APPENDIX L
Acoustic Study

ACOUSTIC STUDY FOR THE MAUI RESEARCH AND TECHNOLOGY PARK KIHEI, MAUI

Prepared for:

MAUI R&T PARTNERS, LLC

Prepared by:

Y. EBISU & ASSOCIATES
1126 12th Avenue, Room 305
Honolulu, Hawaii 96816

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CHAPTER I. SUMMARY

The existing and future traffic noise levels in the vicinity of the planned Maui Research and Technology Park in Kihei, Maui were evaluated for their potential impacts and their relationship to current FHA/HUD noise standards for noise sensitive land uses. The traffic noise level increases along the roadways servicing the project site (see Figure 1) were calculated. Significant increases in traffic noise levels at noise sensitive properties are not expected to occur as a result of project traffic following project build-out by CY 2024 and 2034.

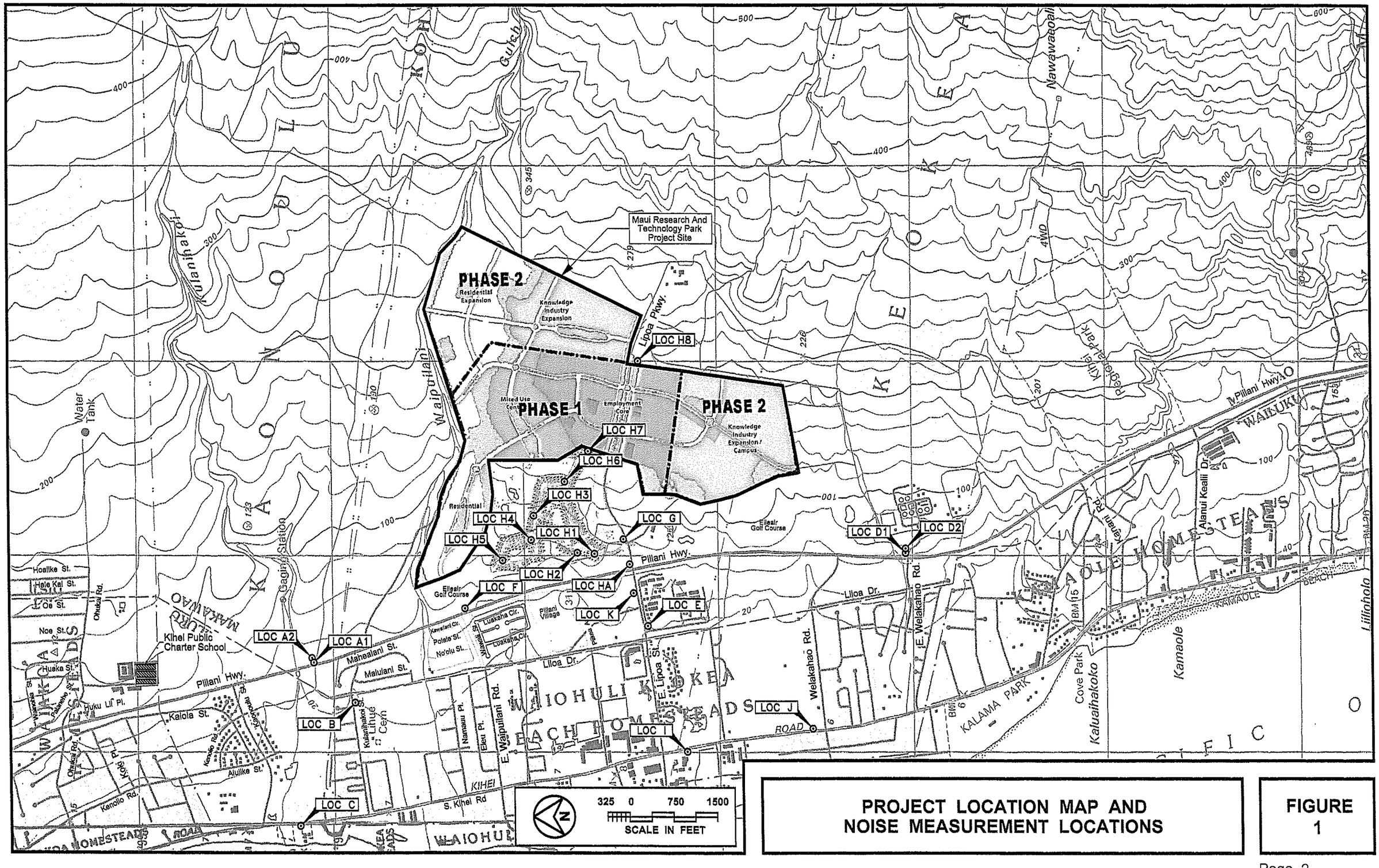
Along Piilani Highway fronting the project site, traffic noise levels of approximately 70 DNL are expected to increase to approximately 71 DNL at 100 foot distance from the centerline by CY 2024 as a result of project and non-project traffic. By CY 2034, traffic noise levels along Piilani Highway are expected to be reduced to existing noise levels following completion of the proposed north-south collector road on the mauka side of the project site.

The largest increases (1.4 to 7.7 DNL) in project related traffic noise are predicted to occur along Lipoa Parkway, East Welakahao Street east of Piilani Highway, and along Lipoa Street west of Piilani Highway. Adverse traffic noise impacts along Lipoa Parkway and East Welakahao Street are not expected to occur since noise sensitive developments are not planned to be located along those two roadways. The noise sensitive buildings along Lipoa Street west of Piilani Highway have adequate setback distances from Lipoa Street, such that predicted CY 2024 and CY 2034 traffic noise levels should remain in the "Moderate Exposure, Normally Acceptable" category at these buildings. For these reasons, traffic noise mitigation measures should not be required.

The project site is planned such that noise sensitive residential uses of the project are situated at very large setback distances from Piilani Highway, where existing and future traffic noise levels are predicted to be less than 60 DNL. The large buffer distances to the highway will allow for the use of naturally ventilated buildings on the project site.

The dominant traffic noise sources in the project environs will continue to be traffic along Piilani Highway and South Kihei Road. In addition, the addition of the proposed north-south collector road mauka of the project will increase the existing background ambient noise levels at the mauka end of the project site and along the proposed corridors of the collector road and connecting roadways.

Unavoidable, but temporary, noise impacts may occur during construction of the proposed project, particularly during the excavation and earth moving activities on the project site. Because construction activities are predicted to 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



PROJECT LOCATION MAP AND NOISE MEASUREMENT LOCATIONS

FIGURE 1

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 levels in the environs of the proposed Maui Research and Technology Park in Kihei on the island of Maui. Traffic forecasts for 2024 and 2034 were used. Traffic noise level increases and impacts associated with the proposed development 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.

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 Piilani Highway and South Kihei Road are typically greater than 65 DNL along the Right-of-Way due to the relatively large volumes of traffic on these major thoroughfares.

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)

EFFECTS[1] / DAY-NIGHT AVERAGE SOUND LEVEL IN DECIBELS	Hearing Loss	Speech Interference		Annoyance[2]	Average Community Reaction[4]	General Community Attitude Towards Area
		Indoor	Outdoor			
	Qualitative Description	%Sentence Intelligibility	Distance in Meters for 95% Sentence Intelligibility	% of Population Highly Annoyed[3]		
75 and above	May Begin to Occur	98%	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%	0.9	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.

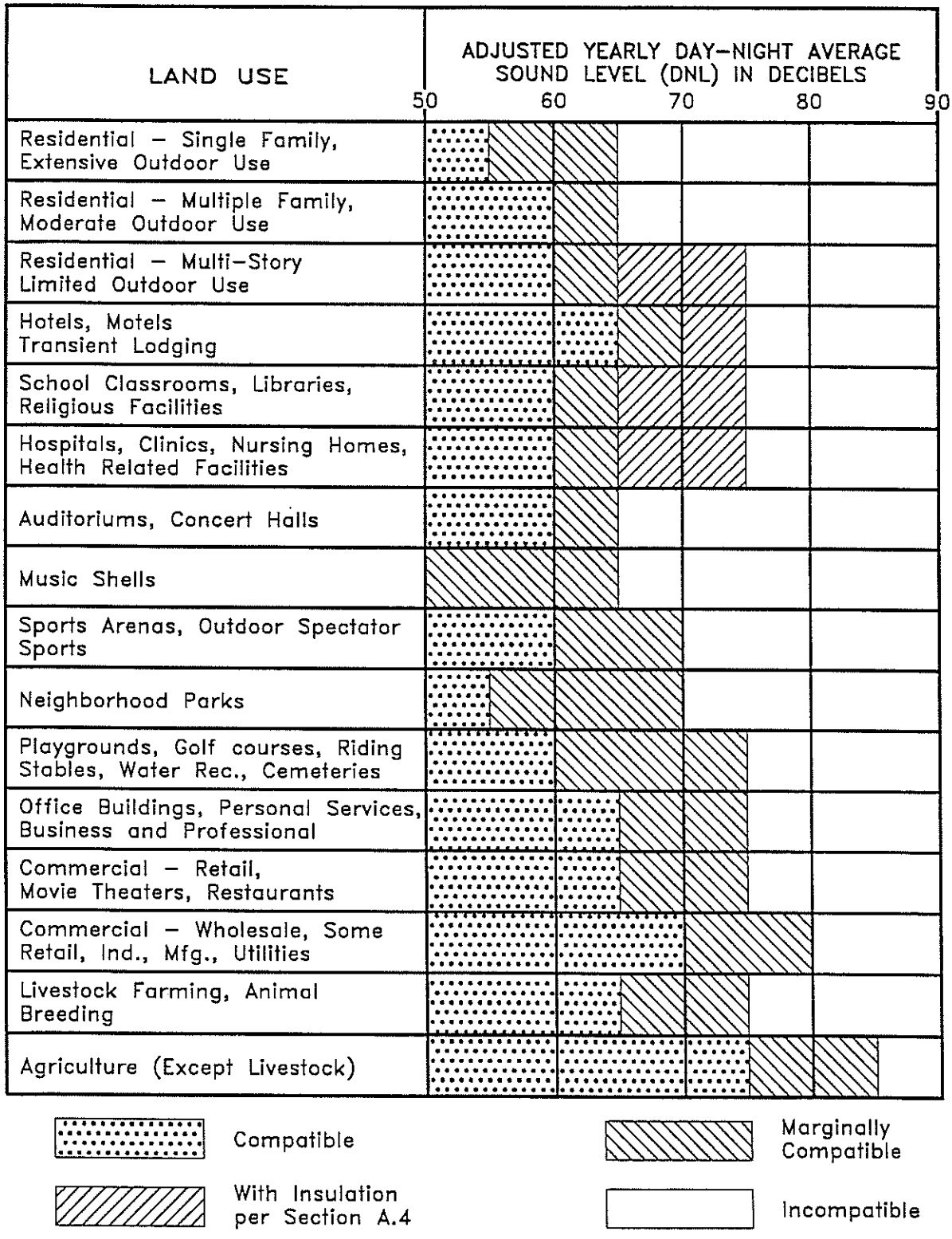
1. "Speech Interference" data are drawn from the following tables in EPA's "Levels Document": Table 3, Fig. D-1, Fig. D-2, Fig. D-3. All other data from National Academy of Science 1977 report "Guidelines for Preparing Environmental Impact Statements on Noise, Report of Working Group 69 on Evaluation 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 twelve locations (A1, A2, B, C, D1, D2, E, F, G. I, J, and K) along public roadways 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. In addition, existing background noise levels were obtained at nine locations (HA and H1 through H8) within the existing Hokulani and proposed project areas to validate the traffic noise model used for predicting future traffic noise levels from Piilani Highway within the project area. The locations of the measurement sites are shown in Figure 1. Noise measurements were performed during the months of September 2011 and April 2012. 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 along the public roadways, 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 Years 2024 and 2034 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 "Loose Soil" propagation loss factor. 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. Appendices C1 through C3 summarize the AM and PM peak hour traffic volumes for CY 2011, 2024, and 2034 which were used to model existing and future traffic noise along the streets in the vicinity of the project site. For existing and future traffic along the streets in the vicinity of the project site, it was assumed that the average noise levels, or Leq(h), during the AM or PM peak traffic hour were equal to the 24-hour DNL along those roadways. This assumption was based on computations of both the hourly Leq and the 24-hour DNL of traffic noise on Piilani Highway (see Figure 3) using Hawaii State Department of Transportation 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.

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

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. 60 FT from the center-line of Piilani Highway (9/12/11)	0634 TO 0734	55	2,358	29	17	74.2	72.9
A2. 120 FT from the center-line of Piilani Highway (9/12/11)	0634 TO 0734	55	2,358	29	17	67.7	68.0
B. 50 FT from the center-line of Kulanihakoi Street (9/12/11)	0757 TO 0857	35	152	2	0	57.9	55.9
C. 50 FT from the center-line of South Kihei Road (9/12/11)	0917 TO 1017	40	802	13	7	64.6	64.8
A1. 60 FT from the center-line of Piilani Highway (9/12/11)	1539 TO 1639	55	2,832	28	10	74.0	73.5
A2. 120 FT from the center-line of Piilani Highway (9/12/11)	1539 TO 1639	55	2,832	28	10	68.0	68.3

TABLE 3 (CONTINUED)

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)
D1. 75 FT from the center-line of Piilani Highway (9/13/11)	0646 TO 0746	55	1,863	18	35	72.0	69.4
D2. 150 FT from the center-line of Piilani Highway (9/13/11)	0646 TO 0746	55	1,863	18	35	62.1	62.5
E. 50 FT from the center-line of Lipoa Street (9/13/11)	0809 TO 0909	35	402	6	12	61.7	61.1
F. 78 FT from the center-line of Piilani Highway (9/13/11)	1030 TO 1130	53	1,950	34	31	69.7	69.7
D1. 75 FT from the center-line of Piilani Highway (9/13/11)	1540 TO 1640	53	2,356	21	15	71.4	69.8
D2. 150 FT from the center-line of Piilani Highway (9/13/11)	1540 TO 1640	53	2,356	21	15	62.5	62.4

TABLE 3 (CONTINUED)

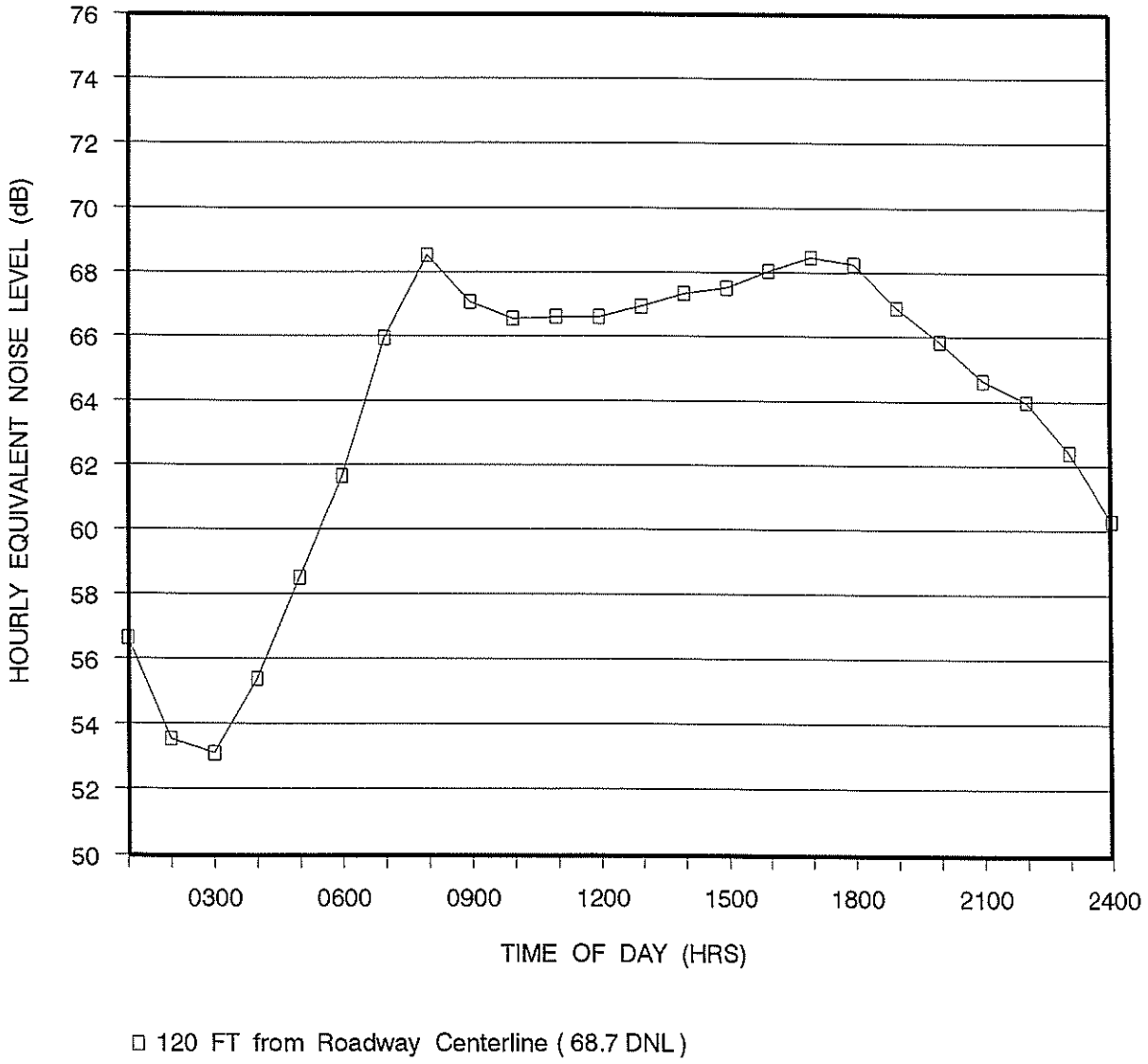
TRAFFIC AND BACKGROUND NOISE MEASUREMENT RESULTS

LOCATION	Time of Day (HRS)	Ave. Speed (MPH)	Hourly Traffic Volume AUTO	M.TRUCK	H.TRUCK	Measured Leq (dB)	Predicted Leq (dB)
K. 50 FT from the center-line of Lipoa Street (4/16/12)	0653 TO 0753	25	870	9	20	62.8	62.7
G. 50 FT from the center-line of Lipoa Parkway (4/16/12)	0802 TO 0902	35	149	0	0	56.5	57.0
I. 50 FT from the center-line of S. Kihei Road (4/16/12)	0923 TO 1023	38	1,234	24	7	66.7	66.6
J. 50 FT from the center-line of S. Kihei Road (4/16/12)	1448 TO 1548	38	1,387	22	5	66.8	67.0
G. 50 FT from the center-line of Lipoa Parkway (4/16/12)	1559 TO 1659	35	121	1	0	59.5 * 57.5 **	57.1

Notes:
* With siren contribution included.
** With siren contribution deleted.

FIGURE 3

HOURLY VARIATIONS OF TRAFFIC NOISE AT 120 FT SETBACK DISTANCE FROM THE CENTERLINE OF PIILANI HIGHWAY BETWEEN MOKULELE HWY. AND LIPOA ST. (STA. B74003100000; APRIL 21, 2009)



V. EXISTING ACOUSTICAL ENVIRONMENT

The existing background ambient noise levels within the project site are relatively low at the mauka (east) end and moderate on the makai (west) end of the site. Traffic along Piilani Highway controls the background noise levels at the makai end of the project site, and diminishes to inaudible levels at the mauka end of the project site. On the makai side of Piilani Highway, existing traffic noise levels also diminish with increasing distances from Piilani Highway, and are controlled by the traffic on connector roads and South Kihei Road in areas between Piilani Highway and the shoreline.

Traffic and background ambient noise measurements along the public roadways in the project environs were obtained in September 2011 and April 2012 at twelve locations (A1, A2, B, C, D1, D2, E, F, G, I, J, and K) in the project environs. These locations are shown in Figure 1. The results of these traffic and background ambient noise measurements are summarized in Table 3, with measurement locations identified in Figure 1. The measurement locations were typically located at street level. As shown in Table 3, correlation between measured and predicted traffic noise levels was good. The Traffic Noise Model's "Loose Soil" and "Field Grass" propagation loss factors were used to obtain the good correlation.

Calculations of existing traffic noise levels along the public roadways in the project environs during the AM or 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 Leq values shown also represent the DNL values for the roadways shown. The existing setback distances from the roadways' centerlines to their associated 65 and 75 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 Piilani Highway are in the "Significant Exposure, Normally Unacceptable" category, and at or greater than 65 DNL at the first row of existing homes on the makai side of the highway. The existing traffic noise levels in the project environs along South Kihei Road are in the "Significant Exposure, Normally Unacceptable" categories, and at or greater than 65 DNL within 61 to 67 feet of the roadway's centerline. Along the lower volume connector streets, existing traffic noise levels are in the "Moderate Exposure, Acceptable" category, and less than 65 DNL at 50 feet or greater distance from the roadways' centerlines.

The existing background noise levels at the project site were estimated by measuring existing background noise levels within the Hokulani project (Locations H1 through H7) and at the mauka end of Lipoa Parkway (Location H8). These measurements were used in conjunction with the FHWA Traffic Noise Model to calculate existing traffic noise level contributions from Piilani Highway at various

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
Piilani Hwy., N. of E. Waipulani Rd. (PM)	55	3,233	3,181	36	16	75.2	70.3	64.5
Piilani Hwy., Between E. Waipulani Rd. & Piikea Ave. (PM)	55	3,174	3,123	35	16	75.1	70.2	64.5
Piilani Hwy., Between Piikea Ave. & E. Lipoa St. (PM)	55	2,993	2,948	30	15	74.8	70.0	64.2
Piilani Hwy., Between E. Lipoa St. & Welakahao Rd. (PM)	55	2,595	2,556	26	13	74.2	69.3	63.6
Piilani Hwy., Between Welakahao Rd. & E. Welakahao St. (PM)	55	2,406	2,346	24	36	74.2	69.3	63.6
Piilani Hwy., S. of E. Welakahao St. (PM)	55	2,377	2,341	24	12	73.8	69.0	63.2
S. Kihei Rd., N. of Piikea Ave. (PM)	40	1,251	1,218	20	13	66.8	61.0	55.0
S. Kihei Rd., Between Piikea Ave. & E. Lipoa St. (PM)	40	1,453	1,415	23	15	67.4	61.6	55.7
S. Kihei Rd., S. of E. Lipoa St. (PM)	38	1,594	1,560	26	8	66.9	61.1	55.1
S. Kihei Rd., N. of Welakahao Rd. (PM)	38	1,518	1,486	24	8	66.7	60.9	54.9
S. Kihei Rd., S. of Welakahao Rd. (PM)	38	1,562	1,529	25	8	66.9	61.0	55.0
Hookena St., E. of Piilani Hwy. (PM)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
E. Waipulani Rd., W. of Piilani Hwy. (PM)	30	140	138	2	0	53.0	46.8	41.8
Piikea Ave., Between Piilani Hwy. & Liloa St. (PM)	30	988	974	13	1	62.2	55.8	50.6
Piikea Ave., Between Liloa St. & S. Kihei Rd. (PM)	30	701	691	9	1	60.1	54.7	48.7
Lipoa Pkwy., E. of Piilani Hwy. (PM)	35	223	220	3	0	58.8	53.2	47.0
E. Lipoa St., Between Piilani Hwy. & Liloa Dr. (AM)	25	765	747	10	8	59.6	53.8	49.3
E. Lipoa St., Between Liloa Dr. & S. Kihei Rd. (PM)	30	604	590	8	6	60.0	54.0	48.5
Welakahao Rd., W. of Piilani Hwy. (PM)	30	510	502	7	1	58.8	53.4	47.5
Welakahao Rd., E. of S. Kihei Rd. (PM)	30	308	304	4	0	56.5	51.0	45.0
E. Welakahao St., E. of Piilani Hwy. (AM)	30	67	66	1	0	49.7	43.4	37.5

TABLE 5

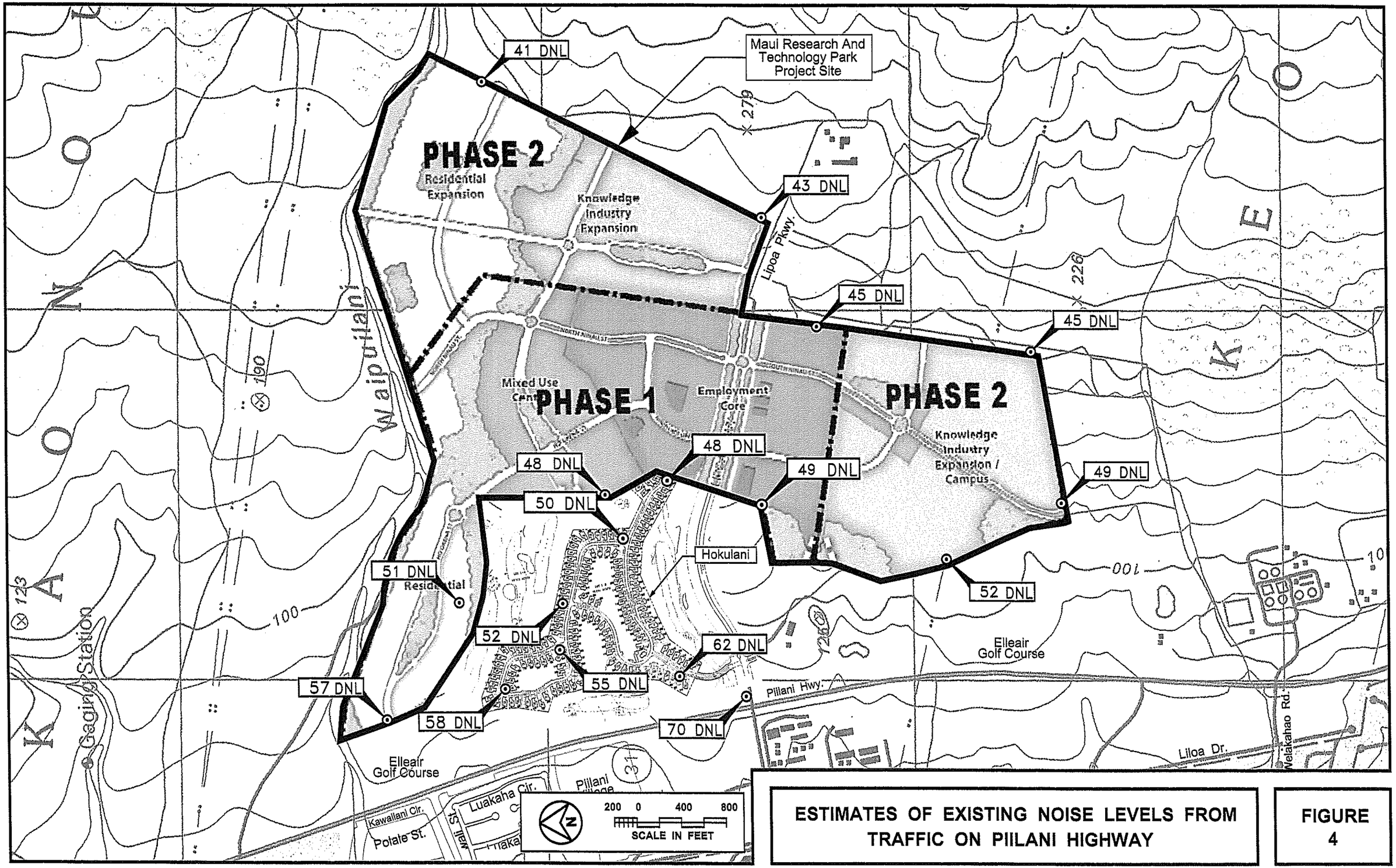
EXISTING AND CY 2024 DISTANCES TO 65 AND 75 DNL CONTOURS

STREET SECTION	65 DNL SETBACK (FT) EXISTING	65 DNL SETBACK (FT) CY 2024	75 DNL SETBACK (FT) EXISTING	75 DNL SETBACK (FT) CY 2024
Piilani Hwy., N. of E. Waipulani Rd.	188	217	51	60
Piilani Hwy., Between E. Waipulani Rd. & Piikea Ave.	188	212	51	59
Piilani Hwy., Between Piikea Ave. & E. Lipoa St.	182	202	49	55
Piilani Hwy., Between E. Lipoa St. & Welakahao Rd.	169	173	45	46
Piilani Hwy., Between Welakahao Rd. & E. Welakahao St.	169	177	45	47
Piilani Hwy., S. of E. Welakahao St.	161	167	42	44
S. Kihei Rd., N. of Piikea Ave.	62	64	19	19
S. Kihei Rd., Between Piikea Ave. & E. Lipoa St.	67	69	20	21
S. Kihei Rd., S. of E. Lipoa St.	63	65	19	20
S. Kihei Rd., N. of Welakahao Rd.	61	64	19	19
S. Kihei Rd., S. of Welakahao Rd.	63	65	19	20
Hookena St., E. of Piilani Hwy.	N/A	15	N/A	< 12
E. Waipulani Rd., W. of Piilani Hwy.	13	13	< 12	< 12
Piikea Ave., Between Piilani Hwy. & Liloa St.	37	39	13	13
Piikea Ave., Between Liloa St. & S. Kihei Rd.	27	27	< 12	< 12
Lipoa Pkwy., E. of Piilani Hwy.	23	60	< 12	17
E. Lipoa St., Between Piilani Hwy. & Liloa Dr.	26	32	< 12	< 12
E. Lipoa St., Between Liloa Dr. & S. Kihei Rd.	28	29	< 12	< 12
Welakahao Rd., W. of Piilani Hwy.	23	23	< 12	< 12
Welakahao Rd., E. of S. Kihei Rd.	17	17	< 12	< 12
E. Welakahao St., E. of Piilani Hwy.	< 12	< 12	< 12	< 12

Notes:

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

locations within the Hokulani and Maui Research and Technology Project sites. The results of these existing traffic noise calculations are shown in Figure 4. From Figure 4, existing traffic noise levels on the project site are estimated to range from 49 to 57 DNL at the westernmost (makai) corners of the project site to 41 to 45 DNL at the easternmost (mauka) corners of the project site.



ESTIMATES OF EXISTING NOISE LEVELS FROM TRAFFIC ON PIILANI HIGHWAY

FIGURE 4

CHAPTER VI. FUTURE NOISE ENVIRONMENT

Predictions of future traffic noise levels were made using the traffic volume assignments of Reference 7 for CY 2024 and 2034 with and without the proposed project. The future projections of project plus non-project traffic noise levels for CY 2034 also included traffic on a new 2-lane or 4-lane, north-south, collector road located to the east (mauka) of the project site. Appendices C1 through C3 summarize the AM and PM peak hour traffic volumes for 2024 and 2034 which were used to model future traffic noise along the streets in the vicinity of the project site.

Future traffic noise levels at distances of 50, 100, and 200 feet from the centerlines of the roadways which would service the project are shown in Tables 6-1, 6-2, and 6-3 for the AM or PM peak hours of traffic, under the Build Alternative. Predicted increases in the setback distances to the 65 and 75 DNL contours are shown in Tables 5 and 7. The separate non-project and project traffic noise contributions for the Build Alternatives for 2024 and 2034 are shown in Table 8.

From Table 8, increases in future traffic noise levels of 0.5 to 1.1 DNL are expected along Piilani Highway in the project environs between CY 2011 and 2024 as a result of project traffic. The growth in non-project traffic by CY 2024 is predicted to result in traffic noise level increases of 0.0 to 0.2 DNL along Piilani Highway. Similar increases in future traffic noise levels due to non-project traffic are predicted to occur along South Kihei Road by CY 2024, with project traffic adding 0.0 to 0.1 DNL to the non-project noise levels by CY 2024. The largest increase (7.7 DNL) in traffic noise level is anticipated to occur along Lipoa Parkway east of Piilani Highway, and is primarily associated with project traffic. The next largest increase (1.4 DNL) in traffic noise due to project traffic is anticipated to occur along Lipoa Street between Piilani Highway and Liloa Drive. Predicted increases in traffic noise by CY 2024 due to project traffic along the other remaining roadways in the project environs are 0.1 DNL or less.

From Tables 9-1 and 9-2, future traffic noise levels are expected to decline along Piilani Highway in the project environs between CY 2011 and 2034 as a result of the transfer of north-south traffic from Piilani Highway to the proposed north-south collector road located mauka of the project site. The amount of the decreases in future traffic noise by CY 2034 range from 0.5 to 0.9 DNL, and are identical for the 2-lane and 4-lane collector roads. With the addition of the proposed north-south collector road located mauka of the project site, CY 2034 traffic noise levels along Piilani Highway and with the project are predicted to be similar to CY 2011 (or existing) levels. Predicted increases in project-related traffic noise levels along South Kihei Road by CY 2034 are slightly higher (by 0.1 DNL) than those predicted by CY 2024. Non-project traffic are anticipated to be the cause of traffic noise increases along South Kihei Road between CY 2024 and CY 2034. The addition of the proposed north-south collector road will slightly reduce the predicted increases in CY 2034 traffic noise levels along Lipoa Parkway and Lipoa Street mauka of Liloa Drive. A relatively large increase (4.9 DNL) in project related traffic noise levels along East Welakahao Street east of Piilani Highway is anticipated by CY 2034.

TABLE 6-1

FUTURE (CY 2024) TRAFFIC VOLUMES AND NOISE LEVELS ALONG ROADWAYS IN PROJECT AREA (AM OR PM PEAK HOUR, BUILD)

LOCATION	SPEED (MPH)	TOTAL VPH	****** VOLUMES (VPH) ******** AUTOS	M TRUCKS	H TRUCKS	50' Leq	100' Leq	200' Leq
Piilani Hwy., N. of E. Waipulani Rd. (AM)	55	4,233	4,165	47	21	76.3	71.5	65.7
Piilani Hwy., Between E. Waipulani Rd. & Piikea Ave. (AM)	55	4,074	4,009	45	20	76.2	71.3	65.5
Piilani Hwy., Between Piikea Ave. & E. Lipoa St. (AM)	55	3,683	3,628	37	18	75.7	70.9	65.1
Piilani Hwy., Between E. Lipoa St. & Welakahao Rd. (AM)	55	2,746	2,705	27	14	74.4	69.6	63.8
Piilani Hwy., Between Welakahao Rd. & E. Welakahao St. (AM)	55	2,594	2,529	26	39	74.5	69.7	64.0
Piilani Hwy., S. of E. Welakahao St. (AM)	55	2,550	2,511	26	13	74.1	69.3	63.5
S. Kihei Rd., N. of Piikea Ave. (PM)	40	1,348	1,313	22	13	67.1	61.3	55.3
S. Kihei Rd., Between Piikea Ave. & E. Lipoa St. (PM)	40	1,555	1,514	25	16	67.7	61.9	56.0
S. Kihei Rd., S. of E. Lipoa St. (PM)	38	1,702	1,666	27	9	67.2	61.4	55.4
S. Kihei Rd., N. of Welakahao Rd. (PM)	38	1,657	1,622	27	8	67.1	61.3	55.3
S. Kihei Rd., S. of Welakahao Rd. (PM)	38	1,701	1,665	27	9	67.2	61.4	55.4
Hookena St., E. of Piilani Hwy. (AM)	35	150	148	2	0	55.2	49.7	43.5
E. Waipulani Rd., W. of Piilani Hwy. (PM)	30	140	138	2	0	53.0	46.8	41.8
Piikea Ave., Between Piilani Hwy. & Liloa St. (PM)	30	1,134	1,118	15	1	62.7	56.4	51.2
Piikea Ave., Between Liloa St. & S. Kihei Rd. (PM)	30	701	691	9	1	60.1	54.7	48.7
Lipoa Pkwy., E. of Piilani Hwy. (PM)	35	1,300	1,282	17	1	66.4	60.9	54.8
E. Lipoa St., Between Piilani Hwy. & Liloa Dr. (AM)	25	1,178	1,151	15	12	61.4	55.7	51.1
E. Lipoa St., Between Liloa Dr. & S. Kihei Rd. (PM)	30	634	620	8	6	60.2	54.1	48.6
Welakahao Rd., W. of Piilani Hwy. (PM)	30	510	502	7	1	58.8	53.4	47.5
Welakahao Rd., E. of S. Kihei Rd. (PM)	30	308	304	4	0	56.5	51.0	45.0
E. Welakahao St., E. of Piilani Hwy. (AM)	30	67	66	1	0	49.7	43.4	37.5

TABLE 6-2

FUTURE (CY 2034) TRAFFIC VOLUMES AND NOISE LEVELS ALONG ROADWAYS IN PROJECT AREA WITH 2-LANE COLLECTOR (AM OR PM PEAK HOUR, BUILD)

LOCATION	SPEED (MPH)	TOTAL VPH	****** VOLUMES (VPH) ******** AUTOS	M TRUCKS	H TRUCKS	50' Leq	100' Leq	200' Leq
Piilani Hwy., N. of E. Waipulani Rd. (AM)	55	3,371	3,317	37	17	75.4	70.5	64.7
Piilani Hwy., Between E. Waipulani Rd. & Piikea Ave. (AM)	55	3,380	3,326	37	17	75.4	70.5	64.7
Piilani Hwy., Between Piikea Ave. & E. Lipoa St. (AM)	55	3,193	3,145	32	16	75.1	70.2	64.5
Piilani Hwy., Between E. Lipoa St. & Welakahao Rd. (AM)	55	2,333	2,298	23	12	73.7	68.9	63.1
Piilani Hwy., Between Welakahao Rd. & E. Welakahao St. (AM)	55	2,238	2,182	22	34	73.9	69.0	63.3
Piilani Hwy., S. of E. Welakahao St. (AM)	55	2,096	2,065	21	10	73.3	68.4	62.6
S. Kihei Rd., N. of Piikea Ave. (PM)	40	1,512	1,473	24	15	67.6	61.8	55.8
S. Kihei Rd., Between Piikea Ave. & E. Lipoa St. (PM)	40	1,737	1,692	28	17	68.2	62.4	56.4
S. Kihei Rd., S. of E. Lipoa St. (PM)	38	1,899	1,860	30	9	67.7	61.9	55.8
S. Kihei Rd., N. of Welakahao Rd. (PM)	38	1,862	1,823	30	9	67.6	61.8	55.8
S. Kihei Rd., S. of Welakahao Rd. (PM)	38	1,906	1,866	30	10	67.7	61.9	55.9
Hookena St., E. of Piilani Hwy. (PM)	35	153	151	2	0	55.3	49.8	43.6
E. Waipulani Rd., W. of Piilani Hwy. (PM)	30	140	138	2	0	53.0	46.8	41.8
Piikea Ave., Between Piilani Hwy. & Liloa St. (PM)	30	1,275	1,257	17	1	63.3	56.9	51.6
Piikea Ave., Between Liloa St. & S. Kihei Rd. (PM)	30	701	691	9	1	60.1	54.7	48.7
Lipoa Pkwy., E. of Piilani Hwy. (PM)	35	769	758	10	1	64.2	58.7	52.6
E. Lipoa St., Between Piilani Hwy. & Liloa Dr. (AM)	25	1,154	1,127	15	12	61.4	55.6	51.1
E. Lipoa St., Between Liloa Dr. & S. Kihei Rd. (PM)	30	648	634	8	6	60.3	54.2	48.7
Welakahao Rd., W. of Piilani Hwy. (PM)	30	576	568	7	1	59.3	53.9	47.9
Welakahao Rd., E. of S. Kihei Rd. (PM)	30	308	304	4	0	56.5	51.0	45.0
E. Welakahao St., E. of Piilani Hwy. (AM)	30	213	210	3	0	54.8	48.4	42.5
2-Lane Mauka Collector N. of Project (AM)	55	1,231	1,213	12	6	70.5	64.7	58.2
2-Lane Mauka Collector S. of Project (AM)	55	854	841	9	4	68.9	63.2	56.7

TABLE 6-3

FUTURE (CY 2034) TRAFFIC VOLUMES AND NOISE LEVELS ALONG ROADWAYS IN PROJECT AREA WITH 4-LANE COLLECTOR (AM OR PM PEAK HOUR, BUILD)

LOCATION	SPEED (MPH)	TOTAL VPH	****** VOLUMES (VPH) ******** AUTOS	M TRUCKS	H TRUCKS	50' Leq	100' Leq	200' Leq
Piilani Hwy., N. of E. Waipulani Rd. (AM)	55	3,371	3,317	37	17	75.4	70.5	64.7
Piilani Hwy., Between E. Waipulani Rd. & Piikea Ave. (AM)	55	3,380	3,326	37	17	75.4	70.5	64.7
Piilani Hwy., Between Piikea Ave. & E. Lipoa St. (AM)	55	3,193	3,145	32	16	75.1	70.2	64.5
Piilani Hwy., Between E. Lipoa St. & Welakahao Rd. (AM)	55	2,333	2,298	23	12	73.7	68.9	63.1
Piilani Hwy., Between Welakahao Rd. & E. Welakahao St. (AM)	55	2,238	2,182	22	34	73.9	69.0	63.3
Piilani Hwy., S. of E. Welakahao St. (AM)	55	2,096	2,065	21	10	73.3	68.4	62.6
S. Kihei Rd., N. of Piikea Ave. (PM)	40	1,513	1,474	24	15	67.6	61.8	55.8
S. Kihei Rd., Between Piikea Ave. & E. Lipoa St. (PM)	40	1,739	1,694	28	17	68.2	62.4	56.4
S. Kihei Rd., S. of E. Lipoa St. (PM)	38	1,901	1,861	30	10	67.7	61.9	55.9
S. Kihei Rd., N. of Welakahao Rd. (PM)	38	1,864	1,825	30	9	67.6	61.8	55.8
S. Kihei Rd., S. of Welakahao Rd. (PM)	38	1,908	1,867	31	10	67.7	61.9	55.9
Hookena St., E. of Piilani Hwy. (PM)	35	153	151	2	0	55.3	49.8	43.6
E. Waipulani Rd., W. of Piilani Hwy. (PM)	30	140	138	2	0	53.0	46.8	41.8
Piikea Ave., Between Piilani Hwy. & Liloa St. (PM)	30	1,275	1,257	17	1	63.3	56.9	51.6
Piikea Ave., Between Liloa St. & S. Kihei Rd. (PM)	30	701	691	9	1	60.1	54.7	48.7
Lipoa Pkwy., E. of Piilani Hwy. (PM)	35	839	827	11	1	64.6	59.0	52.9
E. Lipoa St., Between Piilani Hwy. & Liloa Dr. (AM)	25	1,225	1,197	16	12	61.6	55.8	51.2
E. Lipoa St., Between Liloa Dr. & S. Kihei Rd. (PM)	30	655	639	9	7	60.5	54.4	49.0
Welakahao Rd., W. of Piilani Hwy. (PM)	30	581	572	8	1	59.4	53.9	48.0
Welakahao Rd., E. of S. Kihei Rd. (PM)	30	308	304	4	0	56.5	51.0	45.0
E. Welakahao St., E. of Piilani Hwy. (AM)	30	213	210	3	0	54.8	48.4	42.5
4-Lane Mauka Collector N. of Project (AM)	55	1,368	1,347	14	7	71.5	66.5	60.9
4-Lane Mauka Collector S. of Project (AM)	55	886	873	9	4	69.6	64.6	59.0

TABLE 7

CY 2034 DISTANCES TO 65 AND 75 DNL CONTOURS WITH 2- OR 4-LANE COLLECTOR

STREET SECTION	65 DNL SETBACK (FT)		75 DNL SETBACK (FT)	
	2-LANE COL.	4-LANE COL.	2-LANE COL.	4-LANE COL.
Piilani Hwy., N. of E. Waipulani Rd.	193	193	53	53
Piilani Hwy., Between E. Waipulani Rd. & Piikea Ave.	193	193	53	53
Piilani Hwy., Between Piikea Ave. & E. Lipoa St.	188	188	51	51
Piilani Hwy., Between E. Lipoa St. & Welakahao Rd.	159	159	41	41
Piilani Hwy., Between Welakahao Rd. & E. Welakahao St.	163	163	43	43
Piilani Hwy., S. of E. Welakahao St.	150	150	39	39
S. Kihei Rd., N. of Piikea Ave.	68	68	21	21
S. Kihei Rd., Between Piikea Ave. & E. Lipoa St.	73	73	22	22
S. Kihei Rd., S. of E. Lipoa St.	69	69	21	21
S. Kihei Rd., N. of Welakahao Rd.	68	68	21	21
S. Kihei Rd., S. of Welakahao Rd.	69	69	21	21
Hookena St., E. of Piilani Hwy.	15	15	< 12	< 12
E. Waipulani Rd., W. of Piilani Hwy.	13	13	< 12	< 12
Piikea Ave., Between Piilani Hwy. & Liloa St.	42	42	14	14
Piikea Ave., Between Liloa St. & S. Kihei Rd.	27	27	< 12	< 12
Lipoa Pkwy., E. of Piilani Hwy.	45	48	13	14
E. Lipoa St., Between Piilani Hwy. & Liloa Dr.	33	33	< 12	< 12
E. Lipoa St., Between Liloa Dr. & S. Kihei Rd.	29	30	< 12	< 12
Welakahao Rd., W. of Piilani Hwy.	24	25	< 12	< 12
Welakahao Rd., E. of S. Kihei Rd.	17	17	< 12	< 12
E. Welakahao St., E. of Piilani Hwy.	17	17	< 12	< 12
2-Lane Mauka Collector N. of Project	96	N/A	29	N/A
2-Lane Mauka Collector S. of Project	80	N/A	24	N/A
4-Lane Mauka Collector N. of Project	N/A	120	N/A	31
4-Lane Mauka Collector S. of Project	N/A	95	N/A	24

TABLE 8

CALCULATIONS OF PROJECT AND NON-PROJECT TRAFFIC NOISE CONTRIBUTIONS (CY 2024) (DNL)

STREET SECTION	NOISE LEVEL INCREASE DUE TO: NON-PROJECT TRAFFIC	PROJECT TRAFFIC
Piilani Hwy., N. of E. Waipulani Rd.	0.1	1.1
Piilani Hwy., Between E. Waipulani Rd. & Piikea Ave.	0.2	0.9
Piilani Hwy., Between Piikea Ave. & E. Lipoa St.	0.0	0.9
Piilani Hwy., Between E. Lipoa St. & Welakahao Rd.	-0.2	0.5
Piilani Hwy., Between Welakahao Rd. & E. Welakahao St.	-0.1	0.5
Piilani Hwy., S. of E. Welakahao St.	-0.2	0.5
S. Kihei Rd., N. of Piikea Ave.	0.2	0.1
S. Kihei Rd., Between Piikea Ave. & E. Lipoa St.	0.2	0.1
S. Kihei Rd., S. of E. Lipoa St.	0.3	0.0
S. Kihei Rd., N. of Welakahao Rd.	0.3	0.1
S. Kihei Rd., S. of Welakahao Rd.	0.4	0.0
E. Waipulani Rd., W. of Piilani Hwy.	0.0	0.0
Piikea Ave., Between Piilani Hwy. & Liloa St.	0.6	0.0
Piikea Ave., Between Liloa St. & S. Kihei Rd.	0.0	0.0
Lipoa Pkwy., E. of Piilani Hwy.	0.0	7.7
E. Lipoa St., Between Piilani Hwy. & Liloa Dr.	0.5	1.4
E. Lipoa St., Between Liloa Dr. & S. Kihei Rd.	0.0	0.1
Welakahao Rd., W. of Piilani Hwy.	0.0	0.0
Welakahao Rd., E. of S. Kihei Rd.	0.0	0.0
E. Welakahao St., E. of Piilani Hwy.	0.1	-0.1

TABLE 9-1

CALCULATIONS OF PROJECT AND NON-PROJECT TRAFFIC NOISE CONTRIBUTIONS (CY 2034) (DNL WITH 2-LANE COLLECTOR)

STREET SECTION	NOISE LEVEL INCREASE DUE TO: NON-PROJECT TRAFFIC	PROJECT TRAFFIC
Piilani Hwy., N. of E. Waipulani Rd.	0.7	-0.5
Piilani Hwy., Between E. Waipulani Rd. & Piikea Ave.	0.8	-0.5
Piilani Hwy., Between Piikea Ave. & E. Lipoa St.	0.6	-0.4
Piilani Hwy., Between E. Lipoa St. & Welakahao Rd.	0.4	-0.8
Piilani Hwy., Between Welakahao Rd. & E. Welakahao St.	0.4	-0.7
Piilani Hwy., S. of E. Welakahao St.	0.3	-0.9
S. Kihei Rd., N. of Piikea Ave.	0.7	0.1
S. Kihei Rd., Between Piikea Ave. & E. Lipoa St.	0.7	0.1
S. Kihei Rd., S. of E. Lipoa St.	0.7	0.1
S. Kihei Rd., N. of Welakahao Rd.	0.8	0.1
S. Kihei Rd., S. of Welakahao Rd.	0.8	0.1
E. Waipulani Rd., W. of Piilani Hwy.	0.0	0.0
Piikea Ave., Between Piilani Hwy. & Liloa St.	1.0	0.1
Piikea Ave., Between Liloa St. & S. Kihei Rd.	0.0	0.0
Lipoa Pkwy., E. of Piilani Hwy.	0.0	5.5
E. Lipoa St., Between Piilani Hwy. & Liloa Dr.	0.8	1.0
E. Lipoa St., Between Liloa Dr. & S. Kihei Rd.	0.0	0.2
Welakahao Rd., W. of Piilani Hwy.	0.0	0.5
Welakahao Rd., E. of S. Kihei Rd.	0.0	0.0
E. Welakahao St., E. of Piilani Hwy.	0.1	4.9

TABLE 9-2

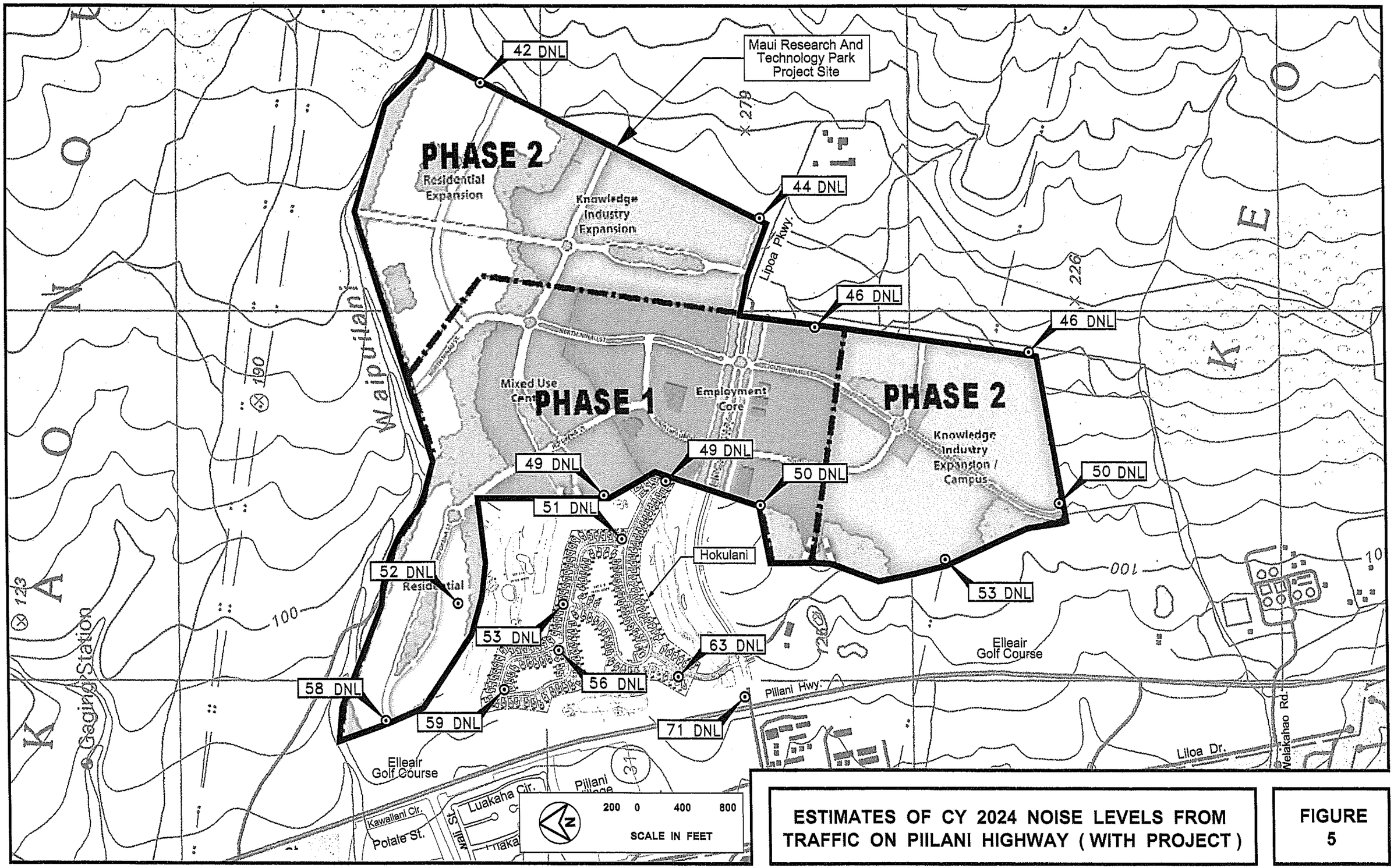
CALCULATIONS OF PROJECT AND NON-PROJECT TRAFFIC NOISE CONTRIBUTIONS (CY 2034) (DNL WITH 4-LANE COLLECTOR)

STREET SECTION	NOISE LEVEL INCREASE DUE TO: NON-PROJECT TRAFFIC	PROJECT TRAFFIC
Piilani Hwy., N. of E. Waipulani Rd.	0.7	-0.5
Piilani Hwy., Between E. Waipulani Rd. & Piikea Ave.	0.8	-0.5
Piilani Hwy., Between Piikea Ave. & E. Lipoa St.	0.6	-0.4
Piilani Hwy., Between E. Lipoa St. & Welakahao Rd.	0.4	-0.8
Piilani Hwy., Between Welakahao Rd. & E. Welakahao St.	0.4	-0.7
Piilani Hwy., S. of E. Welakahao St.	0.3	-0.9
S. Kihei Rd., N. of Piikea Ave.	0.7	0.1
S. Kihei Rd., Between Piikea Ave. & E. Lipoa St.	0.7	0.1
S. Kihei Rd., S. of E. Lipoa St.	0.7	0.1
S. Kihei Rd., N. of Welakahao Rd.	0.8	0.1
S. Kihei Rd., S. of Welakahao Rd.	0.8	0.1
E. Waipulani Rd., W. of Piilani Hwy.	0.0	0.0
Piikea Ave., Between Piilani Hwy. & Liloa St.	1.0	0.1
Piikea Ave., Between Liloa St. & S. Kihei Rd.	0.0	0.0
Lipoa Pkwy., E. of Piilani Hwy.	0.0	5.8
E. Lipoa St., Between Piilani Hwy. & Liloa Dr.	0.8	1.2
E. Lipoa St., Between Liloa Dr. & S. Kihei Rd.	0.0	0.4
Welakahao Rd., W. of Piilani Hwy.	0.0	0.5
Welakahao Rd., E. of S. Kihei Rd.	0.0	0.0
E. Welakahao St., E. of Piilani Hwy.	0.1	4.9

The dominant traffic noise sources in the project environs will continue to be traffic along Piilani Highway and South Kihei Road. Also, the addition of the proposed north-south collector road mauka of the project will increase the existing background ambient noise levels at the mauka end of the project site and along the proposed corridors of the collector road and connecting roadways. The predicted traffic noise levels at 50, 100, and 200 feet setback distances from the 2-lane and 4-lane collector roads are shown in Tables 6-2 and 6-3 under the Build Alternative. The predicted setback distances to the 65 and 75 DNL contours from the centerlines of the collector road for the 2-lane and 4-lane alternatives are shown in Table 7, but need to be refined following finalization of the cross sections of the collector road.

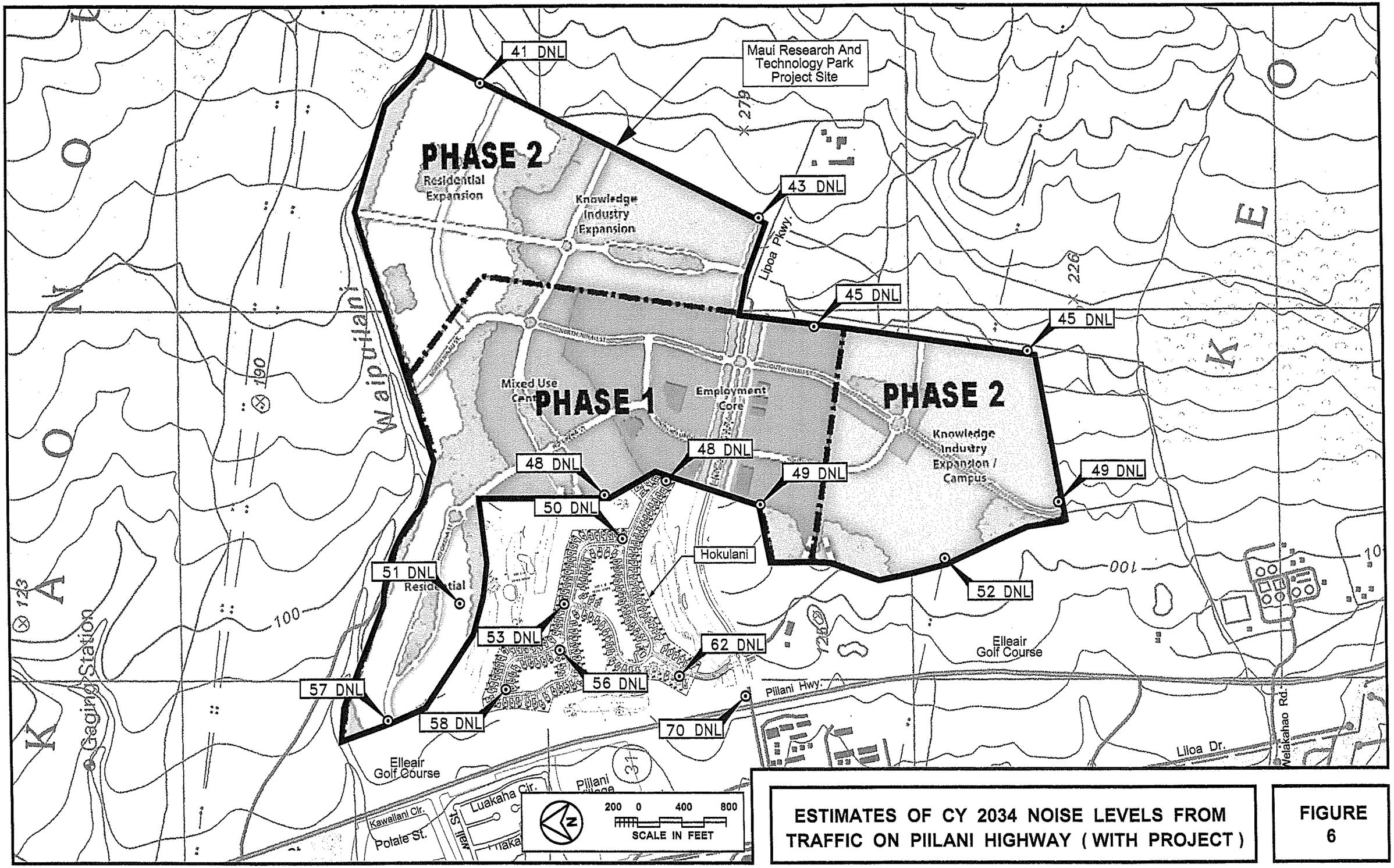
Figures 5 and 6 depict the predicted traffic noise contributions from Piilani Highway in CY 2024 and CY 2034 under the Build Alternative, but do not include the traffic noise contributions from the proposed north-south collector road. The traffic noise levels shown in Figures 5 and 6 will probably increase from the values shown, particularly at the locations near the mauka side of the project (which will be closer to the proposed north-south collector road).

From Figures 5 and 6, future noise levels on the project site from traffic on Piilani Highway are estimated to range from 49 to 58 DNL at the westernmost (makai) corners of the project site to 41 to 46 DNL at the easternmost (mauka) corners of the project site. Because predicted future traffic noise levels from Piilani Highway are very low at the mauka side of the project site, it is expected that traffic noise from the proposed collector road will be the dominant noise source on that side of the project site. Approximately 300 to 415 feet of buffer space between the collector road and the project site will be required to reduce the collector road noise component to approximately 55 DNL.



ESTIMATES OF CY 2024 NOISE LEVELS FROM TRAFFIC ON PIILANI HIGHWAY (WITH PROJECT)

FIGURE 5



ESTIMATES OF CY 2034 NOISE LEVELS FROM TRAFFIC ON PIILANI HIGHWAY (WITH PROJECT)

FIGURE 6

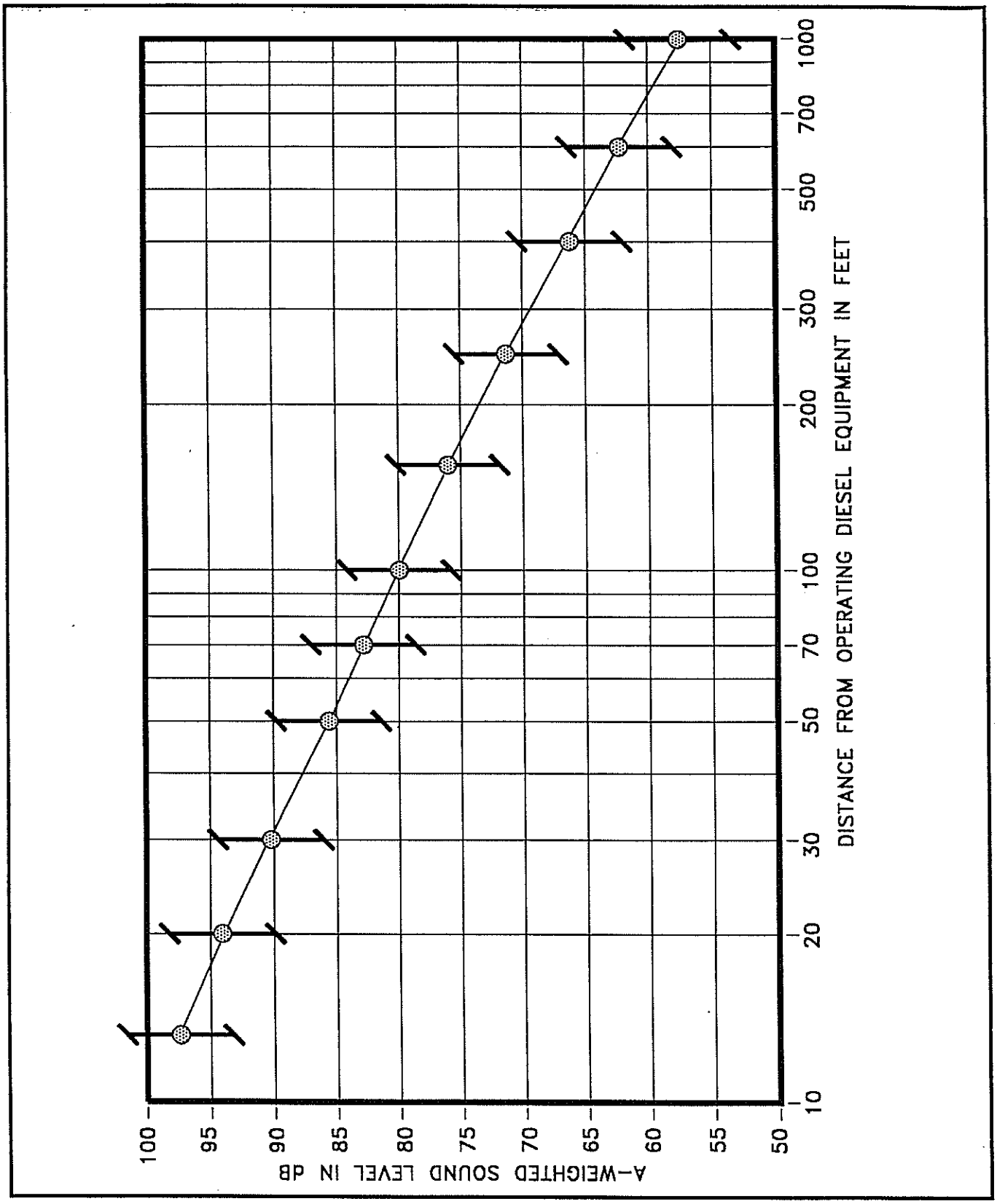
CHAPTER VII. DISCUSSION OF PROJECT-RELATED NOISE IMPACTS AND POSSIBLE MITIGATION MEASURES

Traffic Noise. Existing traffic noise levels along Piilani Highway and South Kihei Road are very high, and are expected to remain so through CY 2024 and 2034. Traffic noise impacts along those two roadways will continue to occur at noise sensitive receptors which are not provided with noise mitigation measures such as sound attenuating walls and/or closure and air conditioning.

Project related traffic along Piilani Highway and South Kihei Road are not expected to cause significant increases in future traffic noise levels. Increases in future traffic noise levels along Piilani Highway resulting from project traffic are expected to range from 0.3 to 1.0 DNL by CY 2024. By 2034, with the completion of the mauka collector road, these increases will be eliminated, and traffic noise levels along Piilani Highway is expected to return to CY 2011 levels. The largest increases (1.2 to 7.7 DNL) in project related traffic noise are predicted to occur along Lipoa Parkway, East Welakahao Street east of Piilani Highway, and along Lipoa Street west of Piilani Highway. Adverse traffic noise impacts along Lipoa Parkway and East Welakahao Street are not expected to occur since noise sensitive developments are not planned to be located along those two roadways. The noise sensitive buildings along Lipoa Street west of Piilani Highway have adequate setback distances from Lipoa Street, such that predicted CY 2024 and CY 2034 traffic noise levels should remain in the "Moderate Exposure, Normally Acceptable" category at these buildings. For these reasons, traffic noise mitigation measures should not be required.

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 7. The impulsive noise levels of impact pile drivers are approximately 15 dB higher than the levels shown in Figure 7, while the intermittent noise levels of vibratory pile drivers are at the upper end of the noise level ranges depicted in the figure.

Figure 7 is useful for predicting exterior noise levels at short distances (within 100 FT) from the work when visual line of sight exists between the construction equipment and the receptor. Direct line-of-sight distances from the construction equipment to existing residential buildings will range from 50 FT to 4,200 FT, with corresponding average noise levels of 86 to 46 dBA (plus or minus 5 dBA). 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 7.



ANTICIPATED RANGE OF CONSTRUCTION NOISE LEVELS VS. DISTANCE

FIGURE 7

The existing residences at the east end of the Hokulani development (at Location H7) are the closest existing residences to the potential construction activities within the project site. The highest noise levels from construction activities of 75 to 85 dBA are expected to occur during earthwork and site preparation activities near the mauka end of the Hokulani development. The noise from construction activities on the project site will be audible at long distances from the Hokulani residences due to the relatively low (40 to 55 dBA) background noise levels within the Hokulani development.

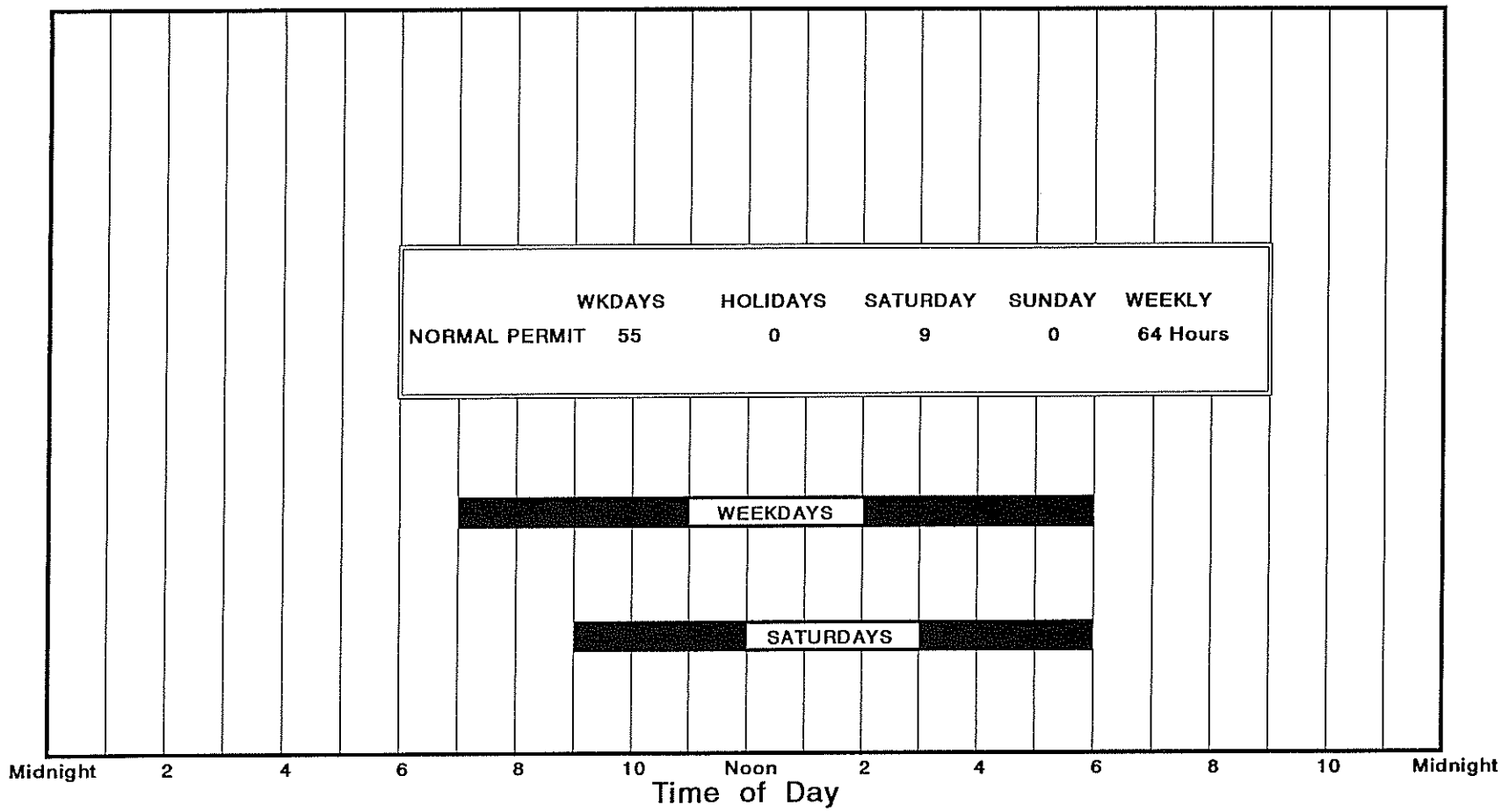
The existing residences across Piilani Highway west of the project site may also hear the construction activities within the project site. The highest noise levels from construction activities of 60 to 65 dBA are expected to occur at these residences during earthwork and site preparation activities at the northwest corner of the project site. The noise from construction activities will decrease and be masked by traffic noise along Piilani Highway at these residences along Piilani Highway as project construction activities move toward the east end of the project site. Adverse impacts from construction noise are not expected to be in the "public health and welfare" category due to the temporary nature of the work, and due to the administrative controls available for regulation of construction noise. Instead, these impacts will probably be limited to the temporary degradation of the quality of the acoustic environment in the immediate vicinity of the project site.

Mitigation of construction noise to inaudible levels will not be practical in all cases due to the intensity of construction noise sources (80 dBA at 100 FT distance), and due to the exterior nature of the work (rock breaking, grading and earth moving, trenching, concrete pouring, hammering, etc.). The use of properly muffled construction equipment should be required on the job site.

Peak airborne noise levels from pile diving may be as much as 15 dBA greater than noise levels shown in Figure 7 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.

Severe noise impacts are not expected to occur inside air conditioned structures which are beyond 200 FT from the project 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 construction site. Closure of all doors and windows facing the construction site would generally reduce interior noise levels by an additional 5 to 10 dBA.

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 8 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.



AVAILABLE WORK HOURS UNDER DOH PERMIT PROCEDURES FOR CONSTRUCTION NOISE

FIGURE 8

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; Maui Research and Technology Park;" Parsons Brinckerhoff, Inc.; February 2012.

(8) Hourly Traffic Counts At Station B74003100000, Piilani Highway - Mokulele Highway To Lipoa Street; Hawaii State Department of Transportation; April 21, 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., deci).

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).

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,

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 C1

SUMMARY OF BASE YEAR AND YEAR 2024 TRAFFIC VOLUMES

ROADWAY LANES	**** CY 2011 ***** AM VPH	PM VPH	CY 2024 (NO BUILD) AM VPH	PM VPH	CY 2024 (BUILD) AM VPH	PM VPH
Piilani Hwy., N. of E. Waipulani (NB)	1,306	1,627	1,442	1,676	1,828	2,131
Piilani Hwy., N. of E. Waipulani (SB)	1,767	1,606	1,990	1,661	2,405	1,830
Two-Way	3,073	3,233	3,432	3,337	4,233	3,961
Piilani Hwy., Between E. Waipulani & Piikea (NB)	1,322	1,670	1,481	1,729	1,722	1,997
Piilani Hwy., Between E. Waipulani & Piikea (SB)	1,713	1,504	1,938	1,564	2,353	1,733
Two-Way	3,035	3,174	3,419	3,293	4,074	3,730
Piilani Hwy., Between Piikea & E. Lipoa (NB)	1,184	1,579	1,330	1,593	1,495	1,788
Piilani Hwy., Between Piikea & E. Lipoa (SB)	1,539	1,414	1,773	1,386	2,188	1,555
Two-Way	2,723	2,993	3,103	2,979	3,683	3,343
Piilani Hwy., Between E. Lipoa & Welakahao (NB)	1,070	1,403	1,175	1,353	1,235	1,377
Piilani Hwy., Between E. Lipoa & Welakahao (SB)	1,166	1,192	1,378	1,055	1,511	1,212
Two-Way	2,236	2,595	2,553	2,407	2,746	2,588
Piilani Hwy., Between Welakahao & E. Welakahao (NB)	985	1,377	1,082	1,323	1,142	1,347
Piilani Hwy., Between Welakahao & E. Welakahao (SB)	1,116	1,029	1,319	895	1,452	1,052
Two-Way	2,101	2,406	2,401	2,217	2,594	2,398
Piilani Hwy., S. of E. Welakahao (NB)	965	1,353	1,063	1,308	1,123	1,332
Piilani Hwy., S. of E. Welakahao (SB)	1,089	1,024	1,294	895	1,427	1,052
Two-Way	2,054	2,377	2,357	2,203	2,550	2,384
S. Kihei Rd., N. of Piikea (NB)	467	675	523	719	534	731
S. Kihei Rd., N. of Piikea (SB)	503	576	550	610	567	617
Two-Way	970	1,251	1,073	1,329	1,101	1,348
S. Kihei Rd., Between Piikea & E. Lipoa (NB)	494	733	545	773	556	785
S. Kihei Rd., Between Piikea & E. Lipoa (SB)	449	720	500	763	517	770
Two-Way	942	1,453	1,045	1,536	1,073	1,555
S. Kihei Rd., S. of E. Lipoa (NB)	466	747	513	783	526	788
S. Kihei Rd., S. of E. Lipoa (SB)	416	847	471	908	475	914
Two-Way	882	1,594	984	1,691	1,001	1,702
S. Kihei Rd., N. of Welakahao (NB)	503	750	565	811	578	816
S. Kihei Rd., N. of Welakahao (SB)	412	768	485	835	490	841
Two-Way	915	1,518	1,050	1,646	1,068	1,657

APPENDIX C1 (CONTINUED)

SUMMARY OF BASE YEAR AND YEAR 2024
TRAFFIC VOLUMES

ROADWAY LANES	**** CY 2011 ***** AM VPH	PM VPH	CY 2024 (NO BUILD) AM VPH	PM VPH	CY 2024 (BUILD) AM VPH	PM VPH
S. Kihei Rd., S. of Welakahao (NB)	455	746	517	807	530	812
S. Kihei Rd., S. of Welakahao (SB)	432	816	505	883	510	889
Two-Way	887	1,562	1,022	1,690	1,040	1,701
Hookena St., E. of Piilani (EB)	N/A	N/A	N/A	N/A	40	16
Hookena St., E. of Piilani (WB)	N/A	N/A	N/A	N/A	110	130
Two-Way	N/A	N/A	N/A	N/A	150	146
E. Waipulani Rd., W. of Piilani (EB)	30	10	30	10	30	10
E. Waipulani Rd., W. of Piilani (WB)	76	130	76	130	76	130
Two-Way	106	140	106	140	106	140
Piikea Ave., Between Piilani & Liloa (EB)	364	464	418	538	418	538
Piikea Ave., Between Piilani & Liloa (WB)	397	524	452	596	452	596
Two-Way	760	988	870	1,134	870	1,134
Piikea Ave., Between Liloa & S. Kihei (EB)	183	288	183	288	183	288
Piikea Ave., Between Liloa & S. Kihei (WB)	224	413	224	413	224	413
Two-Way	406	701	406	701	407	701
Lipoa Pkwy., E. of Piilani (EB)	179	102	179	102	864	381
Lipoa Pkwy., E. of Piilani (WB)	21	121	21	121	436	610
Two-Way	200	223	200	223	1,300	991
E. Lipoa St., Between Piilani & Liloa (EB)	326	319	363	352	573	437
E. Lipoa St., Between Piilani & Liloa (WB)	439	359	488	398	605	536
Two-Way	765	678	851	750	1,178	973
E. Lipoa St., Between Liloa & S. Kihei (EB)	246	283	246	283	276	295
E. Lipoa St., Between Liloa & S. Kihei (WB)	277	321	277	321	293	340
Two-Way	523	604	523	604	569	634
Welakahao Rd., W. of Piilani (EB)	174	189	174	189	174	189
Welakahao Rd., W. of Piilani (WB)	139	321	139	321	139	321
Two-Way	313	510	313	510	313	510
Welakahao Rd., E. of S. Kihei (EB)	96	122	96	122	96	122
Welakahao Rd., E. of S. Kihei (WB)	136	186	136	186	136	186
Two-Way	232	308	232	308	232	308
E. Welakahao St., E. of Piilani (EB)	37	8	37	8	37	8
E. Welakahao St., E. of Piilani (WB)	30	27	30	27	30	27
Two-Way	67	35	67	35	67	35

APPENDIX C2

SUMMARY OF BASE YEAR AND YEAR 2034 TRAFFIC VOLUMES (2-LANE MAUKA COLLECTOR)

ROADWAY LANES	**** CY 2011 ***** AM VPH	PM VPH	CY 2034 (NO BUILD) AM VPH	PM VPH	CY 2034 (BUILD) AM VPH	PM VPH
Piilani Hwy., N. of E. Waipulani (NB)	1,306	1,627	1,654	1,949	1,471	1,819
Piilani Hwy., N. of E. Waipulani (SB)	1,767	1,606	2,276	1,865	1,900	1,496
Two-Way	3,073	3,233	3,930	3,814	3,371	3,315
Piilani Hwy., Between E. Waipulani & Piikea (NB)	1,322	1,670	1,696	1,990	1,470	1,773
Piilani Hwy., Between E. Waipulani & Piikea (SB)	1,713	1,504	2,225	1,773	1,910	1,464
Two-Way	3,035	3,174	3,921	3,763	3,380	3,237
Piilani Hwy., Between Piikea & E. Lipoa (NB)	1,184	1,579	1,517	1,807	1,291	1,624
Piilani Hwy., Between Piikea & E. Lipoa (SB)	1,539	1,414	2,037	1,571	1,902	1,342
Two-Way	2,723	2,993	3,554	3,378	3,193	2,966
Piilani Hwy., Between E. Lipoa & Welakahao (NB)	1,070	1,403	1,327	1,521	1,075	1,246
Piilani Hwy., Between E. Lipoa & Welakahao (SB)	1,166	1,192	1,571	1,142	1,258	987
Two-Way	2,236	2,595	2,898	2,662	2,333	2,233
Piilani Hwy., Between Welakahao & E. Welakahao (NB)	985	1,377	1,227	1,487	975	1,287
Piilani Hwy., Between Welakahao & E. Welakahao (SB)	1,116	1,029	1,485	927	1,263	761
Two-Way	2,101	2,406	2,712	2,414	2,238	2,048
Piilani Hwy., S. of E. Welakahao (NB)	965	1,353	1,209	1,480	963	1,234
Piilani Hwy., S. of E. Welakahao (SB)	1,089	1,024	1,463	932	1,133	770
Two-Way	2,054	2,377	2,672	2,412	2,096	2,004
S. Kihei Rd., N. of Piikea (NB)	467	675	586	804	597	822
S. Kihei Rd., N. of Piikea (SB)	503	576	614	679	652	690
Two-Way	970	1,251	1,200	1,483	1,249	1,512
S. Kihei Rd., Between Piikea & E. Lipoa (NB)	494	733	605	857	616	875
S. Kihei Rd., Between Piikea & E. Lipoa (SB)	449	720	560	851	569	862
Two-Way	942	1,453	1,164	1,708	1,184	1,737
S. Kihei Rd., S. of E. Lipoa (NB)	466	747	569	866	576	874
S. Kihei Rd., S. of E. Lipoa (SB)	416	847	527	1,016	532	1,025
Two-Way	882	1,594	1,096	1,882	1,108	1,899
S. Kihei Rd., N. of Welakahao (NB)	503	750	633	916	640	924
S. Kihei Rd., N. of Welakahao (SB)	412	768	545	929	550	938
Two-Way	915	1,518	1,178	1,845	1,190	1,862
S. Kihei Rd., S. of Welakahao (NB)	455	746	585	912	592	920
S. Kihei Rd., S. of Welakahao (SB)	432	816	565	977	570	986
Two-Way	887	1,562	1,150	1,889	1,162	1,906

APPENDIX C2 (CONTINUED)

SUMMARY OF BASE YEAR AND YEAR 2034 TRAFFIC VOLUMES (2-LANE MAUKA COLLECTOR)

ROADWAY LANES	**** CY 2011 ***** AM VPH	PM VPH	CY 2034 (NO BUILD) AM VPH	PM VPH	CY 2034 (BUILD) AM VPH	PM VPH
Hookena St., E. of Piilani (EB)	N/A	N/A	N/A	N/A	16	33
Hookena St., E. of Piilani (WB)	N/A	N/A	N/A	N/A	59	120
Two-Way	N/A	N/A	N/A	N/A	75	153
E. Waipulani Rd., W. of Piilani (EB)	30	10	30	10	30	10
E. Waipulani Rd., W. of Piilani (WB)	76	130	76	130	76	130
Two-Way	106	140	106	140	106	140
Piikea Ave., Between Piilani & Liloa (EB)	364	464	465	601	554	601
Piikea Ave., Between Piilani & Liloa (WB)	397	524	499	657	499	674
Two-Way	760	988	964	1,258	1,053	1,275
Piikea Ave., Between Liloa & S. Kihei (EB)	183	288	183	288	212	288
Piikea Ave., Between Liloa & S. Kihei (WB)	224	413	224	413	224	413
Two-Way	406	701	406	701	435	701
E. Lipoa St., E. of Piilani (EB)	179	102	179	102	547	299
E. Lipoa St., E. of Piilani (WB)	21	121	21	121	222	443
Two-Way	200	223	200	223	769	742
E. Lipoa St., Between Piilani & Liloa (EB)	326	319	395	380	500	517
E. Lipoa St., Between Piilani & Liloa (WB)	439	359	529	431	655	584
Two-Way	765	678	924	810	1,154	1,101
E. Lipoa St., Between Liloa & S. Kihei (EB)	246	283	246	283	262	300
E. Lipoa St., Between Liloa & S. Kihei (WB)	277	321	277	321	293	348
Two-Way	523	604	523	604	555	648
Welakahao Rd., W. of Piilani (EB)	174	189	174	189	263	189
Welakahao Rd., W. of Piilani (WB)	139	321	139	321	139	387
Two-Way	313	510	313	510	402	576
Welakahao Rd., E. of S. Kihei (EB)	96	122	96	122	96	122
Welakahao Rd., E. of S. Kihei (WB)	136	186	136	186	136	186
Two-Way	232	308	232	308	232	308
E. Welakahao St., E. of Piilani (EB)	37	8	37	8	165	20
E. Welakahao St., E. of Piilani (WB)	30	27	30	27	48	98
Two-Way	67	35	67	35	213	118
2-Lane Mauka Collector N. of Project (NB)	N/A	N/A	N/A	N/A	485	617
2-Lane Mauka Collector N. of Project (SB)	N/A	N/A	N/A	N/A	746	436
Two-Way	N/A	N/A	N/A	N/A	1,231	1,053
2-Lane Mauka Collector S. of Project (NB)	N/A	N/A	N/A	N/A	382	395
2-Lane Mauka Collector S. of Project (SB)	N/A	N/A	N/A	N/A	472	392
Two-Way	N/A	N/A	N/A	N/A	854	787

APPENDIX C3

SUMMARY OF BASE YEAR AND YEAR 2034 TRAFFIC VOLUMES (4-LANE MAUKA COLLECTOR)

ROADWAY LANES	**** CY 2011 ***** AM VPH	PM VPH	CY 2034 (NO BUILD) AM VPH	PM VPH	CY 2034 (BUILD) AM VPH	PM VPH
Piilani Hwy., N. of E. Waipulani (NB)	1,306	1,627	1,654	1,949	1,471	1,819
Piilani Hwy., N. of E. Waipulani (SB)	1,767	1,606	2,276	1,865	1,900	1,496
Two-Way	3,073	3,233	3,930	3,814	3,371	3,315
Piilani Hwy., Between E. Waipulani & Piikea (NB)	1,322	1,670	1,696	1,990	1,470	1,773
Piilani Hwy., Between E. Waipulani & Piikea (SB)	1,713	1,504	2,225	1,773	1,910	1,464
Two-Way	3,035	3,174	3,921	3,763	3,380	3,237
Piilani Hwy., Between Piikea & E. Lipoa (NB)	1,184	1,579	1,517	1,807	1,291	1,624
Piilani Hwy., Between Piikea & E. Lipoa (SB)	1,539	1,414	2,037	1,571	1,902	1,342
Two-Way	2,723	2,993	3,554	3,378	3,193	2,966
Piilani Hwy., Between E. Lipoa & Welakahao (NB)	1,070	1,403	1,327	1,521	1,075	1,246
Piilani Hwy., Between E. Lipoa & Welakahao (SB)	1,166	1,192	1,571	1,142	1,258	987
Two-Way	2,236	2,595	2,898	2,662	2,333	2,233
Piilani Hwy., Between Welakahao & E. Welakahao (NB)	985	1,377	1,227	1,487	975	1,290
Piilani Hwy., Between Welakahao & E. Welakahao (SB)	1,116	1,029	1,485	927	1,263	761
Two-Way	2,101	2,406	2,712	2,414	2,238	2,050
Piilani Hwy., S. of E. Welakahao (NB)	965	1,353	1,209	1,480	963	1,234
Piilani Hwy., S. of E. Welakahao (SB)	1,089	1,024	1,463	932	1,133	770
Two-Way	2,054	2,377	2,672	2,412	2,096	2,004
S. Kihei Rd., N. of Piikea (NB)	467	675	586	804	597	824
S. Kihei Rd., N. of Piikea (SB)	503	576	614	679	658	689
Two-Way	970	1,251	1,200	1,483	1,255	1,513
S. Kihei Rd., Between Piikea & E. Lipoa (NB)	494	733	605	857	616	878
S. Kihei Rd., Between Piikea & E. Lipoa (SB)	449	720	560	851	575	861
Two-Way	942	1,453	1,164	1,708	1,190	1,739
S. Kihei Rd., S. of E. Lipoa (NB)	466	747	569	866	580	874
S. Kihei Rd., S. of E. Lipoa (SB)	416	847	527	1,016	532	1,027
Two-Way	882	1,594	1,096	1,882	1,112	1,901
S. Kihei Rd., N. of Welakahao (NB)	503	750	633	916	644	924
S. Kihei Rd., N. of Welakahao (SB)	412	768	545	929	550	940
Two-Way	915	1,518	1,178	1,845	1,194	1,864
S. Kihei Rd., S. of Welakahao (NB)	455	746	585	912	596	920
S. Kihei Rd., S. of Welakahao (SB)	432	816	565	977	570	988
Two-Way	887	1,562	1,150	1,889	1,166	1,908

APPENDIX C3 (CONTINUED)

SUMMARY OF BASE YEAR AND YEAR 2034 TRAFFIC VOLUMES (4-LANE MAUKA COLLECTOR)

ROADWAY LANES	**** CY 2011 ***** AM VPH	PM VPH	CY 2034 (NO BUILD) AM VPH	PM VPH	CY 2034 (BUILD) AM VPH	PM VPH
Hookena St., E. of Piilani (EB)	N/A	N/A	N/A	N/A	16	33
Hookena St., E. of Piilani (WB)	N/A	N/A	N/A	N/A	59	120
Two-Way	N/A	N/A	N/A	N/A	75	153
E. Waipulani Rd., W. of Piilani (EB)	30	10	30	10	30	10
E. Waipulani Rd., W. of Piilani (WB)	76	130	76	130	76	130
Two-Way	106	140	106	140	106	140
Piikea Ave., Between Piilani & Liloa (EB)	364	464	465	601	554	601
Piikea Ave., Between Piilani & Liloa (WB)	397	524	499	657	499	674
Two-Way	760	988	964	1,258	1,053	1,275
Piikea Ave., Between Liloa & S. Kihei (EB)	183	288	183	288	212	288
Piikea Ave., Between Liloa & S. Kihei (WB)	224	413	224	413	224	413
Two-Way	406	701	406	701	435	701
E. Lipoa St., E. of Piilani (EB)	179	102	179	102	620	294
E. Lipoa St., E. of Piilani (WB)	21	121	21	121	219	490
Two-Way	200	223	200	223	839	784
E. Lipoa St., Between Piilani & Liloa (EB)	326	319	395	380	573	512
E. Lipoa St., Between Piilani & Liloa (WB)	439	359	529	431	652	631
Two-Way	765	678	924	810	1,225	1,143
E. Lipoa St., Between Liloa & S. Kihei (EB)	246	283	246	283	272	301
E. Lipoa St., Between Liloa & S. Kihei (WB)	277	321	277	321	293	354
Two-Way	523	604	523	604	565	655
Welakahao Rd., W. of Piilani (EB)	174	189	174	189	263	189
Welakahao Rd., W. of Piilani (WB)	139	321	139	321	139	392
Two-Way	313	510	313	510	402	581
Welakahao Rd., E. of S. Kihei (EB)	96	122	96	122	96	122
Welakahao Rd., E. of S. Kihei (WB)	136	186	136	186	136	186
Two-Way	232	308	232	308	232	308
E. Welakahao St., E. of Piilani (EB)	37	8	37	8	165	20
E. Welakahao St., E. of Piilani (WB)	30	27	30	27	48	98
Two-Way	67	35	67	35	213	118
2-Lane Mauka Collector N. of Project (NB)	N/A	N/A	N/A	N/A	479	731
2-Lane Mauka Collector N. of Project (SB)	N/A	N/A	N/A	N/A	889	427
Two-Way	N/A	N/A	N/A	N/A	1,368	1,158
2-Lane Mauka Collector S. of Project (NB)	N/A	N/A	N/A	N/A	417	393
2-Lane Mauka Collector S. of Project (SB)	N/A	N/A	N/A	N/A	469	446
Two-Way	N/A	N/A	N/A	N/A	886	839

APPENDIX L-1
Letter from Acoustic Study Consultant

Y. Ebisu & Associates
Acoustical and Electronic Engineers

1126 12th Ave., Room 305
Honolulu, Hawaii 96816
Ph. (808) 735-1634 – Fax (808) 732-0409
e-mail: ebisuyassoc@aol.com

February 22, 2013

Pacific Rim Land, Inc.
P.o. Box 220
1300 North Holopono, Suite 201
Kihei, Hawaii 96753

Attention: Mr. Steve Perkins
Project Coordinator

Subject: Changes to April 2012 Noise Study for Maui Research and Technology Park, Kihei, Maui, Hawaii

Dear Mr. Perkins:

I used the Revised February 2013 Traffic Impact Analysis Report (TIAR) for the Maui Research and Technology Park (MRTP) to develop my revisions to the conclusions of my April 2012 Acoustic Study for the Maui Research and Technology Park. The following conclusions regarding future traffic noise levels in the MRTP environs were based on an examination of the changes in traffic volumes from the February 2012 to the Revised February 2013 TIAR, and the use of logarithmic (or decibel, dB) scaling factors to revise the traffic noise level results contained in my original April 2012 traffic noise study.

The following general conclusions were possible as a result of my examination of the Revised February 2013 TIAR:

1. No changes regarding existing traffic noise levels occurred.

2. Existing traffic noise levels along Piilani Highway from East Waipulani Road to Kaonoulu Street were similar to those previously reported for areas north of East Waipulani Road.

3. Existing traffic noise levels along Kaonoulu and Kulanihakoi Streets west of Piilani Highway are 50 DNL (Day-Night Sound Level) or less at 100 feet setback distance from their centerlines.

4. By 2024, increases in non-project traffic noise levels are anticipated to be between zero and 1.1 DNL greater than those originally reported in my noise study. By 2024, project related traffic noise increases along Piilani Highway are expected to be slightly lower (between zero and 0.5 DNL) than those originally reported in my noise study.

5. By 2034, increases in non-project traffic noise levels are anticipated to be between 0.8 and 1.2 DNL greater than those originally reported in my noise study. By 2024, project related traffic noise increases along Piilani Highway are also expected to be greater (between 0.9 and 1.5 DNL) than those originally reported in my noise study.

6. By 2024, no significant changes in traffic noise levels along Lipoa Parkway or along East Welakahao Street east of Piilani Highway should occur from my prior noise study.

7. By 2034, increases in traffic noise levels along Lipoa Parkway without and with the MRTP and regional roadway improvements were 4.7 and 2.0 DNL (respectively) greater than in my prior noise study.

I have also attached my revisions to Chapter I. Summary of my April 2012 noise study report, which incorporate this current review of the Revised 2013 TIAR. The italicized text in parentheses were deletions from my April 2012 noise study report.

Let me know if you have any questions regarding these findings. If you require copies of my revised report tables, let me know.

Sincerely,

Yoichi Ebisu, P.E.

encl.

CHAPTER I. SUMMARY

The existing and future traffic noise levels in the vicinity of the planned Maui Research and Technology Park (MRTP) in Kihei, Maui were evaluated for their potential impacts and their relationship to current FHA/HUD noise standards for noise sensitive land uses. The traffic noise level increases along the roadways servicing the project site (see Figure 1) were calculated. Significant increases in traffic noise levels at noise sensitive properties are not expected to occur as a result of project traffic following project build-out by CY 2024 and 2034.

Along Piilani Highway fronting the project site, traffic noise levels of approximately 70 DNL are expected to increase to approximately 71 to 73 *(71)* DNL at 100 foot distance from the centerline by CY 2024 as a result of project and non-project traffic. By CY 2034, traffic noise levels along Piilani Highway are expected to increase by 1 to 3 DNL units along Piilani Highway with or without the MRTP and regional roadway improvements. *(be reduced to existing noise levels following completion of the proposed north-south collector road on the mauka side of the project site).*

The largest increases (1.5 to 10.4 DNL) *(1.4 to 7.7 DNL)* in project related traffic noise are predicted to occur along Lipoa Parkway, East Welakahao Street east of Piilani Highway, along Lipoa Street west of Piilani Highway, and along South Kihei Road south of East Lipoa Street. Adverse traffic noise impacts along Lipoa Parkway and East Welakahao Street are not expected to occur since noise sensitive developments are not planned to be located along those two roadways. The noise sensitive buildings along Lipoa Street west of Piilani Highway have adequate setback distances from Lipoa Street, such that predicted CY 2024 and CY 2034 traffic noise levels should remain in the "Moderate Exposure, Normally Acceptable" category at these buildings. For these reasons, traffic noise mitigation measures should not be required.

The project site is planned such that noise sensitive residential uses of the project are situated at very large setback distances from Piilani Highway, where existing and future traffic noise levels are predicted to be less than 61 *(60)* DNL. The large buffer distances to the highway will allow for the use of naturally ventilated buildings on the project site.

The dominant traffic noise sources in the project environs will continue to be traffic along Piilani Highway and South Kihei Road. In addition, the addition of the proposed north-south collector road mauka of the project will increase the existing background ambient noise levels at the mauka end of the project site and along the proposed corridors of the collector road and connecting roadways.

Unavoidable, but temporary, noise impacts may occur during construction of the proposed project, particularly during the excavation and earth moving activities on the project site. Because construction activities are predicted to 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.