4.5 NOISE

4.5.1 Impact Methodology

Noise impacts associated with project alternatives have been evaluated using available noise data for various weapons types, available monitoring data for actual live-fire training exercises, and modeling analyses for various types of noise sources. Major noise sources associated with the Proposed Action include ordnance firing and detonation, demolitions training, and helicopters supporting training exercises. This section is a discussion of noise impacts from aircraft, ordnance, and military vehicle use. The analysis in this section addresses both average noise levels and peak noise levels expected from individual sources. Sections 4.1 and 4.9 provide discussions of noise impacts related to recreation and biological resources.

US Army CHPPM has recently estimated annual average CDNL contours for heavy (or large caliber) weapons firing at MMR, using the computer model, BNOISE2. Analyses were based on the data provided in Table 2-5 and produced CDNL contours based on a representative level of training under each of the alternatives. The use of shape and cratering charges was included in the analysis. The type of cratering charge analyzed, 40 pounds (18 kilograms) of B4, which contains various mixtures of RDX and TNT, may differ from the type of cratering charge actually used. The Army may detonate cratering charges containing up to 150 pounds (68 kilograms) of ammonium nitrate. The maximum charge that the Army would detonate in a single explosion during training exercises is 300 pounds (136 kilograms) of ammonium nitrate. This variability in the type of cratering charge used does not affect the results of the CDNL contours, but it does determine the loudness of individual noises. The use of ammonium nitrate at the levels indicated would produce a louder noise level than the use of B4 at the amount analyzed.

Flyover measurements from studies conducted by the Air Force, Army, FAA, and Navy were used for noise modeling of helicopter operations.

4.5.2 Factors Considered for Determining Significance of Impacts

Results from noise monitoring, noise source modeling, and studies have been compared to various standards and guidelines in order to evaluate the significance of predicted noise levels. The noise criteria considered include State of Hawai‘i community noise standards (Hawai‘i Administrative Rules, Title 11, Chapter 46), Army land use compatibility guidelines (US Army 1997a; US Departments of the Air Force, the Army, and the Navy 1978), and Army CHPPM guidelines for evaluating the significance of short-term blast noises (US Army CHPPM 2001). The noise evaluations have considered both long-term average noise level

conditions and short-term noise levels associated with discrete noises. Other relevant noise exposure conditions (such as time of day, background noise levels, the repetition pattern of brief noises, and the duration of individual noises) have also been considered in evaluating noise impacts. Specific considerations used in evaluating the significance of noise impacts include the following:

- Whether or not land use compatibility problems would be created in terms of DoD guidelines, as outlined in DA PAM 200-1 (see Section 3.5); and
- Whether impulse or other short-term noise levels would be likely to cause significant annoyance to exposed individuals at locations accessible to the general public.

4.5.3 Summary of Impacts

Noise contour maps prepared for the alternatives demonstrate that Alternatives 1, 2, and 3 would result in Zone III noise contours (greater than 70 dBC) extending over Mākua Beach and the coastal waters. The Zone III contour would extend about 1 mile (1.6 kilometers) over the water for Alternative 2 and 1.25 miles (2 kilometers) for Alternatives 3. Based on the guidelines set forth for land use planning purposes in DA PAM 200-1, the projected noise levels from training under the three live-fire alternatives would not be compatible with recreational use of the beach. The noise generated from squad, section, platoon, and company-level troop training is mostly contained within the ridges that form the MMR boundaries.

The summary of potential noise impacts is based primarily on peak noise levels from different types of noise sources. Note that peak noise events from different types of noise sources would not occur simultaneously. Aircraft flights would not occur over MMR while artillery or mortars are being fired or while demolition charges are being detonated. Also, vehicle traffic to and from MMR occurs primarily before and after a live-fire training.

As described in Section 3.5.3, Hawai‘i’s community noise standards are not applicable to the Proposed Action because training activity noise is generated by mobile and not stationary sources. Impulse blast noise may occasionally range from 80 to 130 dBP on the beach, generating a startling short-term impact for humans and wildlife.

Summary of Potential Noise Impacts

Impact Issues	No Action Alternative	Alternative 1 MMR (Reduced Capacity Use with Some Weapons Restrictions)	Alternative 2 MMR (Full Capacity Use with Some Weapons Restrictions)	Alternative 3 MMR (Full Capacity Use with Fewer Weapons Restrictions)	Alternative 4 PTA (Full Capacity Use with Fewer Weapons Restrictions)
Noise from rotary-wing aircraft	⊙	⊙	⊙	⊙	⊙
Noise from fixed-wing aircraft	⊙	⊙	⊙	⊙	⊙
Noise from military vehicle use	⊙	⊙	⊙	⊙	⊙
Noise from ordnance use	○	⊗	⊗	⊗	⊙
Noise from demolitions training	○	⊙	⊙	⊙	⊙
Noise from construction activities	○	○	○	○	⊙

LEGEND:

⊗ = Significant impact

⊘ = Significant impact mitigable to less than significant

⊙ = Less than significant impact

○ = No impact

\+ = Beneficial impact

Appendix G-4 contains noise tables, with data from recently conducted CALFEXs, showing that there have been peak periods when impulse noise reached 100 dBP at the beach. However, these impulse noise levels do not account for the use of new training munitions, including shape and cratering charges used in demolitions training.

The peak impulse blast noise level at the beach resulting from cratering and shape charges would measure between 113 and 130 dBP. A 150-pound (68-kilogram) charge of ammonium nitrate buried 3.3 feet (one meter) in the ground at the MMR ordnance impact area would result in a noise level of 120 dBP at Mākua Beach (one mile [1.6 kilometers] from the impact site). A 40-pound (18-kilogram) shape charge exploding on the surface at the MMR ordnance impact area would result in a noise level at the beach (one mile [1.6 kilometers] from the ordnance impact site) of approximately 128 dBP. These data are summarized in Table 4.5-1.

Table 4.5-1
Estimated Noise Levels (dBP) for Shape and Cratering Charges

Distance	15-pound (6.8-kilogram) Shape Charge	40-pound (18-kilogram) Shape Charge	150-pound (68-kilogram) Cratering Charge	300-pound (136-kilogram) Maximum Charge
	Surface detonation	Surface detonation	Buried 3.3 feet (1 meter)	Buried 6.6 feet (2 meters)
1 mile (1,600 meters)	127	128*	120	125
2 miles (3,200 meters)	120	124**	113	118

*Distance of 1.2 miles (2,000 meters)
**Distance of 1.9 miles (3,000 meters)

The noise from munitions is momentary, while noise from helicopters and other mobile sources is more continuous due to the nature of their respective sound wave properties. With mobile sources, increasing noise from the approaching source provides a warning that allows one to prepare for the increase in noise. With munitions, there is no warning, as the noise is instantaneous. Loud blast noise startles people and causes more annoyance than mobile sources due to the fact that one cannot anticipate the impulse noise. Continuous exposure to long periods of blast noise with peak level exposures of 128 dB would approach the threshold of pain for many people. However, most of the high-level impulse noise from cratering charges and mines would occur during the early morning hours and late evening hours when the beach is less likely to be occupied.

The intermittent periods of approximately 113 dB to 130 dB impulse blast noise would be infrequent. Demolitions training is estimated to take place about 50 to 60 times per year. It may be conducted once a day during a CALFEX week or independent of a CALFEX. Public notification using available media before training exercises generating high noise levels would minimize this short-term adverse annoyance impact on beach goers. Additionally, if the training activity involving shape and cratering charges were to be conducted in the early morning or late evening, the beach population would be lower, resulting in fewer annoyance complaints from the beach goers.

Helicopters would fly directly over the beach during training. If training were to occur five days a week, this would result in 60 overflights per week. Beach goers would hear the helicopter noise for approximately one minute during each flyover, resulting in 60 minutes of overflight per

training week. This would average 12 overflights each training day of a training week. Each overflight would expose beach goers to an SEL noise level of 88 dB.

The helicopter hovering time would be approximately three to four half-hour periods during the estimated five to six hours for each training week. These short hovering periods would result in peak and average noise levels at Mākua Beach of approximately 65.3 dBA while the helicopter is hovering. This contribution to the change in ADNL would be less than one percent. During nighttime exercises (those exercises conducted from 10:01 PM to 6:59 AM), direct flyovers would result in less than one minute of an SEL of 99.9 dB at the beach; the representative ADNL would be approximately 56.3 dBA. The noise from this helicopter activity would not generate noise complaints greater than expected. Most of the exercises are estimated to occur on weekdays in the early morning when fewer beach goers would be present.

Table 4.5-2 indicates the calculated noise levels resulting from CALFEX helicopter operations for each alternative. The number of annoyance complaints is not expected to increase above what is expected historically since the noise exposure to beach goers would be infrequent (six hours per week) rather than periodic (25 hours per week) or continual. During the estimated six hours of weekly operations, the maximum flyover noise level of 88 dBA would be for 20 to 25 minutes.

Table 4.5-2
Summary of Helicopter Noise Levels (dBA) at Mākua Beach for Each Alternative

Alternative	Number of CALFEXs	Number of Helicopter Overflights per Week	SEL for Each 1-Minute Flyover Measured at Mākua Beach
No Action	0	10	88 dBA
Alternative 1	19 to 28	32	88 dBA
Alternatives 2 and 3	Up to 50	32	88 dBA

Hikers on the outside ridges surrounding MMR would experience infrequent impulse noise resulting from training. The infrequent periods of heavy artillery training and the small number of hikers would result in a less than significant impact on the hikers. Local area hikers could be forewarned of heavy artillery and military noise in the area by postings or notification at the check-in trail points. The noise hikers would experience would be impulse blast noise, and the receptors, in addition to humans, would be wildlife on and near MMR.

The Army studied the effects of military training noise on the red-cockaded woodpecker (USACE/ERDC 2001). Results indicated that the woodpeckers did not flush when large-caliber guns were fired at a distance greater than 1,000 feet (305 meters) or small caliber guns were fired at greater than 220 feet (67 meters) from their nests. The study concluded that helicopter overflights at 88 dBA did not cause the woodpeckers to flush, suggesting that the birds seem to have adjusted to the military training environment in which they live. The activities at MMR are similar to the activities in the study, so one could conclude that birds at MMR adjust similarly to the training activities. Additionally, the Army funded a study to determine the effects of artillery noise on the O‘ahu subspecies of the ‘elepaio (*Chasiempis sandwichensis*) (VanderWerf et al. 2000). The study conducted at SBMR investigated the effects of noise from the 155mm and 105mm howitzers, 81mm and 60mm mortars, and hand grenades. Results demonstrated that the ‘elepaio nesting behavior was not significantly affected and the population was not seriously disturbed by artillery training. Furthermore, nesting attendance and nestling provisioning rates during periods of firing at SBMR were similar to rates in Honouliuli, where there is no military training.

No Action Alternative

Less than Significant Impacts

Under No Action, there would be less than significant noise impacts from aircraft and vehicles. The impacts would be similar to those described for “noise from rotary-wing aircraft,” and “noise from military vehicle use,” under Alternative 1.

Alternative 1 (Reduced Capacity Use with Some Weapons Restrictions)

Significant Impacts

Impact 1: Noise from ordnance use. Alternative 1 would include squad, section, and platoon maneuver live-fire and sniper training, in addition to 19 to 28 CALFEXs per year. As shown in Figures 4.5-1 and 4.5-2, the noise generated by these activities would exceed the planning use guidelines established in DA PAM 200-1, resulting in a significant impact. No mitigation measures have been identified to reduce the magnitude of this impact.

Table 2-5 lists the expenditure of weapons planned for MMR. Based on the noise contours generated by the level of ordnance use under Alternative 1 for 19 and 28 CALFEXs, Mākua Beach and the coastal waters (out to approximately 0.5 mile [0.8 kilometer]) would be within Zone III. Zone III is considered incompatible with residential, school, and hospital noise sensitive receptors and with recreational use. While there are no schools, hospitals, or nursing homes within the Zone III contour for MMR, Mākua Beach, a recreational area, is within the zone.

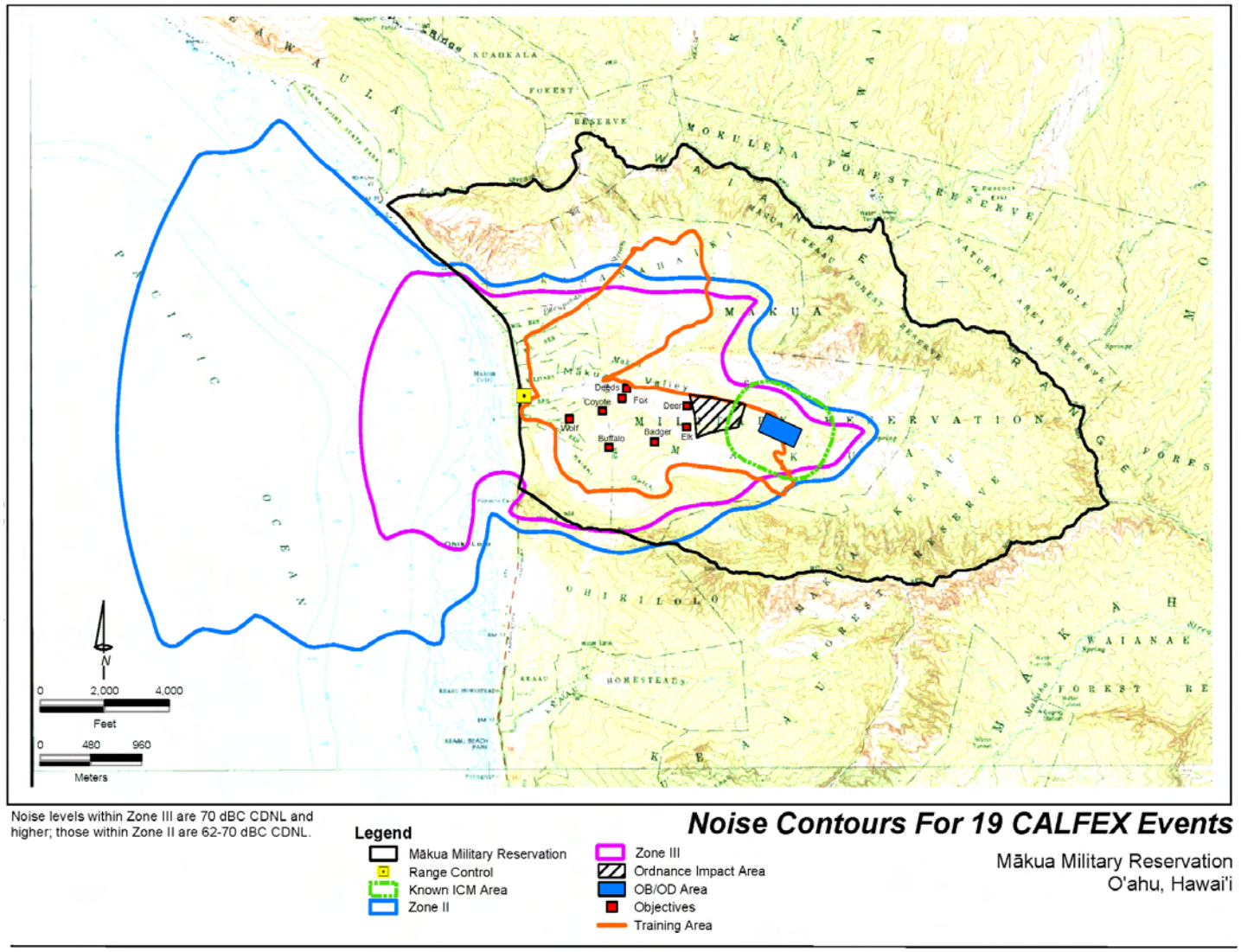
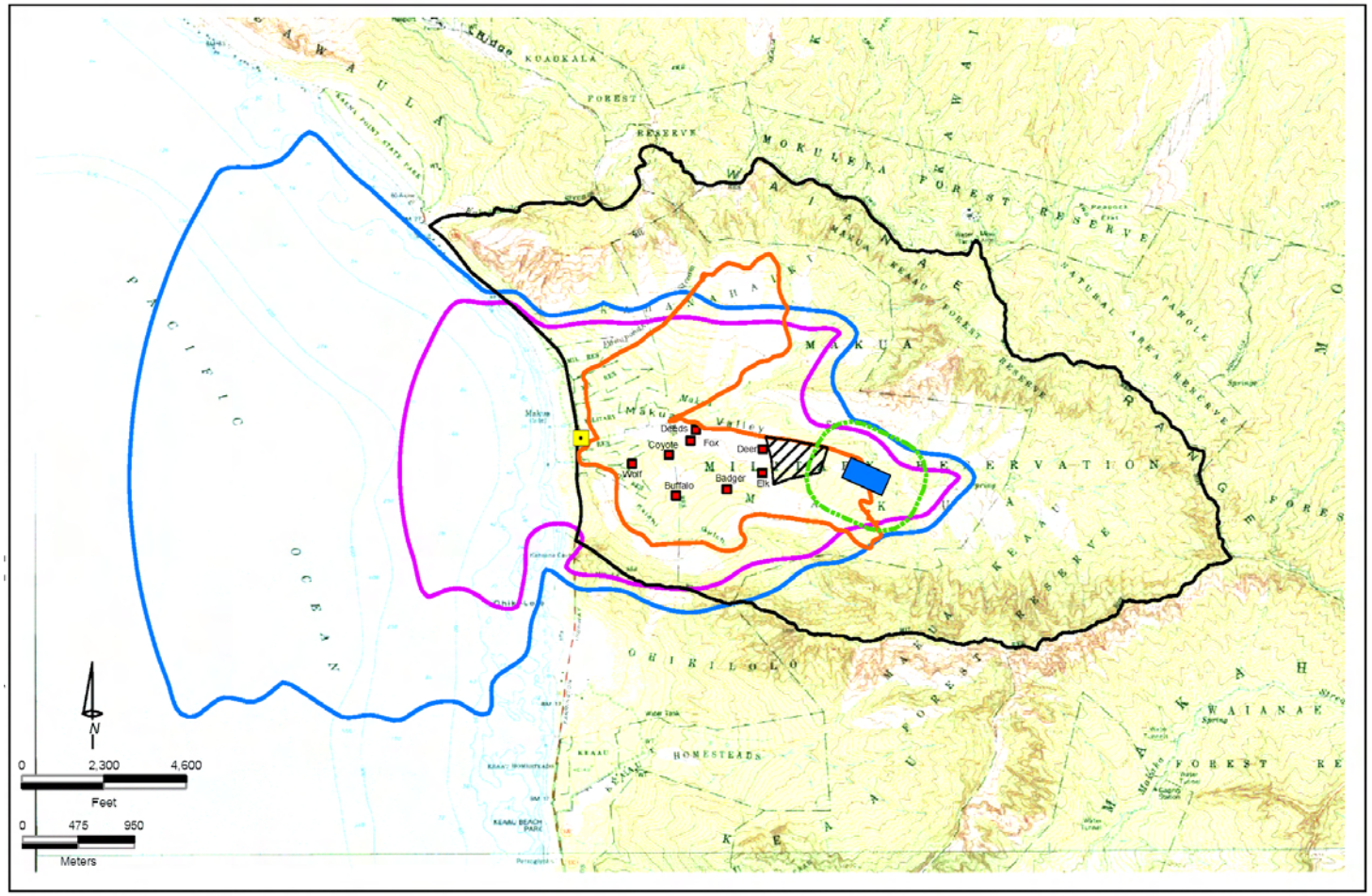


Figure 4.5-1 Noise Contours for 19 CALFEX Events



Noise levels within Zone III are 70 dBC CDNL and higher; those within Zone II are 62-70 dBC CDNL.

Noise Contours For 28 CALFEX Events

Mākua Military Reservation
O'ahu, Hawai'i

Legend

- Mākua Military Reservation
- Range Control
- Known ICM Area
- Zone II
- Zone III
- Ordnance Impact Area
- OB/OD Area
- Objectives
- Training Area

Figure 4.5-2 Noise Contours for 28 CALFEX Events

Less than Significant Impacts

Noise from rotary-wing aircraft. Under Alternative 1, use of helicopters would be limited to CALFEX training. Helicopters would transport equipment and troops to and from MMR and would be used in air assault exercises. Most helicopter landing areas at MMR are close to the administrative trailer area at the western edge of the reservation, so helicopters cross Mākua Beach and Farrington Highway at low altitudes when arriving at or departing from MMR. In addition, helicopters can hover at low altitudes for various periods of time along the western side of MMR. The command and control helicopter also hovers over the water approximately 0.25 to 0.5 mile (0.4 to 0.8 kilometer) offshore, and at times 1 mile (1.6 kilometers) at 1,000 feet (305 meters) above sea level during training.

Periods of infrequent helicopter flights across Mākua Beach would occur for five to six hours each week for each of the 19 or 28 CALFEX weeks. During each CALFEX week, helicopters would make a total of 32 beach overflights, with 18 occurring during the live-fire day. Of the 32 overflights, only 23 would occur during the day. The busiest day would result in 18 beach overflights, which would result in an ADNL of 62.5 dB.

Although the direct flyover of the helicopters would result in less than one minute of an SEL of 99.9 dB, the representative ADNL would be approximately 62.3 dB. Noise levels from helicopters and UAVs are shown in Figure 4.5-3. The helicopter hovering time would be approximately three to four half-hour periods during the estimated five to six hours for each training week. These short hovering periods would result in noise levels at Mākua Beach of approximately 65.3 dB. This contribution to the change in ADNL would be less than 1 percent. Annoyance complaints are expected, but this is considered less than significant because the maximum noise levels from helicopters would occur in early morning and nighttime and would be of a very short duration. Noise from rotary-wing aircraft under Alternative 1 would be less than significant.

Noise from fixed-wing aircraft. The Shadow 200 UAV would be used for reconnaissance and photo observation for approximately three to six hours each week during training. The Shadow, a 38-horsepower rotary type combustion engine operating on mobile vehicle gasoline, generates a noise level similar to a lawnmower and is much less audible than helicopters. The noise generated by a Shadow flyover at 1,000 feet (305 meters) above ground level would be approximately 50 to 55 dB, which is considered less than significant.

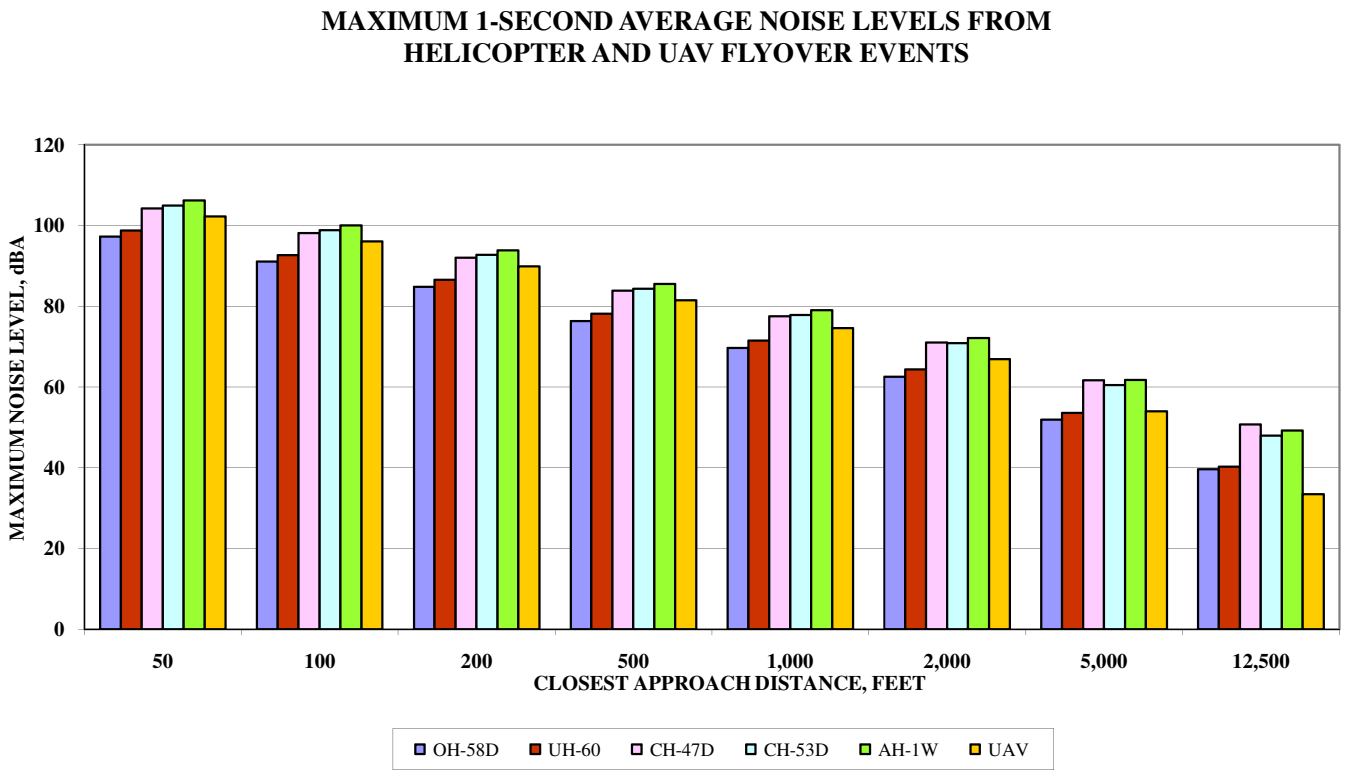


Figure 4.5-3 Maximum 1-Second Average Noise Levels from Helicopters and UAV Flyover Events

Noise from military vehicle use. Under this alternative, Strykers also would be used at MMR for firing at targets and would be restricted to existing roads and paved areas. The noise level of the Stryker vehicle is very similar to the HMWVV combat variant. The noise level of the Stryker in a stationary mode measured at 800 revolutions per minute (rpm) and 1,400 rpm was less than 85 dBA. The Stryker traveling at 25 miles (40 kilometers) per hour measured 81 dBA at 50 feet (15 meters). This is comparable to the HMMWV heavy variant at 25 miles (40 kilometers) per hour and 50 feet (15 meters) that measured 80 dBA.

There would be vehicle activity associated with MMR training activities under Alternative 1. This activity would be restricted to the MMR property, and the noise generated by the vehicles would be mostly contained within the MMR boundaries, with the exception of the beach area. The noise generated at the beach from a Stryker vehicle traveling 25 miles (40 kilometers) per hour at a distance of 1,600 feet (488 meters) is estimated to be 45 dB. Figure 4.5-4 is a summary of maximum pass-by noise levels as a function of speed for various categories of vehicles. Noise levels for the three categories of multi-axle heavy trucks are quite similar at most vehicle speeds.

Noise from demolitions training. Noise levels at the beach resulting from the use of shape and cratering charges are expected to be between 113 and 130 dB. Demolitions training would occur an estimated 50 to 60 times a year. This training could be conducted concurrently with a CALFEX or independently. One to two shape charges would be detonated during the daytime for each demolitions exercise. Demolitions training using cratering charges would occur at an average of twice a month; only one cratering charge would be detonated per training session. Given this small period of time during the entire week of beach availability, a significant increase is not expected in the historical percentage of people annoyed by the noise. Noise from this activity also has been considered in the analysis under Impact 1.

Alternative 2 (Full Capacity Use with Some Weapons Restrictions)

Significant Impacts

Impact 1: Noise from ordnance use. This impact would be similar to that described for Alternative 1. Figure 4.5-5 depicts results for the CDNL contours for 50 CALFEXs under Alternative 2. The Zone III contour extends over Mākua Beach and out over the water approximately one mile (1.6 kilometers). The Zone II contour extends approximately 1.5 miles (2.4 kilometers) offshore. The noise generated under this alternative would exceed the planning use guidelines established in DA PAM 200-1, resulting in significant noise impacts. No mitigation measures have been identified to reduce the magnitude of this impact.

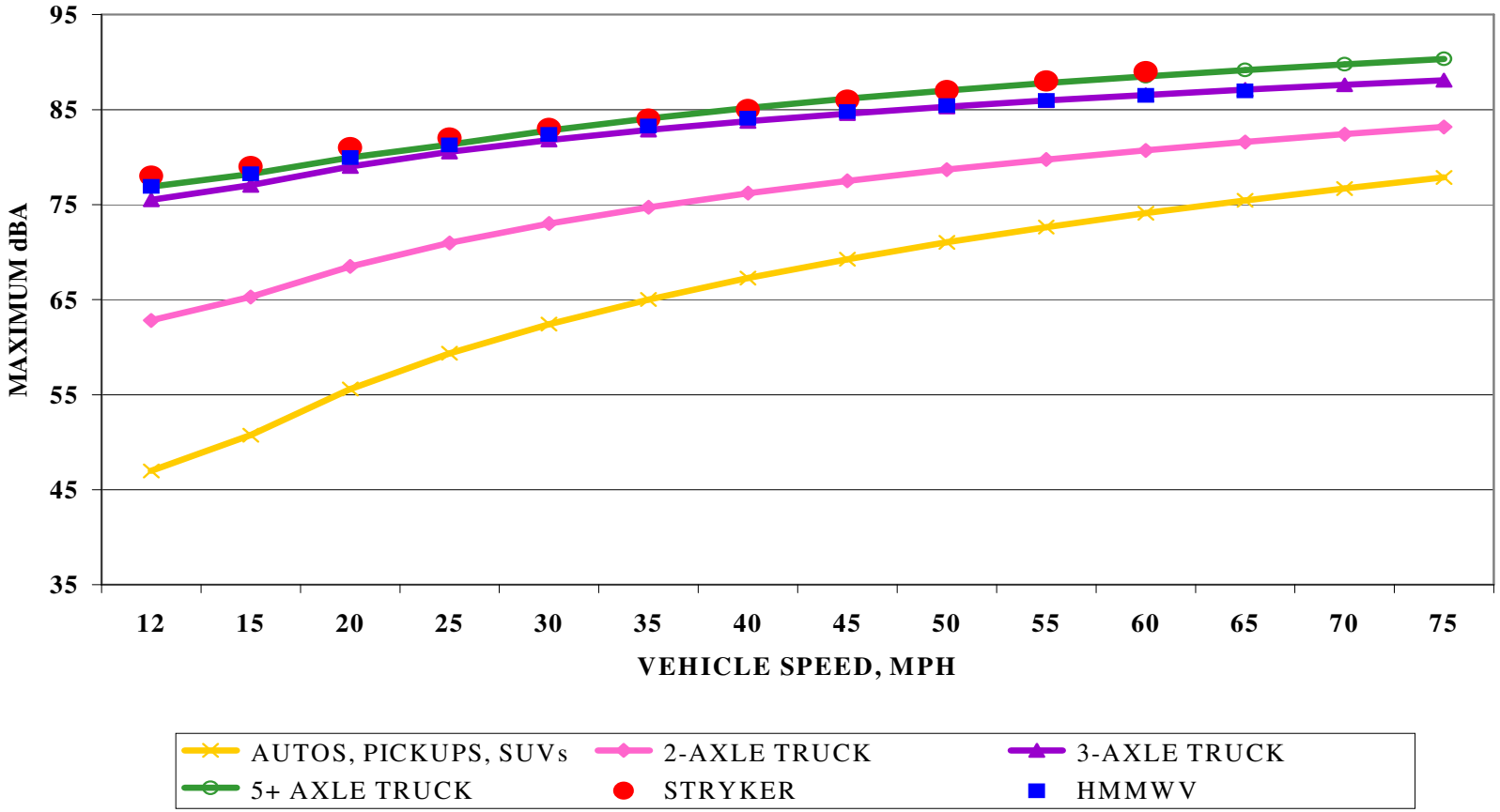


Figure 4.5-4 Peak Pass-By Noise Levels at 50 Feet for Different Vehicles Types

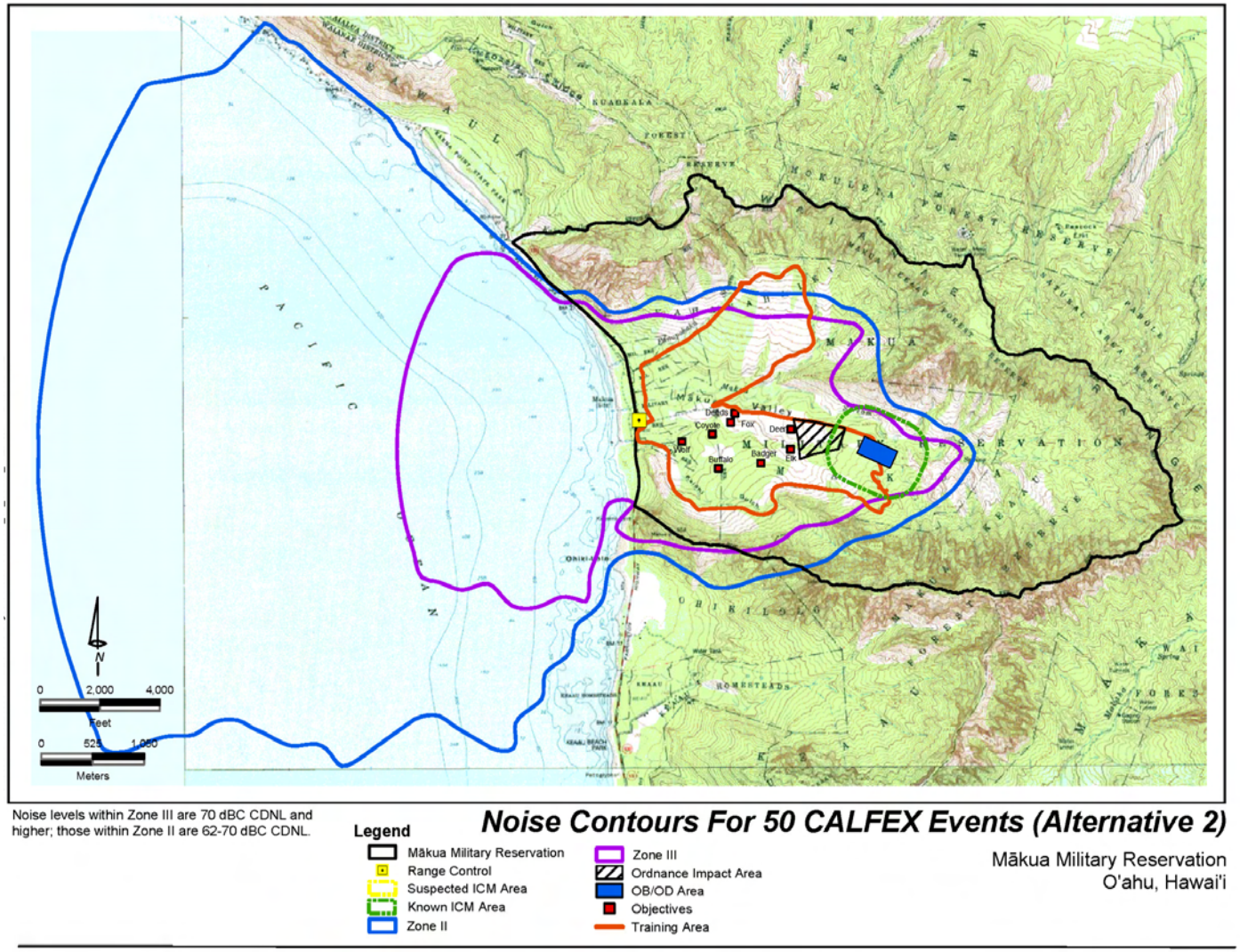


Figure 4.5-5 Noise Contours for 50 CALFEX Events (Alternative 2)

Less than Significant Impacts

Noise from rotary-wing aircraft. Impacts would be similar to those described under Alternative 1. Helicopter flights across Mākua Beach would be infrequent during periods of three to six hours each week for 50 weeks during the year when CALFEX training would be scheduled.

Although the direct flyover of the helicopters would result in less than one minute of an SEL of 99.9 dB, the representative ADNL would remain at 62.3 dB. The noise generated from helicopters would be the same as that under Alternative 1, except the occurrence would be 50 weeks of the year rather than 28 weeks. These short periods would result in noise at the beach area of approximately 62.3 dB ADNL. Noise from helicopters under Alternative 2 would be less than significant.

Noise from fixed-wing aircraft. Impacts would be similar to those described for Alternative 1.

Noise from military vehicle use. Military vehicle use associated with Alternative 2 would involve transporting troops for up to 50 CALFEXs, which is nearly double the vehicle use under Alternative 1. Resulting noise impacts from military vehicle use under Alternative 2 would be similar but somewhat higher than that described for Alternative 1.

Noise from demolitions training. Demolitions training would take place as described for Alternative 2. Due to the infrequent blast noise caused by this type of training, the impacts are not considered to be significant.

Alternative 3 (Full Capacity Use with Fewer Weapons Restrictions)

Significant Impacts

Impact 1: Noise from ordnance use. Noise impacts from Alternative 3 are expected to be similar to those under Alternative 2. Figure 4.5-6 depicts the CDNL contours for 50 CALFEXs, including illumination munitions for the 81mm HE mortar and 105mm HE mortar. With the addition of illumination munitions, the Zone II and Zone III contours increase by a negligible amount compared to Alternative 2. The number of illumination munitions, 2.75-caliber rockets, and inert TOW missiles used would be small and would not increase the project noise contour levels by more than one percent. Under Alternative 3, the noise impact on beach goers would be significant. No mitigation measures have been identified to reduce the magnitude of this impact.

Less than Significant Impacts

Noise from rotary-wing aircraft. Helicopter impacts under Alternative 3 are expected to be the same as those described under Alternative 2.

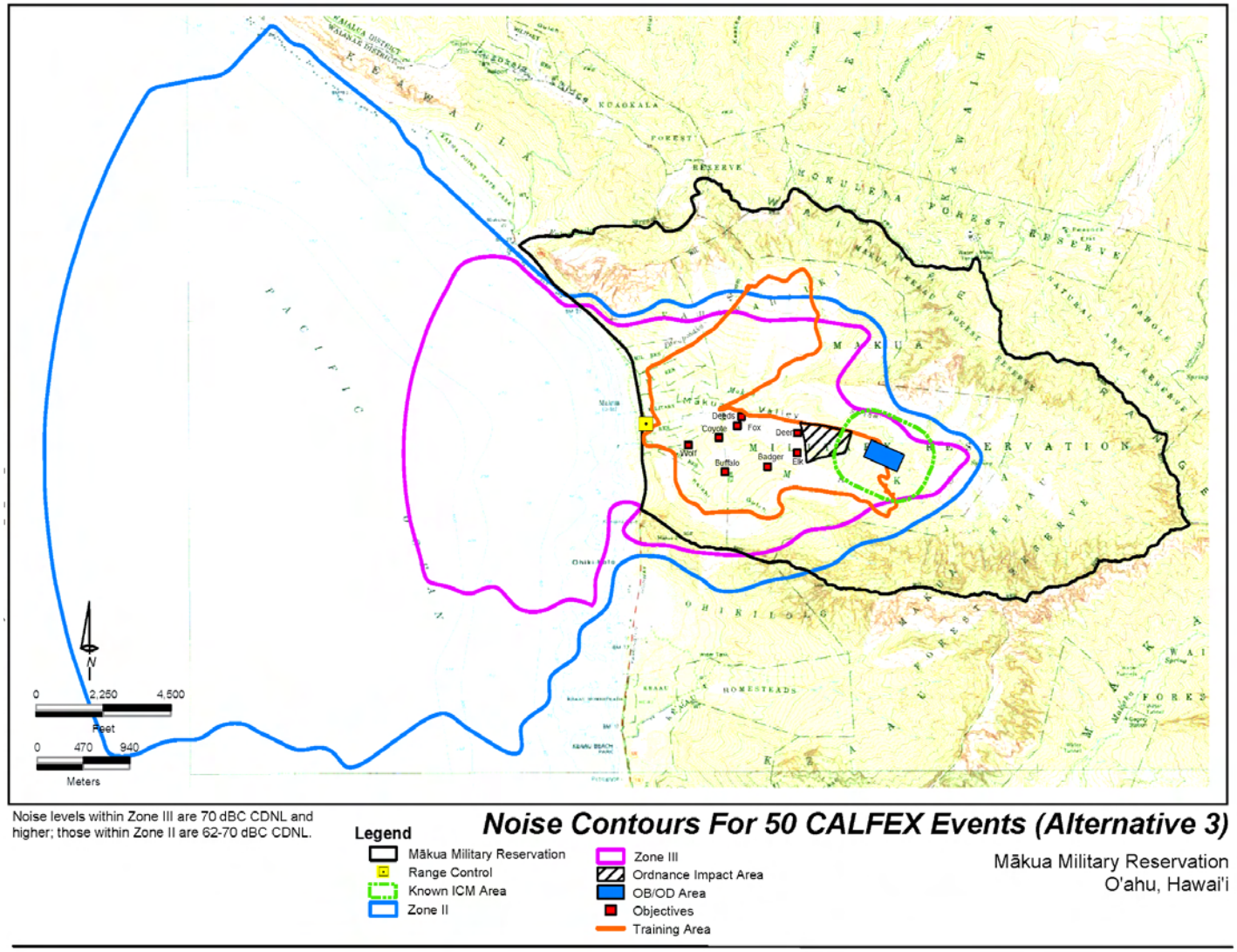


Figure 4.5-6 Noise Contours for 50 CALFEX Events (Alternative 3)

Noise from fixed-wing aircraft. Noise and impacts generated from the Shadow 200 under Alternative 3 would be the same as those described under Alternative 2.

Noise from military vehicle use. Military vehicle use and noise impacts associated with Alternative 3 would be similar to those described under Alternative 2.

Noise from demolitions training. Noise and impacts generated from demolitions training, including detonation of shape and cratering charges, are expected to be the same as those described under Alternatives 1 and 2.

Alternative 4 (Full Capacity Use with Fewer Weapons Restrictions), Pōhakuloa Training Area

Less than Significant Impacts

Noise from rotary-wing aircraft. Overall aircraft activity at PTA would continue to be dominated by helicopter operations. Under Alternative 4, use of helicopters would be limited to CALFEX training. Helicopters may transport troops and equipment from a staging area at BAAF to the range location, a distance of approximately 4.9 miles (7.9 kilometers). They would also be used in air assault exercises. Helicopter landing areas at this range would be at the northwestern edge of the range boundary near the range control tower. This flight activity would occur entirely within the PTA installation boundary. Given this flight path, helicopter activities in the BAAF area associated with CALFEX training at PTA would be closest to sensitive receptors. The distance from BAAF to the closest noise sensitive receptors is listed below (US Army and USACE 2004).

- 2,890 feet (881 meters) – troop housing
- 8,270 feet (2,521 meters) – Mauna Kea State Park cabins
- 6.8 miles (11 kilometers) – Kilohana Girl Scout Camp
- 7.7 miles (12.4 kilometers) – Waiki‘i Ranch

Although residents of areas near PTA would continue to file occasional complaints about low flying aircraft and helicopters, the complaints would likely be about discrete flyover events rather than overall average noise levels. Consequently, noise from aircraft operations at PTA would have a less than significant impact under Alternative 4.

Noise from fixed-wing aircraft. UAV flight operations also would be increased at PTA under the Alternative 4, but would still be relatively small in comparison to continuing helicopter flight operations. The UAV would be used for up to nine hours each week, either during training exercises or independently. In most cases, UAVs would be expected to operate at relatively high altitudes to avoid conflict with other helicopter

and aircraft flight activity. Due to the location of the range in the existing impact area and away from sensitive noise receptors, as well as the relatively high flight patterns, noise from UAV operations at PTA would be less than significant under this alternative.

Noise from military vehicle use. It would be unlikely that a company would travel to PTA solely to conduct CALFEX training. Due to combining of training requirements, it would be expected that there would be no net increase in transportation requirements from O‘ahu to PTA. However, there would be an increase in vehicle traffic within the PTA boundaries. Tactical and support vehicles would travel primarily within the boundaries of PTA, to include some travel on Saddle Road. Convoys would travel approximately 7 miles (11 kilometers) entirely within the boundaries of the installation to the range area utilizing existing roads and/or trails. Beginning at the cantonment area, vehicles would travel in convoys northwest on Saddle Road; southwest on Ahi Road; east on Lava Road; and southwest on Solomon Road. Convoys of tactical and support vehicles typically are spaced about 165 to 330 feet (50.3 to 101 meters) apart and are timed at least 15 to 30 minutes apart. These convoy procedures prevent situations where convoy vehicles dominate local traffic flow for substantial periods. Instead of creating conditions where military vehicle traffic dominates traffic noise conditions for a noticeable amount of time, convoy procedures result in noise from convoy traffic occurring as a sequence of multiple individual vehicle pass-by events within a background of normal traffic noise conditions. Therefore, there would be less than significant impacts from traffic noise levels along public roads.

Noise from ordnance use. Noise impacts from Alternative 4 would be expected to be less than significant due to the fact that the proposed range is located entirely within an existing impact area. The caliber of weapons and size of munitions used for CALFEX training would not exceed those already used in the impact area. As shown in Figure 3.5-2, the estimated annual average noise contours from heavy weapons firing at PTA indicates that Zone III noise conditions are contained within the present boundaries of PTA. Zone II noise conditions affect BAAF and the western portion of the cantonment area. Implementing Alternative 4 would not be not expected to shift these noise contours beyond their present location.

Noise from demolitions training. Noise impacts generated from demolitions training, including detonation of shape and cratering charges, are expected to be the same as those described above for noise from ordnance use.

Noise from construction activities. Construction projects at PTA would be at a far enough distance from noise-sensitive areas to avoid significant noise impacts under this alternative.