB) Alt. 1	N/A	N/A	N/A	N/A	80	372
South Firebreak Rd. S. of Quarry Access Rd.(SB) Alt. 1	N/A	N/A	N/A	N/A	392	100
Two-Way	N/A	N/A	N/A	N/A	472	472
South Firebreak Rd. N. of Project Access Rd.(NB) Alt. 2	20	28	20	28	100	400
South Firebreak Rd. N. of Project Access Rd.(SB) Alt. 2	37	8	37	8	429	108
Two-Way	57	36	57	36	529	508
South Firebreak Rd. S. of Project Access Rd.(NB) Alt. 2	20	28	20	28	20	28
South Firebreak Rd. S. of Project Access Rd.(SB) Alt. 2	37	8	37	8	37	8
Two-Way	57	36	57	36	57	36
Quarry Access Rd. At S. Firebreak Rd. (EB) Alt 2	37	8	37	8	37	39
Quarry Access Rd. At S. Firebreak Rd. (WB) Alt 2	20	28	20	28	20	28
Two-Way	57	36	57	36	57	67
Project Access Rd. At S. Firebreak Rd. (EB) Alt 2	N/A	N/A	N/A	N/A	392	100
Project Access Rd. At S. Firebreak Rd. (WB) Alt 2	N/A	N/A	N/A	N/A	80	372
Two-Way	N/A	N/A	N/A	N/A	472	472