Programmatic Biological Assessment for Routine Military Training and Transformation of the 2nd Brigade 25th Infantry Division (Light), U.S. Army

Oahu, Hawaii

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for

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April 2003

This project was accomplished under a cooperative research agreement with the USDA Forest Service, Rocky Mountain Research Station, Fort Collins, Colorado.

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EXECUTIVE SUMMARY

This biological assessment (BA) was prepared to initiate formal consultation between the U. S. Army Garrison, Hawaii (USAG-HI) and the U. S. Fish and Wildlife Service (USFWS) as set forth in Section 7 of the Endangered Species Act. This BA examines current routine military training and the planned Stryker Brigade Combat Team (SBCT) Transformation by the 25th Infantry Division (Light) on Oahu Army installations and subinstallations. The 25th Infantry Division (Light) is a 10,000-person light (no tanks or armored/tracked vehicles) infantry division requiring large tracts of land to support mission-essential training designed to fight and win military conflicts. The USAG-HI provides land at several areas on Oahu and the island of Hawaii to accomplish this. The specific areas addressed in this BA are discussed below.

The objectives of the BA are to analyze how routine military training (Legacy Force) and SBCT Transformation on Oahu Army installations and subinstallations potentially affect species listed by the USFWS as threatened, endangered, or proposed for threatened or endangered status. In addition, it assesses the impacts to the formally established elepaio critical habitat. This BA also states how the Army will minimize any potential adverse effects to listed taxa or critical habitat and offset these effects through stabilization actions.

The scope of the BA includes all routine military training and SBCT Transformation activities on Oahu. There are two on-going consultations efforts for SBCT (Oahu and Big Island), but one environmental impact statement (EIS) is being developed that combines the two efforts. This BA was developed simultaneously with a BA for SBCT Transformation at Pohakuloa Training Area. Since this BA is written programmatically, descriptions of actions, the analysis, and description of minimization and stabilization actions are done in general fashion.

Makua Military Reservation is an important but nonessential part of SBCT training. The primary live fire training area for the SBCT will be the Schofield Barracks Battle Area Complex (BAX). SBCT forces will use Makua after the completion of the Makua Environmental Impact Statement (EIS) and Record of Decision if Makua is available. Makua will greatly facilitate dismounted CALFEX (combined arms live-fire exercise) throughput and flexibility for all divisional units. The Makua EIS will analyze the potential environmental impacts associated with dismounted CALFEXs which will be similar in scale, scope, and weapons employed for both Legacy and SBCT units. Accordingly, this BA will not analyze training impacts to endangered species at Makua.

Although the routine military and SBCT Transformation activities occur primarily within the boundaries of the subinstallations discussed below, the potential adverse effects to species listed by the USFWS as threatened and endangered may extend beyond the boundaries of these areas. Species occurrence records dating from 1982 to present show 38 endangered plants, nine endangered tree snails, one endangered bird, and an endangered bat in the action areas. This biological assessment concludes that routine military training and SBCT Transformation activities, and operations, maintenance, and construction in the action areas in support of these activities may adversely affect some of these species. This is due to the potential for associated fires and introduction of weeds from these activities. These possible adverse effects cannot be minimized to insignificant or discountable levels or eliminated. Therefore, formal consultation with the USFWS on the action is necessary.

The proposed action would convert the 2nd Brigade (25th ID(L)) (one of two light brigades in Hawaii) to a different configuration that is more self-supported and has Stryker wheeled armored vehicles. The 3rd Brigade, its supporting units, and other users of USARHAW lands would continue to train as they do currently. The proposed usage would be for one light brigade, its supporting units, other USARHAW

users including Marine Corps and Hawaii Army National Guard units, and one Stryker Brigade. The SBCT is essential to support the 25th ID(L) mission to fight and win military conflicts. Transformation of a brigade in Hawaii is anticipated to result in a net gain of approximately 810 soldiers and 400 vehicles. Transformation of the 2nd Brigade involves a number of construction projects at Dillingham Military Reservation, Kahuku Training Area, Schofield Barracks East Range, Kawailoa Training Area, Schofield Barracks Main Post, and the construction of a small arms qualification range on a proposed parcel South of Schofield Barracks.

Many SBCT missions would be very similar to light infantry training currently practiced at USARHAW installations. Infantry activities would continue to center on movements and engagements, utilizing a variety of squad/platoon to company or larger exercises. The primary difference between the Legacy and SBCT training would be the introduction and use of the Stryker armored vehicle, an increase in off-road travel at affected installations on Oahu, and increased live-fire range requirements. Indirect fire requirements for field artillery would be unchanged. SBCT mounted and dismounted maneuvers would take place in the same locations currently used by Legacy units. The new brigade would have integral engineer, military intelligence, and signal companies. New equipment not used in current training that would be used on Oahu consists of the Stryker wheeled armored vehicle and the Stryker Mobile Gun System (105 mm cannon).

SBCT training would be similar to Legacy force training, except for an increase in the numbers of vehicles and troops for an SBCT and additional vehicle requirements. The number and types of aircraft used for aviation training and air assault/movement training are expected to be the same as under Legacy training. Combined arms live-fire exercises (CALFEX) would be carried out in a similar manner as Legacy training. There would be no change in service support operations and training under the proposed action.

Because fire is a major threat to listed species on USARHAW lands, military ignitions will be minimized through limitations placed on training, such as restricted munitions and pyrotechnics. Implementation of fire danger rating systems, construction and maintenance of firebreaks, and improvement of firefighting resources such as dip ponds are examples of special precautions that will be taken to prevent fire ignition and control fire spread. Potential adverse effects can be offset with stabilization actions on non-military threats such as feral ungulates and existing weeds, and genetic banking, propagating and establishing more populations of species on and off Army lands. The Army will write an implementation plan (IP) for species that may be adversely affected and do not meet the U.S. Fish and Wildlife Service definition of being currently stable. The IP will detail how biological stabilization will be carried out in the future. The Army requests that the USFWS consider this stabilization/conservation as an improvement to the environmental baseline and render a “no jeopardy” biological opinion. Stabilization actions planned for areas other than Army lands are subject to agreement with landowners and consultation with the USFWS.

1. Introduction

Primary users of USARHAW (U.S. Army, Hawaii) subinstallations are combat arms, which includes light infantry, attack helicopters, field artillery, and United States Marine Corps combat forces. Major training activities associated with these users on USARHAW subinstallations are light maneuver training, weapons live fire, bivouac, and aviation training. The 25th Infantry Division (Light) (ID(L)) is a rapid strike force that focuses primarily on training for low intensity conflict throughout the Pacific.

The 25th ID(L) has two light infantry brigades at Schofield Barracks and one at Fort Lewis, Washington. The Initial Phase of Transformation involved the creation of two Interim Brigade Combat Teams (IBCTs) from the 1st brigade of the 25th Infantry Division based at Fort Lewis, Washington. The U.S. Army is proposing to convert the 2nd Brigade, 25th ID(L), stationed at Schofield Barracks, Hawaii to a Stryker Brigade Combat Team (SBCT). The term "Interim" was changed to "Stryker" in the name but they have the same meaning and can be used interchangeably. The 2nd Brigade, 25th ID(L) is part of the broader Army Transformation. The SBCT is a rapidly deployable, early entry, medium weight force with a decreased logistical footprint. The proposed action would require: (1) fielding weapon systems, armored vehicles, and equipment; (2) construction, renovation, and demolition of buildings, training facilities, and infrastructures; (3) land transactions; (4) deployment of forces and specific training development; (5) mission readiness training; and (6) a net increase in troops and vehicles. On the island of Oahu, 26 construction projects and acquisition of a parcel of land adjacent to South Range in Schofield Barracks and several access trails are proposed.

In accordance with Section 7 of the Federal Endangered Species Act of 1973, as amended, 16 USC§1521 et seq., and 50 CFR § 402, 424, and 50 CFR part 17, this BA addresses the potential impacts of routine military training and transformation activities on federally designated threatened and endangered species, and critical habitats.

1.1 Objectives and Scope

The objectives of this Biological Assessment (BA) are to:

- Determine in programmatic fashion how routine (i.e., Legacy) military training on Oahu potentially affects listed species or species proposed for listing in the future and designated critical habitat.

- Determine the potential effects of the transformation of the 2nd Brigade, 25th Infantry Division to a Stryker Brigade Combat Team (SBCT) on listed threatened and endangered species and/or critical habitat.

- Determine the potential additive effects of the SBCT with the continuing mission of the 3rd Brigade of the 25th Infantry Division, other supporting units, and other users of USARHAW training lands.

- Determine how the U.S. Army will minimize negative effects associated with routine military training and SBCT Transformation implementation, and stabilize species to offset impacts that cannot be minimized to zero, or very low, insignificant, or discountable levels.

The scope of this BA covers:

- The impacts associated with the routine military training, transformation, SBCT training, and potential additive effects with ongoing missions.

- The BA does not cover specific actions that are not routine such as one-time demonstrations of a new weapon system. However, if such a demonstration is evaluated to be similar in impact to a weapons system covered under this BA, then separate consultation may not be necessary. The service will be apprised of these activities before they occur and the effect of the activity will be addressed pursuant to section 7 of the Endangered Species Act.

- Actions, analysis, minimization, and stabilization of Army training and transformation and engaged SBCT will be specifically addressed. Potential threats associated with actions may extend beyond installation boundaries, and therefore listed species and critical habitats on neighboring lands are included in the analysis.

- Listed threatened and endangered species and elepaio critical habitat.

- The Army will coordinate with the Service on actions that may adversely affect unoccupied essential habitat on Army lands (letter from Colonel Anderson to Paul Henson; March 20, 2003) and implement management activities in proposed critical habitat as part of their ongoing Integrated Natural Resource Management Plan (INRMP) commitment.

- This BA will not address the use of roads and trails for road marches around Kaena Point and across Kealia Trail from Dillingham Military Reservation (DMR) to Makua Military Reservation (MMR).

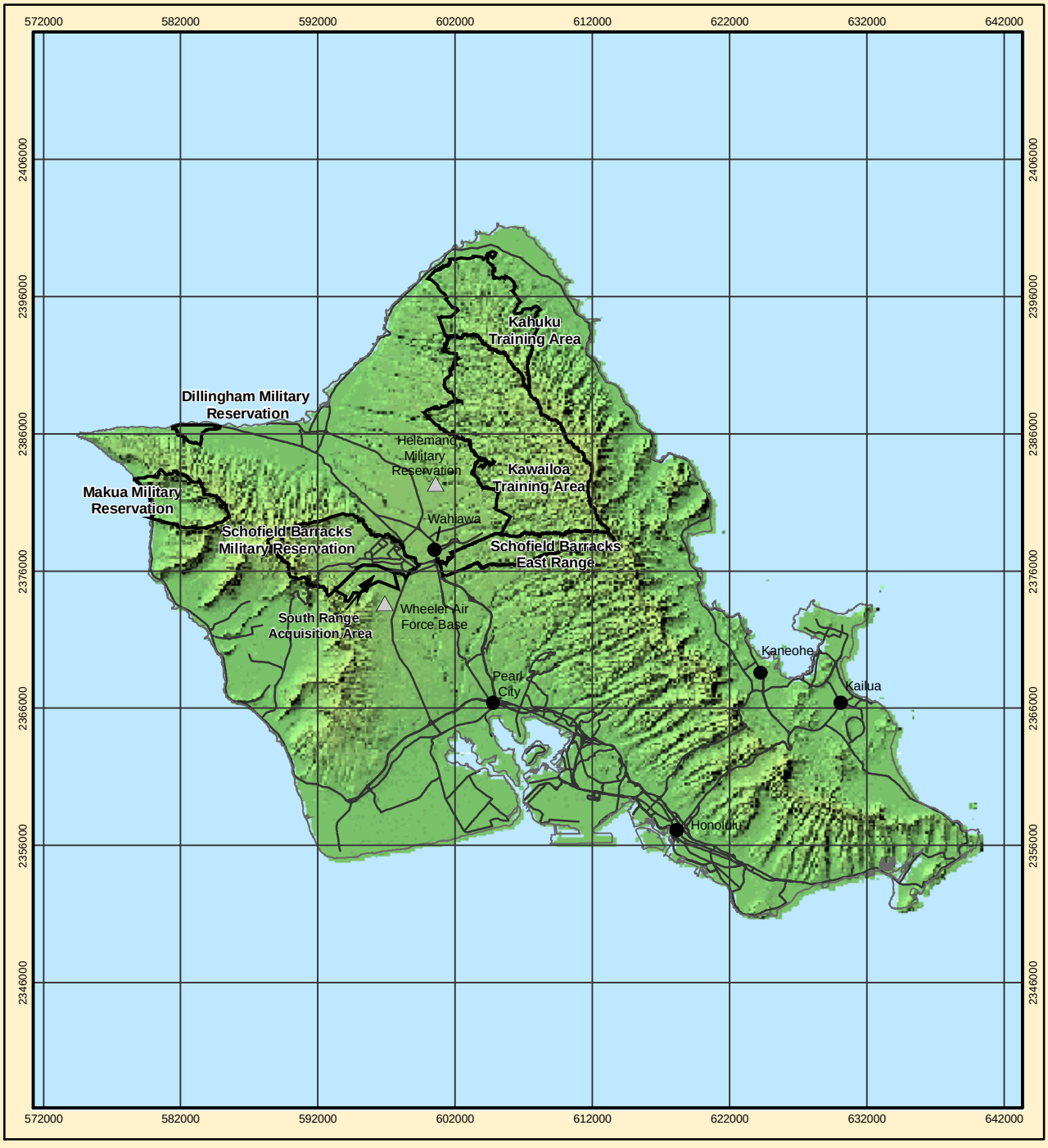
- This BA will not analyze training impacts to Makua (Memorandum from CEPOH-PP-E dated 28 February 2003) because SBCT Transformation training at MMR will not alter the way that training will be conducted and the impacts to species associated with that training. Stryker vehicle maneuver will not be conducted at MMR. The Makua EIS will analyze the potential environmental impacts associated with dismounted CALFEXs which will be similar in scale, scope, and weapons employed for both legacy and SBCT units.

1.2 General Description of Locations on Oahu (25th ID(L) and U.S. Army, Hawaii (USARHAW), 2001).

The Oahu installations and subinstallations addressed in this BA are Dillingham Military Reservation (DMR), Helemano Military Reservation (HMR), Kahuku Training Area (KTA), Kawailoa Training Area (KLOA), Makua Military Reservation (MMR), Schofield Barracks East Range (SBER), Schofield Barracks Military Reservation (SBMR), South Range Acquisition Area (SRAA), and Wheeler Army Air Field (WAAF). For the purposes of this document, SBMR consists of West and South Ranges (Figure 1.a). Makua is an important but nonessential part of SBCT training. The primary live fire training area for the SBCT will be the Schofield Barracks Battle Area Complex (BAX). SBCT forces will use Makua after the completion of the Makua Environmental Impact Statement (EIS) and Record of Decision if the range is available. Makua will greatly facilitate dismounted CALFEX throughput and flexibility for all divisional units. The Makua EIS will analyze the potential environmental impacts associated with dismounted CALFEXs which will be similar in scale, scope, and weapons employed for both legacy and SBCT units. Accordingly, this BA will not analyze training impacts to Makua (Memorandum from CEPOH-PP-E dated 28 February 2003), because SBCT Transformation training at MMR will not alter

Army Training and Stryker Brigade Combat Team (SBCT) Installations - Island of Oahu

Figure 1a



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Data Source: USARHAW Integrated Natural Resource Management Plan 2002-2006

Legend

- Major Roads
- Training Lands

the way that training will be conducted and the impacts to species associated with that training. Stryker vehicle maneuver will not be conducted at MMR. The impacts of routine military training were already addressed in Section 7 consultation with the U.S. Fish and Wildlife Service which rendered "no jeopardy" biological opinions in 1999 and subsequent reinitiating of consultation for additional species found in the action area.

2. Description of the Action – Routine Military Training and the Transformation of the 2nd Brigade, 25th Infantry Division

2.1 Description of Legacy Training

Routine military training includes training by U.S. Army and other units. The 25th ID(L) is the primary fire and maneuver user of Oahu training lands. Oahu subinstallations support infantry brigades, division artillery, aviation brigade, and other divisional combat support (CS) and combat service support (CSS) units. Other non-Army units currently using USARHAW training facilities on Oahu, and included in the scope of this BA, include Hawaii Army National Guard, U.S. Marine Corps Units, and other Allied Forces. Units are described in Section 2.1.11. Oahu subinstallations generally support maneuver training and qualification activities. The 25th ID(L) & USARHAW is the major organization deployed forward in the Pacific region. Missions of the 25th ID(L) and subordinate units are listed below.

- The 25th ID(L) prepares to conduct worldwide deployment and conducts military operations as directed.
- The 45th Corps Support Group (Forward) prepares for worldwide deployment, and when directed, provides combat support and combat service support for military operations.
- The US Army Military Police Brigade Hawaii (USAMPBH) (Provisional) provide trained and ready soldiers and units to perform military police CS missions, prepare to conduct worldwide contingency support, and sustain discipline in the military community. Components of USAMPBH will train in support of other 25th ID(L) units.
- The U.S Army Garrison Hawaii (USAG-HI) provides and coordinates all installation facilities, services, and logistics in Hawaii to ensure readiness and to provide quality of life for the total Army family. USAG-HI is not a tactical unit.
- The 25th ID(L) also has the institutional mission to operate the Noncommissioned Officer Academy and the Light Infantry Training Command. The Academy uses maneuver areas for land navigation and one short field training exercise per class. Most training courses do not involve live fire and maneuver training, and thus have minimal impact on USARHAW training assets.

Primary users of USARHAW subinstallations are combat arms units, which include light infantry, attack helicopters, field artillery, and United States Marine Corps combat forces. Major training activities associated with these users on USARHAW subinstallations are light maneuver training, weapons live fire, bivouac, and aviation training. A rapid strike force of nearly 17,000 soldiers, the 25th ID(L) focuses primarily on training for low intensity conflict throughout the Pacific. The Division is composed of three infantry brigades (two in Hawaii; one at Fort Lewis), an aviation brigade, division artillery, a division support command, and a complement of separate battalions.

Mission training plans provide commanders and leaders with guidance on how to train key missions of the unit. Specific details of a unit's training program are determined by the following and other factors:

- Mission essential task list (METL) for the unit
- Chain of command training directives and guidance
- Training priorities of this unit
- Availability of training resources, areas and environmental constraints

Oahu training resources include an assortment of live-fire (real ammunition) and non-live-fire (blank ammunition) maneuver training facilities, fixed-position live-fire training facilities, infantry and engineer

demolition training facilities, and grenade training facilities. On USARHAW training lands, live-fire maneuvers occur at SBMR, Pohakuloa Training Area (Island of Hawaii), and Makua Military Reservation (MMR)[1]; non-live-fire maneuver training occurs at the other locations. The USARHAW training complex currently has 26 ranges, 49 training areas, one airfield (Wheeler Army Airfield), 5 airborne drop zones, and 13 surveyed field artillery and mortar firing points on Oahu. Soldiers are typically assigned to the USARHAW and 25th ID(L) for a 36-month rotation. Battalion and brigade level commanders are generally assigned for an 18 to 24-month tour. Additionally, USARHAW supports numerous intra-theatre and inter-theatre support missions. Periodic deployment of Oahu forces can create boom or bust demands on training and range areas outside of the typical training cycle.

USARHAW Training Model[2]

The division training model reflects a two-cycle system for the brigade combat team (BCT) and a separate two-cycle system for the division(-)[3] units assigned to the 25th ID(L) and USARHAW. The training model enhances wartime deployment capabilities and allows the major units to conduct training with their habitual CS and CSS units. This enhances readiness and the BCT ability to train, deploy and fight as a combined arms team. Each training cycle ranges from 12 to 14 weeks in duration. The cycles are "mission" and "training" for the Light Infantry Brigade Combat Teams (BCTs), Division(-) Training, and Division(-) Support. There is one 2-week zero cycle that corresponds with the division half-day schedule in December. There are also two 1-week zero cycles that correspond to the training area and post clean-up (TAPCU) and the Division's birthday/Tropic Lightning Week in October. This model establishes a predictable pattern of training and actions executed in each cycle, with a total of approximately four cycles per year. Although the commander sets the exact internal flow of the training, certain tasks or events must be accomplished in the appropriate cycles. Cycles occur simultaneously for different units. Some units are in the mission cycle while others are in the training cycle.

BCT Training Cycle

The BCT in the training cycle focuses on collective tasks at squad level and above. The first 3-4 weeks of this cycle focuses on allowing all units to train squads, sections and platoons. In general, this provides an opportunity for direct support units to train on specific tasks. Following this period, the focus shifts to training as a BCT. Types of training in this cycle include squad and higher live fires, major field training exercises (FTX), and training deployments away from Hawaii.

The training cycle is used to maximize training time in the field for units of all levels. Training land and resources will be prioritized to units in the training cycle. Weekend training is authorized for planned exercises. The emphasis during training cycle is on:

- External Evaluations (EXEVALs). Training cycle will be the only time units may conduct EXEVALs from squad to battalion level. EXEVALs can be considered subordinate unit certification prior to executing larger (i.e., task force and brigade level) collective training events.

- Live Fire Exercises (LFX). Platoon and company combined arms live fire exercises (CALFEXs) will be executed during the training cycle. Units may begin the cycle executing

[1] In 1998, after several wildland fires were started by munitions that fell outside designated impact areas, the Army voluntarily suspended live-fire training at M kua Military Reservation. The Army is currently conducting limited live-fire training exercises and is preparing a separate EIS to evaluate a proposal to resume routine modified live-fire training at MMR.

[2] USARHAW Regulation 350-1, Training, (Working copy from G3 Training Division 3/03).

[3] (-) indicates a force less than a typical division (3 brigades), but larger than one brigade.

platoon level and higher LFXs if squad live-fire events were conducted during the mission cycle. If not, a full ramp-up from squad level must be conducted. BCTs should plan platoon and company level CALFEXs to train as a combined arms team.

- BCTs. The BCT will deploy as a whole for seven to ten days per training cycle while conducting collective training. During this time, the BCT will sustain itself through the forward support battalion (FSB). Battalion task force FTXs and BCT simulation exercises will be executed in this cycle. The BCT in the training cycle will conduct training at home installation and exercises in other theatres. The BCT will receive maximum resource support during this time, and may even receive additional division assets (OH-58Ds, 155mm howitzers, etc.) to support training if it is requested and coordinated with the owning unit.

- Division(-) Training. Division(-) Training units will conduct collective training at any level that does not affect the cycle operations of the BCTs.

- Priority for training resources for the training cycle is small unit training at Schofield Barracks facilities and at KTA, DMR, SBER, and Kawailoa Training Areas.

BCT Mission Cycle

The BCT in the mission cycle will be the Rapid Reaction Force, and will be prepared to deploy on short notice. Training will focus on deployment preparations, individual and squad level exercises and command post exercises (CPX) and simulation exercises. The emphasis during training cycle is on:

- Leader Training. The mission cycle will be used to train and certify leaders on tasks that will be used during collective training events in training cycle. Final planning and preparation for training cycle is conducted. Leader and staff training is focused on the unit mission essential task list (METL).

- Individual and collective training. Weapons qualification and weapons crew drills are conducted during mission cycle. There is generally no collective training above squad level during this cycle. Squad training is conducted concurrently with qualification ranges, and certification training. Leaders take lessons learned in leader training and apply them in the field with their soldiers. Live-fire exercises may be conducted at squad and platoon level, if the land and resources are available, and if the plan is approved at the Quarterly Training Briefing. Training focuses on special skills requirements, such as expert infantry badge, expert field medical badge and other certifiable individual skills.

- Division Ready Force (DRF) -1 Assumption. The battalion task force that will assume DRF-1 during the mission cycle will use the last two weeks of training cycle (as required) to conduct preparation for assumption. The DRF-1 will receive priority on marksmanship ranges in preparation for assumption.

- Priority of training resources for mission cycle is to air assault training, qualification ranges, close-in ranges, and selected close-in training areas, all of which are located on Schofield Barracks Main Post/South Range (existing).

Division(-) Training Cycle

The unit in Division(-) training cycle will focus on collective training to battalion level gunnery for field artillery, air defense artillery, and aviation as needed.

- Collective Training. The Division(-) training cycle is used to maximize training time in the field for units of all levels. Training land and resources will be prioritized to units in the Division(-) training cycle. Division(-) Training units will conduct collective training at any level that does not affect the cycle operations of the BCTs. If parent units wish to conduct collective training with subordinate units, the supported brigade commander must approve the use of the task organized unit for the time required to conduct the training. During the training event, parent units are still responsible for executing recurring and special taskings assigned to the subordinate unit. The parent unit must coordinate for tasking coverage prior to training if unable to perform the missions. Weekend training is authorized for planned exercises (Briefed/approved during a units quarterly training briefing).

- Individual Training. The focus is on training special skills requirements, such as the expert field medical badge, common task training, and other certifiable individual skills.

- EXEVALs. Division(-) training cycle is the only time units may conduct external evaluations from squad to battalion level. External evaluations can be considered subordinate unit certification prior to executing battalion and brigade level collective training events.

- LFXs. In addition to standard gunnery and marksmanship requirements, Division(-) training units conduct convoy live-fire exercises during at least one Division(-) training cycle per fiscal year.

- FTXs. The Division(-) Training unit will deploy for seven to 10 days per training cycle while conducting collective training. Battalion task force FTXs and battle simulation exercises will be executed in this cycle. The units in Division(-) training will receive maximum resource support during this time.

- Priority for resources for the Division(-) training unit is to PTA and a number of close-in training areas and facilities on Schofield Barracks Military Reservation and East Range.

Division(-) Support Cycle

Installation support is the primary focus for the Division(-) in support cycle. Units will plan and conduct leader and individual training, will maximize opportunities for soldier family time and educational opportunities, and provide support to the community. No collective training will be planned during support cycle. Support cycle missions affecting training lands and usage include:

- Leader Training. Leaders and staff must maximize the opportunity offered by support cycle to focus on detailed planning and preparation for the upcoming Division(-) training cycles. Division(-) support leadership training will focus on METL, battle simulations, training events without troops (TEWTs), leadership skills training, and leader certifications.

- Individual Training. Individual training will be conducted as a priority. There will be no collective training in the field such EXEVALs or squad and platoon situational training exercise (SQD/PLT STX) lanes. The keys to success are squad and section leaders who know the individual training strengths and weaknesses of their soldiers.

Live Fire, Pyrotechnics and Other Authorized Uses On Oahu Training Lands

Live-fire training includes many types of munitions, including ball, high-explosive, rockets, mines, grenades, all artillery and mortar, short-range training ammunition (low-velocity plastic bullets),

explosives, and practice and training-practice ammunition. All live-fire training takes place on training ranges within surface danger zones established for that purpose. No live-fire training takes place outside of established ranges or surface danger zones. The firing of blank ammunition, including blank munitions up to .50 caliber, is not considered live fire.

Restrictions on live fire and pyrotechnics are important for minimizing fire ignitions, training safely, and adhering to lease agreements. Pyrotechnics are typically employed for signaling, illumination, or marking targets. Blanks are not considered pyrotechnics. Pyrotechnics are typically employed for signaling, illumination, or marking targets. Blanks are not considered pyrotechnics. The following munitions[4] are considered pyrotechnics on Oahu and Pohakuloa Training Area, Hawaii (USAGHI 2001)[5]:

- grenade and artillery simulators (flash/bang)
- all flares to include smoke flares, aerial signal flares, illumination flares, star clusters, parachute flares, handheld signal flares, and ground flares
- smoke grenades (colored smoke) – signaling, marking of LZs
- HC/TA Smoke (HC - Hexachloroethane, TA - Terephthalic Acid) – obscurement/screening movement
- CS (riot control – tear gas) grenades
- fog oil smoke generation

On Oahu, discussion of pyrotechnics and smoke usage outside of live-fire facilities refers to the munitions listed above. These non-live-fire pyrotechnics may also be used at live-fire ranges during training exercises. Technically speaking, the following munitions are also considered pyrotechnics, but are generally managed as live-fire munitions since they are employed on live-fire ranges only: all tracer ammunition; 20 mm rounds ("hot brass" falling to the ground) fired from aircraft; 40 mm grenade illumination, smoke, and practice (MK19) rounds; 60 mm and 81 mm illumination and white phosphorus rounds; white phosphorus and smoke 2.75" rockets; 105 mm and 155 mm illumination, white phosphorus, and smoke artillery rounds; and TOW and Dragon anti-tank missiles due to the fire-starting nature of the rocket motors and propellant.

The following section lists authorized and prohibited uses on Oahu Army subinstallations[6]:

Dillingham Training Area

Restrictions

- There is no live fire at DMR.
- Airfield is off-limits to military training unless coordinated through Range Division Hawaii (RDH).
- Live ammunition (i.e., live-fire training), aerial pyrotechnics (e.g., star and parachute flares), and CS grenades are not authorized.
- No ignition sources (including cigarettes, cooking/warming fires, and blanks) outside of P-1 until the first firebreak is complete. No ignition sources outside of the first firebreak until the second (future) firebreak is complete. No ignition sources outside of the second (future) firebreak at any time. This includes smoking and cooking/warming fires as well as all munitions.
- Blanks are authorized at DMR but are not currently used.

[4] pyrotechnics types are described in Appendix A: Legacy and SBCT Vehicles and Weapon Systems.
[5] PTA Standing Operating Procedures.
[6] USARHAW Regulation 350-1, Training (25th ID(L) and USARHAW 2000) and 25th ID(L) and USARHAW Regulation 210-6, Installations Ranges and Training Areas (25th ID(L) and USARHAW 1999).

Pyrotechnics

- The use of pyrotechnics, simulators (including demolition effects simulators – DES), and blanks requires approval from RDH Range Operations and will be controlled by the Fire Danger Rating System (FDRS) for DMR.
- RDH will restrict the use of pyrotechnics under the Red FDRS category.
- RDH will authorize and apply safety buffer zones for smoke grenades in training areas P-1, P-2, and P-3 and ground simulators in training areas P-2 and P-3. [7]
- Smoke grenades will only be used in areas devoid of vegetation.

Kahuku Training Area

Restrictions

- There is no live-fire training at KTA[8].
- KA-1 and KA-3 are off limits to military units during weekends and federal holidays, except for brigade field exercises if coordinated through Range Division Hawaii (RDH) at least 30 days before execution.
- Live ammunition and aerial pyrotechnics (star clusters/parachute flares) are not authorized.
- Blank ammunition is authorized in all training areas with approval from RDH.
- Use of pyrotechnics, blank ammunition, and other ignition sources will be controlled by the fire danger rating system for KTA.

Pyrotechnics

- The use of pyrotechnics and simulators (including demolition effects simulators – DES) requires approval from RDH Range Operations.
- RDH may restrict the use of pyrotechnics based on the Fire Danger Rating System (FDRS).
- Smoke and CS grenades, HC/TA smoke, smoke generators, and ground simulators are allowed in all areas, except A-1, A-3.
- RDH will authorize and apply safety buffer zones for HC smoke and CS. [9] (e.g. CS and smoke grenades restricted in an approximate 1000 m buffer south of the northern perimeter of training areas B1 and B2 (pers. comm. Steve Lai, 4/9/03)).
- Smoke grenades will only be used in areas devoid of vegetation.

Kawailoa Training Area

Restrictions

- There is no live fire on KLOA.
- Live ammunition and pyrotechnics are not authorized.
- Agricultural lands are off-limits.
- All additional provisions of the lease agreement must be followed when requesting and using KLOA, which is leased land.
- Civilians have exclusive rights to KLOA during weekends and holidays. Weekend training may be authorized for brigade level and higher training, with coordination for approval 45 days prior to execution.

[7] Buffer information is listed in USARHAW Regulation 210-6, Appendix F.
[8] Live-fire training using short-range training ammunition (low velocity plastic bullets) is proposed as part of the Transformation of the 2nd Brigade.
[9] Buffer information is listed in USARHAW Regulation 210-6, Appendix F.

- 5.56 mm and 7.62 mm blanks are authorized.
- Cigarette smoking and cooking/warming fires will be authorized by Range Division Hawaii (RDH) using the Fire Danger Rating System (FDRS) for KLOA.

Pyrotechnics
- No pyrotechnics of any kind are authorized.

Schofield Barracks East Range
Restrictions
- Small arms (5.5.6 mm and 7.62 mm) blank ammunition is permitted throughout East Range, with the exception of training areas 1A, 1B, 2, 3A, and 3B during the hours of 1800-0600 daily. Noise producing simulators or pyrotechnics are not authorized in these areas at any time.
- CS grenades are not authorized.

Pyrotechnics
- The use of pyrotechnics and simulators (including demolition effects simulators – DES) requires approval from Range Division Hawaii (RDH) Range Operations.
- RDH may restrict the use of pyrotechnics based on the Fire Danger Rating System (FDRS) for East Range.
- Pyrotechnics, including smoke grenades, HC/TA smoke are authorized in all training areas except 1A, 1B, 2, 3A, and 3B.
- No aerial pyrotechnics (star clusters/parachute flares) are permitted on East Range.
- Range Division Hawaii (RDH) will authorize and apply safety buffer zones for HC (Hexachloroethane) smoke. [10]
- Colored smoke grenades allowed in ER-5, ER-6A, ER-6B, ER-10, ER-11, ER-12, and ER-13.
- Smoke grenades will only be used in areas cleared of debris and grass that might provide fuel to start a fire.
- All ignition sources will be controlled by the FDRS.

Schofield Barracks Military Reservation (South Range Training Area Complex)
(applies to 10 sub-areas: SR-1, SR-2A, SR-2B, SR-3, SR-5A, SR-5B, SR-5C, SR-5D, SR-6A, SR-6B)
Live-fire takes place on approved training ranges outside of these sub-areas at South Range.
Restrictions
- Aerial pyrotechnics (star clusters/parachute flares), and CS grenades are not authorized.
- Blanks are authorized at South Range.
- All training at Schofield Barracks Main Post, including South Range is regulated by the fire danger rating system for SBMR. Weapons systems that pose the highest risk of fire will be authorized only under the most benign fire danger category (see Enclosure 7 to Annex A of the Wildland Fire Management Plan (WFMP), 25th ID(L) and USARHAW 2003 for details). These weapons include tracers, pyrotechnics, and white phosphorous mortar and artillery rounds. Under the highest fire danger category, no weapons systems are allowed with the exception of ball ammunition for direct fire weapons on the CR and MF ranges only. These ranges are heavily manicured to minimize the spread and intensity of any fire and it is extremely unlikely that ball ammunition could cause an ignition.

[10] Buffer information is listed in 25th ID(L) and USARHAW Regulation 210-6, Appendix F.

Pyrotechnics

- The use of pyrotechnics and simulators (including demolition effects simulators – DES) requires approval from Range Division Hawaii (RDH) Range Operations.
- RDH may restrict the use of pyrotechnics through the Fire Danger Rating System (FDRS).
- Smoke grenades are allowed in all ten sub-areas.
- Smoke grenades will be used only in areas devoid of vegetation.

The principal current (i.e., Legacy) training activities that would continue for both the untransformed and transformed brigades are described in the following sections. These include: maneuver, reconnaissance, live-fire, bivouac, deployment, aviation, combined-arms live-fire training, major force-on-force training, and training support operations.

2.1.1 Maneuver Training

Maneuver training throughout the state of Hawaii is restricted due to the severity of the terrain, and administrative and environmental considerations. Total maneuver area available to the Army on Oahu is approximately 21,148 ha (52,258 ac). However, the acreage considered suitable for mounted maneuvers on Oahu is approximately 5,770 ha (14,257 ac) (USAESC and Nakata 2002b). Areas considered unsuitable for training on each subinstallation are based largely on topographic and maneuverability constraints. Off-limits and restricted areas, impact areas, habitat and species protection areas, identified cultural resource sites, and recreation areas located within each subinstallation further reduce and compartmentalize the net available maneuver and training space. The subinstallations addressed by this BA are small, non-contiguous, and have limited ability to support tactical exercises above company level. Schofield Barracks Military Reservation can support up to company sized live-fire maneuver training. Kahuku Training Area is the primary maneuver area for both mounted and dismounted (foot) maneuvers on Oahu. Kawailoa and Dillingham are used primarily for helicopter training activities and small unit training. Schofield Barracks East Range is used mainly for small unit exercises and dismounted maneuvers. Available information on the suitability of training areas to support vehicle and foot maneuvers is limited. Areas with a high probability of off-road vehicle travel were identified through spatial analysis using selected criteria. High-probability off-road vehicle maneuver maps were developed for Dillingham Military Reservation, Kahuku Training Area, and Schofield Barracks East Range. These installations support off-road mounted maneuvers in potentially sensitive areas. The development of these maps is discussed in Chapter 3 and each map and results are discussed in the DMR, KTA, and SBER chapters. High-probability off-road vehicle maneuver areas represent areas potentially subject to vehicle disturbance as well as dismounted and other types of training. Vehicle maneuvers are constrained by topography and vegetation (and other applicable constraints listed in Chapter 3), whereas foot maneuvers may occur anywhere that safety or administrative restrictions permit including the high probability vehicle maneuver areas. Dismounted maneuver training could therefore occur anywhere. These maps show areas that are currently used or are available for use. The same areas would be available for use by SBCT units. Based on information about Legacy and SBCT vehicles and doctrine, it is anticipated that vehicles of the two forces will travel in similar places.

Maneuver training is a tactical exercise that can include movement by foot, vehicle, or helicopter, offensive operations, defensive operations, withdrawing under enemy pressure (retrograde), and reconnaissance and security. Maneuver training exercises are conducted at all levels from squad to brigade to ensure a combat ready fighting force, and are sometimes supported by firepower. Training programs focus on units attaining and maintaining proficiency in collective maneuver tasks that support mission essential tasks. Maneuver training is the tactical training for armed forces. Because units must train as they will fight, training exercises must be able to replicate combat conditions as closely as possible. Combat effects such as smoke and obscurants, noise, and simulated nuclear, biological, and

chemical conditions are integrated into training events to condition units for operations in a confused, stressful battlefield environment.

Unit movement during maneuver activities may consist of soldiers in tactical (when contact with an enemy is likely) and non-tactical (when contact with an enemy is not likely) formations moving in a predetermined direction to accomplish a mission. Individual infantry soldiers move in non-tactical formations using vehicles (mounted maneuvers), by walking in administrative formations on roads or trails or in a dispersed fashion overland (dismounted maneuvers), or by helicopter. Individual soldiers move in tactical formations by walking in loose groups overland in designated directions to accomplish a mission. Direction of movement is terrain and tactical scenario dependent. Due to a risk of ambush, tactical formations often do not follow roads or trails. If engagement with an enemy has happened or is likely, then soldiers will seek cover or concealment. When contact with an enemy is simulated during maneuvers, one section of a unit may provide a base of weapons fire while another section maneuvers toward the enemy. Airborne units may parachute in under administrative or tactical scenarios. Paratroopers will parachute from transport Air Force aircraft into a designated drop zone (DZ).

Maneuver also entails the set-up of temporary defensive positions to repel an enemy attack. Defensive positions may consist of soldiers lying in concealed positions and designating fire zones. More complex maneuver defense entails digging individual fighting positions or trenches using hand tools and digging in larger crew-served weapons using excavators. The longer a unit stays in a particular area, the greater the need for digging-in to provide protection from enemy fire, given the greater likelihood of detection.

During extended maneuver training soldiers may sleep in the field. To avoid detection and allow for quick displacement, tents are not set up during light infantry maneuvers. Soldiers normally eat pre-packaged meals in the field. Other prepared meals are brought in from bivouac sites. Training units carry out all trash to avoid detection. Units may use blank ammunition and multiple integrated laser engagement system (MILES) equipment. MILES fires an eye-safe laser beam and each soldier wears a harness that senses the laser and indicates hits or misses. Field artillery and mortar fires are simulated by pyrotechnics that provide sound and visual effects.

Jungle warfare training has many of the same components as basic field training, but emphasizes subjects such as jungle living, land navigation, mines and booby traps, waterborne travel, and jungle combat/patrolling techniques.

2.1.2 Reconnaissance Training

Typical reconnaissance training operations involve small groups, from squad to platoon strength (3 to 50 soldiers). This type of training may take place in all types of terrain but can be constrained to extremely rugged terrain and thick vegetation. In many respects, reconnaissance training resembles dismounted maneuver training but does not have the same type of vehicle support. No live-fire is involved, and vehicles are not used. Reconnaissance training occurs on all Oahu subinstallations.

2.1.3 Live-Fire Training

Firepower is the capacity of an individual or unit to deliver effective weapons fire on a target or area to kill or suppress the enemy in its position, deceive the enemy, and support tactical maneuvers. Without effective firepower support, infantry units cannot maneuver. Firepower is the essential force used by military units to accomplish the combat mission. Maneuver live-fire training combines troop and vehicle movement with targetry on live-fire ranges.

Requirements for live-fire training varies depending on individual and unit mission, weapons assigned, and ammunition available. The individual soldier qualifies with an assigned weapon and then progresses through crew, squad, platoon, and company level live-fire exercises. Live-fire normally entails an individual gunner, a crew of a weapon system, or a collective unit firing at predetermined targets from designated firing positions on a range facility. Live-fire exercises at platoon and company level may incorporate "free" maneuver within the established safety zones of a range. Battalion- and brigade-level fire coordination training exercises may also be conducted on the range complexes designed for smaller units. Each weapon system and soldier has an assigned annual or semiannual live-fire requirement that must be met (HQDA 1997). Unit commanders must ensure that live-fire training meets readiness standards. Weapons proficiency, or qualification, is scored and recorded for each individual or crew and is reported collectively by unit.

All live-fire ranges on Oahu used by Legacy and proposed SBCT activities addressed by this Biological Assessment are located on Schofield Barracks Military Reservation (SBMR) and on the proposed South Range Acquisition Area, and are described in detail in those chapters.

Live-fire training includes many types of munitions, including ball, high-explosive, rockets, mines, grenades, all artillery and mortar, short-range training ammunition (low-velocity plastic bullets), explosives, and practice and training-practice ammunition. All live-fire training takes place on training ranges within surface danger zones established for that purpose. No live-fire training takes place outside of established ranges or surface danger zones. The firing of blank ammunition, including blank munitions up to .50 caliber, is not considered live fire. All live-fire ranges on Oahu used by Legacy and proposed SBCT activities addressed by this Biological Assessment are located on Schofield Barracks Military Reservation (SBMR), on the proposed South Range Acquisition Area (SRAA), and Kahuku Training Area (KTA) (proposed use of short-range training ammunition at KTA), and are described in detail in those chapters.

2.1.4 Bivouac

Bivouac consists of setting up camp for rest, resupply/refit, maintenance, or to provide support. Bivouac is normally not done while in direct or indirect contact with an enemy force. Units bivouac under field conditions to stabilize logistics and provide a common site for support operations. Bivouac sites vary depending on unit size and mission. Tactical operations may be staged from a bivouac site. The size of bivouac areas can range from 100 m X 100 m for a squad or platoon to 300 m X 300 m for a company size bivouac. A battalion (i.e., at Kahuku Training Area) level bivouac would separate into company size bivouac areas.

Depending on unit size, bivouac sites can contain a vehicle and weapons maintenance area, vehicle parking area, general supply area, munitions supply area, medical area, helicopter landing zones, and vehicle off-loading area. A bivouac site may consist of a series of tents, temporary structures, and equipment covered with camouflage nets. Tents provide sleeping/living areas, maintenance shops, supply storage, medical facilities, operations/communication areas and meal preparation areas. Meals are normally prepared in mobile field kitchens. Bivouac is normally done in level or gently rolling areas that provide vehicle and/or aircraft access. Sites are located to accommodate the unit support element, provide communication links and concealment from the enemy, and support maneuver operations. Open fires are not allowed during bivouac, but cooking in special mobile kitchens (enclosed ovens), and use of tent heaters (enclosed) and generators is permitted.

Bivouac sites are not designed to repulse an enemy attack; however, sites will have security and observation posts and may have individual fighting positions. Vehicle access routes are guarded, and roving patrols are established for security. Likely areas an enemy will approach are monitored and

designated for defensive planning and for repulsing an attack. Munitions used in bivouac typically consist of grenade and artillery simulators and blank ammunition. Bivouac training occurs on all Oahu subinstallations.

2.1.5 Deployment Training

Deployment training teaches soldiers how to prepare and move military units and supplies as part of a military action. It involves operational deployment of forces, as well as training that is specifically tied to deployment of forces. Deployment activities occur at Schofield, Wheeler Army Airfield (WAAF), Hickham Air Force Base (HAFB), and Bradshaw Army Airfield (BAAF) at Pohakuloa Training Area, nearly all within the confines of the military installations. All personnel must be trained and prepared for deployment.

Deployment training principally involves moving troops and equipment from SBMR to other subinstallations/installations. Transportation of units consists of a combination of vehicles, sea transport vessels, and aircraft, depending on the type and location of training. Legacy force personnel (25th ID(L) and other units) currently deploy to Pohakuloa Training Area, Hawaii (PTA) from Hickham Air Force Base or Wheeler Army Airfield using C-17 or C-130 aircraft. Equipment is deployed to PTA using approximately 30 Logistics Support Vessel (LSV) round trips from Oahu to PTA per year. Hickham Air Force Base is the strategic platform for out-of-state aerial deployments (i.e., all flights leaving or arriving in Hawaii), and is required to meet all federal and state carrier requirements for agricultural, horticultural, and other pests. Before loading vehicles on aircraft or ships for deployment between Oahu and PTA, vehicles will always be washed, as required by U.S. Air Force and Navy rules (pers. comm. Ron Borne 2/26/03).

Vehicle convoys are required for moving personnel and equipment between installations. A convoy is normally defined as six or more military vehicles moving simultaneously from one point to another over a given period of time. On Oahu, a convoy serial (a group of military vehicles moving together) is limited to 24 vehicles. Per command guidance, USARHAW convoys normally maintain a gap of at least 15 to 30 minutes between serials, and 165 to 330 feet between vehicles. In addition, units must seek permission from the 25th ID(L) for convoys of 25 vehicles or more. Permission must also be granted from the State of Hawaii Department of Transportation to move oversized or outsized cargo using state highways. As long as all federal, state, and Department of Defense (DOD) regulations are followed, no additional permits are required to move munitions. To ensure maximum safety, all convoys must comply with local policies, as specified in standing operating procedures, which address matters such as vehicle safety inspections and convoy safety briefing. Vehicle operators must be properly trained and licensed to operate assigned military vehicles. Military convoys are normally restricted from operating on state highways between the hours of 6:00 AM and 8:00 AM, and 4:00 PM to 6:00 PM during the normal work week. This is to avoid peak traffic hours and to reduce the risk of accident. In addition, convoys and ammunition movements normally are not authorized to pass through a school zone when students are in transit, that is, when school zone lights are flashing.

Typical deployment training focuses on segments of the deployment operation or key personnel and rehearses or exercises an identified element. Deployment training usually requires considerable simulation. Training exercises may range from testing the load plan of any given vehicle in a unit to an Emergency Deployment Readiness Exercise (EDRE), which is designed to simulate the movement plans of a unit or higher level to deploy to an overseas location. All deployable units normally participate in an EDRE annually. Executed realistically, EDREs provide a process for commanders to evaluate their units' strengths and weaknesses in a deployment. EDRE training is conducted primarily at Dillingham Military Reservation.

2.1.6 Aviation Training

Aviation training consists of aircrew training, maneuver training, and aerial gunnery. Aircrew training pertains to normal aviation flight skills, including takeoff and landings; normal, nap-of-the-earth, contour and low level flights; confined and high altitude area landing/takeoff; and navigation for helicopters. Air Force and Naval aviation high performance tactical and transport aircraft practice similar tactics at higher altitudes. Aircrew training tasks accomplished on subinstallations include all tactical maneuvers in accordance with each aircraft's standard aircrew training manual and unit standard operating procedures. Maneuver training pertains to the ability of aviation units to transport ground maneuver and combat support/combat service support units to support the tactical battlefield. High mobility and combat flexibility of aircraft are important assets on the battlefield to a maneuver commander. This type of training requires up to 20 helicopters flying in tactical formations carrying ground troops and equipment to battle areas. Aviation training is conducted daily on Oahu ranging from a single aircraft to flights of 10 helicopters. Large aviation task force operations can exceed 35 aircraft, but this event happens only one or twice per year.

Aviation live fire training follows the standard Army training methodology and progresses in a similar manner as the ground units. Once crews have qualified with their aircraft, they progress through section, platoon, and company live-fire exercises, as resources permit. Aviation live-fire training is supported with designated ranges with ground targets and scoring systems to determine weapons accuracy and weapons effects. Airspace management and control is especially critical in this training, given the speed of the aircraft involved and the multiple units using the airspace (for example, helicopters, artillery rounds, and jets). Aerial gunnery pertains to the abilities of aircraft (Army attack helicopters, cavalry units, and Air Force/ Naval tactical aircraft) to successfully engage targets with cannon rockets, missiles, or bombs. Aerial gunnery is a live-fire task accomplished on fixed ranges directly from the aircraft in flight to designated ground targets.

2.1.6.1 Landing and Drop Zone Activities

Flights of aircraft will pick up units of soldiers in pickup zones and carry them to tactical landing zones. Standard aircraft support packages consist of the following: 1) two UH-60 (Blackhawk) or one CH-47 (Chinook) and OH-58D (Kiowa Warrior) on a case-by-case basis for platoon support; 2) four UH-60 or two CH-47 and two OH-58D for company support; and 3) twelve to eighteen UH-60, four to eight OH-58D and two to four CH-47 for battalion support (25th ID(L) and USARHAW 2000). Primary users of LZs (landing zones) (Kahuku, Kawailoa, SBMR, SBER) are Army and Marine Corps units. LZs are also used by HI Army National Guard units, USARHAW Environmental Staff, civilian contractors and organizations and USARHAW Integrated Training Area Management staff. Drop zones are used primarily by Army, Marine Corps and HI Army National Guard units[11].
The aviation brigade and other aviation units supports infantry training through transport support via landing and pickup zones (LZs and PZs) and parachute drop zones (DZs). The LZ/PZ/DZs are used for training aviation crews on aircraft tasks (aircrew training tasks), infantry units on air assault tasks, ground maneuver tasks and also to train combat support and combat service support units in staging and support operations. Engineer units will occasionally train in these areas as a part of a restoration, or troop construction project, but not normally as excavation training. These LZ/PZ/DZs are important to accomplish tasks requiring single and multiple aircraft helicopter landing areas, parachute drop zones, open assembly/staging areas and open support operations areas. Drop zones are used for parachute drops of troops and equipment. Pickup and landing zones are used as starting and end points for foot

[11] Primary users based on 2002 Range Facility Management Support System (RFMSS) utilization data provided by USARHAW Range Division.

maneuvers. In an air assault exercise, troops dismount from the helicopters, the helicopters take off, and the troops disperse into the area adjacent to the landing zone (i.e., into the woodline). The unit then assembles and may attack one or more objectives before being picked up or moving to another location on foot. A platoon or company-size air assault might involve multiple trips by support helicopters, with the attack on the objective taking place once the entire unit has been transported. Equipment and or vehicles may be dropped as part of the exercise. An air movement exercise is similar but does not involve attacking objectives. At the company or smaller unit level, soldiers may be extracted via helicopter following the assault. For larger exercises at the battalion level or above, troops are not usually picked up by air, but are picked up by vehicles such as Humvees and cargo trucks.

Landing and drop zones are maintained by USARHAW, and may be individually "open" or "closed" depending on maintenance performed or needed. "Closed" drop zones may occasionally be used for emergency or administrative purposes. Personnel and equipment drops may take place at other approved drop zones. Vehicle support associated with landing zone exercises is confined to existing roads and trails.

2.1.7 Combined Arms Live-Fire Maneuver Training

Infantry companies are required to conduct at least one combined arms live-fire maneuver exercise (CALFEX) annually. Squad, platoon, and battalion CALFEX are also conducted. On Oahu, the Infantry Battle Area (Ranges KR4/KR5) are used for squad and platoon CALFEX (Vic Garo pers. comm. 2/6/03) and Makua Military Reservation supports Company and smaller unit CALFEX training. The following sections describe, in general terms, a company-level CALFEX. Similar scenarios using fewer vehicles and personnel apply to smaller units.

Movement to the CALFEX Site - Moving an infantry company to the CALFEX site typically involves approximately 150 persons and supporting elements via 10 to 15 military vehicles. Movements are scheduled to avoid peak commuter and school transit hours. Travel may be in convoys or individual vehicles dispersed throughout the traffic flow. Aviation units fly out to the CALFEX site at scheduled times prescribed in the training scenario. The unit ammunition section from the battalion support platoon draws ammunition to be used for the exercise at the ammunition storage point at WAAF, at the naval magazines at Lualualei, or at West Loch.

Preparation and Dry Fire - Units arrive at the training site and bivouac in designated areas near roadways. Ammunition is stored at ammunition supply points in the vicinity of the exercise and are guarded throughout the exercise period. Soldiers subsist on prepackaged meals-ready-to-eat or on delivered hot foods, and they use portable toilets. Planning and instruction generally last for two days. Pop-up targets and blast simulators are sometimes placed in the training area to replicate contact with the enemy. Unit leaders receive briefings from range division staff on the locations of threatened and endangered species and habitat, locations of known cultural resource sites, fire hazards, and fire prevention measures and procedures. Where necessary, the scenario is modified to reduce the risk of fire or other damage to the environment.

Live Fire Exercise - On the third and fourth days of a typical training week, unit personnel conduct their actual training exercise. The company generally moves with 3 platoons of approximately 30-40 men (or 9 squads of 5 to 10 men each, plus personnel operating machine guns and support personnel) toward the objectives. The soldiers in the first squad in the lead platoon fire their rifles and machine guns at the objective or target. The mortar section fires its 60mm mortars at the target while the lead platoon moves toward the target. When the lead platoon makes contact with the target, the platoon leader moves the squads to a position of advantage and, by spreading out the soldiers to ensure that they can hit every target, gains fire superiority over the "enemy". Most exercises present advancing platoons with the

problem of trench lines, mine fields (simulated), and concertina wire obstacles. Confronted with these situations, platoons must practice the skills required to enter and clear a trench line, to conduct a company deliberate attack, to conduct a platoon and squad attack, to knock out a bunker, and to conduct an initial breach of a mine field/obstacle. Some simulated minefields will be cleared with the aid of engineers attached to the company. Bangalore torpedoes (10-foot tubes filled with explosives) may be used to blast routes through such locations.

Upon seizing their objectives, units must prepare for any counterattack. A company commander may direct the emplacement of claymore mines (small, command-detonated antipersonnel mines) in front of the unit. If artillery is employed in the scenario, the company commander may distribute its fire preparatory to the attack or direct its fire toward a target to suppress counterattack. The commander may also direct the company's anti-armor section to position their missile launchers to prevent any enemy tanks from overrunning the just-taken objective. Company-level scenarios can be modified to include additional training opportunities and combat elements. Helicopters may be used for air assault. Aviation support in observation and attack helicopters may fire their guns into designated impact areas in support of ground troop movement. Helicopters may also be sling-loaded with vehicles and equipment for the company's use. Artillery support is an integral part of combined arms training. The size of the howitzer (155mm or 105mm), a cannon that combines certain characteristics of guns and mortars, depends on the range being used. A typical exercise involves at least two gun sections. Scenarios are typically conducted both day and night in order to complete a training evaluation to Army standard.

Conclusion of Training - On the final day, units remove any target equipment they may have provided, gather brass casings from spent rounds, remove litter, and otherwise make every effort to restore the range to its condition prior to their use. Explosive ordnance disposal (EOD) specialists destroy all unexploded ordnance. Ordnance normally is destroyed where it is found, whether from the training being conducted or from earlier exercises. No known dud rounds are left in place at the conclusion of a training exercise.

2.1.8 Major Force-on-Force Training

In a major force-on-force scenario, a battalion or brigade engages an opposing force in non-live-fire maneuver over a relatively large area, typically for an extended period (ten or more days), with the involvement of combat service and combat service support forces. At SBMR, the elements of a force-on-force training scenario are tailored to fit the available resources. The primary area used for large scale force-on-force missions on Oahu is Kahuku Training Area. A brigade commander would attempt to expose subordinate units to the phases that would be encountered in actual operations, such as pre-deployment, low intensity conflict, mid-intensity conflict, and evaluation, inspection, and cleanup.
In a brigade-sized operation, as an exercise progresses, the battle zone develops into a linear configuration divided into three areas of operations: the forward area or security zone, the main battle area, and the brigade rear. Distinctive types of operations occur in each of these areas.

The security zone is where the opposing force is located, forward of friendly troops. Activities in the security zone are characterized by small unit reconnaissance operations as the friendly forces try to locate the enemy, define the situation, and provide early warning. Most training occurs in the security zone during special forces operations and low-intensity conflict phases. During these phases, both friendly and enemy forces "sneak and peak," attempting to remain undetected as they conduct reconnaissance and harassment operations. Normally, only minimal vehicle and helicopter activity occurs within the security zone. Use of blank ammunition and pyrotechnics is intermittent and sporadic during small unit skirmishes. Ground disturbance is primarily limited to constructing hasty fighting positions and positioning obstacles such as simulated minefields.

The majority of a brigade task force's troops occupy the main battle area. The main battle area is where most intense combat training occurs. It is during the mid-intensity conflict that the main battle area develops and intensified combat operations occur. Participants engage in activities such as preparing defenses and fortifications, moving personnel, vehicles, and aircraft, and engaging in intensive combat. Blank ammunition and pyrotechnics are used extensively in the main battle area.

The brigade rear area, located behind friendly combat units, is where selected headquarters elements, administrative, logistical, medical, and aviation field operating sites are positioned. It is a secured area characterized by fixed field sites from which forward combat units are resupplied either by wheeled vehicles or by helicopter and where maintenance and medical facilities are located. Disabled vehicles may be brought to the brigade rear area for repair. Rear area logistics operations and facilities are centered at a complex called the brigade support area (BSA). The brigade support area itself depends on aerial resupply by participating attached and supporting units. Construction of defensive and fighting positions in the brigade rear are concentrated around the brigade support area for protection against opposing force attacks. There may be some use of blank ammunition and pyrotechnics in the brigade rear.

Specific military activities in a force-on-force exercise normally include cross-country vehicle maneuvers, blackout driving, using pyrotechnics and artillery simulation devices, building hasty/limited defensive positions, emplacing obstacles, and establishing forward/rear support areas or field hospitals. Vehicles are moved on hardened and improved all-weather roads, with limited use of unimproved roads and trails. Cross-country travel usually involves Humvees or other wheeled vehicles.

2.1.9 Combat Service Support (CSS) Operations and Training

Oahu units of the 25th Division Support Command (DISCOM) consist of the 225th Forward Support Battalion (FSB) supporting the 2nd Brigade, the 325th FSB supporting the 3d Brigade, the 725th Main Support Battalion (MSB) supporting the division troops and reinforcing the FSBs, and a Headquarters and Headquarters Company. The mission of the these units is transportation, logistics, maintenance, and medical support. Each battalion has three companies, but is normally deployed for training or combat as a battalion.

Support operations consist of setting up camp for rest, resupply/refit, and maintenance or to provide other services. Support areas normally are not established while units are in direct or indirect contact with an enemy force. Units establish support areas under field conditions to stabilize logistics and provide a common site for support operations. Support areas vary depending on unit size and mission. One of the larger operations is the establishment of a brigade support area (BSA). Tactical operations may be staged from a support area. Depending on unit size, support areas can contain a vehicle and weapons maintenance area, vehicle parking area, general supply area, munitions supply area, medical area, helicopter landing zones, and vehicle off-loading area. A support area typically consists of a series of tents and other temporary structures and equipment covered with camouflage nets. Tents provide sleeping and living areas, maintenance shops, supply storage, medical facilities, operations and communication areas, and meal preparation areas. Meals are normally prepared in mobile field kitchens. Support areas are normally established in level or gently rolling areas that provide vehicle and aircraft access. Sites are chosen to accommodate the unit support element, to provide communication links, to provide concealment from the enemy, and to support maneuvers. Open fires are not allowed, but enclosed tent heaters and generators are permitted.

Support areas have security and observation posts and may have individual fighting positions near the perimeter. Vehicle access routes are guarded, and roving patrols are established for security. Likely areas an enemy will approach are monitored and designated for defensive planning and for repulsing an attack.

Munitions used in training typically consist of grenade and artillery simulators and blank ammunition. CSS operations and training occur on all Oahu subinstallations

2.1.10 Training Exercises and Scenarios Occurring in Hawaii

2.1.10.1 Training Exercises

- *Map exercise (MAPEX).* The MAPEX portrays military situations on maps and overlays. It requires a minimum number of support personnel and may be conducted in garrison or in the field. Communications equipment may be used. A MAPEX helps the commander train his staff and leaders in planning, coordinating, and executing operations tasks on map boards, chalkboards, training mock-ups, and sand tables. A MAPEX trains soldiers and leaders to function as an effective team, exchange information, prepare and give appraisals, make recommendations and decisions, prepare plans and issue orders, and coordinate execution of orders.

- *Tactical Exercise Without Troops (TEWT).* The TEWT is conducted on actual terrain with unit leaders and staffs, without soldiers. A TEWT allows a battalion task force or company commander to train his staff and subordinate leaders. It also allows him to analyze, plan, and present how he would conduct an operation on the actual terrain. Because only the battle staff and selected support personnel are involved, the TEWT is an inexpensive way to familiarize leaders with an area of operations. A TEWT can be used to train personnel to analyze terrain, employ units according to terrain analysis, emplace weapons systems to best support the unit's mission, prepare and validate plans, and to plan combat support and combat service support operations.

- *Fire Coordination Exercise (FCX).* The FCX is used to train the combined arms team chain of command and related fire control elements to rapidly synchronize fires on the battlefield. The exercise can use reduced-scale targets and training facilities to depict combat situations. The chain of command must respond in the form of maneuver and fire coordination techniques and procedures. Each subunit is represented by a single weapon system, which can be equipped with a subcaliber device and commanded by a platoon or section leader. Commanders use FCXs to develop the chain of command into a team, synchronize fires within the combined arms team, train the chain of command prior to a live fire exercise, exercise the communications net, assist in integrating new weapons system, and portray a rapidly changing situation for the chain of command to react to. FCXs are normally used to train from platoon through battalion level.

- *Command Post Exercise (CPX).* The CPX may be conducted in garrison or in the field. It requires the establishment of the command post. When compared with the MAPEX or TEWT, it represents a greater commitment of soldiers' time and resources. A CPX is an expanded MAPEX for staff and all commanders to lead and control tactical operations by using tactical communications systems. Normal battlefield distances between command posts may be reduced. A CPX trains commanders and staff to build teamwork and cohesion, exchange information by proper reporting in accordance with tactical standing operating procedures (SOPs), prepare plans and orders, establish and employ tactical communications, displace headquarters and command posts, and integrate synchronized battlefield operating systems. While battalions and companies may participate in a CPX as part of a larger force, they also may conduct internal CPXs.

- *Situation Training Exercise (STX).* STXs are mission-related, limited exercises designed to train one collective task, or a group of related tasks and drills, through practice. STXs teach the standard, preferred method for carrying out the task. They are more flexible than drills and usually include drills, leader tasks, and soldier tasks. STXs may be modified, based on the unit METL (mission essential task list), or expanded to meet special mission requirements. The company commander trains STXs and other similar exercises while platoons execute combat and crew drills. The battalion commander does the same for company exercises. The battalion commander assigns his staff to evaluate and assist with the STX. The STX's final objective is to prepare units for larger scale exercises. Prerequisite training for the STX is progressive with heavy emphasis on drills. "Close-in" or local training follows with drills executed in a tactical setting using multiple integrated laser engagement systems (MILES).

- *Command Field Exercise (CFX).* The CFX lies on a scale between the CPX and Field Training Exercises (FTX) (see below). The CFX can be a backup for the FTX if maneuver damage, weather, or other factors prohibit a planned FTX. The CFX is an FTX with reduced unit and vehicle density, but with full combat arms, combat support, and combat service support elements. For example, a platoon leader in his vehicle represents the entire platoon. CFXs provide vehicles for training leaders and staff with full command, control, communications, and logistical systems. They sharpen unit skills in such areas as intelligence, fire support, rear area operations, and command, control, and communications. A CFX can train as much, or as little, of the unit as necessary, depending on the commander's assessment and training objectives.

- *Logistical Coordination Exercise (LCX).* LCXs allow leaders to become proficient at conducting unit sustainment operations such as supply, transportation, medical, personnel replacement, maintenance, and graves registration. LCXs provide hands-on opportunities to deal with combat-related challenges of these activities. Through LCXs, leaders develop SOPs essential to effective task accomplishment. An LCX clarifies key elements of a battalion, squadron, or task force logistics apparatus, exercises the flow of logistical information, incorporates a tactical war game that produces a wide variety of logistical requirements, and exercises the communications network.

- *Field Training Exercise (FTX).* FTXs are conducted under simulated combat conditions in the field. FTXs fully integrate the total force in a realistic combat environment. They involve combat arms, combat support, and combat service support units. FTXs encompass such training as battle drills, crew drills, and STXs to reinforce soldier and collective training integration. They are used to train the commander, staff, subordinate units, and attached elements to move and maneuver units realistically, employ organic weapons systems effectively, build teamwork and cohesion, plan and coordinate supporting fires, and plan and coordinate logistical activities to support tactical operations.

- *Live Fire Exercise (LFX).* LFXs are resource-intensive events in which units maneuver and employ organic and supporting weapons systems using full-service ammunition. LFXs integrate all combat arms, combat support, and combat service support elements. Since extensive range and resource requirements usually limit LFXs to platoon and company team levels, their principal focus is on unit and weapons integration at company team level. LFXs provide realistic training on collective and soldier skills in such areas as, fire control and distribution, command and control in a noisy, confusing environment, individual movement techniques, integration of all fire support assets, small-unit tactics, weapons, demolitions, and other pyrotechnics not used in other exercises, and safety awareness.

- *Reconnaissance Training.* Dismounted reconnaissance training is conducted by Legacy units at present and will also be conducted by elements of the SBCT. Typical operations involve small groups, from squad to platoon strength (3 to 50 soldiers). No live fire is involved, and vehicles are not used. The training is conducted between 20 and 40 times per year, in daytime and at night. Unit movement during dismounted training activities may consist of soldiers in tactical (when contact with an enemy is likely) and non-tactical (when contact with an enemy is not likely) formations moving in a predetermined direction to accomplish a mission. Maneuver also entails the set-up of temporary defensive positions to repel an enemy attack. Defensive positions may consist of soldiers lying in concealed positions and designating fire zones. During extended reconnaissance maneuver training, soldiers may sleep in the field. To avoid detection and allow for quick displacement, tents are not set up during light infantry maneuvers. infantry maneuvers.

2.1.10.2 Training Scenarios

- *Force-on-Force (FOF) Operations.* These operations involve armed clashes between two organized forces, up to brigade-level. Activities include dismounted ground maneuvers during day and night, helicopter operations day and night, operation of wheeled and tracked vehicles, establishment of field command centers, establishment of operating sites for logistics and aviation units, and preparation of field fortifications. There is a continuous movement of aircraft, vehicles, and troops within the training area during FOF operations. The multiple integrated laser engagement systems (MILES), blank ammunition and artillery, flares, and other pyrotechnic devices may be used extensively to simulate live fire during FOF operations.

- *Live-Fire Exercises.* These operations involve light infantry units practicing the firing of many types of weapon systems, including the integration of organic and attached aviation and close air support. Depending on the sophistication of the training range, company and platoon-size units maneuver and fire live ammunition at realistic fixed and moving targets in a simulated combat setting. Live-fire maneuver operations for Hawaii-based units are presently limited, but implementation of the proposed action would increase their availability and utility.

- *Military Operations in Urban Terrain (MOUT).* These operations provide realistic training in third world urban warfare scenarios. MOUT facilities typically represent several kinds of properties that might be encountered by soldiers and leaders, such as a city complex, an airfield, and a military compound. Force-on-force training for light infantry and Special Forces can be conducted throughout MOUT facilities using the MILES (laser targeting system). Depending of training complex capabilities, precision engagement live-fire training may be conducted in buildings in a MOUT complex.

- *Special Forces.* Special Forces training concentrates on clandestine, cover, and low-visibility techniques used to gather intelligence data on a target or to conduct limited offensive strikes.

- *Operations Other Than War (OTW).* Training exercises for OTW include activities that occur during peace time and war time and consist of a variety of tasks such as Special Forces Operations, peace-keeping, and peace-enforcement actions. These training activities emphasize military interactions with civilians-on-the-battlefield and MOUT, with limited FOF training. Exercises are often conducted at specially-constructed villages that replicate population centers in third world countries.

2.1.11 Military Unit Missions and Descriptions

The following section describes the military units currently training on Army-controlled Oahu lands. The 25th ID(L) is the primary fire and maneuver user of Oahu training lands. Oahu subinstallations support infantry brigades, division artillery, aviation brigade, and other divisional combat support (CS) and combat service support (CSS) units. The division has two ground maneuver brigades, division artillery with two direct support battalions, and an aviation brigade stationed on Oahu.

2.1.11.1 Army Units – 25th ID(L)

Light Infantry Brigade. The 25th ID(L) has three light infantry brigades (approximately 1,700 soldiers each), two at Schofield Barracks and one at Fort Lewis, Washington. Each brigade contains three light infantry battalions. The mission of these infantry battalions (approximately 500 soldiers each) is to close with and capture, neutralize or destroy the enemy with fire and maneuver. Each infantry battalion contains three infantry maneuver companies. The infantry rifle company (approximately 120 soldiers each) is the fighting organization by which the tactical combat mission is accomplished. Each infantry company consists of three platoons (approximately 35 soldiers each). Each platoon is made up of three infantry squads (approximately 9 soldiers each).

Aviation Brigade. The 25th ID(L) 25th Aviation Brigade (approximately 1,373 soldiers) consists of one Attack Helicopter Battalion (approximately 24 aircraft and 231 soldiers), one Air Assault Helicopter Battalion (approximately 41 aircraft and 358 soldiers) and the Cavalry Squadron (approximately 16 aircraft, 21 tactical vehicles, and 261 soldiers). The mission of the Attack Helicopter Battalion is to close with and neutralize or destroy the enemy with fire and maneuvers. The mission of the Air Assault Helicopter Battalion is to provide command and control, transportation, and air-mobility support. The mission of the Cavalry Squadron is to provide surveillance, detection, screening, deception, and to close with and capture or destroy the enemy with fire and maneuver. Each battalion/squadron will have three line aviation companies/cavalry troops, but are normally deployed for training or combat as battalions/squadrons.

Division Artillery. The 25th ID(L) Division Artillery (approximately 1,000 soldiers) provides artillery support to infantry maneuver units. The Division Artillery has three direct support artillery howitzer cannon battalions (approximately 300 soldiers) (two at Schofield Barracks and one at Fort Lewis), and one general support howitzer cannon battalion, whose mission is to provide indirect fire support to an infantry maneuver brigade to destroy or neutralize the enemy with fire. Each artillery battalion has three artillery batteries. The battery (approximately 40 soldiers) is the firing organization by which the tactical combat mission is accomplished.

Air Defense Artillery Battalion. The 25th ID(L) Air Defense Artillery Battalion (approximately 250 soldiers) provides missile and cannon support to the division maneuver and support units. The Air Defense Battalion has three batteries (approximately 45 soldiers) (two at Schofield Barracks and one at Fort Lewis, Washington).

Division Support Command. The Division Support Command is a brigade-sized (approximately 1,200 soldiers) unit that supports maneuver operations and supervises operations of subordinate units. Under the brigade there are three Forward Support Battalions (two at Schofield Barracks and one at Fort Lewis), and one Main Support Battalion. The mission of the Forward/General Support Battalions is transportation, logistics, maintenance, and medical support. Each battalion will have three companies, but are normally deployed for training or combat as battalions.

Engineer Battalion. The 65th Engineer Battalion (approximately 300 soldiers) is a combat support unit that provides tactical engineering, construction, demolition, breaching, and mine laying support to division maneuver and support units.

Other 25th ID(L) Units. Other 25th ID(L) units include Military Police, Military Intelligence, Signal, and Personnel battalions. These units support infantry maneuver units with specialized expertise to accomplish mission tasks in law enforcement, intelligence, communications, and personnel actions. These units are combat service support units.

Task Force. Task force is a force that combines a maneuver unit and its support slice elements, either habitually or temporary, for training or combat. A task force consists of approximately 2,000-3,000 soldiers. An example of a brigade task force is one infantry brigade supported by one artillery battalion, one support battalion, one aviation company, one engineer company, one air defense company, one military police platoon, one intelligence platoon, and any other required units to field an independent tactical maneuver unit.

2.1.11.2 Army – Other Units

Other Army units include the 45th Corps Support Command (Hawaii) (approximately 2,000 soldiers), a combat service support (CSS) unit, combat support (CS) and combat service support Army Reserve units, and the Hawaiian Army National Guard.

45th Corps Support Command (Hawaii). The Corps Support Group (CSG) is similar to a Division Support Command (DISCOM) and a brigade-sized unit (approximately 2,000 soldiers) whose mission is to provide command and control, provide logistics, support maneuver operations and supervision of operations of the subordinate units. The mission of the internal support units is transportation, logistics, construction, maintenance and medical support. While the 45th CSG will normally support more than one division in combat, it supports the 25thID(L) during training in Hawaii. A CSG is a combat service support unit.

U.S. Army Reserve. Army Reserve units that use Oahu Army lands are normally combat or combat service support units that are similar to DISCOM units in size and mission. In Hawaii there is one reserve Combat Infantry Battalion (100-442 IN BN) that may occasionally train on Oahu Army lands in similar tasks to active duty infantry units.

2.1.11.3 Marines

The USMC (U.S. Marine Corps) training asset inventory does not have adequate land resources to support all of their training. Consequently, they utilize Army training lands to meet their training requirements. These units have organic infantry, artillery, and aviation assets that train to similar standards as the Army. Oahu Army subinstallations are used as a local training area for the 3rd Marine Regiment located at Kaneohe Marine Corps Base, Hawaii, on the island of Oahu.

2.1.11.4 State of Hawaii Army National Guard

The Hawaii Army National Guard has two primary missions. The federal mission is to serve as an integral component of the Army by providing fully manned, operationally ready and well-equipped units that can respond to any national contingency. The state mission is to provide an effective and organized force to respond to natural or human-caused disasters or unique needs of the state and its communities. The National Guard, while a state organization, trains to the federal Army military standards. The 29th Separate Infantry Brigade is part of the Hawaii Army National Guard and is headquartered on Oahu.

2.1.11.5 Allied Armed Forces

Any allied units deploying to Oahu for training will match size and mission tasks to similar 25th ID(L) units.

2.2 Army Transformation and the Stryker Brigade Combat Team (SBCT)

The Army has proposed the transformation of the 2nd Brigade, 25th Infantry Division (Light), or 25th ID(L), from a light brigade to a Stryker Brigade Combat Team (SBCT). The SBCT would help the Army meet the challenges of modern warfare by providing a rapidly deployable lethal force with vehicle transport. Construction and other proposed activities would occur only after the Army signs its Record of Decision on the Environmental Impact Statement prepared under the National Environmental Policy Act (NEPA). The record of decision (ROD) is currently projected for October 2003. The projected equipment fielding date is May 2005. SBCT design conversion will require approximately one year, and the unit is projected to be mission capable by May 2007.[12] Conversion would result in a net gain of approximately 810 soldiers and 400 vehicles to the 25 ID(L) (R. Borne, pers. comm., 30 April 2002, Waianae, Hawaii). The Army's current war fighting prowess is assembled around heavy and light forces. Heavy forces are well equipped for war but difficult to deploy strategically. Light forces can respond rapidly worldwide, but lack staying power against mechanized or armored forces. Army Transformation is driven by the requirement for enhanced lethality, survivability, and deployment capabilities. In this new vision the Army will transform itself into a force capable of dominating the full spectrum of operations at all levels of conflict (Headquarters, Department of the Army (HQDA) 2001).

The three major objectives of the Army Transformation process are the Initial Force, Stryker Force, and Objective Force. The existing force is referred to as the Legacy Force. The Initial Phase of Transformation involved the creation of two Initial Brigade Combat Teams (BCTs) at Fort Lewis, Washington. The initial brigades will be used to evaluate and refine the Operations and Organization (O&O) concept for a BCT, and to validate tactics, techniques, and procedures (USACE Mobile District 2001). The Stryker Capability Phase of Transformation converts five to eight existing brigade-sized units to Stryker BCTs (i.e., the Stryker Force). The Stryker Force is designed to meet a current operational shortfall the Army has had since Desert Storm. These SBCTs will enhance the Army's capabilities as it continues to develop the Objective Force.

All of the BCTs are to be equipped with light and medium armored vehicles (i.e., no heavy armor or tracked vehicles such as tanks and Bradley fighting vehicles). Following the two brigades at Fort Lewis, the following units are currently slated for conversion:

- 172nd Infantry Brigade (Separate), Fort Wainwright, Alaska
- 2nd Armored Cavalry Regiment (Light), Fort Polk, Louisiana
- 2nd Brigade, 25th ID (L), Schofield Barracks, Hawaii
- 56th Brigade, 28th Infantry Division (Mechanized), Philadelphia, Pennsylvania

One of the Fort Lewis units is becoming lighter and more mobile compared to its previous configuration and equipment, while the other Fort Lewis Brigade and the other three active duty brigades slated for conversion are currently light units whose capability will be enhanced by the transformation.

The Stryker Force is being fielded primarily with off-the-shelf equipment and technological insertions and will provide immediate deploy-ability and breakthrough maneuver capabilities to bridge the current

[12] http://www.ttsfo.com/SBCTeis/general/summary.htm, 25th ID(L) and USARHAW Transformation Web Page, 24 July 2002.

gap between the Army's heavy and light forces until technology developments make fielding of the Objective Force possible. The core qualities of the SBCT are high mobility (strategic, operational, and tactical) and the ability to achieve decisive action through dismounted infantry assault, supported by SBCT direct and indirect fire weapons, and enabled by situational understanding (HQDA 2000). The primary fighting elements are motorized infantry battalions.

The Stryker vehicle has been selected as the basic platform for the family of vehicles that will equip SBCTs (Figure 2.a). The Stryker is a highly deployable, wheeled armored vehicle that combines firepower, battlefield mobility, survivability and versatility with reduced logistics requirements. The Stryker is built on a platform similar to that of the LAVIII, Canadian Bison, and Mowag PiranahIII vehicles, all manufactured by General Motors Defense Corporation. At Fort Lewis, Washington, the first of the two initial brigades (3rd Brigade of the 2nd Infantry Division, and the 1st Brigade of the 25th Infantry Division) began training in April 2001 with Light Armored Vehicles (LAVIIIs) borrowed from the Canadian Army, and were equipped with the initial delivery of Stryker vehicles in summer 2002.

Figure 2.a. Stryker Armored Vehicle, Infantry Carrier Vehicle (ICV) Variant[13].

Stryker vehicle maneuvers will constitute a significant component of Stryker brigade training activities. The Stryker will be fielded to SBCT units in two basic configurations: an infantry carrier vehicle (ICV) and a mobile gun system (MGS). There are eight variants of the ICV, including a mortar carrier; reconnaissance; anti-tank guided missile; fire support; engineer support; command and control; medical evacuation; and a nuclear, biological and chemical (NBC) reconnaissance vehicle.

2.2.1 SBCT Operations and Organization

SBCT description, operations, and capabilities are largely derived from the SBCT Organizational and Operational Concept (HQDA 2000). The SBCT is organized primarily as a combined arms, mounted infantry organization. The Stryker Infantry Carrier Vehicle (ICV), previously referred to as the Light Armored Vehicle (LAVIII), serves as the platform for the infantry carriers, mobile gun systems, mortars, RSTA (reconnaissance, surveillance, and target acquisition) elements, anti-tank carriers, engineer mobility support vehicles, NBC reconnaissance, as well as many of the command and control carriers within the Brigade (HQDA 2000). As a supporting brigade to a light division, the SBCT extends the

[13] http://www.gm-defense.com (June 2002). General Motors Defense. Military Products, Stryker Family of Vehicles.

tactical mobility available to the division commander and increases the firepower available to support dismounted infantry assaults. The typical size and composition of each element is presented in Table 2.a. As the most mobile, lethal, and survivable element within the 25th ID (L), the 2nd Brigade SBCT is likely to be employed as the main effort within the Division (HQDA 2000). All tactical vehicles are wheeled (i.e., motorized). The number of vehicles and personnel in each major organizational unit of an SBCT and Legacy Brigade is presented in Table 2.b. Vehicles and weapon systems are described in detail in Appendix A.

Table 2.a. General Structure of Army Forces.

Element	Number of Soldiers	Leader
Team	3-5	Non-commissioned officer
Squad/Section	8-10	Non-commissioned officer
Platoon	16-44	Lieutenant
Company/Battery/Troop	62-190	Captain
Battalion/Squadron	300-1,000	Lieutenant Colonel
Brigade	3,000-5,000	Colonel

Source: USAEC Mobile District 2001

Major elements of the SBCT include:

- Three motorized, combined arms infantry battalions, each composed of three combined arms rifle companies and a headquarters company.
- Reconnaissance, surveillance, and target acquisition (RSTA) squadron
- Antitank company
- Artillery battalion
- Engineer company
- Brigade support battalion
- Brigade headquarters and headquarters company
- Signal company
- Military intelligence company

Each major element of the SBCT is composed of a number of smaller units. Individual training activities often consist of squad, section, platoon and team-sized units operating in a dispersed but coordinated manner. Despite some changes in equipment, capability, and training doctrine, training activities are anticipated to be very similar to those currently conducted by light infantry brigades stationed on Oahu and training on Oahu and the island of Hawaii (pers. comm. Ron Borne, 12 Feb 2002).

SBCT organization consciously excludes other unit-based capabilities often provided in a division slice, such as aviation, air and missile defense, combat and construction engineers, and military police. Embedding separate sub-units would introduce unacceptable challenges with respect to the SBCT requirement to meet a 96-hour deployment timeline as a strategically responsive, early entry force. If specific missions require these capabilities, they will be tailored to the SBCT in augmentation packages (HQDA 2000). Reorganization of division support units, as mentioned above, have not yet been described, so the ratio (if any) of the Legacy force support units being involved or absorbed into the SBCT is not known. No changes are foreseen for the USARHAW Aviation Brigade. Improved tables of organization and equipment (ITOE) may be used to characterize changes in Legacy support slice elements (R. Borne, pers. comm., 30 May 2002).

Table 2.b. Personnel and Major Equipment Breakdown for One SBCT, One Light Infantry Brigade and Other Supporting Units.[1]

Unit Type	Personnel Strength	Command Stryker	Engineer Stryker	Fire Support Stryker	Anti-Tank Stryker	Mobile Gun Sys	Infantry Stryker	Recon Stryker	Mortar Stryker	Ambulance Stryker	Towed Howitzer[2]	Total Strykers	MTVs and LMTVs (Truck)[3]	HEMMT (Truck)[4]	HMMWV[5]	Total Trucks	Trailers	Other Equipment
SBCT Force																		
Headquarters and Headquarters Company	121	2										2	2	0	32	34	10	
Engineer Company	120		9									9	5	0	10	15	20	3 recon boats, 1 bridge set
Anti-Tank/Anti-Armor Company	53			1	9							10	1	0	3	4	2	
Signal Company	74											0	0	0	35	35	3	
Military Intelligence Company	67											0	2	0	28	30	7	
Infantry Battalion	682	8		3		9	36	4	10	4		74	11	0	35	46	48	
Infantry Battalion	682	8		3		9	36	4	10	4		74	11	0	35	46	48	
Infantry Battalion	682	8		3		9	36	4	10	4		74	11	0	35	46	48	
Reconnaissance, Surveillance, and Target Acquisition (RSTA) Squadron	423	1		3				36	6	4		53	7	0	72	79	52	4 unmanned aerial vehicles
Field Artillery Battalion (155mm towed)	290										12	0	25	0	56	81	17	12 towed 155mm howitzers
Combat Support Service (CSS) CO	234																	
Brigade (Forward) Support Battalion	390											0	39	55	80	174	124	6 forklifts
SBCT Totals	3818	27	9	13	9	27	108	48	36	16	12	293	116	55	421	590	379	

Table 2.b. Personnel and Major Equipment Breakdown for One SBCT, One Light Infantry Brigade and Other Supporting Units.[1]

Unit Type **Light Infantry Brigade**	**Personnel Strength**	**Command Stryker**	**Engineer Stryker**	**Fire Support Stryker**	**Anti-Tank Stryker**	**Mobile Gun Sys**	**Infantry Stryker**	**Recon Stryker**	**Mortar Stryker**	**Ambulance Stryker**	**Towed Howitzer[2]**	**Total Strykers**	**MTVs and LMTVs (Truck)[3]**	**HEMMT (Truck)[4]**	**HMMWV[5]**	**Total Trucks**	**Trailers**	**Other Equipment**
Infantry Battalion	570																	
Infantry Battalion	570																	
Infantry Battalion	570																	
Light Brigade Totals	1785												10		164	174	93	
Other Support Slice Units[6]																		
Headquarters and Headquarters Company	74															25	12	
Field Artillery BN	420										18		18		41	59	32	
Forward Support BN	194												28		174	202	19	
Engineer CO	89												11		44	55	40	Misc Tractors - 24
Air Defense Artillery (ADA) CO	79												4		23	27	7	
Signal Company	139																	
Combat Service Support CO	239																	
Military Intelligence CO	41												2		13	15	5	
Military Police Platoon	23														4	4	1	

Table 2.b. Personnel and Major Equipment Breakdown for One SBCT, One Light Infantry Brigade and Other Supporting Units.[1]

Unit Type	Personnel Strength	Command Stryker	Engineer Stryker	Fire Support Stryker	Anti-Tank Stryker	Mobile Gun Sys	Infantry Stryker	Recon Stryker	Mortar Stryker	Ambulance Stryker	Towed Howitzer[2]	Total Strykers	MTVs and LMTVs (Truck)[3]	HEMMT (Truck)[4]	HMMWV[5]	Total Trucks	Trailers	Other Equipment

[1] Data sources: IAV (Stryker Armored Vehicle) counts from 2001 version of the Army Stationing Installation Plan (ASIP) (G. Weith, pers. comm., 26 Feb 2002). Truck and HMMWV counts are from the SBCT Organizational and Operational Concept (HQDA 2001). Personnel counts are from the USARHAW Transformation Office (Cpt. Blandford)
SBCT Trailer, Other equipment, and Combat Service Support Company counts are from MTOE WAH9AA 26 June 2001
Light Infantry Brigade counts are from MTOE WAL1AA, 2d Bde, 25th ID(L) and USARHAW G3 Training Division (Cpt. Owen)
[2] 155mm Stryker is still in development; artillery will be towed 155 mm (G. Weith, pers. comm., 15 June 2002)
[3] MTV and LMTV = Medium and Light Medium Tactical Vehicle (Truck)
[4] HEMMT = Heavy Expanded Mobility Tactical Truck
[5] HMMWV = High Mobility Multipurpose Wheeled Vehicle (also referred to as 'Humvee')
[6] Unit sizes are typical for supporting one Light Infantry Brigade.

2.2.2 SBCT Unit Descriptions[14]

2.2.2.1 Infantry Battalions (Three)

The mission of the SBCT infantry battalion is to close with the enemy by means of fire and maneuver to destroy or capture him, or to repel his assault by fire, close combat, and counterattack. The motorized infantry battalions are the primary maneuver elements within the SBCT. The incorporation of snipers, mobile gun systems, and Stryker (automatic 40 mm grenade launcher) equipped fire support teams provides the appropriate systems required for combined arms integration in support of dismounted operations by squads, platoons, and companies.

Each infantry battalion consists of three rifle companies and a headquarters and headquarters company (HHC). The rifle company is the primary combat element within the infantry battalion. Each rifle company is organized as a combined arms element with a company headquarters section, three rifle platoons, and mobile gun system (MGS) platoon, a mortar section, and a three-person sniper team. Each rifle platoon consists of a mounted element and the infantry squad elements (platoon headquarters, three rifle squads, and one weapons squad). The HHC consists of two elements: (1) the headquarters section, consisting of the battalion command section and the principal and special staff, and (2) the headquarters (HQ) company, which consists of the HHC headquarters and the battalion's reconnaissance, mortar, and medical platoons and sniper squad.

The infantry battalion is able to fight on any type of terrain, but is especially suited for operations in close, complex, or urban terrain. It is also well suited for stability and support operations, where its ability to control terrain and conduct small unit operations (e.g., raids, ambushes, patrols, checkpoints, convoy security, etc.) can be applied. Constituent rifle companies and platoons generally operate dispersed within the battalion's area of operations.

The mobile gun system (MGS) "can move rapidly under a variety of terrain conditions, negotiating soft ground, shallow trenches, small trees, and limited obstacles. The MGS is a fighting vehicle but not a Bradley or tank and should not be employed in the traditional sense of a fighting vehicle." (HQDA Undated, HQDA 2001a). The MGS is designed primarily for breaching walls, bunkers, and other obstacles to facilitate passage by dismounted infantry.

The most common training scenarios focus on dismounted infantry operations by its rifle platoon squad. The primary base of fire is provided by the respective platoon's weapon squads and supported, when possible, by direct and indirect fires from supporting systems.

2.2.2.2 Reconnaissance, Surveillance, and Target Acquisition (RSTA) Squadron

The mission of the RSTA squadron is to develop situational awareness and knowledge in the area of operations through multi-dimensional reconnaissance, surveillance, and target acquisition. The RSTA Squadron is the "eyes and ears" of the SBCT, and the primary intelligence collection and information source, working closely with infantry battalion reconnaissance platoons and other intelligence, surveillance, and reconnaissance (ISR) assets managed at the brigade level. The Squadron can reconnoiter up to nine routes simultaneously or conduct surveillance on up to eighteen designated areas simultaneously or a combination thereof. RSTA can be performed in urban and other complex terrain

[14] Vehicles and equipment contained in each SBCT unit are presented in Table 2.b.

situations. Unmanned aerial vehicles (UAVs) provide air reconnaissance that, in combination with ground reconnaissance, provides situational awareness and knowledge throughout a large area of operations. UAVs will be used at Kahuku and Kawailoa Training Areas.

The RSTA squadron includes a headquarters troop, three reconnaissance troops, and a surveillance and target acquisition troop. Each reconnaissance troop consists of a troop headquarters, three reconnaissance platoons, and a mobile 120 mm mortar section. The squadron's assets are lightly armed and are not capable of surviving protracted engagements with an enemy force. Troop mortars and Javelin anti-tank missile systems will assist in disengagement or responding to contact.

The RSTA squadron must be able to cover critical areas and conduct selected reconnaissance operations throughout the brigade's battlespace, which can consist of areas as large as 100 km by 100 km in size. To accomplish this mission, the squadron deploys throughout the designated areas, moving rapidly in a widely dispersed manner. The squadron employs weapons fire to suppress, delay, or defeat the threats to the organization's mission. The RSTA squadron performs three forms of reconnaissance: zone, area and route. Several of these forms may be carried out simultaneously in the areas of operations. Often used when the threat situation is vague or when information about cross-country traffic-ability is needed, zone reconnaissance involves gathering information concerning all threat forces, routes, obstacles, and terrain within a zone defined by boundaries. Area reconnaissance concentrates on a specific area of interest, such as facilities (e.g., water plants, weapons storage, political headquarters) or focus (e.g., suspected assembly area, cache sites). Route reconnaissance involves gathering information about a specific route and adjacent terrain that the enemy could use to influence movement along the route. The RSTA squadron also conducts operations in urban terrain, performs limited security operations (screening missions), human intelligence for combat support, and other activities.

2.2.2.3 Anti-Tank (AT) Company

The AT company comprises the SBCT's primary long range anti-tank element. Its primary mission is to provide accurate, long-range anti-armor fire support to enhance the lethality, survivability, and maneuver capability of the SBCT, particularly in open terrain. The company fights as part of the SBCT or augments the infantry battalions at the discretion of the brigade commander.

The company consists of a company headquarters section and three platoons, each consisting of three Stryker vehicles specially equipped with four long-range fire-and-forget, tube-launched, optically-tracked, wire-guided (missile) (TOW) IIB systems. The TOW system provides the SBCT with direct anti-armor fire against tanks, armored vehicles, or hard targets up to 3,750 m distance.

Using terrain analysis products, the AT company commander identifies appropriate battle positions for his force and potential mounted enemy avenues of approach. In conjunction with the BCT S3, the AT company commander then builds engagement areas that optimize his weapons' abilities to destroy opposing mounted forces. These objectives may be accomplished by occupying covered and concealed positions and by seeking to employ flank and rear shots against vulnerable areas of the enemy's vehicles. Training activities will vary with the nature of the tactical conditions (i.e., offensive, defensive, complex and urban terrain).

2.2.2.4 Field Artillery Battalion

The mission of the field artillery battalion is to conduct responsive, proactive, counter-battery fire as well as supporting fire. A Stryker-based, self-propelled 155mm howitzer is the required capability. However, this capability is not yet available, and the SBCT will be equipped with M198 towed 155 mm howitzers

while the Army develops the IAV (interim armored vehicle)-based system. Training activities consist of maneuvering to firing points and areas, and firing rounds at targets in the impact area.

2.2.2.5 Engineer Company

The mission of the engineer company is to provide maneuver support (mobility, counter-mobility, force protection), force support (general engineering, force protection, survivability), and terrain visualization (topographic) support to the SBCT.

The company consists of a company headquarters, three combat mobility platoons, and a mobility support platoon. Mobility platoon equipment includes three Stryker vehicles with mountable rollers and blades, eight-man engineer squads, and associated engineer equipment, demolitions, and weapons. The mobility support platoon consists of a platoon headquarters section and three equipment-based mobility sections. Each section focuses on mobility missions such as reducing enemy obstacles and fortifications that inhibit friendly maneuver. Each section has a 12 m gap tactical bridge, lane obstacle reduction capabilities, specialized vehicle mounted tools, and heavy blades for rapid lines of communications repairs. The company can be organized to operate as a single engineer element or task organized with platoons supporting maneuver forces. The company is equipped with reduction assets for existing, natural, and reinforcing obstacles in open rolling terrain as well as in challenging urban and complex terrain.

The engineer company clears and constructs obstacles, emplaces and clears minefields, prepares demolitions, improves roads, provides bridging, and digs fighting positions. Combat mobility platoons are task-organized to maneuver elements to provide mobility support to mounted maneuver, dismounted assault, and urban operations.

2.2.2.6 Brigade Support Battalion (BSB)

The brigade support battalion provides execution-focused, distribution-based, centralized logistics functions. The BSB combines unit-level distribution and area supply points to ensure that services and supplies are delivered to appropriate locations as needed. The BSB is a combat services support (CSS) unit. The small size of the BSB minimizes the logistical footprint. The BSB is equipped with trucks and trailers.

The BSB provides all logistical support including supplies, maintenance, and services for the SBCT. Typical activities include unit (Battalion/Company/Platoon) distribution to one or more central locations, supply point distribution, refuel/resupply on the move, and aerial resupply/sling load (helicopter). The BSB is the primary tenant of brigade support areas (BSAs). It arrays its subordinate tenant units within the BCT to most effectively and efficiently utilize the terrain available for combat services support operations given force protection considerations. The BSB Tactical Operations Center (TOC) is the central nervous system for centrally-managed distribution-based operations for the SBCT. The BSB also establishes consolidated administrative and logistics operation centers (ALOCs) for the supported units within the SBCT.

The battalion also trains to deploy to a theatre of operation and initiate operations with a basic load of at least 72 hours of supplies. Deployment training scenarios involve embarkation and debarkation ports where equipment and supplies are received and transferred to other units.

2.2.2.7 Combat Service Support Company (CSSC)

The CSSC provides support logistics to the SBCT, normally augmenting BSB support. The CSSC has a Headquarters section, a brigade support platoon, a transportation platoon, a maintenance platoon, and a

field-feeding platoon. Equipment consists of trucks and trailers. The unit provides supply support, food service support to CSSC or BSB personnel, distribution transportation support to the BSB, field maintenance support, and field feeding support to SBCT units.

2.2.2.8 Brigade Headquarters and Headquarters Company (HHC)

The SBCT headquarters, comprising command and staff personnel, executes command, control, information management, fires/effects coordination, maneuver support, sustainment, and communications functions. It enables the command to plan, prepare, and execute its assigned mission. The headquarters company provides administrative support to the headquarters. The brigade HHC receives additional services and support from the brigade support battalion (BSB). Equipment consists of trucks and trailers.

2.2.2.9 Signal Company

The brigade signal company (BSC) is responsible for the installation, operation, and management of the information network supporting BCT operations. The BSC is organic to the BCT, consisting of command and network operations sections, BSB and TOC nodal platoons, and signal support platoon. The BSC provides reach-back connectivity, supports BCT voice/data communications, provides network management capabilities, establishes primary Tactical Operations Center voice/video/data services, and performs limited signal electronic maintenance.

2.2.2.10 Military Intelligence Company

The military intelligence company supports the SBCT intelligence team by planning and executing intelligence, surveillance and reconnaissance (ISR) operations, analyzing and presenting intelligence to support situational understanding and force protection, supporting functions of the targeting process, and providing intelligence, counterintelligence, and electronic warfare support to information operations. The MI company consists of a small headquarters element, an intelligence, surveillance and reconnaissance (ISR) integration platoon, a tactical human intelligence (HUMINT) Platoon, and a staff weather officer. The MI company is equipped with trucks and trailers.

2.2.3 Overview of Proposed Transformation Activities

Transformation activities relevant to this Biological Assessment include construction projects and military training on training lands outside of developed (e.g., cantonment) areas. Construction projects are listed below, and are described in detail in the chapter for the subinstallation where they will be located. Training activities are divided into live-fire training, maneuver training, and other military (non live-fire) training.

2.2.4 Construction Projects

SBCT construction projects are planned for five training subinstallations, an Army Airfield, and an Air Force Base on Oahu. Proposed construction includes building, modernizing, and remodeling buildings, training facilities (e.g., live-fire training facilities), and infrastructure. It also involves demolishing buildings and facilities. The projects are as follows:

DILLINGHAM MILITARY RESERVATION

- Schofield Barracks Military Reservation to Dillingham Military Reservation Military Vehicle Trail (Project # 57413)

- Fixed Tactical Internet Antenna (three)[15]

For the complete project description, go to Construction at DMR (**Section 4.3.1**).

KAHUKU TRAINING AREA (KTA)

- Combined Arms Collective Training Facility (Project # 58143)
- Tactical Vehicle Wash (Project # 57415)
- Fixed Tactical Internet Antenna (two)

For the complete project descriptions, go to Construction at KTA (**Section 6.3.1**).

KAWAILOA TRAINING AREA (KLOA)

- Schofield Barracks Military Reservation to Helemano Military Reservation Military Vehicle Trail (Project # 57406)

For the complete project description, go to Construction at KLOA (**Section 7.3.1**).

SCHOFIELD BARRACKS EAST RANGE (SBER)

- Fixed Tactical Internet Antenna (two)
- Tactical Vehicle Wash (Project # 57416)

For the complete project description, go to Construction at SBER (**Section 9.3.1**).

SCHOFIELD BARRACKS MILITARY RESERVATION (SBMR)

- McCarthy Flats Multi-Purpose Qualification Complex (QTR1) (Project # 57835)
- Battle Area Complex (BAX) (Project # 58144)
- Urban Assault Course Training Facility (UACTF) (Project # 58143)
- Range Control Facility (Project # 56923)
- Fixed Tactical Internet Antenna (seven)
- Virtual Fighting Training Facility (Project # 57404)

For the complete project descriptions, go to Construction at SBMR (**Section 10.3.1**).

PROPOSED SOUTH RANGE ACQUISITION AREA (SRAA)

- South Range Multi-Purpose Qualification Range (QTR2) (Project # 57462)
- Brigade Motor Pool (Project # 55269)

For the complete project descriptions, go to Construction at SRAA (**Section 11.3.1**).

[15] A total of fourteen fixed tactical internet antennae locations are proposed for DMR, KTA, SBER, and SBMR.

OTHER OAHU PROJECTS

- Upgrade Wheeler Army Airfield (WAAF) for C-130 Operations (Project # 57405)
- Multiple Deployment Facility at Wheeler Army Airfield (WAAF) (Project # 57422)
- Troop Rigger Facility (Hickham Air Force Base) (Project # 56691)

For the complete project descriptions, go to Other Transformation Project Locations (**Section 12.0**).

2.2.4.1 SBCT Live-Fire Training Activities

The Transformed Brigade will use new and existing live-fire ranges and existing firing points/position areas at Schofield Barracks and the proposed South Range Acquisition Area. SBCT units will perform individual weapon and collective arms live-fire training. Use of live-fire ranges is discussed in the chapter for the affected subinstallation. Use of pyrotechnics, obscurants, and simulators is anticipated to be similar to Legacy Force use. Unless or until amended, all SBCT training will be planned and conducted in accordance with established USARHAW range and training land regulations and standing operating procedures (SOPs) (Vic Garo, pers. comm., 31 May 2002). A summary of changes in live-fire range use is presented in section 2.2.5 General Changes in Training as a Result of Transformation, and in relevant subinstallation chapters.

SBCT forces will conduct dismounted training to include company level combined arms live fire exercises (CALFEX). The SBCT dismounted CALFEXs will be similar to the CALFEXs conducted by the legacy forces using the same types of weapons and similar tactics (see Section 2.1.7 Combined Arms Live-Fire Maneuver Training). SBCT dismounted CALFEX training would occur at the Schofield Barracks Battle Area Complex (BAX), PTA BAX, and Makua Military Reservation. Makua is an important but nonessential part of SBCT training. The primary live fire training area for the SBCT will be the Schofield Barracks Battle Area Complex (BAX). SBCT forces will use Makua after the completion of the Makua Environmental Impact Statement (EIS) and Record of Decision if the range is available. Makua will greatly facilitate dismounted CALFEX throughput and flexibility for all divisional units. The Makua EIS will analyze the potential environmental impacts associated with dismounted CALFEXs which will be similar in scale, scope, and weapons employed for both legacy and SBCT units. Accordingly, this BA will not analyze training impacts to Makua (Memorandum from CEPOH-PP-E dated 28 February 2003).

2.2.4.2 SBCT Non Live-Fire Maneuver Training Activities

Based on available information, it is anticipated that SBCT units will train in similar locations as current forces at SBMR, DMR, SBER, KTA, and KLOA. Limited non-live-fire maneuver training would also occur within the proposed future firebreak road at the SRAA. One notable difference between Legacy and SBCT forces is the introduction of the Stryker vehicle. The exact manner in which these vehicles will be used is not known at this time. Published doctrine indicates that the Stryker vehicle is primarily a troop transport vehicle that will traverse terrain and obstacles to ensure protected delivery of infantry squads to their dismount points. The number of vehicles used for an exercise will vary with the size of the unit. Company and battalion-level maneuvers will involve 27 and 96 vehicles, respectively. SBCT training would involve up to 27 Strykers at SBMR, up to 27 Strykers at DMR, from 27 to 200 Strykers at KTA, and up to 27 Strykers at KLOA (limited to training along Drum Road).

Because of the limitations of the Stryker, the majority of mounted movement takes place on roads or unrestricted terrain (HQDA undated). High potential off-road vehicle maneuver areas are presented in Section 3.1.2.1. These mapped areas are the same as those that are currently/potentially available to Light

Infantry Brigades. The areas available for vehicle maneuvers are generally located at lower elevations on slopes of less than 30 percent that are not forested. Areas that are suitable for vehicle maneuvers generally have been used in the past and are accessible by existing roads and trails. Much of the dismounted training also occurs within these lower elevation vehicle maneuver areas or in adjacent areas with steeper terrain, dense vegetation, or on ridgelines. SBCT maneuvers, both mounted and dismounted, will take place in the same areas currently being used by 25th ID(L) forces. The areas where the vast majority of vehicle maneuvers happen (and would happen in the future) are delineated in the high-probability vehicle maneuver maps (Section 3.1.2.1). These maps give the best available knowledge regarding where vehicles (and much foot travel) occurs and will occur in the future. A summary of changes in maneuver use and extent is presented in section 2.2.5, General Changes in Training as a Result of Transformation, and in relevant subinstallation chapters.

Maneuver/training area requirements are based on Army Training and Evaluation Program (ARTEP) Mission Training Plans (MTPs). These documents provide the doctrinal base from which unit commanders develop their unit training strategies to train their units for combat. SBCT ARTEP missions/tasks and maneuver training area requirements were not yet identified when the most recent (June 2001) version of TC 25-1 *Training Land* (HQDA 2001) was released. The required maneuver area (i.e., maneuver box) represents the area within which training activities and densities simulate those that might occur during combat. The maneuver box does not have to be contiguous, as modern communications and networking allow for various units to coordinate large-scale training activities among different locations within Oahu. Moreover, the area required does not have to be square and will be adapted to available land resources. For example, a tactical operations center may be established at Dillingham, while mounted and dismounted maneuver training takes place on Kahuku Training Area and East Range. Urban operations missions at Kahuku or Schofield may occur simultaneously as part of the large-scale battalion or brigade-level training scenario. Engineer, supply, and aviation support by units integral to the SBCT could occur at multiple locations within the theoretical maneuver box. It is assumed that this area can accommodate all the missions and tasks of an SBCT, at all levels, within a 242-day training year (25th ID(L) and USARHAW 2002). The largest SBCT exercise is the semiannual movement to contact exercise for the SBCT as a whole, requiring approximately 122,564 acres. It involves force-on-force blank-fire maneuver training with Strykers up to SBCT size at Kahuku Training Area. The same exercise at the battalion level would be conducted four times per year and requires only half as much land (USAESC and Nakata 2002a).

2.2.4.3 Other Military Training

Most of the non live-fire and non-maneuver training by SBCT forces will be similar to that currently being conducted by Light Infantry Brigades. Training includes establishment and use of tactical and logistical operations and administrative centers, as well as smaller, more dispersed activities such as bivouac. As with Legacy training, exercises will continue to be at the squad through company level, with some opportunities for battalion and above training. Urban operations training is more highly emphasized in SBCT requirements. New urban warfare facilities will be used extensively by the SBCT. Landing and pickup zones will be used by SBCT units. Because there are no airborne units in the SBCT, drop zones would not be used by the Transformed Brigade but would continue to be used by Legacy forces. Other assets used to train soldiers without the use of weapons include rappel towers, obstacle courses, and other facilities not covered in the previous categories.

2.2.5 General Changes in Training as a Result of Transformation

The Transformed Brigade will use new and existing live-fire ranges and firing points/position areas. SBCT units will perform individual weapon and collective arms live-fire training. Use of pyrotechnics,

obscurants, and simulators is anticipated to be similar to Legacy Force use. Unless or until amended, all SBCT training will be planned and conducted in accordance with established USARHAW range and training land regulations and standing operating procedures (SOPs).

2.2.5.1 Changes in Current and Proposed Live-Fire Range Use

The SBCT will use new and existing live-fire ranges and firing points/position areas. Legacy and SBCT units will perform individual weapon and collective arms live-fire training. New equipment not used in current training includes the Stryker wheeled armored vehicle and the Stryker Mobile Gun System (105 mm cannon). Where SBCT live-fire training is planned (Schofield Barracks, Proposed South Range Parcel, Kahuku Training Area (short-range plastic bullets only)), a detailed comparison between ammunition usage for one Legacy Brigade (and other Legacy units) and one Transformed Brigade is provided in the appropriate chapter. Range types can be grouped using the following categories:

Basic Weapons Marksmanship: These ranges are used to qualify or train on rifles, pistols, sniper rifles, grenade launchers, subcaliber light anti-armor weapons, shotguns, machine guns, and grenade machine guns.

Collective Live Fire: These ranges are used for collective training events such as infantry squad and platoon battle courses (ISBC, IPBC), multipurpose range complexes (both heavy and light), military operations in urban terrain (MOUT) and military assault courses (MACs), and aerial gunnery ranges.

Direct Fire Gunnery: These ranges are used to qualify tank, Bradley, and Stryker crews. This category also includes ranges used to qualify anti-armor weapon systems using service ammunition.

Indirect Fire: These ranges or dedicated firing points are used for the qualification and training of mortars, field artillery, or air defense artillery and observation posts.

Special Live Fire: These ranges and training areas are used for qualification and training of demolitions, live hand grenades, and claymore mines.

Maneuver Training Areas: This land is used for force-on-force maneuver training and situational training exercises (STXs).

A summary of ammunition usage under current training and transformation is presented in each subinstallation chapter.

2.2.5.2 Changes in Non Live-Fire Maneuver Training Activities

Annual SBCT mileage per vehicle is estimated to be 1.3 times greater than Legacy vehicles. Transformation of one brigade (plus several small units) is anticipated to increase the training load on USARHAW lands threefold compared to current training. This increased training load, the majority of which will take place on PTA and the proposed Keamuku Parcel, incorporates factors related to vehicle type, training activities, and quantity and severity of off-road vehicle impacts, quantified by maneuver impact miles (MIMs[16]) (G. Weith ATTACC Brief, 29 October 2002[17]). The training load (i.e., intensity of vehicle impact) will increase more than the mileage because of increase severity associated with the

[16] MIMs are a standardized measure of training impact. MIMs are calculated as part of the Army Training and Testing Area (ATTACC) methodology, which estimates training land carrying capacity by quantifying training load and land condition.
[17] Army Training Support Center (ATSC) Land Team

heavier eight-wheeled Stryker vehicles compared to most Legacy vehicles. The amount and frequency of vehicle use is projected to increase but the locations and patterns of use are anticipated to be the same relative to current training. These increases in off-road impacts would potentially occur in all areas used by vehicles. Currently, Legacy Force vehicles are allowed off-road on Oahu subinstallations (with site-specific restrictions). SBCT vehicles will also travel off established roads and trails in support of the SBCT missions (see Section 3.5, Determination of the Action Area) and will remain close to dismounted units for appropriate missions. The Stryker vehicle is expected to travel over rough surfaces not trafficable by HMMWVs and other Legacy force wheeled vehicles (Ron Borne, pers. comm., 2002), but this difference is much more pronounced for PTA maneuvers compared to Oahu maneuvers.

Published doctrine indicates the Stryker vehicle is primarily a troop transport vehicle that will traverse terrain and obstacles, and ensure the protected delivery of infantry squads to dismount points. Because of Stryker limitations, the majority of mounted movement takes place on roads or unrestricted terrain (HQDA Undated). High probability off-road vehicle maneuver areas will be the same as the current/potential sites available to Light Infantry Brigades and other users of USARHAW lands.

Maneuver Training
Maneuver/training area requirements are based on army training and evaluation program (ARTEP) mission training plans (MTPs). These documents provide the doctrinal base unit for commanders with training strategies. SBCT ARTEP missions/tasks and maneuver training area requirements were not yet identified in the most recent (June 2001) version of TC 25-1, Training Land (HQDA 2001). The required area is assumed to be able to accommodate all the missions and tasks of an SBCT, at all levels, for a 242-day training year (25th ID(L) and USARHAW 2002). Maneuver training requirements are presented in Table 2.c. The proposed SBCT requires a total of 241 maneuver training events (number of units x number of events) while one Light Infantry Brigade requires 192 maneuver training events. As noted in Table 2.c, the land requirements are larger for most SBCT training events compared to Light Infantry events. The number of days per training event is approximately equal for Legacy and SBCT forces.

Reconnaissance Training
Reconnaissance training would be carried out in a similar manner as Legacy training, except that the SBCT Unmanned Aerial Vehicles (UAVs) would offer air reconnaissance that, in combination with ground reconnaissance, would provide situational awareness and knowledge throughout a larger area of operations. UAV training would take place at SBMR, Wheeler Army Airfield, and DMR. Vehicles would be launched from roads or hardened areas.

Typical reconnaissance training operations involve small groups, from squad to platoon strength (3 to 50 soldiers). This type of training may take place in all types of terrain but can be constrained by extremely rugged terrain and thick vegetation. In many respects, reconnaissance training resembles dismounted maneuver training but does not have the same type of vehicle support. No live fire is involved, and vehicles are not used except for drop off or pickup. It is anticipated that the UAV's total flying hours would amount to 2,400 hours of flight per year (4 UAVs at 600 hours per year), or 600 operations (takeoffs) per year. This would be the maximum allowable amount. The UAVs would not need to take off from or land at ordinary airfields, but use a self-supported hydraulic launcher. An arrested recovery system would also be used.

Deployment Training
Deployment training would principally involve moving troops and equipment from SBMR to the other training areas. As with Legacy training, transportation would use a combination of vehicles, vessels and aircraft, depending on the type and location of training. Deployment training would be similar to Legacy

Table 2.c Maneuver Training Area Requirements for One Legacy and One Transformed 25th ID(L) Brigade.

	Legacy Force					SBCT					Collective Requirement (1 Light Brigade + 1 SBCT Brigade) (km²Days)
Unit/Task	Number of Units	Land Requirements (km²)	Iterations (events)	Days Required per Iteration	Required km² Days	Number of Units	Land Requirements (km²)	Iterations	Days Required per Iteration	Required km² Days	
Light Division (1 Brigade)											
Light Infantry Battalion	3	400	4	1	11,256						11,256
Light Infantry Company	9	70	4	2	20,016						20,016
Light Infantry Platoon	27	21	4	2	22,572						22,572
Light Infantry Platoon (National Guard and Reserve)	9	21	1	2	2,822						2,822
Mortar Platoon	3	60	2	1	528						528
Antiarmor Platoon/Company	3	60	3	1	540						540
Scout Platoon	3	20	4	1	480						480
Cumulative Requirement					**58,214.**						
Stryker Brigade Combat Team (1 Brigade)											
SBCT						1	496	2	1	2,688	2,688
Infantry Battalion						3	248	4	1	9,264	9,264
Infantry Company						9	84	4	2	24,19	24,192
Infantry Platoon						27	50	4	2	41,25	41,256
Infantry Platoon (National Guard and Reserve)						9	21	4	2	7,524	7,524
Mortar Platoon						3	60	2	1	528	528
Battalion Reconnaissance Platoon						3	135	4	1	3,240	3,240
RSTA Squadron						1	600	2	1	1,200	1,200
RSTA Troop						3	360	3	1	3,240	3,240
RSTA Platoon						9	135	2	1	2,430	2,430
Cumulative Requirement										**88,03**	
Total Requirement											146,252.00

Data Sources: compiled by John Gallup and Associates April 2002. Legacy Force (25th Infantry Division (Light)) asset and training requirements were derived from Chapters 6 and 7 of the USARHAW and 25th Infantry Division (Light) Range and Training Land Program Development Plan, March 2001. Requirements were interpolated from data in Table 7.70. SBCT asset and training requirements were derived from Chapters 6 and 7 of the USARHAW and 25th Infantry Division (Light) Range and Training Land Program Development Plan, March 2001. Requirements were interpolated from data in Table 7.71.
Note: Land requirement (km²), iterations, and days required are equivalent to the greatest individual requirement per each unit/task. The required km² days figure is the cumulative requirement for all training requirements within each individual unit/task item. This latter figure should be utilized when determining maneuver area requirements.

forces, except SBCT units would be deployed at least twice a year to PTA from HAFB or WAAF using C-17 or C-130 aircraft. The only difference between SBCT strategic deployment and Legacy deployment is the increased numbers of vehicles and troops for a SBCT (pers. comm. Ron Borne 3/5/03) and an increase in the number of Logistics Support Vessel (LSV) round trips from 30 to 38 between Oahu and PTA. Vehicles will be washed at Schofield Barracks and PTA wash racks before inter-island deployments.

Aviation Training
The number and types of aircraft used for aviation training are expected to be the same as under Legacy training. There is no anticipated change in the frequency or times of operations under an SBCT.

Combined-Arms Live-Fire Training
All CALFEX exercises would be carried out in a similar manner as Legacy training. This document addresses CALFEX training at Schofield Barracks. The only increase in CALFEXs would be from the introduction of the Reconnaissance, Surveillance and Target Acquisition (RSTA) Squadron, which could conduct up to three Company CALFEXs per year.

Major Force-on-Force Training
There would be no change in major force-on-force training under the Proposed Action. Major force-on-force training would still occur at SBMR and KTA on Oahu.

Service Support Operations and Training
There would be no change in service support operations and training under the Proposed Action. Training would be carried out in a similar manner as Legacy training.

2.2.5.3 Changes in Other Military Training

Most of the SBCT non live-fire and non-maneuver training will be similar to Light Infantry Brigade training. Training includes establishment and use of tactical and logistical operations and administrative centers, as well as smaller, more dispersed activities such as bivouac. As with Legacy training, exercises will continue to be primarily at the squad through company level, with some opportunities for battalion and larger training. Landing and pickup zones will be used primarily for moving artillery pieces and medevac operations. Because there are no airborne units in the SBCT, drop zones will not be used by the Transformed brigade (R. Borne, pers. comm., May 30 2002).

2.2.5.4 Discussion and Summary of Changes

The SBCT will have a significantly different organization from the Army's current brigade configuration. The SBCT brigade will consist primarily of three infantry battalions, an artillery battalion, and a reconnaissance battalion. The reconnaissance battalion, known as the RSTA squadron (Reconnaissance, Surveillance, and Target Acquisition), will significantly increase the intelligence gathering capability of the brigade. New equipment not used in current training includes the Stryker wheeled armored vehicle and the Stryker Mobile Gun System (105 mm cannon).

Proposed SBCT training would focus more on urban, close, and complex terrain, but many missions would be very similar to light infantry missions currently practiced on USARHAW training lands. Almost all of the SBCT weapon systems are in the current 25th ID(L) inventory, and SBCT training activities in the field are projected to be very similar to Legacy training, the primary difference being the introduction and use of the Stryker medium armored vehicle (R. Borne, pers. comm., 12 Feb 2002 meeting with

CEMML). It is projected that transformation of the 2nd Brigade will result in a net gain of approximately 810 soldiers and 400 vehicles to the 25th ID(L) (R. Borne, pers. comm., 30 April 2002, Waianae, Hawaii).

Maneuver area requirements are higher for the SBCT. The net effect on the intensity and distribution of maneuver miles is difficult to estimate without historic data to draw upon. However, it is estimated that the impacts related to vehicle maneuvers will be approximately three times greater (all USARHAW lands) under the proposed action compared to current training. A large proportion of the SBCT maneuver requirement will be met by land acquisition adjacent to Pohakuloa Training Area. Many changes to training and range usage will be site-specific. For example, at Schofield Barracks Military Reservation, many of the weapons qualification ranges will be moved to a single complex in the McCarthy Flats Area. In other locations, land use changes will be more notable due to land acquisition (e.g., Proposed South Range Parcel), range construction (Proposed South Range Parcel), construction (e.g., Kahuku Training Area MOUT Complex), and intensity of use (e.g., Kahuku Training Area MOUT Complex). The changes in training activities and land use for each subinstallation are discussed in each subinstallation chapter. Based on available information, a summary of throughput (number of soldier trained per unit time) and maneuver requirements for one Light Brigade and one Transformed (i.e., Stryker) Brigade is presented in Table 2.d. The Army will reinitiate consultation with the Service if there is any increase in the areas identified as “high probability off-road vehicle maneuver areas” on Oahu.

The Aviation Brigade will continue to support some SBCT training requirements. Pickup and landing zones (PZs, DZs) will continue to be used for air assault operations for the SBCT, but drop zones (DZs) will not be used by the SBCT because there are no airborne units within the transformed brigade.(R. Borne, pers. comm., 30 May 2002).

Table 2.d Summary of Training Throughput Requirements for One Legacy (Light) Brigade and One Transformed (Medium) Brigade. [1]

Range Category/Weapons Systems	Legacy Force (1 Light Brigade) Throughput Requirement (Days)	SBCT (1 Brigade) Throughput Requirement (Days)	Collective Requirement (1 Light Brigade + 1 SBCT Brigade + POI + Other) (Days)	Notes
Basic Weapons Marksmanship Ranges				
M4/M16 Rifle	57955 Soldiers (197)	66838 Soldiers (191)	124793 Soldiers (314)	
M9/M1911/.38 cal Pistols, Shotgun, and Submachine Guns	3422 Soldiers (46)	3463 Soldiers (47)	6885 Soldiers (68)	
M21/M24 Sniper Rifle	210 Soldiers (9)	216 Soldiers (11)	426 Soldiers (18)	
M203 Grenade Launcher	2112 Soldiers (49)	2171 Soldiers (39)	4283 Soldiers (72)	
Machine Guns				
M249/M60	5519 Soldiers (55)	5564 Soldiers (38)	11083 Soldiers (109)	
M2	349 Soldiers (47)	367 Soldiers (98)	716 Soldiers (138)	
MK19 40 mm Grenade Machine Gun	456 Soldiers (19)	504 Soldiers (12)	960 Soldiers (27)	
AT4 Light Anti-armor Weapon	794 Soldiers (92)	3923 Soldiers (165)	4717 Soldiers (215)	
Direct Fire Gunnery Ranges				
Tube Launched, Optically Tracked, Wire-Guided (TOW) System	N/A	N/A	N/A	
Medium Anti-armor Weapons (Dragon/Javelin)	N/A	N/A	N/A	
Mobile Gun System	N/R	324 Crews (25)	324 Crews (25)	
Infantry Assault Vehicle	N/R	1,512 Crews (98.5)	1,512 Crews (98.5)	
Reconnaissance Infantry Assault Vehicle	N/R	576 Crews (39)	576 Crews (39)	
Engineer Qualification Tables	See note	See note	3 Companies, 27 Squads, 9 Platoons (47)	Throughput requirement is based on live-fire range requirements for the 84th Engineer Battalion.
Collective Live-Fire Ranges				
Squad Live-Fire Exercises (ISBC)	324 Squads (69.5)	351 Squads (73)	675 Squads (113.5)	
Platoon Live-Fire Exercises (IPBC	54 Platoons (56.5)	64 Platoons (59)	188 Platoons (115.5)	
Mobile Gun System	N/R	18 Platoons (4)	18 Platoons (4)	
Infantry Assault Vehicle	N/R	108 Platoons (29)	108 Platoons (29)	Stryker variants
Reconnaissance Infantry Assault Vehicle	N/R	48 Platoons (13)	48 Platoons (13)	Stryker variants
Company or Larger Live-Fire Exercise	9 Companies (9)	9 Companies (9)	18 Companies (18)	

Table 2.d Summary of Training Throughput Requirements for One Legacy (Light) Brigade and One Transformed (Medium) Brigade. [1]

Range Category/Weapons Systems	Legacy Force (1 Light Brigade) Throughput Requirement (Days)	SBCT (1 Brigade) Throughput Requirement (Days)	Collective Requirement (1 Light Brigade + 1 SBCT Brigade + POI + Other) (Days)	Notes
(CALFEX)				
Military Operations on Urban Terrain (MOUT) Live-Fire Exercise	N/A (See note)	N/A (See note)	N/A (See note)	Training doctrine is still being developed, specific throughput requirements cannot be calculated at this time.
Indirect Fire Ranges				
155 mm Howitzer	6 Batteries, 2 Platoons (64)	6 Batteries, 2 Platoons (64)	12 Batteries, 4 Platoons (128)	
105 mm Howitzer	18 Batteries (152)	18 Batteries (152	36 Batteries (304)	
Select Mortar Systems	12 Platoons (24)	12 Platoons (24)	24 Platoons (48)	
Special Live-Fire Ranges				
Live Hand Grenade - Familiarization	3,467 Soldiers (65.5)	3,454 Soldiers (119)	6,921 (173.5)	
Claymore Mine	N/A (See note)	N/A (See note)	N/A (See note)	The Claymore mine training requirements are met as part of the squad and platoon LFXs as training requirements on the ISBC and IPBC.
Other Demolitions	365 Squads (11.5)	365 Squads (11.5)	730 Squads (23)	
Maneuver Training Areas	57 various units (58,214 km^2 days)	68 various units (88,038 km^2) days	125 various units (146,252 km^2 days)	

N/A=Not Available
N/R=Not a Requirement

[1]Source: Legacy Force (25th ID(L) and SBCT asset and training requirements were derived from Chapters 6 and 7 of the USARHAW and 25th ID(L) Range and Training Land Program Development Plan, March, 2001 (USARHAW and 25th ID(L) 2001) – compiled by John Gallup and Associates.

3. Criteria for Determining Action Areas and a General Discussion of the Potential Effects of the Action

3.1 Determination of the Action Area

The "action area" is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action. The following considerations influenced the determination of action area boundaries for routine military training and the transformation of the 2nd Brigade:

- Direct and indirect effects of fire on threatened and endangered species and critical habitat, to include:
  - Areas affected by wildland fire related to training and related land uses.
  - Fire-risk areas caused or enhanced by Transformation activities, including firing range and other live-fire effects, munitions, pyrotechnics, and chronic weed invasion and other effects on fuel availability, ignition, or spread of fire.
  - Increased fire ignitions due to activities on, or the existence of, new roads and trails (military or non-military).
- Projected training footprint (direct effects) (see section 3.1.2).
- Construction projects.
- Areas affected by weed spread caused or enhanced by current and proposed training activities.
- Noise associated with transformation activities and training, most notably the effects of noise on birds.
- Effects of fugitive dust on endangered plants and animals.
- Effects of soil erosion and sedimentation on endangered species, their habitat, and critical habitat.
- Helicopter downdraft effects.
- Other interdependent and interrelated effects.

The action area is based on best available knowledge of the action and its effects, and may extend outside Army subinstallation boundaries. Subinstallation-specific considerations influencing the action area are discussed in Chapters 3-9.

3.1.1 Fire Risk

The following elements were considered in the fire risk assessment: fuel types, training activities, fire history, significant topographic barriers, buffers, defensible boundaries, and fire minimization and prevention. Fire risk areas caused or enhanced by Army training and transformation activities include: firing range and other live-fire effects, munitions, pyrotechnics, and chronic weed invasion and other effects on fuel availability, ignition, or spread of fire. Fire ignitions may increase due to activities associated with new road and trail construction. Site specific considerations are addressed for each subinstallation.

3.1.1.1 Determining the Fire Buffer Width in the Action Areas

Three submodules of the BEHAVE fire prediction system (Andrews 1986 and 1989) were used to determine the likely extent of any fire in a buffer area. Factors that were considered were fuel model, weather, terrain, fuel moisture, response time of fire suppression forces, and line building rates of fire

suppression forces. Using these inputs, an estimated fire size was computed and from this information a buffer distance was ascertained. All inputs approximated worst case scenarios.

All fire buffers are located in forest vegetation types, but not in eucalyptus or other flammable forest types. Standard Northern Forest Fire Laboratory (NFFL) fuel model 8 (Anderson 1982) best represents fire behavior in this fuel type. Therefore, it was used as the input fuel model in fire simulations. Weather data was collected for the entire period of record to July 2002 from the closest Remote Automated Weather Station (RAWS). The SBMR RAWS located next to the Range Control Building was used for SBMR and SRAA, the East Range RAWS was used for SBER and KLOA, and the Kahuku RAWS was used for KTA. No fire buffers were needed for DMR. The data utilized for the buffers included wind speeds and fuel moistures. The worst (highest for wind speed, lowest for fuel moisture) 5% of the readings were selected and then averaged to produce an average worst 5% wind speed and average worst 5% fuel moisture. Fuel moistures collected by the RAWS are 10 hr fuel moistures. To produce the 1 hr and 100 hr fuel moistures necessary to run the BEHAVE models, 2% fuel moisture was subtracted and added, respectively. This is a commonly used rule of thumb when a full set of fuel moistures is not available. All figures were rounded to the nearest $1/10^{th}$ of a percent. Slope was calculated only for the area of interest (where the action area is determined by the buffer) from clipped DEM's. Again, the worst (steepest) 5% of this data was selected and an average calculated to produce an average worst 5% slope. The average worst 5% slope was greater than the maximum slope allowed by BEHAVE in all cases, so the maximum value available in BEHAVE, 100% slope, was substituted. All of this data was entered into the DIRECT subsystem of BEHAVE which produces fire behavior outputs such as rate of spread and flame length. These outputs were then entered into the SIZE subsystem to determine the initial size of the fire upon arrival of the initial attack suppression forces. The SIZE subsystem calculates the size, perimeter length, and length to width ratio of a fire given a length of burning time and the fire behavior inputs from DIRECT. A response time of 6 hours was assumed.

Once the initial size of the fire upon arrival of the suppression forces was determined, the CONTAIN subsystem was used to determine how large the fire would grow before it could be contained by suppression resources. An attack on the head of the fire was assumed in this calculation as well as a very conservative line-building rate of 10 chains per hour (660 ft/hr) (Schmidt and Rinehart 1982). Using the final size of the fire and the length to width ratio, the distance from fire source to the edge of the calculated burned area was determined. This distance was used to define the buffer width. Because many of the inputs from different installations were similar or were the maximum values allowed by BEHAVE, a fire buffer distance of 521 m (1708 ft) was the resultant value calculated for all installations.

3.1.2 Training Footprint – Legacy and Transformed Forces Training[18]

The projected training footprint typically comprises a portion of the action area for this Biological Assessment. It is based on Legacy and SBCT doctrine, equipment, weapons, unit training activities, and tailoring of activities to local conditions and constraints. Specific information regarding training activities, locations, frequencies, and durations have been requested from USARHAW. The USARHAW training footprint (the same for Legacy and SBCT) includes:

- Off-road vehicle maneuver areas.
- Urban terrain training facilities.
- Construction projects.
- Initial staging bases (ISBs), tactical operation centers (TOCs), and battalion support areas (BSAs).
- Roads and trails.
- Firing ranges and associated range fans.

[18] This BA does not include road marches via trails and roads between DMR and Makua Military Reservation. That action will be addressed in the Makua EIS.

- Impact areas.
- Bivouac areas.
- Pickup, landing and drop zones (PZs, LZs and DZs)[19].
- Dismounted maneuvers (foot travel) areas. Extensive areas can be reached on foot. The influence of dismounted maneuvers on action area boundaries varies by location.
- Helicopter and unmanned aerial vehicle (UAV) flight zones.

Land available for training may be reduced due to considerations that render certain areas unusable. Potential constraints on useable training land include environmental restrictions, urban encroachment, irregular shape of training lands, and access and availability. Environmental restrictions include erosion control considerations, pollution prevention, noise avoidance, wildlife management, endangered species protection, forestation, cultural resource sites protection, and wetlands. Natural resources managers can provide planners with information regarding sensitive and unusable land (HQDA 2001, Training Land). The recently completed Land Use Requirement Study (LURS) for USARHAW training lands (USACE and Nakata 2002) classified almost 35,220 ha (87,000 ac) as suitable for maneuver training on USARHAW lands out of a total of approximately 65,580 ha (162,000 ac). Approximately 5,770 ha (14,257 ac) are located on Oahu. "Suitable for maneuver" is defined in the LURS document as lands that are supportive of Pacific Theatre-style training scenarios for USARHAW units. Suitable land therefore encompasses land that could be used for mounted and/or dismounted training. Unusable land consisted of cantonment areas, impact areas, and terrain with slopes greater than 30 percent. Much of the terrain considered unsuitable included steep slopes, long narrow ridges, and extremely thick vegetation (USACE and Nakata 2002).

3.1.2.1 Delineation of High-Probability Off-Road Vehicle Maneuver Areas

Off-road maneuver by vehicles, trucks, humvees, and other vehicles and equipment as well as Stryker vehicles can cause severe environmental damage. High-probability vehicle maneuver areas are delineated through a process of examining a variety of terrains across the landscape. Dismounted (i.e., foot) maneuvers are generally unconstrained by terrain and are considered possible in most cases. Legacy and SBCT force vehicles climb and traverse slopes somewhat similarly; the usable maneuver areas are therefore probably similar. Maneuver planning and training are subject to USARHAW range SOPs, approval by Range Division Hawaii, and environmental restrictions. The following framework, developed cooperatively by USARHAW Environmental Division, USARHAW ITAM staff, USARHAW Range Division, and the USARHAW Transformation Office was used to map areas with a potential for SBCT vehicle traffic on Oahu.

Constraint Areas:

- Slopes >30 percent. A maximum slope steepness of 30% is recommended by ATSC (Army Training Support Center) staff working on Transformation issues for Hawaii and other locations, and the Army Training and Testing Area Carrying Capacity (ATTACC) model (G. Weith, pers comm., 2002). A 30% slope cutoff is used by USARHAW, *Land Use Requirement Study* (LURS) (USACE and Nakata 2002), and supports Stryker and other wheeled vehicle capabilities to traverse slopes. Legacy and SBCT vehicles can conceivably climb slopes of up to 60 percent. This capability would be practiced on a very small proportion of land and is, therefore, removed from discussion. Moreover, the vegetation present on steeper slopes would have to be removed for these areas to support traffic.
- Forested areas with closely spaced trees >6" (15 cm) in diameter are considered unmaneuverable. Initial delineation of forested areas was done by CEMML. Ground truthing of forested areas with slopes less than 30% was conducted by ITAM staff in January 2003, in coordination with the Transformation Office.

[19] No drop zone training will be conducted as part of SBCT activities (R. Borne, pers. comm., 30 May 2002)

- Cantonment and developed areas.
- Firing ranges and fans – surface danger zones are unavailable during live-fire training. At Schofield Barracks, maneuver within range fans would be limited to the battle area course.
- Impact areas.
- Safety hazard areas.

Other Assumptions:
- Dismounted (i.e., foot) maneuvers are possible in areas described as unmaneuverable by vehicles as well as areas that support vehicle maneuvers.
- Established roads and trails are available for training regardless of the presence of adjacent constraint areas.
- Some areas (typically small in size) that otherwise meet off-road maneuver criteria may be inaccessible by road or trail and therefore unusable.

This process delineates areas where vehicles are most likely to go, based on topographic and other constraints. The maps produced by this framework do not relate directly to the Land Use Requirement Study for Oahu Army lands, which did not differentiate between mounted and dismounted maneuver potential (USAESC and Nakata 2002). Additional areas are considered suitable for dismounted maneuvers, but with significantly reduced environmental impacts compared to vehicular travel. Dismounted maneuvers are possible almost anywhere that safety, environmental, and administrative constraints are not present. Maps showing high-potential mounted maneuver areas are presented in subinstallation chapters where off-road vehicle maneuvers are supported (Kahuku Training Area, Dillingham Training Area, and Schofield Barracks East Range). Following this consultation, the Army will reinitiate section 7 consultation if it proposes to conduct off-road mounted maneuver in areas other than those shown on the maps as high-probability off-road vehicle maneuver areas and there may be an effect on listed species or critical habitat.

3.1.3 Construction Projects

Construction projects require significant soil disturbing activities, including land clearing, earthmoving, filling, and paving over of permeable surfaces. Most construction projects are located either in highly urbanized areas or in previously disturbed areas. Maps showing construction areas are presented in each subinstallation chapter.

3.2 Potential Effects of the Action

The potential effects of Army training and transformation on Oahu fall into the categories below. This section is organized according to these categories.

Direct effects are those caused by the action and occur at the same time and place as the action. Examples of this may be a person smashing or stepping on an endangered species, or fires that consume species.

Direct interrelated effects are those caused by interrelated actions. These actions are part of the larger action and depend on the larger action for their justification.

Direct interdependent effects are those caused by interdependent actions. These are actions that would not occur without the proposed action, and have no independent utility apart from the action under consideration. An example of this may be range construction and maintenance projects.

Indirect effects are caused by the action and are later in time, but are still reasonably certain to occur. An example of this may the spread of weeds that affect listed species in areas where a fire had once burned trees.

3.2.1 Direct Effects

3.2.1.1 Helicopter Impacts from Current Military Training

Helicopters are used in current military training on Oahu for aviation training and to transport people, equipment, and supplies for training and land management activities. Potential impacts would include noise (addressed below), helicopter down draft which could knock snails off trees or injure federally listed plants, landing in places with threatened and endangered species, and water drops for fire bucket training.

3.2.1.2 Legacy Construction Projects

Potential affects of Drum Road construction and use are addressed in chapters 6 and 7 (Sections 6.6.3.5 and 7.6.3.5, respectively).

3.2.1.3 SBCT Construction Projects

Construction projects proposed as part of Transformation of the 2nd Brigade have relatively small footprints in lower elevation areas dominated by alien species. No listed species will be directly affected by SBCT construction.

3.2.1.4 Fires from Current Military Training and SBCT Transformation Activities

Though there is little published literature documenting the response of native Hawaiian species to fire, there is voluminous anecdotal evidence to suggest that fire is detrimental to local ecosystems, particularly in the presence of exotic species seed sources. Because these seed sources are present almost everywhere on Oahu, fires that burn through native vegetation allow alien species, particularly grasses and shrubs, to invade and prevent regeneration of native plants (D'Antonio and Vitousek 1992, Freifelder and Vitousek 1998, Hughes and Vitousek 1991). Fire in native vegetation almost invariably damages the ecosystem, in part because every fire burning in native vegetation destroys potential habitat for threatened and endangered species.

3.2.1.5 Alien Species Introductions from Military Sources

Alien plant and animal species, including feral ungulates, small mammals, birds, herpetofauna, and invertebrates have spread and inhabit most of the Hawaiian Islands. They pose a large threat to native island ecosystems because of slow natural evolutionary processes typical of isolated islands, and, because these ecosystems evolved without many of the organisms that have been introduced, they are particularly sensitive to the destructive impacts these species have. Many introductions originated from international ports or were transported from other infested islands. Although Army training activities may not have been the source of introduction and/or spread of these species, Army training and transformation activities can potentially facilitate the spread of existing alien species and result in new introductions to the island of Oahu.

Alien species may be introduced to Army land during military training or transformation, or during proposed changes in military training activities resulting from the transformation (see Section 2.6) via clothing, shoes, equipment, and vehicles. Movements of troops and equipment into Hawaii from other countries, states, or islands, and movements between installations in Hawaii increase the likelihood of introductions into the action areas and the eventual spread into native habitats that support listed species.

Possible points of introduction by military training are mostly on the ranges and range roads. Since the Army does not routinely train on Guam (this will not change as a result of SBCT transformation), there is no threat of brown treesnake (*Boiga irregularis*) introduction to Oahu through this avenue.

The threat of alien species introductions via military sources of is reduced by the following: 1) having significant distances physically separating training ranges from native habitats, 2) minimizing training at or around firebreak roads, 3) minimizing use of roads adjacent to native habitats, 4) having well-manicured training ranges where soldiers maneuver may reduce the possibility of establishment of certain alien species.

Alien plants pose a serious threat to virtually all listed Hawaiian plant taxa and native communities by directly competing for space, nutrients, and light (R.M. Towill Corporation 1997b). Ultimately these alien introductions can reduce the longevity and reproductive capacity of native species. In addition to increased competition, alien species have an indirect impact on rare species through alteration of the habitats they require to survive (Cuddihy and Stone 1990). The impact of alien plant introductions can be devastating to native plant species as they spread into their already limited and fragmented habitats. Some of the more invasive introductions may disrupt native ecosystems by changing habitat conditions, vegetation structure, or ecological processes. There are ecosystems in Hawaii, especially in lowland areas, which have been completely replaced by introduced plant associations (R.M. Towill Corporation 1997b). The threat of colonization of new and aggressive weeds is an ongoing threat in the action areas.

Alien animal species can also be introduced to the action areas from Army activities. Detection of small animals, especially diminutive invertebrates, can be very difficult. This is especially true for those that hide in small areas like machinery and parts of vehicles. Howarth (1985) estimated that there are over 2,000 introduced insect species in the Hawaiian Islands. According to Howarth, there are a rash of dramatic impacts that these species can have on native populations, including predation on native plants and animals, transmission of diseases, alteration of soils, and hybridization with similar native species. Once introduced, the chance of detection via a monitoring program is slim, and evidence that it was introduced by military training or transformation may not be apparent.

3.2.1.6 Trampling from Current Military Training and SBCT Transformation

Trampling of threatened and endangered species, particularly plants and invertebrates, is a potential risk during training exercises when soldiers or troops move through native habitats with listed species.

3.2.1.7 Noise from Current Military Training and SBCT Transformation

Noise is an unwanted sound. It is generated from a source (e.g., explosion) as a wave of energy, which diminishes with distance. Excessive noise from military activities may result when rounds are fired, from helicopters carrying troops or supplies, and from airplanes or jets supporting mission needs.

3.2.2 Direct Interrelated Actions and Effects

3.2.2.1 Soil Erosion by Wind

Wind erosion is initiated when wind speeds are great enough to cause soil movement. It commonly occurs when particle size is less than approximately 1000 microns and it is dependent on wind speed, direction, and duration; soil moisture, soil erodibility properties, surface conditions, and vegetation structure and cover. These blowing particles in strong winds can cause leaf and stem damage, especially to young plants. In addition, areas exposed to wind erosion can become alkaline (high pH), and cause micronutrient deficiencies in plants (Bohn et al. 1985). Alien plant species seem to have an advantage in these soils over native species (Cardea and Gleason, unpublished data). Military and civilian vehicles disturb soil, crush

vegetation, and exacerbate wind erosion in arid environments. Airborne dust can result from military activities as vehicles move through and between training areas. In addition, wind erosion will often increase following a fire, and would not be limited to roads, LZ/PZ/DZ areas, off-road maneuver, and recreational areas. As dust settles on plants it can potentially affect photosynthetic rates, overall plant vigor, and cause mechanical damage to federally listed plant species. Fryrear and Downes (1975) observed that dust can move up to 300 m (0.19 miles) from the source, and may affect photosynthesis and other physiological processes. However, the extent of these negative effects has not been quantified and may not be measurable. The distance to the source of the dust should affect the degree of the impact, therefore a distance <100 m might be more measurable and significant.

3.2.2.2 Soil Erosion by Water

The relative ease of soil particle detachment defines the erodibility of soil, which is affected by texture, structure, organic matter content, and permeability of the soil (Ministry of Agriculture and Food 2000). Other factors affecting soil erodibility include rainfall and slope. The greater the intensity and duration of rain events and the steeper and longer the slope, the greater the risk of erosion.

Concentrated areas of military activity can potentially have an affect on erosion rates, sedimentation, and water quality. The increased erosion rates that result can degrade native habitats and destroy federally listed plant and snail species. These disturbances are common in association with roads, LZ/PZ/DZ areas, and off-road maneuver and recreational areas (e.g., motorcycle trespass). However, they can increase following a fire, and would not be limited to these areas.

3.2.2.3 Ground and Surface Water Degradation

Ground water may be impacted by military training and Army transformation activities, especially in areas where the ground water is relatively close to the surface, when materials such as oil, gasoline, and explosive by-products migrate down to the water table and spread out to other areas in the groundwater. The immediate effect of low levels of ground water contamination resulting from routine military training and SBCT activities on threatened and endangered species is unclear. The immediate concern is when water close to the surface becomes contaminated and threatened and endangered fauna are exposed to the contaminants in the surface water.

3.2.3 Direct Interdependent Actions and Effects

3.2.3.1 Range Construction and Maintenance

Construction and maintenance of military vehicle trails and foot trails, firebreak and fuel break roads, and the rehabilitation and enhancement of training areas, are examples of range activities that can potentially introduce weeds in construction materials such as crushed rock and sand. Work is done primarily by the 84th Engineers and G3 Range Maintenance Branch (Source: Mr. Garo, G-3 Range Division, 25th Inf Div (L)).

3.2.3.2 Integrated Training Area Management (ITAM) Program

This program provides land managers and trainers with long-term assessments of changes in the condition of training lands, provide trainers with a means to schedule training with a consideration of the carrying capacity of training land, and prioritize and evaluate land rehabilitation projects. ITAM monitors and mitigates erosion and loss of vegetative cover, and re-vegetates areas heavily used for training. Native seeds are collected from training areas for propagation at native plant nurseries on Oahu. These species are then outplanted in the training areas. In general native plants grow slowly and in some cases do not serve to control severe erosion fast enough. In such cases ITAM workers may choose to use alien plants

species which already occur near the outplanting site. ITAM workers coordinate these decisions with the Army's Natural Resource Section, but the ITAM program still has the potential to introduce alien plant and animal species via this work. Although the overall effect ITAM has on native species and habitats is very beneficial, the potential to introduce alien plants that may negatively impact federally listed species must be assessed.

3.2.3.3 Natural Resource Program

The Army's ecosystem management program has been developed to comply with the Endangered Species Act (ESA). The ESA requires that federal agencies use their authorities to carry out programs for the conservation of federally-listed species and to ensure that their actions are not likely to jeopardize the continued existence of any federally-listed species (Research Corp. of the University of Hawaii 2001). The Natural Resource staff (NRS) manages rare plants and animals and their ecosystems because the Army retains the land and uses it for training. Natural resource workers could potentially introduce weed species via field vehicles or gear during management. Although the overall effect NRS has on native species and habitats is very beneficial, the potential to introduce alien plants that may negatively impact federally listed species must be assessed.

3.2.3.4 Alien Species Introduction by Recreational Use

Alien Plant Introduction. Most alien plant introductions to islands are human induced, but dispersal within and between islands are common via wind, feral ungulates, and birds. Other potential sources for introductions come from civilians (e.g., general public hiking, hunting, practicing cultural/religious customs and vehicles on roads within and adjacent to action area).

Alien Animal Introduction. Open public accesses to the installation, public access on roads outside the installation boundaries, and non-military personnel with daily access to the installation are all potential non-military sources of animal introductions in the action areas. Also, alien animal species may disperse (usually by flying) into new uninhabited areas within the subinstallation or action area, or the smaller species may be blown in by winds.

3.2.4 Indirect Effects

3.2.4.1 Spread of Alien Species by Fire

Fire caused by military training can increase the spread of alien species, particularly alien grasses. Each successive fire that reaches native forest stands decreases the potential habitats for listed species, affects the moisture and canopy of the forest boundary, and increases the number of alien plants in areas of native vegetation. In addition, certain alien plant species are specially adapted to spread following a fire. These species could increase their range as a result of continued incidence of fires. These alien plant species compete with native plants for light, nutrients, and space, and impact many of the endangered species both directly through competition and indirectly through alteration of the habitats these listed species require to survive (Cuddihy and Stone 1990).

4. Dillingham Military Reservation and Military Vehicle Trail

4.1 General Description of Area

Dillingham Military Reservation (DMR) is located along the northwest shore of the island of Oahu on the Waialua Plain (USARHAW and 25th ID(L), 2000) (Figure 1.a). The installation is bounded by Farrington Highway and the Pacific Ocean to the north and by the Waianae Mountains to the south. Most of the DMR boundary is bordered by agriculture (50%), with some lands held by the Department of Army as conservation lands (15%), city of Honolulu (13%) for recreation, the State of Hawaii for agricultural enterprises (13%), and by private landholders (9%).

DMR comprises 269 ha (664 ac), of which 32 ha (78 ac) are ceded, 12 ha (30 ac) are easement, 223 ha (550 ac) are fee simple, and 3 ha (7 ac) are by license. Thirty-five ha (87 ac) provide for joint civilian/military use as an airfield. Non-military uses are permitted and include hiking, biking, hunting, and glider plane operation and parachuting.

The elevation of DMR ranges from sea level along the northern coastal boundary to 610 m (2000 ft) in the southern ridgeline areas, but the floor of the airfield is 3 to 37 m (10-120 ft) in elevation. The shoreline topography in the north contains reefs with sand pockets and channels (USACE and Nakata Planning Group 2000). The average annual rainfall ranges from 51 to 76 cm (20 to 30 in). The monthly average rainfall ranges from < 2.5 cm (1.0 in) in the summer to 12.7 cm (5.0 in) in the winter

4.2 Current Military Training

DMR is used for small unit (platoon and squad) maneuvers and combat support operations. DMR supports field training for headquarters and service support units. Specific training includes command post exercise operations, emergency deployment readiness exercise (EDRE) support operations, limited maneuver training, lodgment support operations, and night vision goggle (i.e., night flying) training for helicopter pilots. All operations involving significant support activities, tents, field facilities, and vehicles/equipment take place in the flatter areas cleared of vegetation in P1 and the lower elevations of P2 and P3. These activities take place within areas that support off-road vehicle maneuvers. EDRE is a realistic operation testing all aspects of a battalion's readiness. It is a rapid deployment training exercise (not actual deployment) for air and ground forces in response to an emergency threat situation. The objective is to minimize response time for deployment while achieving maximum benefit from testing and training opportunities. During an EDRE, a unit simulates a rapid deployment, but does not actually deploy. EDRE would involve convoys as would most exercises. Deployment itself takes place from Wheeler Army Air Field, Hickham Air Force Base, and Pearl Harbor. Lodgement support operations involve setting up camps for base operations.

Primary users of DMR include Army, Marines, HI Army National Guard, and U.S. Army Reserve Units[20]. Airborne equipment and personnel parachute operations occur but are very rare. Platoon-level Army Training Evaluation Program (ARTEP)[21] missions are supported at DMR. Approximately 147 ha (364 ac) are suitable for maneuver and field training, 43 ha (107 ac) are developed within the cantonment area, and the remaining 82 ha (203 ac) are located on steep slopes of the Waianae Mountains (USAESC

[20] Primary users based on 2002 Range Facility Management Support System (RFMSS) utilization data provided by USARHAW Range Division.

[21] ARTEP exercises are used to evaluate performance and training relative to a specified level of performance. It is essentially a form of training or operational readiness testing. The missions themselves are the same as those that are not being formally evaluated.

2002b) (Figure 4.a)[22]. The former airfield has extensive hardened areas that can support vehicular traffic and headquarters activities. Field activities, or training exercises, can involve a variety of activities, such as vehicle movement, maneuvers and convoys, foot maneuvers, bivouacking (camping), limited aviation training, and staff training exercises. Helicopters may land on hard-surfaces on Dillingham Training Areas P-1, P-2 and P-3 (pers. comm.. Mr. Villalobos). A drop zone is located at DMR but is not used because of the proximity to the ocean and associated safety requirements for drop operations. However, helicopters do use the taxi-way (in portions of P1, P2, and P3) for training for both day and night tactical flight operations and airmobile (i.e., troop transport) exercises. Non-Army military services may also use the Dillingham runway, but the Army does not have control of scheduling or use of the runway. A summary of training types and annual usage (number of days and troops) for each training area at DMR is presented in Table 4.a. The average use of each training area ranges from 74 to 123 days per year and from 7,100 to 13,600 troops per year. Ammunition (blanks, smoke, and simulators) usage for Legacy (i.e., current) training at DMR is presented in (Section 4.3.4, Non Live-Fire Maneuver and Other Training Activities, Table 4.b).

The following rules for allowable and prohibited pyrotechnics use apply at DMR[23]:

Restrictions

- There is no live fire at DMR.
- Airfield is off-limits to military training unless coordinated through Range Division Hawaii (RDH).
- Live ammunition (i.e., live-fire training), aerial pyrotechnics (e.g., star and parachute flares), and CS grenades are not authorized.
- No ignition sources (including cigarettes, cooking/warming fires, and blanks) outside of P-1 until the first firebreak is complete. No ignition sources outside of the first firebreak until the second (future) firebreak is complete. No ignition sources outside of the second (future) firebreak at any time. This includes smoking and cooking/warming fires as well as all munitions. Future firebreak construction is discussed in Section 4.3.1 and a map is presented in Section 4.4.
- Blanks are authorized at DMR but are not currently used.

Pyrotechnics

- The use of pyrotechnics, simulators (including demolition effects simulators – DES), and blanks requires approval from RDH Range Operations and will be controlled by the Fire Danger Rating System (FDRS) for DMR.
- RDH will restrict the use of pyrotechnics under the Red FDRS category.
- RDH will authorize and apply safety buffer zones for smoke grenades in Training Areas P-1, P-2, and P-3 and ground simulators in Training Areas P-2 and P-3. [24]
- Smoke grenades will only be used in areas devoid of vegetation.

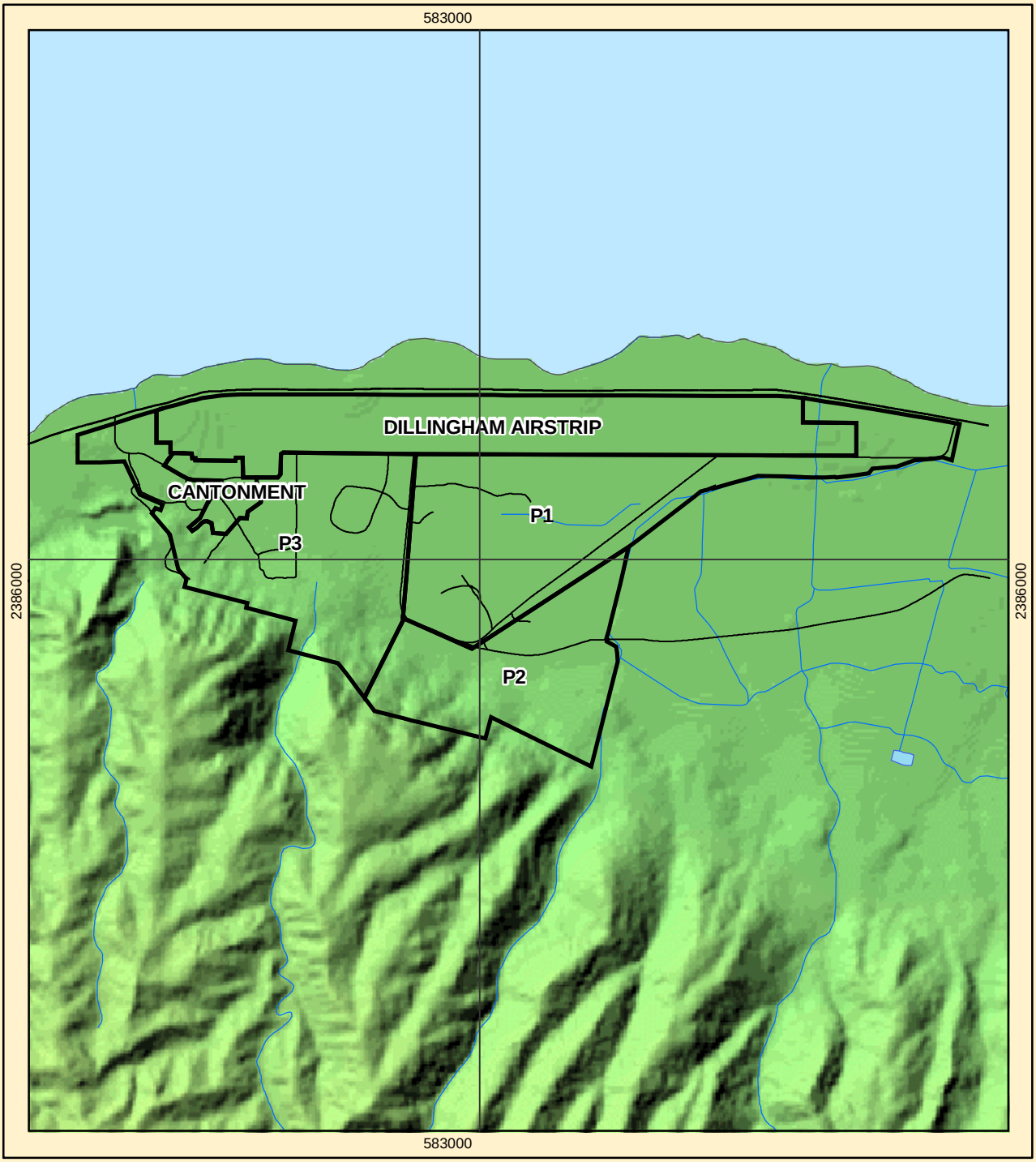
Small unit maneuvers and combat support training would include non-live-fire, mounted maneuver training with Humvees, cargo trucks, trailers, as well as foot training. Field activities, or training exercises can involve vehicle movement, maneuvers and convoys, foot maneuvers, bivouacking (camping), limited aviation training, and staff training exercises.

[22] This acreage figure for maneuver is different from the results of the high-probability vehicle maneuver analysis presented for current and SBCT training due to differences in criteria and available GIS data.
[23] USARHAW Regulation 350-1, Training (25th ID(L) and USARHAW 2000), and 25th ID(L) and USARHAW Regulation 210-6, Installations Ranges and Training Areas (25th ID(L) and USARHAW 1999).
[24] Buffer information is listed in 25th ID(L) and USARJAW Regulation 210-6, Appendix F.

Training Areas

Dillingham Military Reservation, Oahu

Figure 4a



1:24,000

0 250 500 1,000 Meters

0 0.125 0.25 0.5 Miles

N

Data Source: U.S. Army Active/Inactive Range Inventory 2001

Legend

Roads

Streams

Ranges

Surface Water Feature

Table 4.a Types of Legacy Training and Annual Legacy Usage by Training Area for DMR. (Data source: Annual RFMSS Utilization Reports for 1998-2002 obtained from G3 Range Division.)

	Types of Training											**1998-2002**					
Area Name	Mounted maneuver*	Dismounted maneuver*	Live fire	Foot Reconnaissance	Bivouac	Deployment training	Helicopter aviation training	Air assault/movement	Parachute drops of equipment and personnel	Major force-on-force training	CSS Operations and Training**	Min Days Used	Max Days Used	Average # Days Used	Min # Troops	Max # Troops	Average # Troops
P-1	x	x		x	x	x	x	x			x	75	120	101	7137	13308	10025
P-2	x	x		x	x	x	x	x			x	74	122	101	7174	13846	9937
P-3	x	x		x	x	x	x	x			x	72	128	101	7201	13589	10069
Average by training area												74	123	101	7171	13581	10010
* Mounted and dismounted use may be very limited by topography and road access. See vehicle maneuver probability analysis for acreages available in each TA.																	
** Tents and support facilities in flat, open areas																	

Vehicle maneuvers are constrained by topography and vegetation (and other applicable constraints listed), whereas foot maneuvers may occur anywhere that safety or administrative restrictions permit including the high probability vehicle maneuver areas. Dismounted maneuver training could therefore occur anywhere. Most other activities at DMR require vehicle access and firm, relatively flat ground, including the flat open areas that have been used in the past in P1 and at lower elevation in P2 and P3. High-probability off-road vehicle maneuver areas for DMR are discussed below.

4.3 Proposed Transformation Actions at DMR

4.3.1 Construction

Construction associated with the proposed action consists of a military vehicle trail to facilitate movement between Schofield Barracks Military Reservation and DMR and three fixed tactical internet antennas. Firebreaks are also proposed as part of this action. They are discussed here, but effects of firebreak construction will be covered under a separate consultation with FWS.

Schofield Barracks Military Reservation to Dillingham Military Reservation Military Vehicle Trail (57413)
Both construction and usage of this trail are addressed under this BA. This project would construct a 24 foot wide gravel road with 3 foot wide gravel shoulders on both sides from Schofield Barracks Military Reservation to Dillingham Military Reservation (DMR). The road would be one-lane wide and approximately 15 miles long (Figure 4.b). Work includes grading, paving, drainage improvements, culverts at stream crossings, guardrails at drop-offs, and storm drainage structures and lines to preclude excessive storm runoff from flowing over the road and posing a hazard to vehicular traffic. Work will also include provisions for telecommunication lines that will run along side the new paved road. Road grades steeper than 10 percent will be paved with asphalt or concrete. New easement rights are required for the new road and are being purchased with funding under FY04 MCA PN58161 *Land Easement*. Supporting facilities includes provisions for shotcrete, guardrails, retaining walls, concrete swales, grass swales, drainage structures, signage, and information systems. The corridor of disturbance associated with the trail construction will vary with terrain and existing road features, but will not extend significantly outward from the trail shoulders, especially where the alignment follows existing roads (pers. comm. Ray Kong Honolulu COE District, 3/12/03).

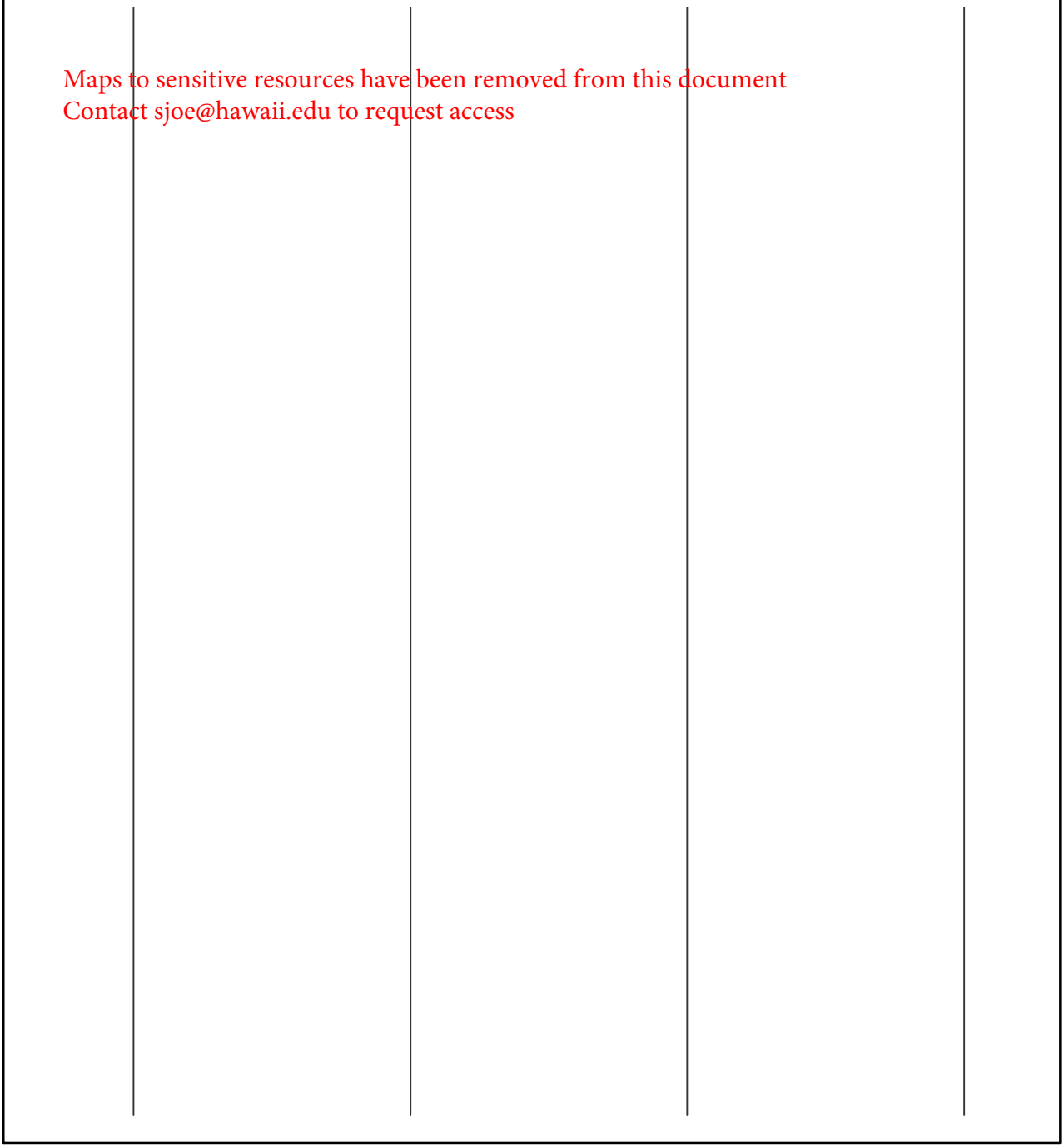
This project is required to provide a safe military vehicle trail for use by military personnel of the 25th Infantry Division (Light) engaged in training activities to get from Schofield Barracks to Dillingham Military Reservation (DMR). This road is also required to support the increasing training needs of the 25th ID(L) and to support Army transformation requirements.

Fixed Tactical Internet (FTI)
Construction of three fixed tactical internet antenna support structures with four antennas each is proposed to provide tactical communications infrastructure enabling units to train at any hour of the day or night without deploying to the field. When linked to the installation information infrastructure architecture (I3A), FTI could also provide connectivity for command and control integration of live-fire and simulation training. FTI is a group of antennas placed strategically throughout a training land parcel. The antennas permit sending and receiving of voice and data signals to radios in military vehicles.

Proposed Military Vehicle Trail from Dillingham Military Reservation to Schofield Barracks Military Reservation, Oahu

Figure 4b

Maps to sensitive resources have been removed from this document
Contact sjoe@hawaii.edu to request access



1:113,404

0 1,000 2,000 4,000 Meters

0 0.5 1 2 Miles

Data Source: U.S. Army Hawaii Staff 2002, HINHP 2002, RCUH 2002a

Legend

- Threatened and Endangered Species
- *Chasiempis sandwichensis ssp. Ibidis*
- *Alectryon macrococcus var. macrococcus*
- Action Area
- Installation Boundary
- Internet Antennas
- Roads
- Military Vehicle Trail
- Surface Water Feature

Four antennas will be installed at each proposed site located on Oahu. Existing antenna support structures and sites will be utilized when possible. The antennas are vertical whips approximately two inches in diameter. Two antennas approximately 1.2 m (4 ft) long and two approximately 10 feet long will be mounted on an antenna mast, utility pole, existing support structure, or building. Some of the antennas may have a red light at the top, according to FAA guidelines, to warn nearby aircraft. Each site will be 6.1 x 7.6 m (20 x 25 ft), including a 4.6 x 6.1 m (15 x 20 ft) concrete pad for the support structure and shed. Each site will be fenced and accessed via existing roads in all cases. Personnel will visit the sites prior to and after Army training events. No security lighting will be installed at the sites. Equipment sheds will house radios and batteries. The three FTI structures associated with DMR are named Dillingham ARPT (42' in height, new equipment shed), Dillingham P1 (12.8 m (42 ft) in height, new equipment shed), and Dillingham Ridge (9.1 m (30 ft) in height, new equipment shed) (Figure 4.b).

Firebreaks
Two firebreaks will be built at DMR (see Detailed Action Area Description for DMR - Section 4.4.3, below) to provide fire containment. These will provide fuel free areas that give firefighters access and a defensible location from which to fight a fire. They will both be built to standards as outlined in the WFMP. The first will largely be composed of existing roads and will contain all of P-1 and portions of P-2 and P-3. This firebreak will be completed in 2005. The second firebreak will be closer to the southern edge of the installation and will contain nearly all of the training areas. This break will be constructed in 2006 and will be built to standard. These firebreaks will be constructed regardless of whether SBCT occurs.

Construction will remove vegetation and clear debris using bulldozers or other mechanical means to create a drivable surface approximately 6 m wide. The vast majority of the area to be used will follow existing roads and/or power line right of ways.

4.3.2 Ranges

No range construction or use is planned.

4.3.3 Live-Fire Training

There is no live-fire training on DMR.

4.3.4 Non Live-Fire Maneuver and Other Training Activities

Most training would be similar to that conducted by the current light infantry brigades. SBCT forces will use DMR for small unit maneuvers and combat support operations, to include Initial Staging Base (ISB) operations[25]. Such training would include non-live-fire, mounted maneuver training with vehicles such as the Stryker, Humvee, and cargo trucks, as well as foot training. Field activities, or training exercises, can involve a variety of activities, such as vehicle movement, maneuvers and convoys, foot maneuvers, bivouacking (camping), limited aviation training, and staff training exercises. As with Legacy training, exercises would continue to be at the squad through company level, with some opportunities for larger unit training. General SBCT training would likely occur between 180 and 242 days per year.

Allowable and restricted uses of pyrotechnics would be the same as under Legacy training. No ignition sources would be permitted outside of the second (future) firebreak at any time. This includes smoking and cooking/warming fires as well as all munitions. Future firebreak construction is discussed in Section 4.3.1. Current and proposed usage of blanks and pyrotechnics are presented in Table 4.b. With

[25] This training is essentially the same as Brigade Support Area operations, which consist of a variety of support, maintenance, and service functions supported by tents and vehicles.

Transformation, usage of both blanks and smoke grenades would increase by approximately 10 percent in Training Areas P1, P2, and P3. Simulators would not be used in P1 and P2, and usage would increase in P3 by approximately 10 percent under Transformation of the 2nd Brigade.

Table 4.b Summary of Ammunition Usage for Current and Transformed Training at KTA, and the Net Difference in Rounds by Ammunition Type. (Source: John Gallup and Associates training description version 5.3).

	FY 05 Projection Un-Transformed (Current)*			**FY 05 Projection Transformed**			**Net Difference With Transformation**
Training area and Ammunition Type	2 Legacy Brigades	Other Units	Total	1 Legacy Brigade & 1 SBCT	Other Units	Total	All Rounds
Dillingham P1							
5.56mm Blank	7182	0	7182	7900	0	7900	718
7.62mm Blank	707	0	707	778	0	778	71
.50 Cal. Blank	61	0	61	67	0	67	6
Pyro - simulators	0	0	0	0	0	0	0
Pyro-Smoke	62	0	62	68	0	68	6
Dillingham P2							
5.56mm Blank	7182	0	7182	7900	0	7900	718
7.62mm Blank	707	0	707	778	0	778	71
.50 Cal. Blank	61	0	61	67	0	67	6
Pyro - simulators	940	0	940	0	0	0	-940
Pyro-Smoke	62	0	62	68	0	68	6
Dillingham P3							
5.56mm Blank	7182	0	7182	7900	0	7900	718
7.62mm Blank	707	0	707	778	0	778	71
.50 Cal. Blank	61	0	61	67	0	67	6
Pyro - simulators	940	0	940	1035	0	1035	95
Pyro-Smoke	62	0	62	68	0	68	6

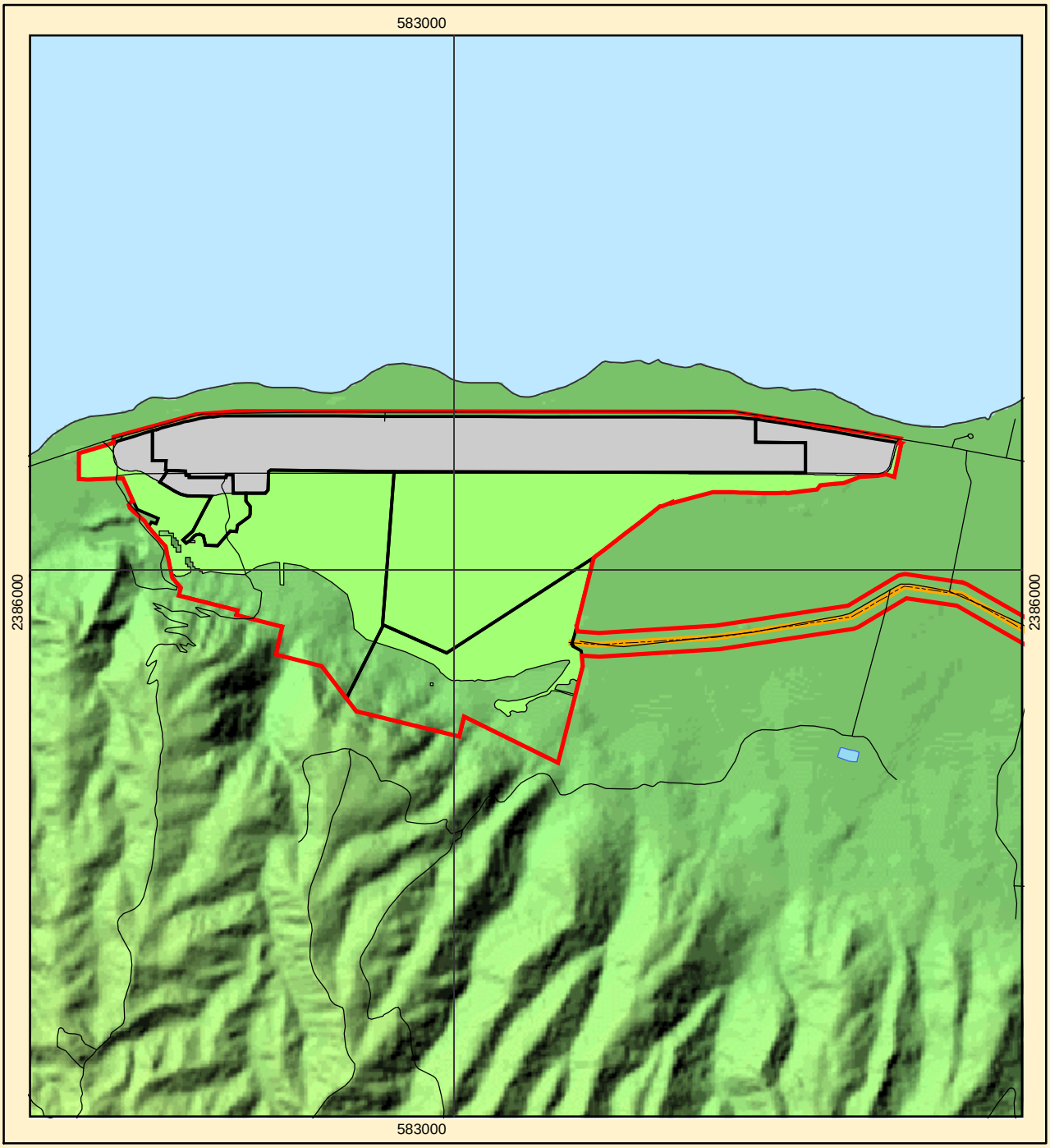
* This comparison of current and transformed ammunition usage is projected for FY 05 based on Draft STRAC (Standards in Training Commissions) information. Information for "Other Units", including other 25ID(L), USMC, and other units was compiled from 2001 RFMSS data and is used as a constant for both Un-Transformed and Transformed projections (John Gallup and Associates product 10/16/02).

High-potential vehicle maneuver areas represent areas potentially subject to vehicle disturbance. High-probability vehicle maneuver areas include most of DMR (Figure 4.c). Delineation of high-potential vehicle maneuver areas is described in Section 3.1.2, Projected Training Footprint. High probability vehicle maneuver areas include the airstrip, 74 ha (183 ac) of area P1, 19 ha (47 ac) of area P2, and 44 ha (109 ac) of area P3, for a total of approximately 205 ha (507 ac) out of a total of 73 ha (662 ac) on DMR. No vehicle maneuver would occur south (i.e., outside) of the future firebreak proposed at DMR. Until the second firebreak is completed, this restriction will apply to the first firebreak. Until the first firebreak is completed, this will apply to the area outside of P-1.

High Probability Off-Road Vehicle Maneuver Areas

Dillingham Military Reservation, Oahu

Figure 4c



1:26,003

0 250 500 1,000 Meters

0 0.125 0.25 0.5 Miles

Data Source: Center for Environmental Management of Military Lands

Legend

- High Probability Areas
- Airstrip
- Training Areas
- Action Area
- Military Vehicle Trail
- Roads
- Surface Water Feature

4.4 Delineation of the Action Area

4.4.1 Approach to Delineating the Action Area

The action area for DMR itself was determined by the impact of fire and the extent of soldier training, while the action area for the military vehicle trail was defined by trampling/crushing and the introduction of exotic species. No smoking will be allowed, inside or outside of vehicles anywhere on the military vehicle trail, and no military vehicles have catalytic converters so the risk of fire ignition is considered to be near zero. Fuels management will also be conducted along the trail as described below in segment C to D.

4.4.2 Sections of the Action Area

Man-made barriers to fire and the spatial extent of training were the factors considered in the delineation of the DMR action area. The man-made barriers include Farrington Highway, agricultural lands, and firebreaks. A 50 m (164 ft) buffer from the centerline defined the action area for the length of the military vehicle trail (Figure 4.d).

4.4.3 Detailed Action Area Description for DMR

Points listed below appear in (Figure 4.d):

A to B – Farrington Highway delineates the action area boundary for the length of this segment. Fuels are managed throughout Dillingham Airfield and there is almost no chance of a fire crossing the road.

B to C – The action area follows the edge of an agricultural field used for coconut, banana, or palm plantations until it meets the 50 meter centerline buffer for the military vehicle trail. The necessary continuity of fuels to allow fire spread are generally not available in these types of agriculture, making them a good barrier to fire. Should these lands fall out of use, the Army will extend the second firebreak (see below and Figure 4.d) along the eastern edge of DMR and tie it into the Dillingham airfield.

C to D – The 50 meter centerline buffer travels the entire length of the military vehicle trail and returns to the DMR boundary 50 meters south of the military vehicle trail intersection. The action area for this segment is defined by the effects of weed introduction, dust, trampling/crushing, and noise. The Army will not allow smoking, in or out of vehicles, bivouacking anywhere on the military vehicle trail, which reduces the threat of fire to near zero. The Army will require personnel to stay within this buffer at all times. Should vehicles be required to stop while en route to or from DMR for any reason, any personnel that dismount will stay within 50 meters of the centerline of the road to avoid any effects outside of the action area. Additionally, the locales that the vehicle trail passes through are almost entirely composed of agricultural lands, which are not vulnerable to wildfire due to the types of fuels available and high percentage of bare ground. Anywhere that the vehicle trail passes through unmanaged fuels, fuel management along the trail will be implemented to further reduce the risk of fire. Because agricultural lands may go in and out of use in the future, fuels management will be adjusted to account for areas that may become overgrown. Fuels management may include mechanical removal and/or chemical application to reduce fuel loads to less than 20% crown cover. These will be applied to 10 feet from the edge of the road.

D to A – The action area follows the installation boundary back to point A. Two firebreaks will be constructed in this area. The first will be a temporary firebreak to be completed in 2005 that will use the

Action Area Delineation

Dillingham Military Reservation and Military Vehicle Trail, Oahu

Figure 4d

1:119,000

0 750 1,500 3,000 Meters

0 0.5 1 2 Miles

Data Source: Center for Environmental Management of Military Lands

Legend

Action Area Input
- 50 Meter Buffer
- Installation Boundary
- Plantations
- Road
- Military Vehicle Trail
- Major Roads
- Firebreaks
- Installation Boundary
- Fixed Internet Antennas
- Surface Water Feature

existing taxiways and roads (Figure 4.d). The roads will be improved to firebreak standards as stated in the WFMP. A second permanent firebreak will be constructed in 2006 approximately following an existing power line near the southern boundary of the installation (Figure 4.d). This firebreak will also be constructed to firebreak standards. The firebreak will tie into the agricultural fields on the east side of the installation and to Dillingham airfield on the west end. Training will be allowed outside of the firebreaks, but will be limited to no ignition sources of any kind. Pyrotechnics, blanks, smoking, and cooking/warming fires are not allowed anywhere outside of the second firebreak at any time. Until the second firebreak is completed, this restriction will apply to the first firebreak. Until the first firebreak is completed, this restriction will apply to any area outside of P-1 and the Dillingham airstrip. Once the second firebreak is completed, the temporary firebreak will be maintained as funds become available, but will not be considered vital to fire suppression.

Fixed Tactical Internet Antennas – Three FTI antennas are considered part of DMR for this BA, and one of those falls outside of the boundary described above. The sites itself will be only several meters across, but a buffer of 25 meters from the center point of the site is used as the extent of the impact associated with the antennas and is included in the action area. Most of this impact will be a result of construction. Impacts include trampling/crushing, potential introduction of exotic species, and fire from catalytic converters (only for sites where there is vehicle access) and sparks from construction. Once the antenna tower is built there will be minimal maintenance necessary and impacts will be very light.

4.5 Description of the Affected Biological Environment and Affected Species

Although Army training and transformation to a Stryker Brigade Combat Team takes place within the boundaries defined in the introduction (section 1.2), for purposes of this BA, and consistent with USFWS recommendations, the "action area" is considered the biological environment affected by either direct, indirect, or interrelated/interdependent effects of the proposed action.

4.5.1 Ecological Zones Affected by the Action

There are no ecological zones designated at DMR because of the disturbed and fragmented nature of the remaining native ecosystems, and the low densities of native species there. There are four native natural communities at DMR action area including Coastal Dry Shrubland, Lonomea (*Sapindus oahuensis*) Lowland Dry Forest, Wiliwili (*Erythrina sandwicensis*) Lowland Dry Forest, and Lowland Mesic Forest and Shrub (Figure 4.e) (R.M. Towill Corp. 1997b, Hawaii Natural Heritage Program (HINHP) 1995). The lowland dry forests are found in sloping cliff areas on southern portions of DMR, the Coastal Dry Shrubland is found along the NNW boundary of the action area, and the mesic forest is along the southern boarder of the AA. The Lonomea Lowland Dry Forest community is considered rare and imperiled (HINHP 1995). There are several areas that are possible wetlands on DMR (USACE 2002). These possible wetlands are seasonally flooded areas dominated by exotic plant species including California grass (*Brachiaria mutica*), and emergent trees and shrubs (HINHP 1995).

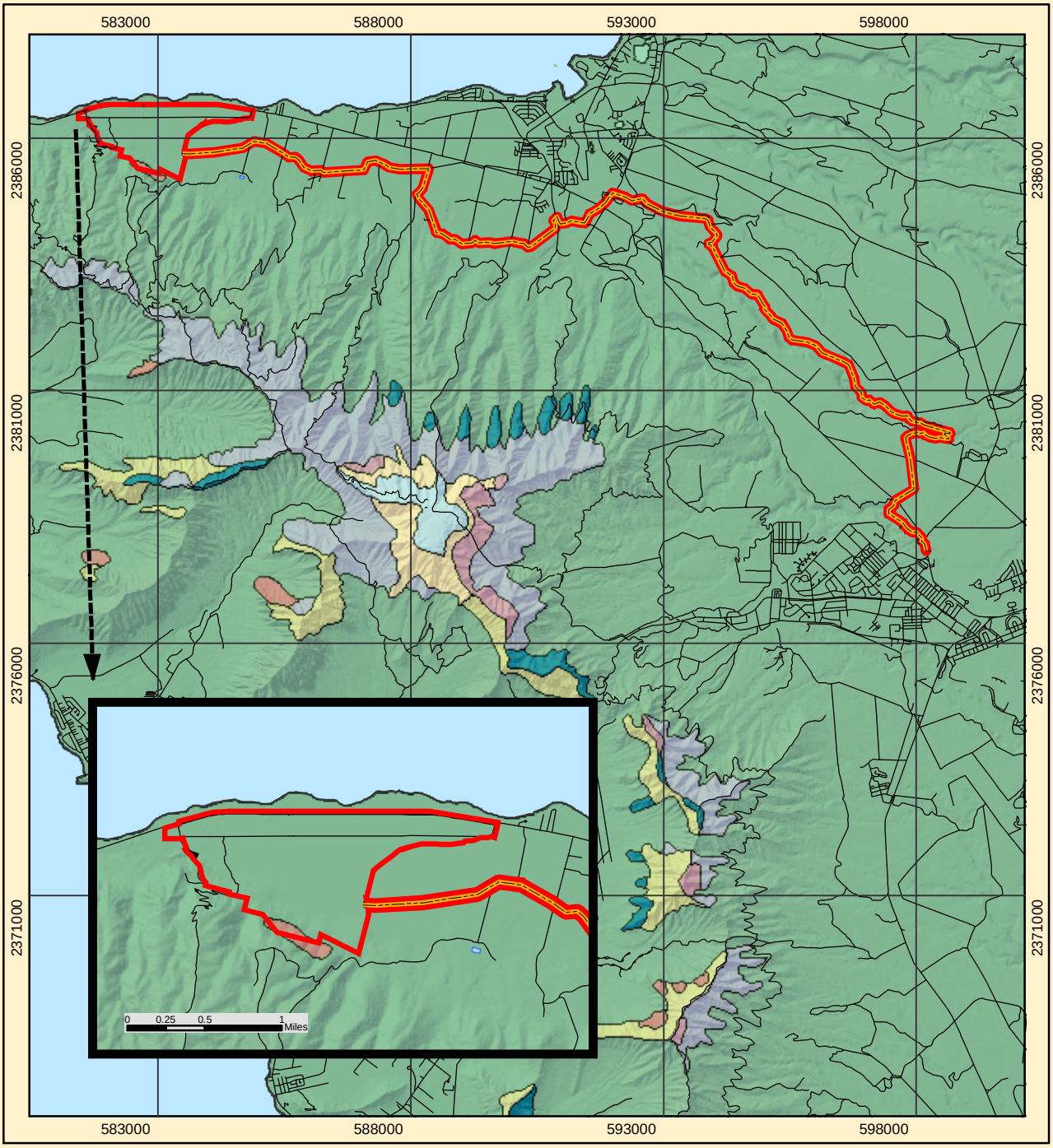
4.5.2 Federally-listed Species Affected by the Action

The first step in determining which species may be affected by Army training and Transformation at Dillingham Military Reservation and along the DMR tank trail was to compile available rare species occurrence data for Army Lands on Oahu. The resources for this data included the Army Natural Resource Geographic Information System (GIS), the Hawaii Natural Heritage Program (HINHP) Database, the USFWS recovery plans, the Makua Military Reservation Implementation Plan Draft documents and information from biological experts. Army Natural Resource Staff conducts rare plant, invertebrate, and vertebrate surveys annually to confirm existing population numbers and locate unreported populations. The most current and detailed data available was used from these various sources.

Ecological Zones

Dillingham Military Reservation Action Area, Oahu

Figure 4e



N

1:123,000

0 750 1,500 3,000 Meters

0 0.5 1 2 Miles

Data Source: Hawaii Natural Heritage Program

Legend

- Dry Cliff
- Lowland Dry Forest Shrubland
- Lowland Dry Shrubland Grassland
- Lowland Mesic Forest Shrubland
- Lowland Wet Forest Shrubland
- Montane Wet Forest Shrubland
- Non-Native Vegetation
- Wet Cliff
- Action Area
- Installation Boundary
- Military Vehicle Trail
- Roads
- Streams
- Surface Water Body

Once compiled, these data were sorted by area and a new list included only those threatened and endangered species within the designated action area for Dillingham Military Reservation. The following threatened and endangered species have historically been documented at DMR action area (see Appendix B for a complete list of rare species historically recorded in DMR AA):.

- 4 endangered birds (*Himantopus mexicanus knudseni* (Hawaiian stilt), *Gallinula chloropus sandvicensis* (Hawaiian gallinule), *Fulica alai* (Hawaiian coot), and *Anus wyvilliana* (Hawaiian duck). These observations were made 1983-1988 in Dillingham Pond (HINHP 2002).

This data was subsequently sorted by date and included all threatened and endangered species occurrences from 1982 until the present in DMR AA (past 20 years). This date was agreed upon by Army Natural Resource Staff (NRS) and the USFWS, because NRS could confirm using recent extensive survey information, whether species prior to 1982 were extirpated (Kapua Kawelo, U.S. Army, pers. comm. 2002). The birds were only included in the list if they were confirmed to be residents. This would exclude the bird species mentioned above. These bird observations represent one time occurrences dating back 15-20 years. NRS has repeatedly surveyed these and other potential sites in DMR over the past 6-7 years looking for wetland species with no success (RCUH 2002b, 2002c). There are no other threatened and endangered species presently documented within the DMR AA (Figure 4.b).

4.5.3 Potential non-military uses of the action area

There are non-military uses at DMR that have the potential to negatively impact federally listed species. They are current actions that are not controlled by the Army. They include hiking, biking, glider plane operations and parachuting at DMR.

- DMR allows hiking and biking on the Kealia Trail (5.63 km) by the general public on weekends and state holidays. However, this access can be limited if military maneuvers are scheduled and notice is given in advance. Permission for the public to hike the Kealia Trail must be given by DPW and DOFAW (CEMML 2001).

- Dillingham Airfield is open daily to the general public as described in a lease with the state of Hawaii, which is valid through 2008. Glider plane operation and parachuting are both allowed in designated areas. The glider (sail) plane area is located on the north side of Runway 8. There are two parachute drop zones. One is located in the Runway Protection Zone of Runway 26 and is usable only when trade winds are favorable and there are no nearby aircraft operations. The other is located in the Runway Protection Zone of Runway 8 and can be used during Kona (south) wind conditions (R.M. Towill Corp. 1997a).

4.6 Minimization of Potential Negative Effects of the Action

To quantify the beginning threat level for each potential effect of the action and the remaining threat following minimization action, a relative numerical threat value system is used. Threat values assigned to each potential effect are 0 = none, 1 = very low, insignificant and discountable (1-10% vulnerability), 2 = low, (11-25% vulnerability), 3 = moderate, (26-50% vulnerability), 4 = high, (51-75% vulnerability), and 5 = very high, (>75% vulnerability). These threat values have been developed for use in our discussion as a means of comparing threats posed to threatened and endangered species in portions of the action area relative to other portions of the action area. They measure the risk of each event occurring in a given area. The reasoning behind the assignment of each value is discussed under each section below.

Minimizing the potential negative effects of Army training and transformation activities involves implementing actions to lessen the amount of negative impact that the action may cause. Minimization is

important for reducing the potential negative impact to listed species, but it also can work to reduce the size of the action area, which in turn can reduce the number of species affected by the action. The potential effects of Army training and transformation at Dillingham Military Reservation and Dillingham Military Vehicle Trail are discussed in this section, along with proposed minimization actions for those that received threat values greater than (1) very low, insignificant and discountable (Table 4.c). Minimization actions may result in the modification of threat values downward. Table 4.c at the end of this section, summarizes the resulting (modified) threat values following minimization actions. Modified threat values of less than low (2) are **not likely to adversely affect any federally-listed species or adversely modify critical habitat in the action area**. Potential effects assigned modified threat values greater than or equal to low (2) are **likely to adversely affect federally-listed species or adversely modify critical habitat** and these are in bold type in Table 4.c.

4.6.1 Direct Effects

4.6.1.1 SBCT Construction Projects

Dillingham Military Vehicle Trail. The Schofield Barracks to Dillingham Military Reservation military vehicle trail is the main SBCT construction project that is part of DMR action area. The action area includes 50 m (164 ft) in both directions from the center line of the trail. All construction and transport of workers will take place within the boundaries of the action area as it is defined, including earth moving, turnarounds, drainage channels, etc. An existing road will be used for most of the length of this vehicle trail, minimizing the need for construction. The closest federally listed species to any part of the military vehicle trail construction (*Himantopus mexicanus knudseni* (Hawaiian stilt), *Fulica alai* (Hawaiian coot), and *Anus wyvilliana* (Hawaiian duck)), were recorded 1983-93, approximately 150 m (492 ft) away, in the Crowbar Ranch Pond (Figure 4.b). Thus, no listed species will be directly affected by this SBCT construction of the Dillingham Military Vehicle Trail.

Fixed tactical internet antennas. There are three fixed tactical internet antennas proposed in the DMR action area (2 within the confines of the Dillingham installation and one on Dillingham Ridge) (Figure 4b). The construction would include a 6.1 x 7.6 m (20 x 25 ft) area, and existing roads would be used to access the antennas. The closest federally listed record to any of these antenna tower construction locations, including a 25 m construction buffer, is the Oahu elepaio (*Chasiempis sandwichensis* ssp. *ibidis*) which is about 300 m (985 ft) to the Dillingham Ridge Antenna, and the closet known listed plant is *Alectryon macrococcus* var. *macrococcus* which is about 470 m (1540 ft) to this antenna (Figure 4.b). The antenna is also about 90 m (295 ft) from elepaio critical habitat. Thus, no listed species will be directly affected by this SBCT construction of the fixed tactical internet antennas. The antennas will be inspected monthly for electrical and physical damage and will be repaired as needed. If there are any specific actions that may affect listed species, the Army will consult with the USFWS.

Therefore, the threat these construction projects pose to listed species is (0) none.

4.6.1.2 Fire from Current Military Training and SBCT Transformation

Ignition sources at DMR include pyrotechnics, smoking, muzzle flash (from blank ammunition), sparks from construction activities and equipment, and catalytic converters. Fuels within the most heavily utilized training areas at DMR are largely composed of mature stands of *Panicum maximum* (guinea grass) mixed with *Leucaena leucocephala* (haole koa). Small stands of *Eucalyptus* exist as well, particularly in P-1. The fuels are broken by several old asphalt taxiways. The climate is semi-arid, with annual precipitation of approximately 35 inches per year (Giambelluca et al. 1986). The average high temperature, as measured in Haleiwa, is 83 degrees F. Prevailing winds are east or northeasterly trades.

For the purposes of this BA, fire vulnerability is defined as the risk of fire ignition combined with the risk of fire spread as determined by characteristics of the vegetation and climate. Because very few fires occur at DMR and the available fire history is very short, an empirical method of determining ignition probability is not possible. The likelihood of fire at DMR is far less than that at a live-fire range such as SBMR. DMR proper will be separated from the hills to the south by a planned firebreak road. The area inside the firebreak is vegetated with heavy fuels and is relatively dry (Figure 4.f). Pyrotechnics, blank fire exercises, and maneuver are allowed. However, no live fire munitions are authorized, reducing the chances of an ignition markedly. This area is **moderately (3) vulnerable** to fire (Figure 4.g). The fuels outside of the firebreak are more heavily dominated by trees, but there is a large grass component in this location as well. The types of training allowed outside the firebreak will be restricted. No ignition sources of any kind will be authorized including, but not limited to, pyrotechnics, blanks, and smoking. Because of the additional restrictions on ignition sources, this area has a **low (2) vulnerability** to fire.

The Dillingham Military Vehicle Trail also has a **low (2) vulnerability** to fire. There are almost no concentrations of heavy fuels along the trail and the low probability of an ignition from this type of training, in addition to the restrictions on smoking and bivouacking anywhere along the trail, reduce the chance of ignition to near zero. Anywhere that the vehicle trail passes through unmanaged fuels, fuel management along the trail will be implemented to further reduce the risk of fire. Because agricultural lands may go in and out of use in the future, fuels management will be adjusted to account for areas that may become overgrown. Fuels management may include mechanical removal and/or chemical application to reduce fuel loads to less than 20% crown cover. These will be applied to 3 m (10 ft) from the edge of the road.

The FTI antenna site outside of the contiguous action area boundary has a **low (2) vulnerability** to fire (Figure 4.b). During construction there is the possibility of sparks or catalytic converters starting fires, but the period of construction will be very short. Additionally, numerous mitigation measures will be in place including spark arrestors and fire extinguishers will be required on heavy machinery. Smoking will be restricted to areas of bare ground. The antennas will be inspected monthly for electrical and physical damage, but there is little chance of an ignition occurring after construction is complete.

Methods to minimize the negative effects of fires on threatened and endangered species will be documented in the finalized Wildland Fire Management Plan (WFMP) (25th ID(L) and USARHAW 2003), Pohakuloa and Oahu Training Areas, scheduled to be completed by September, 2003. Components of the WFMP important in Section 7 consultations with the USFWS are included in the BA (Fire History, Protected Species, Firebreak System, Fuels Management, Enforcement, Ignition Control, Fire Danger Rating System, Fire Reporting and Notification Procedures, Records and Fire Reports and Departmental Responsibilities). The fire management plan defines the responsibilities of Range Control personnel and military training units for the prevention and suppression of fires at DMR. This plan also outlines the prevention and suppression measures that must be carried out to train at DMR. Actions at DMR to minimize impacts include implementing a fire danger rating system and restricting training accordingly, and modifying training or establishing a firebreak road, such that any fires that start will be contained by fuel-free areas. Fuels management may be considered as well, including chemical and mechanical means of fuel reduction and prescribed burning. Immediate and aggressive response to all fires is an unconditional requirement at DMR. Training will be halted or altered to the extent necessary to facilitate achieving this goal. Any fire that leaves the installation will be condition for reconsultation with the FWS. Additionally, any fire outside of the firebreak will be condition for reconsultation. Until the second firebreak is completed, this condition will apply to the first firebreak, and until the first firebreak is completed this condition will apply to fires outside of area P-1.

Fuel Types

Dillingham Military Reservation and Military Vehicle Trail, Oahu

Figure 4f

1:90,000

0 1,000 2,000 4,000 Meters

0 0.5 1 2 Miles

Data Source: Center for Environmental Management of Military Lands

Legend

Fuel Types
- Forest
- Grass/shrub
- Non forest

- Military Vehicle Trail
- Roads
- Installation Boundary
- Surface Water Feature

Fire Vulnerability Areas

Dillingham Military Reservation Action Area, Oahu

Figure 4g

1:116,000

0 1,500 3,000 6,000 Meters

0 0.5 1 2 Miles

N

Legend

- Action Area
- Low Fire Vulnerability
- Moderate Fire Vulnerability
- Military Vehicle Trail
- Major Roads
- Surface Water Feature

Data Source: Center for Environmental Management of Military Lands

The fire threat will be reduced from moderate (3) to low (2) inside the firebreak at DMR proper by following the procedures outlined above. The fire threat will be reduced from low (2) to very low (1) insignificant or discountable through fuels management along the Dillingham Trail and at the FTI antenna site following construction (Table 4.c).

4.6.1.3 Alien Plant Introduction via Current Military Training and SBCT Transformation

The success of alien plants becoming established depends on the type of weed species being introduced (e.g., dry, mesic, or wet forest species) and the proximity of suitable environments and/or plant communities to the action area or point of introduction of the species. Although there are no listed species in DMR AA, the threat of additional alien species introductions is still a concern because of the risk that these species pose of spreading outside the action area boundary into areas dominated by native vegetation. *Pennisetum setaceum* (Fountain grass) has already been found at DMR, but natural resource crews eradicated the population before it became widespread. Weed threat significance numbers are used to designate the level of threat. **The dry microclimates and dominance of alien species at DMR gives the action area a high threat level (4), of additional alien species introductions. Threats are projected to be reduced from high (4) to moderate (3) by doing the following:**

- The Army will prevent any weeds brought in by training activities from becoming established by rigorously monitoring using transects and roadside surveys and eradicating new weeds using most effective means known specific to each of the invasive species. Refer to the pest management sections of the Oahu INRMP (CEMML 2001) for possible treatments for eradication. Detailed methods for the monitoring and eradication of alien plants will be developed as part of the Oahu IP.
- The Army will provide education regarding cleaning vehicles and field gear (these education materials will be Service approved).
- The Army will wash vehicles in the wash rack facility prior to returning to Oahu from the Pohakuloa Training Area (PTA), to minimize weeds (e.g., fountain grass).
- Persons and equipment coming from foreign countries must go through U. S. Department of Agriculture and U.S. Customs inspections before coming into the United States.
- The Army will train and require soldiers to clean their gear and vehicles when first arriving in Hawaii and prior to moving from installation to installation on Oahu, as well as when moving from Oahu to the island of Hawaii or vice versa.

4.6.1.4 Alien Animal Introduction via Current Military Training and SBCT Transformation

The chance of an introduced animal establishing a viable population would be lower than for plants since they would require at least two reproductively viable individuals or a single impregnated female individual be introduced. **The threat of an alien animal species being introduced at DMR from Army activities is moderate (3).**

This threat should be reduced from moderate (3) to low (2) by doing the following:

- To minimize animals (e.g. invertebrates) from coming back to Oahu from the Pohakuloa Training Area (PTA), the Army will wash vehicles in the wash rack facility at PTA prior to returning. (Note: No off-island flights land directly at Dillingham Airfield.)
- Persons and equipment coming from foreign countries must go through U. S. Department of Agriculture and U.S. Customs inspections before coming into the United States.

- The Army will provide education regarding cleaning vehicles and field gear (these education materials will be Service approved).
- The Army will brief soldiers on alien reptilian species and request that all snake and lizard sightings be reported to Army Environmental office.
- The Army has developed and distributed brown tree snake response and alert posters which inform the public about the potential for a brown tree snake introduction with rapid response measures and numbers to call in case of a sighting.
- The Army established the Brown Tree Snake Response Plan for rapid response to and interdiction of brown tree snakes introduced to Army Lands on Oahu.
- The Army is a member and will continue active participation in the Oahu Invasive Species Committee (OISC). This is a voluntary partnership of private, governmental and non-profit organizations and individuals united to prevent new invasive species infestations on the island of Oahu, to eradicate incipient invasive species, and to stop established invasive species from spreading.
- Herpetofauna certification program will be developed as part of the implementation process for plant material purchased by the Department of Defense, to prevent incidental introductions of herpetofauna to the island of Oahu.
- Establish the phytosanitation certification program developed in the Draft Makua IP (Makua Implementation Team 2002).
- Coordinate/collaborate with the Toxicants Working Group in an effort to determine a safe toxicant for controlling populations of newly established invertebrates.
- Use environmentally safe toxicants for alien species control or eradication associated with military operations or natural resource management.
- If a new introduction of an alien animal is found, the source and time of the introduction will be identified, and the area will be searched and treated with an appropriate environmentally safe toxicant to eradicate any other individuals of the target species that may be present. In addition, an area deemed adequate to cover the potential dispersal distance of the new alien animal will be searched and treated as well.
- Pursue support, implementation and funding for the licensing and application of a more toxic rodenticide, and towards broad scale distribution of rodenticides to improve rat control in remote areas, especially in areas with threatened and endangered species.

4.6.1.5 Trampling from Current Military Training and SBCT Transformation

Trampling of threatened and endangered species is presently not a concern in the DMR AA because there are none known in the area. **Therefore, a threat value of none (0) is assigned to trampling by military sources at DMR AA.**

4.6.1.6 Noise from Current Military Training and SBCT Transformation

Noise is an unwanted sound. It is generated from a source (e.g., explosion) as a wave of energy, which diminishes with distance. The only concern related to noise from Army activities is the potential effect on vertebrate species. Although there are no federally listed bird species in the DMR AA, three wetland species (*H. mexicanus knudseni*, *F. alai,* and *A. wyvilliana*) were discussed earlier because of their proximity to the military vehicle trail (150 m, 492 ft). If there are any birds that nest on the Crowbar Ranch Pond, they could potentially be disturbed through use of the trail (Figure 4.b). **Therefore, a threat value of low (2) is assigned to noise from military sources from this portion of the DMR AA.**

The noise threat should be reduced from low (2) to very low (1) insignificant or discountable at Dillingham Military Vehicle Trail by doing the following:

- Conduct surveys of the Crowbar Ranch Pond to determine if there are any federally listed wetland bird species present, and if there are any nesting.
- If nesting species are found, determine if they are in fact impacted from trail noise in their location on the pond.
- The Army will establish natural barriers (e.g. vegetation) to noise if federally listed wetland bird species are present.

4.6.2 Direct Interrelated Action and Effect

None in DMR action area.

4.6.3 Direct Interdependent Effects

4.6.3.1 Range Maintenance and Construction

Range development projects are interdependent actions with interdependent effects. These projects have a similar potential of affecting listed species through alien introductions as do other Army activities, because they occur in the same areas. **Therefore, the threat value for alien species introductions via range maintenance and construction is high (4).**

Most of the range construction is done in-house by the Army and involves road construction and maintenance with crushed rock from the Kolekole Rock Crushing Quarry at Schofield Barracks. Since the rock is obtained from Schofield Barracks, the likelihood of a weed species foreign to Hawaii being in the material is negligible. However, sometimes sand is purchased for different projects and the sand could introduce new weeds. The Army will minimize this threat by conducting weed monitoring using transects and roadside surveys and eradicating new weeds using most effective means known specific to each of the invasive species. Refer to the pest management sections of the Oahu INRMP (CEMML 2001) for possible treatments for eradication. Detailed methods for the monitoring and eradication of alien plants will be developed as part of the Oahu IP. **Therefore, the threat value should be reduced from high (4) to moderate (3) (Table 4.c).**

4.6.3.2 Integrated Training Area Management (ITAM) Program

This program is designed to monitor and mitigate erosion and loss of vegetative cover, which is essential for human safety and realism in training. ITAM workers revegetate areas, which have been heavily used for training. The ITAM program has the potential to introduce alien plant and animal species to Dillingham via this work. **The initial threat value assigned to the ITAM program projects is low (2), because of the overall beneficial nature of the work they conduct, and because they work mostly in areas already heavily impacted by human development, dominated by alien plant species, and far away from federally listed species (including roadsides, LZ's, and maneuver areas).**

ITAM staff coordinate with Army Natural Resource Staff to select native species for outplanting. They purchase plants from native plant nurseries on Oahu. The plants are not delivered until the day before they are planted, to reduce the risk of contamination by alien species. Native plants are always the first alternative because they have the greatest likelihood of successful establishment. In some cases native species are not commercially available, more specifically grasses for Landing Zones. In those cases they coordinate with Army Natural Resource Staff to select something non-invasive, naturalized, and which already occur near the outplanting site. Detailed methods for the monitoring and eradication of alien plants will be developed as part of the Oahu IP.

This potential threat will be further reduced by doing the following:

- Get weed free certification from native plant nurseries for all plants purchased by ITAM for revegetation.
- When using grass seed to revegetate an area, ITAM will periodically monitor these areas for invasive weeds, and remove all non-target introductions from the area before establishment.

In light of the precautions that are taken in choosing revegetation material and proposed actions to reduce the risk of a new introduction, the modified threat value assigned to the ITAM program projects is very low (1), insignificant and discountable.

4.6.3.3 Natural Resources Program

The Army's Natural Resources component of the Ecosystem Management Program provides protection to the listed species in the vicinity of DMR in conjunction with military training there. Ecosystem level management at DMR includes monitoring and propagation of rare plants, ungulate and weed control, control of alien invertebrates and associated diseases. Natural resource workers could potentially introduce weed species via field vehicles or gear during management. Landing zone and disturbance corridor surveys are also conducted in areas where there is a high potential for alien species introduction via their program. **These potential adverse impacts are assigned an initial value of low (2).**

However, NRS (natural resource staff) workers are trained to be very conscious and careful of weed threats, and take precautions such as cleaning gear and vehicles prior to entry into the field. **Therefore, the initial threat value assigned to the natural resources program was modified to very low (1), insignificant and discountable.**

4.6.3.4 Alien Species Introduction by Recreational Use

Alien Animal Introduction. Open public accesses to the installation, public access on roads outside the installation boundaries, and non-military personnel with daily access to the installation are all potential non-military points of animal introductions at DMR. Also, alien animal species may disperse (usually by flying) into new uninhabited areas within the subinstallation or action area, or the smaller species may be blown in by winds. The likelihood of human-induced introductions via recreation activities is lower than from military sources because of the lower frequency of use of the area for these purposes. **The threat of alien animal introduction by recreational use is therefore very low (1), insignificant and discountable and requires no further minimization.**

Alien Plant Introduction. Public access along Kealia Trail at DMR on weekends and state holidays increases the risk of alien introductions along this trail. In addition, Dillingham Airfield is open daily to the general public for glider plane operation and parachuting in designated areas (R.M. Towill Corp. 1997a). **The threat of alien plant introduction by recreational use is moderate (3), because of the frequency of public use of the area.**

This threat should be reduced from moderate (3) to low (2) by doing the following:

- Monitoring trail use by requiring the public to get permission from DPW (Department of Public Works) and DOFAW (Department of Fish and Wildlife) for access to hike the Kealia Trail.
- The Army will prevent any weeds brought in by recreationalists from becoming established by monitoring trails used for these purposes within and adjacent to the DMR AA. Methods for monitoring will be developed as part of the Oahu IP.

- Develop and place signage at appropriate places along DMR boundaries and trail locations to notify users of resource management issues, boundaries, and trail issues.
- Develop maps of the Kealia Trail for distribution with access permits, including the level of difficulty, and natural resources issues (e.g., weed distribution concerns, endangered species information, the importance of staying on the trail).

4.6.4 Indirect Effects

4.6.4.1 Spread of Alien Species by Fire into Dry Forest

The threat values for secondary weed spread are based on the assumption that fire occurs in the area, and are similar to those described above for direct weed introductions from military training and SBCT activities in alien dominated dry microclimates, high (4).
This indirect threat from Army training and transformation activities at DMR should be reduced from high (4) to moderate (3) as a result of the following:

- The Army will prevent secondary weed spread from fire by rigorously monitoring and eradicating newly dispersed weeds. Detailed methods for the monitoring and eradication of alien plants Detailed methods for the monitoring and eradication of alien plants will be developed as part of the Oahu IP..

4.6.4.2 Army Regulated Hunting

Wild pig hunting is allowed on DMR inland of the airfield. The area is open to military personnel and family members, DoD civilian employees and their civilian guests on weekends and federal holidays. Hunters may use spears and knives to hunt; firearms, bows and arrows, and other weapons are not allowed. Hunting dogs may be used, although they must be kept under physical restraint and control except when actually hunting. There are no bag limits, although only one hunting group (of two to six people) is allowed, and permits are issued on a first-come, first-serve basis by the Provost Marshal. The westernmost tip of DMR is off-limits to hunting due to the Kealia Trail. There is no potential threat to federally listed species from hunting in the DMR AA, because there are presently no known listed species there. **Therefore, a threat value of none (0) is assigned to Army regulated hunting at DMR AA.**

4.7 Other Army Consultations for Listed Species at DMR

4.7.1 Review of Planning Documents

The Army has requested USFWS review of Natural Resource planning documents over the years. The USFWS in April of 1996 reviewed the Army's draft Endangered Species Management Plan Report for Oahu Training Areas which was finalized and in place in 1997. In July of 1997 the USFWS sent comments to the Army regarding selected chapters of the Oahu Ecosystem Management Plan Report which was finalized and in place in 1998. In August of 2001 the USFWS sent the Army their review comments for the draft Integrated Natural Resources Management Plan which is the action document for review, guidance, and implementation of Army natural resource activities for 2002-2006 at Oahu Army Installations.

4.8 Cumulative Effects

Cumulative effects include the effects of future state, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to

the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the Endangered Species Act.

4.8.1 Future State Actions

None noted.

4.8.2 Future Private Actions

None noted.

Table 4.c Potential Effects of Routine Military Training and SBCT Transformation Activities at Dillingham Military Reservation, Hawaii.

Effect Type	Potential Effect/Threat[1]	Initial Threat Value	Modified Threat Value with Minimization[2]
Direct	**Fires from Army activities inside the firebreak road at the DMR action area**	3	2
Direct	Fires from Army activities along the Dillingham Trail	2	1
Direct	**Alien plant introduction to dry alien dominated habitats**	4	3
Direct	**Alien animal introduction**	3	2
Direct Interdependent	**Range maintenance and construction, plant introduction**	4	3
Direct Interdependent	Integrated Training Area Management	2	1
Direct Interdependent	Natural Resources Program	2	1
Direct Interdependent	**Alien plant introduction by recreational use**	3	2
Indirect effects	**Spread of alien species by fire into dry alien dominated habitats**	4	3

[1] Potential effects in bold type are those which are assigned modified threat values $\geq$ to low (2). These are likely to adversely affect federally-listed species or adversely modify critical habitat.

[2] Modified threat values of less than low (2) are not likely to adversely affect any federally-listed species or adversely modify critical habitat in the action area. Potential effects assigned modified threat values greater than or equal to low (2) are likely to adversely affect federally-listed species or adversely modify critical habitat.

DMR Action Area will not be addressed further in this BA because it has been determined that the area is already heavily impacted by human development and dominated by alien plant species, and there are no federally-listed species there.

5. Helemano Military Reservation

5.1 General Description of Area

Helemano Military Reservation (HMR) is located in north-central Oahu, in the eastern portion of Wahiawa Plain, west of Kawailoa Training Area (KLOA) and the western slope of the Koolau Mountain Range. It is four miles north of Wahiawa in the Waialua District of Oahu. Private agricultural lands growing mostly pineapples border HMR. It is located at about 335 m (1,100 ft) elevation (Shallenberger 1977).

U.S. Army Security Agency, Pacific and Naval Communication Station, a subinstallation under the Schofield Barracks command, use HMR. The antenna field includes over 90% of the 114 ha (282 ac) reservation area but it is presently inactive. The northern portions of the reservation are used for family housing, offices and motor pool (Shallenberger 1977). The vegetation at HMR consists predominantly of exotic species with a few intermittently dispersed native species that are common elsewhere on the island (Environmental Impact Study Corporation 1977). No federally protected plant species were discovered in these surveys at HMR. According to Kapua Kawelo (U.S. Army, pers. comm. 2003), this area has not changed as described above and is still dominated by alien species with no federally listed species present.

HMR will not be addressed further in this BA because it has been determined that Army activities will not result in any adverse affects to federally listed species, because the area is already heavily impacted by human development and dominated by alien plant species.

6. Kahuku Training Area (KTA)

6.1 General Description of Area

Kahuku Training Area (KTA) is located in northern Oahu on the terminus of the Koolau Mountain Range (Figure 1.a). Main access to KTA is via the Kamehameha Highway. Access gates to KTA are within several miles of the coastal towns of Kahuku (pop. 2,000) and Kawela (pop. 400), and approximately 8 miles northwest of Haleiwa (pop. 2,500). KTA is bounded to the north by private agricultural lands south of the Kamehameha Highway, by Kawailoa Training Area to the south, and by private lands on the remaining perimeter.

KTA comprises 3,808 ha (9,409 ac). Two parcels are owned in fee for a total of 3,335 ha (8,241 ac) and 465 ha (1,150 ac) are leased from the state of Hawaii (USACE and Nakata Planning Group 2000). Non-military uses are permitted and include hiking, biking, hunting, and motocross. KTA is located on the northeastern and windward region of the Koolau Mountains. The elevation of KTA ranges from near sea level along the northern coastal boundary to 567 m (1,860 ft) in the areas along the Koolau Mountains. The topography within KTA is highly variable from the relatively flat coastal plains to almost vertical bluffs and stream drainage basins (USACE and Nakata Planning Group 2000). Average annual rainfall ranges from 102 cm to 127 cm (40-50 in) near the coast, to 381 cm (150 in) at the summit of the Koolau Mountains. The monthly recorded low rainfall is 20 cm (8 in) in July and the high is 89 cm (35 in) recorded in February.

6.2 Current Military Training

KTA is the largest contiguous ground-maneuver training area on Oahu, containing 1,369 ha (3,384 ac) classified as suitable for mounted and/or dismounted maneuver (USAESC and Nakata 2002). KTA contains nine sub-areas (training areas), five open helicopter landing zones (LZs), three closed LZs, and three parachute drop zones (Kanes, Kahuku and X-Strip) also used as LZs (Figure 6.a). Kanes DZ is the most commonly used DZ at KTA. KTA does not have a defined cantonment area, but does have a Range Control compound (Area B-2) and three smaller compounds that are set aside to support Army-related operations. Opana Naval Reservation is located in area B-1. These areas combined occupy less than 100 ha (247 ac) of KTA.

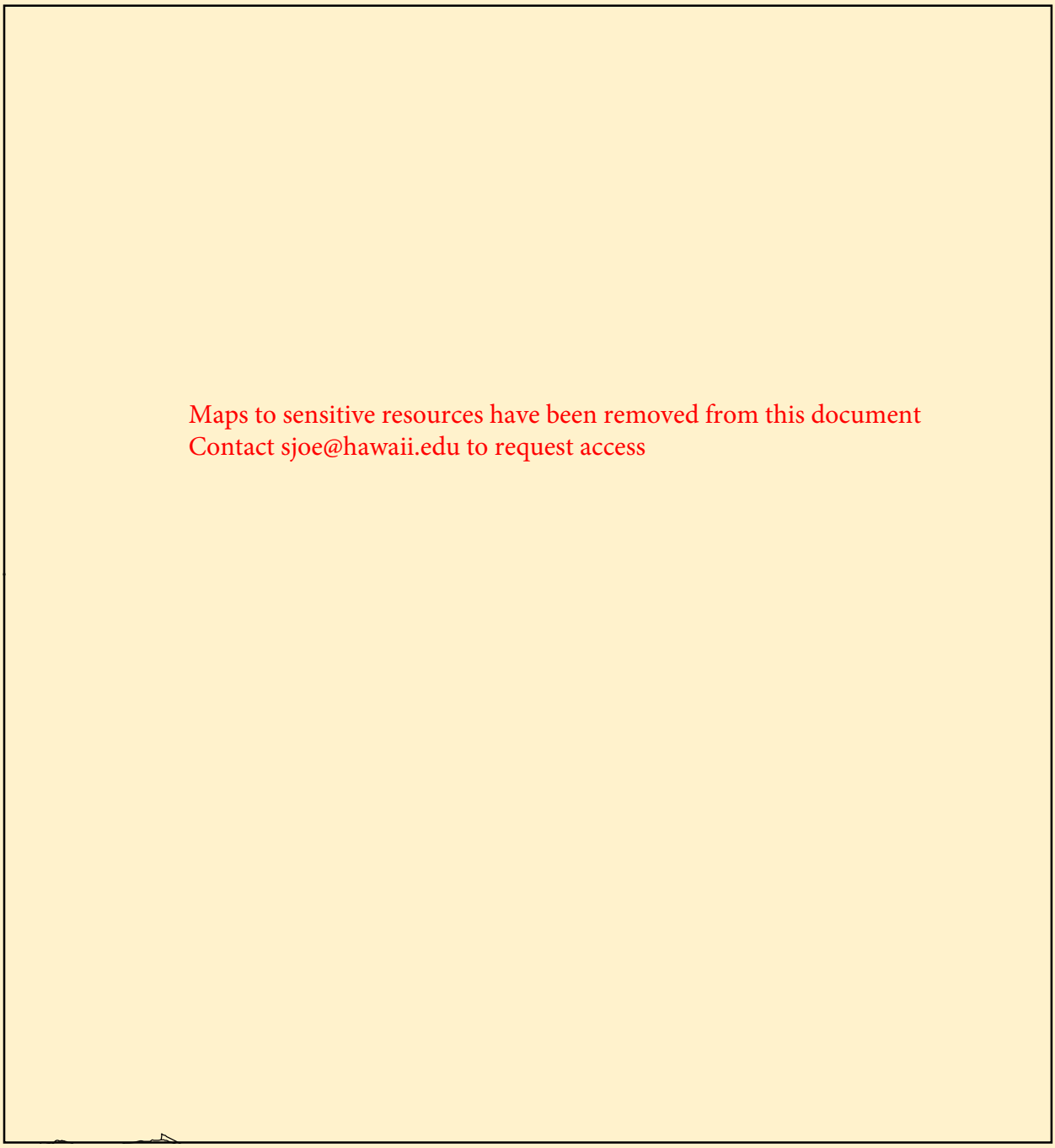
Primary users of KTA include Army and U.S. Marine Corps units[26]. The areas support up to battalion - level exercises. The northern portion of the installation, consisting of rolling grasslands and shrublands with moderate relief, supports all tactical maneuver training scheduled on KTA, including mountain and jungle warfare, and air support training. Only this northern portion of KTA contains an area suitable for maneuver. All operations involving significant support activities, tents, field facilities, and vehicles/equipment take place in the lower elevation and flatter areas cleared of vegetation and accessible by road. These activities take place within areas that support off-road vehicle maneuvers. The entire area is divided by several north-to-south oriented drainages that limit east-west movement between the broader ridge top areas (USACE and Nakata 2002). Historically, use of higher elevation areas including Training Areas A1, A3, C1, C2, D1 and D2 has been limited due to the steep terrain and dense vegetation (USARHAW G3/DPT Memo to Steve Kim, 9 January 2003). KTA can accommodate a number of

[26] Primary users based on 2002 Range Facility Management Support System (RFMSS) utilization data provided by USARHAW Range Division.

Training Areas

Kahuku Training Area, Oahu

Figure 6a



1:59,000

0 350 700 1,400 Meters

0 0.25 0.5 1 Miles

Data Source: U.S. Army Active/Inactive Range Inventory Program 2001

Legend

- *Cyanea koolauensis*
- *Eugenia koolauensis*
- *Gardenia mannii*
- *Tetraplasandra gymnocarpa*
- Landing Zones (Open)
- Landing Zones (Closed)
- Drop Zones
- Major Roads
- Training Area Boundary
- Surface Water Body

training scenarios involving up to infantry battalion Army Training and Evaluation Plan (ARTEP)[27] training missions. A summary of training types and annual usage (number of days and troops) for each training area at KTA is presented in Table 6.a. The average use of each training area ranges from 26 to 44 days per year and approximately 1,500 to 4,800 troops per year. Ammunition (SRTA, blanks, smoke, and simulators) usage at KTA is presented in Section 6.3.2, Live-Fire Ranges.

Small unit maneuvers and combat support training include non-live-fire, mounted maneuver training with Humvees, cargo trucks, trailers, as well as foot training. Field activities, or training exercises can involve vehicle movement, maneuvers and convoys, foot maneuvers, bivouacking (camping), limited aviation training, and staff training exercises. The size of bivouac areas can range from 100 m X 100 m for a squad or platoon to 300 m X 300 m for a comnay size bivouac. Vehicle maneuvers are constrained by topography and vegetation (and other applicable constraints), whereas foot maneuvers occur anywhere that safety or administrative restrictions permit including the high probability vehicle maneuver areas. Pyrotechnics use occurs anywhere that dismounted (and/or mounted) training occurs in accordance with rules for pyrotechnics use at KTA.

Vehicle maneuvers are largely limited to the northern portion of KTA by steep terrain and dense woody vegetation. High-probability off-road vehicle maneuver areas include 437 ha (1080 ac) out of a total area of approximately 5199 ha (12846 ac) in KTA (see Section 6.3.3, Non Live-Fire Maneuver and Other Training Activities) (Table 6.b). Most of the high probability area is located in the northern half of the installation within Training Areas A1, B1, B2, C1, C2 and D1. A few very small and disjunct areas that met maneuver criteria are remote and inaccessible to vehicles, and therefore are not used. Nearly all vehicle travel, and a high proportion of dismounted training occurs within the high probability areas. These areas (i.e., locations of use) are the same for Legacy and SBCT training. This information was obtained from the results of the analysis outlined in Section 3.1.2.1, Delineation of High-Probability Off-Road Vehicle Maneuver Areas. Legacy forces operate wheeled vehicles on existing roads and trails, as well as on off-road areas suitable for maneuver. Units currently use Drum Road through Kawailoa Training Area to access KTA on a minimal and infrequent basis (and very few vehicles – mainly Humvees) due to the poor condition of this pne-lane dirt road. The primary route for vehicles going to KTA is via Kamehameha Highway. Future use of Drum Road to access KTA is expected to be approximately 77 (36 company Level, 41 battalion level) legacy vehicles 12 times per year once the road is upgraded.

Aviation assets are incorporated into appropriate training events, but there are no developed airfield facilities for training use. All aviation support assets found on KTA are temporary in nature and associated with specific training events (USACE and Nakata Planning Group 2000). The southern portion of the installation is more elevated with rugged terrain and dense vegetation. The ruggedness of the terrain makes it poorly suited for large-scale field exercises.

[27] ARTEP is the evaluation process for assessing the readiness of units relative to their required tasks and mission.

Table 6.a Types of Legacy Training and Annual Legacy Usage by Training Area for KTA. (Data source: Annual RFMSS Utilization Reports for 1998-2002 obtained from G3 Range Division.)

	Types of Training											1998-2002					
Area Name	Mounted maneuver*	Dismounted maneuver*	Live fire	Foot Reconnaissance	Bivouac	Deployment training	Helicopter aviation training	Air assault/movement**	Parachute drops of equipment and personnel	Major force-on-force training	CSS Operations and Training	Min Days Used	Max Days Used	Average # Days Used	Min # Troops	Max # Troops	Average # Troops
K-A1	x	x		x	X	x	x			x	x	29	36	32	1149	4629	2486
K-B1	x	x		x	X	x	x			x	x	25	33	28	1159	4578	2450
K-A2	x	x		x	X	x	x			x	x	22	45	33	1332	4866	2509
K-B2	x	x		x	X	x	x			x	x	37	56	43	1840	4909	3270
K-C2	x	x		x	X	x	x			x	x	29	58	45	2565	5671	3995
K-A3	x	x		x	X	x	x			x	x	20	41	30	1136	4511	2797
K-B3	x	x		x	X	x	x			x	x	20	40	28	1235	4522	2594
HILL 904C - LZ		x		x			x	x				1	12	5	3	744	482
KAHUKU RANGE CONTROL - LZ		x		x			x	x				1	3	2	18	24	21
SUMMIT SLIT ROCK - LZ		x		x			x	x				0	0	0	0	0	0
WATER TANK - LZ		x		x			x	x				4	20	12	170	986	739
KAHUKU - DZ	x	x		x			x	x	x			1	17	7	10	3782	1197
KAHUKU SPLIT ROCK - LZ		x		x			x	x				1	2	1	25	734	266
KANES - DZ	x	x		x			x	x	x			21	67	35	321	7151	2370
X-STRIP - LZ/DZ	x	x		x			x	x	x			2	18	10	86	2810	980
Average Training Area Use												26	44	34	1488	4812	2872

* Mounted and dismounted use may be very limited by topography and road access. See vehicle maneuver probability analysis for acreages available in each TA.

** Landing and drop zone assault and movement exercises may involve vehicle support and off-road travel where roads exist.

Table 6.b. Area of High-Probability Off-Road Vehicle Maneuver in Each Training Area at KTA.

Training Area	High Probability Area (hectares)	High Probability Area (acres)	Remainder of Training Area (hectares)	Remainder of Training Area (acres)	Training Area Total (hectares)	Training Area Total (acres)
A1	99	245	248	612	447	1104
A2	5	12	411	1015	582	1438
A3	0	1	287	709	403	997
B1	38	93	239	590	373	922
B2	88	216	305	753	516	1275
C1	53	130	655	1618	973	2404
C2	18	44	217	536	323	797
D1	136	337	357	882	638	1575
D2	0	1	672	1661	945	2334
Totals	437	1080	3390	8377	5199	12846

The following rules for allowable and restricted live fire and pyrotechnics use apply at KTA[28]:

Restrictions

- There is no live-fire training at KTA[29].
- KA-1 and KA-3 are off limits to military units during weekends and federal holidays, except for brigade field exercises if coordinated through Range Division Hawaii (RDH) at least 30 days before execution.
- Live ammunition and aerial pyrotechnics (star clusters/parachute flares) are not authorized.
- Blank ammunition is authorized in all training areas with approval from RDH.
- Use of pyrotechnics, blank ammunition, and other ignition sources will be controlled by the fire danger rating system for KTA.

Pyrotechnics

- The use of pyrotechnics and simulators (including demolition effects simulators – DES) requires approval from RDH Range Operations.
- RDH may restrict the use of pyrotechnics based on the Fire Danger Rating System (FDRS).
- Smoke and CS grenades, HC/TA smoke, smoke generators, and ground simulators are allowed in all areas, except A-1, A-3.
- RDH will authorize and apply safety buffer zones for HC smoke and CS. [30] (e.g. CS and smoke grenades restricted in an approximate 1000 m buffer south of the northern perimeter of Training Areas B1 and B2 (pers. comm. Steve Lai, 4/9/03)).
- Smoke grenades will only be used in areas devoid of vegetation.

[28] USARHAW Regulation 350-1, Training (25th ID(L) and USARHAW 2000), and 25th ID(L) and USARHAW Regulation 210-6, Installations Ranges and Training Areas (25th ID(L) and USARHAW 1999).
[29] Live-fire training using short-range training ammunition (low velocity plastic bullets) is proposed as part of the Transformation of the 2nd Brigade.
[30] Buffer information is listed in 25th ID(L) and USARJAW Regulation 210-6, Appendix F.

6.3 Proposed Transformation Actions at KTA

6.3.1 Construction

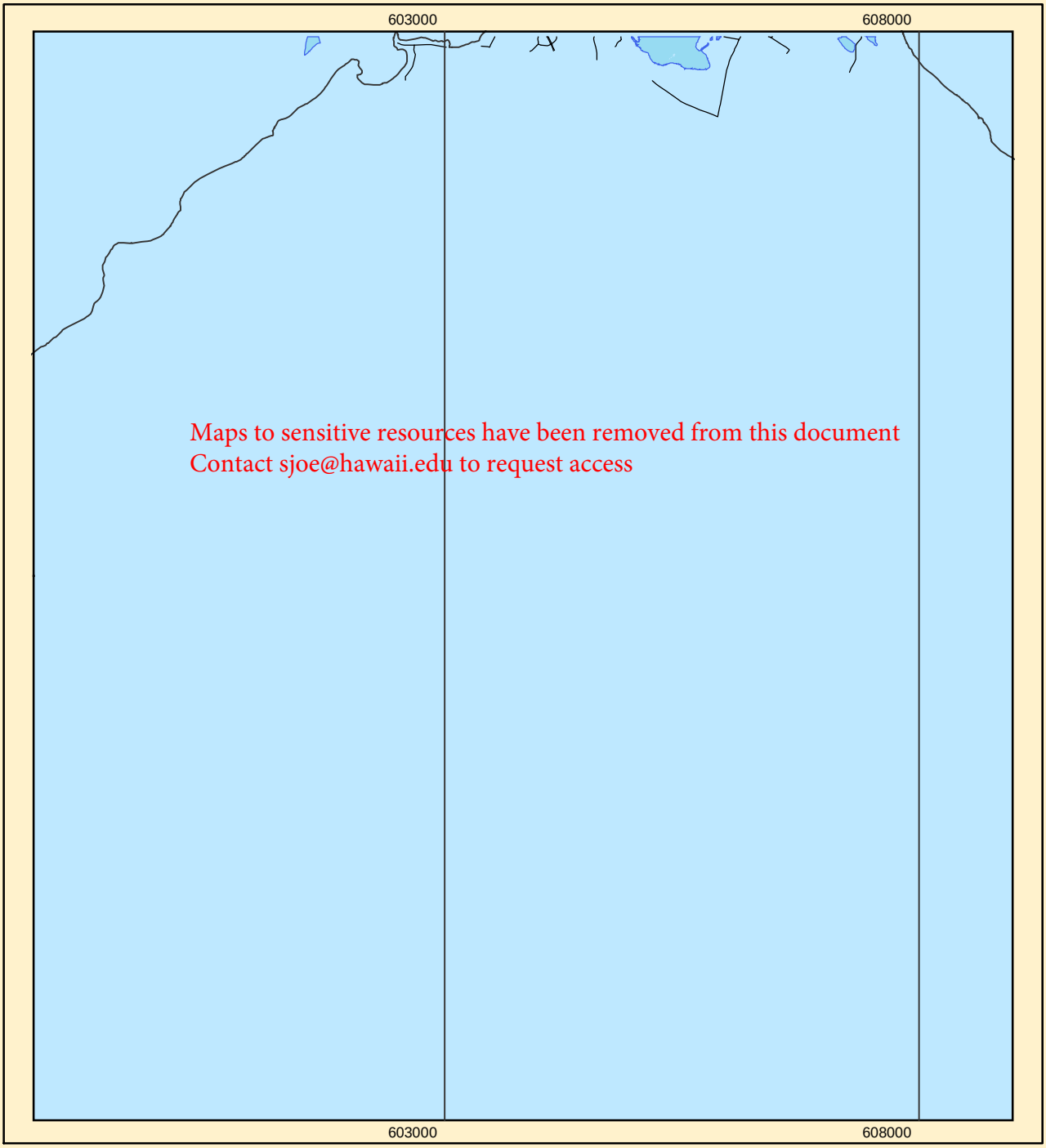
Combined Arms Collective Training Facility (CACTF), with three Combined Arms Urban Training Sites (58143). This project would construct a state-of-the-art Combined Arms Collective Training Facility (CACTF) at Kahuku Training Area, Hawaii, consisting of a site-adapted 24-building facility (Figure 6.b). This facility will use short-range training ammunition (SRTA – low velocity plastic bullets), which is considered live fire. Training objectives would include: Warehouse Buildings (2), Municipal Building, Office Building, Service Station, Business Buildings (4), Hotel Building, Police Station/Jail, Church and collocated Cemetery, Bank Building, Townhouse, Residences (9), School Building, and a Grass Airfield. Range operation support facilities include After Action Review Building (AAR Large), Ammo Breakdown Building, Operations/Storage Building, Dual Sex Dry Vault Latrine, and a Covered Mess. Supporting facilities include a new access trail, a parking area, and primary and secondary power and data distribution systems. Storm drainage, site improvements and berms will be provided as necessary. Approximately 187 acres of earth movement would be associated with construction of the 560 acre CACTF, including tactical movement trails, simulated firing points, obstacles, targets, and other infrastructure.

This project would be used in concert with the Urban Assault Course and Training Facility (at SBMR) to provide the full complement of UACTF functions This project would enable SBCT elements of the 25th Infantry Division (Light) to conduct combined arms MOUT training in a manner that more closely simulates their actual roles in combat. By moving from point to point along the flank of an enemy force and firing at targets as they appear in various locations, training units would be able to accurately simulate the same process as in combat. Short-range training ammunition (SRTA, i.e., plastic bullets) would be used at the CACTF. One to 20 combat vehicles and 1-20 support vehicles would be used per exercise at KTA. Collective training exercises will be conducted 90-180 days per year.

Tactical Vehicle Wash (57415). This project would construct a tactical vehicle wash facility with six wash stations with a new off-site water system (Figure 6.b). The water system would consist of two pump stations, each with motors and controls. A mid point pump station would be provided with a tank with level controls to control operation of pumps. Pumps and tank would be installed inside a pump house with natural ventilation. The wash stations would be sized to support an 18.3-meter (60 ft) long by 3.7-meter (12 ft) wide vehicle. The primary facility would consist of the preparation area and wash stations. The wash stations would utilize a high-pressure wash system and recycle water to minimize wastewater disposal. The water would flow through a water sediment basin, an equalization basin, oil-water separators, and then be deposited into a water supply reservoir. Treatment would include oil and grease removal, grit removal and organic control. A mechanical equipment building would be provided to house the mechanical secondary treatment units and the control panels necessary for the facility. Sediment recovered from the facility would be disposed of off site. The structure will be approximately 12 meters (40 ft) by 9 meters (30 ft) in size. Supporting facilities include utilities, paving, fencing, curbing and site improvements. Concrete curb would be provided at the wash facility to control the flow of wastewater. Trench drains would lie perpendicular, at the center of the wash station, and extend the entire width of the facility.

Proposed Wash Rack, MOUT Facility, and Fixed Tactical Internet Antenna Locations, Kahuku Training Area, Oahu

Figure 6b



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Data Source: Center for Environmental Management of Military Lands, HINHP 2002, RCUH 2002a

Legend

- Internet Antennas
- *Cyanea koolauensis*
- *Eugenia koolauensis*
- *Gardenia mannii*
- *Tetraplasandra gymnocarpa*
- Roads
- Drum Road
- Installation Boundary
- Action Area
- Proposed Wash Rack Location
- Surface Water Feature
- Proposed Combined Arms Collective Training Facility Location

The existing vehicle wash facility at Kahuku Training Area is inoperable, and the drainage system is clogged and silted. Military vehicles at the Kahuku Training Area pick up nonnative grass seeds that may be spread to areas outside the facility. The vehicles also accumulate soil that may be tracked onto state highways when the vehicles return to the SBMR garrison area.

Fixed Tactical Internet (FTI)
Construction of two fixed tactical internet antenna support structures with four antennas each is proposed to provide tactical communications infrastructure enabling units to train at any hour of the day or night without deploying to the field (Figure 6.b). When linked to the installation information infrastructure architecture (I3A), FTI could also provide connectivity for command and control integration of live-fire and simulation training. FTI is a group of antennas placed strategically throughout a training land parcel. The antennas permit sending and receiving of voice and data signals to radios in military vehicles.

Four antennas would be installed at each proposed site located on Oahu. Existing antenna support structures and sites would be utilized when possible. The antennas are vertical whips approximately two inches in diameter. Two antennas approximately 1.2 m (4 ft) long and two approximately 3 m (10 ft) long would be mounted on an antenna mast, utility pole, existing support structure, or building. Some of the antennas may have a red light at the top, in accordance with FAA guidelines, to warn nearby aircraft. Each site would be 6.1 x 7.6 m (20 x 25 ft), including a 4.6 x 6.1 m (15 x 20 ft) concrete pad for the support structure and shed. The equipment shed is included in this footprint. Each site would be fenced and accessed via existing roads in all cases. Personnel would visit the sites prior to and after Army training events. No security lighting would be installed at the sites. Equipment sheds would house radios and batteries. The two FTI structures at KTA are named Kawela (Kahuku) 1 (12.8 m (42 ft) in height, new support structure, new equipment shed) and Kawela @ (Kahuku 2) (31 m (102 ft) in height, existing support structure, new equipment shed).

6.3.2 Live-Fire Ranges

Limited live fire of special plastic simulations ammunition called short range training ammunition (SRTA) is proposed for the CACTF. No tracer ammunition would be used. 25th ID(L) Legacy units and the transformed brigade would conduct at least one major exercise each year that involves at least two battalion-level attacks on the MOUT site. Each brigade would conduct one field training exercise (FTX) each year consisting of 2-4 battalion-size operations at the CACTF. Each battalion would also perform MOUT operations at platoon and company levels at least once a year at the CACTF at KTA. The Marine Corps would train two battalions each year at the CACTF MOUT site. Most small unit training (squad and platoon) would take place at the CTF at Schofield Barracks due to the logistical difficulty of traveling to the CACTF at KTA. The overall estimate for the proposed KTA CACTF for 5.56 mm and .50 cal SRTA is 124,000 rounds per year, mainly within the buildings that make up the complex. Of this total approximately 28,000 rounds are .50 caliber. The .50 cal SRTA. will not be used at the MOUT facility at KTA (pers. comm. Maj. Butler, G3 Training Division, 2/13/03). The proposed CACTF would enable SBCT elements of the 25th Infantry Division (Light) to conduct combined arms MOUT training in a manner that more closely simulates their actual roles in combat. By moving from point to point along the flank of an enemy force and firing at targets as they appear in various locations, training units would be able to accurately simulate the same process as in combat. A summary of blank ammunition, short-range training ammunition (SRTA) and pyrotechnics usage for current and proposed training is presented in Table 6.c.

Table 6.c. Summary of ammunition usage for current and transformed training at KTA, and the net difference in rounds by ammunition type. (Source: John Gallup and Associates training description version 5.3).

	FY 05 Projection Un-Transformed (Current)*			**FY 05 Projection Transformed**			**Net Difference With Transformation**
Ammunition Type	2 Legacy Brigades - All KTA Training Areas Combined	US Marine Corps	Total	1 Legacy Brigade & 1 SBCT - CACTF and other training areas combined	US Marine Corps	Total	All Rounds
5.56mm Blank	646402	4000	650402	394222	4000	398222	-252180
7.62mm Blank	63652	0	63652	55175	0	55175	-8476
.50 Cal. Blank	5508	0	5508	21465	0	21465	15957
Pyro	6583	0	6583	5024	0	5024	-1559
Pyro-Smoke	603	0	603	340	0	340	-263
5.56 SRTA**	0	0	0	104000	0	104000	104000
.50 cal SRTA**	0	0	0	28000	0	28000	28000

* This comparison of current and transformed ammunition usage is projected for FY 05 based on Draft STRAC (Standards in Training Commissions) information. Information for "Other 25ID", "USMC", and "Other" was compiled from 2001 RFMSS data and is used as a constant for both Un-Transformed and Transformed projections, except where use by these units is altered by changes due to range demolition/reconfiguration related to construction of new ranges (John Gallup and Associates product 10/16/02).
** SRTA estimates provided by Maj. Butler, G3 Training Division, 2/13/03. All SRTA would be used within the proposed CACTF.

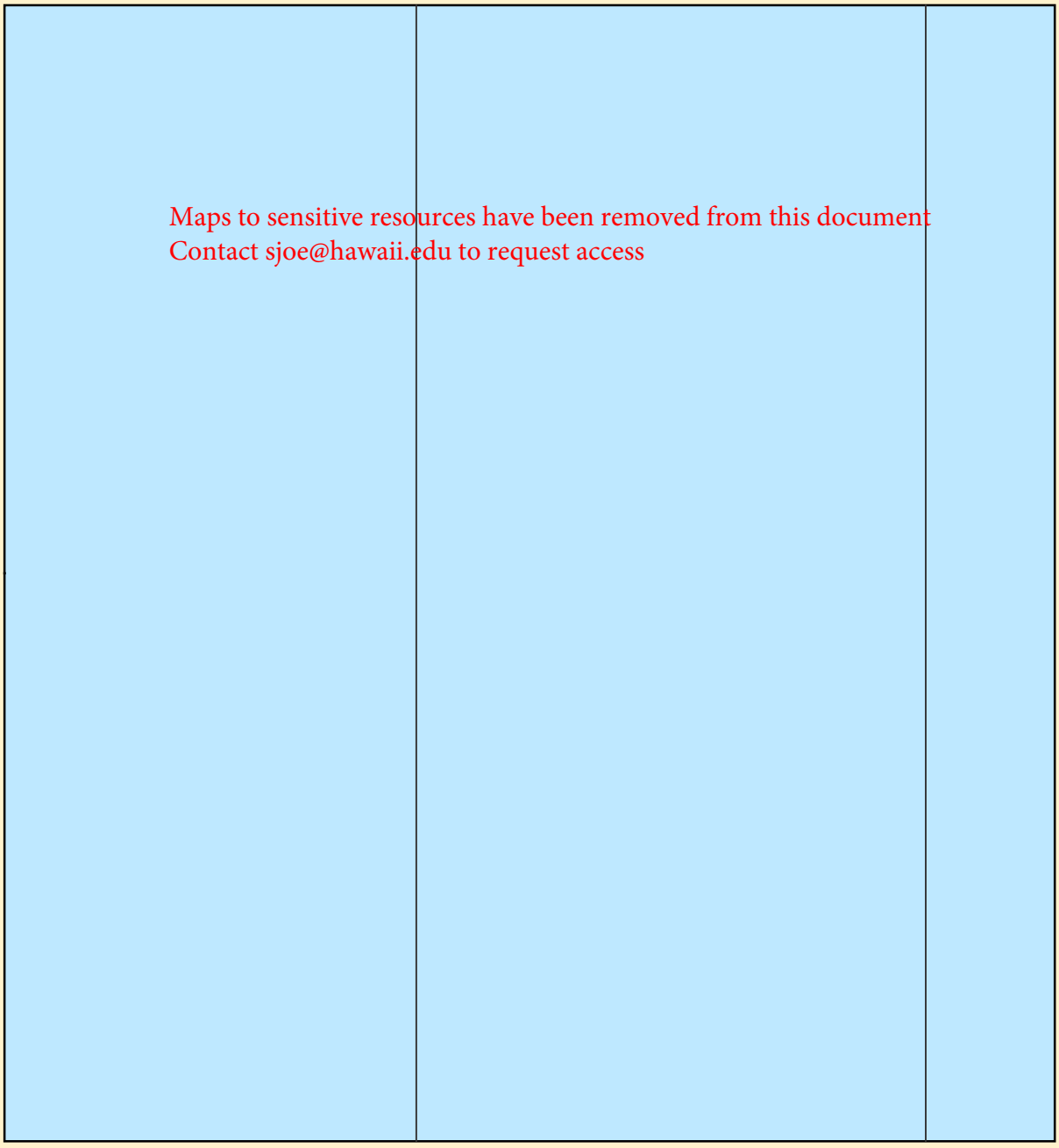
6.3.3 Non Live-Fire Maneuver and Other Training Activities

Mounted and dismounted maneuver and CACTF training would be the primary activities carried out at KTA. Off-road vehicle maneuvers are anticipated to be very similar to Legacy training in terms of areas used, although a greater number of maneuver miles will be driven on an annual basis by the SBCT (see Chapter 2 for discussion of SBCT vehicle maneuvers). Type of training in each training area would be the same for Legacy and SBCT training (Table 6.a). Use of Drum Road through Kawailoa Training Area to access KTA will facilitate movement of vehicles/troops to KTA while minimizing the use of Kamehameha highway. Approximately 15-90 Strykers and 10-90 trucks/humvees would be using the road approximately 12 times per year for SBCT training. However, the Drum Road upgrade by itself would not change training uses or patterns at KTA. Field training can involve a wide variety of activities, such as vehicle movement, maneuvers, and convoys; foot maneuvers; bivouac; limited aviation training; and staff training exercises. Landing and pickup zones may be used by SBCT forces with support from the Aviation Brigade. Vehicle maneuvers are largely limited to the northern portion of KTA by steep terrain and dense woody vegetation. High-probability off-road vehicle maneuver areas include 437 ha (1080 ac) out of a total area of approximately 5199 ha (12846 ac) in KTA (Figure 6.c.) (Table 6.b). Most of the high probability area is located in the northern half of the installation within Training Areas A1, B1, B2, C1, C2 and D1. A few very small and disjunct areas that met maneuver criteria are remote and inaccessible to vehicles, and therefore would not be used. Almost all vehicle travel, and a high proportion

High Probability Off-Road Vehicle Maneuver Areas

Kahuku Training Area, Oahu

Figure 6c



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0 500 1,000 2,000 3,000 Meters

0 0.25 0.5 1 1.5 Miles

Data Source: Center for Environmental Mangement of Military Lands, HINHP 2002, RCUH 2002a

Legend

- Roads
- *Cyanea koolauensis*
- *Eugenia koolauensis*
- *Gardenia mannii*
- *Tetraplasandra gymnocarpa*
- High Probability Off Road Vehicle Areas
- Action Area
- Training Areas
- Surface Water Feature

of dismounted training would occur within the high probability areas. This information was obtained from the results of the analysis outlined in section 3.1.2.1, Delineation of High-Probability Off-Road Vehicle Maneuver Areas. As with current light infantry training, SBCT units driving Strykers and other wheeled vehicles would operate on existing roads and trails, as well as on off-road areas suitable for maneuver. One to 20 combat (i.e., Stryker) vehicles and 1-20 support vehicles would be used per exercise at KTA. Collective training exercises will be conducted 90-180 days per year. Foot maneuver training is anticipated to be similar to current light infantry training.

Rules for allowable and prohibited live fire and pyrotechnics (presented in Section 6.2) would be unchanged and would apply to all future Legacy and SBCT training, with the exception that short-range training ammunition (plastic bullets), which is considered live-fire, would be used at the CACTF urban training facility. As with Legacy training, exercises would continue to be at the squad through company level. The use of higher elevation areas including Training Areas A1, A3, C1, C2, D1 and D2 is currently very limited due to the steep terrain and dense vegetation (USARHAW G3/DPT Memo to Steve Kim, 9 January 2003) and would continue to be limited for SBCT for the same reasons. LZs and DZs would continue to be used as similar levels as current training. General SBCT training would likely occur between 180 and 242 days per year.

6.4 Delineation of the Action Area

6.4.1 Approach to delineating the Action Area

The action area for KTA was determined by the impacts of fire (potential ignition sources include smoking, catalytic converters, and pyrotechnics), trampling, and exotic species introduction via soldier movement throughout the installation. Whichever impact was determined to have the farthest reaching effects in a given locale determined the extent of the action area in that segment. Both FTI antennas at KTA are within the action area boundary.

6.4.2 Sections of the Action Area

The factors considered in delineation of the KTA action area are fuel types (Figure 6.d), man-made barriers, topographic barriers, and buffers for fire and exotic species introduction (Figure 6.e).

6.4.3 Detailed Action Area for KTA

Points listed below appear in Figure 6.e:

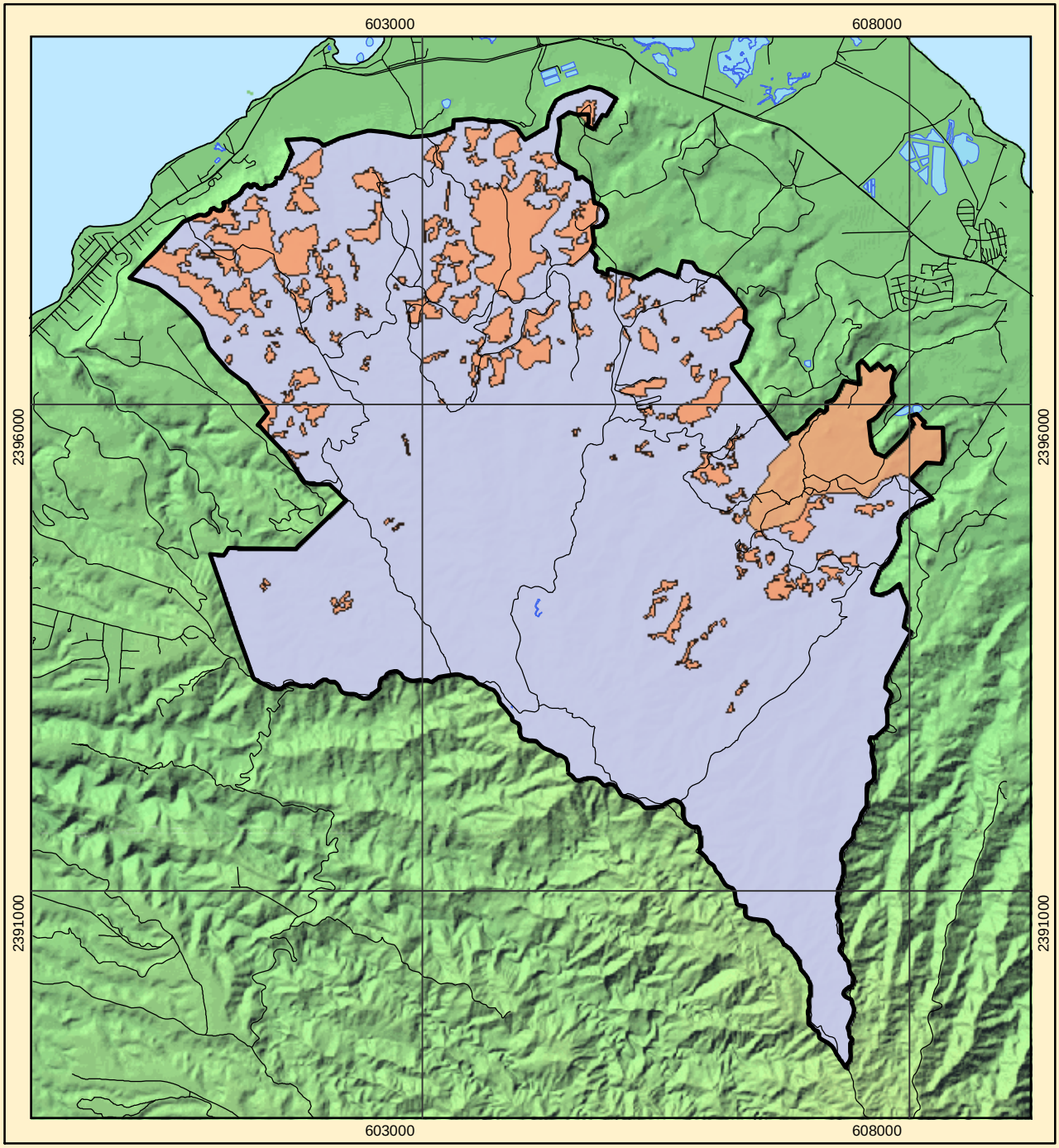
A to B – Starting where Drum Road enters KTA, the action area follows a fire buffer, based on standard NFFL fuel model 8 (closed timber litter), which represents the forest fuels. The buffer runs 521 m (1708 ft) from the KTA boundary until it intersects Paumalu gulch. This deep ravine provides an area in which a fire would be out of the wind, forced to back down a hill, and burn through significantly wetter and less fire prone vegetation than on the grassy benches above making fire containment much more effective. Additionally, Comsat road, which is approximately 500 m (1640 ft) to the northeast of Paumalu gulch, provides a primary containment line, allowing firefighters to potentially stop the fire there. The action area follows the gulch to Kamehameha Highway.

B to C – Kamehameha Highway is a paved two lane thoroughfare. It is the most significant road on the northern side of Oahu. It is unlikely that any fire would reach the road since much of the land between it and the KTA border is agricultural land, but there are several corridors of unmanaged fuels between

Fuel Types

Kahuku Training Area, Oahu

Figure 6d



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0 500 1,000 2,000 Meters

0 0.5 1 2 Miles

Data Source: Center for Environmental Managment of Military Lands

Legend

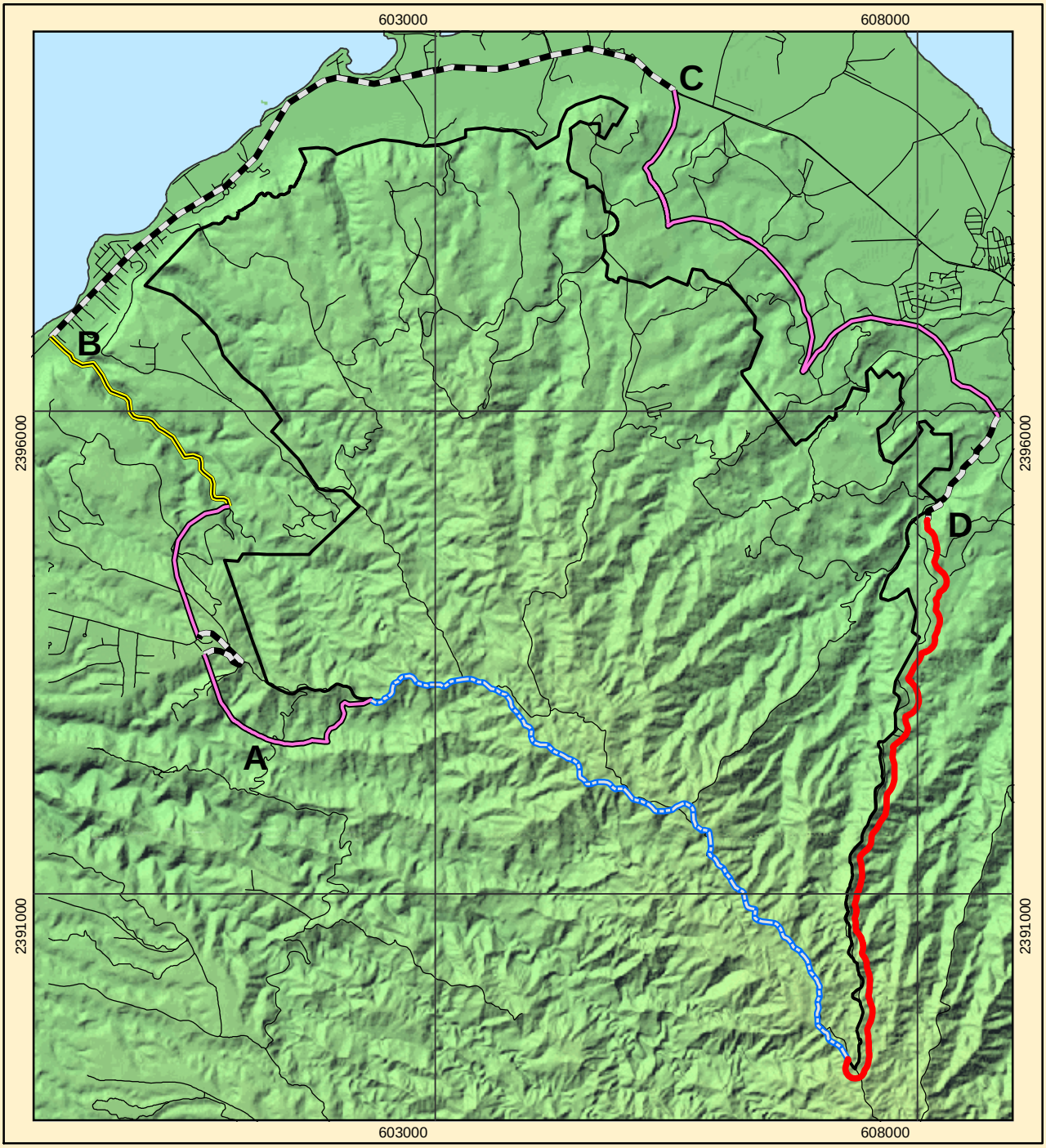
Fuel Types

- Forest
- Non forest
- Roads
- Installation Boundary
- Surface Water Feature

Delineation of Action Area

Kahuku Training Area, Oahu

Figure 6e



1:64,000

0 500 1,000 2,000 Meters

0 0.5 1 2 Miles

Data Source: Center for Environmental Mangement of Military Lands

Legend

Action Area Inputs
- Fire Buffer
- Gulch
- Installation Boundary
- Trail Use Buffer
- Road

- Roads
- Installation Boundary
- Surface Water Feature

ownerships. It provides excellent access, fire hydrants are available in some locations, and the vegetation is managed along the perimeter of the highway by the Department of Transportation. These factors make the highway an excellent barrier to any fire that may move down one of the corridors of fuel between agricultural plots.

C to D – The action area leaves Kamehameha Highway and follows another 521 m (1708 ft) fire buffer around the installation boundary until it meets an unnamed road which it follows to the installation boundary at point D. Much of this segment is composed of agricultural fields, which are not prone to fire. But because many of these fields may go in and out of use in the future, and for the sake of simplicity, the fire buffer was used throughout.

D to A – The action area follows a 100 m (328 ft) buffer from a ridgeline trail along the easternmost portion of the installation. The climate in this area is very wet and the threat of fire is extremely low so the buffer is defined by soldier usage, rather than fire for the length of this segment. The buffer is to account for potential soldier damage to species, and the possible introduction of exotic species along the trail.

6.5 Description of the Affected Biological Environment and Affected Species

Although Army training and transformation to a Stryker Brigade Combat Team takes place within the boundaries defined in the introduction (section 1.2), for purposes of this BA, and consistent with USFWS recommendations, the "action area" is considered the biological environment affected by either direct, indirect, or interrelated/interdependent effects of the proposed action.

6.5.1 Ecological Zones Affected by the Action

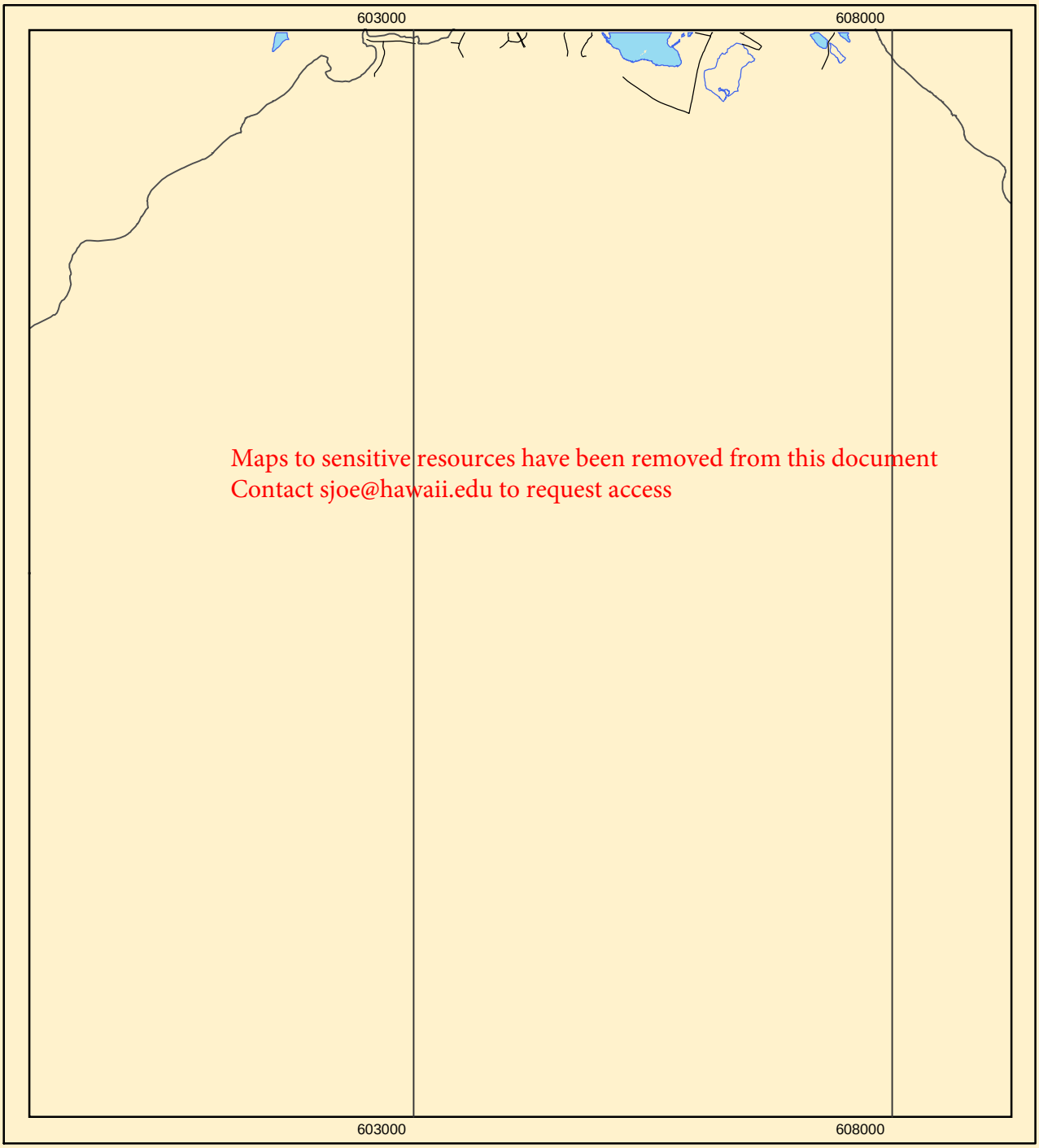
Six native natural community types were categorized into two ecological zones defined by elevation, topography, and prevailing ecological conditions at KTA (R.M. Towill Corp.1997b, Hawaii Natural Heritage Program (HINHP) - The Nature Conservancy of Hawaii 1994a). The ecological zones identified at KTA include the Wet Summit Crest Zone and the Lowland Forest Zone. Only the Lowland Forest Zone will potentially be affected by Army training and transformation. The area this zone occupies is relatively small in comparison to the total size of the range, the majority of which is alien vegetation. The locations of these areas are shown in Figure 6.f. The zone and community types in the KTA AA are briefly described below.

Lowland Forest Zone - This zone occurs in areas between 185 and 610 m (600 and 2,000 ft) elevation below the summit of the Koolau Mountains where conditions are warm, wind-sheltered and mesic to wet, and rainfall decreases with decreasing altitude. The natural communities included in this zone include the following:

Koa/`Ohi`a Lowland Mesic Forest is generally is found below 915 m (3,000 ft) in the Hawaiian Islands, often in areas with well-drained soils in leeward positions. It usually occurs at KTA above 305 m (1,000 ft). Koa disappears from the canopy above 455 m (1,492 ft) in the transition to `ohi`a/uluhe dominated forests. The annual rainfall generally ranges from 770 to 1,920 mm (30-75 in). ***`Ohi`a Lowland Mesic Forest*** community generally occurs below 910 m (3,000 ft) in the Hawaiian Islands on windy ridges with annual rainfall < 1,900 mm (75 in), but at KTA only one stand was observed at 200 m (650 ft) elevation in the moderate to steep slope of Pahipahialua Gulch. ***`Ohi`a Lowland Wet Forest*** occurs between 580 and 610 m (1,900-2,000 ft) below the summit of the Koolau Mountains at KTA. ***Uluhe Lowland Wet Shrubland*** community occurs between 185 and 610 m (600-2,000 ft) on moderate to steep slopes in the Koolau Mountains at KTA. The community is widespread in wet lowland areas, often at elevations below

Ecological Zones
Kahuku Training Area, Oahu

Figure 6f



1:64,000

0 500 1,000 2,000 Meters

0 0.25 0.5 1 Miles

Data Source: Center for Environmental Management of Military Lands, HINHP 2002, RCUH 2002a

Legend

- *Cyanea koolauensis*
- *Eugenia koolauensis*
- *Gardenia mannii*
- *Tetraplasandra gymnocarpa*
- Roads
- Nonnative
- Lowland Mesic Forest - Shrubland
- Lowland Wet Forest - Shrubland
- Installation Boundary
- Action Area
- Surface Water Body

other native vegetation and its prevalence may be important for reclamation of threatened ecosystems in the Hawaiian Islands.

6.5.2 Federally-listed Species Affected by the Action

The first step in determining which species may be affected by Army training and Transformation at the Kahuku Training Area was to compile available rare species occurrence data for Army Lands on Oahu. The resources for this data included the Army Natural Resource Geographic Information System (GIS), the Hawaii Natural Heritage Program (HINHP) Database, the USFWS recovery plans, the Makua Military Reservation Implementation Plan Draft documents and information from biological experts. Army Natural Resource Staff conducts rare plant, invertebrate, and vertebrate surveys annually to confirm existing population numbers and locate unreported populations. The most current and detailed data available was used from these various sources. Once compiled, these data were sorted by area and a new list included only those threatened and endangered species within the designated action area for Kahuku Training Area. The following threatened and endangered species have historically been documented at KTA action area (see Appendix B for a complete list of rare species historically recorded in KTA AA):

- 9 endangered plants
- 4 endangered tree snails
- 1 endangered bird (*Chasiempis sandwichensis* ssp. *ibidis*-Oahu elepaio)

This data was subsequently sorted by date and included all threatened and endangered species occurrences from 1982 until the present in KTA AA (past 20 years). This date was agreed upon by Army Natural Resource Staff (NRS) and the USFWS, because NRS could confirm using recent extensive survey information, whether species prior to 1982 were extirpated (Kapua Kawelo, U.S. Army, pers. comm. 2002). The birds were only included in the list if they were confirmed to be residents. This would exclude *Chasiempis sandwichensis* spp. *ibidis* (Oahu elepaio) recorded at KTA in 1991. This elepaio observation represents a one time occurrence dating back 12 years. NRS has repeatedly surveyed these and other potential sites in KTA annually over the past 6-7 years, but has not observed any federally listed bird species (RCUH 2002b, 2002c). Although NRS has surveyed many historic snail habitats extensively, adequate surveys throughout former snail habitats have not been completed because of the size and ruggedness of the terrain. Thus, remnant snail populations may still persist in remote areas within KTA. The four tree snail species referred to above are *A. curta*, *A. dimorpha, A. sowerbyana*, and *A. valida.* Their records date back to 1946-1967 and they have not been observed since that time. The following tree snail species are not currently known in the wild but still may be extant in remote or unidentified refugia within the KTA AA: *A. bulimoides*, *A. caesia*, *A. curta*, *A. dimorpha, A. elegans*, *A. sowerbyana*, and *A. valida*. These species will be surveyed for by the Army in their historic ranges, identified by HINHP (2002) and USFWS (1993), and within other potential habitats within KTA AA. Table 6.d below contains federally-listed species currently found in the KTA action area. Appendix C lists all species affected by the Oahu Army training and transformation and the designated action area or areas they are found.

Table 6.d Federally-listed Endangered Taxa in the Kahuku Training Area Action Area, Hawaii.[1]

Species Name	Number of individuals	Number of population/occurrences
Plants:		
Cyanea koolauensis	4	1
Eugenia koolauensis	154	4
Gardenia mannii	2	1
Tetraplasandra gymnocarpa	4	2

[1]Source: Hawaii Natural Heritage Program (HINHP 2002) and Research Corporation of the University of Hawaii (RCUH 2002a).

Federally-listed Species Descriptions

See Appendix D for definitions of the components of the species descriptions that follow. For species included in more than one action area, the description can be found where it was first discussed in this BA.

Scientific Name: *Cyanea koolauensis* Lammers, Givnish & Sytsma

Common Name: *Haha, ohawai*
Family: Campanulaceae (Bellflower family)
Federal Status: Endangered
Life history: Short-lived perennial

Description and Biology: *Cyanea koolauensis* is an unbranched shrub 1 to 1.5 m (3.3 to 4.9 ft) tall. The leaves are linear to narrowly elliptic, 16 to 37 cm (6.3. to 14.6 in) long and 1.5 to 4.0 cm (0.6 to 1.6 in) wide. The magenta flowers are 5 to 9 cm (2.0 to 3.5 in) long and form axillary racemes. The fruit is a yellow, orange or purple globose berry, and the seeds are brown to black, smooth and shiny (Wagner et al. 1990).

C. koolauensis has been observed in flower and fruit during the months of May through August (USFWS 1998a). No other information is available on reproductive cycles, longevity, specific environmental requirements, or limiting factors.

Known Distribution: *C. koolauensis* was known historically from about 30 scattered populations/occurrences throughout the Koolau Mountains on Oahu (HINHP 1997).

Population Trends: C. *koolauensis* populations are declining, and those that remain are small and widely dispersed, which puts the species at risk of extinction from naturally occurring events and/or lack of reproductive vigor (HINHP 1997; USFWS 1998a).

Current Status: There are approximately 16 known populations/occurrences of 80 individuals in the Koolau Mountains (USFWS 1998a; RCUH 2002b) (note: state number may need to be recalculated because they came from the recovery plan, which did not include any of the these individuals in the tally). They occur from the Waimea-Malaekahana Ridge to Hawaii Loa Ridge in the Koolau Mountains (HINHP 1997). Four individuals from one population/occurrence are found along the boundary between the KLOA and KTA subinstallations on Waimea-Malaekahana summit ridge North of Kahuku Cabin Koolau summit trail at about 605 m (1980 ft) elevation in the KTA AA (Figure 6.f) (HINHP 2002; RCUH 2002a). They represent about 5% of the total remaining individuals of this species. There are no stable populations > 50 *Cyanea koolauensis* individuals outside the Army AAs (action areas).

Habitat: *Cyanea koolauensis* is found on slopes and ridge crests in wet ohia-uluhe forest or shrubland at elevations from 520 to 810 m (1,700 to 2,660 ft) (USFWS 1996b). Associated plants include alani, hame, *Diplopterygium pinnatum* (uluhe lau nui), uluhe, *Psychotria* spp. (kopiko), *Syzygium sandwichensis* (ohia ha), kanawao, akia, *Bidens* spp. (kookoolau), naenae, hapuu, *Sadleria* sp. (amau), and naupaka kuahiwi (USFWS 1996b; Lammers 1990).

Taxonomic Background: Taxonomic change from *Rollandia angustifolia* (Lammers et al. 1993). The genus *Cyanea* is endemic to Hawaii and is represented by 52 species. There are numerous other representatives of the genus *Cyanea* in the Waianae and Koolau Mountains, but *C. koolauensis* is the only species of the genus documented in the KTA AA.

Outplanting Considerations: It is common to find several *Cyanea* species and *Cyanea* relatives growing together, yet to date there is no good evidence of hybridization occurring between species of *Cyanea* or between a *Cyanea* and a *Cyanea* relative. Therefore, there is little likelihood that hybridization resulting from outplanting of *C. koolauensis* would occur.

Current Threats: The major threats to *Cyanea koolauensisis* are habitat destruction by feral pigs, impacts from military activities, predation by rats and slugs, competition with aggressive alien plants (*Clidemia hirta*-Koster's curse and *Psidium cattleianum*-strawberry guava), trampling by hikers, and over-collection.

Potential Threats from Army Training and Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest location of the KTA AA where *C. koolauensisis* grow (Figure 6.f). There is no fire threat in the location where *C. koolauensisis* occurs in the KTA AA (Figure 6.g). The threat of trampling from foot traffic is very low or non-existent for shrubs, unless they are seedlings. The seedlings from these population occurrences have a moderate threat from foot traffic trampling (Figure 6.h). These results suggest that *C. koolauensisis* is vulnerable to alien plant introductions resulting from military activities in the KTA AA, and *C. koolauensisis* seedlings in this area are vulnerable to trampling from foot traffic as well.

Scientific Name: ***Eugenia koolauensis* Degener**

Common Name: Nioi
Family: Myrtaceae (Myrtle family)
Federal Status: Endangered
Life history: Long-lived perennial

Description and biology: *Eugenia koolauensis* is a tree or shrub 2 to 7 m (7 to 23 ft) tall. The leaves are egg-shaped to elliptic, 2 to 5 cm (0.8 to 2.0 in) long, 1.0 to 3.3 cm (0.4 to 1.5 in) wide, and have a tough and leathery surface. The solitary or paired white flowers originate from the leaf axils. The petals are egg-shaped or elliptic in shape, and 4 to 8 mm (0.2 to 0.3 in) long. The yellow to red berries are ovoid-shaped and 0.8 to 2.0 cm (0.3 to 0.8 in) long (Wagner et al. 1990).

This long-lived perennial has been observed in flower from February to December in various years (USFWS 1996a). No other information exists on reproductive cycles, longevity, specific environmental requirements, or limiting factors.

Known Distribution: *Eugenia koolauensis* was historically known from Maunaloa on western Molokai and from Kaipapau Valley, Hanaimoa and Kahawainui gulches, and a gully southeast of Kahuku on Oahu (USFWS 1996a, Wilson 1957).

Fire Vulnerability Areas

Kahuku Action Area, Oahu

Figure 6g

603000 608000

Maps to sensitive resources have been removed from this document
Contact sjoe@hawaii.edu to request access

1:64,011

0 500 1,000 2,000 Meters

0 0.25 0.5 1 Miles

Data Source: Center for Environmental Management of Military Lands, HINHP 2002, RCUH 2002a

Legend

- *Cyanea koolauensis*
- *Eugenia koolauensis*
- *Gardenia mannii*
- *Tetraplasandra gymnocarpa*

Fire Vulnerability

- Negligible
- Low
- Moderate

- Roads
- Action Area
- Installation Boundary
- Surface Water Feature

Probability Foot Traffic Areas

Kahuku Action Area, Oahu

Figure 6h

Maps to sensitive resources have been removed from this document
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* Please see individual map area for scale information.

Data Source: Center for Environmental Management of Military Lands, HINHP 2002, RCUH 2002a

Legend

- *Cyanea koolauensis*
- *Eugenia koolauensis*
- *Gardenia mannii*
- *Tetraplasandra gymnocarpa*

Threats from Foot Traffic

- Very Low Probability
- Low Probability
- Moderate Probability
- High Probability

- Major Roads
- Action Area
- Installation Boundary
- Surface Water Feature

Population Trends: *Eugenia koolauensis* populations are declining, and those remaining are small, widely dispersed, and have a limited gene pool, which puts the species at risk of extinction from naturally occurring events and/or lack of reproductive vigor (HINHP 1997; USFWS 1998a). There are seedlings and juveniles found in the population at KTA (RCUH 2001).

Current Status: *Eugenia koolauensis* may have been extirpated from Molokai as a result of the pineapple industry (USFWS 1996a). There are presently 158 known individuals remaining (RCUH 2002b); most occur in the northern Koolau Mountains and one disjunct population is in the southeastern Koolau Mountains (HINHP 1997, 2002; USFWS 1996a, 1998a, 1999a; RCUH 2002a, 2002b). About 154 individuals from four population/occurrences are found in the central portion of the KTA AA between Pupkea Road and East Oio (Figure 6.f) (RCUH 2002a, 2002b). Specifically, they include 30 individuals from Pahipahialua in 1999, 40 from Oio in 2003, 59 from Kaunala in 2003, and 25 from Kaleleiki in 2002 (Kawelo, U.S. Army, pers. comm. 2003; Lau, HINHP, pers. comm. 2003). This represents 97% of the total remaining individuals of this species. There are no stable populations > 25 of *Eugenia koolauensis* outside the KTA AA.

Habitat: *Eugenia koolauensis* occurs in dry gulches and ridges of mesic forests, dominated by ohia and/or lama, at 100 to 300 m (350 to 1,000 ft) elevation (USFWS 1996a, Wagner et al. 1990). Other associated plants include *Myrsine lessertiana* (kolea lau nui), *Nestigis sandwicensis* (olopua), *Pittosporum glabrum* (hoawa), *Pouteria sandwicensis* (alaa), *Pleomele halapepe* (halapepe), *Psydrax odoratum* (alahee), and *Rauvolfia sandwicensis* (hao) (USFWS 1996a).

Taxonomic Background: *E. koolauensis* is known to intergrade with *E. reinwardtiana* in the northern Ko`olau Mountains and probably derived from this close relative (Wagner et al. 1990).

Outplanting Considerations: None noted.

Current Threats: Habitat degradation by feral pigs, trampling by humans, disturbance from motor bikes, and competition with alien plants (*Schinus terebinthifolius* (Christmas berry), *Psidium cattelianum*, *Clidemia hirta*, *Ardisia elliptica* (shoebutton ardisia), and *Lantana camara* (lantana)), are the major threats to *Eugenia koolauensis* (USFWS 1996a).

Potential Threats from Army Training and Transformation: The weed threat from current military training and SBCT transformation is high for *E. koolauensis* because of the dry microclimate and prevalence of alien species where they grow (Figure 6.f). The fire threat from Army activities is moderate for all *E. koolauensis* in the KTA AA (Figure 6.g). According to the Army Natural Resource Staff the fire threat is a high due to military and public use of the range (RCUH 2001). There was a fire in 2000 suspected to have been ignited by a flare and grenade from Marines using KTA. The fire burned many native trees and shrubs and burned within 400 m (1,312 ft) of a stand of *Eugenia* trees (RCUH 2001). The threat of trampling from foot traffic is very low or non-existent for trees and shrubs, unless they are seedlings. There are seedlings in these populations (RCUH 2001), and there is a low to moderate threat from foot traffic where they are located in the action area (Figure 6.h). These results suggest that all *E. koolauensis* population/occurrences are vulnerable to alien plant introductions and fire resulting from military activities in the KTA AA, and *E. koolauensis* seedlings in this area are vulnerable to trampling from foot traffic as well.

Scientific Name: *Gardenia mannii* St. John and Kuykendall

Common Name: Nanu, nau
Family: Rubiaceae (Coffee family)
Federal Status: Endangered
Life history: Short-lived perennial

Description and Biology: *Gardenia mannii* is a tree 5 to 15 m (16 to 49 ft) tall with leaves clustered towards the tips of the branches. The leaves are lance-shaped, 6 to 27 cm (2.4 to 11 in) long, and 3.5 to 10.0 cm (1.4 to 3.9 in) wide. The solitary white flowers are fragrant, open in the late afternoon, and last about 2 days. The corolla tube of the flower is 17 to 27 mm (0.7 to 1.1 in) long, and the lobes are 16 to 22 mm (0.6 to 0.9 in) long. The fruit is yellow to orange, broadly ellipsoid, and 1.8 to 4.5 cm (0.7 to 1.8 in) in diameter (Wagner et al. 1990). Plants have been observed with fruit and flowers throughout the year.

Known Distribution: Historically this species was known from 7 widely scattered populations in the Waianae Mountains and 39 populations in the Koolau Mountains (USFWS 1998a).

Population Trends: *G. mannii* populations are declining, and those that remain are small and widely dispersed, which puts the species at risk of extinction from naturally occurring events and/or lack of reproductive vigor (USFWS 1998a).

Current Status: There are 28 populations/occurrences of 70-100 *Gardenia mannii* plants on Oahu (USFWS 1998a). However, the number of unrecorded plants is probably large, particularly in the wet forests of the Koolau Mountains (RCUH 2002c). The majority of the populations/occurrences contain fewer than five individuals (USFWS 1998a). They are distributed along a 42-km (26-mi) length of the Koolau Mountains, from Kaunala Gulch and Kaunala-Waimea Ridge in the north to Palolo in the south and along a 7-kilometer (4-mile) distance in the Waianae Mountains from north Haleauau Valley to Kaluaa Gulch (HINHP 1997). There are 2 individuals from one population/occurrence at KTA, found between Kahuku and Kawailoa Training Areas on the ridge between Paumalu and Kaunala Gulches in the KTA AA (HINHP 2002; RCUH 2002a) (Figure 6.f). They represent >1% of the total remaining individuals of this species. There are no stable populations of > 50 *G. mannii* individuals outside the KTA AA.

Habitat: *Gardenia mannii* occurs in mesic and wet forests from 215 to 700 m (700 to 2,300 ft) (HINHP 1994b). It is endemic to Waianae and Koolau Mountains of Oahu. Common native plants found in close association with *G. mannii* include *Acacia koa, Antidesma platyphyllum* (hame*), Bobea elatior* (ahakea lau nui), *Metrosideros polymorpha* and *Syzygium sandwichensis* (ohia ha).

Taxonomic Background: *G. mannii* and *G. brighamii* are the only two species in the Waianae Mountains from the genus *Gardenia*. *G. brighamii* is extremely rare and known from only two populations with four individuals in dry forest in the Waianae Mountains.

Outplanting Considerations: It is unlikely that *G. mannii* and *G. brighami* could hybridize resulting from outplanting because there is no range of overlap between the two species on Oahu. Outplanting of *G. mannii* should be conducted in mesic to wet forest habitat. The range of *G. brighamii* includes only dry forest.

Current Threats: The major threats to *G. mannii* include habitat degradation by feral pigs; competition from alien plants, particularly *Psidium cattleianum* (strawberry guava), *Clidemia hirta* (Koster's curse), *Rubus argutus* (prickly Florida blackberry), and *Schinus terebinthifolius* (Christmasberry); predation on fruits by rats; *Xylasandrus compactus* (black twig borer); and fire (USFWS 1998a).

Potential Threats from Army Training and Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest location of the KTA AA where *G. mannii* grows (Figure 6.f). The fire threat is low for *G. mannii* in this location (Figure 6.g). The threat of destruction or degradation from foot traffic trampling is very low or non-existent for trees, unless they are seedlings. The seedlings from these population occurrences have a moderate threat from foot traffic trampling (Figure 6.h). These results suggest that *G. mannii* is vulnerable to alien plant introductions and fire resulting from military activities in the KTA AA, and *G. mannii* seedlings in this area are vulnerable to trampling from foot traffic as well.

Scientific Name: *Tetraplasandra gymnocarpa* (Hillebr.) Sherff

Common Name: `Ohe`ohe
Family: Ginseng family (Araliaceae)
Federal Status: Endangered
Life history: Long-lived perennial

Description and Biology: *Tetraplasandra gymnocarpa* is a tree 2.5 to 10.0 m (8.2 to 32.8 ft) tall. It has pinnately compound leaves with 3 to 12 pairs of leaflets and a terminal leaflet. Leaflets are 7 to 18 cm (2.8 to 7.1 in) long, 3 to 8 cm (1.2 to 3.1 in) wide, and egg-shaped. The entire leaf is 30 to 55 cm (11.8 to 21.7 in) long. The flowers form umbels at the tips and racemes along the rays on three to five major branches 10 to 35 cm long. The fruit is purple at maturity and 6 to 12 mm (0.2 to 0.5 in) long (Wagner et al. 1990).

T. gymnocarpa has been observed in flower and fruit in November (USFWS 1996a) and in fruit in May and September (USFWS 1998a). No further information exists on reproductive cycles, longevity, specific environmental requirements, or limiting factors.

Known Distribution: *T. gymnocarpa* historically is known from Punaluu, Waikakalaua Gulch, Mount Olympus, and the region between Niu and Wailupe in the Koolau Mountains (Degener 1938; USFWS 1996a), and from the southern Waianae Mountains at Palikea (USFWS 1998a).

Population Trends: The range of *T. gymnocarpa* has been declining as the species becomes more rare. It presently is restricted to the summit regions of the Koolau Mountains (Wagner et al. 1990).

Current Status: Less than 200 individuals are known from 17 populations (USFWS 1998a), distributed over 45 km (28 mi) along the summit ridges of the Koolau Mountains from the Paumalu region in the

north, to Kuliouou and Waimanalo in the south (HINHP 1997; USFWS 1996a, 1998a). There are four individuals reported from two population/occurrences in the KTA AA, located in Paumalu and Kaunala Gulches (Figure 6.f) (HINHP 2002; RCUH 2002a). These individuals represent 2% of the total remaining individuals of this species. There are 5 stable populations of > 25 *T. gymnocarpa* located outside of the Army AAs, including Kaluanui, Konahuanui to Mt. Olympus, Moanalua to Haiku, Wailupe-Niu, Waimano to Manana (Lau, HINHP, pers. comm. 2003).

Habitat: *T. gymnocarpa* occurs in wet and sometimes mesic forests between 250 and 850 m (820 and 2,790 ft) elevation on windswept summit ridges or in gullies. It is often associated with plants such as *Wikstroemia oahuensis* (akia), *Sadleria* sp. (amau), *Metrosideros polymorpha*, *Cheirodendron trigynum* (olapa), *Dicranopteris linearis*, *Machaerina* sp. (uki), *Freycinetia arborea* (ieie), *Cyrtandra subumbellata* (kanawao), *Psychotria fauriei* (kopiko), *Labordia cyrtandrae* (kamakahala), *Hedyotis fosbergii* (manono), *Bidens* spp. (kookoolau), *Dubautia laxa* (naenae pua melemele), and *Cibotium* spp. (hapu`u) (HINHP 1997; Lowrey 1990; USFWS 1996a).

Taxonomic Background: *Tetraplasandra* is an endemic Hawaiian genus that includes six species believed to have resulted from a single introduction (Philipson 1970). *T. gymnocarpa* possesses a superior ovary, which is a unique characteristic for species within the same family (Wagner et al. 1990).

Outplanting Considerations: None noted.

Current Threats: The major threats to *T. gymnocarpa* are habitat degradation by feral pigs and competition with alien plants such as *Clidemia hirta* and *Psidium cattleianum.* The remaining populations are small and widely dispersed, which puts the species at risk of extinction from naturally occurring events and/or lack of reproductive vigor (USFWS 1996a).

Potential Threats from Army Training and Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest location of the KTA AA where *T. gymnocarpa* grow (Figure 6.f). The fire threat from these military activities is low for *T. gymnocarpa* populations/occurrences in the KTA AA (Figure 6.g). The threat of destruction or degradation from foot traffic trampling is very low or non-existent for trees, unless they are seedlings. The seedlings from these population occurrences have a low to moderate threat from foot traffic (Figure 6.h). These results suggest that all *T. gymnocarpa* population/occurrences are vulnerable to alien plant introductions and fire resulting from military activities in the KTA AA, and *T. gymnocarpa* seedlings in this area are vulnerable to trampling from foot traffic.

6.5.3 Potential non-military uses of the action area

There are non-military uses at KTA that have the potential to negatively impact federally listed species. They are current actions that are not controlled by the Army. They include hiking, biking, motocross and hunting on 465 ha (1,150 ac) leased from the state of Hawaii (USACE and Nakata Planning Group 2000).

- Under a permit from the state, the public (e.g., Hawaii Motor Sports Association (HMA)) has exclusive rights to Training Area A-1 during weekends and federal holidays. Lease provisions allow the Army to close these areas for brigade or larger field exercises only with prior notification to the public. The Hawaii Motosport Association (HMA) hosts eleven or twelve sanctioned motocross events annually on the track at KTA. The association events have followed the regulations established in the lease.
- Hiking and biking are allowed on the Kaunala-West Trail (9.66 km) on KTA. Public access is limited to weekends and federal holidays, unless the Army is conducting maneuvers in the area and provides notification that the trail will be closed. The trail is on land leased by the Army from

the state; hikers must receive permits from the DOFAW to hike the trail. The trail is part of the Na Ala Hele Trail System.

- Public hunting is permitted in the Pupukea State Public Hunting Area in Kahuku Training Area A-3 on Saturdays, Sundays, and federal holidays, unless military training activities have been announced prior to a weekend or holiday. Hunting is allowed from thirty minutes before sunrise to thirty minutes after sunset. Goats and pigs are the only game animals that can be taken. One pig and one goat of either sex may be taken per day. Handgun use is restricted for hunting, but shotguns, bow and arrow, and spear or knife with dog are allowed. Hunting dogs must be kept under restraint except while hunting. Access to the hunting area is through the Air Force Station (subject to military activities). The state maintains a hunter check station for KTA.

6.6 Minimization of Potential Negative Effects of the Action

To quantify the beginning threat level for each potential effect of the action and the remaining threat following minimization action, a relative numerical threat value system is used. Threat values assigned to each potential effect are 0 = none, 1 = very low, insignificant and discountable (1-10% vulnerability), 2 = low (11-25% vulnerability), 3 = moderate (26-50% vulnerability), 4 = high (51-75% vulnerability), and 5 = very high (>75% vulnerability). These threat values have been developed for use in our discussion as a means of comparing threats posed to threatened and endangered species in portions of the action area relative to other portions of the action area. They measure the risk of each event occurring in a given area. The reasoning behind the assignment of each value is discussed under each section below.

Minimizing the potential negative effects of Army training and transformation activities involves implementing actions to lessen the amount of negative impact that the action may cause. Minimization is important for reducing the potential negative impact to listed species, but it also can work to reduce the size of the action area, which in turn can reduce the number of species affected by the action. The potential effects of Army training and transformation at Kahuku Training Area that received threat values greater than (1) very low, insignificant and discountable are discussed along with proposed minimization actions in Table 6.e at the end of this section. Minimization actions may result in the modification of threat values downward. Table 6.e summarizes the resulting (modified) threat values following minimization actions. Modified threat values of less than low (2) are **not likely to adversely affect any federally-listed species or adversely modify critical habitat in the action area**. Potential effects, which are assigned modified threat values greater than or equal to low (2) are **likely to adversely affect federally-listed species or adversely modify critical habitat** and these are in bold type in Table 6.e.

6.6.1 Direct Effects

6.6.1.1 Landing and Drop Zones used in Current Military Training

There are five open LZs and three open LZ/DZs in the KTA action area. The closest federally listed record to any of these zones is *Eugenia koolauensis* (about 465 m (1525 ft)) to LZ Hill 904C (Figure 6.a). All other listed species population/occurrences are > 480 m (1575 ft) to any of the zones, thus no other listed species are directly affected by this military training in KTA AA. **The threat to the closest federally listed species population to LZs in the KTA AA is at most low (2).**

This threat should be reduced from low (2) to very low (1) insignificant or discountable by doing the following:

- Monitoring the population/occurrence regularly for damage from downdraft and for new seedlings.

6.6.1.2 SBCT Construction Projects

Tactical Vehicle Wash. All construction and transport of workers will take place within the boundaries of the action area as it is defined, including earth moving, turnarounds, drainage channels, etc. The closest federally listed species (*Eugenia koolauensis*) is about 1.6 km (1.0 mi) from the construction site (Figure 6.b). No listed species will be directly affected by this SBCT construction.

Combined Arms Collective Training Facility. All construction and operation of the facility will take place within the boundaries of the action area as it is defined. The closest federally listed species (*Eugenia koolauensis*) is about 450 m (1,475 ft) from the construction site (Figure 6.b). No listed species will be directly affected by this SBCT construction.

Fixed Tactical Internet Antennas. There are two fixed tactical internet antennas proposed for the KTA action area. Both locations have been previously disturbed with construction of other structures (Steve Kim, USACE pers. comm. 2002). The construction would include a 6.1 x 7.6 m (20 x 25 ft) area, and existing roads would be used to access the antennas. The closest federally listed record to any of these antenna construction locations, including a 25 m (82 ft) construction buffer, is *Eugenia koolauensis* (about 675 m (2,215 ft)) to the second and more southern antenna (Figure 6.b). No listed species will be directly affected by this SBCT construction of the fixed tactical internet antennas in KTA AA. The antennas will be inspected monthly for electrical and physical damage and will be repaired as needed. If there are any specific actions that may affect listed species, the Army will consult with the USFWS.

The threat SBCT construction projects pose to listed species in KTA AA is (0) none.

6.6.1.3 Potential Off-Road Vehicle Maneuver Areas used for SBCT

Federally listed species can potentially be damaged or destroyed during vehicle maneuvers. Results from the maneuver analysis show that *E. koolauensisis* is 80 m (262 ft) from off-road vehicle maneuver areas, which is the closet among the species in the KTA AA (Figure 6.c). However, this vehicle maneuver area is very small (10 m^2) and is surrounded by areas not conducive to vehicle maneuvers, so likely won't be exploited for these types of maneuvers. The closest large contiguous vehicle maneuver area is about 225 m (738 ft) from *E. koolauensisis*. **Therefore, the threat vehicle maneuvers potentially pose to federally listed species in KTA AA is very low, insignificant, or discountable (1).**

6.6.1.4 Fire from Current Military Training and SBCT Transformation

For the purposes of this BA, fire vulnerability is defined as the risk of fire ignition combined with the risk of fire spread as determined by characteristics of the vegetation and climate. Typical rainfall for KTA averages roughly 50 inches per year at low elevations and nearly 200 inches per year on the Koolau ridge. The most extensively used training lands experience 50 to 70 inches per year. Winds are mostly northeasterly trades and average 13.5 mph at the KTA RAWS (Remote Automated Weather Station) located in Training Area B-2. Hourly maximum wind speed averages 17.4 mph. Temperature averages 73.3 degrees F and daily maximum temperature averages 78.6 degrees F. Average relative humidity is 86% with average daily maximums and minimums of 97% and 71% respectively. Kahuku Training Area encompasses four fire vulnerability areas due to training concentrations and its position straddling the northern end of the Koolau Mountains (Figure 6.g). Fuels and climate change from wetter and less fire prone on the east side of the mountains and at higher elevations, to drier and more fire prone on the western side of the mountains and at lower elevations. No live-fire activity occurs at KTA, so the fire vulnerability is not as high as those training areas in which live-fire is authorized.

Western Low Elevation – This includes most of the large grassy areas and LZ's. Ground pyrotechnics are allowed but aerial pyrotechnics are not. It is considered to be **moderately (3) vulnerable** to fire because of the drier climate, the fire prone vegetation, and the high frequency of training.

Western High Elevation – This area of the installation is dominated by alien forest. It includes some grassy areas and stands of eucalyptus, but receives enough moisture and training levels are low enough, that it has a **low (2) vulnerability** to fire.

Eastern Low Elevation – While these areas still receive significant rainfall, they are sometimes dominated by more fire prone vegetation such as some of the pyrophytic grasses. More frequent training occurs here as well. This area has a **low (2) vulnerability** to fire because of the nature of these fuels and the possibility of drought conditions in which they would become more flammable.

Eastern High Elevation – These areas receive rainfall of up to 200 inches per year, and support less fire prone fuels than other areas of KTA. Military training is also minimal. The fire vulnerability in these areas is considered to be **(0) none**.

Methods to minimize the negative effects of fires on threatened and endangered species will be documented in the finalized Wildland Fire Management Plan (WFMP), Pohakuloa and Oahu Training Areas, scheduled to be completed by September, 2003. Components of the WFMP important in Section 7 consultations with the USFWS are included in the BA (Fire History, Protected Species, Firebreak System, Fuels Management, Enforcement, Ignition Control, Fire Danger Rating System, Fire Reporting and Notification Procedures, Records and Fire Reports, and Departmental Responsibilities). The fire management plan defines the responsibilities of Range Control personnel and military training units for the prevention and suppression of fires at KTA. This plan also outlines the prevention and suppression measures that must be carried out to train at KTA. Immediate and aggressive response to all fires is an unconditional requirement at KTA. The Army will reinitiate consultation with the USFWS if a fire escapes the installation boundary OR if a fire starts are spreads within 521 meters of a listed species. The main action at KTA to minimize impacts will be the implementation of a fire danger rating system that will restrict training according to weather and fuel conditions. Fuels management may be considered as well, including chemical and mechanical means of fuel reduction.

After these fire minimization actions are implemented, threats are projected to be reduced from moderate (3) to low (2) in western low elevation areas, and from low (2) to very low (1), insignificant or discountable in western high elevation areas (Table 6.e).

6.6.1.5 Alien Plant Introduction via Current Military Training and SBCT Transformation

The probability of alien plants becoming established depends on the type of weed species being introduced (e.g. dry, mesic, or wet forest species) and the proximity of suitable environments and/or plant communities to the action area or point of introduction of the species. Weed threat significance numbers are used to designate the level of threat. The KTA action area contains nonnative, mesic and wet forest communities. **Nonnative communities have a high threat level (4) because of dry microclimates and dominance of alien species, mesic forest species have a moderate threat level (3), and wet forest species have a low (2) to moderate (3) threat level of becoming established.** This is because dryer communities are generally lower and closer to training activities, so the distance between the point of introduction and the location of the similar community type would be small compared to for wetter forests. Also, there is a greater chance of a weed becoming established that would impact dry communities than mesic forests because training areas are located in habitat more similar to dry forests.

Threats are projected to be reduced from high (4) to moderate (3) for dry (nonnative communities), moderate (3) to low (2) for mesic forests, and from low (2) or moderate (3) to low (2) for wet forest species by doing the following:

- The Army will prevent any weeds brought in by training activities from becoming established by rigorously monitoring using transects and roadside surveys and eradicating new weeds using most effective means known specific to each of the invasive species. Refer to the pest management sections of the Oahu INRMP (CEMML 2001) for possible treatments for eradication. Detailed methods for the monitoring and eradication of alien plants will be developed as part of the Oahu IP.
- The Army will wash vehicles in the wash rack facility prior to returning to Oahu from the Pohakuloa Training Area (PTA), to minimize weeds (e.g., fountain grass).
- The Army will provide education regarding cleaning vehicles and field gear (these education materials will be Service approved).
- The Army will wash vehicles at SBMR prior to going to KTA and in the wash rack facility at KTA prior to leaving the training area, to remove any seeds and large clumps of soil that may have accumulated on the vehicles and minimize the spread of weeds. Once vehicles are washed they will be traveling on paved roads between the two areas.
- Persons and equipment coming from foreign countries must go through U. S. Department of Agriculture and U.S. Customs inspections before coming into the United States.
- The Army will train and require soldiers to clean their gear and vehicles when first arriving in Hawaii and prior to moving from installation to installation on Oahu, as well as when moving from Oahu to the island of Hawaii or vice versa.

6.6.1.6 Alien Animal Introduction via Current Military Training and SBCT Transformation

The chance of an introduced animal establishing a viable population would be lower than for plants since they would require at least two reproductive viable individuals or a single impregnated female individual be introduced. **The threat of an alien animal species being introduced at KTA from Army training and transformation is moderate (3).**

This threat should be reduced from moderate (3) to low (2) by doing the following:

- To minimize animals (e.g. invertebrates) from coming back to Oahu from the Pohakuloa Training Area (PTA), the Army will wash vehicles in the wash rack facility at PTA prior to returning.
- Persons and equipment coming from foreign countries must go through U. S. Department of Agriculture and U.S. Customs inspections before coming into the United States.
- The Army will provide education regarding cleaning vehicles and field gear (these education materials will be Service approved).
- The Army will brief soldiers on alien reptilian species and request that all snake and lizard sightings be reported to the Army Environmental office.
- The Army has developed and distributed brown tree snake response and alert posters which inform the public about the potential for a brown tree snake introduction with rapid response measures and numbers to call in case of a sighting.
- The Army established the Brown Tree Snake Response Plan for rapid response to and interdiction of brown tree snakes introduced to Army Lands on Oahu.
- The Army is a member and will continue active participation in the Oahu Invasive Species Committee (OISC). This is a voluntary partnership of private, governmental and non-profit

organizations and individuals united to prevent new invasive species infestations on the island of Oahu, to eradicate incipient invasive species, and to stop established invasive species from spreading.
- Herpetofauna certification program will be developed as part of the implementation process for plant material purchased by the Department of Defense, to prevent incidental introductions of herpetofauna to the island of Oahu.
- Establish the phytosanitation certification program developed in the Draft Makua IP (Makua Implementation Team 2002).
- Coordinate/collaborate with the Toxicants Working Group in an effort to determine a safe toxicant for controlling populations of newly established invertebrates.
- Use environmentally safe toxicants for alien species control or eradication associated with military operations or natural resource management.
- If a new introduction of an alien animal is found, the source and time of the introduction will be identified, and the area will be searched and treated with an appropriate environmentally safe toxicant to eradicate any other individuals of the target species that may be present. In addition, an area deemed adequate to cover the potential dispersal distance of the new alien animal will be searched and treated as well.
- Pursue support, implementation and funding for the licensing and application of a more toxic rodenticide, and towards broad scale distribution of rodenticides to improve rat control in remote areas, especially in areas with threatened and endangered species.

6.6.1.7 Trampling from Current Military Training and SBCT Transformation

Trampling of threatened and endangered species, particularly plants and invertebrates, is a potential risk during training exercises when soldiers or troops move through native habitats with listed species. However, the threat of destruction or degradation from trampling by troops will be lower than what one would expect by chance because infantry soldiers are trained to leave no evidence or trace of their presence. For the purposes of this BA, we used percent slope and distance from roads to estimate the frequency of use by foot traffic as a measure of potential trampling intensity. We categorized areas into high, moderate, low, and very low, insignificant or discountable threats from trampling based on the predicted use of lands adjacent to the roads and trails in Kahuku AA. This was done under the assumption that lower slopes and areas on or close to roads are used with greater frequency than the contrary (Figure 6.h).

The threat of trampling varies from high (4) for areas <10 m from roads or trails; moderate (3) for areas 10-1000 m from roads or trails with 0-30% slope, or 10-100 m from roads or trails with 30-60% slope; low (2) for areas 10-100 m from roads or trails with >60% slope, or 100-1000 m from roads or trails with >30% slope, or >1000 m from roads or trails with < 60% slope; and very low (1), insignificant or discountable for areas >1000 m from roads or trails and with >60% slope.

The risk to mature trees or shrubs getting trampled by foot traffic is very low, insignificant and discountable. Only the seedlings of trees and shrubs, and herbaceous plants are at risk of being trampled. **The threat of a listed plant or invertebrate being crushed and killed would be reduced by one from those predicted above (Table 6.e) by doing the following:**

- The Army will educate each set of new soldiers on avoidance of trampling of endangered species.
- Establish LCTA (ITAM) plots to monitor impact of foot traffic trampling by infantry soldiers.
- Fencing of federally listed species populations near roads or trails that have been determined to be impacted by military foot traffic, will be addressed by the implementation team.
- Establishing signage to identify areas that are of limits due to the presence of federally listed species, will be addressed by the implementation team.

6.6.1.8 Noise from Current Military Training and SBCT Transformation

Noise is an unwanted sound. It is generated from a source (e.g., explosion) as a wave of energy, which diminishes with distance. The only potential concern related to noise from Army activities is the potential effect on vertebrate species. Since there are presently no listed vertebrates in the KTA AA, noise is not a concern in this area. **Therefore, a threat value of none (0) is assigned to noise from military sources at KTA AA.**

6.6.2 Direct Interrelated Actions and Effects

6.6.2.1 Soil Erosion by Wind

There are parts of coastal KTA with unprotected slopes that have some of the highest recorded average wind speeds (18 to 20 knots) (USACE and Nakata Planning Group 2000), but there are no listed species in these areas. In addition, the majority of the dust producing military activity is >300 m from threatened and endangered species populations. **Therefore, the threat values for dust generation on federally listed species is very low (1), insignificant or discountable and requires no further minimization.**

6.6.2.2 Soil Erosion by Water

Soil erosion processes modify habitats by removing or adding soil from one location to another. Soil erosion is locally significant in areas where natural drainage and gulches occur. However, dry climate and lack of permanent streambeds may reduce the risk of erosion, as well as in areas where soils are not well developed because of exposed rock. Military activity and construction can have an effect on erosion rates and sedimentation, especially in areas where activity is concentrated. These disturbances are commonly in association with roads, LZ/PZ/DZ areas, and off-road maneuver and recreational areas (e.g., motorcycle trespass. **The ITAM LRAM program is actively working to minimize erosion and control sediment on KTA using a variety of techniques and structures. Therefore, the effect of soil erosion and sedimentation on federally listed species is considered low (2).**

The effect of soil erosion and sedimentation on federally listed species should be further reduced from low (2) to very low (1), insignificant or discountable by doing the following:

- Establish a project review process headed by ITAM and including USAG-HI DPW, G3/DPTM, and Range Control, to optimize watershed protection and rehabilitation (e.g., road construction and maintenance, storm water management, etc.).
- Assess problems and solutions to minimize soil disturbance, vegetation loss, and other degradation associated with motorcycle and off-road vehicle use and trespass in Training Area A1 and other affected areas on KTA. A solution will require cooperation between the Army (user and neighbor), the state (lessor), and the lessee. Site-specific remediation actions will be addressed by ongoing ITAM efforts and an Erosion and Sediment Control Management Plan (Section 5.3.6.2, Land Rehabilitation and Maintenance).
- Establish GIS support headed by ITAM, to develop project data layers, analyze data, and display results.

6.6.3 Direct Interdependent Actions and Effects

6.6.3.1 Range Maintenance and Construction

Range development projects are interdependent actions with interdependent effects. These projects have a similar potential of affecting listed species through alien introductions as do other Army activities,

because they occur in the same areas. **Therefore, the threat values for alien species introductions via range maintenance and construction is moderate (3) to high (4).**

Most of the range construction is done in-house by the Army and involves road construction and maintenance with crushed rock from the Kolekole Rock Crushing Quarry at Schofield Barracks. Since the rock is obtained from Schofield Barracks, the likelihood of a weed species foreign to Hawaii being in the material is negligible. However, sometimes sand is purchased for different projects and the sand could introduce new weeds. The Army will minimize this threat by conducting weed monitoring using transects and roadside surveys and eradicating new weeds using most effective means known specific to each of the invasive species. Refer to the pest management sections of the Oahu INRMP (CEMML 2001) for possible treatments for eradication. Detailed methods for the monitoring and eradication of alien plants will be developed as part of the Oahu IP. **Therefore, the threat value should be reduced from moderate (3) or high (4) to low (2) or moderate (3) (Table 6.e).**

6.6.3.2 Integrated Training Area Management (ITAM) Program

This program is designed to monitor and mitigate erosion and loss of vegetative cover, which is essential for human safety and realism in training. ITAM workers revegetate areas, which have been heavily used for training. The ITAM program has the potential to introduce alien plant and animal species to Kahuku via this work. **The initial threat value assigned to the ITAM program projects is low (2), because of the overall beneficial nature of the work they conduct, and because they work mostly in areas already heavily impacted by human development, dominated by alien plant species, and far away from federally listed species (including roadsides, LZ's, and maneuver areas).**

ITAM staff coordinate with Army Natural Resource Staff to select native species for outplanting. They purchase plants from native plant nurseries on Oahu. The plants are not delivered until the day before they are planted, to reduce the risk of contamination by alien species. Native plants are always the first alternative because they have the greatest likelihood of successful establishment. In some cases native species are not commercially available, more specifically grasses for Landing Zones. In those cases they coordinate with Army Natural Resource Staff to select something non-invasive, naturalized, and which already occur near the outplanting site. Detailed methods for the monitoring and eradication of alien plants will be developed as part of the Oahu IP.

This potential threat will be further reduced by doing the following:

- Get weed free certification from native plant nurseries for all plants purchased by ITAM for revegetation.
- When using grass seed to revegetate an area, ITAM will periodically monitor these areas for invasive weeds, and remove all non-target introductions from the area before establishment.

In light of the precautions that are taken in choosing revegetation material and proposed actions to reduce the risk of a new introduction, the modified threat value assigned to the ITAM program projects is very low (1), insignificant and discountable.

6.6.3.3 Natural Resources Program

The Army's Natural Resources component of the Ecosystem Management Program provides protection to the listed species at KTA in conjunction with military training there. Ecosystem level management at KTA includes surveys, monitoring, propagation and storage of rare plants; ungulate, weed, and rodent control, and control of alien invertebrates and associated diseases. Natural resource workers could potentially introduce weed species via field vehicles or gear during management. Landing zone and disturbance corridor surveys are also conducted in areas where there is a high potential for alien species

introduction via their program. **These potential adverse impacts are assigned an initial value of low (2).**

However, NRS workers are trained to be very conscious and careful of the weed threats, and take precautions such as cleaning gear and vehicles prior to entry into the field. **Therefore, the initial threat value assigned to the natural resources program was modified to very low (1), insignificant and discountable.**

6.6.3.4 Alien Species Introduction by Recreational Use

Alien Animal Introduction. Open public access to the installation, public access on roads outside the installation boundaries, roads accessing the motocross track within KTA, and non-military personnel with daily access to the installation are all potential non-military points of animal introductions at KTA. Also, alien animal species may disperse (usually by flying) into new uninhabited areas within the subinstallation or action area, or the smaller species may be blown in by winds. The likelihood of human-induced introductions via recreation activities is lower than from military sources because of the lower frequency of use of the area for these purposes. **The threat of alien animal introduction by recreational use is therefore very low (1), insignificant and discountable and requires no further minimization.**

Alien Plant Introduction. There are eleven or twelve motocross events annually on the track at KTA, and public access along Kaunala-West Trail and the Pupukea Summit Trails on weekends and state holidays increases the risk of alien introductions in these areas at KTA. **The threat of alien plant introduction by recreational use is therefore considered moderate (3), because of the frequency of public use of the area.**

This threat should be reduced from moderate (3) to low (2) by doing the following:

- Monitoring trail use by requiring the public to get permission from DOFAW and DPW for access to hike Kaunala-West Trail and the Pupukea Summit Trails.
- The Army will prevent any weeds brought in by recreationalists from becoming established by monitoring trails used for these purposes within and adjacent the KTA AA. Methods for monitoring will be developed as part of the Oahu IP.
- Require that hikers clean all gear prior to entry.
- Develop and place signage at appropriate places along KTA boundaries and trail locations to notify users of resource management issues, boundaries, and trail issues.
- Develop maps of the Kaunala-West Trail and the Pupukea Summit Trails for distribution with access permits, including the level of difficulty, and natural resources issues (e.g., weed distribution concerns, endangered species information, the importance of staying on the trail).

6.6.3.5 Construction and Use of Drum Road

Drum Road Construction. The proposed improvements to the existing Drum Road from Helemano Military Reservation through the Kawailoa and Kahuku Training Areas include the following: paving about 23 miles of road with asphaltic concrete, widening the road to 7.3 m (24 ft) to accommodate two lanes, providing 0.9-m (3-ft) compacted gravel shoulders on both sides, realigning dangerous curves to provide better/safer site distances, regrading to correct steep slopes and provide better drainage structure and lines to preclude excessive amounts of storm runoff, and providing safety measures (e.g. guard rails at drop offs, barriers, warning signs) where needed. In addition, some segments of Drum Road may require bridging or viaducts where the full width of the roadway cannot be accommodated on the existing terrain. Site work would include clearing, grubbing, grading, and stockpiling of material for embankments. Fiber optics communication cable would be laid under the road for local telephone and

data network services at KTA. Project actions include the construction of proper drainage features and adequate stream crossing culverts or bridging. This project can also be considered as an interrelated action.

The closest federally listed species to the Kahuku Training Area portion of the road are two populations of *Tetraplasandra gymnocarpa*, at approximately 60 m (195 ft) away (Figure 6.b). All other species population/occurrences are >150 m (490 ft) from the road. Potential adverse construction effects to listed species include fugitive dust and exhaust from construction vehicles, erosion, and weed spread. The fugitive dust and exhaust would have a **low (2) effect on the two populations of *Tetraplasandra gymnocarpa* and a very low, insignificant, or discountable (1)** effect on all other species because the species are far enough away from the road. The potential effect of fugitive dust and exhaust would be reduced to **very low, insignificant, and discountable (1) by the following:**

- **Applying water along sections of road where two *T. gymnocarpa* occur, as needed during construction in these areas.**

The potential erosion effects would be **moderate (3), but will be reduced to very low, insignificant, or discountable (1)** by applying best management engineering practices and assuring that any construction in the vicinity of listed plants downgrade will be protected from the affects of erosion. The Army will consult with the USFWS on the best management practices to be used in the area of the listed plants and will incorporate them into the final designs and specifications for the project. The potential effect of weed spread would be **high (4), but these effects will be decreased to low (2)** by doing the following:

- Contractors and their employees will be educated on the need to wear clean clothes and maintain clean vehicles and equipment when coming onto the construction site.
- Construction equipment would be cleaned and inspected before being transported to the construction sites.
- Vehicles would be left at the construction site, confined to the training area, or recleaned before returning to the construction site.
- Every effort will be made to balance earthwork so no outside fill sources would be needed for the project. If outside fill were used, sites would be monitored for new alien species.
- Army Natural Resources personnel would periodically inspect construction sites for new alien species. Alien species would be documented and removed.

Drum Road Use. After the improvements to the existing Drum Road, it will be the primary route used by Legacy and SBCT for the transport of equipment and soldiers mostly from Schofield Barracks to and from KTA and sometimes KLOA to support training as described for each training area. Once construction is completed the road will have the following approximate usage 12 times per year:

Legacy Units:
Company Level: 36 trucks
Battalion Level: 41 trucks

SBCT Units:
Company Level: 47 Strykers and trucks
Battalion Level: 217 Strykers and trucks

The potential effects from use of the road would be from dust/exhaust and spread of weeds. The dust/exhaust effect would be **very low, insignificant, or discountable (1)** because of the species distance from the road, and because the road will be paved so the dust level will be very low. The potential erosion

effects would be **very low, insignificant, or discountable (1)** and the potential affect of weed spread would be **moderate (3).**

The threat of weed spread from use of the road would be reduced from moderate (3) to low (2) by doing the following:

- Vehicles will be washed in KTA and Schofield Barracks before and after use.
- Roadside monitoring for weeds will be done and new species of weeds that are found will be removed.
- Soldiers will be educated of the importance to wear clean clothes and maintain clean vehicles.

6.6.4 Indirect Effects

6.6.4.1 Spread of Alien Species by Fire into Dry (nonnative) Communities

The threat values for secondary weed spread are based on the assumption that fire occurs in the area, and are similar to those described above for direct weed introductions from military training and SBCT activities in dry (nonnative) communities, high (4).

This indirect threat from military training and transformation activities at KTA should be reduced from high (4) to moderate (3) as a result of the following:

- The Army will prevent secondary weed spread from fire by rigorously monitoring and eradicating newly dispersed weeds. Detailed methods for the monitoring and eradication of alien plants will be developed as part of the Oahu IP.

6.6.4.2 Spread of Alien Species by Fire into Mesic Forest

The threat values for secondary weed spread are based on the assumption that fire occurs in the area, and are similar to those described above for direct weed introductions from military training and SBCT activities in mesic forest, moderate (3).

This indirect threat from military training and transformation activities at KTA should be reduced from moderate (3) to low (2) as a result of the following:

- Detailed methods for the monitoring and eradication of alien plants will be developed as part of the Oahu IP.

6.6.4.3 Spread of Alien Species by Fire into Wet Forest

The threat values for secondary weed spread are based on the assumption that fire occurs in the area, and are similar to those described above for direct weed introductions from military training and SBCT activities in wet forest, low (2) to moderate (3) of becoming established.

This indirect threat from military training and transformation activities at KTA should be reduced from low (2) or moderate (3) to very low (1) or low (2) as a result of the following:

- The Army will prevent secondary weed spread from fire by rigorously monitoring and eradicating newly dispersed weeds. Detailed methods for the monitoring and eradication of alien plants will be developed as part of the Oahu IP.

6.6.4.4 Army Regulated Hunting

Training areas A-1 and A-3 are part of an Army-maintained hunting program on KTA. Training area A-1 is open for hunting when not used for motocross racing or military training, usually on weekdays such as ADONSA (a day of no scheduled activities). Game birds may be hunted in season (November – January)

and wild pigs may be hunted from February to October. Dogs are permitted, but must be kept under physical restraint except while actually hunting. Knives and spears are the only weapons allowed for pig hunting. Active duty, reserve duty, and retired military personnel and authorized family members, and DoD civilian employees and their civilian guests are allowed to hunt this area. The Pupukea State Public Hunting Area (part of Unit C) is located in Training Area A-3 on KTA. The area is open to active duty, reserve, retired military personnel and authorized family members, and DoD civilian employees and their guests on weekdays when Training Area A-3 is not in use for military training. Both goats and pigs may be hunted using shotguns with slugs, bow and arrow, spear, and knife with dog. Rifles are not permitted, and dogs must be kept under restraint except while actually hunting. One pig and one goat of either sex may be taken per day. The area is not used for military training when used for public hunting on weekends. Only one hunting group (two to six persons) is allowed in either of the training areas at a time, and permits are issued on a first-come, first-serve basis by the Provost Marshal. There is a *Tetraplasandra gymnocarpa* population/occurrence in the SE corner of hunting area A-3 that is potentially impacted from hunting there. The threat from alien plant introductions is low to moderate, the fire threat is low, and the threat of destruction or degradation from foot traffic trampling is moderate for seedlings in this portion of the A-3 Training Area. **These threats will be reduced by one by doing the minimization for weed introduction, fire, and trampling resulting from routine military training and SBCT activities discussed above.**

Table 6.e Potential Effects of Military Training and Transformation Activities at Kahuku Training Area, Hawaii.

Effect Type	Potential Effect/Threat[1]	Initial Threat Value	Modified Threat Value with Minimization[2]
Direct	**Fires from military activities in western low elevation areas of the action area**	3	2
Direct	Fires from military activities in western high elevation areas of the action area	2	1
Direct	**Fires from military activities in eastern low elevation areas of the action area**	2	2
Direct	**Alien plant introduction to nonnative communities**	4	3
Direct	**Alien plant introduction to native mesic forest**	3	2
Direct	**Alien plant introduction to native wet forest**	2-3	2
Direct	**Alien animal introduction**	3	2
Direct	Destruction from off-road vehicle maneuvers	4	1
Direct	**Trampling from foot traffic in areas <10 m from roads or trails**	4	3
Direct	**Trampling from foot traffic in areas 10-1000 m from roads or trails**	3	2
Direct	Trampling from foot traffic in areas >1000 m from roads or for areas with 30-60% slope	2	1
Direct Interrelated Action and Effect	Erosion by water	2	1
Direct Interdependent	**Range maintenance and construction, plant**	3-4	2-3

Effect Type	Potential Effect/Threat[1]	Initial Threat Value	Modified Threat Value with Minimization[2]
	introduction		
Direct Interdependent	Integrated Training Area Management	2	1
Direct Interdependent	Natural Resources Program	2	1
Direct Interdependent	**Alien plant introduction by recreational use**	3	2
Direct Interdependent	Dust from Drum Road construction	2	1
Direct Interdependent	Erosion from Drum Road construction	3	1
Direct Interdependent	**Weed spread from Drum Road construction**	4	2
Direct Interdependent	**Weed spread from Drum Road use**	3	2
Indirect effects	**Spread of alien species by fire into nonnative dry forest**	4	3
Indirect effects	**Spread of alien species by fire into native mesic forest**	3	2
Indirect effects	**Spread of alien species by fire into native wet forest**	2-3	1-2

[1] Potential effects in bold type are those which are assigned modified threat values ≥ to low (2), and are likely to adversely affect federally-listed species or adversely modify critical habitat.
[2]Modified threat values of less than low (2) are not likely to adversely affect any federally-listed species or adversely modify critical habitat in the action area.

6.7 Other Army Consultations for Listed Species at KTA

6.7.1 Review of Planning Documents

The Army has requested USFWS review of Natural Resource planning documents over the years. The USFWS in April of 1996 reviewed the Army's draft Endangered Species Management Plan Report for Oahu Training Areas which was finalized and in place in 1997. In July of 1997 the USFWS sent comments to the Army regarding selected chapters of the Oahu Ecosystem Management Plan Report which was finalized and in place in 1998. In August of 2001 the USFWS sent the Army their review comments for the draft Integrated Natural Resources Management Plan which is the action document for review, guidance, and implementation of Army natural resource activities for 2002-2006 at Oahu Army Installations.

6.8 Cumulative Effects

Cumulative effects include the effects of future state, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the Endangered Species Act.

6.8.1 Future State Actions

None noted.

6.8.2 Future Private Actions

The Army is currently a partner in the Koolau Mountains Watershed Partnership (KMWP). This is a non-Federal action expected to happen in the future, regardless of Army training, and should result in a net benefit to T&E species. The Partnership was created in 1999 through a Memorandum of Understanding signed by Koolau Mountain landowners. The KMWP facilitates watershed protection and conservation projects, maximizes available resources, and optimizes information exchange and learning (CEMML 2001). Partners include the Hawaii Department of Land and Natural Resources, the Honolulu Board of Water Supply, the Waiahole Water System, Kamehameha Schools Bishop Estate, The Queen Emma Foundation, the United States Army, the Department of Hawaiian Home Lands, and the Bishop Museum. The partnership is an initiative sponsored by the Hawaii Department of Land and Natural Resources. The KMWP consists of approximately 39,450 ha (97,500 ac). The partners agree that the proactive management of watershed is crucial in eliminating or reducing the threats of damage from weeds, insects, disease, feral ungulates, and human impacts. Partners will work together to develop watershed projects and cooperate to obtain funds for these projects. The KMWP partners meet monthly. Projects may combine one or more activities such as fencing, weed control, ungulate control, restoration and revegetation, stream health and water quality, vegetation monitoring, erosion and sediment control, and other elements.

7. Kawailoa Training Area (KLOA)/Drum and Helemano Military Vehicle Trails

7.1 General Description of Area

Kawailoa Training Area (KLOA) land is owned by Kamehameha Schools Bishop Estate (KSBE) and leased to the US Army. KLOA is located in north-central Oahu on the western slope of the Koolau Mountain Range (Figure 1.a). Access to KLOA is very limited due to the lack of improved roads, steep terrain, and dense vegetation. A single unimproved roadway traverses most of the western boundary, but there is no primary access via road; most training and land management activities use helicopters to transport people, equipment, and supplies. The town of Wahiawa (pop. 18,000) is located near the southwestern corner of the installation. KLOA is bordered on the south by Schofield Barracks East Range; on the Koolau crest to the east by private land, Kaipapau Forest Reserve, Hauula Forest Reserve, and Sacred Falls State Park; on the north by Kahuku Training Area; and on the west by private agricultural lands. The majority of KLOA is located in the Waialua District of Oahu. The southern portion of KLOA falls within the Wahiawa District.

KLOA is the Army's largest training area on Oahu and consists of approximately 9,453 ha (23,348 ac) of land leased from various private landowners. Non-military uses are permitted and include hiking, hunting, and camping. The elevation of KLOA ranges from 305 m (1,000 ft) in the west to 793 m (2,600 ft) at the summit of the Koolau Mountains. The general topography is quite rugged, with deep valley floors rising abruptly to steep mountainous terrain. The average rainfall at KLOA ranges from 635 cm (250 in) at the higher elevations to 127 cm (50 in) in the central plateau region.

7.2 Current Military Training

KLOA is used primarily for helicopter aviation training, including long-range patrol, helicopter unit tactical training, and command post displacement up to Company level. Primary users of KLOA include Army, Marine Corps, HI Army National Guard, and Army Reserve units[31]. Current helicopter usage averages approximately 78 flights per day (pers. comm. Cpt Blandford 3/7/03). The subinstallation is an excellent location for mountain and jungle warfare training because of its ravines and dense vegetation. Approximately 2,049 ha (5,064 ac) of the installation are considered suitable for maneuver (mounted and dismounted) training activities (USACE and Nakata 2002a). The remaining area is considered less desirable for maneuver training activities due to excessively steep slopes and thick vegetation, and is therefore exploited in a very limited fashion. In areas with slopes greater than 20 percent, troop deployment is typically limited to single file, small unit maneuvers along ridgelines and trails.

There are seven training areas, 12 open and seven closed landing zones, three landing zones on private lands west of KLOA, and one drop zone (Puu Kapu DZ) on KLOA (Figure 7.a). No developed facilities exist at KLOA. Troop transport is via helicopter. Historical foot maneuver usage generally occurs in the immediate vicinity of Drum Road, Puu Kapu (Area K2C), Landing Zone (LZ) Red (Area K2B), LZ Black (Area K2B), and LZ 1652 (Area K1B). Usage outside these areas is discouraged by rugged topography and dense vegetation (USARHAW G3/DPT Memo to Steve Kim, 9 January 2003). Forward Support Batallion units use Kawailoa Training Area 17b approximately four times per year for purifying water. A

[31] Primary users based on 2002 Range Facility Management Support System (RFMSS) utilization data provided by USARHAW Range Division.

Training Areas

Kawailoa Training Area, Oahu

Figure 7a

Maps to sensitive resources have been removed from this document
Contact sjoe@hawaii.edu to request access

1:98,000

0 1,000 2,000 4,000 Meters

0 0.5 1 2 Miles

Data Source: U.S. Army Active/Inactive Range Inventory Program 2001

Legend

- *Tetraplasandra gymnocarpa*
- Landing Zones (Open)
- Landing Zones (Closed)
- Landing Zones (Private)
- Threatened and Endangered Species
- Roads
- Ranges

summary of training types and annual usage (number of days and troops) for each training area at KLOA is presented in Table 7.a. The average use of each training area ranges from 100 to 154 days per year and approximately 12,700 to 19,500 troops per year. Ammunition (blanks only) usage at KLOA is presented in Table 7.b. Blank usage is highest for 5.5.6 mm, followed by 7.62 mm and .50 caliber blanks. The following section lists authorized and prohibited uses of pyrotechnics and blanks on KLOA[32]:

Restrictions

- There is no live fire on KLOA.
- Live ammunition and pyrotechnics (including smoke grenades, simulators, and fog oil) are not authorized.
- Agricultural lands are off-limits.
- All additional provisions of the lease agreement must be followed when requesting and using KLOA, which is leased land.
- Civilians have exclusive rights to KLOA during weekends and holidays. Weekend training may be authorized for brigade level and higher training, with coordination for approval 45 days prior to execution.
- 5.56 mm and 7.62 mm blanks are authorized.
- Cigarette smoking and cooking/warming fires will be authorized by Range Division Hawaii (RDH) using the Fire Danger Rating System (FDRS) for KLOA.

Pyrotechnics

No pyrotechnics of any kind are authorized.

One unimproved roadway, Drum Road, runs along the western boundary of KLOA providing vehicle access, but all other access is via foot or helicopter. Legacy units (mainly using Humvees) use Drum Road to access the KLOA training areas (by foot) from the west, occasionally support LZ/DZ operations, and as a route to KTA to minimizing the use of Kamehameha highway. Current use of Drum Road is very limited due to it's poor condition. A few small pockets of suitable terrain exist along the Drum Road corridor, and are used by vehicles but are not mapped. Foot trails lead from the Drum Road corridor to higher elevation areas accessible only by foot (Vic Garo, pers. comm., 31 May 2002).

Dismounted training in Kawailoa Training Area is conducted by Legacy units at present and will also be conducted by elements of the SBCT. Typical operations involve small groups, from squad to platoon strength (3 to 50 soldiers). No live fire is involved, and vehicles are not driven off established roads and trails. The training is conducted between 20 and 40 times per year, in daytime and at night. Areas used for training are based largely on topographic and maneuverability constraints. Off-limits and restricted areas, impact areas, habitat and species protection areas, identified cultural resource sites, cantonment areas, and recreation areas are not used for reconnaissance training

Unit movement during dismounted training activities may consist of soldiers in tactical (when contact with an enemy is likely) and non-tactical (when contact with an enemy is not likely) formations moving

[32] USARHAW Regulation 350-1, Training (25th ID(L) and USARHAW 2000) and 25th ID(L) and USARHAW Regulation 210-6, Installations Ranges and Training Areas (25th ID(L) and USARHAW 1999).

Table 7.a. Types of Legacy Training and Annual Legacy Usage by Training Area for KLOA. (Data source: Annual RFMSS Utilization Reports for 1998-2002 obtained from G3 Range Division.)

	Types of Training											1998-2002 Summary					
Area Name	Mounted maneuver*	Dismounted maneuver*	Live fire	Foot Reconnaissance	Bivouac	Deployment training	Helicopter aviation training	Air assault/movement**	Parachute drops of equipment and personnel	Major force-on-force training	CSS Operations and Training	Min Days Used	Max Days Used	Average # Days Used	Min # Troops	Max # Troops	Average # Troops
KA-1		x		x	x		x	x				91	147	111	11,512	18,830	13,833
KA-2		x		x	x		x	x				83	130	110	9,487	17,282	14,330
KA-3		x		x	x		x	x				65	109	90	9,931	16,603	13,450
KB-1		x		x	x		x	x				116	160	137	14,616	19,764	17,422
KB-2		x		x	x		x	x				115	193	149	16,708	22,288	19,202
KC-1		x		x	x		x	x				142	202	157	15,371	22,955	19,372
KC-2		x		x	x		x	x				116	201	147	13,614	21,927	17,886
KD-1		x		x	x		x	x				88	123	105	12,869	18,574	15,087
KD-2		x		x	x		x	x				82	119	96	10,764	16,761	13,939
1652 - LZ		x		x			x	x				3	3	3	120	120	120
BLACK - LZ		x		x			x	x				1	9	5	6	1,046	424
ELEPHANT'S FOOT - LZ		x		x			x	x				0	0	0	0	0	0
FIELDS - LZ												0	0	0	0	0	0
HAMMER - LZ		x		x			x	x				1	4	2.5	29	45	37
HOUSE - LZ		x		x			x	x				2	9	5	6	44	24
MAXWELL - LZ		x		x			x	x				0	0	0	0	0	0
NIXON - LZ		x		x			x	x				0	0	0	0	0	0
NON-STOP - LZ		x		x			x	x				3	3	3	15	15	15
NORTON - LZ		x		x			x	x				0	0	0	0	0	0
PUU KAPU - LZ/DZ	x	x		x			x	x	x			3	24	10	78	1,440	633
RED - LZ		x		x			x	x				5	11	8	32	779	349
											Average Training Area Use	100	154	122	12,764	19,443	16,058

* Dismounted use may be very limited by topography and road access.

** Landing and drop zone assault and movement exercises may involve vehicle support where roads exist.

Table 7.b Summary of Ammunition Usage for Current and Transformed Training at KLOA, and the Net Difference in Rounds by Ammunition Type. (Source: John Gallup and Associates training description version 5.3).

	FY 05 Projection Un-Transformed (Current)*			**FY 05 Projection Transformed**			**Net Difference With Transformation**
Ammunition Type	2 Legacy Brigades - One Training Area	Other Units	Total for All Training Areas (K1A, K1B, K2A, K2B, K2C, K3A, K3B)	1 Legacy Brigade & 1 SBCT - One Training Area	Other Units	Total for All Training Areas (K1A, K1B, K2A, K2B, K2C, K3A, K3B)	All Rounds
5.56 mm Blank	71,822	0	502,757	43,802	0	306,617	-196,140
7.62 mm Blank	7,072	0	49,507	6,131	0	42,914	-6,593
.50 Cal. Blank	612	0	4,284	2,385	0	16,695	12,411

* This comparison of current and transformed ammunition usage is projected for FY 05 based on Draft STRAC (Standards in Training Commissions) information. Information for "Other Units" was compiled from 2001 RFMSS data and is used as a constant for both Un-Transformed and Transformed projections, except where use by these units is altered by changes due to range demolition/reconfiguration related to construction of new ranges (John Gallup and Associates product 10/16/02).

in a predetermined direction to accomplish a mission. Individual soldiers move in non-tactical formations by walking in administrative formations on roads or trails, or in a dispersed fashion overland. Individual soldiers move in tactical formations by walking in dispersed groups overland in designated directions to accomplish a mission. Direction of movement is terrain and tactical scenario dependent. Due to a risk of ambush, tactical formations often do not follow roads or trails. If engagement with an enemy has happened or is likely, then soldiers will seek cover or concealment. When contact with an enemy is simulated during maneuvers, one section of a unit may provide a base of weapons fire while another section maneuvers toward the enemy.

Maneuver also entails the set-up of temporary defensive positions to repel an enemy attack. Defensive positions may consist of soldiers lying in concealed positions and designating fire zones. More complex maneuver defense entails digging individual fighting positions or trenches using hand tools and digging in larger crew-served weapons using excavators. The longer a unit stays in a particular area, the greater the need for digging-in to provide protection from enemy fire given the greater likelihood of detection. All digging must be approved through Range Control and Environmental Division.

During extended maneuver training, soldiers may sleep in the field. To avoid detection and allow for quick displacement, tents are not set up during light infantry maneuvers. Soldiers normally eat pre-packaged meals in the field. Other prepared meals are brought in from support areas. Training units carry out all trash to avoid detection. Units may use blank ammunition and Multiple Integrated Laser Engagement System (MILES) equipment. MILES fires an eye-safe laser beam and each soldier wears a harness that senses the laser and indicates hits or misses.

Typical reconnaissance training operations involve small groups, from squad to platoon strength (3 to 50 soldiers). This type of training may take place in all types of terrain but can be constrained extremely rugged terrain and thick vegetation. In many respects, reconnaissance training resembles dismounted maneuver training but does not have the same type of vehicle support. No live fire is involved, and vehicles are not used. The training is conducted between 20 and 40 times per year, in daytime and at night, in Kawailoa Training Area.

Hunters and hikers are also allowed access when the area is not scheduled for training purposes (lease para. 16). No Nap of the Earth (NOE) helicopter flights are permitted outside KLOA boundaries due to the presence of cattle ranches on adjacent lands.

7.3 Proposed Transformation Actions at KLOA

7.3.1 Construction

No construction for Transformation is planned on KLOA proper. The following military vehicle trail terminates at the western edge of KLOA and troops will continue north using Drum Road (Figure 7.b).

Schofield Barracks Military Reservation to Helemano Military Reservation Military Vehicle Trail (Project #57406). Both construction and usage of this road is addressed under this BA. The proposal is to purchase approximately 17 acres of land in a perpetual easement and construct a 15-foot-wide gravel road with 3-foot-wide gravel shoulders on both sides that would provide military vehicle access from SBMR to HMR. In conjunction with Drum Road, this project would provide a road network from SBMR to KTA. This proposed project would be sited from SBMR to the HMR for approximately seven miles. It would be north of Wahiawa and would use as much of the existing agriculture roadways as possible. Work includes grading, paving, drainage improvements, culverts at stream crossings, guardrails, shotcrete, retaining walls, concrete swales, grass swales, signage, and storm drainage structures and lines to preclude excessive amounts of storm runoff from sheet flowing over the road and endangering vehicular traffic on the road. Work would also include provisions for telecommunication lines beside the new paved road. Road grades steeper than 10 percent would be paved with asphalt or concrete. Supporting facilities would include provisions for information systems. The corridor of disturbance associated with the trail construction will vary with terrain and existing road features, but will not extend significantly outward from the trail shoulders, especially where the alignment follows existing roads (pers. comm.. Ray Kong Honolulu COE District, 3/12/03).

This project is required to provide a safe military vehicle trail for use by military personnel of the 25th Infantry Division (Light) engaged in training activities to get from Schofield Barracks to Kawailoa and Kahuku Training Areas. This road is also required to support the increasing training needs of the 25th Infantry Division and to support Army transformation activities.

7.3.2 Live-Fire Ranges

No range construction or use is planned for KLOA. No live-fire training would occur on KLOA.

7.3.3 Non Live-Fire Maneuver and Other Training Activities

KLOA would continue to be used at current levels primarily for helicopter aviation training, including long-range patrol, helicopter unit tactical training, and command post displacement. The subinstallation is an excellent location for mountain and jungle warfare training because of its ravines and dense vegetation. Authorized and prohibited uses of pyrotechnics on KLOA would be unchanged from those listed in Section 7.2. Because most of the area is considered unsuitable for maneuver training activities due to excessively steep slopes and thick vegetation, it would continue to be used in a very limited fashion. Dismounted training in Kawailoa Training Area would be conducted by Legacy units. No live fire would be involved. Typical training operations would involve small groups, from squad to platoon strength (3 to 50 soldiers). No live fire or pyrotechnics would be used, and vehicles would not be driven off established roads and trails. The training would be conducted between 20 and 40 times per year, in daytime and at night. In areas with slopes greater than 20 percent, troop deployment would typically be limited to single file, small unit maneuvers along ridgelines. Troop transport would be primarily via helicopter, and the

Proposed Military Vehicle Trail from Schofield Barracks Military Reservation to Helemano Military Reservation Military Vehicle Trail, Oahu	Figure 7b

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same LZs and DZs would be used by Legacy units. Highest levels of foot maneuver usage would generally occur in the immediate vicinity of Drum Road, Puu Kapu (Area K2C), Landing Zone (LZ) Red (Area K2B), LZ Black (Area K2B), and LZ 1652 (Area K1B). Usage of Drum Road would increase with upgrades planned for the route and SBCT training Frequency and types of training associated with landing zones and the drop zone would be unchanged.

SBCT use of KLOA would be confined to vehicular use of the military vehicle trail from Schofield Barracks Military Reservation to Helemano Military Reservation, and subsequently north toward Kahuku Training Area via Drum Road. Approximately 15-90 Strykers and 10-90 trucks/humvees would be using the road approximately 12 times per year for SBCT training. However, the Drum Road upgrade by itself would not change training uses or patterns at KLOA. Some limited dismounted maneuvers may occur but little training is planned for SBCT forces in KLOA. Changes in the amounts of blank ammunition for current and proposed training are presented in Table 7.b.

7.4 Delineation of the Action Area

7.4.1 Approach to Delineating the Action Area

The action area for KLOA was determined by the impacts of fire (potential ignition sources include smoking and catalytic converters on non-military vehicles), trampling, and exotic species introduction via soldier movement throughout the installation. Whichever impact was determined to have the farthest reaching effects in a given segment determined the extent of the action area in that segment.

7.4.2 Sections of the Action Area

The action area for KLOA was determined by the impacts of fire, trampling, and exotic species introduction via soldier movement throughout the installation. Whichever impact was determined to have the farthest reaching effects in a given segment determined the extent of the action area in that segment.

7.4.3 Detailed Action Area Description for KLOA\Drum and Helemano Military Vehicle Trails

The factors considered in delineation of the KLOA action area are fuel types (Figure 7.c), man-made barriers to fire, topographic barriers to fire, fire buffers, exotic species introduction, and the extent of soldier movement within the installation.

Points listed below appear in (Figure 7.d).

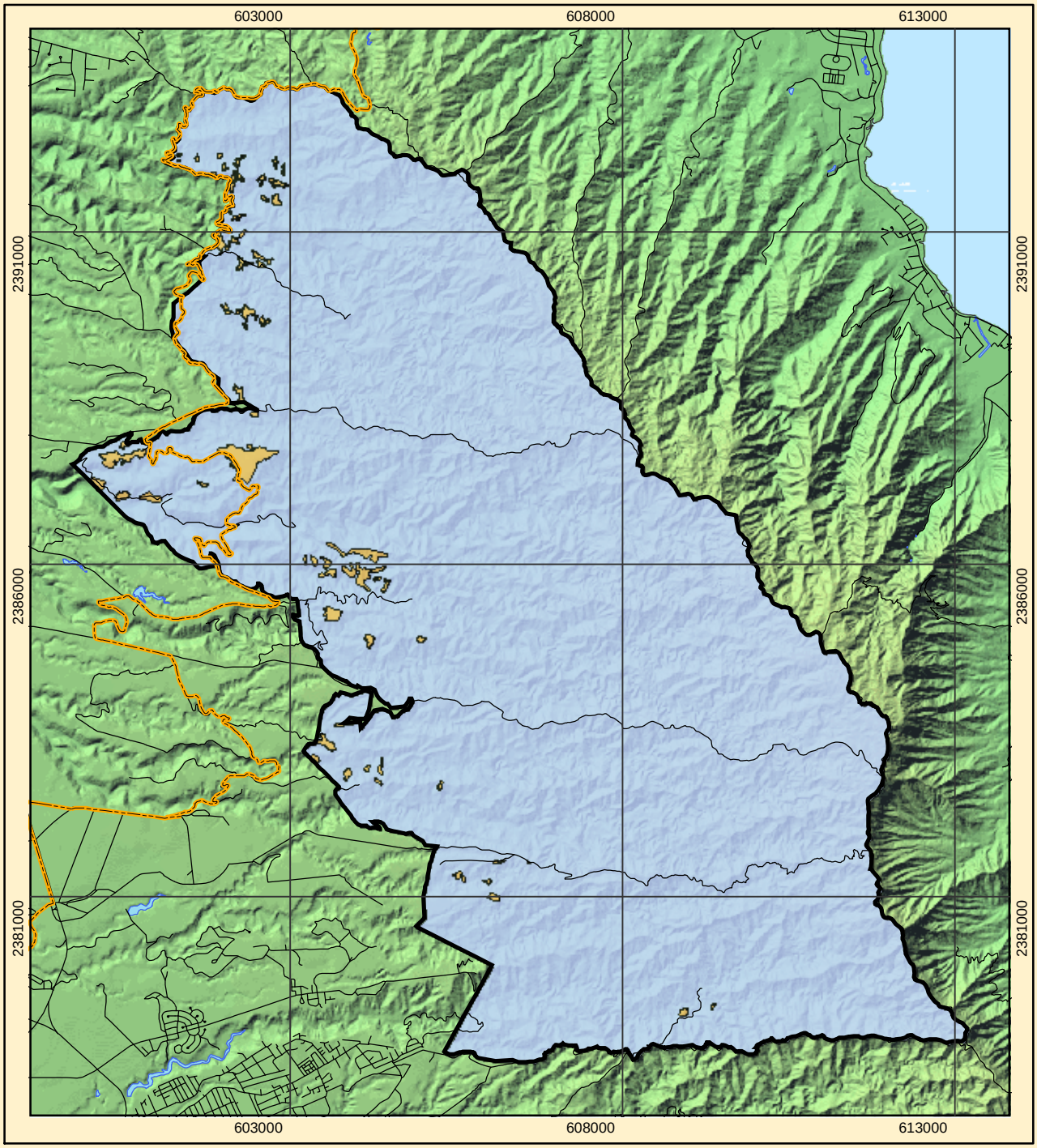
A to B – Starting on the northern end of KLOA where Drum Road exits the installation, the action area follows the installation boundary to the east for the length of its shared boundary with KTA. From the end of the shared boundary to point B, a 100 meter buffer is added to the KLOA installation boundary. This buffer is to account for potential soldier damage to species, and the possible introduction of exotic species along the Koolau summit trail.

B to C – From the Koolau summit, the action area follows the installation boundary westward to the west end of the town of Wahiawa. SBER bounds KLOA throughout this area. The action area turns to the north here and follows the KLOA installation boundary to point C. Average rainfall here is over 254 cm (100 in) per year, so fire threat is extremely low. There are no trails, so soldier usage will be minimal, reducing the chance of exotic species introduction.

Fuel Types

Kawailoa\Drum and Helemano Military Vehicle Trail, Oahu

Figure 7c



1:92,000

0 1,200 2,400 4,800 Meters

0 0.45 0.9 1.8 Miles

Data Source: Center for Environmental Management of Military Lands

Legend

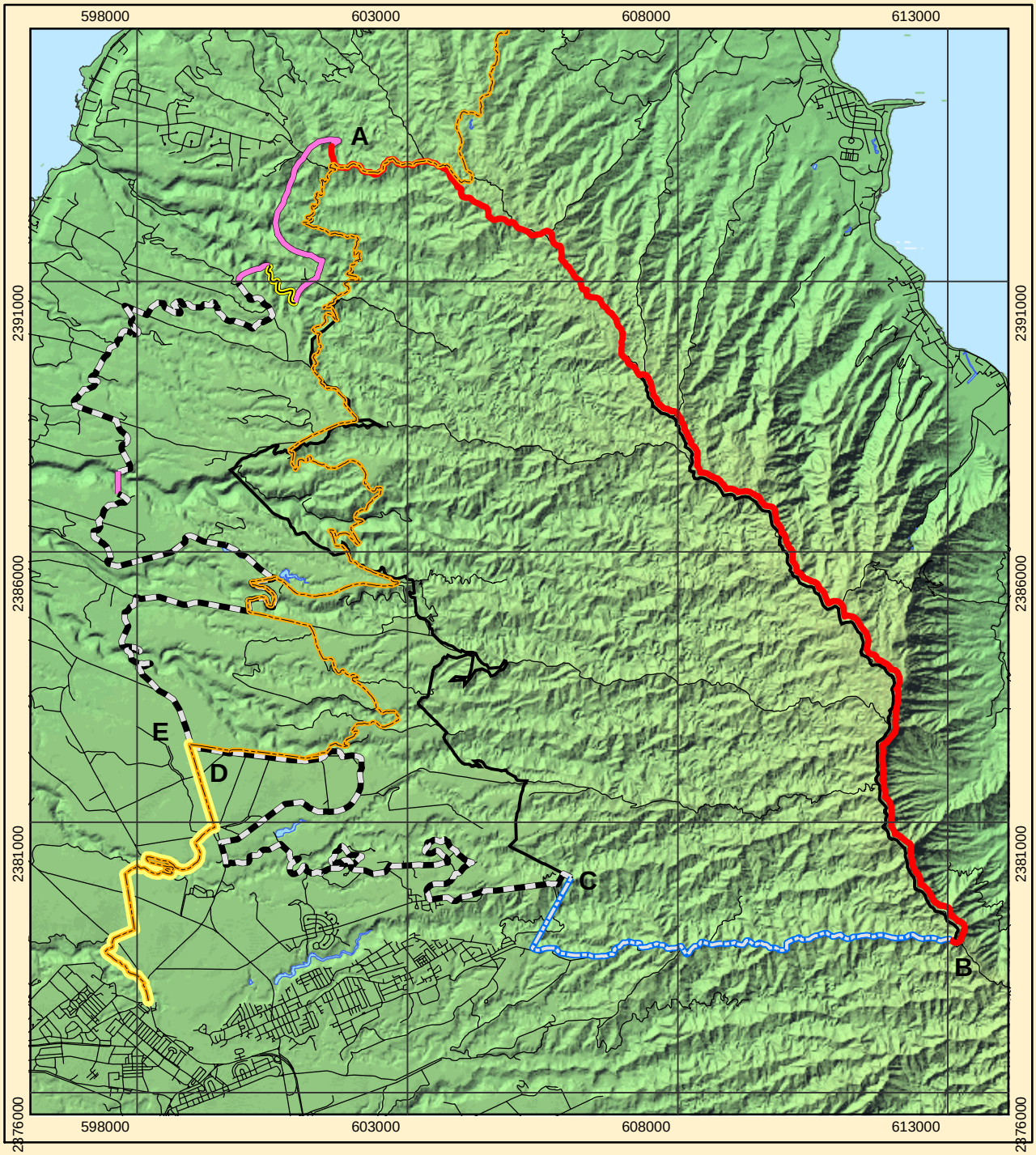
Fuel Types

- Forest/Shrub
- Non forest
- Installation Boundary
- Drum and Helemano Trails
- Roads
- Surface Water Feature

Delineation of Action Area

Kawailoa\Drum and Helamano Military Vehicle Trail, Oahu

Figure 7d



1:113,000

0 750 1,500 3,000 Meters

0 0.5 1 2 Miles

Data Source: Center for Environmental Management of Military Lands

Legend

Action Area Inputs
- 50 Meter Buffer
- Fire Buffer
- Gulch
- Installation Boundary
- Trail Use Buffer
- Road

- Drum and Helemano Trails
- Roads
- Installation Boundary
- Surface Water Feature

C to D – The action area follows a series of improved roads until it reaches Helemano Military Reservation. These roads are significant impediments to the spread of fire and are easily accessed by suppression crews. Many of the roads bound extensively managed vegetation such as sub-developments, making them even stronger barriers against the spread of fire.

D to E – For the Helemano Military Vehicle Trail, a buffer of 50 m (164 ft) from the centerline was used to determine the action area. No smoking, in or out of vehicles, bivouacking, nor pyrotechnics of any kind are allowed anywhere on the trail, virtually eliminating the threat of fire. The Army will require personnel to stay within this buffer at all times. Additionally, unmanaged fuels along the length of the trail will be managed wherever they are not held in check by agricultural or other activities practiced by landowners bounding the trail. Should this be necessary, fuels will either be chemically treated or mechanically removed to a distance of 3 m (10 ft) from the edge of the military vehicle trail.

E to A – Beginning at Helemano, the action area follows a series of roads, fire buffers, and a stream that define the western boundary of the action area back to point A. This segment is characterized by fallowed agricultural fields on plateaus broken by moist gulches supporting dense forest and shrub growth. It is assumed that the fields will remain fallow and while in this state support grassy fuels. Fire buffers, which are only used in some of the forested areas, are based on NFFL fuel model 8 (closed timber litter). The fire buffer at KLOA is 521 m (1708 ft). Buffers were used in several forested areas, while roads were used on the plateaus where grass fuels dominate. Kaiwikoele stream is used at the northern end of this segment for a short distance. This gulch is much deeper and wetter than the others that split the grassy plateaus to the south. Its depth protects it from the sun and wind, increasing the moisture content of the dead and live fuels to the point that it is unlikely that fire could cross it.

7.5 Description of the Affected Biological Environment and Affected Species

Although Army training and transformation to a Stryker Brigade Combat Team takes place within the boundaries defined in the introduction (section 1.2), for purposes of this BA, and consistent with USFWS recommendations, the "action area" is considered the biological environment affected by either direct, indirect, or interrelated/interdependent effects of the proposed action.

7.5.1 Ecological Zones Affected by the Action

Three native natural community types were categorized into one ecological zone defined by elevation, topography, and prevailing ecological conditions at KLOA action area (R.M. Towill Corp. 1997b, Hawaii Natural Heritage Program (HINHP) - The Nature Conservancy of Hawaii 1994b). The ecological zones identified at KLOA include the Wet Summit Crest Zone and the Lowland Forest Zone. Only the Lowland Forest Zone will potentially be affected by Army training and transformation. The area this zone occupies is relatively small in comparison to the total size of the range, the majority of which is alien vegetation. The locations of these areas are shown in Figure 7.e *Ecological Zones - Kawailoa Training Area*. The zones and community types at KLOA are briefly described below.

Lowland Forest Zone - Lowland Forest Zone communities occur in areas between 180 and 670 m (590 and 2,200 ft) elevation in the Koolau Mountains where conditions are warm, wind sheltered, and mesic to wet. Gagné and Cuddihy (1990) described lowland wet communities between 15 and 2,000 m (50-6,600 ft) in areas where the annual precipitation is >250 cm (100 in). The natural communities include:

- Koa/`Ohi`a Lowland Mesic Forest
- `Ohi`a Lowland Wet Forest
- `Ohi`a/Mixed Shrub Lowland Wet Forest

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Ecological Zones
Kawailoa Action Area, Oahu

Figure 7e

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598000 603000 608000 613000

*Please see individual map area for scale information.

N

Data Source: Center for Environmental Management of Military Lands

Legend

Plants
- *Chamaesyce rockii,*
- *Cyanea acuminata*
- *Cyanea crispa*
- *Cyanea humboldtiana*
- *Cyanea koolauensis*
- *Cyanea st. johnii*
- *Cyrtandra dentata*
- *Cyrtandra viridflora*
- *Gardenia mannii*
- *Hesperomania arborescens*
- *Melicope lydgatei*
- *Phlegmariarus nutans*
- *Phyllostegia hirsuta*
- *Pteris lydgatei*
- *Sanicula purpurea*
- *Tetraplasandra gymnocarpa*
- *Viola oahuensis*

Snails
- *Achatinella apexfulva*
- *Achatinella byronii/decipiens*
- *Achatinella curta*
- *Achatinella lila*
- *Achatinella livida*
- *Achatinella pulcherrima*
- *Achatinella sowerbyana*

Ecological Zone
- Lowland Mesic Forest Shrubland
- Nonnative
- Lowland Wet Forest Shrubland
- Wet Cliff

- Roads
- Drum and Helemano Roads
- Action Area
- Installation Boundary
- Surface Water Feature

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- `Ohi`a/`Olapa (Lapaiapa) Lowland Wet Forest
- `Ohi`a/Uluhe Lowland Wet Forest

Koa/`Ohi`a Lowland Mesic Forest usually occurs at KLOA in the Koolau Mountains below 640 m (2,100 ft), often in areas with well-drained soils situated leewardly. The annual rainfall generally ranges from 77 to 192 cm (30-75 in). ***`Ohi`a Lowland Wet Forest*** is found between 580 and 825 m (1,900-2,700 ft) below the summit of the Koolau Mountains at KLOA. ***Uluhe Lowland Wet Shrubland*** community commonly occurs below 670 m (2,200 ft) in moderate to steep slopes at KLOA in the Koolau Mountains. The community is widespread in wet lowland areas of many of the Hawaiian Islands and it is not considered rare (HINHP 1994b).

7.5.2 Federally-listed Species Affected by the Action

The first step in determining which species may be affected by military training and SBCT activities at Kawailoa Training Area was to compile available rare species occurrence data for Army Lands on Oahu. The resources for this data included the Army Natural Resource Geographic Information System (GIS), the Hawaii Natural Heritage Program (HINHP) Database, the USFWS recovery plans, the Makua Military Reservation Implementation Plan Draft documents and information from biological experts. Army Natural Resource Staff conducts rare plant, invertebrate, and vertebrate surveys annually to confirm existing population numbers and locate unreported populations. The most current and detailed data available was used from these various sources. Once compiled this data was sorted by area, and a new list included only those threatened and endangered species within the designated action area for Kawailoa Training Area. The following threatened and endangered species have historically been documented at KLOA action area (see Appendix B for a complete list of rare species currently and historically recorded in KLOA AA):

- 28 endangered plants
- 10 endangered tree snails
  2 endangered birds (*Chasiempis sandwichensis* spp. *ibidis*-Oahu elepaio and *Paroreomyza maculata*-Oahu creeper)
- 1 endangered bat (*Lasiurus cinereus* spp. *semotus*)

This data was subsequently sorted by date and included all threatened and endangered species occurrences from 1982 until the present in KLOA AA (past 20 years). This date was agreed upon by Army Natural Resource Staff (NRS) and the USFWS, because NRS could confirm using recent extensive survey information, whether species prior to 1982 were extirpated (Kapua Kawelo, U.S. Army, pers. comm. 2002). The birds were included in the list only if they were confirmed to be residents. This would exclude *Chasiempis sandwichensis* spp. *ibidis* (Oahu elepaio) and *Paroreomyza maculata* (Oahu creeper) recorded at KLOA in the 1991. These bird observations represent one time occurrences dating back 12 years. NRS has repeatedly surveyed these and other potential sites in KLOA over the past 6-7 years and conducts bird surveys annually, but has not observed either of these two bird species (RCUH 2002b, 2002c). Although NRS has surveyed many historic snail habitats extensively, adequate surveys throughout former snail habitats have not been completed because of the size and ruggedness of the terrain. Thus, unknown remnant snail populations may still persist in remote areas within KLOA. Three of 10 tree snail species referred to above (*A. dimorpha, A. leucorraphe*, and *A. rosea*), were recorded from 1949-67 and they have not been observed since that time. The following tree snail species are not currently known in the wild but still may be extant in remote or unidentified refugia within the KLOA AA: *A. bulimoides*, *A. caesia*, *A. decora*, *A. dimorpha*, *A. elegans*, *A. juncea*, *A. leucorraphe*, *A. papracea*, *A. rosea, A. swiftii*, and *A. valida*. These species will be surveyed for by the Army in their historic ranges as outlined by HINHP (2002) and USFWS (1993), and within other potential habitats

within KLOA AA. Table 7.c below contains federally-listed species currently found in the KLOA action area. Appendix C lists all species affected by the Oahu Army training and transformation and the designated action area or areas they are found in.

Table 7.c Federally-listed Endangered Taxa at Kawailoa Training Area/Drum and Helemano Military Vehicle Trails Action Area, Hawaii.

Species Name	Number of individuals	Number of population/occurrences
Plants:		
Chamaesyce rockii	416	7
Cyanea acuminata	20-25	6
Cyanea crispa	5	1
Cyanea humboldtiana	2	2
Cyanea koolauensis	23	8
Cyanea st. johnii	4	1
Cyrtandra dentata	71	2
Cyrtandra viridiflora	28	4
Gardenia mannii	44	8
Hesperomannia arborescens	70	9
Melicope lydgatei	39	2
Phlegmariarus nutans (Lycopodium nutans)	4	2
Phyllostegia hirsuta	10	6
Pteris lidgatei	5	3
Sanicula purpurea	18	2
Tetraplasandra gymnocarpa	13	5
Viola oahuensis	87	6
Snails:		
Achatinella apexfulva	1	1
Achatinella byronii/decipiens	300	3
Achatinella curta	5	3
Achatinella lila	27	2
Achatinella livida	141	3
Achatinella pulcherrima	3	3
Achatinella sowerbyana	265	11

[1]Source: Hawaii Natural Heritage Program (HINHP 2002) and Research Corporation of the University of Hawaii (RCUH 2002a).

Federally-listed Species Descriptions

See Appendix D for definitions of the components of the species descriptions that follow. For species included in more than one action area, the description can be found where it was first discussed in this BA.

Scientific name: *Chamaesyce rockii* Croizat & Degener

Common name: `Akoko, koko, kokomalei
Family: Euphorbiaceae (Spurge family)
Federal status: Endangered
Life history: Short-lived perennial

Description and biology: *Chamaesyce rockii* is a compact shrub or small tree, 0.5 to 4.0 m (1.6 to 13.1 ft) tall with opposite leaves. The leaves are narrowly oblong or elliptic, leathery, 6 to 17 cm (2.4 to 6.7 in) long and 1.5 to 4.0 cm (0.6 to 1.6 in) wide. The flowers form heads arranged in open to sometimes condensed cymose inflorescences. The fruit are brilliant red or pink and 14 to 25 mm (0.6 to 1.0 in) long. The seeds are brown to grayish brown (Wagner et al. 1990).

This short-lived perennial has been observed fruiting in February (USFWS 1998a). No other information is available on reproductive cycles, longevity, specific environmental requirements, or limiting factors.

Known distribution: Historically, *Chamaesyce rockii* was known from 13 populations in the Koolau Mountains on Oahu (USFWS 1998a).

Population trends: Population sizes and ranges have been declining.

Current status: There are 11 known populations/occurrences of 561-621 *C. rockii* plants (RCUH 2002a: HINHP 2002). This includes seven populations of 416 individuals in the Kawailoa AA (RCUH 2002a, 2002b, 2002c). These populations are located along the eastern boundary of the KLOA AA between Kawaiiki Stream and North Kaukonahua Gulch between 560 and 860 m (1,840 and 2,820 ft) elevation (Figure 7.e). These include Koolau Summit trail between Puu Kainapuaa and Kahuku cabin 58+ individuals in 2002, Kawaiiki and Opaeula ridge about 50 individuals in 1999, Opaeula exclosure 2 mature individuals in 2002, Upper Helemano 300 individuals in 2000, South of Puu Pauao 1 individual in 1993, North Kaukonahua 1 individual in 2002, S. Kaukonahua/Kahana ridge 25 individuals in 1998, Kawaiiki mid-reach 4 mature individuals in 1999 (Kawelo, U.S. Army, pers. comm. 2003; Lau, HINHP, pers. comm. 2003). Individuals that fall within the KLOA AA represent about 67-74% of the total remaining individuals of this species. There is one population/occurrences of >50 plants that is considered stable outside of the KLOA AA, located in the Kaluanui vicinity (USFWS 1998a).

Habitat: *Chamaesyce rockii* is endemic to the Koolau Mountains of Oahu and typically grows in wet ohia-*Dicranopteris linearis* (uluhe) forest and shrubland, primarily along cloud swept summit ridges and occasionally along streams, between 640 and 915 m (2,100 and 3,000 ft) in elevation (HINHP 1997). Associated plants include *Dubautia laxa* (naenae pua melemele), *Machaerina* sp. (uki), *Psychotria fauriei* (kopiko), and *Wikstroemia oahuensis* (akia) (HINHP 1997).

Taxonomic background: *Chamaesyce* is a large genus with approximately 250 species, mostly found in the New World. Twenty-two of these species occur in Hawaii (Wagner et al. 1990).

Outplanting considerations: *C. rockii* should only be outplanted adequate distances from other *Chamaesyce* spp. populations and within its known range.

Current threats: The major threats to *Chamaesyce rockii* is habitat degradation by feral pigs, potential impacts from military activities, and competition with alien plants such as *Psidium cattleianum* (strawberry guava) and *Clidemia hirta* (Koster's curse).

Potential Threats from Army Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest and shrub locations of the KLOA AA where *C. rockii* grow (Figure 7.e). The fire threat ranges from none to very low, insignificant and discountable for *C. rockii* population/occurrences in the KLOA AA (Figure 7.f). The threat from foot traffic trampling is very low, insignificant and discountable for trees and shrubs, unless they are seedlings. The seedlings from these population occurrences have a low to high threat from trampling (Figure 7.g). These results suggest that *C. rockii* is vulnerable to alien plant introductions and *C. rockii* seedlings are vulnerable to trampling from foot traffic resulting from military activities in the KLOA AA.

Scientific Name: *Cyanea acuminata* Hillebr.

Common Name: `Oha, haha, `ohawai
Family: Campanulaceae (Bellflower family)
Federal Status: Endangered
Life history: Short-lived perennial

Description and Biology: *Cyanea acuminata* is a shrub 0.3 to 2.0 m (1.0 to 6.6 ft) tall. The leaves are 11.0 to 32.0 cm (4.3 to 12.6 in) long and 3.0 to 9.0 cm (1.2 to 3.5 in) wide, and lance-shaped or elliptic. The flowers are 3.0 to 3.5 cm (1.2 to 1.4 in) long, white, and occasionally with purplish tinge. The globe-shaped berries are yellow to yellowish orange (Wagner et al. 1990).

Known Distribution: *Cyanea acuminata* is documented from 31 populations on Oahu, scattered throughout the Koolau Mountains and in the Waianae Mountains below Mt. Kaala, Oahu.

Population Trends: Population sizes and ranges have been declining.

Fire Vulnerability Areas
Kawailoa Action Area, Oahu

Figure 7f

Maps to sensitive resources have been removed from this document
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*Please see individual map area for scale information.

N

Data Source: Center for Environmental Management of Military Lands

Legend

Plants
- *Chamaesyce rockii*
- *Cyanea acuminata*
- *Cyanea crispa*
- *Cyanea humboldtiana*
- *Cyanea koolauensis*
- *Cyanea st. johnii*
- *Cyrtandra dentata*
- *Cyrtandra viridflora*
- *Gardenia mannii*
- *Hesperomania arborescens*
- *Melicope lydgatei*
- *Phlegmariarus nutans*
- *Phyllostegia hirsuta*
- *Pteris lydgatei*
- *Sanicula purpurea*
- *Tetraplasandra gymnocarpa*
- *Viola oahuensis*

Snails
- *Achatinella apexfulva*
- *Achatinella byronii/decipiens*
- *Achatinella curta*
- *Achatinella lila*
- *Achatinella livida*
- *Achatinella pulcherrima*
- *Achatinella sowerbyana*

Vulnerability
- None
- Low
- Very Low Insignificant Discountable
- Installation Boundary

- Roads
- Drum and Helemano Roads
- Action Area
- Surface Water Feature

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Current Status: There are 15 known populations of 100 *C. acuminata* individuals remaining (USFWS 1998a; RCUH 2001). There are six known population/occurrences of 20-25 individuals in KLOA AA (located at Kahuku cabin 1 individual in 1993, Kawaiiki 1 individual in 1993, North of Poamoho trail 5 individuals 2000, Poamoho 10-15 individuals in 1993, Helemano 1 individual in 1993, North Kaukonahua 2 individuals in 1994 (Kawelo, U.S. Army, pers. comm. 2003; Lau, HINHP, pers. comm. 2003)) between 530 and 735 m (1740 and 2400 ft) elevation in Koolau Mountains (HINHP 2002). Individuals that fall within the KLOA AA represent about 20-25% of the total remaining individuals of this species (Figure 7.e). There are no stable populations of >50 plants outside of the KLOA AA.

Habitat: *Cyanea acuminata* is found in mesic to wet ohia (*Metrosideros polymorpha*)-uluhe *(Dicranopteris linearis*), koa (*Acacia koa*)-ohia or lama (*Diospyros sandwichensis*)-ohia forest (USFWS 1999b). It typically grows on slopes, ridges, or stream banks at 300 to 915 m (985 to 3,000 ft) in elevation.

Taxonomic Background: The genus *Cyanea* is endemic to Hawaii and is represented by 52 species, many of which occur in the Waianae and Koolau Mountains.

Outplanting Considerations: It is common to find several *Cyanea* species and *Cyanea* relatives growing together, yet to date there is no good evidence of hybridization occurring between species of *Cyanea* or between a *Cyanea* and a *Cyanea* relative. Therefore, there is little likelihood that hybridization resulting from outplanting of *C. acuminata* would occur.

Outplanting Considerations: *Cyanea acuminata* should only be outplanted within its known range. To avoid unnatural hybridization, *C. acuminata* should not be planted adjacent to other *Cyanea* species.

Current Threats: The major threats to *Cyanea acuminata* are habitat degradation by feral pigs, rat and slug predation, and competition with noxious alien plants such as *Rubus argutus* (prickly Florida blackberry) and *Psidium cattleianum*.

Potential Threats from Army Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest location of the KLOA AA where *C. acuminata* grow (Figure 7.e). The fire threat is very low, insignificant and discountable for the *C. acuminata* population/occurrences in the KLOA AA (Figure 7.f). The threat from foot traffic trampling for these small shrubs is low to moderate in the KLOA AA (Figure 7.g). These results suggest that *C. acuminata* is vulnerable to alien plant introductions and to trampling from foot traffic resulting from military activities in the KLOA AA.

Scientific Name: *Cyanea crispa* Gaud.

Common Name: `Oha, haha, `ohawai
Family: Campanulaceae (Bellflower family)
Federal Status: Endangered
Life history: Short-lived perennial

Description and Biology: *Cyanea crispa* is a unbranched shrub with 0.3 to 1.3 m (1.0 to 4.3 ft) long stems. The leaves are 30.0 to 75.0 cm (12 to 30 in) long and 9.0 to 16.0 cm (3.5 to 6.5 in) wide, and egg-shaped. The flowers are 4.0 to 6.0 cm (1.6 to 2.4 in) long, and magenta with dark longitudinal stripes. The globe-shaped berries are about 1.0 cm (2.54 in) long (Wagner et al. 1990).

This short-lived perennial has been observed in flower in April (USFWS 1996a) and fruiting in June and September (USFWS 1998a). No further information is available on reproductive cycles, longevity, specific environmental requirements, or limiting factors.

Known Distribution: Historically, the known range of *C. crispa* extended throughout the upper elevations of the Koolau Mountains from Kaipapau Valley in the north to Waialae Iki Ridge in the southeast on Oahu (Skottsberg 1926; USFWS 1996a).

Population Trends: *C. crispa* populations are declining, and those that remain are small and widely dispersed with restricted distribution, which puts the species at risk of extinction from naturally occurring events and/or lack of reproductive vigor (USFWS 1996a; USFWS 1998a).

Current Status: There are 5 known populations of 29 *C. crispa* individuals remaining (RCUH 2002a: HINHP 2002). There is one known population/occurrence of 5 individuals at KLOA AA located in Kawainui Gulch along the Koolau Summit Trail opposite Kaipapau at 707 m (2,320 ft) elevation (HINHP 2002 RCUH 2002a) (Figure 7.e). Individuals that fall within the KLOA AA represent 17% of the total remaining individuals of this species. There are no stable populations of >50 plants outside of the KLOA AA.

Habitat: *Cyanea crispa* is found on steep to gentle slopes or in moist gullies of closed wet and open mesic forests between 185 and 730 m (600 and 2,400 ft) elevation (USFWS 1996a). Common plant associates include *Cyrtandra* species (haiwale), papala kepau, and *Touchardia latifolia* (olona) (USFWS 1996a).

Taxonomic Background: Taxonomic change from *Rollandia crispa* (Lammers et al. 1993). The genus *Cyanea* is endemic to Hawaii and is represented by 52 species. There are numerous other representatives of the genus *Cyanea* in the Waianae and Koolau Mountains, including *C. humboldtiana, C. koolauensis,* and *C. st. johnii* in the KLOA AA.

Outplanting Considerations: It is common to find several *Cyanea* species and *Cyanea* relatives growing together, yet to date there is no good evidence of hybridization occurring between species of *Cyanea* or between a *Cyanea* and a *Cyanea* relative. Therefore, there is little likelihood that hybridization resulting from outplanting of *C. koolauensis* would occur.

Current Threats: The major threats to *Cyanea crispa* are habitat alteration and suspected predation by rats, slugs, and feral pigs, and competition with noxious alien plants (kukui, Koster's curse, and strawberry guava)(USFWS 1996a).

Potential Threats from Army Training and Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest and shrub location of the KLOA AA where *C. crispa* occurs (Figure 7.e), but there is no fire threat in this area (Figure 7.f). The threat from foot traffic trampling for these small shrubs is low in the KLOA AA (Figure 7.g). These results suggest that *C. crispa* is vulnerable to alien plant introductions and to trampling from foot traffic resulting from military activities in the KLOA AA.

Scientific Name: *Cyanea humboldtiana* Gaud.

Common Name: *Haha, ohawai*
Family: Campanulaceae (Bellflower family)
Federal Status: Endangered
Life history: Short-lived perennial

Description and Biology: *Cyanea humboldtiana* is an unbranched shrub with 1 to 2 m (3.3 to 6.6 ft) long stems. The egg-shaped leaves are 18 to 45 cm (7.1 to 17.7 in) long and 7 to 16 cm (3 to 6 in) wide. The dark magenta or white flowers are 6 to 7.5 cm (2.4 to 3.0 in) long and form axillary racemes. The fruit is an elliptic shaped pale orange-yellow berry, 1.0 to 1.4 cm (0.4 to 0.6 in) long (Wagner et al. 1990).

C. humboldtiana has been observed flowering from September through January. No further information exists on reproductive cycles, longevity, specific environmental requirements, or limiting factors (USFWS 1998a).

Known Distribution: *C. humboldtiana* was known historically from 17 populations in the central portion to the southern end of the Koolau Mountains of Oahu (HHP 1997).

Population Trends: *C. humboldtiana* populations are declining, and those that remain are small and widely dispersed with restricted distribution, which puts the species at risk of extinction from naturally occurring events and/or lack of reproductive vigor (USFWS 1998a).

Current Status: There are 6 known populations/occurrences of approximately 175 to 325 *C. humboldtiana* remaining (RCUH 2002a; HINHP 2002). They are known from Konahuanui summit, Moanalua-Kaneohe summit, and Lulumahu Gulch (USFWS 1998a). Two individuals from two population/occurrences are known from Opaeula Gulch and Poamoho Trail between 590 and 730 m (1940 and 2400 ft) elevation in the Koolau Mountains in the KLOA AA (Figure 7.e) (HINHP 2002; RCUH 2002a). This represents <1 % of the total remaining individuals of this species. There are two stable population/occurrences with > 50 individuals outside the KLOA AA, one at Moanalua-Kaneohe summit (100-200 individuals in 1999) and at Wailupe to Niu (50-100 individuals in 2002) (USFWS 1998a; Kawelo, U.S. Army, pers. comm. 2003; Lau, HINHP, pers. comm. 2003).

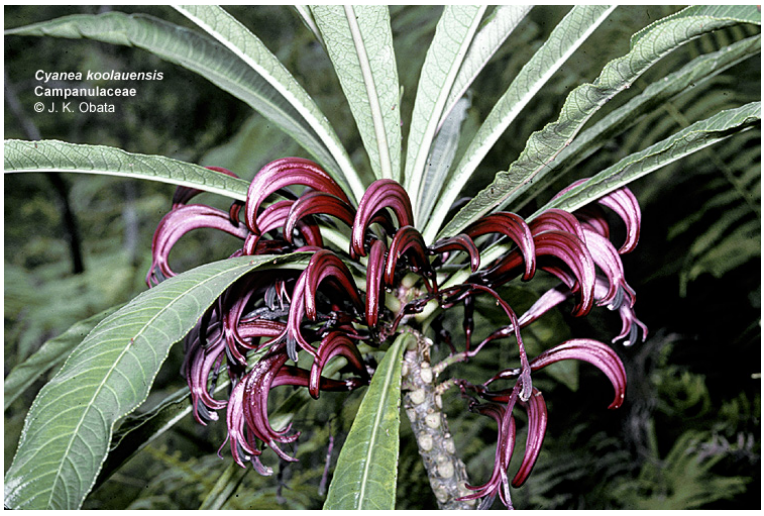
Habitat: *C. humboldtiana* is usually found in wet shrubland dominated by ohia and uluhe between 550 and 960 m (1,800 to 3,150 ft) elevation. Associated native plants include ferns, alani, uki, kawau, *Syzygium sandwicensis* (ohia ha), alani, *Broussasia arguta* (kanawao), *Psychotria mariniana* (kopiko), uluhe, and *Scaevola mollis* (naupaka kuahiwi) (USFWS 1996b; 1998a).

Taxonomic Background Taxonomic change from *Rollandia humboldtiana* (Lammers et al. 1993). The genus *Cyanea* is endemic to Hawaii and is represented by 52 species. There are numerous other representatives of the genus *Cyanea* in the Waianae and Koolau Mountains, including *C. crispa, C. koolauensis,* and *C. st. johnii* in the KLOA AA.

Outplanting Considerations: It is common to find several *Cyanea* species and *Cyanea* relatives growing together, yet to date there is no good evidence of hybridization occurring between species of *Cyanea* or between a *Cyanea* and a *Cyanea* relative. Therefore, there is little likelihood that hybridization resulting from outplanting of *C humboldtiana* would occur.

Current Threats: The major threats to *C. humoldtiana* are habitat degradation and/or destruction by feral pigs, predation by rats and slugs, competition with the alien plants (particularly Koster's curse), and trampling by hikers (particularly the Konahuanui summit population) (HHP 1997; USFWS 1998a).

Potential Threats from Army Training and Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest and shrub location of the KLOA AA where *C. humoldtiana* occurs (Figure 7.e). The fire threat from SBCT transformation activities is very low, insignificant and discountable for *C. humoldtiana* in the KLOA AA (Figure 7.f). The threat from foot traffic trampling is very low, insignificant and discountable for trees and shrubs, unless they are seedlings. The seedlings from these population occurrences have a low and high threat from trampling (Figure 7.g). These results suggest that *C. humoldtiana* is vulnerable to alien plant introductions and *C. humoldtiana* seedlings are vulnerable to trampling from foot traffic resulting from military activities in the KLOA AA.



Scientific Name: *Cyanea koolauensis* Lammers, Givnish & Sytsma

Common Name: *Haha, ohawai*
Family: Campanulaceae (Bellflower family)
Federal Status: Endangered
Life history: Short-lived perennial

Current Status: There are approximately 16 known populations/occurrences of 80 in the Koolau Mountains (USFWS 1998a; RCUH 2002b) (note: state number may need to be recalculated because they came from the recovery plan, which did not include any of the these individuals in the tally). There are 8 populations of 23 individuals in the KLOA AA. They are found between about 488 and 823 m (1,600 and 2,700 ft) elevation, mostly along the eastern boundary of the

action area between the Kawailoa Trail in the North to Helamano Stream in the south (HINHP 2002; RCUH 2002b) (Figure 7.e). Specifically they include 4 individuals from Lower Peahinaia trail in 1999, 5 mature individuals from North Kawaiiki in 1999, 3 individuals from Opaeula stream midreach in 2001, 3 individuals from Helemano in 2001, 2 individuals from Poamoho trail midreach in 1999, 2 individuals from South Kawaiiki in 2001, 2 individuals from Upper Kawailoa trail in 2002, and 2 individuals from Opaeula exclosure in 2002. They represent about 29% of the total remaining individuals of this species. There are no stable populations > 50 *Cyanea koolauensis* individuals outside the Army AAs.

Potential Threats from Army Training and Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest and shrub location of the KLOA AA where *C. koolauensis* grows (Figure 7.e). The fire threat from SBCT transformation activities ranges from none to very low, insignificant and discountable for *C. koolauensis* population/occurrences in the KLOA AA (Figure 7.f). The threat of trampling from foot traffic is very low, insignificant and discountable for shrubs, unless they are seedlings. Seedlings and juveniles have been found in these populations (RCUH 2001). The seedlings from these population occurrences have a low to high threat from trampling (Figure 7.g). These results suggest that *C. koolauensis* is vulnerable to alien plant introductions and *C. koolauensis* seedlings in the KLOA AA are vulnerable to trampling from foot traffic resulting from military activities as well.

For the complete species description, go to Federally-listed Species Affected by the Action at KTA (**Section 6.5.2**).

Scientific Name: ***Cyanea st. johnii*** **Gaud.**

Common Name: *Haha, ohawai*
Family: Campanulaceae (Bellflower family)
Federal Status: Endangered
Life history: Short-lived perennial

Description and Biology: *Cyanea st. johnii* is an unbranched shrub with 0.3 to 0.6 m (1.0 to 2.0 ft) long stems. The lance-shaped leaves are 6 to 13 cm (2.4 to 5.1 in) long and 1.5 to 2.0 cm (0.6 to 0.8 in) wide. The white flowers form groups of 5 to 20 flowers on stalks 0.5 to 1.5 cm (0.2 to 0.6 in) tall. The fruit is probably berry, but detailed information on fruiting is unknown (Wagner et al. 1990).

C. st. johnii has been observed in flower in July through September, but further information is available on reproductive cycles, longevity, specific environmental requirements, or limiting factors (USFWS 1998a).

Known Distribution: *C. st. johnii* was known historically from 11 populations in the central and southern Koolau Mountains of Oahu (HHP 1997).

Population Trends: *C. st. johnii* populations are declining, and those that remain are small and widely dispersed with restricted distribution, which puts the species at risk of extinction from naturally occurring events and/or lack of reproductive vigor (USFWS 1998a).

Current Status: There are 5 known populations/occurrences of approximately 48 *C. st. johnii* remaining (RCUH 2002b; HINHP 2002). One population/occurrence of 4 individuals is located within the KLOA AA near the headwaters of the Helamano Stream (Figure 7.e) (HINHP 2002; RCUH 2002a). This represents 8 % of the total remaining individuals of this species. Outside the action area there are 10 individuals known from Waimano Trail summit to Aiea Trail summit, 4 individuals from the summit ridge crest between Manana and Kipapa trails, 15 plants from Waimano ridge between North and North central Waimano, and 15 plants from North Halawa summit ridge (USFWS 1998a; Kawelo, U.S. Army, pers. comm. 2003; Lau, HINHP, pers. comm. 2003). There are no known stable populations/occurrences of > 50 *C. st. johnii* remaining.

Habitat: *C. st. johnii* is found in ohia mixed shrubland or ohia-uluhe shrubland; on wet, windswept slopes and ridges; between 690 to 850 m (2,260 to 2,800 ft) elevation (USFWS 1996b). Associated plant species found with *C. st. johnii* include naupaka kuahiwi, uki, kookoolau, kamakahala, naenae, kopiko, hapuu, kanawao, maile, hame, and *Freycinetia arborea* (ieie) (USFWS 1996b; 1998a).

Taxonomic Background Taxonomic change from *Rollandia st. johnii* (Lammers et al. 1993). The genus *Cyanea* is endemic to Hawaii and is represented by 52 species. There are numerous other representatives of the genus *Cyanea* in the Waianae and Koolau Mountains, including *C. crispa, C. humboldtiana*, and *C. koolauensis.*

Outplanting Considerations: It is common to find several *Cyanea* species and *Cyanea* relatives growing together, yet to date there is no good evidence of hybridization occurring between species of *Cyanea* or between a *Cyanea* and a *Cyanea* relative. Therefore, there is little likelihood that hybridization resulting from outplanting of *C. st. johnii* would occur.

Current Threats: The major threats to *Cyanea st. johnii* are habitat degradation and/or destruction by feral pigs, predation by rats and slugs, competition with alien plants (particularly *Clidemia hirta* (Koster's curse), *Axonopus fisifolius* (narrow leaved carpet grass), *Sacciolepis indica* (glenwood grass), and trampling by hikers (particularly the population between the summit of Aiea and Halawa Trail) (USFWS 1996b; USFWS 1998a).

Potential Threats from Army Training and Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest and shrub location of the KLOA AA where *C. st. johnii* occurs (Figure 7.e), but there is no fire threat in this area (Figure 7.f). The threat from foot traffic trampling is very low, insignificant and discountable for trees and shrubs, unless they are seedlings. There are juveniles reported in the population. The seedlings from these population/occurrences have a moderate threat from trampling (Figure 7.g). These results suggest that *C. st. johnii* is vulnerable to alien plant introductions and *C. st. johnii* seedlings are vulnerable to trampling from foot traffic resulting from military activities in the KLOA AA.

Scientific name: *Cyrtandra dentata* St. John & Storey

Common name: No common name
Family: Gesneriaceae (African violet family)
Federal status: Listed endangered
Life history: Short-lived perennial

Description and biology: *Cyrtandra dentata* is a shrub, 1.5 to 5.0 m (4.9 to 16.4 ft) tall. The stems are sparsely branched. Leaves are opposite, very broadly elliptical to suborbicular or broadly ovate to ovate, 9 to 33 cm (3.5 to 13.0 in) long and 6 to 17 cm (2.4 to 6.7 in) wide. The 8 to 23 cm (3 to 9 in) tall flowers are open cymes that originate from the leaf axils. The fruit is 1 to 2 cm (0.4 to 0.8 in) long, and the seeds are about 4 to 6 mm (0.2 in) long (Wagner et al. 1990).

This long-lived perennial has been observed in flower and fruit in May and November (USFWS 1998a). No further information is available on reproductive cycles, longevity, specific environmental requirements, or limiting factors.

Known distribution: Historically, *C. dentata* was known from six populations/occurrences in the northern Waianae Mountains and three populations/occurrences from the leeward northern end of the Koolau Mountains (Wagner et al. 1990; USFWS 1998a).

Population trends: *C. dentata* populations are declining, and those that remain are small and widely dispersed, which puts the species at risk of extinction from naturally occurring events and/or lack of reproductive vigor (USFWS 1996b).

Current status: There are approximately 4 populations of 423 *C. dentata* individuals known (Makua Implementation Team 2002). There are 2 population/occurrences of 71 individuals from KLOA AA located in Kawaiiki Gulch and along Opaeula Stream between 384 and 530 m (1,260 and 1,740 ft) elevation (HINHP 2002; RCUH 2002a) (Figure 7.e). Individuals that fall within the KLOA AA represent about 17% of the total remaining individuals of this species. The remaining 352 individuals are found in the MMR (Makua Military Reservation) AA from Kahanahaiki and Pahole to West Makaleha. There are no stable populations of > 50 *C. dentata* individuals outside the Army AAs.

Habitat: *C. dentata* is usually found in moist shaded areas of gulches, slopes, or ravines from 580 to 720 m (1,900 to 2,360 ft) elevation, in mesic forests with *Metrosideros polymorpha* (ohia), *Syzygium sandwicensis* (ohia ha), and *Aleurites moluccana* (kukui) (USFWS 1996, St. John 1966, Wagner *et al*. 1990). Associated species include *Pisonia* sp. (papala kepau), *Pipturus albidus* (mamaki), and *Pouteria sandwicensis* (alaa)(USFWS 1998a).

Taxonomic background: The genus *Cyrtandra* is endemic to Hawaii and is represented by 53 species. *C. dentata* is endemic to Oahu.

Outplanting considerations: *C. dentata* should only be outplanted within its known range. To avoid unnatural hybridization *C. dentata* should not be planted adjacent to *C. viridiflora* or *C. waiolani* at KLOA.

Current Threats: Threats to *C. dentata* include competition with alien plants (including *Clidemia hirta* (Koster's curse), *Schinus terebinthifolius* (Christmas berry), and *Psidium cattelianum* (strawberry guava)), predation by rats and slugs, fire, military activities, and the risk of extinction from random events (such as landslides, hurricanes, and flooding) (USFWS 1996; 1998).

Potential Threats from Army Training and Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest and shrub location of the KLOA AA where *C. dentata* occurs (Figure 7.e). The fire threat is very low, insignificant and discountable for *C. dentata* in the KLOA AA (Figure 7.f). The threat from foot traffic trampling is very low, insignificant and discountable for trees and shrubs, unless they are seedlings. There are juveniles and seedlings in these populations (RCUH 2001). The seedlings from these population/occurrences have a low threat from trampling (Figure 7.g). These results suggest that *C. dentata* is vulnerable to alien plant introductions and seedlings are vulnerable to trampling from foot traffic resulting from military activities in the KLOA AA.

Scientific name: *Cyrtandra viridiflora* St. John & Storey

Common name: No common name
Family: Gesneriaceae (African violet family)
Federal status: Listed endangered
Life history: Short-lived perennial

Description and biology: *Cyrtandra viridiflora* is a small shrub, 0.5 to 2.0 m (1.6 to 6.6 ft) tall. The stems are branched and sparsely leaved. Leaves are opposite, heart-shaped, 6 to 15 cm (2.4 to 5.9 in) long and 3.5 to 7.5 cm (1.4 to 3.0 in) wide. One to 5 green flowers form open cymes that originate from the leaf axils. The fruit is a white berry, 1.3 cm (5.0 in) long. Information on the seeds is lacking (Wagner et al. 1990).

Cyrtandra viridiflora is a long-lived perennial that has been observed in fruit and flower in May and November (USFWS 1998a). No further information is available on reproductive cycles, longevity, specific environmental requirements, or limiting factors.

Known distribution: Historically, *C. viridiflora* was known from seven populations scattered through the Koolau Mountains on the island of Oahu (HHP 1997; USFWS 1998a).

Population trends: *C. viridiflora* populations are declining, and those that remain are small and widely dispersed, which puts the species at risk of extinction from naturally occurring events and/or lack of reproductive vigor (USFWS 1996b).

Current status: There are approximately 8 population/occurrences of 52-53 *C. viridiflora* individuals known (USFWS 1998a). They are restricted to the northern Koolau Mountains at the Kawainui-Laie summit divide, Kawainui-Kaipapau summit, Maakua-Kaipapau Ridge, and the Peahinaia Trail (USFWS 1998a). There are 28 individuals from 4 population/occurrences at KLOA AA including 9 individuals from Kahuku cabin vicinity of the Koolau summit trail in 2002, 4 individuals from Opaeula in 2002, 1 individual from Kawaiiki in 2001, and 14 individuals from Helemano in 2002 (HINHP 2002: RCUH 2002a; Kawelo, U.S. Army, pers. comm. 2003; Lau, HINHP, pers. comm. 2003) (Figure 7.e). Individuals that fall within the KLOA AA represent 53-54% of the total remaining individuals of this species. There are no stable populations of > 50 *C. viridiflora* individuals outside the KLOA AA.

Habitat: *C. viridiflora* is found on wind-blown ridge tops in cloud-covered wet forest or shrublands between 690 and 850 m (2,260 to 2,800 f) elevation. Associated plant species include kanawao, *Trematalobelia macrostachys*, kopiko, manono, *Ilex anomala* (kawau), ohia, ohia ha, alani, naenae, uki, and uluhe (HHP 1997; USFWS 1996b; Wagner *et al*. 1990).

Taxonomic background: The genus *Cyrtandra* is endemic to Hawaii and is represented by 53 species. *C. viridiflora* is endemic to Oahu.

Outplanting considerations: *C. viridiflora* should only be outplanted within its known range. To avoid unnatural hybridization *C. viridiflora* should not be planted adjacent to *C. dentata* or *C. waiolani* at KLOA.

Current Threats: Threats to *C. viridiflora* include competition with alien plants (particularly *Clidemia hirta* (Koster's curse) and *Psidium cattelianum* (strawberry guava)), habitat degradation or destruction by feral pigs, and predation by rats and slugs. (USFWS 1996b, 1998a).

Potential Threats from Army Training and Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest and shrub location of the KLOA AA where *C. viridiflora* occurs (Figure 7.e). There is no fire threat in most of the locations where *C. viridiflora* occurs in the KLOA AA, but it is also very low, insignificant and discountable for one population/occurrences (Figure 7.f). The threat of trampling from foot traffic ranges from low to high along the eastern boarder of the action area (Figure 7.g). These results suggest that *C. viridiflora* is vulnerable to alien plant introductions and to trampling from foot traffic resulting from military activities in the KLOA AA.

Scientific Name: *Gardenia mannii* St. John and Kuykendall

Common Name: Nanu, nau
Family: Rubiaceae (Coffee family)
Federal Status: Endangered
Life history: Short-lived perennial

Current Status: There are 28 populations/occurrences of 70-100 *Gardenia mannii* plants on Oahu (USFWS 1998a). However, the number of unrecorded plants is probably large, particularly in the wet forests of the Koolau Mountains (USFWS 1998a). The majority of the populations/occurrences contain fewer than five individuals (USFWS 1998a). They are distributed along a 42- km (26- mi) length of the Koolau Mountains, from Kaunala Gulch and Kaunala-Waimea Ridge in the north, to Palolo in the south, and along a 7- km (4- mi) distance in the Waianae Mountains from north Haleauau Valley to Kaluaa Gulch (HINHP 1997). There are 44 individuals from 8 population/occurrences in the KLOA AA (RCUH 2002b) located between Malaekahana-Waimea Ridge, and Poamoho and Helemano Gulches from about 520 to 670 m (1,700 and 2,200 ft.) elevation (Figure 7.e). Specific locations include: 1 individual from mid-reach Poamoho trail, 8 individuals from lower Peahinaia trail, 11 individuals from Kawailoa trail, 3 individuals from upper Poamoho trail, 1 individual from Upper Kawainui, 10 individuals from Lower Helemano, and 10 individuals from Malaekahana-Waimea Ridge (between KTA and KLOA subinstallations). It represents about 44-63% of the total remaining individuals of this species. There are no stable populations of > 50 *G. mannii* individuals outside the KLOA AA.

Potential Threats from Army Training and Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest and shrub location of KLOA where *G. mannii* is found (Figure 7.e). The fire threat is mostly very low, insignificant and discountable for *G. mannii* in the KLOA AA, but it is also none for several population/occurrences there (Figure 7.f). The threat of destruction or degradation from foot traffic trampling is very low, insignificant and discountable for trees, unless they are seedlings. The seedlings from these population occurrences have a low to high threat from foot traffic trampling (Figure 7.g). These results suggest that *G. mannii* is vulnerable to alien plant introductions and seedlings are vulnerable to trampling from foot traffic resulting from military activities in the KLOA AA.

For the complete species description, go to Federally-listed Species Affected by the Action at KTA (**Section 6.5.2**).

Scientific name: *Hesperomannia arborescens* A. Gray

Common Name: None known
Family: Asteraceae (Sunflower family)
Federal Status: Endangered
Life history: Long-lived perennial

Description and Biology: *Hesperomannia arborescens* is a tree 1.5 to 5 m (4.9 to 16 ft) tall, but it has been reported up to 10 m (33 ft) tall (Degener 1946). The 10.5 to 20 cm (4.1 to 7.9 in) long, 3 to 8 cm (1.2 to 3.1 in) wide leaves are lance-shaped or egg-shaped. The yellow-brown flowers form 2 to 10 clusters at the stem tips or are sometimes solitary, and they are perfect (possessing both male and female reproductive parts). The dry one-seeded fruit is 1.2 to 1.4 cm (0.5 to 0.6 in). They produce flowers and fruits between May and June. The fruit of *H. arborescens* are glabrous, and very large and heavy compared to other members of the sunflower family that are wind-dispersed. Given these characteristics, dispersal by wind over long distances is probably not common. This might explain why *H. arborescens* usually grows in tight colonies (RCUH 2002c).

Known Distribution: *H. arborescens* is found in the Koolau and Waianae Mountains on Oahu, on Molokai and West Maui, and was formerly found on Lanai. The elevational range of this taxon is 360 to 750 m (1,180-2,460 ft).

Population Trends: *H. arborescens* populations are declining, and those remaining are small, widely dispersed, and have a limited gene pool, which puts the species at risk of extinction from naturally occurring events and/or lack of reproductive vigor (HINHP 1997; USFWS 1998a). The survival of the single remaining population on Maui is questionable, as they are heavily impacted by pigs (USFWS 1998a).

Current Status: Currently, this species is known from at least 15 populations totaling 127 individuals on the islands of Oahu, Molokai, and Maui (USFWS 1998a; RCUH 2002a; HINHP 2002). It is considered extinct on Lana`i and rare on other islands (Wagner 1990; USFWS 1998a). There are 9 population/occurrences of 70 individuals known from the KLOA action area (RCUH 2002a, HINHP 2002; Kawelo, U.S. Army, pers. comm. 2003; Lau, HINHP, pers. comm. 2003), scattered through the

Koolau Mountains between Kamananui Gulch in the north and Schofield-Waikane Trail in the south (HINHP 2002) (Figure 7.e). Specific locations include: 1 individual from Poamoho, 13 individuals from Lower Peahinaia trail, 1 individual from North Kaukonahua midreach, 4 individuals from North Kaukonahua upper reach, 4 individuals from Kawailoa trail near Puu Kainapuaa, 11 individuals from South Kawaiiki, 30 individuals from North Kawaiiki, 5 individuals from Kamananui, and 1 individuals from North of Kahuku cabin on Koolau Summit trail. Much of the habitat for this species in the Koolau Mountains has not been surveyed, which might reflect lower population numbers than that are actually present. Individuals that fall within the KLOA AA represent about 55% of the total remaining individuals of this species. There are no stable populations of > 25 *H. arborescens* outside of the Army action areas.

Habitat: *H. arborescens* occurs in wet forests on Oahu, Molokai and Maui. It can be found in habitat ranging from gulch bottoms to ridge tops, although the majority of the known populations in the Koolau Mountains are found mid-slope in secondary gulches. Native species found in close association with *H. arborescens* include *Antidesma platyphyllum* (hame), *Hibiscus arnottianus* (kokio keokeo), and *Metrosideros polymorpha* (ohia).

Taxonomic Background: *Hesperomannia* is an endemic Hawaiian genus that includes two species in addition to *H. arborescens*. *H. lydgate* is endemic to Kauai, and *H. arbuscula* is known from the Waianae Mountains on Oahu and from West Maui.

The *H. arborescens* population in Palikea Gulch has bracts that are green rather than red, which is anomalous for the species; however, their lack of hairs is a definitive characteristic for the species.

Outplanting Considerations: *H. arborescens* is known from many populations in the Koolau Mountains, so the priority for management for the species should be placed on managing in situ populations. Since the plants found in Palikea Gulch in the Waianae Mountains are morphologically very different from all other known populations in the Koolau Mountains, Molokai, and West Maui, the Palikea Gulch population should be protected if conducting reintroduction efforts. Morphological differences between the various Waianae Range populations/occurrences should be maintained as much as possible by preserving the various stocks separately. However, if future research clearly shows that populations of the species are suffering from inbreeding depression, controlled experiments on the consequences of mixing the morphologically different stocks should be initiated.

Current Threats: The major threats to *H. arborescens* include feral pigs and goats, which degrade its habitat through foraging, trampling and/or uprooting. Invasive alien plants including *Paspalum conjugatum* (hilo grass), *Clidemia hirta*, *Psidium cattelianum*, and *Tibouchina herbacea* (herbaceous glorytree), threaten *H. arborescens* by altering their habitat and competing for sunlight, moisture, nutrients, and growing space (USFWS 1996a). Also, the spread of highly flammable alien grasses increases the incidence and destructiveness of wildfires that impact *H. arborescens* populations.

Potential Threats from Army Training and Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest and shrub location of the KLOA AA where *H. arborescens* grow (Figure 7.e). The fire threat is mostly very low, insignificant and discountable for *H. arborescens* in the KLOA AA, but it is also none in some of the population/occurrence locations (Figure 7.f). The threat of trampling from foot traffic is very low, insignificant and discountable for trees, unless they are seedlings. Seedlings have been found in these populations (RCUH 2001).

The seedlings from these population occurrences have mostly a low to moderate threat from foot traffic trampling, but also high for one population/occurrence in KLOA AA (Figure 7.g). These results suggest

that *H. arborescens* is vulnerable to alien plant introductions and *H. arborescens* seedlings are vulnerable to trampling from foot traffic resulting from military activities in many areas in KLOA AA.

Scientific name: ***Melicope lydgatei* (Hillebr.) T. Hartley & B. Stone**

Common name: Alani
Family: Rutaceae (Rue Family)
Federal status: Listed endangered
Life history: Long-lived perennial

Description and biology: *Melicope lydgatei* is a shrub that grows to 3 m (9.8 ft) tall. Leaves are crowded and opposite, elliptic-oblanceolate, elliptic, or elliptic-ovate, 4 to 10 cm (1.6 to 3.9 in) long and 2.5 to 6 cm (1.0 to 2.4 in) wide. The 3 to 20 mm (0.1 to 0.8 in) stemmed flowers form axillary cymes of 1 to 5 flowers. The flowers are green or red, with petals 10 mm (3.9 in) long and 5 mm (2 in) wide. The berries are white and ovoid shaped, 1 to 2.6 cm (0.4 to 1.0 in) long, and the seeds are about 0.5 mm (0.02 in) long (Wagner et al. 1990).

This species has been observed flowering in May and fruiting from June to July (USFWS 1996a; 1998). No other information exists on reproductive cycles, longevity, specific environmental requirements, or limiting factors.

Known distribution: Historically, *M. lydgatei* was known scattered throughout the Koolau Mountains of Oahu from Hauula to Kahana, Kipapa Gulch to Waimano, and Kalihi Valley to Wailupe Valley (Wagner 1990; USFWS 1996a).

Population trends: No seedlings have been observed in the populations but juveniles are present (RCUH 2001).

Current status: Two population/occurrences of 39 *M. lydgatei* are known in the wild (RCUH 2002a; Kawelo, U.S. Army, pers. comm. 2003). All are found within the KLOA AA, including 38 individuals along the Opaeula/Lower Peahinaia Trail, and one near the Poamoho Trail (RCUH 2001, HINHP 2002) (Figure 7.e). Individuals that fall within the KLOA AA represent 100% of the total remaining individuals of this species. There are no stable populations of *M. lydgatei* outside the KLOA AA.

Habitat: *M. lydgatei* is found on open ridges in mesic and occasionally wet forests between 410 and 550 m (1,350 and 1,800 ft) elevation. Common plant associates include koa, ohia, hapuu, maile, uluhe, kopiko, and *Bobea elatior* (ahakea lau nui) (Stone *et al*. 1990; USFWS 1996a).

Taxonomic background: Species within the genus *Pelea* were considered congeneric with *Melicope* and thus *Pelea* was submerged into *Melicope* (Hartley and Stone). *M. lydgatei* is endemic to Oahu.

Outplanting considerations: *M. lydgatei* should only be outplanted within its historic range, in suitable habitat free of impacts from ungulates and alien plants.

Current Threats: The primary threats to *M. lydgatei* are competition from aggressive alien plants (strawberry guava, and Koster's curse), feral pigs, and potential predation from the black twig borer (USFWS 1996a). The remaining populations of *M. lydgatei* are small and have limited distribution, this puts the species at risk of extinction from naturally occurring events and/or lack of reproductive vigor (USFWS 1996a).

Potential Threats from Army Training and Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest and shrub location of the KLOA AA where *M. lydgatei* grows (Figure 7.e). The fire threat is very low, insignificant and discountable for *M. lydgatei* in this portion of KLOA AA (Figure 7.f). The threat of trampling from foot traffic is very low, insignificant and discountable for trees, unless they are seedlings. The seedlings from these population occurrences have mostly a high threat from foot traffic trampling, but also a low to moderate threat (Figure 7.g). These results suggest that *M. lydgatei* is vulnerable to alien plant introductions and *M. lydgatei* seedlings are vulnerable to trampling from foot traffic resulting from military activities in KLOA AA.

Scientific name: ***Myrsine juddii*** **Hosaka**

Common name: Kolea
Family: Myrsinaceae (Myrsine Family)
Federal status: Listed endangered
Life history: Short-lived perennial

Description and biology: *Myrsine juddii* is a many branched shrub ranging from 1 to 2 m (3.5-6.6 ft) tall. Younger branches are brown short-hirtellous and younger leaves are yellowish green. Mature leaves are dark green, closely spaced, and clustered toward branch tips. The leathery leaves are 4 to 12 cm (1.6 to 4.7 in.) long and 1.5 to 3.2 cm (0.6 to 1.3 in.) wide. The leaves are narrowly inverse lance-shaped to elliptic. The leaf base is broadly wedge-shaped to heart-shaped, and the margins are smooth and curl under. The upper leaf surface is hairless, whereas the lower surface is sparsely to moderately covered with short, coarse, stiff, whitish or brownish hairs toward the base and along the midrib. The midrib is prominent and lateral veins are moderately conspicuous. Submarginal veins are present (Wagner et al. 1990). The flowers are unisexual (dioeceous with male and female flowers are on separate plants). Flowers occur in groups of four to eight in tight clusters surrounded by small bracts. The yellowish green petals are narrowly inverse lance-shaped, 2.8 to 3.2 mm (0.1 in.) long and with short hairs, becoming smooth. The margins are ciliate. The fleshy, round fruit (drupe) contains a single seed. The fruits are about 6 mm in diameter.

This species is distinguished from others in the genus by the hairiness of the lower leaf surface and the shape of the leaf base (Wagner et al. 1990). In addition, the hairy leaves distinguish this species from all other species of Myrsine on Oahu (Environmental Impact Study Corporation 1977).

Known distribution: Historically, *M. juddii* was known only from the Koolau Mountains of Oahu (Wagner 1990; USFWS 1996a).

Population trends: The National Tropical Botanical Garden has collected seed from this species, but it has not been propagated (USFWS 1998b).

Current status: Three populations of 505-3005 *M. juddii* are known in the wild. The majority (500-3000) are found in one population along the North Kaukonahua-Kahana Summit divide. Five are known from North Kaukonahua Gulch in the KLOA AA, but represents <1% of the total remaining individuals of this species (Figure 7.e). There is one stable population of *M. juddii* outside the KLOA AA.

Habitat: *M. juddii* typically grows in wet forests dominated by 'ohi'a or a mixture of 'ohi'a and uluhe at elevations between 580 and 860 m (1,900 and 2,820 ft) (HHP 1994u1 to 1994u3). Associated plant taxa include 'uki, Cheirodendron trigynum ('olapa), *Melicope clusiifolia* (kolokolo mokihana), *Psychotria mariniana* (kopiko), *Syzygium sandwicensis* ('ohi'a ha), and *Chamaesyce rockii* (USFWS 1998b).

Taxonomic background: *M. juddii* is endemic to Oahu (Wagner 1990).

Outplanting considerations: *M. juddii* should only be outplanted within its historic range, in suitable habitat free of impacts from ungulates and alien plants.

Threats: The primary threats to *M. juddii* are habitat degradation and/or destruction by feral pigs; potential impacts from military activities; competition with alien plant species such as *Clidemia hirta* and *Psidium cattleianum*; and a risk of extinction from naturally occurring events and/or reduced reproductive vigor due to the small number of extant populations (Service 1998b; 61 FR 53089; HINHP Database 2001).

Potential Threats from Army Training and Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest and shrub location of the KLOA AA where *M. juddii* grow (Figure 7.e). The fire threat is very low, insignificant and discountable in this location is (Figure 7.f). The threat of trampling from foot traffic is very low, insignificant and discountable for shrubs, unless they are seedlings. The seedlings from this population/occurrence has a low threat from foot traffic trampling (Figure 7.g). These results suggest that *M. juddii* is vulnerable to alien plant introductions and *M. juddii* seedlings are vulnerable to trampling from foot traffic resulting from military activities in KLOA AA.

Scientific Name: ***Phlegmariarus nutans (Lycopodium nutans)***

Common Name: Wawae`iole
Family: Lycopodiaceae
Federal Status: Endangered
Life history: Short-lived perennial

Description and Biology: *Phlegmariurus nutans* is an erect perennial plant, < 50 cm (20 in) tall, with a few tufted branches. Leaves are lance-shaped or linear, 10 to 15 mm (0.4 to 0.6 in) long, 2 to 3 mm (0.1 in) wide. Cone is slender, 3 to 15 cm (1.2 to 5.9 in) long, 0.1 to 0.2 mm wide; sporophylls in 4 overlapping rows (Thompson 1994).

P. nutans has been observed fertile with spores in May and December (USFWS 1998a). No other information is available on reproductive cycles, longevity, specific environmental requirements, or limiting factors.

Known Distribution: Historically, *P. nutans* was known from the islands of Kauai and Oahu. It was found in various locations in the Koolau Mountains of Oahu between Kaluanui Valley to the north, Paalaa to the west, and Mount Tantalus to the south (Skottsberg 1936; USFWS 1996a).

Population Trends: *P. nutans* populations are declining, and those that remain are small and widely dispersed.

Current Status: *P. nutans* is believed extinct in Kauai (USFWS 1999a). Currently, *P. nutans* is known from three sites within its historical range: Kaukonahua Ridge, Kaukonahua Gulch, and along Waikane-Schofield Trail on Oahu (HINHP 1997; USFWS 1996a). There are only an estimated 7 individuals from 4 population occurrences remaining (RCUH 2002b). There are four individuals from two population/occurrences at KLOA AA (RCUH 2002a), they are located in the Koolau Mountains in North Kaukonahua Gulch and along the Koolau Summit Trail North of Kahuku cabin between 560 and 730 m (1,840 and 2,400 ft) elevation (HINHP 2002) (Figure 7.e). They represent about 57% of the total remaining individuals of this species (HINHP 2002). There are no stable populations of > 50 *P. nutans* remaining in the wild.

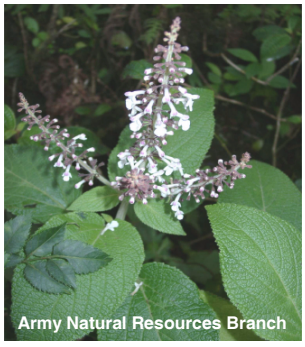
Habitat: *P. nutans* occurs on open ridges and slopes in ohia-dominated wet forests and occasionally mesic forests (USFWS 1996a, Hosaka1 1937) between 600 and 1,070 m (2,000 and 3,500 ft) in elevation (Robinson 1914, Selling 1946) where it grows on tree trunks. Other common vegetation in these areas includes kanawao, kopiko, uluhe, uki, kokio keokeo, and hame (USFWS 1996a).

Taxonomic Background: (*in progress)*

Outplanting Considerations: *P. nutans* should be outplanted only within its historic range, in areas free of impacts from ungulates and alien plants. A possible outplanting concern for the species is the vicinity of any existing wild populations of *Lycopodium* ssp.

Current Threats: *P. nutans* populations are threatened by feral pigs and noxious alien plants, including Koster's curse and strawberry guava (USFWS 1996a). The remaining populations of *P. nutans* are small and widely dispersed, which puts the species at risk of extinction from naturally occurring events and/or lack of reproductive vigor (USFWS 1996a).

Potential Threats from Army Training and Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest and shrub location of the KLOA AA where *P. nutans* grow (Figure 7.e). The fire threat is very low, insignificant and discountable in the southern locations and none for the northern/population occurrence (Figure 7.f). The threat of trampling from foot traffic is low and moderate for *P. nutans* in of KLOA AA (Figure 7.g). These results suggest that *P. nutans* is vulnerable to alien plant introductions and to trampling from foot traffic resulting from military activities in the KLOA AA.



Scientific name: ***Phyllostegia hirsuta* Benth.**
Common Name: No common name
Family: Lamiaceae (Mint family)
Federal Status: Endangered
Life history: Short-lived perennial

Description and Biology: *Phyllostegia hirsuta* is an erect sub-shrub or vine. The ovate-shaped leaves are 14.5 to 30.0 cm (5.7 to 11.8 in) long and 6.5 to 18.0 cm (2.6 to 7.1 in) wide. The white flowers are 7 to 11 mm (0.3 to 0.4 in) long and form compound racemes 10 to 20 cm (3.9 to 7.9 in) in length. The nutlets are about 2.5 to 3.0 mm (0.1 in) long (Wagner et al. 1990).

P. hirsuta is a short-lived perennial. *P. hirsuta* has been observed in flower in February and in fruit in June (USFWS 1998a). No other information on reproductive cycles, longevity, specific environmental requirements, or limiting factors is available.

Known Distribution: Historically, *P. hirsuta* was known from widespread populations in the Waianae and Koolau Mountains on Oahu. In the Waianae Mountains, it ranged from the head of Kukuiula Gulch (Pahole) to North Palawai Gulch, and it ranged almost the entire length of the Koolau Mountains from Pupukea-Kahuku Trail to Palolo (HINHP 1997).

Population Trends: *P. hirsuta* populations are declining, and those remaining are small and widely dispersed.

Current Status: There are currently 16 known populations of 150-200 *P. hirsuta* individuals remaining (USFWS 1998a). Ten populations occur in the Waianae Mountains, restricted to the southern part of the historical range (from the ridge between Makaha and Waianae Kai to the south fork of North Palawai Gulch), and six populations are distributed over 10-km (6-mi) along the summit of the Koolau Mountains (from Kawainui Gulch in Kawailoa Training Area to South Kaukonahua Drainage) (HINHP 1997). There are 10 individuals in the KLOA AA, from six populations/occurrences (RCUH 2002a). They are located in the Koolau Mts. between Kawaiiki Gulch and Poamoho Trail, between 665 and 775 m (2,190-2,430 ft) elevation (Figure 7.e) (HINHP 2002). Specific locations include: 2 individuals from Kawaiiki, 2 individuals from Opaeula, 2 individuals from Helemano, 1 individual from Upper Poamoho trail, 2 individuals from North Kaukonahua, and 1 individual from Lower Peahinaia trail. These individuals represent about 5-7% of the total remaining individuals of this species. There are no stable populations of > 50 *P. hirsuta* outside of the KLOA AA.

Habitat: *P. hirsuta* occurs in mesic to wet forests from 305 to 1,100 m (1,000 to 3,610 ft) in elevation (HINHP 1994; USFWS 1996b). *Phyllostegia hirsuta* is usually found on steep shaded slopes in areas dominated by ohia or a mixture of ohia and uluhe (USFWS 1996b). Associated plants include *Pouteria sandwicensis* (alaa), kanawao, mamaki, pilo, *Hedyotis terminalis* (manono), *Myrsine lessertiana* (kolea lau nui), and native and alien ferns (USFWS 1996b).

Taxonomic Background: There are 27 endemic species recognized in Hawaii under the genus *Phyllostegia*. The range of three of these species, *P. mollis, P. kaalaensis* and *P. parviflora ssp. lydgatei,* overlaps with *P. hirsuta*. All of these species are federally-listed as endangered. Hybrids have never been observed between any of these species. It is believed that *Phyllostegia* may share a common ancestor with *Stenogyne* and *Haplostachys,* which are two other native Hawaiian mint genera.

Outplanting Considerations: The geographical and ecological ranges of *P. hirsuta* broadly overlap with several other species of *Phyllostegia* in the Waianae Mountains, including the endangered *P. mollis*, *P. parviflora*, and *P. kaalaensis*. Several natural hybrid combinations have already been identified among Hawaiian members of the genus. Since hybridization seems to be a natural occurrence in *Phyllostegia*, the presence of other endangered *Phyllostegia* spp. in an area should not preclude the establishment of outplantings of *P. hirsuta*. However, outplantings should be conducted a good distance away from any pre-existing wild populations of other species.

Current Threats: The primary threats to *P. hirsuta* are habitat degradation by feral pigs, potential military impacts, and competition with alien plants including *Schinus terebinthifolius, Passiflora suberosa* (huehue haole)*, Melinis minutiflora* (molasses grass)*,* and *Psidium cattleianum.*

Potential Threats from Army Training and Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest and shrub location of the KLOA AA where *P. hirsuta* grows (Figure 7.e). The fire threat is very low, insignificant and discountable (Figure 7.f), but the threat from foot traffic trampling is low to high for *P. hirsuta* in these portions of

KLOA AA (Figure 7.g). These results suggest that *P. hirsuta* is vulnerable to alien plant introductions and to trampling from foot traffic resulting from military activities in the KLOA AA.

Scientific Name: ***Pteris lidgatei***

Common Name: No common name
Family: Adiantaceae (Maidenhair fern family)
Federal Status: Endangered
Life history: Short-lived perennial

Description and Biology: *Pteris lidgatei* is an herb 0.5 to 1.0 m (1.6 to 3.3 ft) tall. It has fronds that are 60 to 95 cm (23.6 to 37.4 in) long (including the leafstalks) and 20 to 45 cm (7.9 to 17.7 in) wide. The leafy portion of the frond is oblong-deltoid to broadly ovate-deltoid, and is thick and brittle in texture. It also has a horizontal rhizome 1.5 cm (0.6 in) thick and at least 10 cm (3.9 in) long when mature. The sori are located along leaf margins and are either fused into long linear sori or, more commonly, are separated into distinct shorter sori (Wagner 1949).

Pteris lidgatei is a short-lived perennial. No information on reproductive cycles, longevity, specific environmental requirements, or limiting factors is available.

Known Distribution: *Pteris lidgatei* is endemic to the Koolau Mountains of Oahu, Molokai, and West Maui.

Population Trends: *Pteris lidgatei* populations are declining, and those that remain are small and widely dispersed.

Current Status: The Molokai populations are now believed to be extinct (USFWS 1999a). There are presently 7 known populations of *Pteris lidgatei* remaining, totaling 33 plants (USFWS 1998b). There are five individuals from three population/occurrences at the KLOA AA; 3 individuals from Kawaiiki Stream, 1 individual from Kawainui, and 1 individual from North Kaukonahua, found between 490 to 720 m (1600-2,360 ft) elevation (RCUH 2002a; HINHP 2002; U.S. Kawelo, Army, pers. comm. 2003; Lau, HINHP, pers. comm. 2003) (Figure 7.e). These individuals represent about 15% of the total remaining individuals of this species. There are no stable populations of >50 *Pteris lidgatei* outside of the KLOA AA.

Habitat: *P. lidgatei* has been found in riparian areas on stream banks and next to waterfalls in wet forests between 535 to 915 m (1,750 to 3,000 ft) in elevation (HINHP 1994).

Taxonomic Background: None noted.

Outplanting Considerations: *P. lidgatei* should only be outplanted within its historic range, in areas free of impacts from ungulates and alien plants. A possible outplanting concern for the species is outplanting in the vicinity of any existing wild populations of *Pteris spp.*

Current Threats: The major threats to this species are habitat degradation and predation by feral pigs and competition with alien plants.

Potential Threats from Army Training and Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest and shrub location of the KLOA AA where *P. lidgatei* grow (Figure 7.e). The fire threat is very low, insignificant and discountable (Figure 7.f) but the threat of trampling from foot traffic is low and moderate in these portions of KLOA AA (Figure 7.g). These results suggest that *P. lidgatei* is vulnerable to alien plant introductions and to trampling from foot traffic resulting from military activities in KLOA AA.

Scientific Name: *Sanicula purpurea* St. John & Hosaka

Common Name: No common name
Family: Apiaceae (Parsley family)
Federal status: Endangered
Life history: Short-lived perennial

Description and Biology: *Sanicula purpurea* is a stout and erect perennial herb 8 to 36 cm (3.1 to 14.2 in) tall. It has numerous kidney-shaped or roundish to egg heart-shaped basal leaves that are 3 to 7-lobed and 2 to 8 cm (0.8 to 3.1 in) wide. The small purple or cream-colored flowers form branched terminal clusters of 6 to 10 flowered umbels. The spherical-shaped prickly fruits are 2.0 to 3.5 mm (0.08 to 0.14 in) long and 2 to 3 mm (0.08 to 0.12 in) wide (Wagner et al. 1990).

Information on reproductive cycles, longevity, specific environmental requirements, or limiting factors is not presently available.

Known Distribution: *S. purpurea* was known historically from six locations in the Koolau Mountains of Oahu and from four locations in West Maui Mountains.

Population Trends: *S. purpurea* populations are declining, and those that remain are small and widely dispersed.

Current Status: There are presently 4-5 known populations of *S. purpurea* remaining totaling 181-261 plants (USFWS 1999b). There are 18 individuals from two population/occurrences at KLOA AA (Figure 7.e), 8 individuals from South of Puu Pauao and 10 individuals from Poamoho summit, found between 760 and 800 m (2500-2620 ft.) elevation (HINHP 2002). Individuals that fall within the KLOA AA

represent approximately 7-9% of the total remaining individuals of this species. There are 1 to 2 stable populations of > 50 *S. purpurea* located in West Maui.

Habitat: *S. purpurea* occurs along the Koolau Mountain summit crest from 700 to 1,698 m (2,300 to 5,570 ft), on wet, windswept slopes. The habitat is dominated by open mixed montane bogs or ohia mixed montane wet shrubland, comprised of mosses, grasses, and small shrubs (USFWS 1999b).

Taxonomic Background: There are about 40 species of *Sanicula* known mostly from temperate and warm temperate regions in the New World, including 4 endemic Hawaiian species.

Outplanting Considerations: *S. purpurea* should only be outplanted within its historic range, in areas free of impacts from ungulates and alien plants. There are no apparent outplanting concerns because no other *Sanicula* spp. range overlaps with *S. purpurea*.

Current Threats: The major threats to this species are habitat degradation by feral pigs, direct human impacts (e.g., trampling, collection), competition from alien plants (including narrow-leaved carpetgrass), and potential threat from military activities (USFWS 1999b). The remaining populations of *S. purpurea* are small and widely dispersed, which puts the species at risk of extinction from naturally occurring events and/or lack of reproductive vigor (USFWS 1996c).

Potential Threats from Army Training and Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the wet cliff and lowland wet forest and shrub location of the KLOA AA where *S. purpurea* occurs (Figure 7.e), and there is no threat of fire there (Figure 7.f). The threat of trampling from foot traffic is moderate for *S. purpurea* in the KLOA AA (Figure 7.g). These results suggest that *S. purpurea* is vulnerable to alien plant introductions and foot traffic trampling resulting from military activities in the KLOA AA.

Scientific Name: *Tetraplasandra gymnocarpa* (Hillebr.) Sherff

Common Name: `Ohe`ohe
Family: Ginseng family (Araliaceae)
Federal status: Endangered
Life history: Long-lived perennial

Current Status: Less than 200 individuals are known from 17 populations (USFWS 1998a), distributed over 45 km (28 mi) along the summit ridges of the Koolau Mountains from the Paumalu region in the north, to Kuliouou and Waimanalo in the south (HINHP 1997; USFWS 1996a, 1998a). There are 13 individuals from five populations/occurrences in the KLOA AA, located between Kawailoa Trail and the north side of Peahinaia Ridge from 380 and 625 m (1,250-2,040 ft) elevation (Figure 7.e) (HINHP 2002). Specific locations include: 1 individual at Kawailoa trail, 8 individuals at lower Kawaiiki, 2 individuals at lower Peahinaia trail, 1 individual at Peahinaia trail midreach, and 1 individual at Upper Kawaiiki. These individuals represent about 4% of the total

remaining individuals of this species. There are 5 stable populations of > 25 *T. gymnocarpa* located outside of the Army AAs, including Kaluanui, Konahuanui to Mt. Olympus, Moanalua to Haiku, Wailupe-Niu, Waimano to Manana (Lau, HINHP, pers. comm. 2003).

Potential Threats from Army Training and Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest and shrub community where most *T. gymnocarpa* population/occurrences occur, and moderate and high for the population/occurrences located in the lowland mesic forest and in the dry microclimate dominated by alien plants, respectively (Figure 7.e). The fire threat from these military activities is very low, insignificant and discountable for *T. gymnocarpa* populations/occurrences in the KLOA AA (Figure 7.f). The threat of trampling from foot traffic is very low, insignificant and discountable for trees, unless they are seedlings. The seedlings from these population/occurrences have a mostly low, but also a moderate threat from foot traffic trampling (Figure 7.g). These results suggest that all *T. gymnocarpa* population/occurrences are vulnerable to alien plant introductions and foot traffic trampling resulting from military activities in the KLOA AA

For the complete species description, go to Federally-listed Species Affected by the Action at KTA (**Section 6.5.2**).

Scientific Name: *Viola oahuensis* C. Forbes

Common Name: No common name
Family: Violet family (Violaceae)
Federal Status: Endangered
Life history: Short-lived perennial

Description and Biology: *Viola oahuensis* is an erect, usually unbranched sub-shrub 6 to 40 cm (2.4 to 15.7 in) tall, with leaves somewhat clustered at the ends of the branches. The leaves are elliptic, 2 to 12 cm (0.8 to 4.7 in) long and 1.5 to 5.8 cm (0.6 to 2.3 in) wide. The pale-yellow flowers have petals 8 to 16 mm (0.3 to 0.6 in) long and occur on stalks of 1 to 2 flowers. The fruit is 9 to 16 mm (0.4 to 0.6 in) long and the pale brown seeds are obovoid shaped and 1.6 to 2.1 mm (0.06 to 0.08 in) long (Wagner et al. 1990).

V. oahuensis is a short-lived perennial. It has been observed flowering in August and September (USFWS 1998a). No further information is available on reproductive cycles, longevity, specific environmental requirements, or limiting factors.

Known Distribution: Historically, *V. oahuensis* was known from 17 populations/occurrences in the Koolau Mountains on Oahu, ranging from Puu Kainapuaa to Palolo (more than approximately 37 km (23 mi) (USFWS 1996b).

Population Trends: V. *oahuensis* populations are declining, and those that remain are small and widely dispersed.

Current Status: There are presently 8 known populations/occurrences of <180 *V. oahuensis* remaining (USFWS 1998a), most occur in the KLOA Training Area. There are 92 individuals from six populations/occurrences in the KLOA AA located in the Koolau Mts between Kamananui Gulch and Helemano, from 635 to 915 m (2,090 to 3,000 ft) (Figure 7.e) (HINHP 2002). Specific locations of *V. oahuensis* include 20 plants on Peahinaia trail, 7 plants in Upper Kawaiiki, 50 plants in Helemano, 1 plant in Kamananui, 5 plants on Schofield-Waikane trail, and 9 plants North of Kahuku cabin. Individuals that fall within the KLOA AA represent approximately 51% of the total known remaining individuals of this species. There are two known stable populations >50 *Viola oahuensis* outside the Army action areas, including 50-100 individuals located at Koolau Summit between Manana to Kipapa and >50 at Waimalu-Koolaupoko divide.

Habitat: *V. oahuensis* is endemic to the Koolau Mountains of Oahu. It is found on exposed, windswept ridges, with moderate to steep slopes, in wet ohia-uluhe shrublands, from 600 to 855 m (1,970 to 2,800 ft) in elevation (HINHP 1994; USFWS 1996b). *V. oahuensis* is often associated with wind-stunted naenae pua melemele, akia, manono, hame, *Metrosideros* spp. (ohia ha), alani, kookoolau, uki, amau, ohia ha, and *Vaccinium* sp. (ohelo) (USFWS 1996b).

Taxonomic Background: The seven endemic Hawaiian species in the genus *Viola* are believed to be derived from a single common ancestor (Wagner et al. 1990).

Outplanting Considerations: The only other native *Viola* occurring in the Koolau Mountains is *V. kauaensis* var. *kauaensis.* Similar to *V. oahuensis, V. kauaensis* is confined to the cool, wet summit regions of the Koolau Mountains. However, *V. kauaensis* is confined to the boggy windswept areas around Kaipapa`u, while *V. oahuensis* is known from cloudswept summits in wet forest in the Ko`olau Mountains of KLOA (RCUH 2001). Hybridization between the two has not been reported in the wild, and the potential for it to occur is not known.

Current Threats: The major threats to this species are habitat degradation by feral goats and pigs, potential impacts from military activities, and competition with alien plants including *Schinus terebinthifolius, Erigeron karvinskianus* (Daisy fleabane)*, Ageratina adenophora* (Maui pamakani)*, A.riparia* (Hamakua pamakani)*, Paspalum conjugatum* (hilo grass)*, Psidium cattleianum* and *Melinis minutiflora.*

Potential Threats from Army Training and Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest and shrub location of the KLOA AA where *V. oahuensis* grows (Figure 7.e). There is no fire threat in most of the locations where *V. oahuensis* occurs in the KLOA AA, but it is also very low, insignificant and discountable for several population/occurrences (Figure 7.f). The threat of trampling from foot traffic is mostly moderate in this portion of KLOA AA, and low for several other population/occurrences there (Figure 7.g). These results suggest that *V. oahuensis* is vulnerable to alien plant introductions and to trampling from foot traffic resulting from military activities in KLOA AA.

Scientific Name: *Achatinella apexfulva* Dixon

Common Name: *pupu kanioe, pupu kuahiwi, kahuli*
Family: Achatinellidae (Endemic Hawaiian Tree Snails are in the subfamily Achatinellinae)
Federal Status: Endangered (all species of the genus *Achatinella*)

Description and Biology: *Achatinella apexfulva* adults reach lengths of up to 19.0 mm (0.7 in), diameters of 12.5 mm (0.5 in), and have 6 whorls. The dextral or sinistral shell is short, egg-shaped and solid, glossy, and the color ranges from yellow to blackish carob brown and chestnut, with white streaks and spiral lines (USFWS 1993).

Achatinella spp. are primarily nocturnal, preferring cool, humid conditions when active. During the day they usually seal themselves to leaves or trunks and remain motionless until nightfall (USFWS 1993). Individuals are hermaphroditic, but it has not been determined if they are capable of self-fertilization. *Achatinella* spp. bear live young after a lengthy gestation.

Known Distribution: *A. apexfulva* was historically found throughout the southern half of KLOA and in the north central portions of Schofield Barracks East Range (Pilsbry and Cooke 1912-1914). However, since Polynesian and European settlement of Oahu, most forests below about 300 m (1,000 ft) were cleared for agricultural purposes, leaving the only native vegetation and microclimates suitable for *Achatinella* habitat at higher elevations. *Achatinella* spp. are presently most abundant in higher elevation ravines and upper ridges (USFWS 1993).

Population Trends: This species may be extinct from the wild because it was known to thrive in lower elevations where *E. rosea* first invaded, however, eight snails of this species are kept at the captive rearing facility at University of Hawaii. *A. apexfulva* is considered extremely rare and its present range is very restricted (RCUH 2001).

Current Status: There are presently no known populations/occurrences of *A. apexfulva* remaining (RCUH 2002b), other than a small population that was collected for captive rearing more recently along the Poamoho Trail in the KLOA AA at about 550 m (1,800 ft) elevation (RCUH 2002a) (Figure 7.e). One snail was found and brought back for captive rearing in 1998 and two more snails were captured in the same location for rearing at the lab at University of Hawaii in 2001 (RCUH 2001). Presently, there are no known individuals remaining at the Poamoho trail site, in what may be the last wild population remaining (RCUH 2002c).

Habitat: *A. apexfulva* and all other species in the genus are arboreal. They feed on fungus from the leaves of primarily native, and some introduced, vegetation (Pilsbry and Cooke, 1912-1914). *Achatinella* spp. are found on a variety of native trees and shrubs in dry, mesic, and wet forests, and they are rarely seen on alien vegetation (USFWS 1993). According to Pilsbry and Cooke (1912-1914), they usually avoid trees and shrubs with pubescent leaves.

Taxonomic Background: The genus *Achatinella* is restricted to the island of Oahu in the Hawaiian Islands. This genus originally included 41 species, each endemic to a small region of either the Koolau or Waianae Mountains (Hadfield et al.1993), but over-collection of the snails for their shells, predation, and habitat degradation have dramatically impacted this genus. All 41 species in the genus are federally-listed as endangered. By 1993, 16 of these species were extinct, 5 had not been seen in over 15 years, and 18 of the remaining 20 species were on the verge of extinction (USFWS 1993). Only *A. mustelina* and *A. sowerbyana* still exist in substantial numbers, though their numbers are declining (USFWS 1993; Hadfield et al. 1993).

Current Threats: The major threats to *Achatinella* spp. include habitat destruction from human activities and feral ungulates, predation, loss of host plants due to competition from alien plant species, and fire. Common tree snail predators include *Euglandina rosea* (carnivorous snail), *Rattus exulans* (Polynesian rat), *Rattus rattus* (European rat), and *Rattus norvegicus* (Norwegian rat). *Platydemis manokwari* (a terrestrial flatworm) is a known predator of arboreal snails in other areas and is a potential threat to all *Achatinella* species if it ever becomes established in the snail's range (U.S. Army 2002a). Low reproductive rates and limited dispersal abilities make *Achatinella* spp. very sensitive to loss of habitat, shell collecting, and predation (Hadfield 1986).

Reintroduction Considerations: Habitat quality should be carefully examined when choosing potential reintroduction sites for *A. apexfulva*. Elevation and vegetation should be similar to that of the source *A. apexfulva* population. There should be a low incidence of invasive plants and no evidence of rats or carnivorous snails in the area. When introducing captive snails into the wild, care must be taken to avoid the introduction of pathogens. Rats and carnivorous snails must be baited for at all reintroduction sites and a snail predator exclosure should be built if topography allows it.

An effort should be made to establish maximum genetic diversity within each reintroduction group based on molecular genetic data of laboratory stocks. Care should be taken to select the healthiest individuals from a predominantly adult or large sub-adult stock for introduction.

Potential Threats from Army Training and Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest and shrub location of the KLOA AA where *A. apexfulva* was found (Figure 7.e). There is no fire threat (Figure 7.f), but the threat of trampling from foot traffic is high in this portion of the KLOA AA (Figure 7.g). These results suggest that *A. apexfulva* is vulnerable to alien plant introductions and trampling from foot traffic resulting from military activities in KLOA AA.

Scientific name: *Achatinella byronii* Wood/ *Achatinella decipiens* Newcomb

Common Name: *pupu kanioe, pupu kuahiwi, kahuli*
Family: Achatinellidae (Endemic Hawaiian Tree Snails are in the subfamily Achatinellinae)
Federal status: Endangered (all species of the genus *Achatinella*)

Description and Biology: *Achatinella byronii* and *A. decipiens* are discussed collectively because of taxonomic discrepancies among malacologists. Adults reach lengths of 20.5 mm (0.8 in), diameters of 9.0 to 11.0 mm (0.4 in), and have 6 to 6.5 whorls. The dextral or sinistral shell is cone-shaped. The color is usually green, with light green-yellow streaking on the last two whorls, and green and chestnut banding on the suture below for *A. byronii* and white or yellow, with yellow or white banding respectively for *A. decipiens* (USFWS 1993).

Achatinella spp. are primarily nocturnal, preferring cool, humid conditions when active. During the day they usually seal themselves to leaves or trunks and remain motionless until nightfall (USFWS 1993). Individuals are hermaphroditic, but it has not been determined if they are capable of self-fertilization. *Achatinella* spp. bear live young after a lengthy gestation.

Known Distribution: *A. byronii/decipiens* was historically known from the southern boundary of KLOA/SBER and areas to the south (RCUH 2001). However, since Polynesian and European settlement of Oahu, most forests below about 300 m (1,000 ft) elevation were cleared for agricultural purposes, leaving the only native vegetation and microclimates suitable for *Achatinella* habitat at higher elevations. *Achatinella* spp. are presently most abundant in higher elevation ravines and upper ridges (USFWS 1993).

Population Trends: Many of the known populations of *A. byronii/decipiens* have declined significantly and it is now considered extremely rare (USFWS 1999a).

Current Status: Approximately 324 *A. byronii/decipiens* individuals have recently been observed (V. Costello, Army Natural Resource staff per. comm., 2002) in the wild from 5 populations/occurrences (RCUH 2001). Locations where they were reported include, Schofield Waik ne Trail, North Kaukonahua Stream drainage, Pu'u Ka`aumakua, and areas to the west of Pu'u Pauao and the Summit Trail. Approximately 300 of these are found in KLOA AA from three population/occurrences (V. Costello, Army Natural Resource staff per. comm., 2002; RCUH 2002a)(Figure 7.e). These population/occurrences are found near Poamoho Trail on Helemano-Poamoho Ridge and in North Kaukonahua Gulch between about 605 and 770 m (1980-2520 ft) elevation (HINHP 2002; RCUH 2002c). Individuals that fall within the KLOA AA represent approximately 93% of the total remaining individuals of this species

Habitat: *A. byronii/decipiens* and all other species in the genus are arboreal. They feed on fungus from the leaves of primarily native, and some introduced vegetation (Pilsbry and Cooke, 1912-1914). *Achatinella* spp. are found on a variety of native trees and shrubs in dry, mesic, and wet forests, and they are rarely seen on alien vegetation (USFWS 1993). According to Pilsbry and Cooke (1912-1914) they usually avoid trees and shrubs with pubescent leaves.

Taxonomic Background: The genus *Achatinella* is restricted to the island of Oahu in the Hawaiian Islands. This genus originally included 41 species, each endemic to a small region of either the Koolau or Waianae Mountains (Hadfield et al. 1993), but over-collection of the snails for their shells, predation, and habitat degradation have dramatically impacted this genus. All 41 species in the genus are federally-listed as endangered. By 1993, 16 of these species were extinct, 5 had not been seen in over 15 years, and 18 of the remaining 20 species were on the verge of extinction (USFWS 1993). Only *A. mustelina* and *A. sowerbyana* still exist in substantial numbers, though their numbers are declining (USFWS 1993; Hadfield et al.1993).

Current Threats: The major threats to *Achatinella* spp. include habitat destruction from human activities and feral ungulates, predation, loss of host plants due to competition from alien plant species, and fire. Common tree snail predators include *Euglandina rosea* (carnivorous snail), *Rattus exulans* (Polynesian rat), *Rattus rattus* (European rat), and *Rattus norvegicus* (Norwegian rat). *Platydemis manokwari* (a terrestrial flatworm) is a known predator of arboreal snails in other areas and is a potential threat to all *Achatinella* species if it ever becomes established in the snail's range (U.S. Army 2002a). Low reproductive rates and limited dispersal abilities make *Achatinella* spp. very sensitive to loss of habitat, shell collecting, and predation (Hadfield 1986).

Reintroduction Considerations: Habitat quality should be carefully examined when choosing potential reintroduction sites for *A. byronii/decipiens*. Elevation and vegetation should be similar to that of the source *A. byronii/decipiens* population. There should be a low incidence of invasive plants and no evidence of rats or carnivorous snails in the area. When introducing captive snails into the wild, care must be taken to avoid the introduction of pathogens. Rats and carnivorous snails must be baited for at all reintroduction sites and a snail predator exclosure should be built if topography allows it.

An effort should be made to establish maximum genetic diversity within each reintroduction group based on molecular genetic data of laboratory stocks. Care should be taken to select the healthiest individuals from a predominantly adult or large sub-adult stock for introduction.

Potential Threats from Army Training and Transformation The weed threat from current military training and SBCT transformation is low to moderate in the wet cliff location of the KLOA AA where *A. byronii* is found (Figure 7.e). There is no fire threat (Figure 7.f) but the threat of trampling from foot traffic is high for those populations along the ridgeline trails, and low for the population/occurrence further south in the action area (Figure 7.g). These results suggest that *A. byronii/decipiens* is vulnerable to alien plant introductions and trampling from foot traffic resulting from military activities in KLOA AA.

Scientific Name: *Achatinella curta* Newcomb

Common Name: pupu kanioe, pupu kuahiwi, kahuli
Family: Achatinellidae (Endemic Hawaiian Tree Snails are in the subfamily Achatinellinae)
Federal status: Endangered (all species of the genus *Achatinella*)

Description and Biology: *Achatinella curta* adults reach lengths of up to 21.4 mm (0.8 in) and diameters of 10.3 mm (0.4 in) at maturity. The shell is polished yellow or chestnut with a plain or black sutural band. The combination of rounded whorls and stoutness are definitive characteristics of the species. Shell morphology and geographic location are used to distinguish *A. curta* from other species of *Achatinella* (USFWS 1993).

Achatinella spp. are primarily nocturnal, preferring cool humid conditions when active. During the day, the snails usually seal themselves to leaves or trunks and remain motionless until nightfall (USFWS 1993). Individuals are hermaphroditic, but it has not been determined if they are capable of self-fertilization. *Achatinella* spp. bear live young after a lengthy gestation.

Known Distribution: *A. curta* was historically found throughout KLOA and in the southeastern corner of KTA (Pilsbry and Cooke 1912-1914). However, since Polynesian and European settlement of Oahu, most forests below about 300 m (1,000 ft) elevation were cleared for agricultural purposes, leaving the only

native vegetation and microclimates suitable for *Achatinella* habitat at higher elevations. *Achatinella* spp. are presently most abundant in higher elevation ravines and upper ridges (USFWS 1993).

Population Trends: Many of the known populations of *Achatinella* spp. have declined significantly in recent years.

Current Status: There have been five *A. curta* individuals reported since 1982, from three population/occurrences within KLOA, but none have been seen in the past 13 years (Figure 7.e). These individuals fall within the KLOA AA and represent 100 % of the total reported since 1982. They were observed at Paalaa Uka on the ridge south of Opaeula Gulch and Peahinaia Trail in the Kawailoa Forest Reserve, and on the Kawailoa Trail in the Koolau Mountains (HINHP 2002). This species is known from lower elevations where snails are no longer reported, and it is probably extirpated (Vince Costello, Army NRS, per. comm. 2002).

Habitat: *Achatinella curta* and all other species in the genus are arboreal. They feed on fungus from the leaves of primarily native plants and some introduced vegetation (Pilsbry and Cooke 1912-1914). Data

on habitat preferences of *Achatinella curta* is lacking. Most recent *Achatinella* spp. studies have involved A. *mustelina* individuals. They are more often found in mesic forests on a few species of native trees and shrubs. Some of vegetation A. *mustelina* has been found inhabiting includes *Antidesma platyphyllum, Coprosma* spp. (pilo), *Dubautia plantanginea* (naenae), *Metrosideros polymorpha, Myrsine lessertiana* (kolea lau nui)*, Nestegis sandwicensis* (olopua), and *Pisonia sandwicensis* (aulu) (U.S. Army 2002a).

Taxonomic Background: The genus *Achatinella* is restricted to the island of Oahu in the Hawaiian Islands. This genus originally included 41 species, each endemic to a small region of either the Koolau or Waianae Mountains (Hadfield et al.1993), but over-collection of the snails for their shells, predation, and habitat degradation have dramatically impacted this genus. All 41 species in the genus are federally listed as endangered. By 1993, 16 of these species were extinct, 5 had not been seen in over 15 years, and 18 of the remaining 20 species were on the verge of extinction (USFWS 1993). Only *A. mustelina* and *A. sowerbyana* still exist in substantial numbers, though their numbers are declining (USFWS 1993; Hadfield et al.1993).

Reintroduction Considerations: No need to consider until individuals of *A. curta* are located.

Current Threats: The major threats to *Achatinella* spp. include habitat destruction from human activities and feral ungulates, predation, loss of host plants due to competition from alien plant species, and fire. Common tree snail predators include *Euglandina rosea* (carnivorous snail), *Rattus exulans* (Polynesian rat), *Rattus rattus* (European rat), and *Rattus norvegicus* (Norwegian rat). *Platydemis manokwari* (a terrestrial flatworm) is a known predator of arboreal snails in other areas and is a potential threat to all *Achatinella* species if it ever becomes established in the snail's range (U.S. Army 2002a). Low reproductive rates and limited dispersal abilities make *Achatinella* spp. very sensitive to loss of habitat, shell collecting, and predation (Hadfield 1986).

Potential Threats from Army Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest and shrub locations of the KLOA AA where *A. curta* is found (Figure 7.e). The fire threat is very low, insignificant and discountable in this portion of the action area (Figure 7.f). The threat of trampling from foot traffic is low and moderate because of the proximity of these population/occurrences to trails (Figure 7.g). These results suggest that *A. curta* is vulnerable to alien plant introductions and trampling from foot traffic resulting from military activities in KLOA AA.

Scientific Name: *Achatinella lila*

Common Name: *pupu kanioe, pupu kuahiwi, kahuli*
Family: Achatinellidae (Endemic Hawaiian Tree Snails are in the subfamily Achatinellinae)
Federal status: Endangered (all species of the genus *Achatinella*)

Description and Biology: *Achatinella lila* adults reach lengths of 17 mm (0.7 in), diameters of 11 mm (0.4 in), and have 5.5 whorls. The sinistral shell is thin, egg-shaped or cone-shaped, smooth and glossy, brown to whitish in adults and banded on the last whorl (USFWS 1993).

Achatinella spp. are primarily nocturnal, which may be a result of their need for cool moist conditions. During the day they usually seal themselves to leaves or trunks and remain motionless until nightfall (USFWS 1993). Individuals are hermaphroditic, but it has not been determined if they are capable of self-fertilization. *Achatinella* spp. bear live young after a lengthy gestation.

Known Distribution: *A. lila* is historically known from the Schofield Waik ne Trail, Poamoho Trail and connecting Summit Trail areas. Since Polynesian and European settlement of Oahu, most forests below about 300 m (1,000 ft) in elevation have been cleared for agricultural purposes. By 1900, the native vegetation and microclimates necessary to sustain *Achatinella* populations were absent from low elevation areas. Since then, populations of *Achatinella* have been found only at elevations above approximately 300 m (1,000 ft) in native Hawaiian shrublands and forests. Species of *Achatinella* seem to be most abundant in higher elevation ravines and upper ridges (USFWS 1993).

Population Trends: The species is no longer observed in the southern regions but is still found north of the Poamoho Trail and Summit Trail junctions. It is considered to be uncommon, with a very restricted range (RCUH 2001).

Current Status: Approximately 33 *A. lila* individuals have recently been observed in the wild from 3 populations/occurrences (RCUH 2001). There are presently an estimated 50 individuals in the wild (V. Costello, Army Natural Resource staff per. comm. 2002). Locations where they were recorded include Pe`ahin i`a Trail and Summit area, Poamoho/Summit junction on the windward side, and north of the Poamoho/summit junction. These population/occurrences are included in the KLOA AA and include about 27 individuals (HINHP 2002; RCUH 2002a), which represent about 54% of the total remaining individuals (Figure 7.e.).

Habitat: *A. lila* and all other species in the genus are arboreal. They feed on fungus from the leaves of primarily native plants, and some introduced vegetation (Pilsbry and Cooke, 1912-1914). *Achatinella* spp. are found on a variety of native trees and shrubs in dry, mesic, and wet forests, and they are rarely seen on alien vegetation (USFWS 1993). According to Pilsbry and Cooke (1912-1914), they usually avoid trees and shrubs with pubescent leaves.

Taxonomic Background: *Achatinella* spp. are restricted to the island of Oahu in the Hawaiian Islands. This genus originally included 41 species, each endemic to a small region of either the Koolau or Waianae Mountains (Hadfield et al. 1993). Over-collection of the snails for their shells, predation, and habitat degradation has taken a huge toll on this genus. All 41 species in the genus are federally-listed as endangered. As of 1993, 16 species were extinct, 5 had not been seen in over 15 years, and 18 of the remaining 20 species were on the verge of extinction (USFWS 1993). Only *A. mustelina* and *A. sowerbyana* still exist in substantial numbers, though their numbers are declining (USFWS 1993; Hadfield et al. 1993).

Reintroduction Considerations: Habitat is an important consideration in choosing potential reintroduction sites. Elevation should be similar to that of the source snail population. Vegetation should be composed mostly of known host vegetation for *A. lila*, preferably similar to that of the source population. There should be a low incidence of invasive weeds and trees, and no evidence of rats or carnivorous snails. When introducing captive snails into the wild, care must be taken to avoid the introduction of pathogens. Previous reintroductions of *A. mustelina* have shown that, in the absence of predation, reintroduction can be successful. It is therefore important to bait rats and carnivorous snails at all reintroduction sites of *A. lila* and to build a snail predator exclosure if topography allows it.

An effort should be made to establish maximum genetic diversity within each reintroduction group based on molecular genetic data of laboratory stocks. It is optimal to introduce mainly adult or large sub-adult snails.

Current Threats: The major threats to *Achatinella* spp. include habitat destruction from human activities and feral ungulates, predation, loss of host plants due to competition from alien plant species, and fire. Common tree snail predators include *Euglandina rosea*, *Rattus exulans*, *Rattus rattus*, and *Rattus*

norvegicus. Platydemis manokwari is a known predator of arboreal snails in other areas and is a potential threat to all *Achatinella* species if it ever becomes established in the snail's range (U.S. Army 2002a). Low reproductive rates and limited dispersal abilities make *Achatinella* spp. very sensitive to loss of habitat, shell collecting, and predation (Hadfield 1986).
Potential Threats from Army Training and Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest and shrub and wet cliff locations of the KLOA AA where *A. lila* is found (Figure 7.e). There is no fire threat (Figure 7.f), but the threat of trampling from foot traffic is low to high because of the proximity of these population/occurrences to trails (Figure 7.g). These results suggest that *A. lila* is vulnerable to alien plant introductions and trampling from foot traffic resulting from military activities in KLOA AA.

Scientific Name: *Achatinella livida* Swainson

Common Name: *pupu kanioe, pupu kuahiwi, kahuli*
Family: Achatinellidae (Endemic Hawaiian Tree Snails are in the subfamily Achatinellinae)
Federal Status: Listed endangered (all species of the genus *Achatinella*)

Description and Biology: *Achatinella livida* adults reach lengths of up to 17.0 mm (0.7 in), diameters of 9.0 mm (0.4 in), and have 6 whorls. The dextral or sinistral shell is ovate and obtuse, and brown or gray to purple in color, with white on the whorls and no banding (USFWS 1993).

Achatinella spp. are primarily nocturnal, preferring cool-humid conditions when active. During the day they usually seal themselves to leaves or trunks and remain motionless until nightfall (USFWS, 1993). Individuals are hermaphroditic, but it has not been determined if they are capable of self-fertilization. *Achatinella* spp. bear live young after a lengthy gestation.

Known Distribution: *A. livida* was historically found throughout KLOA and in the north central portions of Schofield Barracks East Range (Pilsbry and Cooke 1912-1914). However, since Polynesian and European settlement of Oahu, most forests below about 300 m (1,000 ft) elevation were cleared for agricultural purposes, leaving the only native vegetation and microclimates suitable for *Achatinella* habitat at higher elevations. *Achatinella* spp. are presently most abundant in higher elevation ravines and upper ridges (USFWS, 1993c).

Population Trends: Many of the known populations of *A. livida* have declined significantly in recent years. However, *A. livida* is subject to all the same threats that other Ko`olau *Achatinella* species face, yet they continue to survive at lower elevations and in more microhabitats.

Current Status: There are currently an estimated 141 *A. livida* individuals from three population/occurrences known in the wild (Vince Costello, Army Natural Resource staff per. comm. 2002). *A. livida* is currently found predominantly in the Ko`olau Summit region along the summit trail. Two populations/occurrences were managed by Natural Resource Staff (NRS) from which 12 and 36 individuals were captured in mark/recapture studies in 2001.The three known population/occurrences are all found in the KLOA AA (RCUH 2002c), located along the Koolau Summit Trail, between about 1 mile and 1.25 miles southeast of Puu Kainapuaa, and between 690 and 705 m (2270-2320 ft) elevation in the Koolau Mountains (HINHP 2002; RCUH 2002a) (Figure 7.e). These individuals represent about 100% of the total remaining individuals.

Habitat: *A. livida* and all other species in the genus are arboreal. They feed on fungus from the leaves of primarily native, and some introduced vegetation (Pilsbry and Cooke, 1912-1914). Data on habitat preferences of *Achatinella livida* is lacking. Most recent *Achatinella* spp. studies have involved A. *mustelina* individuals. They are more often found in mesic forests on a few species of native trees and shrubs. Some of vegetation A. *mustelina* has been found inhabiting includes *Antidesma platyphyllum, Coprosma* spp. (pilo), *Dubautia plantanginea* (naenae), *Metrosideros polymorpha, Myrsine lessertiana* (kolea lau nui)*, Nestegis sandwicensis* (olopua), and *Pisonia sandwicensis* (aulu) (U.S. Army 2002a).

Taxonomic Background: The genus *Achatinella* is restricted to the island of Oahu in the Hawaiian Islands. This genus originally included 41 species, each endemic to a small region of either the Koolau or Waianae Mountains (Hadfield et al.1993), but over-collection of the snails for their shells, predation, and habitat degradation have dramatically impacted this genus. All 41 species in the genus are federally listed as endangered. By 1993, 16 of these species were extinct, 5 had not been seen in over 15 years, and 18 of the remaining 20 species were on the verge of extinction (USFWS, 1993a). Only *A. mustelina* and *A. sowerbyana* still exist in substantial numbers, though their numbers are declining (USFWS, 1993a; Hadfield et al.1993).

Current Threats: The major threats to *Achatinella* spp. include habitat destruction from human activities and feral ungulates, predation, loss of host plants due to competition from alien plant species, and fire. Common tree snail predators include *Euglandina rosea*, *Rattus exulans*, *Rattus rattus*, and *Rattus norvegicus. Platydemis manokwari* (a terrestrial flatworm) is a known predator of arboreal snails in other areas and is a potential threat to all *Achatinella* species if it ever becomes established in the snail's range (SB BA 2002). Low reproductive rates and limited dispersal abilities make *Achatinella* spp. very sensitive to loss of habitat, shell collecting, and predation (Hadfield 1986).

Reintroduction Considerations: Habitat quality should be carefully examined when choosing potential reintroduction sites for *A. livida*. Elevation and vegetation should be similar to that of the source *A. livida* population. There should be a low incidence of invasive plants and no evidence of rats or carnivorous snails in the area. When introducing captive snails into the wild, care must be taken to avoid the introduction of pathogens. Rats and carnivorous snails must be baited for at all reintroduction sites and a snail predator exclosure should be built if topography allows it.

An effort should be made to establish maximum genetic diversity within each reintroduction group based on molecular genetic data of laboratory stocks. Care should be taken to select the healthiest individuals from a predominantly adult or large sub-adult stock for introduction.

Potential Threats from Army Training and Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest and shrub locations of the KLOA AA where *A. livida* is found (Figure 7.e). There is no fire threat (Figure 7.f), but the threat of trampling from foot traffic is low to moderate (Figure 7.g). These results suggest that *A. livida* is vulnerable to alien plant introductions and trampling from foot traffic resulting from military activities in KLOA AA.

Scientific Name: *Achatinella pulcherrima* Swainson

Common Name: pupu kanioe, pupu kuahiwi, kahuli
Family: Achatinellidae (Endemic Hawaiian Tree Snails are in the subfamily Achatinellinae)
Federal Status: Endangered (all species of the genus *Achatinella*)

Description and Biology: *Achatinella pulcherrima* adults reach lengths of up to 20.0 mm (0.8 in) and diameters of 11.2 mm (0.4 in) at maturity. The shell is white or yellow with or without several broad chestnut bands. The shell is slender, ovate-oblong, and subcylindrical in shape (USFWS 1993).

Achatinella spp. are primarily nocturnal, preferring cool humid conditions when active. During the day they usually seal themselves to leaves or trunks and remain motionless until nightfall (USFWS 1993). Individuals are hermaphroditic, but it has not been determined if they are capable of self-fertilization. *Achatinella* spp. bear live young after a lengthy gestation.

Known Distribution: *A. pulcherrima* was historically found throughout KLOA and in the north central portions of Schofield Barracks East Range (Pilsbry and Cooke 1912-1914). However, since Polynesian and European settlement of Oahu, most forests below about 300 m (1,000 ft) elevation were cleared for agricultural purposes, leaving the only native vegetation and microclimates suitable for *Achatinella* habitat at higher elevations. *Achatinella* spp. are presently most abundant in higher elevation ravines and upper ridges (USFWS 1993).

Population Trends: Many of the known populations of *A. pulcherrima* have declined significantly in recent years. This species was last observed in 1993 on Peahinaia Trail, 0.6 miles from the summit of Koolau Mountains and on the summit trail, near headwaters of the Opaeula stream.

Current status: There have been three *A. pulcherima* individuals reported since 1982, from three population/occurrences all within KLOA. Two *A. pulcherima* were reported in 1993 along the Summit trail near the head of the south fork of Opaeula stream, and one was reported on the Peahinaia Trail about 1 km (0.6 mi) from the Summit Trail in KLOA (Figure 7.e)(HINHP 2002). These three individuals fall within the KLOA AA and represent 100% of the total reported. This species has not recently been seen and is possibly extirpated (Vince Costello, Army NRS, per. comm. 2002).

Habitat: *A. pulcherima* and all other species in the genus are arboreal. They feed on fungus from the leaves of primarily native plants, and some introduced vegetation (Pilsbry and Cooke, 1912-1914). *Achatinella* spp. are found on a variety of native trees and shrubs in dry, mesic, and wet forests, and they are rarely seen on alien vegetation (USFWS 1993). According to Pilsbry and Cooke (1912-1914), they usually avoid trees and shrubs with pubescent leaves. Data on specific habitat preferences of *Achatinella pulcherima* is lacking. Most recent *Achatinella* spp. studies have involved A. *mustelina* individuals. Vegetation they have been found inhabiting includes *Antidesma platyphyllum, Coprosma* spp. (pilo), *Dubautia plantanginea* (naenae), *Metrosideros polymorpha, Myrsine lessertiana* (kolea lau nui)*, Nestegis sandwicensis* (olopua), and *Pisonia sandwicensis* (aulu) (U.S. Army 2002a).

Taxonomic Background: The genus *Achatinella* is restricted to the island of Oahu in the Hawaiian Islands. This genus originally included 41 species, each endemic to a small region of either the Koolau or Waianae Mountains (Hadfield et al.1993), but over-collection of the snails for their shells, predation, and habitat degradation have dramatically impacted this genus. All 41 species in the genus are federally listed as endangered. By 1993, 16 of these species were extinct, 5 had not been seen in over 15 years, and 18 of the remaining 20 species were on the verge of extinction (USFWS 1993). Only *A. mustelina* and *A. sowerbyana* still exist in substantial numbers, though their numbers are declining (USFWS 1993; Hadfield et al.1993).

Reintroduction Considerations: No need to consider until individuals of *A. pulcherima* are located.

Current Threats: The major threats to *Achatinella* spp. include habitat destruction from human activities and feral ungulates, predation, loss of host plants due to competition from alien plant species, and fire. Common tree snail predators include *Euglandina rosea*, *Rattus exulans*, *Rattus rattus*, and *Rattus norvegicus. Platydemis manokwari* (a terrestrial flatworm) is a known predator of arboreal snails in other areas and is a potential threat to all *Achatinella* species if it ever becomes established in the snail's range (SB BA 2002). Low reproductive rates and limited dispersal abilities make *Achatinella* spp. very sensitive to loss of habitat, shell collecting, and predation (Hadfield 1986).

Potential Threats from Army Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest and shrub location of the KLOA AA where *A. pulcherima* is found (Figure 7.e). There is no fire threat in these locations in KLOA AA (Figure 7.f). The threat of trampling from foot traffic is moderate because of the proximity of these population/occurrences to trails (Figure 7.g). These results suggest that *A. pulcherima* is vulnerable to alien plant introductions and trampling from foot traffic resulting from military activities in KLOA AA.

Scientific Aame: *Achatinella sowerbyana* Pfeiffer

Common Aame: *pupu kanioe, pupu kuahiwi, kahuli*
Family: Achatinellidae (Endemic Hawaiian Tree Snails are in the subfamily Achatinellinae)
Federal Status: Endangered (all species of the genus *Achatinella*)

Description and Biology: *Achatinella sowerbyana* adults reach lengths of up to 18.0 mm (0.7 in), diameters of 9.0 mm (0.4 in), and have 6 whorls. The dextral shell is imperforate, conic-oblong, and solid. The color is a glossy tawny buff with dark streaks (USFWS 1993).

Achatinella spp. are primarily nocturnal, preferring cool, humid conditions when active. During the day they usually seal themselves to leaves or trunks and remain motionless until nightfall (USFWS 1993). Individuals are hermaphroditic, but it has not been determined if they are capable of self-fertilization. *Achatinella* spp. bear live young after a lengthy gestation.

Known Distribution: *A. sowerbyana* was historically found throughout KLOA/SBER (Pilsbry and Cooke 1912-1914; RCUH 2001). However, since Polynesian and European settlement of Oahu, most forests below about 300 m (1,000 ft) in elevation were cleared for agricultural purposes, leaving the only native vegetation and microclimates suitable for *Achatinella* habitat at higher elevations. *Achatinella* spp. are presently most abundant in higher elevation ravines and upper ridges (USFWS 1993).

Population Trends: Many of the known populations of *A. sowerbyana* have declined significantly in recent years. However, *A. sowerbyana* is subject to all the same threats that other Ko`olau *Achatinella* species face, they continue to survive at lower elevations and in more microhabitats.

Current Status: *A. sowerbyana* is currently found mostly in the Ko`olau Summit region at Castle Trail, Poamoho Trail, and Schofield Barracks East Range (RCUH 2001). It is considered to be the most commonly found *Achatinella* species on Oahu after *A. mustelina*. Three populations/occurrences were reported by Natural Resources Staff in 2000 and 2001, totaling >150 individuals. There are presently an estimated 265 individuals in the wild (V. Costello, Army NRS, per. comm., 2002). All occur in the KLOA AA, from 11 population/occurrences (RCUH 2002a) (Figure 7.e). They occur from Kawainui-Kaipapau divide near the Summit Trail south to Poamoho Trail, and along Peahinaia Trail (HINHP 2002). Individuals in the KLOA AA represent 100% of the total known remaining individuals.

Habitat: *A. sowerbyana* and all other species in the genus are arboreal. They feed on fungus from the leaves of primarily native plants, and some introduced vegetation (Pilsbry and Cooke, 1912-1914). *Achatinella* spp. are found on a variety of native trees and shrubs in dry, mesic, and wet forests, and they are rarely seen on alien vegetation (USFWS 1993). According to Pilsbry and Cooke (1912-1914), they usually avoid trees and shrubs with pubescent leaves.

Taxonomic Background: The genus *Achatinella* is restricted to the island of Oahu. This genus originally included 41 species, each endemic to a small region of either the Koolau or Waianae Mountains (Hadfield et al.1993), but over-collection of the snails for their shells, predation, and habitat degradation have dramatically impacted this genus. All 41 species in the genus are federally-listed as endangered. By 1993, 16 of these species were extinct, 5 had not been seen in over 15 years, and 18 of the remaining 20 species were on the verge of extinction (USFWS 1993). Only *A. mustelina* and *A. sowerbyana* still exist in substantial numbers, though their numbers are declining (USFWS 1993; Hadfield et al.1993).

Reintroduction Considerations: Habitat should be carefully examined when choosing potential reintroduction sites for *A. sowerbyana*. Elevation and vegetation should be similar to that of the source *A. sowerbyana* population. There should be a low incidence of invasive plants and no evidence of rats or carnivorous snails in the area. When introducing captive snails into the wild, care must be taken to avoid the introduction of pathogens. Rats and carnivorous snails must be baited for at all reintroduction sites and a snail predator exclosure should be built if topography allows it.

An effort should be made to establish maximum genetic diversity within each reintroduction group based on molecular genetic data of laboratory stocks. Care should be taken to select the healthiest individuals from a predominantly adult or large sub-adult stock for introduction.

Current Threats: The major threats to *Achatinella* spp. include habitat destruction from human activities and feral ungulates, predation, loss of host plants due to competition from alien plant species, and fire. Common tree snail predators include *Euglandina rosea*, *Rattus exulans*, *Rattus rattus*, and *Rattus norvegicus. Platydemis manokwari* (a terrestrial flatworm) is a known predator of arboreal snails in other areas and is a potential threat to all *Achatinella* species if it ever becomes established in the snail's range (SB BA 2002). Low reproductive rates and limited dispersal abilities make *Achatinella* spp. very sensitive to loss of habitat, shell collecting, and predation (Hadfield 1986).

Potential Threats from Army Training and Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest and shrub and wet cliff locations of the KLOA AA where *A. sowerbyana* is found (Figure 7.e). There is no fire threat in most of the *A. sowerbyana* locations in KLOA AA, but it is also very low, insignificant and discountable for several population/occurrences (Figure 7.f). The threat of trampling from foot traffic is moderate to high because of the proximity of these population/occurrences to trails (Figure 7.g). These results suggest that *A. sowerbyana* is vulnerable to alien plant introductions and trampling from foot traffic resulting from military activities in KLOA AA.

7.5.3 Potential non-military uses of the action area

There are non-military uses at KLOA that have the potential to negatively impact federally listed species. They are current actions that are not controlled by the Army. They include hiking, biking, and hunting on 465 ha (1,150 ac) leased from the state of Hawaii (USACE and Nakata Planning Group 2000).

- The Ewa Forest Reserve (Wahiawa) State Public Hunting Area (part of Unit C) is located in the KLOA between Poamoho Trail and the Schofield-Waikane Trail. Access to the hunting area is via the Schofield-Waikane Trail through East Range. Wild pigs and wild goats may both be taken with shotguns with slugs, bow and arrow, spear, and knife with dog. Rifles are not permitted, and dogs must be restrained except when actually hunting. One pig and one goat of either sex may be taken per day. The area is open for Army hunting when not in use for military training and when the public is not hunting (such as weekdays with no scheduled training). Only one group (two to six persons) is allowed to hunt at a time, and permits are issued on a first-come, first-serve basis by the Provost Marshall. Eligible users are active duty, reserve, retired military personnel and authorized family members, and DoD civilian employees and their guests. The general public is allowed to hunt the state-owned portion of KLOA, which is the southern end of the subinstallation (Area C). Public hunting is allowed on Saturday, Sunday, and federal holidays, unless military training activities have been announced prior to a weekend or holiday, and is permitted from 30 minutes before sunrise to 30 minutes after sunrise. Goats and pigs are the only game animals that can be taken. One pig and one goat of either sex may be taken per day. Rifles are not permitted for hunting, but shotguns with slugs, bow and arrow, spear, and knife with dog are all allowed. Hunting dogs must be kept under restraint except while hunting.

- There is public hiking on the Pupukea Summit Trail which follows the boundary of KLOA, Kahuku Training Area, and Schofield Barracks East Range. To use the Pupukuea Summit Trail, the public is required to obtain an access permit from DPW. If accessing the trail through non-Army lands, hikers are required to obtain permission from the appropriate landowners.

- A Cooperative Agreement was signed in 1999, creating the Opaeula Watershed Protection Project. Cooperators consist of Kamehameha Schools Bishop Estate (KSBE), the state of Hawaii (Natural Area Reserve System (NARS), Division of Forestry and Wildlife (DOFAW), Department of Land and Natural Resources (DLNR), the U.S. Army Garrison, Hawaii, and the U.S. Fish and Wildlife Service. The Cooperative Agreement is in effect until 2010. The Opaeula Stream watershed, located within Kawailoa Training Area (KLOA), lies almost entirely within Training Area K2B. It extends from the Koolau Mountain ridgeline to the western border of KLOA, where the stream is diverted into the Opaeula Ditch Tunnel and subsequently feeds into Opaeula Reservoir. The purpose of the Opaeula Watershed Protection Project is to preserve watershed health and the biological integrity of an area in the uppermost portion of the northern leeward Koolau Mountains. The project aims to ensure the continued existence of the resources from the Upper Opaeula drainage for future generations to enjoy. Resources from this area may also be used for educational purposes at Kamehameha Schools. Introduced species (e.g., strawberry guava) in the area will be controlled in order to restore native ecosystems and protect rare plants and animals that contribute to the health of the watershed. The project involves hand clearing a corridor no more than five feet wide and erecting a 42-inch tall fence. The elevation of the fence ranges from 2600 ft to 2800 ft. In addition to feral pig control within the fenced area, a threat management program was initiated to control rats, weeds, mongooses, and human disturbance. In conjunction with the fence project, a shelter platform will be constructed to support fence construction and natural resources management crews while working in the area. The fence will create a pig-free habitat of approximately 150 acres, which will also be used for outplanting of native plants. The owner of the project site is KSBE. KSBE prepared an

Environmental Assessment for the project in April 1999. The LCTA program began monitoring the effectiveness of fencing, pig removal, and weed control in 2000. Monitoring responsibilities were assumed by natural resources staff in 2001.

7.6 Minimization of Potential Negative Effects of the Action

To quantify the beginning threat level for each potential effect of the action and the remaining threat following minimization action, a relative numerical threat value system is used. Threat values assigned to each potential effect are 0 = none, 1 = very low, insignificant and discountable (1-10% vulnerability), 2 = low (11-25% vulnerability), 3 = moderate (26-50% vulnerability), 4 = high (51-75% vulnerability), and 5 = very high (>75% vulnerability). These threat values have been developed for use in our discussion as a means of comparing threats posed to threatened and endangered species in portions of the action area relative to other portions of the action area. They measure the risk of each event occurring in a given area. The reasoning behind the assignment of each value is discussed under each section below.

Minimizing the potential negative effects of Army training and transformation activities involves implementing actions to lessen the amount of negative impact that the action may cause. Minimization is important for reducing the potential negative impact to listed species, but it also can work to reduce the size of the action area, which in turn can reduce the number of species affected by the action. The potential effects of Army training and transformation at Kawailoa/Drum Road/Helemano AA that received threat values greater than (1) very low, insignificant and discountable are discussed along with proposed minimization actions. Minimization actions may result in the modification of threat values downward. Table 7.d at the end of this section, summarizes the resulting (modified) threat values following minimization actions. Modified threat values of less than low (2) are **not likely to adversely affect any federally-listed species or adversely modify critical habitat in the action area**. Potential effects, which are assigned modified threat values greater than or equal to low (2) are **likely to adversely affect federally-listed species or adversely modify critical habitat** and these are in bold type in Table 7.d.

7.6.1 Direct Effects

7.6.1.1 Helicopter Impacts from Current Military Training

KLOA supports helicopter operations for aviation training and to transport people, equipment, and supplies for training and land management activities. Potential impacts would include noise (addressed below in Section 7.6.1.7), helicopter down draft, landing places with threatened and endangered species, and water drops for fire bucket training. Much of the helicopter use is restricted to specified landing zones (LZs) and drop zones (DZs). There are 12 open LZs and 1 open LZ/DZ in the KLOA action area. The closest federally listed record to any of these zones is *Tetraplasandra gymnocarpa* (about 140 m (460 ft)) to LZ Red (Figure 7.a). All other listed species are > 250 m (820 ft) to any of the landing zones. All aviation units (Army, USMC, etc) are restricted to use only LZ black pu'u for fire bucket training contingent upon DPW's (Department of Public Works) environmental survey identifying location of listed species to determine "no-fly/drop" areas (Gayland Enriques, U.S. Army, pers. comm. 2002). Aviation Brigade will formally incorporate written procedures either before Section 7 consultation is complete or after consultation but before they do any water drops. The only listed species near LZ black is *Tetraplasandra gymnocarpa* which is located due east about 770 m (2525 ft) away. **Therefore, a threat value of very low (1), insignificant or discountable is assigned to the helicopter downdraft by Army activities at Kawailoa Action Area. This requires no further minimization.**

7.6.1.2 SBCT Construction Projects

The Schofield Barracks Military Reservation to Helemano Military Reservation military vehicle trail is the only SBCT construction project that is part of KLOA Action Area. The action area includes 50 m (164 ft) in both directions from the center line of the trail. All construction and transport of workers will take place within the boundaries of the action area as it is defined, including earth moving, turnarounds, drainage channels, etc. The closest federally listed species is *Tetraplasandra gymnocarpa* (about 1600 m (1 mi)) to the military vehicle trail (Figure 7.b). **Therefore, the threat of this SBCT construction project to listed species is (0) none.**

7.6.1.3 Fire from Current Military Training and SBCT Transformation

Ignition sources at KLOA are limited to smoking, muzzle flash (from blank ammunition), and catalytic converters. There is no live fire at KLOA, and pyrotechnics are not authorized for use. Fuel loads at KLOA are heavy, but tend not to be the fire prone grasses, particularly at high elevations. There are few roads in KLOA to break up the fuels, but many of the gulches are too wet for fire to cross. Average annual rainfall is 60 inches on the western side of the action area and increases to well over 270 inches towards the Koolau summit ridgeline. Winds are dominated by trades out of the northeast. Average wind speed as measured by the SBER RAWS is 4.7 mph, with average max wind speed (average of the highest hourly wind speeds) at 8.2 mph. Temperatures average 71 degrees F, with an average high temperature of 80 degrees F.

For the purposes of this BA, fire vulnerability is defined as the risk of fire ignition combined with the risk of fire spread as determined by characteristics of the vegetation and climate. The Kawailoa Training area is separated into three fire vulnerability areas (Figure 7.f).

Low Elevation – This includes all of the grass dominated locations within the action area as well as most of the forests dominated by eucalyptus. Training is restricted to maneuver only, reducing the chances of ignition. Though blank ammunition is allowed, it poses a very low fire ignition risk, both because the ammunition is very unlikely to cause a fire, and because of the moist environment at KLOA. The fact that there is only one record of a fire ever being caused by blank fire at KLOA, supports this contention. Additionally, in looking at all of the available fire history for all USARHAW installations, only two other fires have ever been listed as being caused by blanks. These areas have a **low (2) vulnerability** to fire. Gulches within this area have a very low fire vulnerability because they support less fire prone vegetation, are moister, and are less exposed to the wind and sun.

Medium Elevation – These areas have a mix of alien and native forest, receive less rainfall than upslope areas, but do not support the fire prone grass fuels of lower elevations. The frequency of training is also limited, reducing the chance of ignition. Medium elevation areas have a **very low, insignificant, or discountable (1) vulnerability** to fire.

High Elevation – This is the summit crest vegetation type. Rainfall is frequent and heavy at times. There are no highly flammable fuels present, live or dead. Additionally, training intensity is low and ignition sources are very rare. There is **no (0) vulnerability** to fire in this location.

Methods to minimize the negative effects of fires on threatened and endangered species will be documented in the finalized Wildland Fire Management Plan (WFMP), Pohakuloa and Oahu Training Areas, scheduled to be completed by September, 2003. Components of the WFMP important in Section 7 consultations with the USFWS are included in the BA (Fire History, Protected Species, Firebreak System, Fuels Management, Enforcement, Ignition Control, Fire Danger Rating System, Fire Reporting and Notification Procedures, Records and Fire Reports, and Departmental Responsibilities). The fire management plan defines the responsibilities of Range Control personnel and military training units for

the prevention and suppression of fires at KLOA. This plan also outlines the prevention and suppression measures that must be carried out to train at KLOA. Actions to minimize impacts will include implementing a fire danger rating system that will restrict training according to weather and fuel conditions. Immediate and aggressive response to all fires is an unconditional requirement at KLOA. The Army will reinitiate consultation with the USFWS if a fire escapes the installation boundary OR starts or spreads to within 521 meters of a listed species. Fuels management may be considered as well, including chemical and mechanical means of fuel reduction. However, much of the fire-prone environment in the KLOA action area lies outside of the KLOA installation boundary, and it is unlikely that the fuels there will be managed by the Army.

If the fuels are managed within the entire action area, then the threats will be reduced from low (2) to very low (1) in low elevation areas.

7.6.1.4 Alien Plant Introductions via Current Military Training and SBCT Transformation

The probability of alien plants becoming established depends on the type of weed species being introduced (e.g. dry, mesic, or wet forest species) and the proximity of suitable environments and/or plant communities to the action area or point of introduction of the species. Weed threat significance numbers are used to designate the level of threat. The KLOA action area is predominantly alien species, with native wet forest, and some mesic forest. **Nonnative communities have a high threat level (4) because of dry microclimates and dominance of alien species, mesic forest species have a moderate threat level (3), and wet forest species have a low (2) to moderate (3) threat level of becoming established.** This is because dryer communities are generally lower and closer to training activities, so the distance between the point of introduction and the location of the similar community type would be small compared to wetter forests. Also, there is a greater chance of a weed becoming established that would impact dry communities than mesic forests because training areas are located in habitat more similar to dry forests.

Threats are projected to be reduced from high (4) to moderate (3) for dry (nonnative communities), moderate (3) to low (2) for mesic forests, and from low (2) or moderate (3) to low (2) for wet forest species by doing the following:

- The Army will prevent any weeds brought in by training activities from becoming established by rigorously monitoring using transects and roadside surveys and eradicating new weeds using the most effective means known specific to each of the invasive species. Refer to the pest management sections of the Oahu INRMP (CEMML 2001) for possible treatments for eradication. Detailed methods for the monitoring and eradication of alien plants will be developed as part of the Oahu IP.
- The Army will provide education regarding cleaning vehicles and field gear.
- The Army will wash vehicles in the wash rack facility prior to returning to Oahu from the Pohakuloa Training Area (PTA), to minimize weeds (e.g. fountain grass).
- Persons and equipment coming from foreign countries must go through U. S. Department of Agriculture and U.S. Customs inspections before coming into the United States.
- The Army will train and require soldiers to clean their gear and vehicles when first arriving in Hawaii and prior to moving from installation to installation on Oahu, as well as when moving from Oahu to the island of Hawaii or vice versa.

7.6.1.5 Alien Animal Introductions via Current Military Training and SBCT Transformation

The chance of an introduced animal establishing a viable population would be lower than for plants since they would require at least two reproductive viable individuals or a single impregnated female individual to be introduced. **The threat of an alien animal species being introduced at KLOA from Army training and transformation is moderate (3).**

This threat should be reduced from moderate (3) to low (2) by doing the following:

- To minimize animals (e.g. invertebrates) from coming back to Oahu from the Pohakuloa Training Area (PTA), the Army will wash vehicles in the wash rack facility at PTA prior to returning.
- Persons and equipment coming from foreign countries must go through U. S. Department of Agriculture and U.S. Customs inspections before coming into the U.S.
- The Army will provide education regarding cleaning vehicles and field gear.
- The Army will brief soldiers on alien reptilian species and request that all snake and lizard sightings be reported to Army Environmental office.
- The Army has developed and distributed brown tree snake response and alert posters which inform the public about the potential for a brown tree snake introduction with rapid response measures and numbers to call in case of a sighting.
- The Army established the Brown Tree Snake Response Plan for rapid response to and interdiction of brown tree snakes introduced to Army Lands on Oahu.
- The Army is a member and will continue active participation in the Oahu Invasive Species Committee (OISC). This is a voluntary partnership of private, governmental and non-profit organizations and individuals united to prevent new invasive species infestations on the island of Oahu, to eradicate incipient invasive species, and to stop established invasive species from spreading.
- Herpetofauna certification program will be developed as part of the implementation process for plant material purchased by the Department of Defense, to prevent incidental introductions of herpetofauna to the island of Oahu.
- Establish the phytosanitation certification program developed in the Draft Makua IP (Makua Implementation Team 2002).
- Coordinate/collaborate with the Toxicants Working Group in an effort to determine a safe toxicant for controlling populations of newly established invertebrates.
- Use environmentally safe toxicants for alien species control or eradication associated with military operations or natural resource management.
- If a new introduction of an alien animal is found, the source and time of the introduction will be identified, and the area will be searched and treated with an appropriate environmentally safe toxicant to eradicate any other individuals of the target species that may be present. In addition, an area deemed adequate to cover the potential dispersal distance of the new alien animal will be searched and treated as well.
- Pursue support, implementation and funding for the licensing and application of a more toxic rodenticide, and towards broad scale distribution of rodenticides to improve rat control in remote areas, especially in areas with threatened and endangered species.

7.6.1.6 Trampling from Current Military Training and SBCT Transformation

Trampling of threatened and endangered species, particularly plants and invertebrates, is a potential risk during training exercises when soldiers or troops move through native habitats with listed species. However, the threat of destruction or degradation from trampling by troops should be lower than what

one would expect by chance because infantry soldiers are trained to leave no evidence or trace of their presence. For the purposes of this BA, we used percent slope and distance from roads to estimate the frequency of use by foot traffic as a measure of potential trampling intensity. We categorized areas into high, moderate, low, and very low, insignificant or discountable threats from trampling based on the predicted use of lands adjacent to the roads and trails in Kawailoa AA. This was done under the assumption that lower slopes and areas on or close to roads are used with greater frequency than the contrary (Figure 7.g).

The threat of trampling varies from high (4) for areas <10 m from roads or trails; moderate (3) for areas 10-1000 m from roads or trails with 0-30% slope, or 10-100 m from roads or trails with 30-60% slope; low (2) for areas 10-100 m from roads or trails with >60% slope, or 100-1000 m from roads or trails with >30% slope, or >1000 m from roads or trails with < 60% slope; and very low (1), insignificant or discountable for areas >1000 m from roads or trails and with >60% slope.

The risk to mature trees or shrubs getting trampled by foot traffic is very low, insignificant and discountable. Only the seedlings of trees and shrubs, and herbaceous plants are at risk of being trampled. **The threat of a listed plant or invertebrate being crushed and killed would be reduced by one from those predicted above (Table 7.d) by doing the following:**

- The Army will brief each set of new soldiers on avoidance of trampling of endangered species.
- Establish LCTA (ITAM) plots to monitor impact of foot traffic trampling by infantry soldiers.
- Fencing of federally listed species populations near roads or trails that have been determined to be impacted by military foot traffic, will be addressed by the implementation team.
- Establishing signage to identify areas that are off limits due to the presence of federally listed species, will be addressed by the implementation team.

7.6.1.7 Noise from Current Military Training and SBCT Transformation

Noise is an unwanted sound. It is generated from a source (e.g., explosion) as a wave of energy, which diminishes with distance. The only potential concern related to noise from Army activities is the potential effect on vertebrate species. Since there are presently no listed vertebrates in the KLOA AA, noise is not a concern in this area. **Therefore, a threat value of none (0) is assigned to noise from military sources at KLOA AA.**

7.6.2 Direct Interrelated Actions and Effects

7.6.2.1 Soil Erosion by Wind

The majority of the dust producing military activity is >300 m from threatened and endangered species populations at KLOA. **Therefore, the threat values for dust generation on federally listed species is very low (1), insignificant or discountable and requires no further minimization.**

7.6.2.2 Soil Erosion by Water

Soil erosion processes modify habitats by removing or adding soil from one location to another. Soil erosion is locally significant in areas where natural drainage and gulches occur. However, dry climate and lack of permanent streambeds may reduce the risk of erosion, as well as in areas where soils are not well developed because of exposed lava. Military activity and construction can have an effect on erosion rates and sedimentation, especially in areas where activity is concentrated. These disturbances are commonly in association with roads, LZ/PZ/DZ areas, and off-road maneuver and recreational areas (e.g., motorcycle trespass. Monitoring surface water quality of current or potential problem areas helps to identify sources

of degradation and ensure compliance with Hawaii and Federal water quality standards. Also, the lease agreement with Dole Food Co. and Waialua Sugar Co. (7,533 ha) specifies that the Army must initiate and maintain an active program to prevent and control erosion with the NRCS, and replant lost trees and vegetation. **Therefore, the effect of soil erosion and sedimentation on federally listed species is considered low (2).**

The effect of soil erosion and sedimentation on federally listed species should be further reduced from low (2) to very low (1), insignificant or discountable by doing the following:

- Establish a project review process headed by ITAM and including USAG-HI DPW, G3/DPTM, and Range Control, to optimize watershed protection and rehabilitation (e.g., road construction and maintenance, storm water management, etc.).
- Establish GIS support headed by ITAM, to develop project data layers, analyze data, and display results.

7.6.3 Direct Interdependent Actions and Effects

7.6.3.1 Range Maintenance and Construction

Range development projects are interdependent actions with interdependent effects. Most of the range projects occur along the main road which is further away from native forest than Army activities. **Therefore, the threat values for alien species introductions via range maintenance and construction is moderate (3).**

Most of the range construction is by the Army and involves road construction and maintenance with crushed rock from the Kolekole Rock Crushing Quarry at Schofield Barracks. The likelihood of a weed species foreign to Hawaii being in the material is negligible. However, sometimes sand is purchased for different projects and the sand could introduce new weeds. The Army will minimize this threat by conducting weed monitoring using transects and roadside surveys and eradicating new weeds using the most effective means known specific to each of the invasive species. Refer to the pest management sections of the Oahu INRMP (CEMML 2001) for possible treatments for eradication. Detailed methods for the monitoring and eradication of alien plants will be developed as part of the Oahu IP. **Therefore, the threat value should be reduced from moderate (3) to low (2).**

7.6.3.2 Integrated Training Area Management (ITAM) Program

This program is designed to monitor and mitigate erosion and loss of vegetative cover, which is essential for human safety and realism in training. ITAM workers revegetate areas, which have been heavily used for training. The ITAM program has the potential to introduce alien plant and animal species to Kawailoa via this work. **The initial threat value assigned to the ITAM program projects is low (2), because of the overall beneficial nature of the work they conduct, and because they work mostly in areas already heavily impacted by human development, dominated by alien plant species, and far away from federally listed species (including roadsides, LZ's, and maneuver areas).**

ITAM staff coordinate with Army Natural Resource Staff to select native species for outplanting. They purchase plants from native plant nurseries on Oahu. The plants are not delivered until the day before they are planted, to reduce the risk of contamination by alien species. Native plants are always the first alternative because they have the greatest likelihood of successful establishment. In some cases native species are not commercially available, more specifically grasses for Landing Zones. In those cases they coordinate with Army Natural Resource Staff to select something non-invasive, naturalized, and which

already occur near the outplanting site. Detailed methods for the monitoring and eradication of alien plants will be developed as part of the Oahu IP.

This potential threat will be further reduced by doing the following:

- Get weed free certification from native plant nurseries for all plants purchased by ITAM for revegetation.
- When using grass seed to revegetate an area, ITAM will periodically monitor these areas for invasive weeds, and remove all non-target introductions from the area before establishment.

In light of the precautions that are taken in choosing revegetation material and proposed actions to reduce the risk of a new introduction, the modified threat value assigned to the ITAM program projects is very low (1), insignificant and discountable.

7.6.3.3 Natural Resources Program

The Army's Natural Resources component of the Ecosystem Management Program provides protection to the listed species at KLOA in conjunction with military training there. Ecosystem level management at KLOA includes surveys, monitoring, propagation, storage, and reintroduction of rare plants; surveys, monitoring, and protection of rare invertebrates; ungulate, weed, and rodent control, and control of alien invertebrates and associated diseases. Natural resource workers could potentially introduce weed species via field vehicles or gear during management. Landing zone and disturbance corridor surveys are also conducted in areas where there is a high potential for alien species introduction via their program. **These potential adverse impacts are assigned an initial value of low (2).**

However, NRS workers are trained to be very conscious and careful of weed threats, and take precautions such as cleaning gear and vehicles prior to entry into the field. **Therefore, the initial threat value assigned to the natural resources program was modified to very low (1), insignificant and discountable.**

7.6.3.4 Alien Species Introduction by Recreational Use

Alien Animal Introduction. Open public access to the installation, public access on roads outside the installation boundaries, and non-military personnel with daily access to the installation are all potential non-military points of animal introductions at KLOA. Also, alien animal species may disperse (usually by flying) into new uninhabited areas within the subinstallation or action area or the smaller species may be blown in by winds. Non-military users must adhere to the conditions of their hiking permit, which is issued by DPW and states that they must clean all gear prior to entry. The likelihood of these human-induced introductions via recreation activities is lower than from military sources because of the lower frequency of use of the area for these purposes. **The threat of alien animal introduction by recreational use is therefore very low (1), insignificant and discountable and requires no further minimization.**

Alien Plant Introduction. Public access along the Pupukuea Summit Trail increases the risk of alien introductions at KLOA.**The threat of alien plant introduction by recreational use is therefore low (2).**

This threat should be reduced from low (2) to very low (1), insignificant and discountable by doing the following:

- Monitor trail use by requiring permits through DPW Environmental to hike the Pupukuea Summit Trail, and require permission from the appropriate landowners if accessing the trail through non-Army lands.

- The Army will prevent any weeds brought in by recreationalists from becoming established by monitoring trails used for these purposes within and adjacent to the KLOA AA. Methods for monitoring will be developed as part of the Oahu IP.
- Require hikers to clean all gear prior to entry.
- Due in part to a complicated permit system, hiking use will be limited.
- Develop and place signage at appropriate places along KLOA boundaries and trail locations to notify users of resource management issues, boundaries, and trail issues.
- Develop maps of hiking trails for distribution with access permits, including the level of difficulty, and natural resources issues (e.g., weed distribution concerns, endangered species information, the importance of staying on the trail).

7.6.3.5 Construction and Use of Drum Road

Drum Road Construction. The proposed improvements to the existing Drum Road from Helemano Military Reservation through the Kawailoa and Kahuku Training Areas include the following: paving about 23 miles of road with asphaltic concrete, widening the road to 7.3 m (24 ft) to accommodate two lanes, providing 0.9-m (3-ft) compacted gravel shoulders on both sides, realigning dangerous curves to provide better/safer site distances, regrading to correct steep slopes and provide better drainage structure and lines to preclude excessive amounts of storm runoff, and providing safety measures (e.g. guard rails at drop offs, barriers, warning signs) where needed. In addition, some segments of Drum Road may require bridging or viaducts where the full width of the roadway cannot be accommodated on the existing terrain. Site work would include clearing, grubbing, grading, and stockpiling of material for embankments. Project actions include the construction of proper drainage features and adequate stream crossing culverts or bridging. This project can also be considered as an interrelated action.

There are no listed species located down slope from the road in the Kawailoa AA, and the closest federally listed species to this portion of the road is a population of *Tetraplasandra gymnocarpa*, at about 1225 m (4020 ft) away (Figure 7.b). Potential adverse road construction effects to listed species include fugitive dust and exhaust from construction vehicles, erosion, and weed spread. Fugitive dust and exhaust would have a **very low, insignificant, or discountable (1)** effect on federally listed species in KLOA AA because the species are far from Drum road and in the opposite direction from prevailing winds. The impacts of erosion from construction on Drum Road in KLOA AA will be **none (0)** because the location and distance of all listed species down slope from the road. The potential effect of weed spread would be **high (4), but these effects will be decreased to low (2) by doing the following:**

- Contractors and their employees will be educated on the need to wear clean clothes and maintain clean vehicles and equipment when coming onto the construction site.
- Construction equipment would be cleaned and inspected before being transported to the construction sites.
- Vehicles would be left at the construction site, confined to the training area, or recleaned before returning to the construction site.
- Every effort will be made to balance earthwork so no outside fill sources would be needed for the project. If outside fill were used, sites would be monitored for new alien species.
- Army Natural Resources personnel would periodically inspect construction sites for new alien species. Alien species would be documented and removed.

Drum Road Use. After the improvements to the existing Drum Road, it will be the primary route used by Legacy and SBCT for the transport of equipment and soldiers mostly from Schofield Barracks to and from KTA and sometimes KLOA to support training as described for each training area. Once construction is completed the road will have the following approximate vehicle usage 12 times per year:

Legacy Units:
Company Level: 36 trucks.
Battalion Level: 41 trucks.

SBCT Units:
Company Level: 47 Strykers and trucks.
Battalion Level: 217 Strykers and trucks.

The potential effects from use of the road would be from dust/exhaust and spread of weeds. The dust/exhaust effect would be **none (0)** because of the species distance from the road, and because the road will be paved so the dust level will be very low. The potential erosion effects would be **none (0)** and the potential affect of weed spread would be **moderate (3).**

The threat of weed spread from use of the road would be reduced from moderate (3) to low (2) by doing the following:

- Vehicles will be washed in KTA and Schofield Barracks before and after use.
- Monitor roadsides for weeds, and new species of weeds that are found will be removed.
- Soldiers will be educated of the importance to wear clean clothes and maintain clean vehicles.

7.6.4 Indirect Effects

7.6.4.1 Spread of Alien Species by Fire into Dry (nonnative) Communities

The threat values for secondary weed spread are based on the assumption that fire occurs in the area, and are similar to those described above for direct weed introductions from military training and SBCT activities in dry (nonnative) communities, high (4).

This indirect threat from Army training and transformation activities at KLOA should be reduced from high (4) to moderate (3) as a result of the following:

- The Army will prevent secondary weed spread from fire by rigorously monitoring and eradicating newly dispersed weeds. Detailed methods for the monitoring and eradication of alien plants will be developed as part of the Oahu IP.

7.6.4.2 Spread of Alien Species by Fire into Mesic Forests

The threat values for secondary weed spread are based on the assumption that fire occurs in the area, and are similar to those described above for direct weed introductions from military training and SBCT activities in mesic forests, moderate (3).

This indirect threat from Army training and transformation activities at KLOA should be reduced from moderate (3) to low (2) as a result of the following:

- The Army will prevent secondary weed spread from fire by rigorously monitoring and eradicating newly dispersed weeds. Detailed methods for the monitoring and eradication of alien plants will be developed as part of the Oahu IP.

7.6.4.3 Spread of Alien Species by Fire into Wet Forest

The threat values for secondary weed spread are based on the assumption that fire occurs in the area, and are similar to those described above for direct weed introductions from military training and SBCT activities in wet forests, low (2) to moderate (3).

This indirect threat from Army activities at KLOA should be reduced from low (2) or moderate (3) to very low (1) or low (2) for wet forest species as a result of the following:

- The Army will prevent secondary weed spread from fire by rigorously monitoring and eradicating newly dispersed weeds. Detailed methods for the monitoring and eradication of alien plants will be developed as part of the Oahu IP.

Table 7.d Potential Effects of Military Training and Transformation Activities in Kawailoa Training Area/ Drum and Helemano Military Vehicle Trails Action Area.

Effect Type	Potential Effect/Threat[1]	Initial Threat Value	Modified Threat Value with Minimization[2]
Direct	Fires from military activities in low elevation areas	2	1
Direct	**Alien plant introduction to nonnative communities**	4	3
Direct	**Alien plant introduction to native mesic forest**	3	2
Direct	**Alien plant introduction to native wet forest**	2-3	2
Direct	**Alien animal introduction**	3	2
Direct	**Trampling from foot traffic in areas <10 m from roads or trails**	4	3
Direct	**Trampling from foot traffic in areas 10-100 m from roads or trails**	3	2
Direct	Trampling from foot traffic in areas >100 m from roads	2	1
Direct Interrelated Action and Effect	Erosion by water	2	1
Direct Interdependent	**Range maintenance and construction, plant introduction**	3	2
Direct Interdependent	Integrated Training Area Management	2	1
Direct Interdependent	Natural Resources Program	2	1
Direct Interdependent	Alien plant introduction by recreational use	2	1
Direct Interdependent	**Weed spread from Drum Road construction**	4	2
Direct Interdependent	**Weed spread from Drum Road use**	3	2
Indirect effects	**Spread of alien species by fire into nonnative communities**	4	3
Indirect effects	**Spread of alien species by fire into native mesic forest**	3	2
Indirect effects	**Spread of alien species by fire into native wet forest**	2-3	1-2

[1] Potential effects in bold type are those which are assigned modified threat values ≥ to low (2). These are likely to adversely affect federally-listed species or adversely modify critical habitat.

[2] Modified threat values of less than low (2) are not likely to adversely affect any federally-listed species or adversely modify critical habitat in the action area. Potential effects assigned modified threat values greater than or equal to low (2) are likely to adversely affect federally-listed species or adversely modify critical habitat.

7.7 Other Army Consultations for Listed Species at KLOA.

7.7.1 Review of Planning Documents

The Army has requested USFWS review of Natural Resource planning documents over the years. The USFWS in April of 1996 reviewed the Army's draft Endangered Species Management Plan Report for Oahu Training Areas which was finalized and in place in 1997. In July of 1997 the USFWS sent comments to the Army regarding selected chapters of the Oahu Ecosystem Management Plan Report which was finalized and in place in 1998. In August of 2001 the USFWS sent the Army their review comments for the draft Integrated Natural Resources Management Plan which is the action document for review, guidance, and implementation of Army natural resource activities for 2002-2006 at Oahu Army Installations.

7.8 Cumulative Effects

Cumulative effects include the effects of future state, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the Endangered Species Act.

7.8.1 Future State Actions

None noted.

7.8.2 Future Private Actions

Future private actions at KLOA AA include:

- The Army is currently a partner in the Koolau Mountains Watershed Partnership (KMWP). The Partnership was created in 1999 through a Memorandum of Understanding signed by Koolau Mountain landowners. The KMWP facilitates watershed protection and conservation projects, maximizes available resources, and optimizes information exchange and learning (CEMML 2001). Partners include the Hawaii Department of Land and Natural Resources, the Honolulu Board of Water Supply, the Waiahole Water System, Kamehameha Schools Bishop Estate, The Queen Emma Foundation, the United States Army, the Department of Hawaiian Home Lands, and the Bishop Museum. The partnership is an initiative sponsored by the Hawaii Department of Land and Natural Resources. The KMWP consists of approximately 39,450 ha (97,500 ac). The partners agree that the proactive management of watershed is crucial in eliminating or reducing the threats of damage from weeds, insects, disease, feral ungulates, and human impacts. Partners will work together to develop watershed projects and cooperate to obtain funds for these projects. The KMWP partners meet monthly. Projects may combine one or more activities such as fencing, weed control, ungulate control, restoration and revegetation, stream health and water quality, vegetation monitoring, erosion and sediment control, and other elements.

8. Makua Military Reservation (MMR)

8.1 General Description of Area

Makua Military Reservation (MMR) is located in an amphitheater-shaped valley south of Kaena Point in northwestern Oahu. Access is via Farrington Highway from the south, approximately six miles north of the town of Makaha (pop. 8,000) and eight miles north of Waianae (pop. 9,000). The installation extends from the Farrington Highway on the coast to the Waianae Mountain ridgeline to the northwest (Figure 1.a). Neighboring lands along the ridgeline consist of the Kuakola Forest Reserve, Mokuleia Forest Reserve, and Pahole Natural Area Reserve. The southern boundary follows an east-west ridge bordering private lands and the Makua Keaau Forest Reserve.

MMR comprises 1,696 ha (4,190 ac), of which 1,310 ha (3,236 ac) are ceded, 317 ha (782 ac) are leased from the state of Hawaii (DA-94-626-ENG-79), 0.6 ha (1.6 ac) are licensed, and 69 ha (170 ac) are fee simple (USACE and Nakata Planning Group 2000). Non-military uses are limited at MMR due to the safety hazard of the impact area, unexploded ordnance, and risks to rare and endangered plant species. The elevation of the valley floor of MMR ranges from 6 to 122 m (20 to 400 ft) while the steep Waianae Mountain ridgeline cliffs bordering the area range from 640 to 915 m (2,100 to 2,900 ft)(USACE and Nakata Planning Group 2000). The reservation includes Makua Valley, Kahanahaiki Valley and Koiahi Gulch. Average inland precipitation at higher elevations in the upper valley is affected by the rainshadow of the Waianae Mountains, but it still receives 1,270 mm (50 inches) compared to 381 mm (15 inches) near the coast (USACE and Nakata Planning Group 2000). Overall the average annual rainfall for the area is 737 mm (29 in).

Makua is an important but nonessential part of SBCT training. The primary live fire training area for the SBCT will be the Schofield Barracks Battle Area Complex (BAX). SBCT forces will use Makua after the completion of the Makua Environmental Impact Statement (EIS) and Record of Decision if the range is available. Makua will greatly facilitate dismounted CALFEX (combined arms live-fire exercise) throughput and flexibility for all divisional units. The Makua EIS will analyze the potential environmental impacts associated with dismounted CALFEXs which will be similar in scale, scope, and weapons employed for both legacy and SBCT units.

MMR will not be addressed further in this BA because SBCT Transformation training at MMR will not alter the way that training will be conducted and the impacts to species associated with that training. Stryker vehicle maneuver will not be conducted at MMR. The impacts of routine military training were already addressed in Section 7 consultation with the U.S. Fish and Wildlife Service which rendered "no jeopardy" biological opinions in 1999 and subsequent reinitiating of consultation for additional species found in the action area.

9. Schofield Barracks East Range (SBER)

9.1 General Description of Area

Schofield Barracks East Range (SBER) is located in central Oahu, approximately 3 miles north of Mililani (pop. 30,000) and 8 miles southeast of Haleiwa (pop. 3,000) (Figure 1.a). The town of Wahiawa (pop. 18,000) is located along the northwestern boundary of SBER. Primary access to SBER is via H-2 and Kamehameha Highway, which separates SBER from Schofield Barracks Main Post. SBER extends east of Kamehameha Highway to the crest of the Koolau Mountain Range, where it borders the Kahana Valley State Park. SBER is bordered on the north by Kawailoa Training Area and on the south by private agricultural and forest lands.

SBER comprises 2,086 ha (5,154 ac), all of which are ceded (USACE and Nakata Planning Group 2000). It is located in the Kawailoa uplands on the leeward side of the 732 m (2,400 ft) Koolau Mountains. Non-military uses are permitted and include archery, hiking, fishing, and hunting. The western portion of SBER is mostly gently sloping open areas with mixed cover of grass, shrubs and native trees, separated by steep drainages. The eastern portion of SBER is extremely rugged and densely forested, with limited road access (USACE and Nakata Planning Group 2000). The annual average precipitation recorded at 354 m elevation in the Koolau Mountains at SBER Koolau Dam weather station was 314 cm (123.5 in).

9.2 Current Military Training

East Range provides training lands for the 25th ID (L) and for tactical field exercises of other Army and U.S. Marine Corps units. Primary users of SBER include Army, Marine Corps, HI Army National Guard, and Army Reserve Units[33]. East Range contains 2,050 ha (5,067 ac), 776 ha (1,917 ac) of which are considered suitable for maneuver training (USACE and Nakata 2002). The western maneuver area on East Range is valuable for rappelling, jungle survival, and patrolling operations. Several open areas are used for Air assault and airborne operations. Unit uses include limited battalion and company-level training missions including maneuver and bivouac activities. Climate, terrain, and vegetation provide excellent training for Pacific and Asian Theatre of Operational readiness. The eastern portion of East Range has extremely rugged terrain and is densely forested. For this reason, use of higher elevation areas including Training Areas ER-12 and ER-13 has been limited in the past (USARHAW G3/DPT Memo to Steve Kim, 9 January 2003). A summary of training types and annual usage (number of days and troops) for each training area at SBER is presented in Table 9.a. The average use of each training area ranges from 78 to 120 days per year and approximately 5,600 to 20,500 troops per year, and would continue to be used in the future at similar levels by Legacy and SBCT forces (Figure 9.a). Ammunition (blanks and pyrotechnics) usage at SBER is presented in Section 9.3.3, Non Live-Fire Maneuver and Other Training Activities.

Small unit maneuvers and combat support training include non-live-fire, mounted maneuver training with Humvees, cargo trucks, trailers, as well as foot training. Field activities, or training exercises can involve vehicle movement, maneuvers and convoys, foot maneuvers, bivouacking, and aviation training.

[33] Primary users based on 2002 Range Facility Management Support System (RFMSS) utilization data provided by USARHAW Range Division.

Table 9.a. Types of Legacy Training and Annual Legacy Usage by Training Area for SBER. (Data source: Annual RFMSS Utilization Reports for 1998-2002 obtained from G3 Range Division)

	Types of Training											1998-2002					
Area Name	Mounted maneuver*	Dismounted maneuver*	Live fire	Foot Reconnaissance	Bivouac	Deployment training	Helicopter aviation training	Air assault/movement	Parachute drops of equipment and personnel	Major force-on-force training	CSS Operations and Training**	Min Days Used	Max Days Used	Average # Days Used	Min # Troops	Max # Troops	Average # Troops
ER-1A	x	x		x	x		x	x			x	53	91	75	2781	19327	8579
ER-1B	x	x		x	x		x	x			x	53	105	79	2648	23789	10121
ER-2	x	x		x	x		x	x			x	58	116	89	3303	19554	9753
ER-3A	x	x		x	x		x	x			x	97	156	113	6501	24409	14044
ER-3B	x	x		x	x		x	x			x	102	171	126	7737	24464	15438
ER-4	x	x		x	x		x	x			x	75	104	85	4561	25294	10314
ER-5	x	x		x	x		x	x			x	101	127	115	8424	26645	12798
ER-6A	x	x		x	x		x	x			x	87	121	109	7459	20912	11944
ER-6B	x	x		x	x		x	x			x	89	125	112	8013	20815	12131
ER-10	x	x		x	x		x	x			x	112	159	139	9524	16216	11911
ER-11	x	x		x	x		x	x			x	88	124	105	6737	19214	10983
ER-12		x		x	x		x	x				61	100	82	3403	17839	8705
ER-13		x		x	x		x	x				34	60	47	1676	8114	5067
LIGHTNING - DZ	x	x		x			x	x	x			121	147	132	2298	3422	2712
ITALY - LZ		x		x			x	x				1	7	4	6	130	47
KU TREE - LZ		x		x			x	x				8	34	18	248	1799	903
LOWER 36 - LZ		x		x			x	x				2	22	14	20	1268	608
LOWER 72 - LZ		x		x			x	x				2	3	3	20	90	55
UPPER 72 - LZ		x		x			x	x				3	3	3	282	282	282
UPPER 36 - LZ		x		x			x	x				13	73	36	865	1469	1196
Average Training Area Use												78	120	98	5597	20507	10907

* Mounted and dismounted use may be very limited by topography and road access. See vehicle maneuver probability analysis for acreages available in each TA.

** Landing and drop zone assault and movement exercises may involve vehicle support and off-road travel where roads exist.

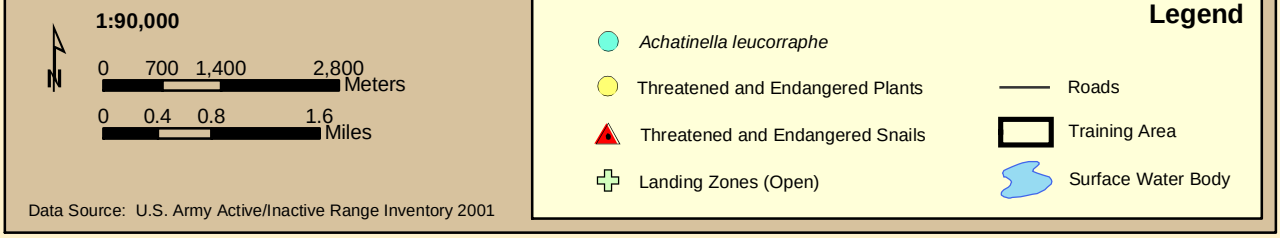
*** Usage estimates for ER-12 and ER-13 (and others) may be inflated since relatively small sections of road go into these areas and therefore require scheduling.

Training Areas

Schofield Barracks East Range, Oahu

Figure 9a

Maps to sensitive resources have been removed from this document
Contact sjoe@hawaii.edu to request access



Data Source: U.S. Army Active/Inactive Range Inventory 2001

Vehicle maneuvers are constrained by topography and vegetation (and other applicable constraints), whereas foot maneuvers occur anywhere that safety or administrative restrictions permit including the high probability vehicle maneuver areas. Pyrotechnics use occurs anywhere that dismounted (and/or mounted) training occurs in accordance with rules for pyrotechnics use at SBER. Much of the dismounted maneuvers such as land navigation take place at lower elevations. Rappelling training usually occurs on short cliffs near roads and at the rappelling tower facility at SBER. No rappelling is done in training area ER-13. Reconnaissance units may travel along ridgelines in the upper areas of ER-12 and ER-13.

Vehicle maneuvers are limited to the western portion of East Range by steep terrain and dense woody vegetation. There are no areas that can support off-road vehicle travel in ER-12 and ER-13. High-probability off-road vehicle maneuver areas include 214 ha (530 ac) out of a total area of approximately 2,727 ha (6,739 ac) in SBER (Table 9.b). Training areas 1A, 2, 5 and 10 have the most high probability area. A few very small and disjunct areas that met maneuver criteria are remote and inaccessible to vehicles, and therefore are not used. Nearly all vehicle travel, and a high proportion of dismounted training occurs within the high probability areas. These areas (i.e., locations of use) are the same for Legacy and SBCT training. This information was obtained from the analysis outlined in Section 3.1.2.1, Delineation of High-Probability Off-Road Vehicle Maneuver Areas. Legacy forces operate wheeled vehicles on existing roads and trails, as well as on off-road areas suitable for maneuver. Existing roads traverse portions of the higher eastern training areas 12 and 13, and account for some of the usage documented for those training areas. There is currently no vehicle wash rack at East Range.

The following rules for allowable and prohibited live fire and pyrotechnics use apply at East Range:

Restrictions

- Small arms (5.5.6 mm and 7.62 mm) blank ammunition is permitted throughout East Range, with the exception of training areas 1A, 1B, 2, 3A, and 3B during the hours of 1800-0600 daily. Noise producing simulators or pyrotechnics are not authorized in these areas at any time.
- Fog oil generation is allowed in permitted in ER-6B, 11, 12, and 13 only. This training is done on roads.
- CS grenades are not authorized.

Pyrotechnics

- The use of pyrotechnics and simulators (including demolition effects simulators – DES) requires approval from Range Division Hawaii (RDH) Range Operations.
- RDH may restrict the use of pyrotechnics based on the Fire Danger Rating System (FDRS) for East Range.
- Pyrotechnics, including smoke grenades, HC/TA smoke are authorized in all training areas except 1A, 1B, 2, 3A, and 3B.
- No aerial pyrotechnics (star clusters/parachute flares) are permitted on East Range.
- Range Division Hawaii (RDH) will authorize and apply safety buffer zones for HC (Hexachloroethane) smoke. [34]
- Colored smoke grenades allowed in ER-5, ER-6A, ER-6B, ER-10, ER-11, ER-12, and ER-13.
- Smoke grenades will only be used in areas cleared of debris and grass that might provide fuel to start a fire.

All ignition sources will be controlled by the FDRS.

[34] Buffer information is listed in 25th ID(L) and USARHAW Regulation 210-6, Appendix F.

Table 9.b. Area of High-Probability Off-Road Vehicle Maneuver in Each Training Area at East Range.*						
Training Area	**High Probability Area (hectares)**	**High Probability Area (acres)**	**Remainder of Training Area (hectares)**	**Remainder of Training Area (acres)**	**Training Area Total (hectares)**	**Training Area Total (acres)**
Air Assault/JTC	10	24	16	39	32	79
Cantonment	1	1	136	336	191	473
Confidence Course	8	19	13	32	26	64
ER-10	20	49	67	166	114	282
ER-11	6	15	101	249	148	365
ER-12	2	4	332	819	467	1155
ER-13	1	2	706	1743	992	2451
ER-1A	14	34	36	90	65	161
ER-1B	9	21	16	40	31	78
ER-2	28	70	37	90	80	197
ER-3A	9	23	24	61	44	108
ER-3B	11	27	56	138	90	222
ER-4	5	13	64	158	95	234
ER-5	44	108	50	124	114	282
ER-6A	10	24	24	59	43	106
ER-6B	5	11	52	127	77	190
ER-9	2	6	35	87	52	128
Italy	0	1	0	0	0	1
Ku Tree	4	10	0	0	4	10
Ku Tree Training	3	7	25	62	38	94
Lower 36	13	31	0	0	13	31
Lower 72	1	1	0	0	1	1
Upper 36	10	24	0	0	10	24
Upper 72	1	3	0	0	1	3
Totals	214	530	1789	4420	2727	6739

* Analysis procedure is described in Section 3.1.2.

The average use of the East Range consisted of 5 vehicles during 141 days in year 2000. Once every two years, a major training exercise is held on the range. The exercise runs for two weeks and approximately 200 vehicles are utilized each day (Source: 1391 for Wash Rack formerly proposed for East Range). Aviation training consists of air assault school training, aviator training missions (ATMs), and air assault operations on a daily basis. Night operations occur approximately eight times per week. In addition to flight training, fixed wing aircraft and helicopters provide support for drop and landing zone activities, respectively.

9.3 Proposed Transformation Actions at SBER

9.3.1 Construction

Tactical Vehicle Wash (57416). This project would construct a tactical vehicle wash facility with six wash stations with a new off-site water system (Figure 9.b). The water system would consist of two pump

Proposed Location of Tactical Vehicle Wash and Fixed Tactical Internet Antenna, East Range, Oahu

Figure 9b

Maps to sensitive resources have been removed from this document
Contact sjoe@hawaii.edu to request access

1:91,000

0 900 1,800 3,600 Meters

0 0.5 1 2 Miles

Data Source: HINHP 2002, RCUH 2002a

Legend

- Fixed Tactical Internet Antenna
- Threatened and Endangered Plants
- Threatened and Endangered Snails
- Roads
- Action Area
- Tactical Vehicle Wash
- Installation Boundary
- Surface Water Body

stations, each with motors and controls. A mid point pump station would be provided with a tank with level controls to control operation of pumps. Pumps and tank would be installed inside a pump house with natural ventilation. The wash stations would be sized to support an 18.3-m (60 ft) long by 3.7-m (12 ft) wide vehicle. The primary facility would consist of the preparation area and wash stations. The wash stations would utilize a high-pressure wash system and recycle water to minimize wastewater disposal. The water would flow through a water sediment basin, an equalization basin, oil-water separators, and then be deposited into a water supply reservoir. Treatment would include oil and grease removal, grit removal and organic control. A mechanical equipment building would be provided to house the mechanical secondary treatment units and the control panels necessary for the facility. Sediment recovered from the facility would be disposed of off site. The structure will be approximately 12 m (40 ft) by 9 m (30 ft) in size. Supporting facilities include utilities, paving, fencing, curbing and site improvements. Concrete curb would be provided at the wash facility to control the flow of wastewater. Trench drains would lie perpendicular, at the center of the wash station, and extend the entire width of the facility.

The project is required to help prevent the spread of non-native and invasive plant seeds to other areas outside of East Range and to reduce the amount of soil that may be tracked onto the public highway system. The facility will remove seeds and large clumps of soil that may have accumulated on the vehicles during maneuvers in the training area.

Fixed Tactical Internet (FTI)
Construction of two fixed tactical internet antenna support structures with four antennas each is proposed to provide tactical communications infrastructure enabling units to train at any hour of the day or night without deploying to the field (Figure 9.b). When linked to the installation information infrastructure architecture (I3A), FTI could also provide connectivity for command and control integration of live-fire and simulation training. FTI is a group of antennas placed strategically throughout a training land parcel. The antennas permit sending and receiving of voice and data signals to radios in military vehicles.

Four antennas will be installed at each proposed site located on Oahu. Existing antenna support structures and sites will be utilized when possible. The antennas are vertical whips approximately two inches in diameter. Two antennas approximately 1.2 m (4 ft) long and two approximately 3 m (10 ft) long will be mounted on an antenna mast, utility pole, existing support structure, or building. Some of the antennas may have a red light at the top, in accordance with FAA guidelines, to warn nearby aircraft. Each site will be 6.1 x 7.6 m (20 x 25 ft), including a 4.6 x 6.1 m (15 x 20 ft) concrete pad for the support structure and shed. Each site will be fenced and accessed via existing roads in all cases. Personnel will visit the sites prior to and after Army training events. No security lighting will be installed at the sites. Equipment sheds will house radios and batteries. The two FTI structures at East Range are East Range 1 (31 m (102 ft) in height, new support structure, new equipment shed) and East Range 2 (31 m (102 ft) in height, new support structure, new equipment shed).

9.3.2 Live-Fire Training

No live-fire exercises would be conducted on East Range.

9.3.3 Non Live-Fire Maneuver and Other Training Activities

Only blank ammunition will be used in a variety of field training exercises. Blank ammunition estimates under Legacy and Transformation for East Range are presented in Table 9.c. The rules for allowable and prohibited live fire and pyrotechnics use at East Range would remain unchanged (see Section 9.1.2).

Table 9.c.Comparison of Current and Transformed Ammunition Usage by Range for SBER*.

	FY 05 Projection Un-Transformed (Current)			FY 05 Projection Transformed			Net Difference With Transformation
Ammunition Type	2 Legacy Brigades - One Training Area	Other Units	Total for All Training Areas Listed	1 Legacy Brigade & 1 SBCT - One Training Area	Other Units	Total for All Training Areas Listed	All Rounds
TA 1A, 1B, 2, 3A, 3B, 4							
5.56mm Blank	71822	0	430934	43802	0	262814	-168120
7.62mm Blank	7072	0	42434	6131	0	36784	-5651
.50 Cal. Blank	612	0	3672	2385	0	14310	10638
Pyro	0	0	0		0	0	0
Pyro-Smoke	0	0	0		0	0	0
TA 5							
5.56mm Blank	71822	0	71822	43802	0	43802	-28020
7.62mm Blank	7072	0	7072	6131	0	6131	-942
.50 Cal. Blank	612	0	612	2385	0	2385	1773
Pyro	938	0	938	877	0	877	-61
Pyro-Smoke	62	0	62	35	0	35	-27
TA 6A							
5.56mm Blank	71822	0	71822	43802	0	43802	-28020
7.62mm Blank	7072	0	7072	6131	0	6131	-942
.50 Cal. Blank	612	0	612	2385	0	2385	1773
Pyro	940	0	940	877	0	877	-63
Pyro-Smoke	62	0	62	35	0	35	-27
TA 6B							
5.56mm Blank	71822	0	71822	43802	0	43802	-28020
7.62mm Blank	7072	0	7072	6131	0	6131	-942
.50 Cal. Blank	612	0	612	2385	0	2385	1773
Pyro	940	0	940	877	0	877	-63
Pyro-Smoke	62	0	62	35	0	35	-27
TA 7,8,9							
5.56mm Blank	35911	0	107734	43802	0	131407	23674
7.62mm Blank	3552	0	10657	6131	0	18392	7735
.50 Cal. Blank	306	0	918	2385	0	7155	6237
Pyro	0	0	0	0	0	0	0
Pyro-Smoke	0	0	0	0	0	0	0

Table 9.c.Comparison of Current and Transformed Ammunition Usage by Range for SBER*.

	FY 05 Projection Un-Transformed (Current)			FY 05 Projection Transformed			Net Difference With Transformation
Ammunition Type	2 Legacy Brigades - One Training Area	Other Units	Total for All Training Areas Listed	1 Legacy Brigade & 1 SBCT - One Training Area	Other Units	Total for All Training Areas Listed	All Rounds
TA 10							
5.56mm Blank	35911	0	35911	43802	0	43802	7891
7.62mm Blank	3552	0	3552	6131	0	6131	2578
.50 Cal. Blank	306	0	306	2385	0	2385	2079
Pyro	940	0	940	877	0	877	-63
Pyro-Smoke	62	0	62	35	0	35	-27
TA 11							
5.56mm Blank	71822	0	71822	43802	0	43802	-28020
7.62mm Blank	7072	0	7072	6131	0	6131	-942
.50 Cal. Blank	612	0	612	2385	0	2385	1773
Pyro	940	0	940	877	0	877	-63
Pyro-Smoke	78	0	78	35	0	35	-43
TA 12							
5.56mm Blank	71822	0	71822	43802	0	43802	-28020
7.62mm Blank	7072	0	7072	6131	0	6131	-942
.50 Cal. Blank	612	0	612	2385	0	2385	1773
Pyro	940	0	940	877	0	877	-63
Pyro-Smoke	78	0	78	35	0	35	-43
TA 13							
5.56mm Blank	71822	0	71822	43802	0	43802	-28020
7.62mm Blank	7072	0	7072	6131	0	6131	-942
.50 Cal. Blank	612	0	612	2385	0	2385	1773
Pyro	940	0	940	877	0	877	-63
Pyro-Smoke	78	0	78	35	0	35	-43

* This comparison of current and transformed ammunition usage is projected for FY 05 based on Draft STRAC (Standards in Training Commissions) information. Information for "Other 25ID", "USMC", and "Other" was compiled from 2001 RFMSS data and is used as a constant for both Un-Transformed and Transformed projections, except where use by these units is altered by changes due to range demolition/reconfiguration related to construction of new ranges (John Gallup and Associates product 10/16/02).
** Training Areas 7 and 8 are within the Cantonment Area at East Range.

Non live-fire training would be very similar to current training activities. On average, each training area is used between 78 and 120 days per year, and would continue to be used in the future at similar levels by Legacy and SBCT forces. The western portion of East Range would continue to be used for rappelling, jungle survival, and patrolling operations. Landing and drop zones would continue to be used for air assault/movement and airborne operations. Unit uses would include limited battalion and company-level training missions including maneuver and bivouac activities. Squad and platoon activities would continue in the current dispersed manner. The use of higher elevation areas in the eastern portion of East Range, including Training Areas (TA) ER-12 and ER-13, would continue to be limited for foot maneuvers by extremely rugged terrain and dense forest vegetation.

Unit uses include limited battalion and company-level missions including maneuver and bivouac activities. The breakdown of maneuver miles by training area is not available for Legacy or SBCT units. High-probability off-road vehicle maneuver areas in East Range include 214 ha (530 ac) out of a total of approximately 2727 ha (6739 ac) on the installation (Figure 9.c). The areas meeting off-road maneuver criteria are located in the Western half of East Range on broad, unforested ridges and other suitable areas. Several small areas at higher elevations in the eastern part of the installation are inaccessible to vehicles even though they are shown on the map. This information was obtained from the analysis outlined in section 3.1.2.1. As with Legacy training, most vehicle maneuver training is confined to established roads and trails, but some off-road travel could occur where trafficability and vegetation permits, typically in areas with past use. The breakdown of high-probability maneuver areas by training area is presented in Table 9.b. Legacy and SBCT units would wash vehicles using the proposed vehicle wash rack before leaving SBER.

9.3.4 Summary of Changes in Training Activities as a Result of Transformation

SBCT training will be very similar to current training activities. No live-fire exercises or other activities that significantly increase the risk of fire will occur on East Range. Regulations governing the use of pyrotechnics will remain unchanged. The number of vehicles, days of use, and personnel will likely increase with SBCT training compared to Legacy training; however, similar activities are anticipated to occur in similar areas. Use of 5.56 mm and 7.62 mm blanks is projected to decrease significantly in TAs 1A, 1B, 2, 3A, 3B, 4, 5, 6A, 6B, 11, 12, and 13, and increase significantly in TAs 7, 8, 9, and 10. Use of .50 cal blanks is projected to increase significantly in all TAs. Vehicles would be washed before leaving SBER. The proposed vehicle wash rack would therefore minimize spread of undesirable species to other training areas.

9.4 Delineation of the Action Area

9.4.1 Approach to Delineating the Action Area

The action area for SBER was determined by the impacts of fire, trampling, and exotic species introduction. Whichever impact was determined to have the farthest reaching effects in a given locale determined the extent of the action area in that segment.

9.4.2 Sections of the Action Area

The installation boundary was considered to be the extent of impacts of soldiers trampling vegetation or introducing exotic species, since no ground training will occur outside of the installation boundaries. The factors considered in delineation of the action area where fire was considered the primary threat are fuel types and man-made barriers. Buffers based on fuel types were constructed as described in Section 3.1 (Figure 9.d). The risk of fire isn't as great at SBER as it is for some of the other action areas (e.g. SBMR) because no live fire is allowed there. However, because fires can still occur, the action area assumes an average worst case scenario when determining what presents a significant barrier to fire. Areas where fire is not a concern were delineated by the potential for exotic species introduction (see Figure 9.e below).

High Probability Off-Road Vehicle Manuever Areas

Schofield Barracks East Range, Oahu

Figure 9c

Maps to sensitive resources have been removed from this document
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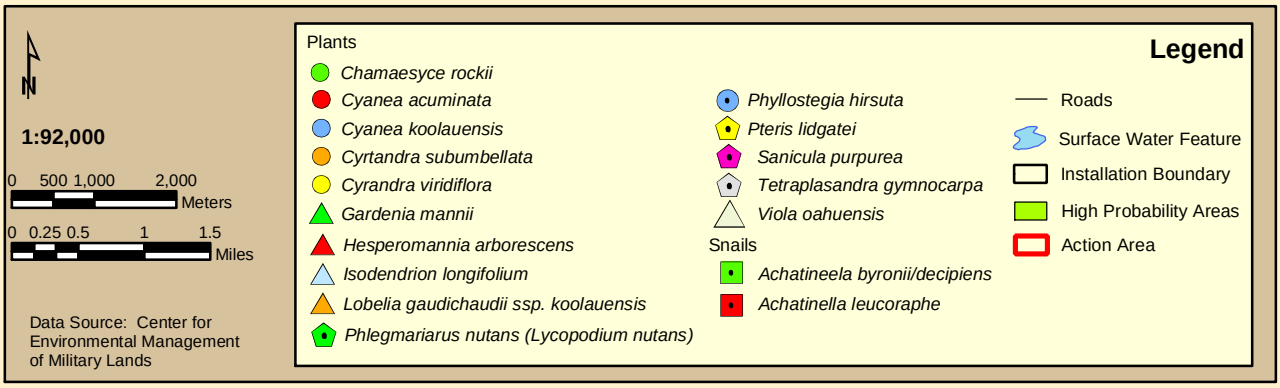
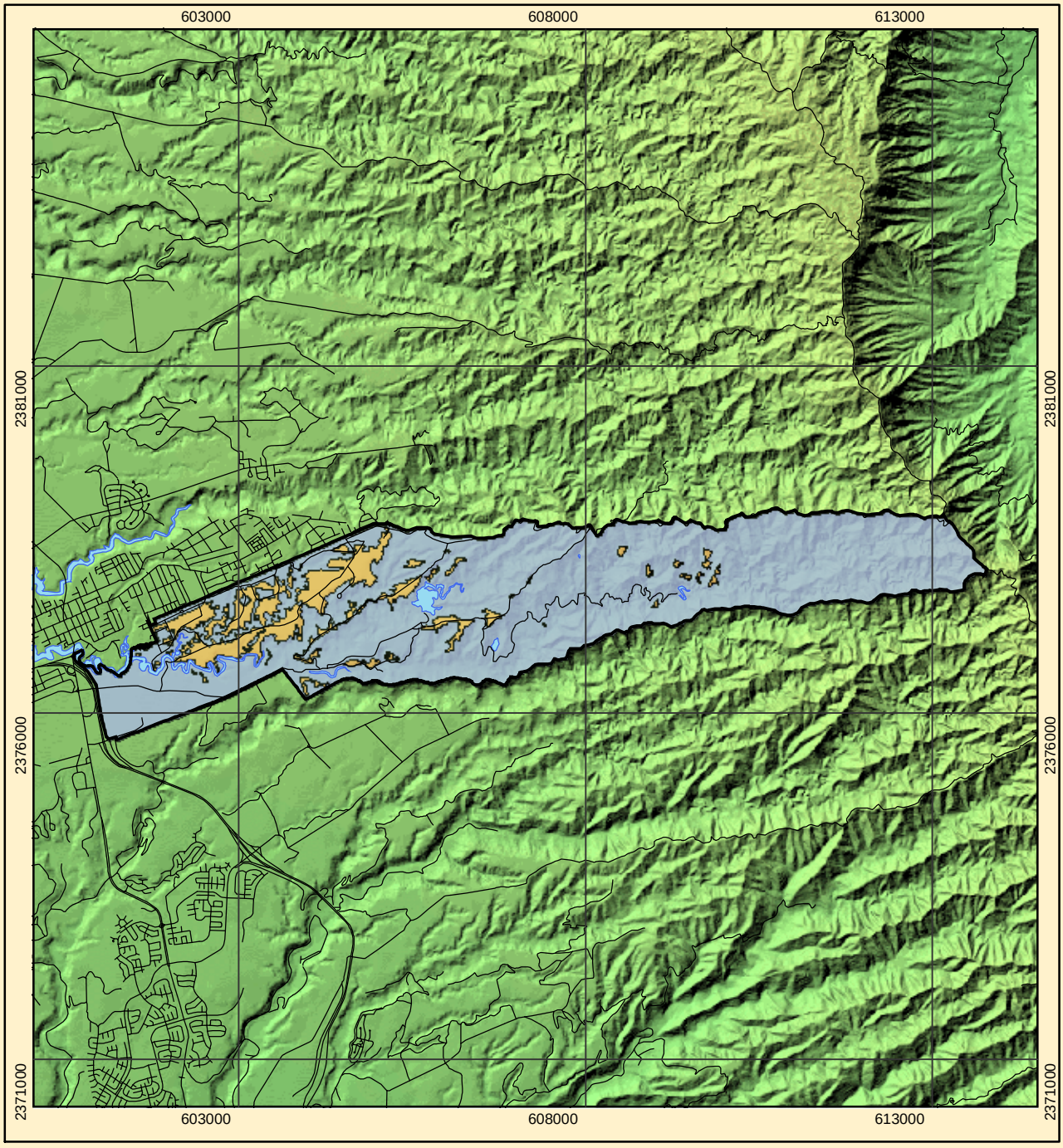


Fuel Types

Schofield Barracks East Range, Oahu

Figure 9d



1:90,388

0 550 1,100 2,200 Meters

0 0.3 0.6 1.2 Miles

Legend

Fuel Types

- Forest/Shrub
- Non forest

- Roads
- Surface Water Body
- Installation Boundary

Data Source: Center for Environmental Management of Military Lands

9.4.3 Action Area Description

Points listed below appear in Figure 9.e:

A to B – The action area follows Kahelu Avenue for approximately 2.4 km (1.5 mi). This road represents a barrier that fire is unlikely to cross. Here it intersects a fire buffer of 521 m (1710 ft) based on NFFL (Northern Forest Fire Laboratory) fuel model 8 (closed timber litter). This buffer based from the southernmost road in SBER. The action area follows this buffer until it intersects the installation boundary at point B.

B to C – With the exception of two small sections of fire buffers, the action area follows the installation boundary for the entirety of this segment. The buffers are, again, 521 meters and are based off of roads and trails well within the installation. Thus, only small portions of the buffers extend beyond the installation boundary. Most of this area is usually far too wet to carry fire.

C to D – The Koolau summit trail is the westernmost training allowed in SBER. A 100 meter buffer from the trail is used to account for potential weed introductions via soldier use.

D to E – From point D, the boundary of SBER is again used to delineate the action area. KLOA borders SBER to the north for the extent of this segment.

E to F – The action area is defined by a fire buffer of 521 meters built around the closest road, again based on NFFL fuel model 8. It follows this buffer until it reaches the outskirts of Wahiawa. It then follows the outline of the town back to the installation boundary. The highly managed nature of the fuels within Wahiawa and the existence of fire hydrants throughout make it extremely unlikely that a fire could move beyond this boundary.

F to A – Most of this segment is defined by the edge of the town of Wahiawa, which follows the installation boundary. This is a suburban area with highly modified vegetation that will not carry fire. With one exception – a small gulch with forest vegetation where the action area boundary is determined by a fire buffer – the action area follows the installation boundary until it meets the south fork of Kaukonahua Stream. This is a significant barrier to fire and defines the action area boundary until it meets H2 near the Wahiawa exit. From here it follows the interstate south to the intersection with Kahelu Avenue and point A.

9.5 Description of the Affected Biological Environment and Affected Species

Although Army training and transformation to a Stryker Brigade Combat Team takes place within the boundaries defined in the introduction (section 1.2), for purposes of this BA, and consistent with USFWS recommendations, the “action area” is considered the biological environment affected by either direct, indirect, or interrelated/interdependent effects of the proposed action.

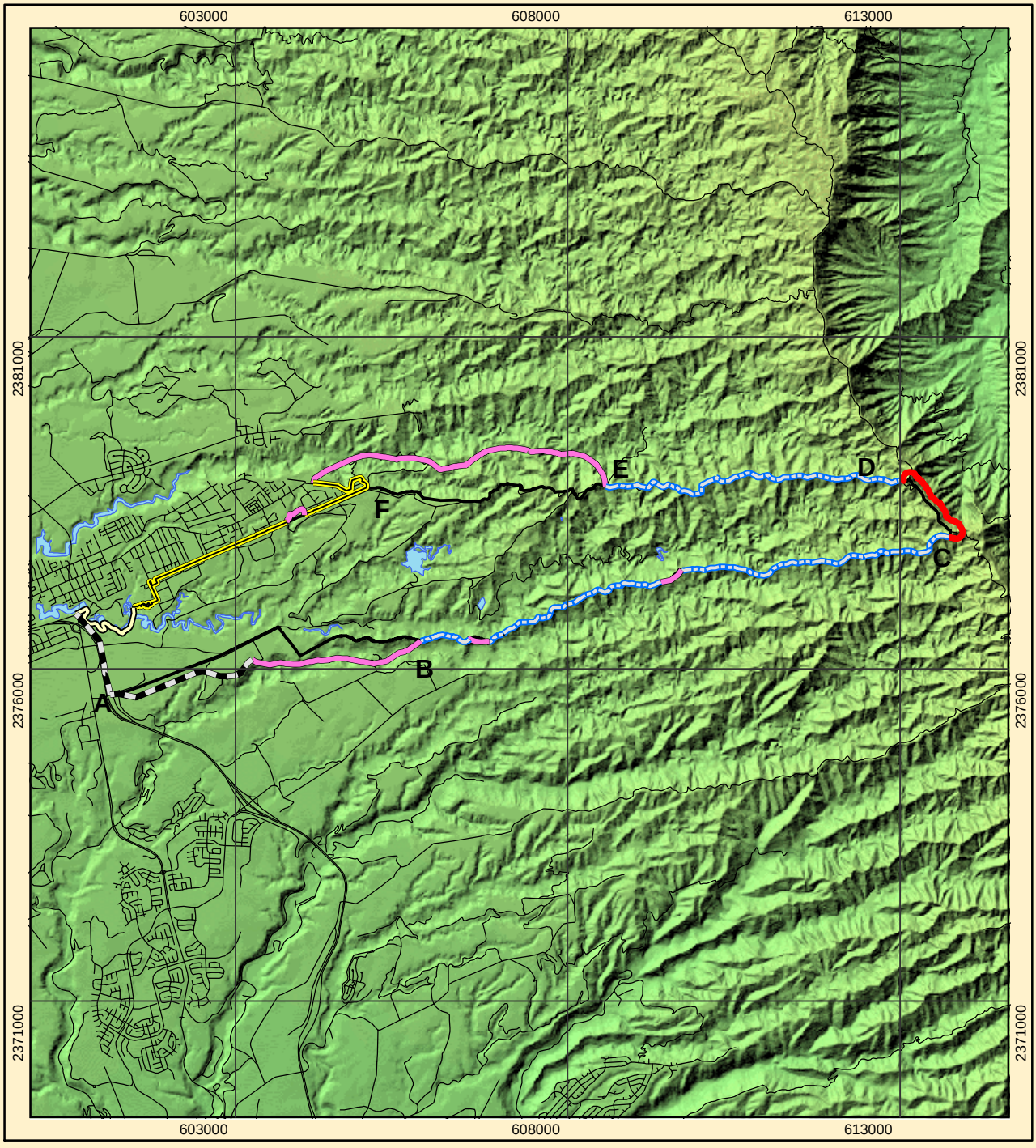
9.5.1 Ecological Zones Affected by the Action

Nine native natural community types were categorized into two ecological zones defined by elevation, topography, and prevailing ecological conditions at SBER (R.M. Towill Corp. 1997b, Hawaii Natural Heritage Program (HINHP) - The Nature Conservancy of Hawaii 1994d). The ecological zones identified

Delineation of Action Area

Schofield Barracks East Range, Oahu

Figure 9e



1:92,000

0 750 1,500 3,000 Meters

0 0.45 0.9 1.8 Miles

Data Source: Center for Environmental Management of Military Lands

Legend

Action Area Inputs
- Fire Buffer
- Installation Boundary
- Trail Use Buffer
- Residential Area
- River
- Road

- Roads
- Installation Boundary
- Surface Water Feature

at SBER include the Wet Summit Crest Zone and the Lowland Forest Zone. Only the Lowland Forest Zone will potentially be affected by Army training and transformation. The area this zone occupies is relatively small in comparison to the total size of the range, the majority of which is alien vegetation (Figure 9.f).

Wet Summit Crest Zone - Wet Summit Crest Zone communities occur at areas above 700 m (2,300 ft) at the crest of the Koolau Mountains in SBER. Gagné and Cuddihy (1990) described them between 900 and 2,200 m (2,950-7,220 ft) in areas where the annual precipitation is >250 cm (100 in). These areas are usually cool, wet, windy, and often cloud covered. The topography ranges from moderate sloping to steep cliffs. This zone does not overlap with SBER AA.

Lowland Forest Zone - Lowland Forest Zone communities occur in areas between 300 and 700 m (1,000 and 2,300 ft) in elevation in the Koolau Mountains where conditions are warm, windy, and mesic to wet. Gagné and Cuddihy (1990) described lowland wet communities between 15 and 2,000 m (50-6,600 ft) in areas where the annual precipitation is >250 mm (100 in). The natural communities include:

Koa/`Ohi`a Lowland Mesic Forest usually occurs at SBER in the Koolau Mountains below 640 m (2100 ft). The annual rainfall generally ranges from 77 to 190 cm (30-75 in).

`Ohi`a Lowland Wet Forest is found between 580 and 730 m below the summit of the Koolau Mountains at SBER**.**

- Ohi`a/Mixed Shrub Lowland Wet Forest
- `Ohi`a/`Olapa (Lapaiapa) Lowland Wet Forest
- `Ohi`a/Uluhe Lowland Wet Forest

Uluhe Lowland Wet Shrubland community commonly occurs below 670 m (2,200 ft) in moderate to steep slopes at SBER in the Koolau Mountains. The community is widespread in wet lowland areas of many of the Hawaiian Islands and is not considered rare (HINHP 1994d).

9.5.2 Federally-listed Species Affected by the Action

The first step in determining which species may be affected by routine military training and SBCT activities at Schofield Barracks East Range was to compile available rare species occurrence data for Army Lands on Oahu The resources for this data included the Army Natural Resource Geographic Information System (GIS), the Hawaii Natural Heritage Program (HINHP) Database, the USFWS recovery plans, the Makua Military Reservation Implementation Plan Draft documents and information from biological experts. Army Natural Resource Staff conducts rare plant, invertebrate, and vertebrate surveys annually to confirm existing population numbers and locate unreported populations. The most current and detailed data available was used from these various sources. Once compiled, this data was sorted by area, and a new list included only those threatened and endangered species within the designated action area for Schofield Barracks East Range. The following threatened and endangered species have historically been documented at SBER action area (AA) (see Appendix B for a complete list of rare species currently and historically recorded in SBER AA):

- 15 endangered plants
- 6 endangered tree snails
- 1 endangered birds (*Chasiempis sandwichensis* spp. *ibidis*--Oahu elepaio)
- 1 threatened plant (*Isodendrion longifolium*-Aupaka)

Ecological Zones

Schofield Barracks East Range Action Area, Oahu

Figure 9f

603000 608000 613000

Maps to sensitive resources have been removed from this document. Contact sjoe@hawaii.edu to request access

N

1:90,000

0 500 1,000 2,000 Meters

0 0.35 0.7 1.4 Miles

Data Source: Center for Environmental Management of Military Lands

Plants

- *Chamaesyce rockii*
- *Cyanea acuminata*
- *Cyanea koolauensis*
- *Cyrtandra subumbellata*
- *Cyrandra viridiflora*
- *Gardenia mannii*
- *Hesperomannia arborescens*
- *Isodendrion longifolium*
- *Lobelia gaudichaudii ssp. koolauensis*
- *Phlegmariarus nutans (Lycopodium nutans)*
- *Phyllostegia hirsuta*
- *Pteris lidgatei*
- *Sanicula purpurea*
- *Tetraplasandra gymnocarpa*
- *Viola oahuensis*

Snails

- *Achatinella byronii/decipiens*
- *Achatinella leucoraphe*

Installation Boundary

Action Area

Legend

Roads

Ecological Zones

- Lowland Mesic Forest Shrubland
- Lowland Wet Forest Shrubland
- Nonnative
- Wet Cliff

Surface Water Body

This data was subsequently sorted by date and included all threatened and endangered species occurrences from 1982 until the present in SBER AA (past 20 years). This date was agreed upon by Army Natural Resource Staff (NRS) and the USFWS, because NRS could confirm using recent extensive survey information, whether species prior to 1982 were extirpated (Kapua Kawelo, U.S. Army, pers. comm. 2002). The vertebrates were included in the list only if they were confirmed to be residents. This would exclude *Chasiempis sandwichensis* spp. *ibidis* (Oahu elepaio) recorded at SBER in the 1992. This bird observation represents a one time occurrence dating back 11 years. NRS has repeatedly surveyed these and other potential sites in SBER over the past 6-7 years looking for bird species with no success (RCUH 2002b, 2002c). Although NRS has surveyed many historic snail habitats extensively, adequate surveys throughout former snail habitats have not been completed because of the size and ruggedness of the terrain. Thus, unknown remnant snail populations may still persist in remote areas within SBER. Three of six tree snail species referred to above (*A. apexfulva, A. lila*, and *A. swiftii*), were recorded between 1953-70s and they have not been observed since that time. The following tree snail species are not currently known in the wild but still may be extant in remote or unidentified refugia within the SBER AA: *A. apexfulva*, *A. bulimoides*, *A. caesia*, *A. dimorpha, A. elegans*, *A. lila*, *A. livida, A. papracea, A. pulcherrima*, *A. rosea*, and *A. swiftii*. These species will be surveyed for by the Army in their historic ranges as outlined by HINHP (2002) and USFWS (1993), and within other potential habitats within SBER AA. Table 9.d below contains federally-listed species currently found in the SBER action area. Appendix C lists all species affected by the Oahu Army training and transformation and the designated action area or areas in which they are found.

Table 9.d Federally-listed Endangered Taxa at Schofield Barracks East Range Action Area, Hawaii.

Species Name	Number of individuals in SBER AA	Number of population/occurrences in SBER AA
Plants:		
Chamaesyce rockii	25	1
Cyanea acuminata	2	1
Cyanea koolauensis	9	1
Cyrtandra subumbellata	6	1
Cyrtandra viridiflora	1	1
Gardenia mannii	2	1
Hesperomannia arborescens	46	2
Isodendrion longifolium	10	1
Lobelia gaudichaudii ssp. *koolauensis*	50-80	1
Phlegmariarus nutans (Lycopodium nutans)	1	1
Phyllostegia hirsuta	21	1
Pteris lidgatei	15	1
Sanicula purpurea	22	1
Tetraplasandra gymnocarpa	3	2
Viola oahuensis	5	1
Snails:		
Achatinella byronii/decipiens	14	3
Achatinella leucoraphe	1	1
Achatinella sowerbyana	1	1

Federally-listed Species Descriptions

See Appendix D for definitions of the components of the species descriptions which follow.

Scientific name: *Chamaesyce rockii* Croizat & Degener

Common name: `Akoko, koko, kokomalei
Family: Euphorbiaceae (Spurge family)
Federal status: Endangered
Life history: Short-lived perennial

Current status: There are 11 known populations/occurences of 561-621 *C. rockii* plants (RCUH 2002b). One population with 25 individuals occurs at Schofield Barracks East Range (RCUH 2002a). This population is located on South Kaukonahua-Kahana summit area between 707 and 732 m (2320-2400 ft) north of Puu Kaaumakua in the Koolau Mountains. Individuals that fall within the SBER AA represent about 4% of the total remaining individuals of this species (Figure 9.f) (HINHP 2002). There is one population/occurrence of >50 plants that is considered stable outside of the Army AAs, located in the Kaluanui vicinity (USFWS 1998a).

Potential Threats from Army Training and Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest and shrub location of the SBER AA where *C. rockii* grows (Figure 9.f), but there is no fire threat in this area (Figure 9.g). The threat from foot traffic trampling is very low, insignificant and discountable for trees and shrubs, unless they are seedlings. The seedlings from these population occurrences have a low threat from foot traffic trampling (Figure 9.h). These results suggest that *C. rockii* is vulnerable to alien plant introductions and *C. rockii* seedlings are vulnerable to trampling from foot traffic resulting from military activities in the SBER AA.

For the complete species description, go to Federally-listed Species Affected by the Action at KLOA (**Section 7.5.2**).

Fire Vulnerability
Schofield Barracks East Range Action Area, Oahu

Figure 9g

Maps to sensitive resources have been removed from this document. Contact sjoe@hawaii.edu to request access

Figure 9h Page 204 removed

Scientific Name: *Cyanea acuminata* Hillebr.

Common Name: `Oha, haha, `ohawai
Family: Campanulaceae (Bellflower family)
Federal Status: Endangered
Life history: Short-lived perennial

Current Status: There are 15 known populations of 100 *C. acuminata* individuals remaining (USFWS 1998a; RCUH 2001). There is one known population/occurrence of 2 individuals in SBER AA (RCUH 2002a, 2002c), located near South Kaukonahua Stream at 561 m (1840 ft) elevation in the southeast corner of the subinstallation in Koolau Mountains (HINHP 2002; RCUH 2002a) (Figure 9.f). Individuals that fall within the SBER AA represent 2% of the total remaining individuals of this species. There are no stable populations of >50 plants outside of the Army AAs.

Potential Threats from Army Training and Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest location of the SBER AA where *C. acuminata* grows (Figure 9.f). The fire threat is low for *C. acuminata* population/occurrences in the SBER AA (Figure 9.g). The threat from foot traffic trampling for these small shrubs is low in the SBER AA (Figure 9.h). These results suggest that *C. acuminata* is vulnerable to alien plant introductions and fire resulting from military activities, and seedlings and small *C. acuminata* are vulnerable to trampling from foot traffic in the SBER AA

For the complete species description, go to Federally-listed Species Affected by the Action at KLOA (**Section 7.5.2**).

Scientific Name: *Cyanea koolauensis* Lammers, Givnish & Sytsma

Common Name: *Haha, ohawai*
Family: Campanulaceae (Bellflower family)
Federal Status: Listed endangered
Life history: Short-lived perennial

Current Status: There are approximately 16 known populations/occurrences of 80 in the Koolau Mountains (USFWS 1998a; RCUH 2002b) (note: state number may need to be recalculated because they came from the recovery plan, which did not include any of these individuals in the tally; Kawelo, U.S. Army, pers. comm. 2003). They occur from the Waimea-Malaekahana Ridge to Hawaii Loa Ridge in the Koolau

Mountains (HINHP 1997). Nine individuals from one population/occurrence is found near South Kaukonahua Stream or Gulch in the SBER AA (Figure 9.f) (HINHP 2002; RCUH 2002a, 2002c). They represent about 11% of the total remaining individuals of this species. There are no stable populations > 50 of *Cyanea koolauensis* individuals outside the Army AAs.

Potential Threats from Army Training and Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest and shrub location of the SBER AA where *C. koolauensis* grows (Figure 9.f) and the fire threat is low for *C. koolauensis* there (Figure 9.g). The threat from foot traffic trampling is very low, insignificant and discountable for trees and shrubs, unless they are seedlings. The seedlings from these population occurrences have a low threat from foot traffic trampling (Figure 9.h). These results suggest that *C. koolauensis* is vulnerable to alien plant introductions and fire resulting from military activities, and *C. koolauensis* seedlings are vulnerable to trampling from foot traffic in the SBER AA

For the complete species description, go to Federally-listed Species Affected by the Action at KTA (**Section 6.5.2**).

Scientific Name: *Cyrtandra subumbellata* St. John & Storey

Common Name: Ha`iwale, kanawao ke`oke`o
Family: Gesneriaceae (African violet family)
Federal Status: Endangered
Life history: Short-lived perennial

Description and Biology: *Cyrtandra subumbellata* is a shrub, 2 to 3 m tall with opposite leaves. The leaves are suborbicular to ovate, 12 to 39 cm (4.7 to 15.4 in) long and 3 to 19 cm (1.2 to 7.5 in) wide with textured surfaces. The white flowers are 18 to 20
mm (0.7 to 0.8 in) long and form dense umbelliform cymes of 5 to 15 flowers. The white berries are 1.0 to 1.5 cm (0.4 to 0.6 in) long and ovoid shaped (Wagner et al. 1990).

This long-lived perennial has been observed in fruit in September (USWFS 1998a). No other information is available on reproductive cycles, longevity, specific environmental requirements, or limiting factors.

Known Distribution: Historically, *C. subumbellata* was known from six populations scattered through the north-central Koolau Mountains from Kaluanui to Waiahole valleys, Oahu (USFWS 1998a).

Population Trends: Population sizes and ranges have been declining.

Current Status: Currently, *C. subumbellata* is known from three populations in the North and Central Ko`olau Mountains (RCUH 2002b) totaling 108 individuals: 2 individuals from Schofield-Waikane Trail, individuals from Kaukonahua drainage, and > 100 individuals from Punaluu Rim (RCUH 2002a; HINHP 2002; Kawelo, U.S. Army, pers. comm. 2003; Lau, HINHP, pers. comm. 2003). The latter represents a new population discovered since the recovery plan was published. The 6 individuals from South Kaukonahua Drainage are located in the southeast corner of SBER AA, between 561 and 567 m (1840 and 1860 ft) elevation (Figure 9.f) (HINHP 2002; RCUH 2002a). Individuals that fall within the SBER AA represent about 6% of the total remaining individuals of this species. The population/occurrence from Punaluu Rim is the only stable population of >50 plants outside of the SBER AA.

Habitat: This species typically grows on moist, forested slopes or gulch bottoms dominated by ohia or a mixture of ohia and uluhe, between 460 and 670 m (1,500 and 2,200 ft) in elevation (USFWS 1996b). Associated plants include uki, *Boehmeria grandis* (akolea), kanawao, and the ferns, *Thelypteris sandwicensis* and *Tectaria cicutaria* ssp. *gaudichaudii* (HINHP 1997; USFWS 1996b; St. John 1966; Wagner et al. 1990).

Taxonomic Background: *C. subumbellata* is endemic to the central Koolau Mountains of Oahu.

Outplanting Considerations: *C. subumbellata* should only be outplanted within its known range. To avoid unnatural hybridization *C. subumbellata* should not be planted adjacent to other *Cyrtandra* species.

Current Threats: The major threats to *C. subumbellata* are competition with the noxious alien plant Koster's curse (*Clidemia hirta*), impacts from military activities, and predation by rats and slugs (USFWS 1998a). The remaining populations are small and widely dispersed which puts the species at risk of extinction from naturally occurring events and/or lack of reproductive vigor (USFWS 1996b).

Potential Threats from Army Training and Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest and shrub location of the SBER AA where *C. subumbellata* grows (Figure 9.f) and the fire threat is low for *C. subumbellata* there (Figure 9.g). The threat from foot traffic trampling is very low, insignificant and discountable for trees and shrubs, unless they are seedlings. The seedlings from these population occurrences have a low threat from foot traffic trampling (Figure 9.h). These results suggest that *C. subumbellata* is vulnerable to alien plant introductions and fire resulting from military activities, and *C. subumbellata* seedlings are vulnerable to trampling from foot traffic in the SBER AA

Scientific name: *Cyrtandra viridiflora* St. John & Storey

Common name: No common name
Family: Gesneriaceae (African violet family)
Federal status: Listed endangered
Life history: Short-lived perennial

Current status: Presently, there are approximately 8 population/occurrences of 52-53 *C. viridiflora* individuals known (USFWS 1998a). They are restricted to the northern Koolau Mountains at the Kawainui-Laie summit divide, Kawainui-Kaipapau summit, Maakua-Kaipapau Ridge, and the Peahinaia Trail (USFWS 1998a). There is one individual from one population/occurrence known at SBER AA (RCUH 2002a), located near South Kaukonahua Stream in the southeast corner of the subinstallation (HINHP 2002) (Figure 9.f). This individual represents 2% of the total remaining individuals of this species. There are no stable populations of > 50 *C. viridiflora* individuals outside the Army AAs.

Potential Threats from Army Training and Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest and shrub location of the SBER AA where *C. viridiflora* occurs (Figure 9.f) and the fire threat is low (Figure 9.g). The threat of

trampling from foot traffic is low for *C. viridiflora* in the SBER AA (Figure 9.h). These results suggest that *C. viridiflora* is vulnerable to alien plant introductions, fire, and foot traffic trampling resulting from military activities in the SBER AA.

For the complete species description, go to Federally-listed Species Affected by the Action at KLOA (**Section 7.5.2**).

Scientific Name: ***Gardenia mannii* St. John and Kuykendall**

Common Name: Nanu, nau
Family: Rubiaceae (Coffee family)
Federal Status: Endangered
Life history: Short-lived perennial

Current status: There are 28 populations/occurrences of *Gardenia mannii* on Oahu consisting of 70-100 plants (USFWS 1998a); however the number of unrecorded plants is probably large, particularly in the wet forests of the Koolau Mountains (RCUH 2002c). The majority of the population/occurrences contain fewer than five individuals (USFWS 1998a). They are distributed along a 42-kilometer (26-mile) length of the Koolau Mountains, from Kaunala Gulch and Kaunala-Waimea Ridge in the north to Palolo in the south and along a 7-km (4-mi) distance in the Waianae Mountains from north Haleauau Valley to Kaluaa Gulch (HINHP 1997). Two plants from one population/occurrence are found in SBER AA (RCUH 2002a) at about 660 m (2160 ft) elevation along South Kaukonahua Gulch (Figure 9.f) (HINHP 2002). These individuals represent >1% of the total remaining individuals of this species. There are no stable populations of > 50 *G. mannii* individuals outside the SBER AA.

Potential Threats from Army Training and Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest and shrub location of the SBER AA where *G. mannii* grows (Figure 9.f). The fire threat is low for *G. mannii* in SBER AA (Figure 9.g). The threat from foot traffic trampling is very low, insignificant and discountable for trees and shrubs, unless they are seedlings. The seedlings from these population occurrences have a low threat along South Kaukonahua Gulch (Figure 9.h). These results suggest that *G. mannii* is vulnerable to alien plant introductions, fire, and seedlings are vulnerable to trampling from foot traffic resulting from military activities in the SBER AA

For the complete species description, go to Federally-listed Species Affected by the Action at KTA (**Section 6.5.2**).

Scientific name: *Hesperomannia arborescens* A. Gray

Common Name: None known
Family: Asteraceae (Sunflower family)
Federal Status: Endangered
Life history: Long-lived perennial

Current Status: Currently, this species is known from at least 15 population/occurrences totaling 127 individuals on the islands of Oahu, Molokai, and Maui (USFWS 1998a; RCUH 2002a; HINHP 2002). It is considered extinct on Lana`i and rare on other islands (Wagner 1990; USFWS 1998a). There are 46 plants from two population/occurrences in the SBER AA, located in South Kaukonahua Gulch between 540 and 600 m (1770 -1960 ft) elevation in the eastern portion of the action area in the Koolau Mountains (Figure 9.f) (RCUH 2002a, HINHP 2002; Kawelo, U.S. Army, pers. comm. 2003; Lau, HINHP, pers. comm. 2003). Individuals that fall within the SBER AA represent about 36% of the total remaining individuals of this species. There are no stable populations of > 25 *H. arborescens* located outside of the Army action areas.

Potential Threats from Army Training and Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest and shrub location of the SBER AA where *H. arborescens* grows (Figure 9.f). The fire threat is low for *H. arborescens* in SBER AA (Figure 9.g). The threat from foot traffic trampling is very low, insignificant and discountable for trees and shrubs, unless they are seedlings. There are juveniles and seedlings in these populations (RCUH 2001). The seedlings from these population occurrences have a low to moderate threat from foot traffic trampling (Figure 9.h). These results suggest that *H. arborescens* is vulnerable to alien plant introductions, fire, and seedlings are vulnerable to foot traffic trampling resulting from military activities in the SBER AA.

For the complete species description, go to Federally-listed Species Affected by the Action at KTA (**Section 7.5.2**).

Scientific Name: *Isodendrion longifolium* Gray

Common Name: Aupaka
Family: Violaceae (Violet family)
Federal status: Threatened
Life history: Short-lived perennial

Description and Biology: *Isodendrion longifolium* is a 0.6 to 2 m (2.0 to 6.6 ft) tall shrub with leaves at the tips of the branches. Leaves are 10 to 30 cm (3.9 to 11.8 in) long and 3.4 to 6.5 cm (1.3 to 2.6 in) wide, lance-shaped (tapering from a narrow base to the apex), and have netted venation that is raised on both surfaces. The purple flowers are fragrant and originate singly along the branches. The fruit is 1 cm (0.4 in) long and ovoid-ellipsoid in shape (Wagner et al. 1990). In cultivation this taxon is self-compatible and capable of self-pollination.

Known Distribution: Historically, *Isodendrion longfolium* was known from scattered locations on Kauai and in the Waianae Mountains on Oahu at elevations ranging from 200 to 700 m (655 to 2,295 ft).

Population Trends: *I. longfolium* populations are declining, and those that remain are small and widely dispersed.

Current Status: There are < 1,000 *I. longfolium* individuals remaining in scattered locations on Kauai and Oahu. On northwestern Kauai there are 16 populations of 500 to 800 individuals found mostly on ridges and valley slopes. On Oahu three populations of about 30 to 40 individuals are known from the Koolau Mountains (Kaukonahua and Makaua drainages) and in the Waianae Mountains (Kaawa and Palikea Gulches of Mt. Kaala NAR and in West Makaleha). The largest population on Oahu is located in Kaawa Gulch. There are 10 individuals from one population/occurrence in the SBER AA, located along South Kaukonahua Stream at about 540 m (1770 ft) elevation (HINHP 2002) (Figure 9.f). These individuals represent < 1% of the total remaining individuals of this species. There are 3 stable populations of > 50 *I. longfolium* outside the SBER AA, located on the island of Kauai.

Habitat: *Isodendrion longifolium* is found on steep slopes, gulches, and stream banks in mixed mesic or wet ohia forests, between 410 and 760 m (1,345 and 2,490 ft) in elevation. Associated plants include *Antidesma platyphyllum*, *Bobea* spp. (ahakea), *Cyanea* spp. (haha), *Cyrtandra* spp. (haiwale), *Hedyotis* spp., *Peperomia* spp. (ala ala wai nui), *Perrottetia sandwicensis* (olomea), *Pittosporum* spp. (hoawa), and *Psychotria* spp. (kopiko).

Taxonomic Background: *Isodendrion* is an endemic Hawaiian genus with four species. *I. longifolium* and *I. laurifolium* overlap in range on Kauai and Oahu, and they occur in close proximity to one another on Oahu (Kaawa Gulch, Mt. Kaala NAR), but they are not known to hybridize.

Outplanting Considerations: Outplanting of *I. longifolium* should not be conducted in the vicinity of any existing wild populations of *I. laurifolium.*

Current Threats: Threats to this species include habitat degradation by feral goats and pigs, and competition with alien plants, particularly *Clidemia hirta, Psidium cattleianum,* and *Schinus terebinthifolius* (Christmasberry).

Potential Threats from Army Training and Transformation: The weed threat from current military training and SBCT transformation is moderate in the lowland wet forest location of the SBER AA where *I. longifolium* grows (Figure 9.f). The fire threat from SBCT transformation activities is low for the *I. longifolium* population/occurrence in the SBER AA (Figure 9.g). The threat from foot traffic trampling is very low, insignificant and discountable for trees and shrubs, unless they are seedlings. Seedlings and even smaller mature plants of this small shrub species have a low to moderate threat from foot traffic trampling (Figure 9.h). These results suggest that *I. longifolium* is vulnerable to alien plant introductions, fire, and seedlings are vulnerable to foot traffic trampling resulting from military activities in the SBER AA.

Scientific Name: *Lobelia gaudichaudii* ssp. *koolauensis* A. DC

Common Name: `Oha, haha, `oha wai
Family: Campanulaceae (Bellflower family)
Federal Status: Endangered
Life history: Short-lived perennial

Description and Biology: *Lobelia gaudichaudii* ssp *koolauensis* is a woody branchless plant, 0.3 to 1 m (1 to 3.3 ft) long and 1.5 to 4 cm (0.6 to 1.6 in) wide. The leaves are 8 to 19 cm (3.1 to 7.5 in) long, 1.3 to 2.8 cm (0.5 to 1.1 in) wide, and lance or oblong shaped. The greenish or yellowish-white flowers are 5 to 7.5 cm (2 to 3 in) long and 8 to 15 mm (0.3 to 0.6 in) wide, and 2 to 6 branched. The ovoid-shaped fruit is 1.5 to 2 cm (0.6 to 0.8 in) long and the seeds are brown, ovoid, and slightly winged (Wagner et al. 1990).

L. gaudichaudii ssp. *koolauensis* is a long-lived perennial. It has been observed in flower in September and fruiting in December (USFWS 1998a). No other information is available on reproductive cycles, longevity, specific environmental requirements, or limiting factors.

Known Distribution: Historically, *L. gaudichaudii* ssp. *koolauensis* was known from two populations in the central Koolau Mountains on Oahu. (HINHP 1997; USFWS 1998a).

Population Trends: *L. gaudichaudii* ssp. *koolauensis* populations are declining, and those that remain are small and widely dispersed. Juveniles have been observed in these populations (RCUH 2001).

Current Status: This species is currently known from four population/occurrences totaling <280 individuals (USFWS 1998a). Three populations/occurrences are on Manana Ridge and one is in South Kaukonahua Gulch at SBER in the central Koolau Mountains. The SBER AA population/occurrence contains of 50-80 individuals (RCUH 2002a, HINHP 2002; Kawelo, U.S. Army, pers. comm. 2003; Lau, HINHP, pers. comm. 2003). It is located on a ridge above South Kaukonahua Gulch at about 760 m (2,500 ft) in the Koolau Mts. The individuals that fall within the SBER AA represent about 18-29% of the total remaining individuals of this species (HINHP 2002) (Figure 9.f). There are two stable populations > 50 *L. gaudichaudii* ssp. *koolauensis* outside the SBER action area, located at Waimano and Waiau/Waimano ridge, each with about 90 individuals (Kawelo, U.S. Army, pers. comm. 2003; Lau, HINHP, pers. comm. 2003).

Habitat: *L. gaudichaudii* ssp. *koolauensis* occurs in cloudswept wet forest on moderate to steep slopes in ohia or ohia-uluhe lowland wet shrublands between 640 and 730 m (2,100 and 2,400 ft) in elevation in Koolau Mountains, Oahu (USFWS 1996b). Associated plants include alani, kookolau, naupaka, uki, maile, manono, hapuu, olapa, and kanawao (USFWS 1996b).

Taxonomic Background: There are more than 350 species of Lobelia known worldwide, including 13 endemic Hawaiian species. This sub-species is identified from the closely related and also rare *L. gaudichaudii* var. *gaudichaudii* by the unbranched and pinkish flowers of the latter.

Outplanting Considerations: *L. gaudichaudii* ssp. *koolauensis* should only be outplanted within its historic range, in areas free of impacts from ungulates and alien plants. Outplanting of *L. gaudichaudii* ssp. *koolauensis* should not be conducted in the vicinity of any existing wild populations of *L. gaudichaudii* ssp. *gaudichaudii*.

Current Threats: The major threats to *L. gaudichaudii* ssp. *koolauensis* are habitat degradation by feral pigs, competition with alien plants (*Clidemia hirta, Psidium cattleianum, Pterolepis glomerata* (false meadowbeauty)*, Axonopus fissifolius* (common carpetgrass)), potential rat and slug predation, trampling by hikers, and potential over-collection (USFWS 1998a). The remaining populations are small and widely dispersed, which puts the species at risk of extinction from naturally occurring events and/or lack of reproductive vigor (USFWS 1996b).

Potential Threats from Army Training and Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest and shrub location of the SBER AA where *L. gaudichaudii* ssp. *koolauensis* occurs (Figure 9.f), but there is no fire threat there (Figure 9.g). The threat of trampling from foot traffic is low for *L. gaudichaudii* ssp. *koolauensis* in the SBER AA (Figure 9.h). These results suggest that *L. gaudichaudii* ssp. *koolauensis* is vulnerable to alien plant introductions, fire, and foot traffic trampling resulting from military activities in the SBER AA.

Scientific Name: ***Phlegmariarus nutans (Lycopodium nutans)***

Common Name: Wawae`iole
Family: Lycopodiaceae
Federal Status: Endangered
Life history: Short-lived perennial

Current Status: *P. nutans* is believed extinct in Kauai (USFWS 1999a). Currently, *P. nutans* is known from three sites within its historical range: Kaukonahua Ridge, Kaukonahua Gulch, and along Waikane-Schofield Trail on Oahu (HINHP 1997; USFWS 1996a). There are only an estimated 7 individuals from at least 4 population occurrences remaining (RCUH 2002a; HINHP 2002; Kawelo, U.S. Army, pers. comm. 2003; Lau, HINHP, pers. comm. 2003). There is one individual from one population/occurrence in SBER AA (RCUH 2002a), located in South Kaukonahua Gulch at about 660 m (2160 ft) elevation (HINHP 2002) (Figure 9.f). This individual represents about 14% of the total remaining individuals of this species. There are no stable populations of > 50 *Phlegmariurus nutans* outside of the SBER AA.

Potential Threats from Army Training and Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest and shrub location of the SBER AA where *P. nutans* grows (Figure 9.f), and the fire threat is low there (Figure 9.g). The threat of trampling from foot traffic is low, especially for smaller individuals of the species in this location within the SBER AA (Figure 9.h). These results suggest that *P. nutans* is vulnerable to alien plant introductions, fire, and foot traffic trampling resulting from military activities in the SBER AA.

For the complete species description, go to Federally-listed Species Affected by the Action at KLOA (**Section 7.5.2**).

Scientific name: ***Phyllostegia hirsuta* Benth.**

Common Name: No common name
Family: Lamiaceae (Mint family)
Federal Status: Endangered
Life history: Short-lived perennial

Current Status: There are currently 16 known populations of 150-200 *P. hirsuta* individuals remaining (USFWS 1998a). Ten populations occur in the Waianae Mountains, restricted to the southern part of the historical range (from the ridge between Makaha and Waianae Kai to the south fork of North Palawai Gulch), and six populations are distributed over 10-km (6-mi) along the summit of the Koolau Mountains (from Kawainui Gulch in Kawailoa Training Area to South Kaukonahua Drainage) (HINHP 1997). There are 21 individuals from one population/occurrence located between 670 to 740 m (2198 and 2420 ft) elevation at South Kaukonahua Gulch in the SBER AA (Figure 9.f) (HINHP 2002). These individuals represent 11-14% of the total remaining individuals of this species. There are no stable populations of > 50 *P. hirsuta* outside of the SBER AA

Potential Threats from Army Training and Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest and shrub and wet cliff locations of the SBER AA where *P. hirsuta* occurs (Figure 9.f), but there is no fire threat there (Figure 9.g). The threat of trampling from foot traffic is low-high for *P. hirsuta* in the SBER AA (Figure 9.h). These results suggest that *P. hirsuta* is vulnerable to alien plant introductions and foot traffic trampling resulting from military activities in the SBER AA.

For the complete species description, go to Federally-listed Species Affected by the Action at KLOA (**Section 7.5.2**).

Scientific Name: ***Pteris lidgatei***

Common Name: No common name
Family: Adiantaceae (Maidenhair fern family)
Federal Status: Endangered
Life history: Short-lived perennial

Current Status: The Molokai populations are now believed to be extinct (USFWS 1999b). There are presently 7 known population/occurrences totaling 33 plants of *Pteris lidgatei* remaining (RCUH 2002b). This includes 13 individuals from one population/occurrence at the SBER AA, located along the South Kaukonahua Gulch between 575 and 620 m (1880 and 2030 ft) elevation (Figure 9.f) (HINHP 2002). These individuals represent 39% of the total remaining individuals of this species. There are no stable populations of >50 *P. lidgatei* outside of the SBER AA.

Potential Threats from Army Training and Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest and shrub location of the SBER AA where *P. lidgatei* occurs (Figure 9.f), and the threat of fire is low (Figure 9.g). The threat of trampling from foot traffic is low for *P. lidgatei* in the SBER AA (Figure 9.h). These results suggest that *P. lidgatei* is vulnerable to alien plant introductions, fire, and foot traffic trampling resulting from military activities in the SBER AA.

For the complete species description, go to Federally-listed Species Affected by the Action at KLOA (**Section 7.5.2**).

Scientific Name: *Sanicula purpurea* St. John & Hosaka

Common Name: No common name
Family: Apiaceae (Parsley family)
Federal status: Endangered
Life history: Short-lived perennial

Current Status: There are presently 4-5 known populations of *S. purpurea* remaining totaling 181-261 plants (USFWS 1999b). There are 22 individuals from one population/occurrence at SBER AA (Figure (9.f) (HINHP 2002). They are located near South Kaukonahua-Kahana Divide and the Schofield-Waikane Trail between 700 and 735 m (2300-2400 ft) elevation. Individuals that fall within the SBER AA represent approximately 8-12% of the total remaining individuals of this species. There are 1 to 2 stable populations of > 50 *S. purpurea* located in West Maui.

Potential Threats from Army Training and Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest and shrub location of the SBER AA where *S. purpurea* occurs (Figure 9.f), but there is no threat of fire (Figure 9.g). The threat of trampling from foot traffic is high for *S. purpurea* in the SBER AA (Figure 9.h). These results suggest that *S. purpurea* is vulnerable to alien plant introductions and foot traffic trampling resulting from military activities in the SBER AA.

For the complete species description, go to Federally-listed Species Affected by the Action at KLOA (**Section 7.5.2**).

Scientific Name: *Tetraplasandra gymnocarpa* (Hillebr.) Sherff

Common Name: `Ohe`ohe
Family: Ginseng family (Araliaceae)
Federal status: Endangered
Life history: Long-lived perennial

Current Status: Fewer than 200 individuals are known from 17 populations (USFWS 1998a), distributed over 45 km (28 mi) along the summit ridges of the Koolau Mountains from the Paumalu region in the north, to Kuliouou and Waimanalo in the south (HINHP 1997; USFWS 1996a, 1998a). There are three individuals from two population/occurrences in the SBER AA, 2 individuals located in South Kaukonahua Gulch and 1 individual from Waikakalaua between 560 and 730 m (1860-2400) elevation (Figure 9f) (HINHP 2002). These individuals represent about 2% of the total remaining individuals of this species. There are 5 stable populations of > 25 *T. gymnocarpa* located outside of the Army AAs, including Kaluanui, Konahuanui to Mt. Olympus, Moanalua to Haiku, Wailupe-Niu, Waimano to Manana (Lau, HINHP, pers. comm. 2003).

Potential Threats from Army Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest and shrub location of the SBER AA where *T. gymnocarpa* occurs (Figure 9.f). There is no fire threat for the Waikakalaua population/occurrence, but a low threat for the South Kaukonahua Gulch individuals (Figure 9.g). The threat from foot traffic trampling is very low, insignificant and discountable for trees and shrubs, unless they are seedlings. The seedlings from these population occurrences have a high and low threat from foot traffic trampling for the Waikakalaua and South Kaukonahua Gulch population/occurrences respectively (Figure 9.h). These results suggest that *T. gymnocarpa* is vulnerable to alien plant introductions, possibly fire, and seedlings are vulnerable to foot traffic trampling resulting from military activities in the SBER AA.

For the complete species description, go to Federally-listed Species Affected by the Action at KTA (**Section 6.5.2**).

Scientific Name: *Viola oahuensis* C. Forbes

Common Name: No common name
Family: Violet family (Violaceae)
Federal Status: Endangered
Life history: Short-lived perennial

Current Status: There are presently 8 known populations/occurrences of <180 *V. oahuensis* remaining (USFWS 1998a), and most occur in the KLOA training area. There are five individuals from one

population/occurrence in the SBER AA located along the Schofield-Waikane trail on North Kaukonahua-South Kaukonahua Ridge (Figure 9.f) (HINHP 2002). Individuals that fall within the SBER AA represent approximately 3% of the total remaining individuals of this species. There are two known stable populations >50 *Viola oahuensis* outside the Army action areas, including 50-100 individuals located at Koolau Summit between Manana to Kipapa and >50 at Waimalu-Koolaupoko divide.

Potential Threats from Army Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest and shrub location of the SBER AA where *V. oahuensis* occurs (Figure 9.f), and the fire threat is low (Figure 9.g). The threat of trampling from foot traffic is high for *V. oahuensis* in the SBER AA, especially for smaller individuals of the species (Figure 9.h). These results suggest that *V. oahuensis* is vulnerable to alien plant introductions, fire, and foot traffic trampling resulting from military activities in the SBER AA.

For the complete species description, go to Federally-listed Species Affected by the Action at KLOA (**Section 7.5.2**).

Scientific name: *Achatinella byronii* Wood/ *Achatinella decipiens* Newcomb

Common Name: *pupu kanioe, pupu kuahiwi, kahuli*
Family: Achatinellidae (Endemic Hawaiian Tree Snails are in the subfamily Achatinellinae)
Federal status: Endangered (all species of the genus *Achatinella*)

Current Status: Approximately 324 *A. byronii/decipiens* individuals have recently been observed (V. Costello, Army Natural Resource staff per. comm., 2002) in the wild from 5 populations/occurrences (RCUH 2002b). Locations where they were reported include, Schofield Waik ne Trail, North Kaukonahua Stream drainage, Pu'u Ka`aumakua, and areas to the west of Pu'u Pauao and the Summit Trail. Approximately 14 of these are found in SBER (V. Costello, Army Natural Resource staff per. comm., 2002) and in the SBER AA. These include five individuals from two population/occurrences at Schofield-Waikane Trail (one in Ewa Forest Reserve and the other four were along the eastern boundary of SBER in the Koolau Mountains) and a population occurrence of nine individuals was reported from the southeast corner of the SBER AA (HINHP 2002; RCUH 2002c) (Figure 9.f). Individuals that fall within the SBER AA represent approximately 4% of the total remaining individuals of this species.

Potential Threats from Army Transformation: *A. byroni/decipiens* is located in lowland wet forest in the SBER AA where the weed threat from current military training and SBCT transformation is low to moderate (Figure 9.f). There is no fire threat for the population/occurrence along the eastern boundary of SBER, but the fire threat is low for the other two population/occurrences in the SBER AA (Figure 9.g). The threat of trampling from foot traffic is moderate for *A. byroni/decipiens* population/occurrence in the south and high for those in the northern portion of the SBER AA. (Figure 9.h). These results suggest that *A. byroni/decipiens* is vulnerable to alien plant introductions, fire, and foot traffic trampling resulting from military activities in the SBER AA.

For the complete species description, go to Federally-listed Species Affected by the Action at KLOA (**Section 7.5.2**).

Scientific Name: *Achatinella leucorraphe* Gulick

Common Name: *pupu kanioe, pupu kuahiwi, kahuli*
Family: Achatinellidae (Endemic Hawaiian Tree Snails are in the subfamily Achatinellinae)
Federal Status: Endangered (all species of the genus *Achatinella*)

Description and Biology: *Achatinella leucorraphe* adults reach lengths of up to 19.0 mm (0.7 in), diameters of 12 mm (0.5 in), and have 6½ whorls. The dextral or sinistral shell is short, egg-shaped or cone-shaped with striations, and gray with dark streaks and indistinct white spiral lines (USFWS 1993).

Achatinella spp. are primarily nocturnal, preferring cool, humid conditions when active. During the day they usually seal themselves to leaves or trunks and remain motionless until nightfall (USFWS 1993). Individuals are hermaphroditic, but it has not been determined if they are capable of self-fertilization. *Achatinella* spp. bear live young after a lengthy gestation.

Known Distribution: Historically, *A. leucorraphe* was found in Schofield Barracks East Range and areas to the south. Since Polynesian and European settlement of Oahu, most forests below about 300 m (1,000 ft) were cleared for agricultural purposes, leaving the only native vegetation and microclimates suitable for *Achatinella* habitat at higher elevations. *Achatinella* spp. are presently most abundant in higher elevation ravines and upper ridges (USFWS 1993).

Population Trends: This species may also be extinct because it was known to thrive in lower elevations where *Euglandina rosea* first invaded. *A. leucorraphe* is considered critically rare and may only be surviving in very fragmented habitat (RCUH 2001).

Current Status: There was 1 *A. leucorraphe* individual reported in 1989 near the Schofield-Waikane Trail in the Koolau Mountains (HINHP 2002). This is the only individual of this species reported in the past 14 years (Figure 9.f). This may be surviving in very fragmented habitat (RCUH 2001), but it is most likely extirpated (V. Costello, Army NR staff, per. comm., 2002).

Habitat: *A. leucorraphe* and all other species in the genus are arboreal. They feed on fungus from the leaves of primarily native, and some introduced, vegetation (Pilsbry and Cooke, 1912-1914). *Achatinella* spp. are found on a variety of native trees and shrubs in dry, mesic, and wet forests, and they are rarely seen on alien vegetation (USFWS 1993). According to Pilsbry and Cooke (1912-1914), they usually avoid trees and shrubs with pubescent leaves.

Taxonomic Background: The genus *Achatinella* is restricted to the island of Oahu in the Hawaiian Islands. This genus originally included 41 species, each endemic to a small region of either the Koolau or Waianae Mountains (Hadfield et al.1993), but over-collection of the snails for their shells, predation, and habitat degradation have dramatically impacted this genus. All 41 species in the genus are federally-listed as endangered. By 1993, 16 of these species were extinct, 5 had not been seen in over 15 years, and 18 of the remaining 20 species were on the verge of extinction (USFWS 1993). Only *A. mustelina* and *A. sowerbyana* still exist in substantial numbers, though their numbers are declining (USFWS 1993; Hadfield et al. 1993).

Current Threats: The major threats to *Achatinella* spp. include habitat destruction from human activities and feral ungulates, predation, loss of host plants due to competition from alien plant species, and fire. Common tree snail predators include *Euglandina rosea* (carnivorous snail), *Rattus exulans* (Polynesian rat), *Rattus rattus* (European rat), and *Rattus norvegicus* (Norwegian rat). *Platydemis manokwari* (a terrestrial flatworm) is a known predator of arboreal snails in other areas and is a potential threat to all

Achatinella species if it ever becomes established in the snail's range (U.S. Army 2002a). Low reproductive rates and limited dispersal abilities make *Achatinella* spp. very sensitive to loss of habitat, shell collecting, and predation (Hadfield 1986).

Reintroduction Considerations: Habitat quality should be carefully examined when choosing potential reintroduction sites for *A. leucorraphe*. Elevation and vegetation should be similar to that of the source *A. leucorraphe* population. There should be a low incidence of invasive plants and no evidence of rats or carnivorous snails in the area. When introducing captive snails into the wild, care must be taken to avoid the introduction of pathogens. Rats and carnivorous snails must be baited for at all reintroduction sites and a snail predator exclosure should be built if topography allows it.

An effort should be made to establish maximum genetic diversity within each reintroduction group based on molecular genetic data of laboratory stocks. Care should be taken to select the healthiest individuals from a predominantly adult or large sub-adult stock for introduction.

Potential Threats from Army Transformation: *A. leucorraphe* is reported from the lowland wet forest and shrub community in the SBER AA where the weed threat from current military training and SBCT transformation is low to moderate (Figure 9.f) and the fire threat is low (Figure 9.g). The threat of trampling from foot traffic is moderate for *A. leucorraphe* in the SBER AA. (Figure 9.h). These results suggest that *A. leucorraphe* is vulnerable to alien plant introductions, fire, and foot traffic trampling resulting from military activities in the SBER AA.

Scientific Aame: *Achatinella sowerbyana* Pfeiffer

Common Aame: *pupu kanioe, pupu kuahiwi, kahuli*
Family: Achatinellidae (Endemic Hawaiian Tree Snails are in the subfamily Achatinellinae)
Federal Status: Endangered (all species of the genus *Achatinella*)

Current Status: *A. sowerbyana* is currently found mostly in the Ko`olau Summit region at Castle Trail, Poamoho Trail, and Schofield Barracks East Range (RCUH 2001). It is considered to be the most commonly found *Achatinella* species on Oahu after *A. mustelina*. Three populations/occurrences were reported by Natural Resources Staff in 2000 and 2001, totaling >150 individuals. There are presently an estimated 265 individuals in the wild (V. Costello, Army NRS, per. comm., 2002). All known occurrences are in KLOA AA, but one individual was reported from Schofield-Waikane Trail in SBER in 1989 (Figure 9.f). No individuals of this species have been documented by NRS at this location. This individual represents <1% of the total remaining individuals.

Potential Threats from Army Training and Transformation: The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest and shrub location of the SBER AA where *A. sowerbyana* is found (Figure 9.f). The fire threat is low for *A. sowerbyana* in this location in SBER AA (Figure 9.g). The threat of trampling from foot traffic is moderate because of the proximity of this population/occurrence to the Schofield-Waikane Trail (Figure 9.h). These results suggest that *A. sowerbyana* is vulnerable to alien plant introductions, fire, and trampling from foot traffic resulting from military activities in SBER AA.

9.5.3 Potential non-military uses of the action area

There are non-military uses at SBER that have the potential to negatively impact federally listed species. They are current actions that are not controlled by the Army. They include hiking on 465 ha (1,150 ac) leased from the state of Hawaii (USACE and Nakata Planning Group 2000).

- There is public hiking on the Pupukea Summit Trail which is over 22 km long, and passes along the border of KTA, Kawailoa Training Area, and Schofield Barracks East Range. Hiking the Pupukea Summit Trail is only allowed by DPW permit. The Schofield-Waikane Trail is owned by the state of Hawaii and the Army. If accessing either trail through non-Army lands, hikers are required to obtain permission from the appropriate landowners. Due in part to a complicated permit system that requires hikers to get permits from every landowner or manager on a hiking trail, hiking use has been limited. These objectives are designed to improve trail utilization by the general public and to assist in keeping recreationists safe through the distribution with educational materials.

9.6 Minimization of Potential Negative Effects of the Action

To quantify the beginning threat level for each potential effect of the action and the remaining threat following minimization action, a relative numerical threat value system is used. Threat values assigned to each potential effect are 0 = none, 1 = very low, insignificant and discountable (1-10% vulnerability), 2 = low (11-25% vulnerability), 3 = moderate (26-50% vulnerability), 4 = high (51-75% vulnerability), and 5 = very high (>75% vulnerability). These threat values have been developed for use in our discussion as a means of comparing threats posed to threatened and endangered species in portions of the action area relative to other portions of the action area. They measure the risk of each event occurring in a given area. The reasoning behind the assignment of each value is discussed under each section below.

Minimizing the potential negative effects of Army training and transformation activities involves implementing actions to lessen the amount of negative impact that the action may cause. Minimization is important for reducing the potential negative impact to listed species, but it also can work to reduce the size of the action area, which in turn can reduce the number of species affected by the action. The potential effects of Army training and transformation at SBER that received threat values greater than (1) very low, insignificant and discountable are discussed along with proposed minimization actions. Minimization actions may result in the modification of threat values downward. Table 9.e at the end of this section, summarizes the resulting (modified) threat values following minimization actions. Modified threat values of less than low (2) are **not likely to adversely affect any federally-listed species or adversely modify critical habitat in the action area**. Potential effects, which are assigned modified threat values greater than or equal to low (2) are **likely to adversely affect federally-listed species or adversely modify critical habitat** and these are in **bold** type in Table 9.e.

9.6.1 Direct Effects

9.6.1.1 Landing Zones used in Current Military Training

There are six open LZs and one open LZ/DZ in the SBER action area. The closest federally listed species to any of these zones is *Achatinella leucorraphe,* which was last recorded 4.2 km (2.6 mi) from Upper 72 LZ (Figure 9.a). No federally listed species are directly affected by this military training in SBER AA.

9.6.1.2 SBCT Construction Projects

Tactical Vehicle Wash (57416). The proposed location of the tactical vehicle wash at SBER action area is located in lower elevation areas dominated by alien species > 7.5 km (4.8 mi) from any federally listed species (Figure 9.b).

Fixed Tactical Internet Antenna. There are two fixed tactical internet antennas included in the SBER action area. The construction would include a 6.1 x 7.6 m (20 x 25 ft) area, and existing roads would be used to access the antennas. There are no listed species any where near these sites, thus no listed species will be directly affected by this SBCT construction of the fixed tactical internet antenna in SBER AA (Figure 9.b). The antennas will be inspected monthly for electrical and physical damage and will be repaired as needed. If there are any specific actions that may affect listed species, the Army will consult with the USFWS.

The threat SBCT construction projects pose to listed species in SBER AA is (0) none.

9.6.1.3 Potential Off-Road Vehicle Maneuver Areas used for SBCT

Federally listed species can potentially be damaged or destroyed during vehicle maneuvers. Results from the maneuver analysis show that the closet among the listed species in the SBER AA is *C. koolauensis* at > 2.0 km (1.2 mi) to off-road vehicle maneuver areas (Figure 9.c). **Therefore, the threat vehicle maneuvers potentially pose to federally listed species in SBER AA is very low, insignificant, or discountable (1).**

9.6.1.4 Fire from Current Military Training and SBCT Transformation

Ignition sources at SBER include pyrotechnics, smoking, muzzle flash (from blank ammunition), sparks from construction activities and equipment, and catalytic converters. Fuels within the most heavily utilized training areas are composed primarily of *Panicum maximum* (guinea grass), various species of *Eucalyptus*, and *Schinus terebinthifolius* (Christmas berry), the first two being highly fire prone. Rainfall estimates range widely from just under 60 inches near H2, to over 240 inches at the Koolau summit (Giambelluca *et al,* 1986). The lower elevation training areas, where most military activity occurs, receive 60 to 100 inches per year, with summer months the driest and winter the wettest. Winds are dominated by trades out of the northeast and average 4.7 mph. Average maximum wind speed is 8.2 mph. The average temperature is 71 degrees F, while the average maximum and average minimum temperatures are 80 and 64 degrees F, respectively. Average relative humidity is 82%, with an average maximum and average minimum of 95% and 59% respectively.

For the purposes of this BA, fire vulnerability is defined as the risk of fire ignition combined with the risk of fire spread as determined by characteristics of the vegetation and climate (Figure 9.g). SBER can be broken into three fire vulnerability areas.

Low Elevation – This encompasses all of the area used for mounted training and is the site of most dismounted training. The higher levels of training relate to an increased risk of fire ignition. Additionally, the lower areas are drier and support more fire prone vegetation including large expanses of grass dominated fields and eucalyptus dominated alien forest. These factors combine to produce a **moderate (3) fire vulnerability** for this area.

Medium Elevation – These areas have a mix of alien and native forest, receive less rainfall than upslope areas, but do not support the fire prone fuels of lower elevations. Despite the low vulnerability of the fuels to fire, the relatively heavy training load of SBER justifies a **low (2) vulnerability** to fire within this elevation range.

High Elevation – This is the summit crest vegetation type. Rainfall is frequent and heavy at times. There are no highly flammable fuels present, live or dead. Additionally, training intensity is low and ignition sources are very rare. There is **no (0) vulnerability** to fire in this location.

Methods to minimize the negative effects of fires on threatened and endangered species will be documented in the finalized Wildland Fire Management Plan (WFMP), Pohakuloa and Oahu Training Areas, scheduled to be completed by September, 2003. Components of the WFMP important in Section 7 consultations with the USFWS are included in the BA (Fire History, Protected Species, Firebreak System, Fuels Management, Enforcement, Ignition Control, Fire Danger Rating System, Fire Reporting and Notification Procedures, Records and Fire Reports, and Departmental Responsibilities). The fire management plan defines the responsibilities of Range Control personnel and military training units for the prevention and suppression of fires at SBER. This plan also outlines the prevention and suppression measures that must be carried out to train at SBER. The Army will reinitiate consultation with the USFWS if a fire escapes the installation boundary OR starts or spreads to within 521 meters of a listed species. The main action to minimize impacts will be the implementation of a fire danger rating system that will restrict training according to weather and fuel conditions. Fuels management may be considered as well, including chemical and mechanical means of fuel reduction.

After these fire minimization actions are implemented, **threats are projected to be reduced from moderate (3) to low (2) in low elevation areas (Table 9.e)**.

9.6.1.5 Alien Plant Introductions via Current Military Training and SBCT Transformation

The probability of alien plants becoming established depends on the type of weed species being introduced (e.g., dry, mesic, or wet forest species) and the proximity of suitable environments and/or plant communities to the action area or point of introduction of the species. The SBER action area is predominantly alien species, with native wet forest, and some mesic forest. **Nonnative communities have a high threat level (4) because of dry microclimates and dominance of alien species, mesic forest species have a moderate threat level (3), and wet forest species have a low (2) to moderate (3) threat level of becoming established.** This is because drier communities are generally lower and closer to training activities, so the distance between the point of introduction and the location of the similar community type would be small compared to wetter forests. Also, there is a greater chance of a weed becoming established that would impact dry communities than mesic forests because training areas are located in habitat more similar to dry forests.

Threats are projected to be reduced from high (4) to moderate (3) for dry (nonnative communities), moderate (3) to low (2) for mesic forests, and from low (2) or moderate (3) to low (2) for wet forest species by doing the following:

- The Army will prevent any weeds brought in by training activities from becoming established by rigorously monitoring using transects and roadside surveys and eradicating new weeds using the most effective means known specific to each of the invasive species. Refer to the pest management sections of the Oahu INRMP (CEMML 2001) for possible treatments for eradication. Detailed methods for the monitoring and eradication of alien plants will be developed as part of the Oahu IP.
- The Army will provide education regarding cleaning vehicles and field gear (these education materials will be Service approved).

- The Army will wash vehicles in the wash rack facility prior to returning to Oahu from the Pohakuloa Training Area (PTA), to minimize weeds (e.g., fountain grass).
- Persons and equipment coming from foreign countries must go through U. S. Department of Agriculture and U.S. Customs inspections before coming into the United States.
- The Army will train and require soldiers to clean their gear and vehicles when first arriving in Hawaii and prior to moving from installation to installation on Oahu, as well as when moving from Oahu to the island of Hawaii or vice versa.

9.6.1.6 Alien Animal Introduction via Current Military Training and SBCT Transformation

The chance of an introduced animal establishing a viable population would be lower than for plants since they would require at least two reproductive viable individuals or a single impregnated female individual to be introduced. **The threat of an alien animal species being introduced at SBER from Army training and transformation is moderate (3).**

This threat should be reduced from moderate (3) to low (2) by doing the following:

- To minimize animals (e.g., invertebrates) from coming back to Oahu from the Pohakuloa Training Area (PTA), the Army will wash vehicles in the wash rack facility at PTA prior to returning.
- Persons and equipment coming from foreign countries must go through U. S. Department of Agriculture and U.S. Customs inspections before coming into the United States.
- The Army will provide education regarding cleaning vehicles and field gear.
- The Army will brief soldiers on alien reptilian species and request that all snake and lizard sightings be reported to the Army Environmental office.
- The Army has developed and distributed brown tree snake response and alert posters which inform the public about the potential for a brown tree snake introduction with rapid response measures and numbers to call in case of a sighting.
- The Army established the Brown Tree Snake Response Plan for rapid response to and interdiction of brown tree snakes introduced to Army Lands on Oahu.
- The Army is a member and will continue active participation in the Oahu Invasive Species Committee (OISC). This is a voluntary partnership of private, governmental and non-profit organizations and individuals united to prevent new invasive species infestations on the island of Oahu, to eradicate incipient invasive species, and to stop established invasive species from spreading.
- Herpetofauna certification program will be developed as part of the implementation process for plant material purchased by the Department of Defense, to prevent incidental introductions of herpetofauna to the island of Oahu.
- Establish the phytosanitation certification program developed the Draft Makua IP (Makua Implementation Team 2002).
- Coordinate/collaborate with the Toxicants Working Group in an effort to determine a safe toxicant for controlling populations of newly established invertebrates.
- Use environmentally safe toxicants for alien species control or eradication associated with military operations or natural resource management.
- If a new introduction of an alien animal is found, the source and time of the introduction will be identified, and the area will be searched and treated with an appropriate environmentally safe toxicant to eradicate any other individuals of the target species that may be present. In addition, an area deemed adequate to cover the potential dispersal distance of the new alien animal will be searched and treated as well.

- Pursue support, implementation and funding for the licensing and application of a more toxic rodenticide, and towards broad scale distribution of rodenticides to improve rat control in remote areas, especially in areas with threatened and endangered species.

9.6.1.7 Trampling from Current Military Training and SBCT Transformation

Trampling of threatened and endangered species, particularly plants and invertebrates, is a potential risk during training exercises when soldiers or troops move through native habitats with listed species. However, the threat of destruction or degradation from trampling by troops should be lower than what one would expect by chance because infantry soldiers are trained to leave no evidence or trace of their presence. For the purposes of this BA, we used percent slope and distance from roads to estimate the frequency of use by foot traffic as a measure of potential trampling intensity. We categorized areas into high, moderate, low, and very low, insignificant or discountable threats from trampling based on the predicted use of lands adjacent to the roads and trails in SBER AA. This was done under the assumption that lower slopes and areas on or close to roads are used with greater frequency than the contrary (Figure 9.h).

The threat of trampling varies from high (4) for areas <10 m from roads or trails; moderate (3) for areas 10-1000 m from roads or trails with 0-30% slope, or 10-100 m from roads or trails with 30-60% slope; low (2) for areas 10-100 m from roads or trails with >60% slope, or 100-1000 m from roads or trails with >30% slope, or >1000 m from roads or trails with < 60% slope; and very low (1), insignificant or discountable for areas >1000 m from roads or trails and with >60% slope.

The risk to mature trees or shrubs getting trampled by foot traffic is very low, insignificant and discountable. Only the seedlings of trees and shrubs, and herbaceous plants are at risk of being trampled. **The threat of a listed plant or invertebrate being crushed and killed would be reduced by one from those predicted above (Table 9.e) by doing the following:**

- The Army will brief each set of new soldiers on avoidance of trampling of endangered species.
- Establish LCTA (ITAM) plots to monitor impact of foot traffic trampling by infantry soldiers.
- Fencing of federally listed species populations near roads or trails that have been determined to be impacted by military foot traffic, will be addressed by the implementation team.
- Establishing signage to identify areas that are off limits due to the presence of federally listed species, will be addressed by the implementation team.

9.6.1.8 Noise from Current Military Training and SBCT Transformation

Noise is an unwanted sound. It is generated from a source (e.g., explosion) as a wave of energy, which diminishes with distance. The only potential concern related to noise from Army activities is the potential effect on vertebrate species. Since there are presently no listed vertebrates in the SBER AA, noise is not a concern in this area. **Therefore, a threat value of none (0) is assigned to noise from military sources at SBER Action Area.**

9.6.2 Direct Interrelated Actions and Effects

9.6.2.1 Soil Erosion by Wind

The majority of the dust producing military activity is >300 m from threatened and endangered species populations at SBER. **Therefore, the threat values for dust generation on federally listed species are very low (1), insignificant or discountable and requires no further minimization.**

9.6.2.2 Soil Erosion by Water

Soil erosion processes modify habitats by removing or adding soil from one location to another. Soil erosion is locally significant in areas where natural drainage and gulches occur. However, dry climate and lack of permanent streambeds may reduce the risk of erosion, as well as in areas where soils are not well developed because of exposed lava. Military activity and construction can have an effect on erosion rates and sedimentation, especially in areas where activity is concentrated. Anecdotal evidence and aerial photographs already suggest that there have been significant water quality (i.e., turbidity and suspended solids) problems on SBER (John Fukuda, pers. comm.). The South Fork of Kaukonahua Stream is significantly more turbid than the North Fork upon entry into Lake Wilson, also known as Wahiawa Reservoir. Probable sources include denuded training areas (including bivouac sites, LZs and DZs), roads and other concentrated flow sites, and gullies at lower elevations where training occurs, and disturbance from feral ungulates, and potentially high natural rates of erosion in upper watershed areas. The ITAM LRAM program is actively working to minimize erosion and control sediment on SBER using a variety of techniques and structures including revegetation, erosion control structures such as check dams, and road drainage improvements. **Therefore, the effect of soil erosion and sedimentation on federally listed species is considered low (2).**

The effect of soil erosion and sedimentation on federally listed species should be further reduced from low (2) to very low (1), insignificant or discountable by doing the following:

- Establish a project review process headed by ITAM and including USAG-HI DPW, G3/DPTM, and Range Control, to optimize watershed protection and rehabilitation (e.g., road construction and maintenance, storm water management, etc.).
- Establish GIS support headed by ITAM, to develop project data layers, analyze data, and display results.

9.6.3 Direct Interdependent Actions and Effects

9.6.3.1 Range Maintenance and Construction

Range development projects are interdependent actions with interdependent effects. These projects have a similar potential of affecting listed species through alien introductions than most Army training and transformation activities, because they may occur in close proximity to the native habitat areas. **Therefore, the threat values for alien species introductions via range maintenance and construction is moderate (3).**

Most of the range construction is done in-house by the Army and involves road construction and maintenance with crushed rock from the Kolekole Rock Crushing Quarry at Schofield Barracks. Since the rock is obtained from Schofield Barracks, the likelihood of a weed species foreign to Hawaii being in the material is negligible. However, sometimes sand is purchased for different projects and the sand could introduce new weeds. The Army will minimize this threat by conducting weed monitoring using transects and roadside surveys and eradicating new weeds using most effective means known specific to each of the invasive species. Refer to the pest management sections of the Oahu INRMP (CEMML 2001) for possible treatments for eradication. Detailed methods for the monitoring and eradication of alien plants will be developed as part of the Oahu IP. **Therefore, the threat value should be reduced from moderate (3) to low (2) (Table 9.e).**

9.6.3.2 Integrated Training Area Management (ITAM) Program

This program is designed to monitor and mitigate erosion and loss of vegetative cover, which is essential for human safety and realism in training. ITAM workers revegetate areas, which have been heavily used

for training. The ITAM program has the potential to introduce alien plant and animal species to Schofield East Range via this work. **The initial threat value assigned to the ITAM program projects is low (2), because of the overall beneficial nature of the work they conduct, and because they work mostly in areas already heavily impacted by human development, dominated by alien plant species, and far away from federally listed species (including roadsides, LZ's, and maneuver areas).**

ITAM staff coordinate with Army Natural Resource Staff to select native species for outplanting. They purchase plants from native plant nurseries on Oahu. The plants are not delivered until the day before they are planted, to reduce the risk of contamination by alien species. Native plants are always the first alternative because they have the greatest likelihood of successful establishment. In some cases native species are not commercially available, more specifically grasses for Landing Zones. In those cases they coordinate with Army Natural Resource Staff to select something non-invasive, naturalized, and which already occur near the outplanting site. Detailed methods for the monitoring and eradication of alien plants will be developed as part of the Oahu IP.

This potential threat will be further reduced by doing the following:

- Get weed free certification from native plant nurseries for all plants purchased by ITAM for revegetation.
- When using grass seed to revegetate an area, ITAM will periodically monitor these areas for invasive weeds, and remove all non-target introductions from the area before establishment.

In light of the precautions that are taken in choosing revegetation material and proposed actions to reduce the risk of a new introduction, the modified threat value assigned to the ITAM program projects is very low (1), insignificant and discountable.

9.6.3.3 Natural Resources Program

The Army's Natural Resources component of the Ecosystem Management Program provides protection to the listed species at SBER in conjunction with military training there. Ecosystem level management at SBER includes surveys, monitoring, propagation, storage, and reintroduction of rare plants; surveys, monitoring, and protection of rare invertebrates; ungulate, weed, and rodent control, and control of alien invertebrates and associated diseases. Natural resource workers could potentially introduce weed species via field vehicles or gear during management. Landing zone and disturbance corridor surveys are also conducted in areas where there is a high potential for alien species introduction via their program. **These potential adverse impacts are assigned an initial value of low (2).**

However, NRS workers are trained to be very conscious and careful of the weed threats, and take precautions such as cleaning gear and vehicles prior to entry into the field. **Therefore, the initial threat value assigned to the natural resources program was modified to very low (1), insignificant and discountable.**

9.6.3.4 Alien Species Introduction by Recreational Use

Alien Animal Introduction Open public access to the installation, public access on roads outside the installation boundaries, and non-military personnel with daily access to the installation are all potential non-military points of animal introductions at SBER. Also, alien animal species may disperse (usually by flying) into new uninhabited areas within the subinstallation or action area, or the smaller species may be blown in by winds. Non-military users must adhere to the conditions of their hiking permit, which is issued by DPW and states that they must clean all gear prior to entry. The likelihood of human-induced introductions via recreation activities is lower than from military sources because of the lower frequency

of use of the area for these purposes. **The threat of alien animal introduction by recreational use is therefore very low (1), insignificant and discountable and requires no further minimization.**

Alien Plant Introduction Open public access along the Pupukea Summit Trail and The Schofield-Waikane Trail increases the risk of alien introductions along these trails. If accessing either trail through non-Army lands, hikers are required to obtain permission from the appropriate landowners and permits are required from DPW to use Army land. Due in part to a complicated permit system that requires hikers to get permits from every landowner or manager on a hiking trail, hiking use has been limited. In addition, non-military users must adhere to the conditions of their hiking permits issued by DPW, which require that they must clean all gear prior to entry. **The threat of alien plant introduction by recreational use is therefore low (2).**

This threat should be reduced from low (2) to very low (1), insignificant and discountable by doing the following:

- Monitoring trail use by requiring permits from DPW Environmental for access to hike the Pupukuea Summit Trail, and permission is required from the appropriate landowners if accessing the trail through non-Army lands.
- The Army will prevent any weeds brought in by recreationalists from becoming established by monitoring trails used for these purposes within and adjacent the SBER AA. Methods for monitoring will be developed as part of the Oahu IP.
- Require that hikers clean all gear prior to entry.
- Develop and place signage at appropriate places along SBER boundaries and trail locations to notify users of resource management issues, boundaries, and trail issues.
- Develop maps of hiking trails for distribution with access permits, including the level of difficulty, and natural resources issues (e.g., weed distribution concerns, endangered species information, the importance of staying on the trail).

9.6.4 Indirect Effects

9.6.4.1 Spread of Alien Species by Fire into Dry (nonnative) Communities

The threat values for secondary weed spread are based on the assumption that fire occurs in the area, and are similar to those described above for direct weed introductions from Army training and transformation activities in dry (nonnative) communities, high (4).

This indirect threat from Army training and transformation activities at SBER should be reduced from high (4) to moderate (3) as a result of the following:

- The Army will prevent secondary weed spread from fire by rigorously monitoring and eradicating newly dispersed weeds. Detailed methods for the monitoring and eradication of alien plants will be developed as part of the Oahu IP.

9.6.4.2 Spread of Alien Species by Fire into Mesic Forests

The threat values for secondary weed spread are based on the assumption that fire occurs in the area, and are similar to those described above for direct weed introductions from routine military training and SBCT activities in mesic forests, moderate (3).

This indirect threat from Army training and transformation activities at SBER should be reduced from moderate (3) to low (2) as a result of the following:

- The Army will prevent secondary weed spread from fire by rigorously monitoring and eradicating newly dispersed weeds. Detailed methods for the monitoring and eradication of alien plants will be developed as part of the Oahu IP.

9.6.4.3 Spread of Alien Species by Fire into Wet Forest

The threat values for secondary weed spread are based on the assumption that fire occurs in the area, and are similar to those described earlier for direct weed introductions from routine military training and SBCT activities in wet forest, low (2) to moderate (3).

This indirect threat from Army activities at SBER should be reduced from low (2) or moderate (3) to very low (1) or low (2) as a result of the following:

- The Army will prevent secondary weed spread from fire by rigorously monitoring and eradicating newly dispersed weeds. Detailed methods for the monitoring and eradication of alien plants will be developed as part of the Oahu IP.

9.6.4.4 Army Regulated Fishing and Hunting

Freshwater fishing is allowed to active duty, reserve, retired military personnel and authorized family members, and DoD civilian employees and their civilian guests on the south fork of Kaukonahua Stream in Hunting Area. The fishing area is above and east of the Wahiawa State Freshwater Park and extends about 2.5 miles upstream. Parking is permitted near the East Pump Reservoir Bridge. Fishing is permitted with hook and line only, and each person is limited to two lines. All fishing is from the shore – no boats or personal flotation devices are allowed. Fishing is open throughout the year. "Catch-and release" applies to tucunare over 15 inches caught during 1 May to 31 July; the bag limit is four. The bag limit for bass is three (total) large and smallmouth. From 1 February to 31 March, bass over 15 inches must be released. One oscar may be caught.

Three hunting areas are located on SBER. The areas are open for hunting during the week when not in use for military training. Only one group (two to six persons) is allowed to hunt at a time, and permits are issued on a first-come, first-serve basis by the Provost Marshal. Eligible users are active duty, reserve, retired military personnel and authorized family members, and DoD civilian employees and their guests. All hunters must have a valid hunting license from the state of Hawaii. Wild pigs may be taken with bow and arrow, spear, and knife with dog in Hunting Area 1. Firearms are not permitted. Hunting Area 2 permits the use of shotgun with slugs, bow and arrow, spear, and knife with dog. Dogs must be restrained except when actually hunting. There are no bag limits.

There is no potential threat to federally listed species from fishing, or from hunting in areas 1 and 2, because there are no known listed species there. However, there is a potential threat in the eastern portion of hunting Area 3 from use by hunters, because of the presence of listed species there. The threat from alien plant introductions is low to moderate, the fire threat is mostly low but also none for some population/occurrences, and the threat of destruction or degradation from foot traffic trampling is low to high depending on the location and species (see Federally Listed Species Descriptions above, for species specifics). **These threats will be reduced by one by doing the minimization for weed introduction, fire, and trampling resulting from routine military training and SBCT activities discussed above.**

Table 9.e. Potential Effects of Army Activities at Schofield Barracks East Range, Hawaii.

Effect Type	Potential Effect/Threat[1]	Initial Threat Value	Modified Threat Value with Minimization[2]
Direct	**Fires from military activities in low elevation areas**	3	2
Direct	**Fires from military activities in medium elevation areas**	2	2
Direct	**Alien plant introduction to nonnative communities**	4	3
Direct	**Alien plant introduction to native mesic forest**	3	2
Direct	**Alien plant introduction to native wet forest**	2-3	2
Direct	**Alien animal introduction**	3	2
Direct	**Trampling from foot traffic in areas <10 m from roads or trails**	4	3
Direct	**Trampling from foot traffic in areas 10-1000 m from roads or trails**	3	2
Direct	Trampling from foot traffic in areas >1000 m from roads or for areas with 30-60% slope	2	1
Direct Interrelated Action and Effect	Erosion by water	2	1
Direct Interdependent	**Range maintenance and construction, plant introduction**	3	2
Direct Interdependent	Integrated Training Area Management	2	1
Direct Interdependent	Natural Resources Program	2	1
Direct Interdependent	Alien plant introduction by recreational use	2	1
Indirect effects	**Spread of alien species by fire into nonnative communities**	4	3
Indirect effects	**Spread of alien species by fire into native mesic forest**	3	2
Indirect effects	**Spread of alien species by fire into native wet forest**	2-3	1-2

[1] Potential effects in bold type are those which are assigned modified threat values $\geq$ to low (2). These are likely to adversely affect federally-listed species or adversely modify critical habitat.

[2] Modified threat values of less than low (2) are not likely to adversely affect any federally-listed species or adversely modify critical habitat in the action area. Potential effects assigned modified threat values greater than or equal to low (2) are likely to adversely affect federally-listed species or adversely modify critical habitat.

9.7 Other Army Consultations for Listed Species at SBER

9.7.1 Review of Planning Documents

The Army has requested USFWS review of Natural Resource planning documents over the years. The USFWS in April of 1996 reviewed the Army's draft Endangered Species Management Plan Report for Oahu Training Areas which was finalized and in place in 1997. In July of 1997 the USFWS sent comments to the Army regarding selected chapters of the Oahu Ecosystem Management Plan Report

which was finalized and in place in 1998. In August of 2001 the USFWS sent the Army their review comments for the draft Integrated Natural Resources Management Plan which is the action document for review, guidance, and implementation of Army natural resource activities for 2002-2006 at Oahu Army Installations.

9.8 Cumulative Effects

Cumulative effects include the effects of future state, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the Endangered Species Act.

9.8.1 Future State Actions

There are no known future state actions that are reasonably certain to occur within the proposed action area.

9.8.2 Future Private Actions

Future private actions at SBER AA include:

- The Army is currently a partner in the Koolau Mountains Watershed Partnership (KMWP). The Partnership was created in 1999 through a Memorandum of Understanding signed by Koolau Mountain landowners. The KMWP facilitates watershed protection and conservation projects, maximizes available resources, and optimizes information exchange and learning (CEMML 2001). Partners include the Hawaii Department of Land and Natural Resources, the Honolulu Board of Water Supply, the Waiahole Water System, Kamehameha Schools Bishop Estate, The Queen Emma Foundation, the United States Army, the Department of Hawaiian Home Lands, and the Bishop Museum. The partnership is an initiative sponsored by the Hawaii Department of Land and Natural Resources. The KMWP consists of approximately 39,450 ha (97,500 ac). The partners agree that the proactive management of watershed is crucial in eliminating or reducing the threats of damage from weeds, insects, disease, feral ungulates, and human impacts. Partners will work together to develop watershed projects and cooperate to obtain funds for these projects. The KMWP partners meet monthly. Projects may combine one or more activities such as fencing, weed control, ungulate control, restoration and revegetation, stream health and water quality, vegetation monitoring, erosion and sediment control, and other elements.

10. Schofield Barracks Military Reservation

10.1 General Description of Area

Schofield Barracks Military Reservation (SBMR) is one of six Army subinstallations located on the island of Oahu (Figure 1.a). It is located in central Oahu, west of the town of Wahiawa (pop. 18,000). SBMR extends from the Kamehameha Highway to the Waianae Mountain Range. Kamehameha Highway divides SBMR from SBER (Schofield Barracks East Range). Primary access is via the H-2 Freeway and Kamehameha Highway. SBMR is bordered to the east by the cantonment area and Kamehameha Highway, to the north by private lands and the Mount Kaala Natural Area Reserve, to the west by the Waianae Kai Forest Reserve on the Waianae crest, and to the south by Lualualei Naval Reservation, private, and state lands.

For the purposes of this document, SBMR consists of West and South Ranges, the impact area, and the cantonment area. All of South Range is ceded land and most of West Range is ceded except for a portion owned in fee. Non-military uses are permitted and include hiking and hunting. SBMR comprises approximately 3,506 ha (8,663 ac) (USACE and Nakata Planning Group 2000). The elevation at the SBMR ranges from < 201 m (660 ft) in the cantonment area to > 915 m (3,000 ft) in the Waianae Range (USACE and Nakata Planning Group 2000). The area receives a medium amount of rainfall when compared to the other areas on the island. Rainfall ranges from less than 127 cm (50 in) at about 1,000 ft to more than 190 cm (75 in) at the Mount Kaala summit at over 4,000 ft (Gioambelluca et al. 1986).

10.2 Current Military Training[35]

Schofield Barracks is the primary range complex for individual weapons qualification with limited light maneuver training areas. Primary users of SBMR include Army, Marine Corps, HI Army National Guard, and Army Reserve units[36]. Training and live-fire impact areas are situated west of the cantonment area. The South Range area is used primarily for tactical infantry maneuver training, including land navigation training. The SBMR master plan designates approximately 500 ha (1,235 ac) as suitable maneuver training (South Range) and an additional 610 ha (1,506 ac) to support ranges and indirect fire activities. The Land Use Requirement Study (USAESC and Nakata 2002a) classifies 858 ha (2,120 ac) as suitable terrain for mounted and dismounted maneuvers. Small unit maneuvers and combat support training include non-live-fire, mounted maneuver training with Humvees, cargo trucks, trailers, as well as foot training. Field activities, or training exercises can involve vehicle movement, maneuvers and convoys, foot maneuvers, bivouacking (camping), limited aviation training, and staff training exercises. The size of bivouac areas can range from 100 m X 100 m for a squad or platoon to 300 m X 300 m for a company size bivouac. There are nine open LZs and 1 LZ/DZ on SBMR.

The fixed ranges are grouped into two areas: West Range and South Range (Figure 10.a). West Range, located north of Trimble Road, includes the impact area and surrounding firebreak road. South Range contains range and maneuver land south of Trimble Road and has the Wahiawa District/ Ewa District dividing line on its southern boundary. Within these two general areas (West Range and South Range) are various fixed ranges where live-fire and non live-fire training occur. Ranges are classified into three types: small arms sustainment ranges, maneuver and live-fire ranges, and ranges in the South Range area.

[35] Portions adapted from Draft Schofield Barracks Biological Assessment (April 2002)
[36] Primary users based on 2002 Range Facility Management Support System (RFMSS) utilization data provided by USARHAW Range Division.

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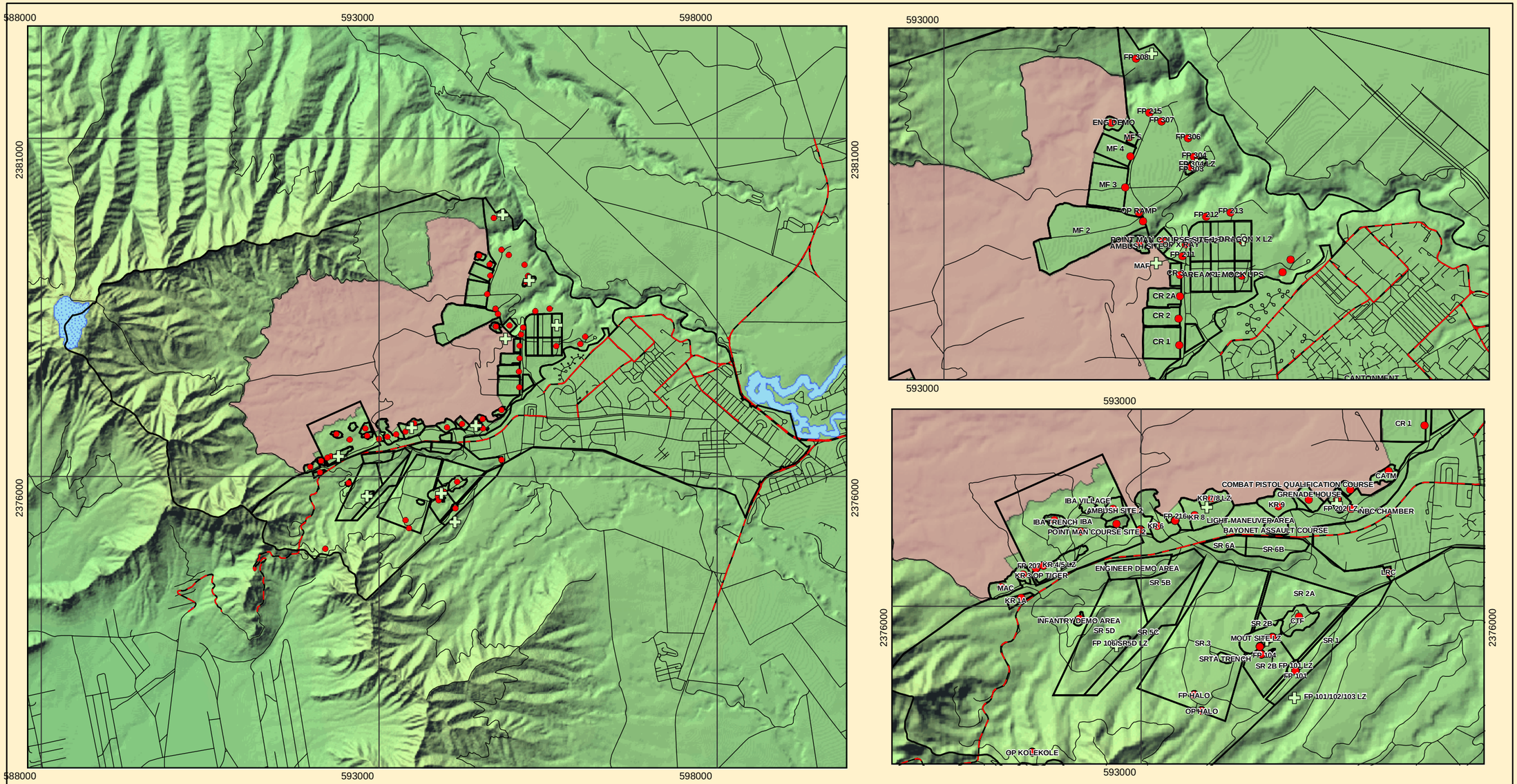
Legacy Ranges and Training Facilities

Schofield Barracks Military Reservation, Oahu

Figure 10a



1:61,000

0 650 1,300 2,600 Meters

0 0.375 0.75 1.5 Miles

Data Source: HQDA 2002a

Legend

- Firing Points
- Landing Zones (Open)
- Primary Roads
- Other Roads
- Ranges
- Impact Area
- Surface Water Body
- Bog

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The perimeter of the combined surface danger zones (SDZs) for artillery firing points and the impact area are presented in Figure 10.b. A list of Schofield ranges and authorized ammunition is presented in Tables 10.a-d. With the exception of the Infantry Demolition and Hand Grenade range, all high explosive and tracer ammunition is fired into the impact area in the West Range area. The grenade and demolition facilities are self contained ranges that are several hundred meters in diameter. Their surface danger zones are much smaller than for the other weapons and do not have the same type of fan shape. The following rules for allowable and restricted live fire and pyrotechnics use apply at SBMR South Range Training Area Complex (applies to 10 sub-areas: SR-1, SR-2A, SR-2B, SR-3, SR-5A, SR-5B, SR-5C, SR-5D, SR-6A, SR-6B). All other pyrotechnics and live-fire training on SBMR occurs on live-fire ranges. Live-fire also takes place on approved live-fire ranges outside of these sub-areas at South Range [37]:

Restrictions

- Aerial pyrotechnics (star clusters/parachute flares), and CS grenades are not authorized.
- Blanks are authorized at South Range.
- All training at Schofield Barracks Main Post, including South Range is regulated by the fire danger rating system for SBMR. Weapons systems that pose the highest risk of fire will be authorized only under the most benign fire danger category (see Enclosure 7 to Annex A of the Wildland Fire Management Plan (WFMP) for details). These weapons include tracers, pyrotechnics, and white phosphorous mortar and artillery rounds. Under the highest fire danger category, no weapons systems are allowed with the exception of ball ammunition for direct fire weapons on the CR and MF ranges only. These ranges are heavily manicured to minimize the spread and intensity of any fire and it is extremely unlikely that ball ammunition could cause an ignition.

Pyrotechnics

- The use of pyrotechnics and simulators (including demolition effects simulators – DES) requires approval from Range Division Hawaii (RDH) Range Operations.
- RDH may restrict the use of pyrotechnics through the Fire Danger Rating System (FDRS).
- Smoke grenades are allowed in all ten sub-areas.
- Smoke grenades will only be used in areas devoid of vegetation.

A summary of training types and annual usage (number of days and troops) for SBMR training facilities and South Range training areas is presented in Table 10.a. The average use of each South Range training area ranges from 34 to 114 days per year and approximately 1,650 to 20,800 troops per year. Ammunition usage at SBMR is presented in Tables 10.b - 10.d.

Artillery firing points are located on SBMR. Mobile Howitzers are towed by a humvee or truck to a designated point. Once at the firing point, the gun crew positions the gun tube to fire on a designated target. These points also support use of mortars.

[37] USARHAW Regulation 350-1, Training (25th ID(L) and USARHAW 2000), and 25th ID(L) and USARHAW Regulation 210-6, Installations Ranges and Training Areas (25th ID(L) and USARHAW 1999).

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Impact Area and Landing Zones

Schofield Barracks Military Reservation, Oahu

Figure 10b

Maps to sensitive resources have been removed from this document
Contact sjoe@hawaii.edu to request access

N

* Please see individual map area for scale information.

Data Source: HINHP 2002, RCUH 2002a

Legend

Plants
- *Abutilon sandwicense*
- *Alectryon macrococcus macrococcus*
- *Alsinidendron trinerve*
- *Cyanea acuminata*
- *Cyanea grimesiana obatae*
- *Delisea subcordata*
- *Diellia falcata*
- *Flueggea neowawraea*
- *Gardenia mannii*
- *Hesperomannia arborescens*
- *Isodendrion longifolium*
- *Labordia cyrtandrae*
- *Lepidium arbuscula*
- *Lobelia oahuensis*
- *Phyllostegia hirsuta*
- *Phyllostegia kaalaensis*
- *Phyllostegia mollis*
- *Plantago princeps*
- *Schiedea hookeri*
- *Schiedea kaalae*
- *Viola chammisoniana chammisoniana*

Snails
- *Achatinella mustelina*

Mammals
- *Lasiurus cinereus semotus*

Landing Zones (Open)

Threats from Indirect Fire Munitions
- None
- Low (Surface Danger Zone)
- Moderate (Impact Area)

Primary Roads
Other Roads
Installation Boundary
Action Area
Surface Water Body
Bog

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Table 10.a Types of Legacy Training and Annual Legacy Usage by Training Area for SBMR. (Data source: Annual RFMSS Utilization Reports for 1998-2002 obtained from G3 Range Division) Training details for each facility/training area are presented in Tables 10.b-10-e.

	Types of Training											1998-2002 Summary					
Facility/ Training Area Name	Mounted maneuver*	Dismounted maneuver*	Live fire	Foot Reconnaissance	Bivouac	Deployment training	Helicopter aviation training	Air assault/movement	Parachute drops of equipment and personnel	Major force-on-force training	CSS Operations and Training	Min Days Used	Max Days Used	Average # Days Used	Min # Troops	Max # Troops	Average # Troops
Mout Assault Course (MAC)			x									43	77	61	1030	3910	2212
KR-1A			x									27	94	60	1152	7996	3482
KR-3			x									27	54	40	277	2654	1287
IBC TRENCH			x									15	138	80	1216	9968	4612
KR-5			x									152	185	171	6246	9774	8009
IBC VILLAGE			x									26	125	82	1801	9150	4092
CONVOY			x									17	52	36	489	2409	1279
AMBUSH 2			x									26	57	45	444	2179	1536
POINTMAN 2			x									33	60	49	547	2111	1579
Grenade House			x									104	141	125	2664	4645	3499
KR-6			x									71	107	86	1877	4015	2807
KR-8			x									137	168	156	1710	3953	2830
KR-9			x									106	138	126	2165	4129	2867
Combined Arms Training and Maintenance (CATM) (small arms)			x									160	223	188	2129	3749	2969
Combat Pistol Range (CPR)			x									78	166	134	1977	3923	3397
CR-1			x									195	269	229	12121	19394	15465
CR-2			x									72	92	83	2569	3174	2966
CR-2A			x									201	330	246	4737	5877	5256
CR-3			x									204	251	227	12041	14317	13026
MF-2			x									247	281	262	5877	7398	6546
MF-2 DEMO			x									11	27	19	54	700	342
MF-3			x									68	156	128	2859	9785	6511
MF-4			x									80	169	127	3069	9893	6144
MF-5			x									115	115	115	5422	5422	5422
MF-5 CPR			x									45	114	80	1328	4601	2965
MF-5 DEMO			x									22	65	48	461	1691	1115

Table 10.a Types of Legacy Training and Annual Legacy Usage by Training Area for SBMR. (Data source: Annual RFMSS Utilization Reports for 1998-2002 obtained from G3 Range Division) Training details for each facility/training area are presented in Tables 10.b-10-e.

	Types of Training											1998-2002 Summary					
Facility/ Training Area Name	Mounted maneuver*	Dismounted maneuver*	Live fire	Foot Reconnaissance	Bivouac	Deployment training	Helicopter aviation training	Air assault/movement	Parachute drops of equipment and personnel	Major force-on-force training	CSS Operations and Training	Min Days Used	Max Days Used	Average # Days Used	Min # Troops	Max # Troops	Average # Troops
INF DEMO			x									67	99	85	2198	5954	3585
ENGINEER AREA												18	86	53	664	8458	4657
SKEET RNGE			x									69	78	74	400	1146	769
FP-101			x									22	70	48	1362	10402	4127
FP-102			x									20	62	43	1076	9400	4050
FP-103			x									27	61	43	876	9067	3950
FP-104			x									18	68	45	1110	8283	3881
FP-HALO			x									11	52	33	45	8386	2772
FP-202			x									26	102	54	118	2409	1536
FP-207			x									65	87	78	1271	2086	1567
FP-210			x									16	52	31	320	1045	716
AMBUSH 1			x									29	70	44	574	2351	1004
POINTMAN 1			x									38	74	52	619	2636	1275
FP-211			x									56	119	80	1810	3981	2989
FP-212			x									57	102	78	1429	6509	3602
FP-213			x									35	93	70	381	4076	1808
FP-215			x									27	88	54	448	1784	1226
FP-216			x									38	73	62	1060	2049	1594
FP-217			x									27	53	38	295	1890	1076
FP-303			x									74	93	85	2748	5974	3972
FP-304			x									74	105	84	2885	6089	4274
FP-306			x									83	95	87	4190	6371	5169
FP-307			x									52	86	66	3150	4937	3820
FP-308			x									15	31	21	60	2181	620
OP-HALO	x	x										10	42	28	109	4693	1679
OP-KNOB	x	x										5	27	12	399	1410	703
OP-KOLEKOLE	x	x										45	82	57	297	725	526
OP-KRIST	x	x										2	8	6	28	950	358
OP-RAMP	x	x										7	20	14	49	496	178
OP-TIGER	x	x										32	46	38	200	1607	575

Table 10.a Types of Legacy Training and Annual Legacy Usage by Training Area for SBMR. (Data source: Annual RFMSS Utilization Reports for 1998-2002 obtained from G3 Range Division) Training details for each facility/training area are presented in Tables 10.b-10-e.

	Types of Training											1998-2002 Summary					
Facility/ Training Area Name	Mounted maneuver*	Dismounted maneuver*	Live fire	Foot Reconnaissance	Bivouac	Deployment training	Helicopter aviation training	Air assault/movement	Parachute drops of equipment and personnel	Major force-on-force training	CSS Operations and Training	Min Days Used	Max Days Used	Average # Days Used	Min # Troops	Max # Troops	Average # Troops
OP-X-RAY	x	x										32	54	44	379	1141	696
OP-MIKE	x	x										2	20	12	13	2240	779
CTF MOUT - LZ	x	x					x	x				6	213	148	346	25921	13715
DRAGON-X (LZ/DZ)	x	x					x	x				19	66	43	1275	8061	3481
FP-101/102103 - LZ		x					x	x				3	11	7	69	735	402
FP-202 - LZ		x					x	x				1	1	1	25	25	25
FP-304 - LZ		x					x	x				1	2	2	44	125	76
FP-308 - LZ		x					x	x				1	8	3	1	363	124
KR-4/5 - LZ		x					x	x				2	28	15	56	1576	815
MAF - LZ		x					x	x				8	11	9	214	479	321
SR-1 maneuver area	x	x		x	x	x	x				x	27	140	93	2444	24213	13328
SR-2A maneuver area	x	x		x	x	x	x				x	36	132	93	2764	25755	14204
SR-2B maneuver area	x	x		x	x	x	x				x	37	125	87	2890	25328	13325
SR-3 maneuver area	x	x		x	x	x	x				x	60	139	103	2486	26033	14400
SR-5A maneuver area	x	x		x	x	x	x				x	1	1	1	3	3	3
SR-5B maneuver area	x	x		x	x	x	x				x	35	129	92	815	23342	13795
SR-5C maneuver area	x	x		x	x	x	x				x	31	113	85	766	22446	12902
SR-5D maneuver area	x	x		x	x	x	x				x	14	103	75	400	21181	12239
SR-6A maneuver area	x	x		x	x	x	x				x	51	133	88	2105	19463	10782
SR-6B maneuver area	x	x		x	x	x	x				x	52	127	83	2042	19490	10450
Average Training Area Use												34	114	80	1672	20725	11543

* Dismounted use may be very limited by topography and road access.

** Landing and drop zone assault and movement exercises may involve vehicle support where roads exist.

Table 10.b. Qualification Ranges and Authorized Ammunition for Schofield Barracks Military Reservation, Hawaii.[1]

Name	Location	Primary Use	Authorized Ammunition	# Sites
CR-1	EJ 95077732	Automated record fire	5.56mm	9 lanes
		Mortar firing point	60/81mm SRTA	1 firing point
CR-2	EJ 95067755	Automated field fire	5.56mm	10 lanes
		Automated field fire	.50cal SRTA	3 firing points
		Mortar firing point	60/81mm SRTA	1 firing point
CR-2A	EJ 95087775	25m Zero	5.56mm, 7.62mm, shotgun, pistol	25 lanes
		Rod & gun club	Civilian small arms	
CR-3	EJ 95087794	25m Zero	5.56mm, 7.62mm	65 lanes
		10m Zero, qualification	.50cal SRTA	
MF-2	EJ 94767840	Multipurpose MG fam/qual	5.56mm, 7.62mm	7 lanes
		.50cal Zero/qual	.50cal SRTA	
		.50cal Familiarization	.50cal	
		Sniper range	7.62mm Match	1 lane
		Mortar firing point	60/81mm Mortar	1 firing point
MF-3	EJ 94607870	Automated record fire	5.56mm	18 lanes
MF-4	EJ 94657897	25 meter zero	5.56mm	36 lanes
		10 meter Zero/qual	.50cal SRTA	
KR-1A	EJ 92137606	Hand grenade combat practice	Grenade (practice)	7 stations
KR-8	EJ 93397667	Antitank fam/qual	AT-4, SMAW live/sub-cal	3 lanes
		MK-19 fam/qual	M918 TP	
		Artillery powder burn site	105/155mm Powder charges	2 burn pans
KR-9	EJ 94007685	M203 fam/qual	40mm (HE, TP, SMK, Illum)	4 lanes
CPR	EJ 94537690	Combat pistol range	9mm	10 lanes
FP-216	EJ 93257663	Mortar firing point	60/81mm HE	1 firing point

[1] Source: 25th ID(L) and USARHAW (2000).

Table 10.c. Close-In Ranges and Training Areas and Authorized Ammunition at Schofield Barracks Military Reservation, Hawaii.[1]

Name	Location	Primary Use	Authorized Ammunition	# Sites
KR-3	EJ 92157625	Ammunition transfer point		n/a
Grenade House	EJ 94227678	Hand grenade assault course	Grenade (Practice, HE, Smoke), 5.56mm, 9mm, 7.62mm Match, shotgun, 40mm TP, 5.56mm SRTA	6 rooms
MAC	EJ 91987614	MOUT assault course	5.56mm, 40mm TP, 5.56mm SRTA, DES, 9mm	5 structures
Skeet Range	EJ 95107770	Schofield rod & gun club	Shotguns	2 lanes
Engr. Demo	EJ 93817791	Demolition training	Block, shape, crater charges (up to 300 lbs)	1 pit
EQA	EJ 94497925	Engineer qualification area	Block, shape, crater charges (150 lbs), claymore	1 pit
ETA	EJ 92987629	Engineer training area	Blank ammo	n/a
BAC	EJ 93907655	Bayonet assault course	None	2 lanes
LRC	EJ 94817625	Leadership reaction course	None	17 stations
DragonX	EJ 95667820	Training area	Blank ammo	n/a
Obstacle Course	EJ 05607725	Physical conditioning	None	n/a
Confidence Course	EJ 05267710	Confidence course	None	13 stations

[1] Source: 25th ID(L) and USARHAW (2000)

Table 10.d. Maneuver Ranges and Authorized Ammunition at Schofield Barracks Military Reservation, Hawaii.[1]

Name	Location	Primary Use	Authorized Ammunition	# Sites
CTF	EJ 94167592	Urban terrain ops (dry)	Blank ammo, smoke grenades/generator	18 buildings
		Urban terrain ops (live)	5.56mm SRTA	3 buildings
Infantry Demo	EJ 92557591	Demolition training	Demo (1 lb), claymore	3 pits
		Grenade training	Grenade HE	
Convoy Ambush	EJ 92807670	Vehicle ambush	5.56mm, 7.62mm, 9mm, 40mm TP, claymore, DES	1 lane
IBA Trench	EJ 92407662	Infantry battle area trench	5.56mm, 7.62mm, 9mm, 40mm TP, DES, grenades, 60/81mm SRTA	5 bunkers
KR4/5 Infantry battle course (IBC)		Squad (ISBC) and platoon (IPBC) level live-fire and maneuver	pistol, .45 cal, 7,62mm, 5.56mm, .50 cal, 9mm TP-T, 40mm TP (M203 and MK19), Dragon Practice, ¼ block TNT, Inert TOW, smoke grenades, Claymore mine	ISBC Trench incorporated in the range can be scheduled separately. This range incorporates the IBC village, convoy ambush site, ambush site 2, and point man course 2
KR-6	EJ 93127659	Squad defense course	5.56mm, 7.62mm, 40mm TP, claymore, DES, 5.56mm SRTA, .50 cal SRTA	5 lanes
		Mortar Firing Point	60/81mm SRTA	1 firing point
Point Man #1	EJ 94937823	Quick fire	5.56mm, 40mm TP, 9mm, shotgun, 5.56mm SRTA	7 targets
Point Man #2	EJ 92847656	Quick fire	5.56mm, 9mm, shotgun. 5.56mm SRTA	6 targets
Ambush # 1	EJ 94737822	Ambush	5.56mm, 7.62mm, 9mm, claymore, 40mm TP, DES	1 lane
Ambush # 2	EJ 92807671	Ambush	5.56mm, 9mm, DES, claymore, 40mm TP, 5.56mm SRTA	1 lane

[1] Source: 25th ID(L) and USARHAW (2000)

The Infantry Battle Area (IBA) provides maneuver training under live-fire support, and includes the following ranges: Infantry Battle Course (KR-5), Live Fire Trench, Live Fire Village, Ambush Site #2, Pointman Course #2, and KR-6 Squad Defense Course. It is generally open terrain and is currently used predominantly for day and night maneuver live-fires up to platoon level. Units can fire the following on the IBA: 5.56mm, 7.62mm, 9mm, 40mm TP grenades, AT-4 anti-tank missiles, 7.62mm, Claymore mines, demolition effects simulators (DES), Bangalore, 60/81mm SRTA, Javelin/TOW (Inert), Grenades (CS/HC/SMK), 7.62mm door gun, aerial gunnery. The purpose of use, size of units and controls for the IBA Village and IBA Trench are the same as at the IBA. The IBA Village is a small group of wooden, one room buildings. Units may fire the following at IBA Village: 5.56mm, 7.62mm, 9mm, 5.56mm SRTA, Bangalore, Claymore, DES, and 40mm TP grenades. The IBA Trench supports 5.56mm, 7.62mm, 9mm, 40mm TP grenades, grenades, and 60/81mm SRTA (pers. comm. Cpt Blandford, Transformation Office, February 2003).

The South Range area consists of ten sub-areas and contains five landing zones. South Range serves as the maneuver corridor to the Infantry Battle Area (IBA) and is where maneuvers on SBMR takes place. The units begin their movement just west of the Schofield Barracks Leaders' Reaction Course (LRC) near SR-2A. A typical battalion rotates companies to attack either the CTF-MOUT Site or the SR-3 Trench as an intermediate objective. The units proceed to and across Trimble Road and then attack the final objective on the IBA. Types of training conducted in Schofield Barracks South Range are listed in Table 10.a. Live-fire training in South Range consists of artillery and mortar firing points, demolition and grenade training, blanks, and pyrotechnics.

Impact Area and Surface Danger Zones

A surface danger zone (SDZ) is a segment of a range endangered by the firing of a particular type of weapon. An SDZ consists of the target area, impact area, ricochet area, secondary danger areas on all sides of the primary danger area, and other associated areas (HQDA 1983). Surface danger zones for ranges at SBMR terminate in a common impact area. The impact area is the primary danger area for all indirect fired weapon rounds. When applied to direct fire weapons, the impact area is the area located between established range limits in the approved surface danger zone. The impact area is off-limits to unauthorized personnel due to fired munitions hazards. The portion of the impact area where high explosive rounds have landed but did not detonate (duds) is termed a dedicated, or dudded, impact area.

Artillery and Mortars

Artillery and mortars are fired from designated firing points (Table 10.e). Detailed safety and firing procedures for artillery and mortars are contained in the 25th ID(L) and USARHAW Regulation 210-6, Installations, Ranges, and Training Areas, Appendix 8. The range of artillery and mortars varies with the amount of propellant charge used. Artillery firing (105 and 155mm howitzer cannons) is limited to a charge of three to ensure that the weapon will not overshoot the Schofield Barracks ridgeline (i.e., western SBMR boundary) (pers. comm.. Cpt. Bockholt, Artillery Battallion Fire Direction Officer, 3/4/03). This rule is specified in USARHAW Regulation 350-1, Training. In this way, ammunition (and especially high explosive ammunition) is also more likely to land within the firebreak road and the impact area. In addition, units are required to pick up a range card from Range Control that lists the right and left limits and the minimum and maximum range allowed for each firing point and weapon. Maximum allowable charges and distance of artillery firing is listed in Appendix A. Ammunition may land outside the impact area.

Table 10.e.Close-In Firing, Mortar and Observation Points at Schofield Barracks Military Reservation, Hawaii.[1]

Name	Location	Primary Use	Authorized Ammunition	# Sites
FP-101		Mortar Point	60mm, 81mm	1 point
FP-104		Mortar Point	60mm, 81mm	1 point
FP-202	EJ 94497671	Firing Point	Dry	1 Firing Point
FP-210	EJ 94737822	Firing Point	81mm	1 Firing Point
FP-211	EJ 95107810	Firing Point	81mm, 105mm	1 Firing Point
FP-212	EJ 95317845	Firing Point	105mm	1 Firing Point
FP-213	EJ 95527848	Ammo Verification Site	Dry	1 Firing Point
FP-216	EJ 93257663	Firing Point	60mm, 81mm	1 Firing Point
FP-303	EJ 95187888	Firing Point	105mm	1 Firing Point
FP-304	EJ 95207897	Firing Point	105mm, 155mm	1 Firing Point
FP-306	EJ 95157913	Firing Point	105mm, 155mm	1 Firing Point
FP-307	EJ 94927928	Firing Point	105mm, 155mm	1 Firing Point
FP-308	EJ 94647980	Firing Point	105mm, 155mm	1 Firing Point
FP-Halo		Firing Point	105mm	1 Firing Point
OP X-Ray	EJ 95137820	Artillery Observation Point	Laser	n/a
OP-Halo		Artillery Observation Point	None	n/a
OP-Knob		Artillery Observation Point	None	n/a
OP-Kolekole		Artillery Observation Point	None	n/a
OP-Krist		Artillery Observation Point	None	n/a
OP-Tiger		Artillery Observation Point	None	n/a
OP Mike	EJ 94547671	Artillery Observation Point	None	n/a
OP Ramp	EJ 94727848	Artillery Observation Point	None	n/a

[1] Source: 25th ID(L) and USARHAW (2000)

Small Arms

For small arms ranges that utilize tracers, the ranges are laid out so that tracer burnout occurs before a round leaves the impact area. However, in most cases, since small arms firing is concentrated on targets that are rather close in, the highly disturbed area where most projectiles impact is located immediately around the target area. It is highly unlikely that small arms ammunition would cross the firebreak road but if it does, the distance to the firebreak road ensures that tracer burnout occurs before then. Tracer burnout distances are listed by ammunition type in Appendix A, Legacy and SBCT Vehicles, and Weapons Systems.

The complete list of weapons and ammunition is shown in Table 10.f. Descriptions of weapons ammunition, and pyrotechnics are provided in Appendix A. Tracer ammunition is the primary cause of fires started within the impact area. This is due to the incendiary nature of the ammunition and the high number of tracers fired relative to other high fire-ignition munitions. Most tracer bullets land near target areas inside the firebreak road and all tracer ammunition burns out within the impact area.

Training is planned and executed in accordance with 25th ID(L) and USARHAW Regulation 210-6, Installations, Ranges, and Training Areas (25th ID(L) and USARHAW 2002) In addition, Standing Operating Procedures (SOP's) for each live-fire range at SBMR are being updated and consolidated into a single SOP at this time. Existing SOP's outline the safety precautions that soldiers must follow to prevent fires from starting outside the firebreak road. The new SOP and the WFMP will include additional specific fire minimization and suppression procedures that will be followed by range personnel and soldiers. It will also provide additional procedures to protect biological and archaeological resources.

Table 10.f.Weapons, Ammunition, and Pyrotechnics Potential to Initiate Wildfires at Schofield Barracks Military Reservation, Hawaii.[1]

Weapon	Ammunition	Potential to Start Fires[2]
Small Arms: Rifles Pistols Machine Guns Shot Guns Helicopter Guns	Ball bullets: .50 caliber 5.56, 7.62, 9 millimeter (mm) 20mm target practice (TP) 12 Gauge buck shot	Low
	Blank ammunition: .50 caliber 5.56, 7.62 mm	Low
	Tracer bullets: .50 caliber tracers 5.56, 7.62, 9mm tracers 20 mm TP tracer (helicopter gunnery)	All High
Mortars	60mm high explosive (HE) 60mm illumination (ILL) 60mm white phosphorus (WP) 81mm high explosive (HE) 81mm illumination (ILL) 81mm white phosphorus (WP)	Medium High High Medium High High
Artillery	105mm high explosive (HE) 105mm illumination (ILL) 105mm white phosphorus (WP) 155mm high explosive (HE)	Medium High High Medium

Weapon	Ammunition	Potential to Start Fires[2]
	155mm illumination (ILL) 155mm white phosphorus (WP) 155mm Copperhead (laser guided) 155mm RAP (rocket assist)	High High Medium High
AT-4 Anti-Tank Weapon	84mm high explosive anti-tank rocket	Medium
Light Anti-Tank Weapon (LAW)	66mm high explosive anti-tank rocket 35mm subcaliber practice rocket	Medium
Shoulder-Launched Multipurpose Assault Weapon (SMAW)	Launcher Assault Rockets: SMAW practice, SMAW common practice	Medium
Tube-Launched, Optically Tracked, Wire Command Link (TOW), Guided Missile System	TOW blast effect simulator	Low
Grenades	Smoke Grenades: Colored, HC white smoke, and TA smoke practice Explosive Grenades: 40mm M203 and MK19 Training Practice (TP) ,fragmentation, offensive, practice	Medium Low
Demolitions	Demolitions (Limit 300 lb. net explosive weight, including bangalore torpedoes)	Medium
Mines	Mines: claymore antipersonnel, inert antipersonnel (volcano delivery device), anti-tank	Medium
Ground Pyrotechnic Signals (Flares)	Handheld	High
Simulators	Simulators: projectile – ground burst, booby trap, hand grenade	Medium
	Smoke Pot	Medium
Fog Oil	Smoke (fog oil) Generator	Low

[1] Source: 25th ID(L) and USARHAW (2000)

[2] Potentials are based on historical fire data. This ignition rating system was developed initially for Makua Military Reservation by USARHAW Range Division, Wildland Fire, and Environmental Division Staff. High explosive rounds receive a low potential to start fires because the explosive nature of the round starves the immediate area of oxygen, resulting in a low potential for ignition. Smoke and illumination rounds have a high potential because there is an exposed flame associated with these munitions. White phosphorus rounds are highly flammable.

10.3 Proposed Transformation Actions at SBMR

10.3.1 Construction

The following construction projects are planned as part of the proposed action:

McCarthy Flats Multi-Purpose Qualification Complex (QTR1) (57835). This complex supports qualification for:

- Pistol (38 cal, 9mm, 45 cal)
- Shotgun and rifle (M16, M4, M14 sniper rifle, M21, M24)
- Machine gun (M60, M249, M240B, M2)

This project will construct a standard Qualification Training Range (Figure 10.c). The range will include 10 lanes for combat pistol and MP qualification, 16 modified record fire lanes, and 4 multipurpose machine gun/sniper lanes. The range will be approximately 500 m wide and 1000 m long. The range will have a similar orientation to the impact area as the CR and MF ranges it is replacing. Primary facilities also include stationary infantry target emplacements, moving infantry target emplacements, zero panel and standing silhouette emplacements, two range control towers, operation and storage building, two ammunition breakdown facilities, two general instruction buildings, latrine, bleacher enclosure, and covered mess. Primary facilities will also include all construction within the perimeter of the range complex, which consists of necessary information systems requirements, earthwork, clearing of unexploded ordnance, electrical service, limit markers, berms, service roads, site drainage, and erosion control. Supporting facilities include all construction outside the perimeter of the range complex and consists of electrical service, fencing, lighting, parking, military vehicle trail, storm drainage, information systems, and site improvements.

This range is required to train and test units of the 25th ID(L) on the skills necessary to detect, identify, engage, and defeat dismounted and mounted enemy forces. This project is specifically required to meet live-fire training requirements for individual and crew-served weapon systems. This range is also required to provide maneuver area in support of the Stryker Brigade Combat Team (SBCT) that will be stationed in Hawaii. Targetry is estimated to consist of 286 stationary infantry targets, 8 moving infantry targets, 26 zero panels, and 10 standing silhouettes.

Training at QTR1 is anticipated to disturb approximately 49 ha (120 ac). The range would be used between 180 and 242 days per year. No combat (i.e., Stryker and Humvee) vehicles would be in service at the range, but between five and ten support vehicles (trucks) would be used per training episode per day.

Battle Area Complex (BAX or BAC) (58144). This complex supports qualification for:

- Graduated live-fire training from squad to company level, and some Battalion exercises
- Incorporates all weapons intrinsic to the SBCT Infantry Company except the Javelin
- Allows a variety of live-fire exercise scenarios

The battle area complex will be constructed in accordance with CEHNC standard design and TC 25-8, *Training Ranges* (HQDA 2002a) with modifications to suit the terrain and scenario for this project (Figure 10.d). Features of this range include: 2-4 course roads with crossover capability, 22 stationary armor targets, 3 moving armor targets, 167 stationary infantry targets, 27 moving infantry targets, 16 machine gun/observation bunkers, 2 grenade/breaching obstacles, 3 landing zones, 13 mortar simulation devices, and 8-16 vehicle firing positions/hull-down defilades. Range operations support facilities will include a vault latrine, bleacher enclosure, covered mess area, range operations center, storage building, an ammunition loading dock and an After Action Review building. Supporting facilities will include site improvements, erosion control, a bivouac area, electrical service, security fencing and gates.

This project is required to provide a digital, multi-purpose battle area complex in support of implementation of evolving Department of the Army and Training and Doctrine Command (TRADOC) Combat Doctrine and Training Strategies. It will allow the 25th ID (L) and US Army Hawaii to meet live-fire maneuver training requirements for individual and crew (mobile gun system) familiarization, and qualification of personal and crew-served weapon systems. Primary uses include gunnery training and qualification requirements for various weapons systems employed by the 25th ID(L), including dismounted infantry platoon tactical live-fire operations, either independent of, or simultaneously with, supporting vehicles. This facility will also satisfy the requirement for zeroing and boresighting the 105-millimeter main gun on the mobile gun system. The facility will contain digital information and telecommunication technologies to safely track and manage all forces undergoing individual and

Proposed SBCT Ranges

Schofield Barracks Military Reservation, Oahu

Figure 10c

Maps to sensitive resources have been removed from this document
Contact sjoe@hawaii.edu to request access

1:80,148

0 400 800 1,600 Meters

0 0.25 0.5 1 Miles

Data Source: John Gallup & Associates 2002, HINHP 2002, RCUH 2002a

Legend

- Threatened and Endangered Species
- Urban Assault Course
- Qualification Training Range Surface Danger Zone
- Battle Area Complex Surface Danger Zone
- Primary Roads
- Other Roads
- Installation Boundary
- Surface Water Body
- Bog

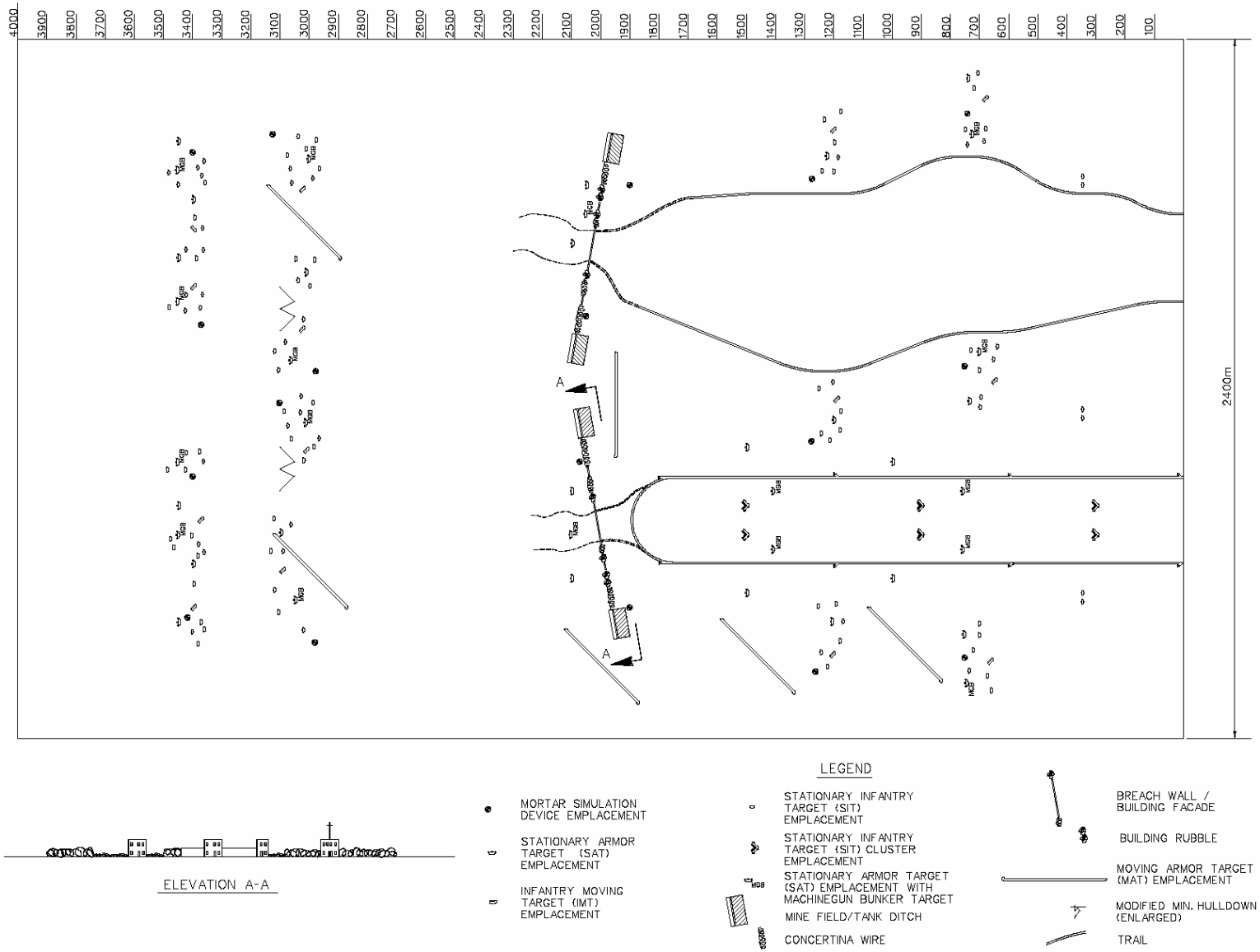


Figure 10.d. Battle Area Complex, Standard Design (HQDA 2002a).

collective live-fire training qualifications, dry firing, and sub-caliber engagements. The range will primarily be used by the 25th ID(L), but also by Marine Corps, Army Reserve, and Army National Guard units. Operations will be conducted by moving/stationary vehicles and/or dismounted personnel against simulation systems, which can create a synthetic picture of adjacent facilities, terrain, enemy forces, and battlefield conditions. The command and control targetry instruments will accurately score all engagements against established standards, capture all related telemetry and scoring information, and relay the data to a complete After Action Review of the exercise. The target arrays and scenarios are in accordance with qualification requirements. This facility will allow for enhanced scenario flexibility, engagement range realism, and offensive capabilities.

Training at the BAX is anticipated to affect approximately 840 ha (2,075 ac). The BAX is anticipated to use combat vehicles between 5 and 21 days per year and support vehicles between four and eight days per year. Various types of ammunition, mines, and pyrotechnics would be used at the BAX (see Table 10.f).

Urban Assault Course and Training Facility (UACTF) (57305). This complex supports qualification for:

- Urban Assault Course (live fire)
- Breach Facility (live fire)
- Shoot House (live fire)

This project will develop an urban assault course (UAC) (Figure 10.e), shoot house (Figure 10.f), breach facility (Figure 10.g), and the necessary support facilities on an existing military operations in urban terrain (MOUT) assault course (MAC). The project footprint would approximate that of the existing MAC facility on Schofield Barracks. The complex would support use of 5.56 mm and 5.56 mm blanks, 40 mm TP grenades, practice grenades, 7.62 mm blanks, smoke grenades, and simulators. The breach facility would be used to train soldiers in the proper techniques to enter buildings through doors, windows, and walls. The urban assault training facility would train soldiers in other techniques associated with urban combat, including underground training. The live-fire shoothouse would be used to train individuals, squads, and platoons on the proper techniques to enter and clear a building. The shoothouse is the culmination of the training at the breach facility and the urban assault training facility and is required to support the combined arms urban operations training strategy for conducting full spectrum operations (offense, defense, stability, and support). Range operations facilities will include a small after action review building, a latrine, and an operations/storage building. Simulated overhead power lines would be run from building to building throughout the “city” training objective, but they would not be connected nor energized. Range operational supporting facilities include a new access road and temporary parking area for privately owned vehicles and tactical vehicles, primary and secondary power, and data distribution systems. Storm drainage, site improvements, and berms will be provided as necessary. This facility is proposed to replace the military assault course (MAC) on the Kolekole Range at Schofield Barracks and would be sited 100 yards north of Trimble Road, approximately 1.25 miles west of the intersection of Beaver Road and Trimble Road. The proposed range project would be oriented to the north using the current range impact area. This project would be used in concert with the combined arms collective training facility (CACTF) proposed for Kahuku Training Area to provide the full complement of Urban Assault Training Facility functions.

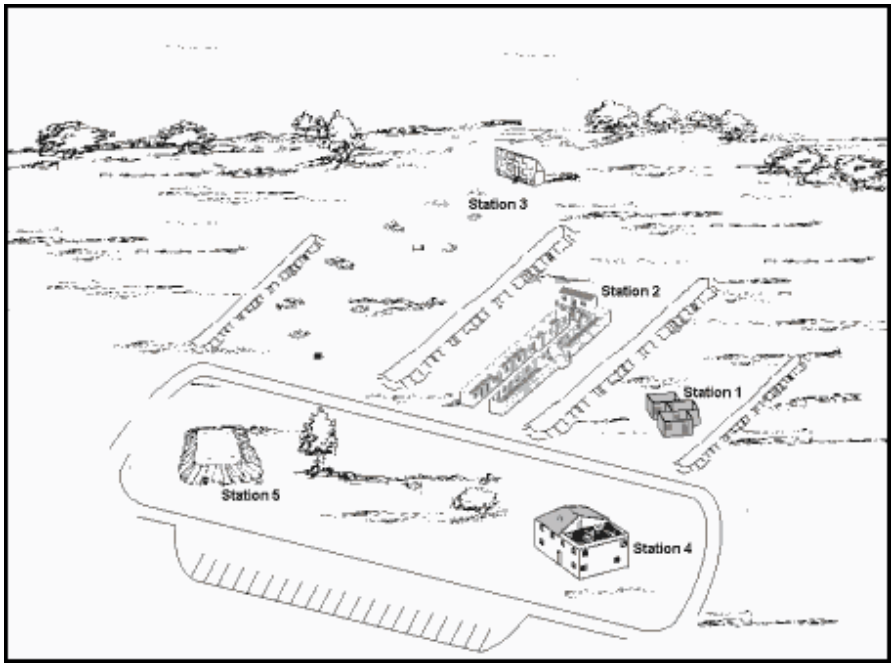


Figure 10.e. Urban Assault Course, Proposed (HQDA 2002).

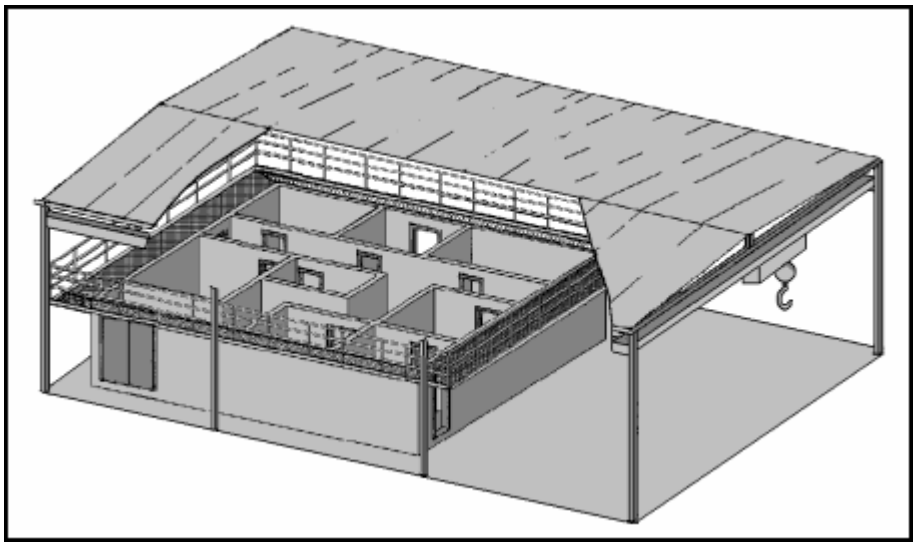


Figure 10.f Shoot House, Proposed (HQDA 2002).

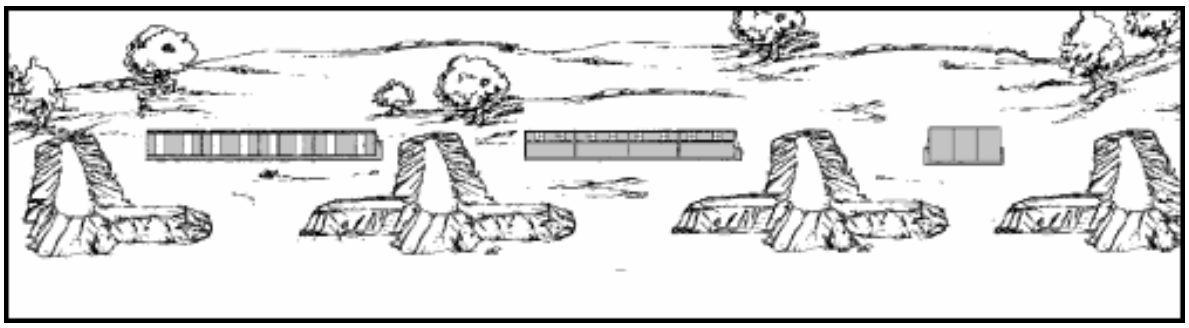


Figure 10.g. Breach Facility, Proposed (HQDA 2002).

The CACTF provides blank fire training for platoon and company situational training exercises (STX) and battalion task force field training exercises (FTX). The recommended usage is semi-annually for active units.

Urban Assault Course (UAC)

The UAC has five training stations that facilitate the crawl/walk/run training concept (Figure 10.e).

(1) Station 1, Individual and Team Trainer. This station is a three-room trainer where team leaders and squad leaders train the basics of building and room clearing.

(2) Station 2, Squad and Platoon Trainer. This station is a four-structure trainer with multiple rooms. Squads build upon tasks learned at Station 1 and begin to learn the concepts of clearing multiple buildings. The station is designed in such a way that it can be used as individual buildings with a narrow street or as rooms inside a building with a long connecting hallway.

(3) Station 3, Grenadier Gunnery Trainer. This station is a live-fire station where M203 gunners master target engagements in an urban area, move tactically, and respond to the fire commands.

(4) Station 4, Offense/Defense House. This station is where a platoon can train to attack and or defend a building. This station can also be divided into a number of smaller training stations to reinforce training or to train tasks not yet trained at the other stations. (For example, upper-level entry techniques.)

(5) Station 5, Underground Trainer. This station provides training for subterranean operations.

The facility provides Infantry, Engineer, Military Police and other units with a facility to train the individual soldier through platoon-level urban operations skills. Combat, CS, and CSS units can use this facility and the UAC can also be used as a mission rehearsal exercise site.

Shoot House

The shoot house provides leaders with a facility to train and evaluate the unit during a live-fire exercise. Units are trained and evaluated on their ability to move tactically, engage targets, conduct breaches, and practice target discrimination in an urban environment. This facility has two parts, the live-fire facility and the after action review (AAR) room. The live-fire facility is a single-level structure with a barn roof, catwalk, and eight adjoining rooms with video capture capability that should be used for AARs. The walls are bullet proof and prevent ricochets. There are four entrances, one on each side of the facility. Replaceable blow panels are located throughout the facility for entry into the building by means other

than through doors. The shoot house has a crane system in the roof that allows for removal of doorways and blow panels not needed for training, and replacement with solid wall sections. This gives the unit the ability to vary the training scenarios. Unit's can conduct explosive and mechanical breaches. For safety reasons, there are no windows in the structure (Figure 10.f). The after action review (AAR) building has a conference/AAR room that can accommodate up to a platoon size element, an instrumentation and targetry control room, and an AAR edit and projection room that can facilitate a formal AAR.

Breach Facility

The breach facility is used to train soldiers semiannually on the technical aspects of breaching techniques. The facility has three stations (Figure 10.g):

Station 1. This station is a facade that is 2.4 m high and 26.8 m wide (8 ft high and 88 ft wide) with four sections of two doors for a total of eight doors. Soldiers can conduct mechanical, thermal, ballistic, and explosive breaching techniques on doors at this station. Half of the doors open from the exterior, and the other half of the doors open from the interior.

Station 2. This station is a facade that is 3 m high and 26.8 m wide (10 ft high and 88 ft wide) that has four sections of two windows each for a total of eight windows. Soldiers can conduct mechanical and explosive breaching techniques on windows at this station.

Station 3. This station is a facade that looks like a wall of a building. This facade is about 2.4 m high and 8.5 m wide (8 ft high by 28 ft wide). The facade has three sections that precast built panels will fit into. The pre-cast panels are 2.4 m high and 2.4 m wide (8 ft high and 8 ft wide) and can be made of concrete, concrete masonry unit (blocks), stone, brick, wood or other material. The panels are designed to accommodate thermal and explosive breaching techniques.

This project is required to comply with the U.S. Army Training and Doctrine Command (TRADOC) approved urban operations doctrine and training strategy. The urban assault course, breach facility and live-fire shoot house all support the combined arms urban operations training strategy for conducting full spectrum operations (offense, defense, stability and support) detailed in coordinating draft Training Circular 90-1, *Urban Operations Training* (HQDA 2002). The project will allow units to conduct combined arms MOUT training in a manner that more closely simulates their actual roles in combat. By moving from point to point along the flank of an enemy force and firing at targets as they appear in various locations, training units are able to accurately simulate the same process as in combat. These facilities support squad and platoon training, multiple scenarios, all breaching tasks, limited live-fire capability, and close quarters marksmanship skills described in Field Manual 3-23.9: *M16A1 and M16A2 Rifle Marksmanship*. This range is designed to satisfy the training requirements for the mobile gun system, Stryker vehicle, and reconnaissance infantry armored vehicle crews to defeat stationary and moving targets in a tactical array. It also supports dismounted infantry training.

Training at the UACTF is anticipated to affect approximately 6 ha (14 ac). The UACTF is anticipated to be used between 75 and 150 days per year. Support vehicles would be used in training activities between three and five days per year. Ammunition to be used at the UACTF consists of 5.56 mm ball, 5.56 blank, 7.62 mm ball, 7.62 blank, 9 mm, 40 mm TP grenades, smoke grenades, and simulators.

Range Control Facility (56923). The proposed project will construct a consolidated Range Control Complex for Range Division-Hawaii Headquarters, Schofield Range Operations, Range Maintenance (Oahu), and Integrated Training Area Management (ITAM) (Figure 10.h). Range Maintenance uses include a carpentry shop, welding shop, and target and raw material storage. The building will consist of approximately 6,000 ft^2 of space. Approximately 6,000 ft^2 parking area will be constructed for parking for

tactical and personal vehicles and equipment used by Range Division on Schofield Barracks. Supporting facilities include water, sewer and electrical service, paving, walks, parking, security fencing, information systems and site improvements. Eight buildings consisting of 35,867 ft^2 will be demolished to make room for the proposed complex.

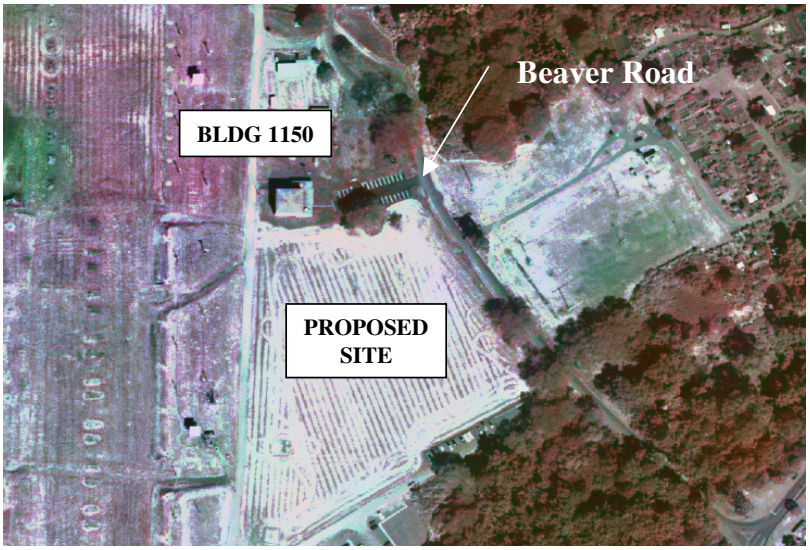


Figure 10.h Range Control Facility, Proposed Location (USAG HI Transformation Office, June 6 2002).

Fixed Tactical Internet (FTI). Construction of seven fixed tactical internet antenna support structures with four antennas each is proposed to provide tactical communications infrastructure enabling units to train at any hour of the day or night without deploying to the field (Figure 10.i). When linked to the installation information infrastructure architecture (I3A), FTI could also provide connectivity for command and control integration of live-fire and simulation training. FTI is a group of antennas placed strategically throughout a training land parcel. The antennas permit sending and receiving of voice and data signals to radios in military vehicles.

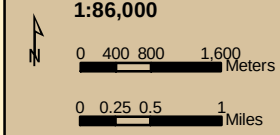
Four antennas will be installed at each proposed site located on Oahu. Existing antenna support structures and sites will be utilized when possible. The antennas are vertical whips approximately two inches in diameter. Two antennas approximately 1.2 m (4 ft) long and two approximately 3 m (10 ft) long will be mounted on an antenna mast, utility pole, existing support structure, or building. Some of the antennas may have a red light at the top, in accordance with FAA guidelines, to warn nearby aircraft. Each site will be 6.1 x 7.6 m (20 x 25 ft), including a 4.6 x 6.1 m (15 x 20 ft) concrete pad for the support structure and shed. Each site will be fenced and accessed via existing roads in all cases. Personnel will visit the sites prior to and after Army training events. No security lighting will be installed at the sites. Equipment sheds will house radios and batteries. The seven FTI structures associated with SBMR are Kolekole (31 m (102 ft) in height, existing support structure, new equipment shed), Mt. Kaala East (25' in height, new support structure, existing equipment shed), Mt. Kaala West (25' in height, new support structure, new equipment shed), MSTF/ISF Schofield 1 (31 m (102 ft) in height, new support structure, existing equipment shed), Schofield 2 (31 m (102 ft) in height, existing support structure, new equipment shed), West Range MF201 (18 m (60 ft) in height, new support structure, new equipment shed), West Range MF501 (18 m (60 ft) in height, new support structure, new equipment shed).

Proposed Location of Fixed Tactical Internet Antenna (FTI)

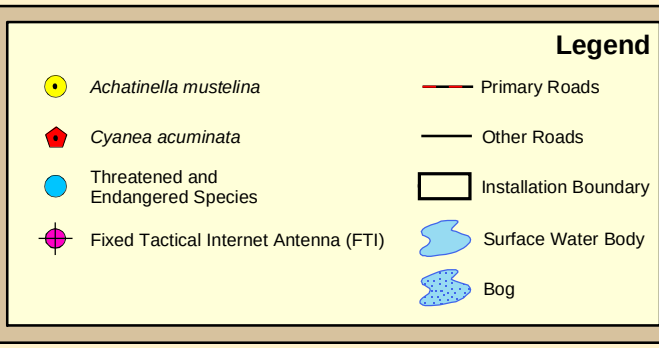
Schofield Barracks Military Reservation, Oahu

Figure 10i

Maps to sensitive resources have been removed from this document
Contact sjoe@hawaii.edu to request access



Data Source: John Gallup & Associates 2002, HINHP 2002, RCUH 2002a



Virtual Fighting Training Facility (57404)
The proposal is to construct an 11,496-square-foot single-story state-of-the-art virtual fighting training facility to house war-fighting simulation operations to support small arms marksmanship and dismounted weapons system training. The facility would include 25 to 50 engagement skills trainer lanes (video game-like weapons simulators), an after-action review (AAR) room, conference area, break area, administrative office space, storage, restrooms, telecommunications room, mechanical room, classroom, and electrical room. Support facilities would include water, sanitary sewer, storm drainage, electric service, fire protection and alarm systems, telephone, paving, walks, curbs, gutters, parking, information systems, and state-of-the-art intra-communications and intercommunications systems and site improvements. The building would be constructed within the Schofield cantonment area on the south side of Trimble Road, approximately half a mile west of the intersection of Beaver Road and Trimble Road.

10.3.2 Live-Fire Range Use

Individual and collective weapons qualification and training will take place on new ranges (i.e., battle area complex, QTR1, QTR2 and combined-arms MOUT training facility) and existing ranges, other facilities, and artillery/mortar firing points. No new artillery or mortar firing points are proposed. The proposed Battle Area Course will support up to company-level CALFEX training, with some battalion-level exercises possible. Small arms training formerly conducted at McCarthy Flats qualification Ranges 3 and 4, will move to the QTR2 range on the new South Acquisition Area.

Weapons to be fired on the QTR2 range would be only direct-fire weapons (e.g., rifles, pistol, shotgun). Tracer ammunition or indirect fire weapons (i.e., mortars, howitzer cannon artillery pieces) would not be used at the South Acquisition Area. Since the QTR2 range is a backup range for direct fire weapons, it will not be used as heavily as the QTR1 range on McCarthy Flats at Schofield Barracks, where all direct-fire small arms and tracer ammunition are permitted. The frequency of use for the QTR2 would be approximately 150 days per year. Because no dud-producing munitions will be used on this range, there are no safety hazards associated with the surface danger zone when the range is not in operation. Therefore, the QTR2 surface danger zone (i.e. range safety fan) would be accessible for natural resources management and range maintenance approximately 210 days per year (pers. comm.. Ron Borne, 2/25/03 meeting). The layout of the planned future firebreak with respect to the QTR2 surface danger zone would allow continuous access (365 days per year) by the Nature Conservancy, Hawaii to their lands via the planned firebreak (pers. comm.. Ron Borne, 2/25/03 meeting). There would be no mortar or artillery firing from the South Range Acquisition Area.

A range usage comparison for one Legacy and one SBCT Brigade is presented in Section 2.6, General Changes in Training as a Result of Transformation. Changes in live-fire range use at SBMR are summarized in Table 10.g for individual ranges. Table 10.h summarizes anticipated changes in ammunition usage for all SBMR ranges combined.

10.3.3 Non Live-Fire Maneuver and Other Training Activities

Legacy and SBCT units would use SBMR for tactical infantry training, including land navigation training, and will also use other facilities inside and outside the cantonment area. Such training would include non-live-fire mounted and dismounted maneuver training (e.g., using Strykers, Humvees, cargo trucks, etc.) on South Range sub-areas. The primary use of SBMR would continue to be for weapons qualification, live-fire training, and MOUT training. Training would continue to include establishing tactical and logistics operations and administrative centers, as well as smaller and more dispersed activities such as bivouac. As with Legacy training by Army and other units, most training would be at the squad through company level, with some opportunities for larger-scale training. General SBCT training would occur between 180 and 242 days per year. At the proposed South Range Acquisition Area,

Table 10.g Comparison of Current and Transformed Ammunition Usage by Range for SBMR.

	FY 05 Projection Un-Transformed (Current)						FY 05 Projection Transformed						Net Difference With Transformation	
RANGE and Ammunition Type	2 Legacy Brigades	Other 25th ID(L)	USMC	Other Units	Total	Tracer Rounds	1 Legacy Brigade & 1 SBCT	Other 25th ID(L)	USMC	Other Units	Total	Tracer Rounds	All Rounds	Tracer Rounds
Grenade House														
5.56mm	281,454	22,542	35,518	30,280	369,794	27,735	192,120	22,542	35,518	30,280	280,460	21,034	-89,334	-6,700
7.62mm	3,771	1,240	4,900	29,551	39,462	4,341	11,942	1,240	4,900	29,551	47,633	5,240	8,171	899
9mm	0	8,047	930	578	9,555		0	8,047	930	578	9,555		0	
40mm M203 TP	3,329	0	0	100	3,429		3,842	0	0	100	3,942		513	
Practice Grenade	8,228	100	492	0	8,820		10,657	100	492	0	11,249		2,429	
Frag Grenade	2,055	0	1,112	0	3,167		2,443	0	1,112	0	3,555		388	
Pyro	1,490	0	0	45	1,535		797	0	0	45	842		-692	
Pyro-Smoke	146	0	0	0	146		57	0	0	0	57		-89	
5.56mm Blank	35,911	0	6,000	0	41,911		43,802	0	6,000	0	49,802		7,891	
7.62mm Blank	3,617	0	800	0	4,417		6,131	0	800	0	6,931		2,513	
MOUT Assault Course							**Urban Assault Course (proposed)**							
5.56mm	281,454	0	28,291	0	309,745	23,231	192,120	0	28,291	0	220,411	16,531	-89,334	-6,700
9mm	0	0	750	0	750		0	0	750	0	750		0	
40mm M203 TP	3,329	0	488	0	3,817		3,842	0	488	0	4,330		513	
Practice Grenade	4,114	0	0	0	4,114		5,329	0	0	0	5,329		1,215	
5.56mm Blank	35,911		23,000		58,911		43,802		23,000		66,802		7,891	
7.62mm	0	0	0	0	0		0	0	0	0	0		0	
7.62mm Blank	3,617	0	0	0	3,617		6,131	0	0	0	6,131		2,513	
Pyro-Smoke	86	0	0	0	86		57	0	0	0	57		-29	
Pyro	1,020	0	0	0	1,020		796	0	0	0	796		-223	
KR 1-A														
5.56mm	0	0	28,291	0	28,291	2,122	0	0	28,291	0	28,291	2,122	0	0
9mm	0	0	750	0	750		0	0	750	0	750		0	
Practice Grenade	32,912	7,866	0	0	40,778		42,630	7,866	0	0	50,496		9,718	
KR 5 Infantry														

Table 10.g Comparison of Current and Transformed Ammunition Usage by Range for SBMR.

	FY 05 Projection Un-Transformed (Current)						FY 05 Projection Transformed						Net Difference With Transformation	
RANGE and Ammunition Type	2 Legacy Brigades	Other 25th ID(L)	USMC	Other Units	Total	Tracer Rounds	1 Legacy Brigade & 1 SBCT	Other 25th ID(L)	USMC	Other Units	Total	Tracer Rounds	All Rounds	Tracer Rounds
Battle Course														
5.56mm	1,125,816	28,869	27,010	33,928	1,215,623	91,172	640,400	28,869	27,010	33,928	730,207	54,766	-485,416	-36,406
7.62mm	79,644	16,100	11,200	0	106,944	11,764	125,673	16,100	11,200	0	152,973	16,827	46,029	5,063
9mm	0	250	750	0	1,000		0	250	750	0	1,000		0	
40mm M203 TP	6,658	53	0	200	6,911		7,683	53	0	200	7,936		1,025	
40mm Wh Star	2,565	0	0	0	2,565		3,465	0	0	0	3,465		900	
40mm MK19 TP	0	1,000	0	0	1,000		0	1,000	0	0	1,000		0	
Practice Grenade	4,114	0	90	0	4,204		5,329	0	90	0	5,419		1,215	
Frag Grenade	0	60	30	0	90		0	60	30	0	90		0	
AT-4	0	4	34	25	63		0	4	34	25	63		0	
Mortar 60mm HE	0	0	0	48	48		0	0	0	48	48		0	
Claymore Mine	78	0	0	87	165		31	0	0	87	118		-47	
Demo C-4	0	0	0	121	121		0	0	0	121	121		0	
Pyro-Smoke	526	27	14	0	567		285	27	14	0	326		-242	
Pyro-Flares	4,970	0	2	0	4,972		4,545	0	2	0	4,547		-425	
5.56mm Blank	179,556	14,700	8,000	0	202,256		219,012	14,700	8,000	0	241,712		39,456	
7.62mm Blank	17,762	0	1,200	4,800	23,762		30,653	0	1,200	4,800	36,653		12,891	
.50 cal. Blank	1,530	400	0	0	1,930		11,925	400	0	0	12,325		10,395	
.50 cal. SRTA	0	600	0	0	600		0	600	0	0	600		0	
9mm Tracer	12,922	0	0	0	12,922	12,922	15,427	0	0	0	15,427	15,427	2,506	2,506
Infantry Battle Course Trench														
5.56mm	112,582	0	0	0	112,582	8,444	128,080	0	0	0	128,080	9,606	15,498	1,162
7.62mm	7,594	0	0	0	7,594	835	15,191	0	0	0	15,191	1,671	7,597	836
40mm M203 TP	1,332	0	0	0	1,332		1,537	0	0	0	1,537		205	
Practice Grenade	4,114	0	0	0	4,114		1,066	0	0	0	1,066		-3,048	
5.56mm Blank	35,911	0	0	0	35,911		43,802	0	0	0	43,802		7,891	
7.62mm Blank	3,617	0	0	0	3,617		6,131	0	0	0	6,131		2,513	

Table 10.g Comparison of Current and Transformed Ammunition Usage by Range for SBMR.

	FY 05 Projection Un-Transformed (Current)						FY 05 Projection Transformed						Net Difference With Transformation	
RANGE and Ammunition Type	2 Legacy Brigades	Other 25th ID(L)	USMC	Other Units	Total	Tracer Rounds	1 Legacy Brigade & 1 SBCT	Other 25th ID(L)	USMC	Other Units	Total	Tracer Rounds	All Rounds	Tracer Rounds
Pyro-Smoke	15	0	0	10	115		57	0	0	0	57		-58	
Pyro	1,489	0	0	0	1,489		910	0	0	0	910		-578	
Infantry Battle Course Village														
5.56mm	146,773	0	0	0	146,773	11,008	128,080	0	0	0	128,080	9,606	-18,693	-1,402
7.62mm	7,594	0	0	0	7,594	835	15,191	0	0	0	15,191	1,671	7,597	836
40mm M203 TP	1,332	0	0	0	1,332		1,537	0	0	0	1,537		205	
Practice Grenade	4,114	0	0	0	4,114		1,066	0	0	0	1,066		-3,048	
5.56mm Blank	35,911	0	0	0	35,911		43,802	0	0	0	43,802		7,891	
7.62mm Blank	3,617	0	0	0	3,617		6,131	0	0	0	6,131		2,513	
Pyro-Smoke	119	0	0	0	119		57	0	0	0	57		-62	
Pyro	1,489	0	0	0	1,489		605	0	0	0	605		-884	
KR 6 Squad Defense Course														
5.56mm	562,908	15,280	7,580	1,025	586,793	44,009	320,200	15,280	7,580	1,025	344,085	25,806	-242,708	-18,203
7.62mm	18,984	4,000	0	200	23,184	2,550	37,977	4,000	0	200	42,177	4,639	18,993	2,089
40mm M203 TP	3,329	0	0	0	3,329		3,842	0	0	0	3,842		513	
Claymore Mine	0	18	0	0	18		0	18	0	0	18		0	
Pyro-Smoke	115	15	0	0	130		57	15	0	0	72		-58	
Pyro-Booby Trap	1,020	46	0	0	1,066		910	46	0	0	956		-110	
5.56mm Blank	35,911	1,400	0	0	37,311		43,802	1,400	0	0	45,202		7,891	
7.62mm Blank	3,585	0	1,200	0	4,785		6,131	0	1,200	0	7,331		2,546	
Combat Pistol Range														
9mm	37,488	87,162	2,000	3,190	129,840								na	
QTR 1 and 1-A														
5.56mm							4,059,160	0	0	0	4,059,160	304,437	na	
7.62mm							38,019	0	0	0	38,019	4,182	na	

Table 10.g Comparison of Current and Transformed Ammunition Usage by Range for SBMR.

	FY 05 Projection Un-Transformed (Current)						FY 05 Projection Transformed						Net Difference With Transformation	
RANGE and Ammunition Type	2 Legacy Brigades	Other 25th ID(L)	USMC	Other Units	Total	Tracer Rounds	1 Legacy Brigade & 1 SBCT	Other 25th ID(L)	USMC	Other Units	Total	Tracer Rounds	All Rounds	Tracer Rounds
.50 Caliber							143,099	0	0	0	143,099	18,603	na	
9mm							81,776	0	0	0	81,776		na	
12 Ga. Shotgun							1,092	0	0	0	1,092		na	
KR 8														
9mm Tracer	0	5,887	208	200	6,295	6,295	0	5,887	208	200	6,295	6,295	0	0
40mm M203 TP	0	210	0	0	210		0	210	0	0	210		0	
40mm MK 19 TP	57,154	12,707	0	1,900	71,761		156,804	12,707	0	1,900	171,411		99,650	
AT-4	324	4	0	22	350		756	4	0	22	782		432	
KR 9														
40mm M203 TP	16,646	0	0	0	16,646		19,209	0	0	0	19,209		2,563	
40mm M203 HE	5,846	0	0	0	5,846		7,601	0	0	0	7,601		1,754	
40mm MK 19 HE	0	1,113	73	50	1,236		0	1,113	73	50	1,236		0	
CR 1														
5.56mm	3,376,117	414,033	8,727	112,106	3,910,983	293,324		Range facility will go away with Transformation						
7.62mm	0				0			Replaced by proposed QTR1(Schofield) and QTR2 (South Range Acquisition Area)						
5.56mm Blank	0	4,000			4,000									
CR 2														
5.56mm	0	12,269	57,209	2,017	71,495	5,362		Range facility will go away with Transformation						
9mm	0	0	0	497	497			Replaced by proposed QTR1(Schofield) and QTR2 (South Range Acquisition Area)						
Pyro-Smoke	0	0	18	0	18									
Pyro-Booby Trap	0	0	58	0	58									
CR 2A														
5.56mm	0	122,954	0	27,859	150,813	11,311		Range facility will go away with Transformation						
12 Ga. Shotgun	0	1,711	0	9,262	10,973			Replaced by proposed QTR1(Schofield) and QTR2 (South Range Acquisition Area)						
9mm Pistol	0	69,810	0	27,067	96,877									

Table 10.g Comparison of Current and Transformed Ammunition Usage by Range for SBMR.

	FY 05 Projection Un-Transformed (Current)						FY 05 Projection Transformed						Net Difference With Transformation	
RANGE and Ammunition Type	2 Legacy Brigades	Other 25th ID(L)	USMC	Other Units	Total	Tracer Rounds	1 Legacy Brigade & 1 SBCT	Other 25th ID(L)	USMC	Other Units	Total	Tracer Rounds	All Rounds	Tracer Rounds
CR 3														
5.56mm	0	324,886	0	134,543	459,429	34,457		Range facility will go away with Transformation						
7.62mm	0							Replaced by proposed QTR1(Schofield) and QTR2 (South Range Acquisition Area)						
MF 2														
5.56mm	3,617,268	970,309	0	124,675	4,712,252	353,419		Range facility will go away with Transformation						
7.62mm	15,714	42,363	62,410	6,400	126,887	13,958		Replaced by proposed QTR1(Schofield) and QTR2 (South Range Acquisition Area)						
5.56mm Blank	0	13,000	0	0	13,000									
7.62mm Blank	0	0	5,100	0	5,100									
MF 3														
5.56mm	964,605	324,886	0	134,543	1,424,034	106,803		Range facility will go away with Transformation						
								Replaced by proposed QTR1(Schofield) and QTR2 (South Range Acquisition Area)						
MF 4														
5.56mm	0	220,541	0	23,935	244,476	18,336		Range facility will go away with Transformation						
9mm	0	0	0	6,000	6,000			Replaced by proposed QTR1(Schofield) and QTR2 (South Range Acquisition Area)						
MF 5														
9mm	27,264	81,428	0	20,840	129,532			Range facility will go away with Transformation						
Claymore Mine	0	164	0	0	164			Replaced by proposed QTR1(Schofield) and QTR2 (South Range Acquisition Area)						
Other Mines	0	188	0	0	188									
Bangalore Torpedo	0	162	0	0	162									
Demo Charges	0	3,320	521	26	3,867									
Ambush #1														
5.56mm	90,482	0	0	0	90,482	6,786	64,040	0	0	0	64,040	4,803	-26,442	-1,983
7.62mm	18,984	0	0	0	18,984	2,088	7,595	0	0	0	7,595	835	-11,389	-1,253
40mm M203 TP	1,332	0	0	0	1,332		1,537	0	0	0	1,537		205	

Table 10.g Comparison of Current and Transformed Ammunition Usage by Range for SBMR.

	FY 05 Projection Un-Transformed (Current)						FY 05 Projection Transformed						Net Difference With Transformation	
RANGE and Ammunition Type	2 Legacy Brigades	Other 25th ID(L)	USMC	Other Units	Total	Tracer Rounds	1 Legacy Brigade & 1 SBCT	Other 25th ID(L)	USMC	Other Units	Total	Tracer Rounds	All Rounds	Tracer Rounds
Claymore Mine	78	0	0	0	78		47	0	0	0	47		-31	
5.56mm Blank	35,911	0	0	0	35,911		43,802	0	0	0	43,802		7,891	
7.62mm Blank	3,682	0	0	0	3,682		6,131	0	0	0	6,131		2,449	
Pyro-Smoke	134	0	0	0	134		57	0	0	0	57		-77	
Pyro	1,075	0	0	0	1,075		1,578	0	0	0	1,578		503	
Ambush #2														
5.56mm	90,482	3,051	9,737	0	103,270	7,745	64,040	3,051	9,737	0	76,828	5,762	-26,442	-1,983
7.62mm	18,984	0	1,700	0	20,684	2,275	0	0	1,700	0	1,700	187	-18,984	-2,088
40mm M203 TP	1,332	0	0	0	1,332		1,537	0	0	0	1,537		205	
Claymore Mine	0	3	6	0	9		0	3	6	0	9		0	
5.56mm Blank	35,911	0	0	0	35,911		43,802	0	0	0	43,802		7,891	
7.62mm Blank	3,682	0	0	0	3,682		6,131	0	0	0	6,131		2,449	
Pyro-Smoke	134	0	0	0	134		57	0	0	0	57		-77	
Pyro	1,062	0	0	0	1,062		1,579	0	0	0	1,579		517	
Pointman #1														
5.56mm	90,482	2,618	0	0	93,100	6,983	64,040	2,618	0	0	66,658	4,999	-26,442	-1,983
7.62mm	18,984	0	0	0	18,984		0	0	0	0	0		-18,984	
40mm M203 TP	0	0	0	0	0		0	0	0	0	0		0	
5.56mm Blank	35,911	0	0	0	35,911		43,802	0	0	0	43,802		7,891	
7.62mm Blank	3,585	0	0	0	3,585		6,131	0	0	0	6,131		2,546	
Pyro-Smoke	134	0	0	0	134		57	0	0	0	57		-77	
Pyro	1,073	0	0	0	1,073		911	0	0	0	911		-162	
Pointman #2														
5.56mm	90,482	11,673	29,734	0	131,889	9,892	64,040	11,673	29,734	0	105,447	7,909	-26,442	-1,983
7.62mm	18,984	0	2,400	0	21,384	2,352	0	0	2,400	0	2,400	264	-18,984	
40mm M203 TP	0	0	100	0	100		0	0	100	0	100		0	
Claymore Mine	0	3	1	0	4		0	3	1	0	4		0	
5.56mm Blank	43,802	0	15,000	0	58,802		43,802	0	15,000	0	58,802		0	

Table 10.g Comparison of Current and Transformed Ammunition Usage by Range for SBMR.

	FY 05 Projection Un-Transformed (Current)						FY 05 Projection Transformed						Net Difference With Transformation	
RANGE and Ammunition Type	2 Legacy Brigades	Other 25th ID(L)	USMC	Other Units	Total	Tracer Rounds	1 Legacy Brigade & 1 SBCT	Other 25th ID(L)	USMC	Other Units	Total	Tracer Rounds	All Rounds	Tracer Rounds
7.62mm Blank	3,585	0	6,000	0	9,585		6,131	0	6,000	0	12,131		2,546	
Pyro-Smoke	134	0	0	0	134		57	0	0	0	57		-77	
Pyro	1,075	0	0	0	1,075		911	0	0	0	911		-164	
Convoy Ambush														
5.56mm	90,482	29,120	1,072	0	120,674	9,051	64,040	29,120	1,072	0	94,232	7,067	-26,442	-1,983
7.62mm	18,984	0	0	0	18,984		0	0	0	0	0		-18,984	
40mm M203 TP	1,332	0	0	0	1,332		1,537	0	0	0	1,537		205	
Pyro-Smoke	134	23	0	0	157		57	23	0	0	80		-77	
Pyro-Flares	1,077	19	0	0	1,096		905	19	0	0	924		-172	
5.56mm Blank	35,911	0	0	0	35,911		43,802	0	0	0	43,802		7,891	
7.62mm Blank	3,682	0	0	0	3,682		6,131	0	0	0	6,131		2,449	
Infantry Demolition														
Practice Grenade	0	830	0	0	830		0	830	0	0	830		0	
Frag Grenade	1,850	2,330	300	220	4,700		2,443	2,330	300	220	5,293		594	
Claymore Mine	233	0	0	0	233		31	0	0	0	31		-202	
Demo TNT	9,888	0	245	0	10,133		9,166	0	245	0	9,411		-723	
Battle Area Complex														
5.56mm							1,601,000	0	0	0	1,601,000	120,075	na	
7.62mm							201,627	0	0	0	201,627	22,179	na	
9mm Tracer							19,284	0	0	0	19,284	19,284	na	
40mm M203 TP							15,367	0	0	0	15,367		na	
40mm Wh Star							2,888	0	0	0	2,888		na	
40mm MK19 TP							12,972	0	0	0	12,972		na	
Practice Grenade							10,657	0	0	0	10,657		na	
.50 Caliber							143,099	0	0	0	143,099	18,603	na	
105mm TPDS							0	0	0	0	0		na	

Table 10.g Comparison of Current and Transformed Ammunition Usage by Range for SBMR.

	FY 05 Projection Un-Transformed (Current)						FY 05 Projection Transformed						Net Difference With Transformation	
RANGE and Ammunition Type	2 Legacy Brigades	Other 25th ID(L)	USMC	Other Units	Total	Tracer Rounds	1 Legacy Brigade & 1 SBCT	Other 25th ID(L)	USMC	Other Units	Total	Tracer Rounds	All Rounds	Tracer Rounds
105mm TP-T							0	0	0	0	0		na	
105mm HEP-TP-T							0	0	0	0	0		na	
105mm Cannister							0	0	0	0	0		na	
Volcano							0	0	0	0	0		na	
Claymore Mine							0	0	0	0	0		na	
5.56mm Blank							438,024	0	0	0	438,024		na	
7.62mm Blank							61,306	0	0	0	61,306		na	
.50 Cal. Blank							35,775	0	0	0	35,775		na	
Pyro-Smoke							721	0	0	0	721		na	
Pyro							11,005	0	0	0	11,005		na	
FP 10														
60mm Mortar HE		63	0	0	63			63	0	0	63		0	
81mm HE		300	0	0	300			300	0	0	300		0	
FP 20														
60mm Mortar HE	3,845	0	1,597	465	5,907		5,767	0	1,597	465	7,829		1,922	
60mm ILLUM	367	0	63	220	650		551	0	63	220	834		184	
60mm WP	389	0	0	0	389		583	0	0	0	583		194	
FP 21														
60mm Mortar HE	0	0	0	1,176	1,176		0	0	0	1,176	1,176		0	
60mm ILLUM	0	0	300	143	443		0	0	300	143	443		0	
81mm HE	2,635	320	969	138	4,062		9,007	320	969	138	10,434		6,372	
81mm ILLUM	360	0	123	40	523		1,220	0	123	40	1,383		860	
81mm Red Phos	0	0	20	0	20		0	0	20	0	20		0	
81mm WP	432	0	50	54	536		1,296	0	50	54	1,400		864	
105mm HE	0	1,024	0	240	1,264		0	1,024	0	240	1,264		0	
105mm ILLUM	0	188	0	0	188		0	188	0	0	188		0	
105mm WP	0	30	0	0	30		0	30	0	0	30		0	

Table 10.g Comparison of Current and Transformed Ammunition Usage by Range for SBMR.

	FY 05 Projection Un-Transformed (Current)						FY 05 Projection Transformed						Net Difference With Transformation	
RANGE and Ammunition Type	2 Legacy Brigades	Other 25th ID(L)	USMC	Other Units	Total	Tracer Rounds	1 Legacy Brigade & 1 SBCT	Other 25th ID(L)	USMC	Other Units	Total	Tracer Rounds	All Rounds	Tracer Rounds
155mm HE	0	0	0	30	30		0	0	0	30	30		0	
FP 30														
155mm HE	3,581	1,021	744	9	5,355		5,670	1,021	744	9	7,444		2,089	
105mm HE	0	3,176	0	532	3,708		0	3,176	0	532	3,708		0	
105mm ILLUM	0	365	0	0	365		0	365	0	0	365		0	
105mm WP	0	31	0	18	49		0	31	0	18	49		0	
105mm Smoke	0	104	0	0	104		0	104	0	0	104		0	
Pyro-Smoke	0	0	4	0	4		0	0	4	0	4		0	
155mm ILLUM	324	0	0	0	324		540	0	0	0	540		216	
155mm WP	91	0	0	0	91		152	0	0	0	152		61	
155mm Copperhead	2	0	0	0	2		4	0	0	0	4		2	
155mm RAP	58	0	0	0	58		96	0	0	0	96		38	

Ammunition is projected for FY 05 based on Draft STRAC information. Information for "Other 25ID", "USMC", and "Other" was compiled from 2001 RFMSS data and is used as a constant for both Un-Transformed and Transformed projections.

Table 10.h Combined Summary of Ammunition Usage for Current and Proposed Ranges on SBMR

	FY 05 Projection Un-Transformed (Current)						FY 05 Projection Transformed*						Net Difference With Transformation	
Ammunition Type**	2 Legacy Brigades	Other 25th ID(L)	USMC	Other Units	Total	Tracer Rounds	1 Legacy Brigade & 1 SBCT	Other 25th ID(L)	USMC	Other Units	Total	Tracer Rounds	All Rounds	Tracer Rounds
5.56mm	10,921,388	2,282,490	233,169	624,911	14,061,958	1,054,647	8,741,119	113,153	167,233	65,233	9,086,738	681,505	-4,975,221	-373,142
7.62mm	228,220	63,703	82,610	36,151	410,684	45,175	453,215	21,340	20,200	29,751	524,506	57,696	113,821	12,520
.50 Caliber	0	0	0	0	0	0	286,198	0	0	0	286,198	37,206	286,198	37,206
9mm Ball	64,752	176,887	5,180	31,105	277,924		99,389	8,297	3,180	578	111,444		-166,480	
9mm Tracer	12,922	5,887	208	200	19,217	19,217	34,711	5,887	208	200	41,006	41,006		21790
12 GA Buckshot	0	1,711	0	9,262	10,973		1,092	0	0	0	1,092		-9,881	
40mm M203 TP	39,950	263	588	300	41,101		61,467	263	588	300	62,618		21,517	
40mm MK19 TP	57,154	13,707	0	1,900	72,761		169,776	13,707	0	1,900	185,383		112,622	
60mm Mortar HE	3,845	63	1,597	1,641	7,146		5,767	63	0	1,176	7,006		-140	
60mm Mortar Illum	367	0	363	363	1,093		551	0	363	363	1,277		184	
60mm Mortar WP	389	0	0	0	389		583	0	0	0	583		194	
81mm Mortar HE	2,635	620	969	138	4,362		9,007	620	969	138	10,734		6,372	
81mm Mortar Illum	360	0	123	40	523		1,220	0	123	40	1,383		860	
81mm Mortar WP	432	0	50	54	536		1,296	0	50	54	1,400		864	
120mm Mortar HE	0	0	0	0	0		0	0	0	0	0		0	
120mm Mortar Illum	0	0	0	0	0		0	0	0	0	0		0	
120mm Mortar WP	0	0	0	0	0		0	0	0	0	0		0	
105mm HE	0	4200	0	772	4972	0	0	4200	0	772	4972	0	0	0
105mm ILLUM	0	553	0	0	553	0	0	553	0	0	553	0	0	0
105mm Smoke	0	104	0	0	104	0	0	104	0	0	104	0	0	0
105mm WP	0	61	0	18	79	0	0	61	0	18	79	0	0	0
105mm TPDS-T	0	0	0	0	0		0	0	0	0	0		0	
105mm TP-T	0	0	0	0	0		0	0	0	0	0		0	
155mm HE	3,581	1,021	744	39	5,385		5,670	1,021	744	39	7,474		2,089	
155mm ILLUM	324	0	0	0	324		540	0	0	0	540		216	

Table 10.h Combined Summary of Ammunition Usage for Current and Proposed Ranges on SBMR

	FY 05 Projection Un-Transformed (Current)						FY 05 Projection Transformed*						Net Difference With Transformation	
Ammunition Type**	2 Legacy Brigades	Other 25th ID(L)	USMC	Other Units	Total	Tracer Rounds	1 Legacy Brigade & 1 SBCT	Other 25th ID(L)	USMC	Other Units	Total	Tracer Rounds	All Rounds	Tracer Rounds
155mm WP	91	0	0	0	91		152	0	0	0	152		61	
155mm Copperhead	2	0	0	0	2		4	0	0	0	4		2	
155mm RAP	58	0	0	0	58		96	0	0	0	96		38	
AT-4 HEAT	324	8	34	47	413		756	8	34	47	845		432	
Javelin	0	0	0	0	0		0	0	0	0	0		0	
TOW	0	0	0	0	0		0	0	0	0	0		0	
Frag Grenade	3,905	2,390	1,442	220	7,957		4,886	2,390	1,442	220	8,938		982	
Demo	9,888	3,320	766	147	14,121		9,166	0	245	121	9,532		-4,590	
Pyro	16,838	65	60	45	17,008		25,452	65	2	45	25,564		8,556	
Pyro-Smoke	1,777	65	32	0	1,874		1,575	65	14	0	1,654		-221	
Blanks-All Caliber	602,120	33,500	66,300	4,800	706,720		1,283,764	16,500	61,200	4,800	1,366,264		659,543	

* Includes ammo usage for new QTR2
- no tracer use on QTR2
**Ammunition is projected for FY 05 based on Draft Standards in Training and Commission (STRAC) information. Information for "Other 25ID", "USMC", and "Other" was compiled from 2001 RFMSS data and is used as a constant for both UN-Transformed and Transformed projections.

all mounted and dismounted maneuver would take place within the boundary of the planned future firebreak road. The currently/previously disturbed areas (agricultural fields and access roads) within the parcel would be used for walking (foot maneuvers) and driving administratively between locations. However, units would not conduct Stryker training maneuvers within the proposed acquisition area and would be limited to travel in previously disturbed areas dominated by non-native vegetation at low elevations. For this reason, a high-probability off-road vehicle maneuver map was not developed for the South Acquisition Area (pers. comm. Ron Borne). Smoking on the QTR2 range would be restricted to designated areas away from vegetation fuels adjacent to forested areas.

10.3.4 Summary of Changes in Training Activities as a Result of Transformation

Throughput requirements generally increase for most ranges but usage in days may vary by range and weapon system. Major changes to live-fire activities include the addition of direct fire gunnery[38] (Mobile Gun System), collective live fire by the mobile gun system (MGS) and Stryker vehicle variants. Overall changes in ammunition usage for all SBMR ranges combined are summarized in Table 10.h. Ammunition usage of the Mobile Gun System is not yet known. Significant changes in ammunition usage include a decrease in 5.56mm ball and tracer ammunition, increases in other small arms ball and ammunition except for 9mm ball ammunition, increases in most grenade and mortar ammunition, and increases in 155 mm artillery use.

10.4 Action Area Delineation

10.4.1 Approach to Delineating the Action Area

The action area at SBMR is determined by the impact of fire, indirect fire SDZs (surface danger zone), and restrictions to environmental crews due to direct fire SDZs, potential exotic species introductions, and soldier movement. The factors considered in delineation of the SBMR action area are fuel types, man-made barriers to fire, topographic barriers to fire, maximum range of indirect fire weapons, and restrictions on the environmental staff's ability to access areas for management due to direct fire weapon SDZs. Direct fire weapon SDZs are considered only in respect to the effect they have on access of the environmental management personnel. This is a human safety issue. The entire SDZ for some of the direct fire weapons is not included in the action area for two reasons. First, the tracer burnout distance of all direct fire munitions is far shorter than that which would be necessary to start a fire anywhere outside of the AA (see Appendix A, 'Legacy and SBCT Weapons Description – Tracer Information). The .50 caliber machine gun, which at 2450 meters has the farthest tracer burnout of any weapon used at SBMR, cannot start a fire outside of the firebreak road. Second, the chance that any round would reach beyond the AA is very small. The chances that a round would reach beyond the action area *and* strike a listed species is infinitesimal. For these reasons, portions of some of the direct fire munitions SDZs are not included in the action area.

All SDZs for indirect fire weapons fall within the action area. It is not possible for any artillery piece authorized for use at SBMR using the 3 bag limit on powder charge to fire a round over the SBMR ridgeline (personal communication, Cpt. Bockholdt, Battalion Fire Direction Officer, 211 Field Artillery). Additionally, the maximum range with three bags of powder of the 155mm, which has the longest range of the indirect fire weapons authorized at SBMR, is 6100 meters (email communication, Cpt. Blandford, Transformation Office). This range does not reach to the top of Mt. Kaala from any of the firing points at which the 155 is authorized. Therefore, the area around the top of Mt. Kaala is not included in the action area.

[38] Direct fire gunnery traditionally refers to mechanized or tank firing using large caliber guns where the target is in view of the gunner. the Stryker-muonted 105 mm gun would be used at the Battle Area Course.

Vegetation throughout the installation was mapped in a survey reported in "Wildland Fire Risk and Management, West and South Ranges, Schofield Barracks, Oahu" (Beavers and Burgan 2001) and then reclassified into broader fuel types. Eight fuel types were recognized and mapped with a minimum mapping unit of approximately 100 m^2 (Figure 10.j). Detailed descriptions of each vegetation type can be found on pages 12 to 18 of Beavers and Burgan, and a description of the reclassification into fuel types on page 19. The topographic barriers considered within SBMR include Palikea gulch, Puu Pane/Kamaohanui ridge, and some of the boundary ridges. Man-made barriers consist of Pahole Natural Area Reserve Road, several paved roads within SBMR, the south range perimeter road, and the pineapple fields east of SBMR (Figure 10.k).

It is assumed in this BA, that the Army will implement the recommendations made in Beavers and Burgan (2001) to minimize the number of ignitions on the ranges. The Army will strive for zero fires outside the firebreak road.

10.4.2 The Action Area

There are two sectors of the action area:

West Range – This includes the impact area and is the more heavily utilized sector for military training. Live fire exercises occur frequently and include weapons systems from pistols to artillery. The entire impact area and a buffer around it are included in the action area, because of the frequency of live fire exercises there and the fire prone nature of the area.

South Range – All live fire munitions from South Range are intended to land in West Range in the impact area. Other actions here include blank fire exercises and maneuvers. The chance of fire ignition at South Range is greatly reduced because there is no impact area. Additionally, South Range is compartmentalized by frequently used roads. Fire history for the area is limited to several small fires since 1994. All fires in this area were caused by misfired weapons systems, which occurs infrequently. The Army will improve the perimeter road around South Range to the same standards as the impact area firebreak road. For these reasons, the action area is limited to that area below the perimeter road and does not include a buffer.

10.4.3 Detailed Action Area Description

Points listed below appear in Figure 10.k.

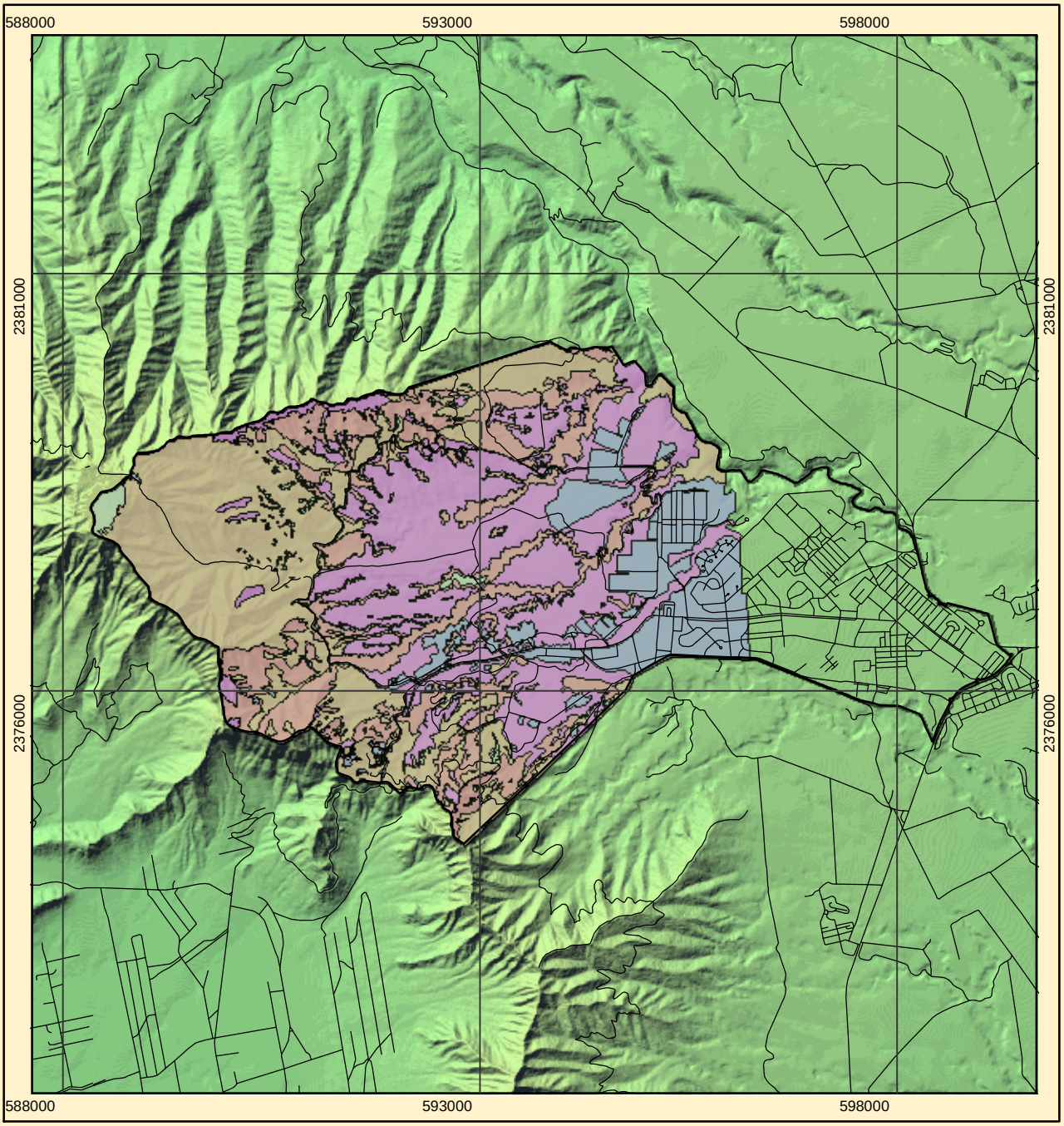
A to B - The action area in this vicinity wraps around Puu Pane beyond the SBMR property boundary to the North side of the peak. The action area is bounded to the North by the Mt. Kaala NAR access road and to the West by the Western fork of Palikea gulch. In the unlikely event that a fire crossed the ridge from Schofield Barracks, the road would provide a defensible boundary from which to contain the fire. It is downslope from the ridge, meaning a fire would have to back down the hill towards the road. The microclimate provided by Palikea gulch is wet, protected from the wind, and supports vegetation that is not conducive to fire spread. These factors make it a very significant barrier to fire. In addition, a proposed firebreak, scheduled for completion in 2006, will help to contain fires originating from the MF ranges (Figure 10.k).

B to C - From the Western fork of Palikea Gulch the action area follows the Puu Pane/Kamaohanui ridge. The ridge in this area is very sharp with precipitous drops on both sides. Such topographical conditions do not encourage fire spread beyond the SBMR boundary, regardless of weather conditions. The vegetation also becomes much wetter in this area as elevation increases.

Fuel Types

Schofield Barracks Military Reservation, Oahu

Figure 10j



1:75,000

0 350 700 1,400 Meters

0 0.25 0.5 1 Miles

Legend

Fuel Type

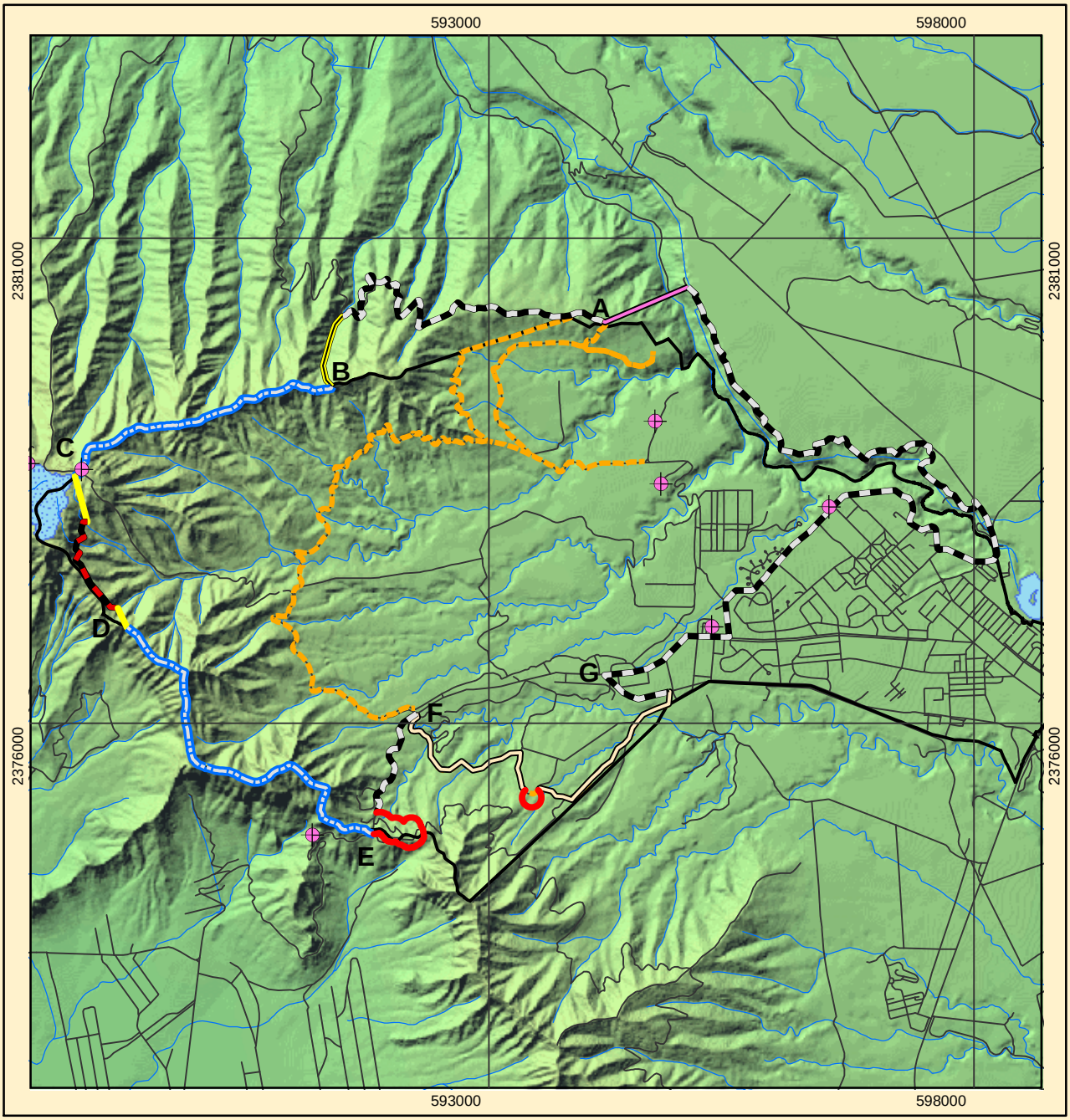
- Denuded
- Forest
- Grass
- Kukui
- Shrub
- Roads
- Installation Boundary
- Surface Water Body

Data Source: Center for Environmental Managment of Military Lands

Delineation of Action Area

Schofield Barracks Military Reservation, Oahu

Figure 10k



1:65,000

N

0 500 1,000 2,000 Meters

0 0.35 0.7 1.4 Miles

Data Source: Center for Environmental Management of Military Lands

Legend

Action Area Inputs
- Artillery Max Range
- Environmental Staff Access
- Fire History
- Firebreak
- Gulch
- Trail Use Buffer
- Ridgeline
- Road

- Fixed Internet Antenna
- Firebreaks
- Roads
- Streams
- Installation Boundary
- Surface Water Body
- Bog

C to D - The action area cuts off the Puu Pane//Kamaohanui ridge just east of the Mount Kaala bog. It follows the edge of the 6100 m range of the 155m artillery for several hundred meters. Here it intersects the line defining the area of direct fire SDZs that affect environmental staff access. It follows this zigzag path for just over a kilometer before it again intersects the line denoting the 6100m range of the 155mm artillery. It follows this line until it reaches the Schofield Barracks ridgeline approximately 700 meters north of Puu Kalena.

D to E - From point D, the action area follows the Schofield Barracks ridgeline to Kolekole pass. As stated earlier, no indirect fire weapons using the 3 bag limit on powder charge is capable of firing over the ridgeline. The ridge also provides a significant barrier to fire for several reasons. First, much of the vegetation below the ridge is composed of vegetation that is not readily flammable, mostly *Psidium cattleianum*, *Psidium cattleianum* var. *lucidum* and *Schinus terebinthifolius*, though there are pockets of grasses and more flammable shrubs. Second, the topography of the ridgeline makes it difficult for fire to cross and, therefore, a strategic location to fight the fire.

E to F - From the intersection of the Puu Kumakalii ridge with the top of the Kolekole Pass road, the action area follows a 100 meter buffer from a trail used to access Observation Point (OP) Kolekole. This is a rarely used training location, but there is the possibility of exotic species introduction. No pyrotechnics, smoking, or any other ignition sources will be allowed on the trail or at the OP. The buffer extends around the OP and returns to Kolekole Road. From here it follows Kolekole road until the intersection with the perimeter roads which encircle Schofield Barracks, South Range and point F.

F to G - Around South Range the action area follows the perimeter road. Though these roads are currently in disrepair, the Army will improve them to the same standards as the impact area firebreak in 2006. As a general rule, a minimum of a 20-30 foot width of fuel free surface will be maintained where firebreaks pass through vegetated areas. Actual width will be adjusted, as appropriate, to meet specific requirements as dictated by slope and other terrain features, fuel loads/height, and alignment. Fuel removal/control alternatives include grading, herbicide application, mowing, and manual removal of heavier fuels. A small portion of the SDZs for firing points 101, 102, 103, 104, and halo fall outside of the action area in this location. However, only the beginning of the cone falls outside of the action area, so the target area is not in the vicinity. Additionally, these firing points are rarely used. Only firing point 101 has been used for live fire in the last two years (Martin Borja, Range Division).

No training will occur to the east of Kolekole Road or to the south of the South Range firebreak (the area not included in the action area), with the exception of the use of OP-Kolekole, mentioned previously, and OP-Halo. OP-Halo also has a 100 meter buffer around it and the same restrictions on ignition sources will apply. The firebreak will end where it intersects Lymann road. Here the action area follows Lymann road to the west and then north to the intersection with Kolekole Road.

G to A - Where Lymann Road intersects Trimble Road, the action area turns sharply to the east and continues to follow a series of paved roads through the cantonment area to McNair Gate, where it exits the installation. From here, the action area crosses the bridge over Kaukonahua Stream, then turns west onto the pineapple fields. It follows the edge of the fields until it reaches the closest point to the Mt. Kaala NAR road. From here it crosses Kaukonahua gulch again to reach point A.

FTI Antennas – Seven FTI antennas are considered part of SBMR for this BA, and two of those falls outside of the boundary described above. The sites themselves will be only several meters across, but a buffer of 25 meters from the center point of the site is used as the extent of the impact associated with the antennas and is included in the action area. Most of this impact will be a result of construction. Impacts include trampling/crushing, potential introduction of exotic species, and fire from catalytic converters

(only for sites where there is vehicle access) and sparks from construction. Once the antennas are built there will be minimal maintenance necessary and impacts will be very light.

10.5 Description of the Affected Biological Environment and Affected Species

Although Army training and transformation to a Stryker Brigade Combat Team takes place within the boundaries defined in the introduction (section 1.2), for purposes of this BA, and consistent with USFWS recommendations, the "action area" is considered the biological environment affected by either direct, indirect, or interrelated/interdependent effects of the proposed action.

10.5.1 Ecological Zones Affected by the Action

Native natural community types were categorized into three ecological zones defined by elevation, topography, and prevailing ecological conditions at SBMR (R.M. Towill Corp. 1997b, Hawaii Natural Heritage Program (HINHP) - The Nature Conservancy of Hawaii 1994d). The ecological zones identified at SBMR include the Wet Summit Crest Zone, Mesic Ridges and Cliffs Zone, and Lowland Forest Zone (Figure 10.l). The areas these zones occupy are relatively small in comparison to the total size of the ranges.

Wet Summit Crest Zone - This zone occurs above 900 m (approx. 3,000 ft) elevation in the summit crest areas of Mount Kaala, Puu Kalena, and Puu Hapapa in the Waianae Mountains. Conditions are cool, usually wet, windswept, and often cloud-shrouded. Topography ranges from moderate sloping to steep cliffs. This zone is included in the AA where it reaches its highest elevations in Haleauau Drainage, below Mt. Kaala. The topography varies from cliffs to moderate slopes and is characterized as Ohia Montane Wet Forest. This zone does not overlap with the Schofield Barracks AA

Mesic Ridges and Cliffs Zone - Natural communities in this zone are found on slopes and ridges beneath steep cliffs below 900 m (approx. 3,000 ft) in the Waianae Mountains. They are commonly windy, warm, and mesic; especially when compared to the Wet Summit Crest Zone. This ecological zone dominates the upper to middle elevation portions of the AA. The natural communities in this zone include:

- Ohia Lowland Mesic Shrubland
- Kawelu Lowland Mesic Grassland

Lowland Forest Zone - This zone occurs mostly between 475 and 700 m and contains warm and mesic to wet forest. The natural communities in this zone include:

- Koa (*Acacia koa*/ Ohia (*Metrosideros polymorpha*) Lowland Mesic Forest
- Oahu Diverse Lowland Mesic Forest (Considered to be rare)
- Ohia (*Metrosideros polymorpha)* Lowland Wet Forest
- Uluhe (*Dicranopteris linearis*) Lowland Wet Shrubland (widespread and not considered rare)
- Lowland Dry Shrubland and Grassland

The *Oahu Diverse Forest* and *Koa/`Ohi`a Forest* communities occur from the ridge tops to the bottom of gulches below 900 m (3,000 ft). The *Oahu Diverse Forest* is the only native natural community type presently considered rare at SBMR. The *Ohi`a Forest* community is restricted to the wet ridge tops and upper regions of similar elevations. The *Uluhe Shrubland* community commonly occurs below 670 m (2200 ft) in moderate to steep slopes in the Waianae Mountains (HINHP 1994d). Although more of the AA falls within this zone than the others described, about 70% of the land in the lower elevations outside the fuel break road in West Range, and about 95% in lower elevations above the contour trail in South Range is alien vegetation.

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Ecological Zones
Schofield Barracks Actionn Area, Oahu

Figure 10l

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* Please see individual map area for scale information.

Data Source: HINHP 2002, RCUH 2002a

Legend

Plants
- *Abutilon sandwicense*
- *Alectryon macrococcus macrococcus*
- *Alsinidendron trinerve*
- *Cyanea acuminata*
- *Cyanea grimesiana obatae*
- *Delisea subcordata*
- *Diellia falcata*
- *Flueggea neowawraea*
- *Gardenia mannii*
- *Hesperomannia arborescens*
- *Isodendrion longifolium*
- *Labordia cyrtandrae*
- *Lepidium arbuscula*
- *Lobelia oahuensis*
- *Phyllostegia hirsuta*
- *Phyllostegia kaalaensis*
- *Phyllostegia mollis*
- *Plantago princeps*
- *Schiedea hookeri*
- *Schiedea kaalae*
- *Viola chammisoniana chammisoniana*

Snails
- *Achatinella mustelina*

Mammals
- *Lasiurus cinereus semotus*

- Dry Cliff
- Lowland Dry Shrubland & Grassland
- Lowland Mesic Forest & Shrubland
- Lowland Wet Forest & Shrubland
- Montane Wet Forest & Shrubland
- Nonnative
- Wet Cliff

- Roads
- Installation Boundary
- Action Area
- Surface Water Body
- Bog

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10.5.2 Federally-listed Species and Critical Habitat Affected by the Action

The first step in determining which species may be affected by routine military training and SBCT transformation activities at SBMR, was to compile available rare species occurrence data for Army Lands on Oahu. The resources for this data included the Army Natural Resource Geographic Information System (GIS), the Hawaii Natural Heritage Program (HINHP) Database, the USFWS recovery plans, the Makua Military Reservation Implementation Plan Draft documents and information from biological experts. Army Natural Resource Staff conducts rare plant, invertebrate, and vertebrate surveys annually to confirm existing population numbers and locate unreported populations. The most current and detailed data available was used from these various sources. Once compiled, these data were sorted by area, and a new list included only those threatened and endangered species within the designated action area for Schofield Barracks Military Reservation. The following threatened and endangered species have historically been documented at SBMR Action Area (see Appendix B for a complete list of rare species currently and historically found in SBMR AA):

- 29 endangered plants
- 1 endangered tree snail (*Achatinella mustelina*-Oahu tree snail)
- 1 endangered bird (*Chasiempis sandwichensis* spp. *ibidis*-Oahu elepaio)
- 1 endangered mammal (*Lasiurus cinereus* spp. *semotus*-Hawaiian hoary bat)
- 1 threatened plant (*Isodendrion longifolium*-Aupaka)

This data was subsequently sorted by date and included all threatened and endangered species occurrences from 1982 until the present (past 20 years). This date was agreed upon by Army Natural Resource Staff (NRS) and the USFWS, because NRS could confirm using recent extensive survey information, whether species prior to 1982 were extirpated (Kapua Kawelo, U.S. Army, pers. comm. 2002). The vertebrates were only included in the list if they were confirmed to be residents. Although NRS has surveyed many historic snail habitats extensively, adequate surveys throughout former snail habitats have not been completed because of the size and ruggedness of the terrain. Thus, unknown remnant snail populations may still persist in remote areas within SBER. The following tree snail species are not currently known in the wild but still may be extant in remote or unidentified refugia within the SBMR AA: *A. spaldingi* and *A. thaanumi*. These species will be surveyed for by the Army in their historic ranges as outlined by USFWS (1993), and within other potential habitats within SBMR AA. Table 10.i below contains federally-listed species currently found in the SBMR action area. Appendix C lists all species affected by routine military training and SBCT transformation and the designated action area or areas where they are found on Oahu.

Table 10.i Federally-listed Species on Schofield Barracks Military Reservation, Hawaii.

Species Name	Number of individuals in SBMR AA	Number of populations/occurrences in SBMR AA
Plants:		
Abutilon sandwicense	10	1
Alectryon macrococcus var. *macrococcus*	22-25	4
Alsinidendron trinerve	72	2
Cyanea acuminata	62	3
Cyanea grimesiana ssp. *obatae*	1	1
Delissea subcordata	4	2
Diellia falcata	71	4
Flueggea neowawraea	3	2
Gardenia mannii	4	1
Hesperomannia arborescens	4	2
Isodendrion longifolium	11	2
Labordia cyrtandrae	14	2
Lepidium arbuscula	60	2
Lobelia oahuensis	1 (extirpated)	1(extirpated)
Phyllostegia hirsuta	73	3
Phyllostegia kaalaensis	10	1
Phyllostegia mollis	1	1
Plantago princeps	20	1
Schiedea hookeri	15	2
Schiedea kaalae	1	1
Viola chammisoniana ssp. *chammisoniana*	19	1
Snails:		
Achatinella mustelina	175	11
Mammals:		
Lasiurus cinereus spp. *semotus*	1	1
Birds:		
Chasiempsis sandwicensis ssp. *ibidis*	306	Na

[1]Source: Hawaii Natural Heritage Program (HINHP 2002) and Research Corporation of the University of Hawaii (RCUH 2002a).

Federally-listed Species Descriptions

See Appendix D for definitions of the components of the species descriptions which follow. For species included in more than one action area, the complete description can be found where it was first discussed in this BA.

Scientific name: *Abutilon sandwicense* (Degener) Christoph.

Common name: None known
Family: Malvaceae (Mallow family)
Federal status: Listed endangered
Life history: Short-lived perennial

Description and biology: *Abutilon sandwicense* is a tall shrub 1.5 and 6.0 m (4.9 to 20 ft) in height with white to yellowish hairs. The leaves are 8 and 22 cm (3 to 8.7 in) long and heart-shaped. A single bright green to reddish brown flower originates in the leaf axil of the plant. The yellow-brown fruit is 1.7 to 2.5 cm (0.7 to 1.0 in) long with 8 to 10 mericarps, each containing 2 to several dull brown seeds (Wagner et al. 1990).

Abutilon sandwicense has been observed flowering in winter and spring and fruit capsules develop within six weeks. Juvenile plants of *A. sandwicense* are observed frequently in the wild (RCUH 2002c).

Known distribution: *Abutilon sandwicense* was known from most of the Waianae Mountains from Kapuna Gulch in Mokuleia Forest Reserve to Nanakuli Valley (Bates 1990; RCUH 2002c).

Population trends: A decline in population numbers of *A. sandwicense,* possibly from drought has occurred in recent years (RCUH 2002c).

Current status: An estimated <300 individuals from 17 population/occurrences exist in the wild (USFWS 1998a; RCUH 2002b). Approximately 10 individuals of *A. sandwicense* are found within the SBMR AA at Palikea Gulch, Mt. Kaala NAR (Figure 10.l), which represents approximately 3% of the remaining wild individuals. There is one population of > 50 individuals at Makaha that is considered stable (RCUH 2002c).

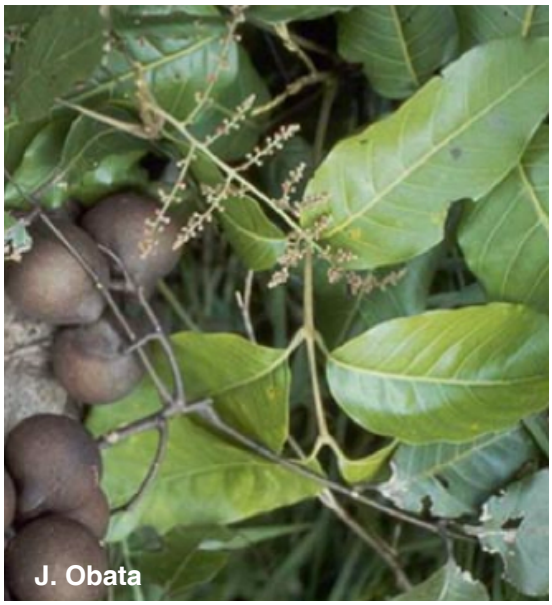
Habitat: *Abutilon sandwicense* occurs on steep slopes or gulches in dry to dry-mesic forest between 300 to 600 m (985 to 1,970 ft) elevation (USFWS 1995, 1998). *A. sandwicense* is often closely associated with *Diospyros* spp. (lama), *Pipturus albidus* (mamaki), *Eleocarpus bifidus* (kalia), *Sapindus oahuensis* (aulu), *Nestegis sandwicesis* (olopua), and *Psydrax odoratum* (alahee) (USFWS 1995).

Taxonomic background: *A. sandwicense* is endemic to Oahu. The native Hawaiian genus of *Abutilon* is a result of two or three independent colonizations. *Abutilon sandwicense* and *A. menziesii* both occur in the Waianae Mountains. Historically, their habitats may have overlapped, but no hybrids between these taxa have been documented in a wild setting, although in garden experiments they hybridize readily.

Outplanting Considerations: The two *Abutilon* taxa should not be outplanted in close proximity to each other. The only known populations of *A. menziesii* on Oahu are located in the Ewa plain and in Lualualei. Outplanting of *A. sandwicensis* at these sites should be avoided.

Current Threats: Some major threats to *A. sandwicense* include *Xylasandrus compactus* (black twig borer) and *Adorectus sinicus* (Chinese rose beetle), as well as competition from alien plant species (*Schinus terebinthifolius* (Christmasberry), *Syzygium cumini* (Java plum), Koster's curse, molasses grass, and huehue haole), fire, and trampling and foraging by goats and pigs (USFWS 1995, 1998).

Potential Threats from Army Training and Transformation: There is no threat from munitions landing in the locations where *A. sandwicensis* occurs (Figure 10.b). It occurs in the lowland dry shrubland at SBMR AA where the weed threat from current military training and SBCT transformation is high (Figure 10.l) and the fire threat is low (Figure 10.m). There is no threat from foot traffic trampling for this population/occurrence above the firebreak road where foot maneuvers are restricted because of unexploded ordnance (UXO) (Figure 10.n). These results suggest that *A. sandwicensis* is vulnerable to alien plant introductions and possibly fire as a result of military activities in the SBMR AA.



Scientific Name: *Alectryon macrococcus* Radlk. var. *macrococcus*

Common Name: *Mahoe*, *alaalahua*
Family: Sapindaceae (Soapberry family)
Federal Status: Endangered
Life history: Short-lived perennial

Description and Biology: *Alectryon macrococcus* var. *macrococcus* is a tree up to 11 m (36 ft) tall. Multiple trunks are common in mature trees. The leaves are compound with 2 to 5 pairs of 10 to 28 cm (3.9 to 11 in) long leaflets. The flowers form panicles up to 30 cm (12 in) long. Flowers are either perfect (possessing male and female reproductive parts) or staminate (possessing only male reproductive parts), and are probably insect pollinated. The roundish fruits are 2.5 to 7 cm (1.0 to 2.8 in) in diameter. The firm and fleshy red fruit is covered by a hard rind and contains a single glossy pale brown seed at the end of the fruit (Wagner et al. 1990).

Upon maturity the fruit sometimes cracks open to expose the bright red fruit inside. This may act as an attractant to birds that subsequently could act as dispersal agents for *A. macrococcus* var. *macrococcus*. Some trees have been observed to flower, but never bear fruit despite appearing relatively healthy (RCUH 2002c). Although the cause of this is not substantiated, it may be that some trees only produce flowers that are functionally male.

Information on growth rates and age of maturation of wild *A. macrococcus* var. *macrococcus* is lacking. However, two trees in cultivation were observed flowering for the first time when they were about 15 years old, 6 m (20 ft) tall, and each with a single 14 cm (5.5 in) diameter trunk (RCUH 2002c). The longevity of *A. macrococcus* var. *macrococcus* individuals is unknown.

Fire Vulnerability Areas

Schofield Barracks Action Area, Oahu

Figure 10m

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* Please see individual map area for scale information.

Data Source: HINHP 2002, RCUH 2002a

Legend

Plants

- *Abutilon sandwicense*
- *Alectryon macrococcus macrococcus*
- *Alsinidendron trinerve*
- *Cyanea acuminata*
- *Cyanea grimesiana obatae*
- *Delisea subcordata*
- *Diellia falcata*
- *Flueggea neowawraea*
- *Gardenia mannii*
- *Hesperomannia arborescens*
- *Isodendrion longifolium*
- *Labordia cyrtandrae*
- *Lepidium arbuscula*
- *Lobelia oahuensis*
- *Phyllostegia hirsuta*
- *Phyllostegia kaalaensis*
- Phyllostegia mollis
- Plantago princeps
- Schiedea hookeri
- Schiedea kaalae
- Viola chammisoniana chammisoniana

Snails

- Achatinella mustelina

Mammals

- Lasiurus cinereus semotus

Fire Vulnerability

- Very Low Insignificant Discountable
- Low
- Moderate
- Very High

- Roads
- Installation Boundary
- Action Area
- Surface Water Body
- Bog

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Probability Foot Traffic Areas

Schofield Barracks Action Area, Oahu

Figure 10n

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* Please see individual map area for scale information.

Data Source: HINHP 2002, RCUH 2002a

Legend

Plants

- *Abutilon sandwicense*
- *Alectryon macrococcus macrococcus*
- *Alsinidendron trinerve*
- *Cyanea acuminata*
- *Cyanea grimesiana obatae*
- *Delisea subcordata*
- *Diellia falcata*
- *Flueggea neowawraea*
- *Gardenia mannii*
- *Hesperomannia arborescens*
- *Isodendrion longifolium*
- *Labordia cyrtandrae*
- *Lepidium arbuscula*
- *Lobelia oahuensis*
- *Phyllostegia hirsuta*
- *Phyllostegia kaalaensis*
- *Phyllostegia mollis*
- *Plantago princeps*
- *Schiedea hookeri*
- *Schiedea kaalae*
- *Viola chammisoniana chammisoniana*

Snails

- *Achatinella mustelina*

Mammals

- *Lasiurus cinereus semotus*

Threats from Foot Traffic

- None
- Very Low
- Low
- Moderate
- High

- Roads
- Installation Boundary
- Action Area
- Surface Water Body
- Bog

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Known Distribution: *Alectryon macrococcus* var. *macrococcus* is known from Kauai, Oahu, Molokai, and West Maui. On Kauai it has been found on the western side of the island from Olokele Canyon to Kalalau Valley. On Oahu it is known primarily from the Waianae Mountains, where it has been recorded throughout the mountain range, on both the windward and leeward sides. There are only two historical records of the taxon in the Koolau Mountains. On Molokai it has been documented only from the western portion of East Molokai. On West Maui it has been found in the valleys and gulches on the eastern, southern, and western sides of the mountains.

Population Trends: *A. macrococcus* var. *macrococcus* has been steadily declining since the introduction of the black twig borer. Currently, many of the mature trees are dying, young trees are uncommon, and seedlings seldom reach sapling size before being killed by the black twig borer.

Current Status: *A. macrococcus* var. *macrococcus* is present throughout its historic range except for the Koolau Mountains of Oahu. The total number of individuals known statewide totals about 329-334 from approximately 21 population/occurrences (RCUH 2002b; Makua Implementation Team 2002). The species has always been considered relatively rare on Molokai and West Maui. Over the last 3 decades, only about 10 plants have been observed on Molokai and fewer than 20 have been observed on West Maui (HINHP 2000). This taxon is most common on parts of Kauai and in the Waianae Mountains of Oahu. Approximately 80 plants are thought to remain on Kauai. It is estimated that about 300 plants still remain in the Waianae Mountains, with more than half occurring in 3 populations from Central Kaluaa to Central Waieli, Makaha, and West Makaleha. An estimated 22-25 plants from five populations/occurrences are found in the SBMR AA, which represents approximately 7-8 % of the remaining wild individuals (HINHP 2002; RCUH 2002a) (Figure 10.l). Two to three individuals are located in Palikea Gulch, one to two individuals are located in South Mohiakea Gulch, one to two are located in North Waieli (near ridge crest and Puu Kumakalii), one individual is from Haleauau, and the remaining 17 individuals are found East of Puu Kalena in Mohiakea Gulch. There are 3 population/occurrences of >25 *A. macrococcus* var. *macrococcus* outside the Army AAs, (located at Makaha, central Kaluaa to central Waieli, and in Koaie Kauai). However, the species is heavily impacted by the black twig borer, resulting in no recruitment and most remaining individuals are likely to be old, senescent individuals that will die out soon without replacement. Thus, no population/occurrences are presently considered stable (Marie Bruegmann, USFWS, pers. comm. 2003).

Habitat: *Alectryon macrococcus* var. *macrococcus* occurs in gulch bottoms and on lower gulch slopes in native mesic forests from 370 to 1,100 m (1,200 to 3,600 ft) elevation. These forests are often composed of a mix of tree species such as *Diospyros sandwicensis* and *D. hillebrandii* (lama), *Metrosideros* spp. (ohia), *Myrsine* spp. (kolea), *Pisonia* spp. (papala kepau), *Pouteria sandwicensis* (alaa), and *Psychotria* spp. (kopiko). Similarly to other rare Hawaiian mesic forest species, *A. macrococcus* var. *macrococcus* is found primarily on the north-facing sides of gulches.
Taxonomic Background: *A. macrococcus* is the only species in the genus *Alectryon* occurring in Hawaii. It is comprised of two varieties, var. *macrococcus* and var. *auwahiensis*. The latter is endemic to the south and northwestern slopes of East Maui. The two varieties are distinguished by the hairiness of the leaf underside, var. *auwahiensis* is the hairier of the two (Linney 1987).

Outplanting Considerations: Care should be taken in outplanting *A. macrococcus* var. *macrococcus* due to the severity of the black twig borer attack on saplings. Any outplanting should be done in conjunction with twig borer control. There are no concerns with respect to inadvertently allowing unnatural hybridization between the two varieties, as their ranges are well separated. *Alectryon macrococcus* does not have any close relatives in Hawaii that could potentially hybridize with it.

Current Threats: The most serious threat to *A. macrococcus* var. *macrococcus* is the black twig borer. All trees of this taxon are being affected by the black twig borer to some degree. Other threats to *A.*

macrococcus var. *macrococcus* include invasive alien ungulate species, which degrade native habitat and harm the plants by eating, trampling, or uprooting them. Alien plants are a threat as they alter habitat and compete for sunlight, moisture, nutrients, and growing space with *A. macrococcus* var. *macrococcus*. Some alien plants, such as tall grasses, can increase the frequency and size of fires. Additional threats to the species include rats preying on seeds, cattle grazing, and fire.

Potential Threats from Army Training and Transformation: There is a low threat from munitions landing on two *A. macrococcus* var. *macrococcus* population/occurrences in Mohiakea Gulch (Figure 10.b). The weed threat from current military training and SBCT transformation is moderate for the *A. macrococcus* var. *macrococcus* population/occurrence in lowland mesic forests of the northern part of the AA and high for the majority of the populations in alien dominated plant areas in the south because of the dry microclimate and prevalence of alien species there (Figure 10.l). The fire threat is low in these portions of the action area (Figure 10.m). There is no threat from foot traffic trampling for the population/occurrences in the western and northern portions of the action area, which is above or part of the dudded impact area where foot maneuvers are restricted because of UXO (Figure 10.n). The seedlings from the population/occurrences in the southern portions of the action area have a low threat from foot traffic trampling (Figure 10.n). These results suggest that *A. macrococcus* var. *macrococcus* populations/occurrences are vulnerable to alien plant introductions, fire, and some from munitions, and seedlings outside the impact area in the south are vulnerable to trampling from foot traffic as a result of military activities in the SBMR AA

Scientific name: *Alsinidendron trinerve* H. Mann.

Common name: None known
Family: Caryophyllaceae (Pink family)
Federal status: Endangered
Life history: Short-lived perennial

Description and biology: *Alsinidendron trinerve* is a shrub 30 to 80 cm tall. Leaves are 6 to 12 cm long and 3 to 5 cm wide and oppositely arranged. There are 12 to 20 flowers in each inflorescence. Fruit are capsules, which are egg-shaped or roundish. They measure 8 to 12 mm in length and contain numerous black seeds. The flowers lack petals, but the calyx lobes are petal-like in appearance. These calyx lobes are green and white in color and are 6-10 mm long (Wagner et al. 1990). *A. trinerve* flowers and fruits year round, but flowering is usually heaviest in the winter and spring. *A. trinerve* is a self-pollinating species (Weller, pers. comm.). As the fruit matures, the calyx lobes stay alive and become purple and fleshy. This 'false berry' is very likely to attract fruit-eating birds that may disperse the species' seeds (Carlquist 1970). The longevity of individual plants is unknown.

Known Distribution: *A. trinerve* is endemic to the Waianae Mountains. It has been recorded from wet forests from 700 to 1,220 m (2,300 to 4,000 ft) in elevation. (HHP 1994b; Wagner et al. 1990). This species was collected from the east side of the Mt. Kaala area on numerous occasions during the early and mid-1900s (HHP 1994b).

Population Trends: There are no documented population trends for this taxon.

Current status: There are 87-89 total *A. trinerve* individuals known from 3 population/occurrences known statewide (RCUH 2002a; HINHP 2002). This includes approximately 72 *A. trinerve* individuals from two population/occurrences found within the SBMR AA (including 70 mature and 152 immature from Mt. Kaala in 2002 and 2 mature and 5 immature from Kalena in 2003) (Kawelo, U.S. Army, pers. comm. 2003; Lau, HINHP, pers. comm. 2003) (Figure 10.l). This represents approximately 81-83% of the remaining wild individuals. The are only 15-17 known plants out of the action area, found in Makaha Valley in 2003. There are no stable populations of >50 plants outside of the SBMR AA (RCUH 2002c).

Habitat: *A. trinerve* typically grows in wet ohia (*Metrosideros polymorpha*) forest in gradually sloped to steep terrain. Other canopy species, which grow in close association with A. trinerve, include *Boehmeria grandis and Pipturus albidus.*

Taxonomic background: The endemic Hawaiian genera *Schiedea* and *Alsinidendron* constitute a complex of species descended from a single colonizing ancestor (Wagner et al. 1995). There are four species of *Alsinidendron*, two on Kauai and two on Oahu. The Oahu taxa are *A. trinerve* and the closely related *A. obovatum*.

Outplanting considerations: Since *A. trinerve* is a naturally self-pollinating plant (Weller, pers. comm.), plants from different stocks should not be mixed together in outplantings. *A. obovatum*, like *A. trinerve*, is an endangered plant. The ranges of the two species do not overlap geographically. *A. obovatum* is known from mesic koa/ohia forests in the Makua-West Makaleha vicinity and was historically known from Palehua in the southern portion of the Waianae Mountains. *A. trinerve* should not be reintroduced within the range or habitat of *A. obovatum.*

Current Threats: The major threats to *A. trinerve* are competition from the aggressive alien plant species*, Rubus argutus* (blackberry), habitat degradation by feral pigs and goats and trampling or collection by individuals along trails.

Potential Threats from Army Training and Transformation: There is no threat from munitions landing in the locations where *A. trinerve* occurs (Figure 10.b). It occurs in lowland wet forest and shrubland and in montane wet forest and shrubland at SBMR AA where the weed threat from current military training and SBCT transformation is low to moderate (Figure 10.l) and the fire threat is very low, insignificant and discountable (Figure 10.m). There is no threat from foot traffic trampling for these population/occurrences because they occur in the dudded impact area where foot maneuvers are restricted (Figure 10.n). These results suggest that *A. trinerve* is vulnerable to alien plant introductions as a result of military activities in the SBMR AA.

Scientific Name: *Cyanea acuminata* Hillebr.

Common Name: `Oha, haha, `ohawai
Family: Campanulaceae (Bellflower family)
Federal Status: Endangered
Life history: Short-lived perennial

Current Status: There are 15 known populations of 100 *C. acuminata* individuals remaining (USFWS 1998a; RCUH 2001). There are three known population/occurrences of 62 individuals in SBMR AA (RCUH 2002a, 2002c), located in Kaala and Haleauau (RCUH 2002a) (Figure 10.l). Individuals that fall within the SBMR AA represent 62% of the total remaining individuals of this species. There are no stable populations of >50 plants outside of the Army AAs.

Potential Threats from Army Training and Transformation: There is no threat from munitions landing in the locations where *C. acuminata* occurs (Figure 10.b). It occurs in wet cliff and lowland mesic forest and shrubland areas at SBMR AA where the weed threat from current military training and SBCT transformation is low to moderate and moderate respectively (Figure 10.l) and the fire threat is very low, insignificant and discountable (Figure 10.m). There is no threat from foot traffic trampling for these population/occurrences because they occur in the dudded impact area where foot maneuvers are restricted (Figure 10.n). These results suggest that *C. acuminata* is vulnerable to alien plant introductions, and seedlings and small *C. acuminata* are vulnerable to trampling from foot traffic as a result of military activities in the SBMR AA.

For the complete species description, go to Federally-listed Species Affected by the Action at KLOA (**Section 7.5.2**).

Scientific name: *Cyanea grimesiana* Gaud. ssp. *obatae* (St. John) Lammers

Common Name: *Haha, ohawai*
Family: Campanulaceae (Bellflower family)
Federal Status: Endangered
Life history: Short-lived perennial

Description and Biology: *Cyanea grimesiana* ssp. *obatae* is a shrub 1.0 to 3.2 m (3.3 to 10.5 ft) tall. It is single-stemmed or sparingly branched. The leaves are 27 to 58 cm (10.6 to 22.8 in) long and 14 to 32 cm (5.5 to 12.6 in) wide, pinnately divided, and are clustered towards the tips of the stems. Stalks of 6 to 12 purple or green to yellow-white flowers, 5.5 to 8.0 cm (2.2 to 3.1 in) long, originate amongst the leaves. The orange berries are 1.8 to 3.0 cm (0.7 to1.2 in) long and 0.8 to 1.5 cm (0.3 to 0.6) wide (Wagner et al. 1990).

C. grimesiana spp. *obatae* flowers and fruits year-round, depending on rainfall (USFWS 1995). The long tubular flowers and orange berries of this taxon, suggest pollination and seed dispersal by birds may be common. However, they are capable of self-pollination

because isolated plants have been found with viable seeds. *C. grimesiana* ssp. *grimesiana* is presumably fairly short-lived (about 10 to 20 years) like other species of its size in the genus. Specifics on reproductive cycles, longevity, specific environmental requirements, and limiting factors of the species are unknown.

Known Distribution: Historically, *C. grimesiana* ssp. *obatae* was known only from the southern Waianae Mountains.

Population Trends: Most of the *C. grimesiana* ssp. *obatae* population units were recently discovered, but those that have been tracked for at least 15 or 20 years have either died out or have declined markedly.

Current Status: *C. grimesiana* ssp. *obatae* is currently known from the southern Waianae Mountains and the Mokuleia region of the northern Waianae Mountains. There are a total of about 18 individuals of *C. grimesiana* ssp. *obatae* known in the wild (Makua Implementation Team 2002). One individual is known from one population/occurrence in the SBMR AA located at lower Kaala NAR in Palikea Gulch between 610 and 700 m (2000-2300 ft) elevation (Figure 10.l) (HINHP 2002; RCUH 2002a). This represents about 6% of the remaining known individuals of this taxon. There are no known stable populations of >50 outside of the Army AAs.

Habitat: *C. grimesiana* ssp. *obatae* is found from 550 to 670 m (1,800 to 2,200 ft) in elevation (HINHP 2000) in mesic to wet forests on steep shaded slopes or gulch bottoms. They often grow on steep vertical embankments in rock or a mix of rock and soil (RCUH 2002c). Common plant associates include mamaki, *Charpentiera* (papala), *Claoxylon sandwicense* (poola), papala kepau, koa, and various ferns species (USFWS 1995).

Taxonomic Background: *Cyanea grimesiana* includes one species in addition to ssp. *obatae*, namely ssp. *grimesiana*, which has been recorded primarily in the Koolau Mountains of Oahu, but which has also been found in the northern and central Waianae Mountains and on Molokai. The two species are distinguished by the size and shape of their calyx lobes. Certain *Cyanea* populations on Molokai, Maui, Lanai, and Hawaii formerly included in *C. grimesiana* have recently been recognized as constituting three separate species (Lammers 1998).

Outplanting Considerations: *Cyanea* taxa and *Cyanea* relatives known to occur naturally with or near *C. grimesiana* ssp. *obatae* are: *C. longiflora*, *C. superba* ssp. *superba*, *C. angustifolia*, *C. membranacea*, *C. calycina*, *C. acuminata*, *Clermontia persicifolia, Cl. oblongifolia*, *Cl. kakeana*, *Cl. fauriei, Delissea subcordata,* and *D. sinuata*. It is common to find several *Cyanea* species and *Cyanea* relatives growing together, yet to date there is no good evidence of hybridization occurring between species of *Cyanea* or between a *Cyanea* and a *Cyanea* relative. Therefore, there is little likelihood that hybridization resulting from outplanting of *C. grimesiana* ssp. *obatae* would occur.

Both *C. grimesiana* ssp. *obatae* and *C. grimesiana* ssp. *grimesiana* have been recorded in the northern and central Waianae Mountains. Although no individuals of ssp. *grimesiana* are known in the Waianae Mountains, there remains a chance that plants still survive there. The relationship between the two species with respect to distribution and genetics is unclear. Prior to establishing outplanting sites for *C. grimesiana* ssp. *obatae,* the potential area should be searched thoroughly for both species.

Current Threats: Major threats to *C. grimesiana* ssp. *obatae* include feral pigs and goats. These ungulates degrade the taxon's habitat and harm the plants through feeding, trampling, or uprooting them when rooting for food. Alien plants threaten the taxon by altering its habitat and competing for sunlight,

moisture, nutrients, and growing space. The spread of highly flammable alien grasses increases the incidence and destructiveness of wildfires. Rats pose a threat through their predation of plant parts and fruits. Introduced slugs and snails threaten the taxon by feeding on leaves, stems, and seedlings.

The long-billed, nectar-feeding native Hawaiian birds that were the presumed pollinators of *C. grimesiana* ssp. *obatae* have been almost totally eliminated from the Waianae Mountains. Although the taxon is capable of self-pollinating, the loss of its normal pollinators likely results in decreased genetic variability within its populations over successive generations.

Potential Threats from Army Training and Transformation: There is a low threat from munitions landing on *C. grimesiana* ssp. *obatae* in lower Kaala NAR (Figure 10.b). The weed threat from current military training and SBCT transformation is moderate in the lowland mesic forest and shrub community of the northern part of the AA where *C. grimesiana* ssp. *obatae* is located (Figure 10.l), and the fire threat is low (Figure 10.m). There is no threat from foot traffic trampling for this population/occurrence above the firebreak road where foot maneuvers are restricted because of unexploded ordnance (UXO) (Figure 10.n). These results suggest that *C. grimesiana* ssp. *grimesiana* is vulnerable to alien plant introductions, possibly fire, and from munitions as a result of military activities in the SBMR AA.

Scientific Name: *Delissea subcordata* Gaud.

Common name: *Haha, ohawai*
Family: Campanulaceae (Bellflower family)
Federal status: Endangered
Life history: Short-lived perennial

Description and Biology: *Delissea subcordata* is a single stemmed or occasionally branched shrub, 1 to 3 m (3.3 to 9.8 ft) tall. The stems are erect and topped by a cluster of leaves. The ovate or ovate-lanceolate shaped leaves are 12 to 30 cm (4.7 to 12 in) long and 6 to 17 cm wide with toothed or cut margins. The white to green flowers originate close to the stem among the leaves in groups of 6 to 18. The berries are 1.2 to 1.6 cm (0.5 to 0.6 in) long and are purple when ripe (Wagner et al. 1990).

Flowering has been observed from February to June and fruiting from June to August. As with other species of *Delissea,* it has long tubular flowers and is probably pollinated by nectar-feeding birds. It is capable of self-pollination, as evidenced by the production of viable seeds by isolated plants. The purple berries of *D. subcordata* are indicative of plants with seeds dispersed by fruit-eating birds.

The growth rates of wild, outplanted and cultivated plants suggest *D. subcordata* is a short-lived species. The average life span appears to be under 10 years (RCUH 2002c).

Known Distribution: *Delissea subcordata* has been recorded from both mountain ranges on Oahu. In the Koolaus it has been found scattered, primarily in the southeastern Koolau Mountains and in both the windward and leeward central Koolaus. In the Waianae Mountains it has been found primarily along the windward side of the range. The only recorded leeward sites for the plant are in Kahanahaiki Valley on Makua Military Reservation. The species has been documented from elevations of 430 to 760 m (1,400 to 2,500 ft) (USFWS 1996b).

Population Trends: *D. subcordata* populations are declining, and those that remain are small and widely dispersed. Most species of *Delissea* are considered to be extinct and the long-term trend for *D. subcordata* populations has been downward. Many population/occurrences known in 1970s and 1980s are now extirpated.

Current Status: *Delissea subcordata* has not been observed in the Koolau Mountains since 1934, however it is still found throughout the Waianae Mountains. The total number of known plants remaining is 44 from 10 population/occurrences, which includes four individuals for two population/occurrence in the SBMR AA (Figure 10.l) (Makua Implementation Team 2002). This represents approximately 9% of the remaining wild individuals. Two of these individuals are from South Mohiakea Gulch and two are from Palikea Gulch (RCUH 2002a, 2002c). There are no stable populations of >50 *D. subcordata* outside the Army AAs.

Habitat: *Delissea subcordata* is usually found on north-facing gulch slopes and sometimes in gulch bottoms in mesic forests dominated by *Diospyros* spp. (lama), *Metrosideros* spp. (ohia), and/or *Acacia koa* (koa). It also occurs in forests composed of a diverse mix of tree species. It grows under the forest canopy or in sunny openings in the forest.

Taxonomic Background: *Delissea* is endemic to Hawaii and is composed of 11 species (Lammers 1990, 1998). *D. laciniata*, *D. lauliiana*, and *D. sinuata* have been recorded from Oahu in addition to *D. subcordata*. *D. laciniata* and *D. lauliiana* have been recorded only from the southeastern Koolau Mountains, while *D. sinuata* has only been found in the northern Waianae Mountains and was last collected in 1937.

Populations of *D. subcordata* exhibit forms of morphological variation. Some of the more obvious variation occurs in the leaves, including size, shape, and the degree to which the margins are toothed or cut.

Outplanting Considerations: *Delissea* taxa and relatives commonly found near *D. subcordata* in the wild of the Waianae Mountains are *Cyanea grimesiana* ssp. *grimesiana, C. grimesiana* ssp. *obatae*, *C. superba* ssp. *superba*, *C. angustifolia*, *C. membranacea, C. calycina, C. longiflora, Clermontia persicifolia*, *Cl. kakeana*, *Cl. oblongifolia*, *Cl. fauriei*, and *D. sinuata*. Although it is common to find these species growing together with *D. subcordata*, there is no evidence of hybridization occurring between the species. Therefore, there is little likelihood that hybridization resulting from outplanting of *D. subcordata* would occur.

Current Threats: A major threat to *D. subcordata* is road construction and maintenance, which has destroyed entire colonies of *D. subcordata* in the past (Takeuchi et al. 3422, BISH). Feral pigs have been observed predating on *D. subcordata* at SBMR West Range. These invasive alien ungulate species degrade native habitat and harm the plants by eating, trampling, or uprooting them. Alien plants also threaten the species by altering habitat and competing for nutrients, light, and space. Rats pose a threat through predation of plant parts and fruits. Introduced slugs and snails threaten the species by feeding on leaves, stems, and seedlings. In addition, many of the nectar-feeding native Hawaiian birds, which are the presumed pollinators of *D. subcordata,* have been almost totally eliminated from the Waianae Mountains. The species is capable of self pollination, but the loss of its normal pollinators could result in decreased genetic variability within its populations over successive generations.

Potential Threats from Army Training and Transformation: There is a low threat from munitions landing on *D. subcordata* in South Mohiakea Gulch (Figure 10.b). The weed threat from current military training and SBCT transformation is moderate for the *D. subcordata* population/occurrence in lowland

mesic forests and high for those individuals in alien dominated plant areas because of the dry microclimate and prevalence of alien species there (Figure 10.l). The fire threat is low in these portions of the action area (Figure 10.m). There is no threat from foot traffic trampling for these population/occurrences in the western and northern portions of the action area, which is above or part of the dudded impact area where foot maneuvers are restricted because of UXO (Figure 10.n). These results suggest that *D. subcordata* populations/occurrences are vulnerable to alien plant introductions, possibly fire, and one population/occurrence from munitions as a result of military activities in the SBMR AA

Scientific Name: ***Diellia falcata* Brack.**

Common Name: None known
Family: Aspleniaceae (Spleenwort family)
Federal Status: Endangered
Life history: Short-lived perennial

Description and Biology: *Diellia falcata* is a medium-sized fern with erect rhizomes and numerous large, tan or brown to reddish-brown scales at the stipe base (Palmer, in press, 2002). Fronds are 0.2 to 0.95 m (0.7 to 3.1 ft) long and 2.5 to 9 cm (1.0 to 3.5 in) wide, with 12 to 45 pinnae pairs of leaflets. A usually single, short and separate sorus originates on the underside of each leaflet. The sori are 1 to 3 mm (0.04 to 0.12 in) long and are distributed along the margins of the pinnae (Wagner 1952).

Known Distribution: *Diellia falcata* is endemic to Oahu and is rare to occasional in the under-story of mixed native/alien mesic forests. It occurs from 390 to 825 m (1,280 to 2,700 ft) in elevation, from Manini Gulch to Palehua Iki, which is almost the entire length of the Waianae Mountains, as well as from the Koolau Mountains from Kaipapau Valley to Aiea Gulch (HINHP 1994b; USFWS 1995).

Population Trends: *D. falcata* is the only *Diellia* that seems to be maintaining a viable population.

Current Status: *D. falcata* is locally common in the Waianae Range, but it is probably extirpated from the Koolau Range. There are currently 21 known populations/occurrences of *Diellia falcata* on Oahu totalling about 5,540 (HINHP 1994c; USFWS 1999a; RCUH 2001). *D. falcata* has been found in most of the Waianae Mountains drainages in SBMR, north and south of Kolekole Pass. There are 71 *D. falcata* individuals from four populations/occurrences in SBMR AA (Figure 10.l). Five plants occur in Mohiakea Gulch north of Puu Kumakalii, six are known east of Puu Kumakalii, 50 plants occur East of Puu Kalena on Kalena side of ridge in South Mohiakea Gulch, and ten occur in Palikea Gulch in Mt. Kaala NAR (HINHP 2002; RCUH 2002a). This represents about 1% of the remaining individuals in the wild. More than three stable populations of > 50 *D. falcata* exist outside of the SBMR action area. These are located at Kaluaa, Huliwai, Napepeiaoolelo, South Palawai, North Palawai, Makaha, East Makaleha and Mt. Kaala NAR (Lau, HINHP, pers. comm. 2003)

Habitat: *Diellia falcata* populations are found scattered between 400 and 1,000 m (1,300 and 3,300 ft), within deep shade or open understory in mesic or dryland forests, often in loamy soil (HINHP 1994b; USFWS 1995). It is rare to occasional in the understory of mixed native/alien mesic forests (HINHP

1994b). It is often closely associated with several canopy species including *Diospyros hillebrandii* (lama*), Claoxylon sandwichense* (poola*), Psydrax odoratum* (alahee*), Pisonia sandwicensis* (aulu), and *Pouteria sandwicensis* (alaa) (USFWS 1995).

Taxonomic Background: *Diellia* is endemic to Hawaii and includes six species that all may have originated from a single common ancestor. *Diellia* is most closely related to *Asplenium,* which is another genus of Hawaiian fern (Palmer, in press, 2002). *D. unisora* is the only other *Diellia* species that occurs in the Waianae Mountains. It is found in an isolated region of the southern Waianaes. The two are known to hybridize and hybrids are called *D*. x *lauii*.

Outplanting Considerations: *Diellia falcata* is relatively common in the Waianae Mountains, so in situ populations should be managed prior to any outplanting. If outplanting is required in the future, it should be done in habitat as described above and at locations well separated from *D. unisora*.

Current Threats: The major threats to *D. falcata* are habitat degradation by feral goats and pigs; competition from alien plants including *Blechnum occidentale* (blechnum fern), *Clidemia hirta* (Koster's curse), *Melinis minutiflora* (molasses grass), *Psidium cattleianum* (strawberry guava), and *Schinus terebinthifolius* (Christmasberry); and fire. The two-spotted leafhopper (*Sophonia rufofascia*) is also a potential threat (USFWS 1998a).

Potential Threats from Army Training and Transformation: There is a low threat from munitions landing on *D. falcata* in Mohiakea Gulch and South Mohiakea Gulch (Figure 10.b). The weed threat from current military training and SBCT transformation is high for all *D. falcata* population/occurrences because they are located in lowland dry shrublands and in areas dominated by alien plant species in the SBMR AA (Figure 10.l). The fire threat is low in these portions of the action area (Figure 10.m). There is no threat from foot traffic trampling for the population/occurrences in the western and northern portions of the action area, which is above or part of the dudded impact area where foot maneuvers are restricted because of UXO (Figure 10.n). Population/occurrences in the southern portions of the action area have a low threat from foot traffic trampling (Figure 10.n). These results suggest that *D. falcata* populations/occurrences are vulnerable to alien plant introductions, possibly fire, and two population/occurrences from munitions. In addition, population/occurrences outside the impact area in the south may be vulnerable to trampling from foot traffic as a result of military activities in the SBMR AA

Scientific Name: *Flueggea neowawraea* W. Hayden

Common Name: Mehamehame
Family: Euphorbiaceae (Spurge family)
Federal Status: Endangered
Life history: Short-lived perennial

Description and Biology: *Flueggea neowawraea* is a tree that grows up to 30 m (98 ft) tall, with a trunk that can reach 2 m (6.6 ft) in diameter. The trees are often multi-trunked. The bark of the tree is rough and scaly textured, and pale brown in color. The leaves are 4 to 14 cm (1.6 to 5.5 in) long and 2 to 9 cm (0.8 to 3.5 in) wide, ovate-elliptic in shape, and are arranged alternately along the stems. Flowers form axillary clusters of 2 to 6 and are usually all male or all female on a given plant. The reddish brown to black fruit are 3 to 6 mm (0.12 to 0.24 in) in diameter and usually contain 6 seeds, 2 to 4 mm (0.8 to 0.16 in) long (Wagner et al. 1990).

A cultivated plant isolated from others was observed to produce viable seeds, which suggests the species is not completely dioecious (RCUH 2002c). Flowering occurs over a brief period sometime in the late summer through fall and may be dependent on the area's weather patterns and rainfall amounts in the particular year. The flowering of different trees in a given area is normally well synchronized (RCUH 2002c). The pollination biology of *F. neowawraea* has not been studied, but they are probably insect pollinated, which is the case for most species with small inconspicuous flowers. The red color of fruits suggests that the species may be or may have been dispersed by fruit-eating birds.

Little is known of *F. neowawraea*'s growth rate and age of maturation in the wild. In cultivation, the species grows rapidly and matures early. Within 3 years of germination, an individual can attain a height of over 2 m (6.6 ft) and be mature enough to flower and fruit (RCUH 2002c).

Individuals of *F. neowawraea* are often the most massive trees in the forests where they are found. Many of the remaining live trees are partially dead, with a strip or strips of bark extending up the trunks to crowns that have experienced dieback. The remaining living branches are often relatively healthy. For this species, dieback may be a means of coping with environmental stresses. The wood of *F. neowawraea*s is very hard and lasts a long time after the death of the tree. It rots in a very distinctive fashion, and as a result, the decayed trunks and limbs of the species are readily identified. Old logs on the ground and pieces of wood in the gulch bottoms and in stream beds document the former occurrence of the species throughout the Waianae Mountains.

Known Distribution: *Flueggea neowawraea* has been documented from Kauai Oahu, Molokai, East Maui, and the leeward side of the island of Hawaii. It is found throughout the Waianae Mountains on Oahu (USFWS 1999b).

Population Trends: The remaining living trees and the dead remains of *F. neowawraea* indicate that the species was formerly common in at least some parts of the Hawaiian Islands (RCUH 2002c). The recorded history of *F. neowawraea* is relatively short for a tree, as it was not discovered until 1912. Reports of the species in the first half of the 1900s indicate that it had already been declining in numbers

and health for a considerable time prior to its discovery. There were many reports of large mature trees, portions of which were already dead, but there were no reports of younger trees or immature plants. The decline of *F. neowawraea* was undoubtedly dramatically accelerated by the introduction of the black twig borer in 1961.

Current Status: Of the *F. neowawraea* individuals alive 20 years ago, more than half are now dead (RCUH 2002c). There are approximately 93 to 117 *Flueggea neowawraea* plants known statewide from 20 population/occurrences (Makua Implementation Team 2002). It is still present throughout its recorded range except on Molokai, where only a single tree has ever been found. Two trees are known to persist on East Maui and five to nine trees are known on the island of Hawaii. The species is most common on Kauai where there are 68-78 trees, and it is especially abundant in the eastern branches of Waimea Canyon (Makua Implementation Team 2002). Approximately 30 trees are known to survive on Oahu, including three trees from two population occurrences in the SBMR AA (Figure 10.l). These plants occur in the western fork of Palikea Gulch at Mt. Kaala NAR and in North Mohiakea Gulch (HINHP 2002; RCUH 2002a) and represent about 3% of the remaining individuals in the wild. There are no stable populations of > 25 *F. neowawraea* outside of the SBMR action area.

Habitat: *F. neowawraea* is found between 250 and 1,000 m (820 to 3,280 ft) in elevation (Hayden 1990), in the drier parts of mesic forests, in gulch bottoms or on north-facing lower to mid-gulch slopes. *Diospyros sandwicensis* (lama) or *D. sandwicensis* and *Metrosideros polymorpha* (ohia) often dominate these forests. There are presently only a few known remaining live trees in dry forests, but the numerous old logs and standing dead trunks suggest *F. neowawraea* was formerly more common in these forests.

Taxonomic Background: *Flueggea neowawraea* is the only member of the genus occurring in Hawaii. There are no obvious morphological differences between plants on the different islands (RCUH 2002c).

Outplanting Considerations: Since the species does not have any close relatives in Hawaii, there are no hybridization concerns for outplanting; however, the threat of black twig borer to the species will make outplanting challenging.

Current Threats: The primary threat to *F. neowawraea* is the introduced black twig borer, which has affected all populations of the species. Another threat to the species is the Chinese rose beetle, which arrived in Hawaii before 1896 (Koebele 1897). This beetle feeds on the leaves of the tree, sometimes reducing them to skeletons. Other major threats include feral pigs and goats, alien plant species, cattle grazing, and fire. In addition, *F. neowawraea* is threatened by the need for cross-pollination between male and female trees in populations where individuals are now sparsely distributed and in some cases may be too far apart to be effectively cross-pollinated.

Potential Threats from Army Training and Transformation: There is a low threat from munitions landing on *F. neowawraea* in North Mohiakea Gulch (Figure 10.b). The weed threat from Army current military training and SBCT transformation is moderate for the *F. neowawraea* population/occurrence in lowland mesic forests and high for those individuals in alien dominated plant areas because of the dry microclimate and prevalence of alien species there (Figure 10.l). The fire threat is low in these portions of the action area (Figure 10.m). There is no threat from foot traffic trampling for these population/occurrences in the western and northern portions of the action area, which is above or part of the dudded impact area where foot maneuvers are restricted because of UXO (Figure 10.n). These results suggest that *F. neowawraea* populations/occurrences are vulnerable to alien plant introductions, possibly fire, and one population/occurrence from munitions as a result of military activities in the SBMR AA

Scientific Name: ***Gardenia mannii* St. John and Kuykendall**

Common Name: Nanu, nau
Family: Rubiaceae (Coffee family)
Federal Status: Endangered
Life history: Short-lived perennial

Current status: There are 28 populations/occurrences of *Gardenia mannii* on Oahu of 70-100 plants (USFWS 1998a), however the number of unrecorded plants is probably large, particularly in the wet forests of the Koolau Mountains (RCUH 2002c). The majority of the population/occurrences contain fewer than five individuals (USFWS 1998a). They are distributed along a 42 km (26 mi) length of the Koolau Mountains, from Kaunala Gulch and Kaunala-Waimea Ridge in the north to Palolo in the south and along a 7 km (4 mi) distance in the Waianae Mountains from north Haleauau Valley to Kaluaa Gulch (HINHP 1997). Four plants from one population/occurrence is found in SBMR AA (RCUH 2002a) at about 730 m (2400 ft) elevation in North Haleauau Gulch (Figure 10.l) (HINHP 2002). These individuals represent about 4-6% of the total remaining individuals of this species. There are no stable populations of > 50 *G. mannii* individuals outside the SBER AA.

Potential Threats from Army Transformation: The threat from munitions landing in the location where *G. mannii* occurs is very low, insignificant, or discountable (Figure 10.b). The weed threat from current military training and SBCT transformation is moderate in the lowland mesic forest and shrub community of the eastern part of the AA where *G. mannii* is located (Figure 10.l) and the threat from fire is low in this location (Figure 10.m). There is no threat from foot traffic trampling for this population/occurrence because it occurs in the dudded impact area where foot maneuvers are restricted. (Figure 10.n). These results suggest that *G. mannii* is vulnerable to alien plant introductions and possibly fire as a result of military activities in the SBMR AA.

For the complete species description, go to Federally-listed Species Affected by the Action at KTA (**Section 6.5.2**).

Scientific name: *Hesperomannia arborescens* A. Gray

Common Name: None known
Family: Asteraceae (Sunflower family)
Federal Status: Endangered
Life history: Long-lived perennial

Current Status: Currently, this species is known from at least 15 population/occurrences totaling 127 individuals on the islands of Oahu, Molokai, and Maui (USFWS 1998a; RCUH 2002a; HINHP 2002). It is considered extinct on Lana`i and rare on other islands (Wagner 1990; USFWS 1998a). There are two population/occurrences known in the Waianae Mountains which are comprised of 4 individuals and located in Palikea Gulch in the SBMR AA (Figure 10.l) (RCUH 2002a). Much of the habitat for this species in the Koolau Mountains has not been surveyed, which might reflect lower population numbers than that are actually present.

Individuals that fall within the SBMR AA represent 3% of the total remaining individuals of this species. There are no stable populations of > 25 *H. arborescens* outside of the Army action areas.

Potential Threats from Army Training and Transformation: There is a low threat from munitions landing on one of the *H. arborescens* population/occurrences in Palikea Gulch (Figure 10.b). The weed threat from current military training and SBCT transformation is moderate for *H. arborescens* in the SBMR AA (Figure 10.l), and the fire threat is low (Figure 10.m). There is no threat from foot traffic trampling for these population/occurrences above the firebreak road where foot maneuvers are restricted because of unexploded ordnance (UXO) (Figure 10.n). These results suggest that *H. arborescens* is vulnerable to alien plant introductions, possibly fire, and one population/occurrence from munitions as a result of military activities in the SBMR AA

For the complete species description, go to Federally-listed Species Affected by the Action at KLOA (**Section 7.5.2**).

Scientific Name: *Isodendrion longifolium* Gray

Common Name: Aupaka
Family: Violaceae (Violet family)
Federal Status: Threatened
Life history: Short-lived perennial

Current Status: There are < 1,000 *I. longfolium* individuals remaining in scattered locations on Kauai and Oahu. On northwestern Kauai there are 16 populations of 500 to 800 individuals found mostly on ridges and valley slopes. On Oahu three populations of about 30 to 40 individuals are known from the Koolau Mountains (Kaukonahua and Makaua drainages) and in the Waianae Mountains (Kaawa and Palikea Gulches of Mt. Kaala NAR and in West Makaleha). The largest population on Oahu is located in Kaawa Gulch. There are 11 individuals found in the SBMR AA, six plants are located in the eastern fork of Palikea Gulch and another 5 are from just outside the boundary of the Mt. Kaala NAR to the east (RCUH 2002c) (Figure 10.l). These individuals represent 1.1 % of the total remaining individuals of this species. There are 3 stable populations of > 50 *I. longfolium* outside the Army AAs, located on the island of Kauai.

Potential Threats from Army Training and Transformation: There is a low threat from munitions landing on one of the *I. longfolium* population/occurrences in Palikea Gulch, all others have a very low threat (Figure 10.b). The weed threat from current military training and SBCT transformation is moderate for the *I. longifolium* population/occurrences in lowland mesic forests and high for those individuals in alien dominated plant areas because of the dry microclimate and prevalence of alien species there (Figure 10.l). The fire threat is low in this portion of the SBMR AA (Figure 10.m). There is no threat from foot traffic trampling for these population/occurrences above the firebreak road where foot maneuvers are restricted because of unexploded ordnance (UXO) (Figure 10.n). These results suggest that *I. longifolium* populations/occurrences are vulnerable to alien plant introductions, and possibly fire, and one population/occurrence from munitions as a result of military activities in the SBMR AA.

For the complete species description, go to Federally-listed Species Affected by the Action at SBER (**Section 9.5.2**).

Scientific Name: ***Labordia cyrtandrae* (ball.) St. John**

Common Name: Kamakahala
Family: Loganiaceae (Logania family)
Federal Status: Endangered
Life history: Short-lived perennial

Description and Biology: *Labordia cyrtandrae* is a 0.7 to 2 m (2.3 to 6.6 ft) tall shrub with leaves crowded at the branch tips. The leaves are 12 to 30 cm (4.7 to 11.8 in) long and 4 to 14 cm (1.6 to 5.5 in) wide, and ovate to broadly elliptic in shape. The pale greenish-yellow flowers form compound paniculate cymes of 8 to 80. The fruit is 3.2 to 3.5 cm (1.3 to 1.4 in) long, and are some of the largest in the genus (Wagner et al. 1990).

Labordia cyrtandrae has been observed flowering from May through June and fruiting from July through August and is sporadically fertile year-round. The flowers are functionally unisexual, and male and female flowers are on separate plants (USFWS 1998a).

Known Distribution: *Labordia cyrtandrae* is endemic to Oahu and is known from both the Koolau and Waianae Mountains (USFWS 1998a).

Population Trends: *Labordia cyrtandrae* populations are declining, and those that remain are small and widely dispersed, which puts the species at risk of extinction from naturally occurring events and/or lack of reproductive vigor (USFWS 1998a).

Current status: There are 18 known *L cyrtandrae* individuals remaining from seven population/occurrences, all located on the island of Oahu (RCUH 2002a; HINHP 2002; Kawelo, U.S. Army, pers. comm. 2003; Lau, HINHP, pers. comm. 2003). According to the NRS there is a great deal of under-surveyed potential habitat for this taxon on the upper slopes of Mt. Kaala (RCUH 2002c). There are presently fourteen known individuals from five population/occurrences in SBMR AA, 1 individual is located east of Puu Kalena in North Mohiakea, and 13 individuals are from 4 population/occurrences in North Haleauau Gulch/Kaala area (RCUH 2002a; Kawelo, U.S. Army, pers. comm. 2003; Lau, HINHP, pers. comm. 2003), all are between 640 and 800 m (2100- 2620 ft) elevation (Figure 10.l) (HINHP 2002). These plants represents approximately 78% of the remaining individuals. There are no stable populations of > 50 *L. cyrtandrae* outside the SBMR AA.

Habitat: *Labordia cyrtandrae* is found from 730 to 1,100 m (2,400 to 3,700 ft) in elevation in gulch bottoms to steep slopes of mesic and wet forests (USFWS 1996b; RCUH 2002c). It is also found in rock talus substrates of mesic forests (RCUH 2002c). Associated native plants include *Boehmeria grandis* (akolea), *Cyrtandra waianaeensis (*hahala*), Metrosideros polymorpha, Perrotetia sandwicensis,* and *Pipturus albidus* in the Waianae Mountains (USFWS 1996b).

Taxonomic background: *Labordia* is an endemic Hawaiian genus of 12 species known to hybridize readily (RCUH 2002c). *Labordia cyrtandrae* overlaps in range with numerous other taxa in the genus, yet

no hybrids involving *L. cyrtandrae* have been documented. The New York Botanical Garden has attempted to hybridize this species with other members of the genus without success (RCUH 2002c).

Outplanting considerations: There are no known hybridization concerns for *L. cyrtandrae*. Surveys should be conducted around the Mt. Kaala summit, which is vastly under-surveyed. A better understanding of the extent and numbers of this taxon should be acquired prior to reintroducing individuals of this species.

Current Threats: Threats to *L. cyrtandrae* include habitat degradation by feral goats and pigs, competition with various alien plants, and loss of pollinators (USFWS 1998). Alien plant competitors include *Clidemia hirta* (Koster's curse) , *Psidium cattleianum* (strawberry guava), *Schinus terebinthifolius* (Christmasberry), and *Rubus argutus* (prickly Florida blackberry).

Potential Threats from Army Training and Transformation: There is a low threat from munitions landing on the *L. cyrtandrae* population/occurrence in North Mohiakea, all others have a very low, insignificant, or discountable threat (Figure 10.b). The weed threat from current military training and SBCT transformation is moderate in the lowland mesic forest and shrubland, and low to moderate in the wet cliff and lowland wet forest and shrubland where *L. cyrtandrae* occurs along the western boundary of the SBMR AA (Figure 10.l). The fire threat ranges from low to very low, insignificant, and discountable in these areas (Figure 10.m). There is no threat from foot traffic trampling for these population/occurrences because they occur in the dudded impact area where foot maneuvers are restricted (Figure 10.n). These results suggest that *L. cyrtandrae* is vulnerable to alien plant introductions, some population/occurrences are vulnerable to fire, and one population/occurrence from munitions as a result of military activities in the SBMR AA.

Scientific name: *Lepidium arbuscula* Hillebr.

Common name: `Anaunau, naunau, kunana
Family: Brassicaceae (Mustard family)
Federal status: Endangered
Life history: Short-lived perennial

Description and Biology: *Lepidium arbuscula* is a shrub 0.6 to 1.2 m (2.0 to 4.0 ft) tall. The leaves are crowded at the ends of the branches and are 2.6 to 6.0 cm (1.0 to 2.4 in) long and 0.8 to 1.8 cm (0.3 to 0.7 in) wide. The small white flowers form one to three erect simple racemes, 7 to 15 cm (2.8 to 5.9 in) long. The fruit is short and ovate to suborbicular in shape, and 3.5 to 4 mm (0.1 to 0.2 in) long and wide. The reddish brown seeds are 1.5 to 2.0 mm (0.1 in) long (Wagner et al. 1990).

This species has been observed in flower in February. No further information is available on reproductive cycles, longevity, specific environmental requirements, or limiting factors (USFWS 1998a).

Known Distribution: Historically, *Lepidium arbuscula* was known from 11 populations/occurrences in the Waianae Mountains (USFWS 1998a).

Population Trends: *L. arbuscula* populations are declining and those that remain are small and widely dispersed.

Current Status: There are < 900 *Lepidium arbuscula* individuals remaining from 10 populations/occurrences on the island of Oahu (USFWS 1998a). The populations are distributed from Kuaokala in the northern Waianae Mountains to Lualualei-Nanakuli Ridge in the southern Waianae Mountains (USFWS 1998a). At least 9% (80 plants) of the individuals occur within the Makua action area. Two populations/occurrences of approximately 60 individuals are known from SBMR AA. One consists of 10 individuals on the south side of Mohiakea Gulch between 670 and 730 m (2,200 and 2,400 ft) (Figure 10l) and the other has at least 50 individuals on the slopes of Puu Kalena (RCUH 2001). They represent about 7% of the remaining individuals. Three stable populations >50 *L. arbuscula* exist outside the SBMR AA, located in Kamaileunu (>100 individuals in 2000), Halona (600 individuals in 1994), and in the Lualualei side of Puu Kaua (150 individuals in 1994).

Habitat: *L. arbuscula* is endemic to the Waianae Mountains of Oahu where it is found in dry to mesic cliffs and ridgetops from 230 to 915 m (755 to 3,000 ft) in elevation. Common plant associates include *Dodonaea viscosa* (aalii), *Rumex albescens*, *Sida fallax* (ilima), *Psydrax odoratum* (alahee), *Eragrostis variabilis* (kawelu), *Bidens* sp. (kookoolau), *Artemisia australis* (hinahina), *Lysimachia* sp. (kolokolo kuahiwi), and *Carex* spp. (USFWS 1996b, 1998a).

Taxonomic Background: The only other *Lepidium* species in the Waianae Mountains are non-native species which in general are found along disturbance corridors and not in native habitats. There are no other taxonomic considerations for *L. arbuscula*.

Outplanting Considerations: Outplanting of *L. arbuscula* into the wild should be conducted only within its known range of distribution.

Current Threats: The major threats to *Lepidium arbuscula* are habitat degradation by feral goats, potential impacts from military activities, competition from alien plants (*Clidemia hirta, Psidium cattleianum, Schinus terebinthifolius, Ageratina adenophora* (Maui pamakani)*, A.riparia* (Hamakua pamakani)*, Grevillea robusta* (silkoak)*, Melinis minutiflora*, *Erigeron karvinskianus* (Daisy fleabane) and *Lantana camara* (lantana)), and fire (USFWS 1998a).

Potential Threats from Army Training and Transformation: There is no threat from munitions landing in the locations where *L. arbuscula* occurs (Figure 10.b). The weed threat from current military training and SBCT transformation is high for *L. arbuscula* located in lowland dry shrubland and grassland community and moderate for the population/occurrence in lowland mesic forest and shrubland in Puu Kalena (Figure 10.l). The fire threat is low in both these areas (Figure 10.m). There is no threat from foot traffic trampling for these population/occurrences because they occur in the dudded impact area where foot maneuvers are restricted (Figure 10.n). These results suggest that *L. arbuscula* populations/occurrences are vulnerable to alien plant introductions and possibly fire, as a result of military activities in the SBMR AA.

Scientific name*: Lobelia oahuensis* Rock

Common Name: `Oha, haha, `oha wai
Family Name: Campanulaceae (Bellflower family)
Federal status: Listed endangered
Life history: Short-lived perennial

Description and biology: *Lobelia oahuensis* is an erect woody plant, 1.0 to 3.0 m (3.3 to 9.8 ft) tall. Leaves are elliptic, 40 to 60 cm (15.7 to 23.6 in) long and 4.0 to 6.0 cm (1.6 to 2.4 in) wide. Three-5 branched inflorescences, 1.0 to 1.5 m (3.3 to 4.9 ft) long, form from the base of the plant. The flowers have pale blue petals that are 42-45 mm (1.7 to 1.8 in) long. Fruits are capsules 10 to 17 mm (0.4 to 0.7 in) long and 8 to 10 mm (0.3 to 0.4 in) wide, with brownish seeds (Wagner et al. 1990).

This species has been observed flowering September to November and with fruit in December. No additional information is available on reproductive cycles, longevity, specific environmental requirements, or limiting factors (USFWS 1998a).

Known Distribution: Historically, *L. oahuensis* was known from Kahana Ridge, Kipapa Gulch, and the southeastern Koolau Mountains of Oahu (USFWS 1998a).

Population trends: *L. oahuensis* populations are declining, and those that remain are small and widely dispersed, which puts the species at risk of extinction from naturally occurring events and/or lack of reproductive vigor (USFWS 1998a).

Current status: There are 110 *L. oahuensis* individuals remaining from 11 populations/occurrences on Oahu (USFWS 1998a). The population/occurrences are located within an area of about 27 kilometers (17 miles) along Koolau Mountain ridge tops from Waikane and Halawa to Mount Olympus and the summit ridges above Kuliouou and Waimanalo (HHP 1997, USFWS 1998a). The range of *L. oahuensis* was extended to the Waianae Mountains of Oahu in 1995, when a plant was discovered in SBMR (USFWS 1996a). This individual was known from just off the summit of Puu Kalena in SBMR AA (HINHP 2002; RCUH 2002a) (Figure 10.l), but it has since been extirpated. This population/occurrence represented <1% of the remaining individuals. There are two populations/occurrences that contain between 30 to 40 individuals, but all other populations/occurrences contain fewer than 10 individuals (Mt. Olympus, Konahuanui, Puu Kona, Aiea-Halawa Valley summit ridge, Kaneohe-Moanalua summit, Kapakahi-Waimanalo summit ridge, Puu Kalena) (USFWS 1998a). There are no stable populations > 50 *L. oahuensis* outside the Army AAs.

Habitat: *L. oahuensis* occurs on summit cliffs in cloud-swept wet forests or in areas of low-shrub cover that are frequently exposed to heavy wind and rain, between 850 and 920 m (2,800 and 3,000 ft) in elevation. Associated plants include *Wikstroemia oahuensis* (akia), *Broussaisia arguta* (kanawao), Hedyotis terminalis (manono), Cibotium glaucum (hapuu), *Metrosideros polymorpha* (ohia), *Dicranopteris linearis* (uluhe), *Coprosma* spp. (pilo), *Machaerina angustifolia* (uki), Cheirodendron trigynum (olapa), *Dubautia laxa* (naenae pua melemele), and *Labordia hosakana* (kamakahala) (HINHP 1997; USFWS 1998a).

Taxonomic background: There are three other species of *Lobelia* in the Waianae Mountains, including *L. yuccoides, L. niihauensis,* and an un-described species of *Lobelia* from SBMR, West Range.

Outplanting considerations: *L. oahuensis* should not be planted in habitat occupied by other *Lobelia* species. *Lobelia yuccoides* and *L.* spp. both occur at similar elevations and habitats as *L. oahuensis,* so care should be taken to conduct outplantings sufficient distances away from any pre-existing wild populations of these species.

Current Threats: The major threats to *L. oahuensis* are habitat degradation and predation by feral pigs, rats, and slugs; fire; and competition from alien plants. *Clidemia hirta* (Koster's curse) is the primary threat to *Lobelia oahuensis* because it effectively competes with this species for water, space, light, and nutrients.

Potential Threats from Army Training and Transformation: The potential threats in the area the plant was extirpated from are included here for possible future reintroduction efforts. There is no threat from munitions landing in the locations where *L. oahuensis* occurs (Figure 10.b). The weed threat from current military training and SBCT transformation is low to moderate where *L. oahuensis* occurred in lowland wet forest and shrubland along the western boundary of the SBMR AA (Figure 10.l) and the fire threat is low (Figure 10.m). There is no threat from foot traffic trampling in this location in the dudded impact area where foot maneuvers are restricted (Figure 10.n). These results suggest that the *L. oahuensis* population/occurrence would be vulnerable to alien plant introductions and possibly fire as a result of military activities in the SBMR AA if it were still present..

Scientific name: *Phyllostegia hirsuta* Benth.

Common Name: No common name
Family: Lamiaceae (Mint family)
Federal Status: Endangered
Life history: Short-lived perennial

Description and Biology: *Phyllostegia hirsuta* is an erect sub-shrub or vine. The ovate-shaped leaves are 14.5 to 30.0 cm (5.7 to 11.8 in) long and 6.5 to 18.0 cm (2.6 to 7.1 in) wide. The white flowers are 7 to 11 mm (0.3 to 0.4 in) long and form compound racemes 10 to 20 cm (3.9 to 7.9 in) in length. The nutlets are about 2.5 to 3.0 mm (0.1 in) long (Wagner et al. 1990).

P. hirsuta is a short-lived perennial and has been observed in flower in February and in fruit in June (USFWS 1998a). No other information on reproductive cycles, longevity, specific environmental requirements, or limiting factors is available.

Known Distribution: Historically, *P.hirsuta* was known from widespread populations in the Waianae and Koolau Mountains on Oahu. In the Waianae Mountains, it ranged from the head of Kukuiula Gulch (Pahole) to North Palawai Gulch, and it ranged almost the entire length of the Koolau Mountains from Pupukea-Kahuku Trail to Palolo (HINHP 1997).

Population Trends: *P. hirsuta* populations are declining, remaining ones are small and widely dispersed.

Current Status: There are currently 16 known populations of 150-200 *P. hirsuta* individuals remaining (USFWS 1998a). Ten populations occur in the Waianae Mountains, restricted to the southern part of the historical range (from the ridge between Makaha and Waianae Kai to the south fork of North Palawai Gulch), and six populations are distributed over 10-km (6-mi) along the summit of the Koolau Mountains (from Kawainui Gulch in Kawailoa Training Area to South Kaukonahua Drainage) (HINHP 1997). There are 73 individuals from three population/occurrences located in the SBMR AA between 915 to 1035 m (3,000-3400 ft) elevation, including 50 at Puu Kalena in North Mohiakea Gulch, 20 at Kaala-Kalena ridge, and three at South Haleauau (Figure 10.l) (HINHP 2002; RCUH 2002a). These individuals represent 37-49% of the total remaining individuals of this species. There are no stable populations of > 50 *P. hirsuta* outside of the Army AAs.

Habitat: *P. hirsuta* occurs in mesic to wet forests from 305 to 1,100 m (1,000 to 3,610 ft) in elevation (HINHP 1994; USFWS 1996b). *Phyllostegia hirsuta* is usually found on steep shaded slopes in areas dominated by ohia or a mixture of ohia and uluhe (USFWS 1996b). Associated plants include *Pouteria sandwicensis* (alaa), kanawao, mamaki, pilo, *Hedyotis terminalis* (manono), *Myrsine lessertiana* (kolea lau nui), and native and alien ferns (USFWS 1996b).

Taxonomic Background: There are 27 endemic species recognized in Hawaii under the genus *Phyllostegia*. The range of three of these species, *P. mollis, P. kaalaensis* and *P. parviflora ssp. lydgatei,* overlaps with *P. hirsuta*. All of these species are federally-listed as endangered. Hybrids have never been observed between any of these species. It is believed that *Phyllostegia* may share a common ancestor with *Stenogyne* and *Haplostachys,* which are two other native Hawaiian mint genera.

Outplanting Considerations: The geographical and ecological ranges of *P. hirsuta* broadly overlap with several other species of *Phyllostegia* in the Waianae Mountains, including the endangered *P. mollis*, *P. parviflora*, and *P. kaalaensis*. Several natural hybrid combinations have already been identified among Hawaiian members of the genus. Since hybridization seems to be a natural occurrence in *Phyllostegia*, the presence of other endangered *Phyllostegia* spp. in an area should not preclude the establishment of outplantings of *P. hirsuta* there. However, outplantings should be conducted a good distance away from any pre-existing wild populations of other species.

Current Threats: The primary threats to *P. hirsuta* are habitat degradation by feral pigs, potential military impacts, and competition with alien plants including *Schinus terebinthifolius, Passiflora suberosa* (huehue haole)*, Melinis minutiflora* (molasses grass)*,* and *Psidium cattleianum*.

Potential Threats from Army Training and Transformation: There is no threat from munitions landing in the locations where *P. hirsuta* occurs (Figure 10.b). The weed threat from current military training and SBCT transformation is low to moderate in the lowland wet forest and shrubland and wet cliff locations of the SBMR AA where *P. hirsuta* grows (Figure 10.l). The fire threat is low for the population/occurrence in North Mohiakea Gulch, but very low, insignificant, and discountable in the other locations it occurs (Figure 10.m). There are seedlings in this population/occurrence (RCUH 2001) which might be more vulnerable to destruction from foot traffic trampling, but there is no threat from foot traffic trampling for these population/occurrences because they occur in the dudded impact area where foot maneuvers are restricted (Figure 10.n). These results suggest that some *P. hirsuta* are vulnerable to fire, and all are threaten by alien plant introductions as a result of military activities in the SBMR AA.

Scientific Name: *Phyllostegia kaalaensis* St. John

Common Name: None known
Family: Lamiaceae (Mint family)
Federal Status: Endangered
Life history: Short-lived perennial

Description and Biology: *Phyllostegia kaalaensis* is a perennial herb with long stems extending out from the base of the plant. The leaves are 5 to 13 cm (2.0 to 5.1 in) long and oppositely arranged. Three to six tubular, white, and slightly fragrant flowers originate at the stem tips. The fruits are segmented into four and each segment contains a single seed surrounded by a fleshy pulp. The fruits turn blackish when ripe (Wagner et al. 1990).

Flowering in *P. kaalaensis* has been reported from January to June (Nagata 1980). Moths are presumed to pollinate the flowers. The fleshy blackish fruits are indicative of plants with seeds that are dispersed by fruit-eating birds. The branches of *P. kaalaensis* are known to take root when they touch the ground and a rooted stem becomes a separate plant when the stem connecting it to its maternal plant is severed. Reproduction in this species may be primarily through vegetative means, as most of the currently known plants are in dense patches far away from any other plants of the species. To date there have been no reports of seedlings or immature plants that obviously originated from a seed (RCUH 2002c). Given the ability of *P. kaalaensis* to reproduce vegetatively, its clones have the potential for living indefinitely.

Known Distribution: *Phyllostegia kaalaensis* is endemic to the Waianae Mountains of Oahu. Historically, it is known from six scattered populations in the Waianae Mountains (HHP 1997).

Population Trends: *Phyllostegia kaalaensis* colonies have been known only since the 1970s. Plants can no longer be found at a number of sites where the species had previously been recorded, including sites along the branches of Ekahanui Gulch in the southern Waianaes, and several spots in Pahole Gulch in the northern Waianaes. In addition, the Waianae Kai colony has experienced a marked decrease in size over the past decade. When first discovered in 1993, the colony contained about 30 plants, and by 1998 the count was down to 8 plants (RCUH 2002c).

Current Status: Currently, there 30 to 35 known *P. kaalaensis* individuals in the wild (Makua Implementation Team 2002). There are 10 individuals from one population/occurrence known from SBMR AA (Figure 10.l), which occurs in Palikea Gulch, Mt. Kaala Natural Area Reserve and represents approximately 29-33% of the remaining individuals (RCUH 2002a; Makua Implementation Team 2002). No stable populations >50 *P. kaalaensis* exist outside the SBMR AA. However, because of the vegetative reproduction discussed earlier, the three largest population units may each represent a single clone, and the known genetically unique clones of the species are $\leq$ 7 (RCUH 2002c).

Habitat: *Phyllostegia kaalaensis* is found in gulch bottoms and on gulch slopes in mesic to dry-mesic areas from 490 to 760 m (1,610 to 2,500 ft) in elevation (USFWS 1996b). It occurs most commonly in forests dominated by *Diospyros sandwicensis* and/or *Sapindus oahuensis* or in forests containing a mix of several tree species. The species grows either under the forest canopy or in sunny openings. Associated plants include ieie, opuhe, *Claoxylon sandwicense* (poola), and kokio keokeo (USFWS 1996b).

Taxonomic Background: *P. glabra* is the closest relative of *P. kaalaensis.* It is considered common and its range includes the Waianae Mountains. *Phyllostegia kaalaensis* was accepted as a separate species

from *P. glabra* only within the past decade (Wagner et al. 1999). Morphological characteristics, as well as different habitat requirements, distinguish the two species. *P. kaalaensis* occurs in habitats drier than those of *P. glabra*. The two species are not known to grow near one another.

Outplanting Considerations: The geographical and ecological ranges of *P. kaalaensis* broadly overlap those of several other species of *Phyllostegia* in the Waianae Mountains, including the endangered *P. mollis*, *P. parviflora*, and *P. hirsuta*. Several natural hybrid combinations have already been identified among Hawaiian members of the genus. Since hybridization seems to be a natural occurrence in *Phyllostegia*, the presence of other endangered *Phyllostegia* spp. in an area should not preclude the establishment of outplantings of *P. kaalaensis* there. However, outplantings should be conducted at a good distance away from any pre-existing wild populations of other species. Given the ecological separation between *P. kaalaensis* and *P. glabra*, as long as outplanting sites for *P. kaalaensis* are established in habitat appropriate to the species, there should be no *P. glabra* growing nearby.

Current Threats: Major threats to *P. kaalaensis* include feral pigs and goats. These invasive alien ungulate species degrade native habitat and harm the plants by eating, trampling, or uprooting them. Alien plants also threaten the species by altering habitat and competing for nutrients, light, and space. The spread of highly flammable alien grasses also increases the incidence and destructiveness of wildfires. Since all of the population units of *P. kaalaensis* are small and concentrated in tight patches, they are especially vulnerable to extirpation due to natural disasters.

Potential Threats from Army Training and Transformation: There is no threat from munitions landing in the locations where *P. kaalaensis* occurs (Figure 10.b). The weed threat from current military training and SBCT transformation is moderate in lowland mesic forest and shrubland of the northern part of the SBMR AA where *P. kaalaensis* occurs (Figure 10.l). The fire threat is low in this portion of the action area (Figure 10.m). There is no threat from foot traffic trampling for this population/occurrence above the firebreak road where foot maneuvers are restricted because of unexploded ordnance (UXO) (Figure 10.n). These results suggest that the *P. kaalaensis* population/occurrence is vulnerable to alien plant introductions and possibly fire as a result of military activities in the SBMR AA.

Scientific Name: *Phyllostegia mollis* Benth.

Common Name: No common name
Family: Lamiaceae (Mint family)
Federal Status: Endangered
Life history: Short-lived perennial

Description and Biology: *Phyllostegia mollis* is a sub-erect perennial herb. The leaves are 6 to 24 cm (2.4 to 9.4 in) long, 2.5 to 7.0 cm (1 to 2.8 in) wide, and ovate to occasionally elliptic-ovate in shape. The white flowers are 8.5 to 12 mm (0.3 to 0.5 in) long, and form groups of 2 to 6 flowers on compound racemes, 8 to 17 cm (3.1 to 6.7 in) long. The fruits are dry, indehiscent, one-seeded nutlets, about 2 to 3 mm (0.1 in) long (Wagner et al. 1990).

Known Distribution: Historically, *Phyllostegia mollis* was known from Molokai, East Maui, and Oahu. It was known from

the central and southern Waianae Mountains from Mt. Kaala to Honouliuli, and from Makiki in the Koolau Mountains on Oahu.

Population Trends: The Hawaii Natural Heritage Program observed 19 mature plants from South Mohiakea Gulch, SBMR, West Range in 1994. These numbers have declined to approximately 5 mature plants today. This dramatic decline is largely due to the uncontrolled feral pig populations in the vicinity of these plants.

Current Status: *P. mollis* is extirpated from Molokai, East Maui, and from the Koolau Mountains on Oahu (USFWS 1998a). It is known from approximately six populations of 35 individuals in the Waianae Mountains (RCUH 2002a; HINHP 2002; Kawelo, U.S. Army, pers. comm. 2003; Lau, HINHP, pers. comm. 2003). There is one population/occurrence of 1 mature individual (5 seedlings) known from SBMR AA (RCUH 2002a; Kawelo, U.S. Army, pers. comm. 2003) (Figure 10.l), located in Puu Kalena on the Kaala side of Mohi ridge in South Mohiakea Gulch (HINHP 2002; RCUH 2002a). This represents approximately 3% of the remaining individuals. No stable populations of >50 *P. mollis* exist outside the SBMR AA.

Habitat: *Phyllostegia mollis* is found in the understory of diverse mesic forest from 455 to 855 m (1,500 to 2,800 ft) in elevation in the Waianae Mountains (USFWS 1998a). Common canopy components of this forest include *Metrosideros polymorpha*, *Elaeocarpus bifidus* and *Antidesma platyphylla*.

Taxonomic Background: There are 27 endemic species recognized in Hawaii in the genus *Phyllostegia*. The range of three of these species: *P. hirsuta, P. kaalaensis* and *P. parviflora ssp. lydgatei,* overlaps with *P. mollis*. All of these species are federally-listed as endangered. Hybrids have never been observed between any of these species. It is believed that *Phyllostegia* may share a common ancestor with *Stenogyne* and *Haplostachys,* which are two other native Hawaiian mint genera.

Outplanting Considerations: *P. mollis* should not be planted in close proximity to any of the other listed endangered *Phyllostegia* species that have similar ranges.

Current Threats: The major threats to *P. mollis* are competition from *Schinus terebinthifolius, Toona ciliata* (Australian redcedar) and *Heliocarpos popayensis* (Moho, white moho); habitat degradation and predation by feral pigs; and the small and concentrated populations, which makes the species especially vulnerable to extirpation due to natural disasters (USFWS 1998a). In addition, arthropod damage has been observed on the stems of *P. mollis* (RCUH 2002c).

Potential Threats from Army Training and Transformation: There is no threat from munitions landing in the locations where *P. mollis* occurs (Figure 10.b). The weed threat from current military training and SBCT transformation is high in the alien dominated plant community where *P. mollis* occurs in the SBMR AA, because of the dry microclimate and prevalence of alien species there (Figure 10.l). The fire threat is low (Figure 10.m). There is no threat from foot traffic trampling for this population/occurrence because it occurs in the dudded impact area where foot maneuvers are restricted (Figure 10.n). These results suggest that the *P. mollis* population/occurrence is vulnerable to alien plant introductions and possibly fire as a result of military activities in the SBMR AA.

Scientific name: *Plantago princeps* Cham. & Schlechtend. var. *princeps*

Hawaiian name: *Ale*
Family: Plantaginaceae (Plantain family)
Federal status: Listed endangered
Life history: Short-lived perennial

Description and biology: *Plantago princeps* var. *princeps* is a woody shrub, which is unusual for the genus. Most continental species in this genus are small herbs. The plant is either single stemmed or sparingly branched at the base, and attains a height of at least 1 m (3.3 ft) tall. The leaves are arranged in a cluster at the tip of each branch, are strap-shaped, and measure up to 20 cm (7.8 in) long. Each stem tip usually bears several erect, axillary inflorescences, each of which consists of a single stem bearing densely arranged flowers on its upper portion. The flowers and capsules are small and inconspicuous. The capsules each bear 3-4 black seeds measuring 1.5-2.1 mm (0.06-0.08 in) long (Wagner et al. 1990).

Flowering and fruiting specimens have been collected throughout the year. The surface of the seed is covered by a mucilaginous membrane (Wagner et al. 1990), which is theorized to cause the seeds to stick to animals (Carlquist 1974). With the complete absence of ground mammals in Hawaii prior to the arrival of the Polynesians, birds, including the many now extinct flightless species, would have been the primary dispersal agents of Hawaiian *Plantago*s. Little is known about the breeding system, pollination vectors, and longevity of *P. princeps* var. *princeps*.

Known distribution: *Plantago princeps* var. *princeps* has been recorded from three general areas on the island of Oahu. Most of the currently known plants are at locations scattered throughout the Waianae Mountains, on both the leeward and windward sides of the mountain range. There are also historical records of it from the southeastern Koolau Mountains in the valleys of Kalihi, Nuuanu, and Manoa. It has not been observed in that region for over half a century. The taxon was discovered for the first time in the central Koolau Mountains in 2001, when plants were found at Waiawa. These plants are located just a short distance to the lee of the Koolau summit ridge. Recorded elevations for the plant range from 480-792 m (1,580-2,600 ft) (HINHP 2002).

Population trends: When *P. princeps* var. *princeps* was rediscovered in 1987 in the Waianae Range, it had not been seen in over half a century in the Koolaus, and not since the 1800's in the Waianaes. Since all currently known colonies of the taxon were discovered relatively recently, the taxon's population trends are not well documented. The colony of plants discovered in 1987, which is in the north branch of North Palawai Gulch, is the only colony for which a trend has been observed. When found in 1987, the colony contained approximately 20 plants, but only five have been seen in the last five years (HINHP, 2000). In this case, the species' rapid decline can be attributed to competition from daisy fleabane (*Erigeron karvinskianus*), a highly invasive alien plant.

Current status: *P. princeps* var. *princeps* is known from approximately eight population/occurrences of 146-196 individuals on Oahu (Makua Implementation Team 2002). About 26 individuals are found within the Makua action area. One population/occurrence of approximately 20 individuals is known from Puu Kalena in North Mohiakea Gulch, between 815 and 975 m (3,000 and 3,200 ft) in SBMR AA

(HINHP 2002; RCUH 2002a) (Figure 10.l). This population/occurrence represents 20% of the remaining individuals. One stable population/occurrence of > 50 *P. princeps* var. *princeps* exists outside the Army AAs. This population/occurrence contains 50-100 individuals and is located at Halona.

Habitat: *Plantago princeps* var. *princeps* occurs in two extremely different types of habitat. In the Waianae Mountains the plants are found in the mesic zone on cliff faces, cliff ledges, and at the bases of cliffs. The majority of these plants are accessible only with the aide of ropes. Their cliff habitat is vegetated with native grasses, sedges, herbs, and shrubs. The historic southeastern Koolau Range plants also grew in mesic cliff habitats. In contrast, the Waiawa plants are situated in a rainforest area close to the Koolau summit ridge. This zone receives more precipitation than anywhere else on the island. The plants were observed to be growing on a streamside embankment (RCUH 2002c).

Taxonomic background: *Plantago princeps* is endemic to the Hawaiian Islands. The species is divided into four varieties: var. *anomala* of Kauai; var. *laxiflora* of Molokai, Maui, and Hawaii; var. *longibracteata* of Kauai and the Koolau Mountains of Oahu; and var. *princeps* of both mountain ranges on Oahu. All of the varieties except var. *longibracteata* are sizable woody shrubs. In contrast, var. *longibracteata* is a small herb.

When the Waianae Range plants were rediscovered in 1987, the specimens collected were classified as var. *anomala*. Only the southeastern Koolau Range plants were considered to represent var. *princeps* (Wagner et al. 1990). The Waianae Range plants were subsequently reclassified as var. *princeps* (Wagner et al. 1999).

Outplanting considerations: *Plantago princeps* var. *princeps* is the only native *Plantago* in the Waianae Mountains. The situation is more complex in the Koolau Mountains, where in addition to var. *princeps*, there is another variety recorded, var. *longibracteata.* This variety is known from historical specimens collected on the windward side of the Koolaus in the Kaluanui area between Punaluu Valley and Hauula. It has been recorded on wet cliffs and alongside waterfalls. Additionally, there is a second native species in the Koolaus, *P. pachyphylla*, which is common in the Koolau summit areas. On Kauai, *P. princeps* var. *longibracteata* and *P. pachyphylla* form a hybrid population at the Waialeale summit (Bruegmann, pers. comm.). It is not yet known whether the ranges of *P. pachyphylla* or *P. princeps* var. *longibracteata* overlap that of *P. princeps* var. *princeps* of the Koolau rainforests, and whether any hybridization occurs or could potentially occur. No outplantings are currently proposed in the Koolaus, but if they are deemed necessary in the future, these unknowns on the distribution of the Koolau Range *Plantago* taxa and their potential for hybridizing should be studied prior to the establishment of outplantings.

Given the extreme differences between the habitats of the Waianae Range and Waiawa plants, it would not be prudent to mix the stock from one mountain range with the other at a single outplanting site.

Threats: The primary threats to *P. princeps* var. *princeps* of the Waianae Mountains include feral pigs and goats. Only a few goats are present in the Koolau Mountains, and none are in the rainforests of the mountain range. Pigs however, are common in parts of the Koolaus and they may threaten the Waiawa population unit. Various alien plant species threaten *P. princeps* var. *princeps* by altering its habitat and competing with it for sunlight, moisture, nutrients, and growing space. Also, the spread of highly flammable alien grasses increases the incidence and destructiveness of wildfires. The alien weed threats are worse in the mesic Waianae sites than in the wet Waiawa site in the Koolaus.

Potential Threats from Army Training and Transformation: There is no threat from munitions landing in the locations where *P. princeps* var. *princeps* occurs (Figure 10.b). The weed threat from current military training and SBCT transformation is moderate in lowland mesic forest and shrubland of

the southwestern part of the SBMR AA where *P. princeps* var. *princeps* occurs (Figure 10.l) and the fire threat is low (Figure 10.m). There is no threat from foot traffic trampling for this population/occurrence because they occur in the dudded impact area where foot maneuvers are restricted (Figure 10.n). These results suggest that the *P. princeps* var. *princeps* population/occurrence is vulnerable to alien plant introductions and possibly fire as a result of military activities in the SBMR AA.

Scientific name: ***Schiedea hookeri* A. Gray**

Common name: None known
Family: Caryophyllaceae (Pink family)
Federal status: Endangered
Life history: Short-lived perennial

Description and biology: *Schiedea hookeri* is a sprawling perennial herb that often appears as a matted clump of vegetative material. Stems are 30 to 50 cm (11.8 to 19.7 in) long and woody at the base. The leaves are 3 to 8 cm (1.2 to 3.1 in) long, 0.4 to 1.5 cm (0.2 to 0.6 in) wide, narrowly lanceolate to narrowly elliptic shaped, and oppositely arranged. Flowers are perfect and form open paniculate cymes 5 to 22 cm (2.0 to 8.7 in) long. The fruits are dry, dehiscent, capsules, about 2.5 to 3 mm (0.1 in) long, and the dark reddish brown seeds are small and few (Wagner et al. 1990).

S. hookeri is hermaphroditic (each individual has both male and female reproductive organs) (Weller et al. 1990). Mature fruits have been observed in June and August (USFWS 1999b). Individuals of *S. hookeri* appear to be relatively long-lived, but there is no evidence of reproduction from seed under field conditions. *Schiedea hookeri* differs considerably through its range in its potential for clonal growth. Plants from Kaluakauila Gulch are upright and show little potential for clonal spread. In contrast, clonal growth has been detected in individuals at Kaluaa Gulch, where the growth form is decumbent and plants apparently root at the nodes (USFWS 1998a). The species is presumed to be pollinated by insects, although none have been observed.

Known distribution: Historically, *Schiedea hookeri* is known from the Waianae Mountains of Oahu and from a single collection at Haleakala on Maui. Positive identification of individuals from the Maui collection was not definitive because they were fragmented, and they may represent *S. menziesii* rather than *S. hookeri* (Weller et al. 1990; USFWS 1996c, 1998b).

Population trends: *Schiedea hookeri* populations are declining, and those that remain are small and widely dispersed.

Current status: *S. hookeri* is known from 11 populations/occurrences, totaling 220-330 individuals scattered on slopes and ridges from Kaluakauila Gulch to Lualualei Valley in northern and central Waianae Mountains on Oahu (USFWS 1999b). There are two population/occurrences of 15 individuals known from SBMR AA (Figure 10.l) (HINHP 2002; RCUH 2002a). Five are found in South Mohiakea Gulch and 10 occur in Palikea Gulch (RCUH 2002a). These individuals represent approximately 5-7% of

the remaining wild population. Three stable populations of >25 occur outside the SBMR AA including >100 at Waianae-Kai, >100 at Kalena-Kaala ridge (Waianae side), and 60 individuals at Kaluaa Gulch in Honouliuli Preserve (HINHP 2002; Kapua Kawelo, U.S. Army, pers. comm. 2003).

Habitat: *Schiedea hookeri* is known from 365 to 900 m (1,200 to 2,950 ft) in elevation, in diverse mesic or dry lowland forest often dominated by *Diospyros sandwicensis* or *Metrosideros polymorpha*. It occurs on open leeward and windward cliffs, and sunny gaps in dry forest on the edge of vertical cliffs. Associated plant taxa include *Artemisia australis* (ahinahina), *Bidens* spp. (kookoolau*), Carex*, *Eragrostis, Dodonaea viscosa* (aalii), and *Rumex albescens)* (USFWS 1996c, 1998b).

Taxonomic background: *Schiedea* is an endemic Hawaiian genus related to *Alsinidendron.* The two genera constitute a complex of species descended from a single colonizing ancestor. *Schiedea* contains 22 species, ten of which occur on Oahu, and all but two of these are found in the Waianae Mountains. S. *mannii* and *S. ligustrina* are the most closely related to *S. hookeri,* of the species found in the Waianae Mountains. *Schiedea hookeri* is often found in close association with *S. mannii* and *S. ligustrina (*Wagner et al. 1990*)*.

Outplanting considerations: The geographical and ecological ranges of *S. hookeri* broadly overlap those of several other species of *Schiedea* in the Waianae Mountains, including *S.mannii* and *S. ligustrina*. However, no natural hybrids have been documented between these taxa, therefore concerns for unnatural hybrids from outplanting is not high. Nevertheless, outplantings should be conducted at a good distance away from any pre-existing wild populations of related species.

Current Threats: Current threats to *S. hookeri* include habitat degradation by feral goats and pigs, competition with alien plants, fire, and predation on seedlings by introduced slugs and snails (USFWS 1998a). The extent of slug damage is not known for *S. hookeri,* but introduced slugs and snails have been observed feeding on *S. membranacea*, another mesic forest species found on Kauai. Inbreeding depression may be a serious problem for *S. hookeri*. A series of self-pollinations, intra-population crosses, and crosses among populations has demonstrated that *S. hookeri* experiences moderately strong inbreeding depression. Consequently, reductions in population size could result in expression of inbreeding depression among progeny, with deleterious consequences for the long-term persistence of this species (USFWS 1998a).

Potential Threats from Army Training and Transformation: There is no threat from munitions landing in the locations where *S. hookeri* occur (Figure 10.b). The weed threat from current military training and SBCT transformation is high for *S. hookeri* because it occurs in alien dominated plant communities with dry microclimates and prevalence of alien species in the SBMR AA (Figure 10.l). The fire threat is low in these areas (Figure 10.m). There is no threat from foot traffic trampling for these population/occurrences in the western and northern portions of the action area, which is above or part of the dudded impact area where foot maneuvers are restricted because of UXO (Figure 10.n). These results suggest that *S. hookeri* populations/occurrences are vulnerable to alien plant introductions and possibly fire as a result of military activities in the SBMR AA

Scientific name: *Schiedea kaalae* Wawra

Common name: No common name
Family: Caryophyllaceae (Pink family)
Federal status: Listed endangered
Life history: Short-lived perennial

Description and biology: *Schiedea kaalae* has a short woody caudex less than 20 centimeters long. Leaves are opposite, thick, single-veined, 14 to 24 centimeters long, 2 to 5 centimeters wide, and bunched at the top of the stem. Inflorescences are 20 to 40 centimeters long with flowers lacking petals, but having purple bracts and sepals. Seeds are dark grayish brown and about 1.0 millimeter long (Wagner et al. 1990).

This plant has been observed in flower from March through June (USFWS 1998b). Based on field and greenhouse observations, *Schiedea kaalae* has perfect flowers (each individual has both male and female reproductive organs) (Weller *et al.* 1990). Individuals of *Schiedea kaalae* appear to be relatively long-lived, but there is no evidence of regeneration from seed under field conditions.

Known distribution: Historically, *Schiedea kaalae* was known from the north-central and south-central Waianae Mountains and the northern Koolau Mountains of Oahu (USFWS 1998b).

Population trends: *Schiedea kaalae* populations are declining, and those that remain are small and widely dispersed.

Current status: There are eight population/occurrences including 23-24 total individuals of *Schiedea kaalae* remaining (Makua Implementation Team 2002). There are six known populations/occurrences of *Schiedea kaalae* remaining in the Waianae Mountains, which are distributed over an area of about 1.6 by 16 kilometers (1 by 10 miles), and two known populations/occurrences in the Koolau Mountains, which are about 7 kilometers (4 miles) apart. There is one individual known from SBMR AA, located in North Mohiakea Gulch (Figure 10.l) at about 640 to 885 m (2100-2900 ft) elevation. This individual represents approximately 4% of the remaining wild population. There are no stable populations of >50 individuals remaining of this species.

Habitat: *Schiedea kaalae* is found in diverse mesic to wet forest on steep shady slopes between 210 and 790 m (700 to 2,600 ft) elevation (USFWS 1998a). Associated plant species include *Diplazium sandwicense* (hoio) and *Pisonia umbellifera* (papala kepau) (USFWS 1998b). Populations are known in Pahole Gulch, Kaluaa Gulch, Pohakea Pass, and Puu kaua in the Waianae Mountains, and Maakua Gulch and Makaua Stream in the Koolau Mountains.

Taxonomic background: *Schiedea* is an endemic Hawaiian genus related to *Alsinidendron.* The two genera constitute a complex of species descended from a single colonizing ancestor. *Schiedea* contains 22 species, ten of which occur on Oahu, and all but two of these are found in the Waianae Mountains. *S. kaalae* is quite distinct in the genus *(*Wagner et al. 1990*)*.

Outplanting considerations: The geographical and ecological ranges of *S. kaalae* overlap those of several other species of *Schiedea* in the Waianae Mountains, including *S.mannii, S. ligustrina* and *S. hookeri*. However, no natural hybrids have been documented between these taxa, therefore concerns for unnatural hybrids from outplanting is not high. Nevertheless, outplantings should be conducted at a good distance away from any pre-existing wild populations of related species.

Current Threats: Current threats to *Schiedea kaalae* include habitat degradation by feral pigs and goats; competition from alien plant species; fire; military activities; predation by introduced slugs and snails; the risk of extinction from random events; and reduced reproductive vigor due to the small number of remaining individuals. Alien plant species include *Schinus terebinthifolius* (Christmas berry), *Ageratina adenophora* (Maui pamakani), *Passiflora suberosa* (huehue haole), *Clidemia hirta* (Koster's curse), *Melinis minutiflora* (molasses grass), and *Myrica faya* (firetree) (USFWS 1998b). Seedlings of *Schiedea kaale*, like those of other *Schiedea* species in mesic or wet sites are apparently consumed by introduced slugs and snails, which have been observed feeding on *Schiedea membranacea*, a mesic forest species from Kauai. *Schiedea* occurring in dry areas produce abundant seedlings following winter rains, presumably because dry areas have fewer alien consumers (USFWS 1998b).

Potential Threats from Army Training and Transformation: There is a low threat from munitions landing where *S. kaalae* occurs (Figure 10.b). The weed threat from current military training and SBCT transformation is moderate in lowland mesic forest and shrubland of the southwestern part of the SBMR AA where *S. kaalae* occurs (Figure 10.l) and the fire threat is low (Figure 10.m). There is no threat from foot traffic trampling for this population/occurrence because they occur in the dudded impact area where foot maneuvers are restricted (Figure 10.n) These results suggest that *S. kaalae* is vulnerable to alien plant introductions, fire, and from munitions as a result of military activities in the SBMR AA.

Scientific Name: ***Viola chamissoniana*** **Ging. ssp.** ***Chamissoniana***

Common Name: *Olopu, pamakani*
Family: Violaceae (Violet family)
Federal status: Endangered
Life history: Short-lived perennial

Description and Biology: *Viola chamissoniana* ssp. *chamissoniana* is a woody shrub. This growth habit is unusual in the genus *Viola*, as most non-Hawaiian species are small herbs. The taxon is basal-branching, with branches measuring 20 to 100 cm (8 to 40 in) long. Some populations, especially the ones on steep cliffs, have plants with lax, reclining, or drooping branches. Other populations consist of plants with erect branches forming upright shrubs. At the end of each stem is a cluster of roughly triangular leaves measuring about 2 to 4 cm (0.8 to 1.6 in) in length. Flowers are large, white, and held above the leaves. Due to the conspicuousness of the flowers, flowering plants are easily recognized from a distance. Capsules open as they dry and contain egg-shaped, dark brown to almost black seeds, which measure about 2 mm (0.1 in) long (Wagner et al. 1990).

Little is known about the taxon's breeding system. Its pollinators are as yet unrecorded, but the presence of large white fragrant flowers held above leaves suggests the species is moth pollinated. Dispersal agents

and the longevity of this taxon are unknown. Two flowering pulses have been observed to occur each year, usually in early fall and early summer.

Known Distribution: *Viola chamissoniana* ssp. *chamissoniana* is known only from the Waianae Mountains. It has been recorded throughout the mountain range on both the windward and leeward sides, and it has been found from 700 to 1,000 m (2,300 to 3,300 ft) (HINHP 2000).

Population Trends: Since all the known populations of this taxon were discovered in the last two decades, population trends have not been well documented. Populations grow on steep cliffs inaccessible to feral ungulates, so the taxon has probably not declined in numbers as abruptly as most other rare Hawaiian plant taxa, which are not cliff-dwelling.

Current Status: There are 6 known population/occurrences of *V. chamissoniana* ssp. *chamissoniana* in the wild, totaling 370 individuals (Makua Implementation Team 2002). Populations of this taxon occur as far south as Halona and as far North as Makua Valley. Approximately 19 individuals are known from Puu Kumakalii at SBMR (Figure 10.l) (HINHP 2002; RCUH 2002a). This population/occurrence is located between 780 and 825 m (2,560- 2,700 ft) in the SBMR AA (HINHP 2002). They represent about 5% of the total remaining individuals of the species. There is one stable population of > 50 *V. chamissoniana* ssp. *chamissoniana* outside of the Army action areas, located in Makaha (Makua Implementation Team 2002).

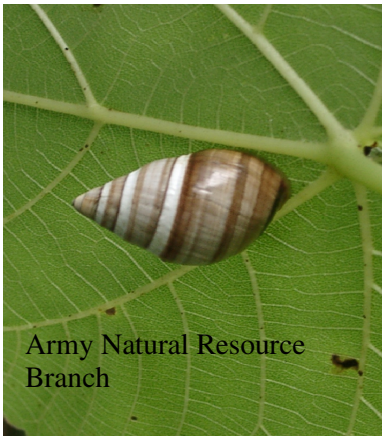
Habitat: *Viola chamissoniana* ssp. *chamissoniana* occurs in mesic habitats. At the majority of the taxon's sites the plants grow on cliffs and cliff ledges that are usually more or less north-facing. Typically, few plants at these sites are reachable without the aid of ropes. These cliffs are sparsely to moderately vegetated with native shrubs, grasses, and sedges. The steep north-facing cliffs in the Waianaes are among the mountain range's most native and undisturbed mesic habitats. Although the taxon is usually found growing on cliffs, there are sites where the plants grow on gentle slopes in native shrubland.

Taxonomic Background: There are seven endemic Hawaiian species in the genus *Viola*. *Viola chamissoniana* contains two species in addition to ssp. *chamissoniana.* Ssp. *tracheliifolia* is endemic to Kauai, Oahu, Molokai, and Maui; and ssp. *robusta* is endemic to Molokai. These two species are not considered rare. The primary differences of species *chamissoniana* from the other species is the presence of large white flowers held above its leaves. The other species have relatively inconspicuous flowers borne amongst their leaves.

Outplanting Considerations: The only other native *Viola* occurring in the Waianae Mountains is the common *V. chamissoniana* ssp. *tracheliifolia.* Similarly to ssp. *chamissoniana,* ssp. *tracheliifolia* occurs throughout the mountain range. Species *tracheliifolia* is generally found growing in the forest understory, while ssp. *chamissoniana* most often grows in open exposed habitats. Several sites are known where the two species grow side by side. Hybridization between the two has not been reported in the wild, and the potential for it to occur is not known. Since ssp. *chamissoniana* occurs naturally in close proximity to the non-endangered ssp. *tracheliifolia*, hybridization concerns are minimal. It may be impossible to avoid planting adjacent to ssp. *tracheliifolia*.

Current Threats: Invasive alien plants gravely threaten *V. chamissoniana* ssp. *chamissoniana* by altering the taxon's habitat and competing with it for moisture, nutrients, and growing space. Although many individuals of this taxon grow on steep cliffs where they cannot be reached by ungulates, others are within their reach and are thus susceptible to predation. In addition, ungulates degrade the plant habitat by hastening the spread of invasive weeds. They also disturb substrates above the cliffs, thereby increasing the size and frequency of landslides and rock falls on the cliff faces. These disturbances directly affect even plants inaccessible to the ungulates.

Potential Threats from Army Training and Transformation: There is no threat from munitions landing in the locations where *V. chamissoniana* ssp. *chamissoniana* occur (Figure 10.b). The weed threat from current military training and SBCT transformation is high for *V. chamissoniana* ssp. *chamissoniana* in lowland dry shrubland and grassland community location in the southwestern portion of the SBMR AA (Figure 10.l). The fire threat is low in this portion of the SBMR AA (Figure 10.m). There are seedlings in this population/occurrence (RCUH 2001) which might be more vulnerable to destruction from foot traffic trampling, but there is no threat from foot traffic trampling for this population/occurrence because it occurs in the dudded impact area where foot maneuvers are restricted (Figure 10.n). These results suggest that *V. chamissoniana* ssp. *chamissoniana* is vulnerable to alien plant introductions and possibly fire as a result of military activities in the SBMR AA.


Army Natural Resource Branch

Scientific name: *Achatinella mustelina* Mighels

Common name: *pupu kanioe, pupu kuahiwi, kahuli*
Family: Achatinellidae (Endemic Hawaiian Tree Snails are in the subfamily Achatinellinae)
Federal status: Endangered (all species of the genus *Achatinella*)

Description and Biology: *Achatinella mustelina* is a long-lived tree snail species. Adults are relatively large, reaching lengths of up to 22 mm (0.9 in) at maturity. Shell color is variable, often dark brown with a light band or white with numerous transverse brown or black lines. Shell morphology and geographic location are used to distinguish *A. mustelina* from other species of *Achatinella* (USFWS 1993).

Achatinella mustelina is primarily nocturnal, preferring cool humid conditions when active. During the day, the snails usually seal themselves to leaves or trunks and remain motionless until nightfall (USFWS 1993). Individuals are hermaphroditic, but it has not been determined if they are capable of self-fertilization. Like all members of its genus, *A. mustelina* bears live young after a lengthy gestation. Individuals are about 4.5 mm (0.2 in) at birth and grow slowly to lengths of 19 to 22 mm (0.7 to 0.9 in) long when they become reproductively mature at 3 to 5 years of age. Mature snails produce 4 to 7 offspring per year and can live to be over 10 years of age (Hadfield et al. 1993).

Known Distribution: Historically, *Achatinella mustelina* was reported throughout the entire Waianae Mountains from north to south on Oahu (Pilsbry and Cooke, 1912-1914). However, since Polynesian and European settlement of Oahu, most forests below about 300 m (1,000 ft) elevation were cleared for agricultural purposes, leaving the only native vegetation and microclimates suitable for *Achatinella* habitat at higher elevations. *Achatinella* spp. are presently most abundant in higher elevation ravines and upper ridges (USFWS 1993).

Population Trends: Many of the known populations of *A. mustelina* have declined significantly in recent years. For example, a population at Pahole Natural Area Reserve declined dramatically as a result of rat predation (RCUH 2002c). *A. mustelina* currently is not found anywhere below 550 m (1,800 ft) elevation.

Current status: *A. mustelina* is the most abundant of the Oahu tree snails (USFWS 1993). Currently, it is known from 22 populations in the Waianae Mountains, totaling approximately 950 individuals. Eleven populations totaling 175 individuals are found within the SBMR AA (Figure 10.l) (RCUH 2002a). The

locations of these population/occurrences include 17 in Mt. Kaala Natural Area Reserve, 15 east-northeast of Puu Kalena, 76 from two population occurrences near the boundary of Lualualei Naval Magazine and SBMR at Puu Kumakalii, and one individual east of Puu Kumakalii (HINHP 2002). They represent approximately 11 % of the remaining wild individuals.

Habitat: This arboreal species spends most of the time in trees or bushes where it feeds on fungi scraped from the surfaces of leaves (Pilsbry and Cooke, 1912-1914). Individuals of this species are generally found in mesic forests on a few species of native trees and shrubs, and they are rarely seen on alien vegetation. Trees and shrubs *A. mustelina* commonly inhabits include *Antidesma platyphyllum* (hame), *Coprosma* spp. (pilo), *Dubautia plantanginea* (naenae), *Metrosideros polymorpha, Myrsine lessertiana* (kolea lau nui), *Nestegis sandwicensis* (olopua), and *Pisonia sandwicensis* (aulu).

Taxonomic Background: The genus *Achatinella* is restricted to the island of Oahu in the Hawaiian Islands. This genus originally included 41 species, each endemic to a small region of either the Koolau or Waianae Mountains (Hadfield et. al.1993), but over-collection of the snails for their shells, predation, and habitat degradation have dramatically impacted this genus. All 41 species in the genus are federally listed as endangered. By 1993, 16 of these species were extinct, five had not been seen in over 15 years, and 18 of the remaining 20 species were on the verge of extinction (USFWS 1993). Only *A. mustelina* and *A. sowerbyana* still exist in substantial numbers, though their numbers are also declining (USFWS 1993; Hadfield et.al.1993).

Reintroduction Considerations: Habitat quality for each species must be considered when choosing potential reintroduction sites. Elevation should be similar to that of the source *A. mustelina* snail population. Vegetation should be composed mostly of known host vegetation for *A. mustelina*, preferably similar to that of the source population. There should be a low incidence of invasive weeds and trees, and no evidence of rats or carnivorous snails. When introducing captive snails into the wild, care must be taken to avoid the introduction of pathogens.

Previous reintroductions of *A. mustelina* have been successful when predation is controlled. It is therefore important to bait rats and carnivorous snails at all reintroduction sites and to build a snail predator exclosure if topography allows it.

An effort should be made to establish maximum genetic diversity within each reintroduction group based on molecular genetic data of laboratory stocks. It is optimal to introduce mainly adult or large sub-adult snails.

Current Threats: The major threats to *Achatinella mustelina* include habitat destruction by feral ungulates and human activities, loss of host plants due to competition from alien plant species, fire, and predation. The *Euglandina rosea* (carnivorous snail), *Rattus exulans* (Polynesian rat), *Rattus rattus* (European rat), and *Rattus norvegicus* (Norwegian rat) all prey upon *A. mustelina. Platydemis manokwari* (terrestrial flatworm) is a known predator of arboreal snails in other areas and is a potential threat to all *Achatinella* species if it ever becomes established in the snail's range (RCUH 2002c). Low reproductive rates and limited dispersal abilities make *A. mustelina* very sensitive to loss of habitat, shell collecting, and predation (Hadfield 1986)

Potential Threats from Army Training and Transformation: *A. mustelina* population/occurrences are located in lowland mesic forests of the SBMR AA where the weed threat is moderate, and in the lowland dry shrubland and grassland where the weed threat from current military training and SBCT transformation is high (Figure 10.l). The fire threat is low in three of these locations and moderate for two of the more southern population/occurrences near Puu Kumakalii (Figure 10.m). Most population/occurrences are located in the west central portion of the action, where there is no threat from

foot traffic trampling because it is the dudded impact area, and is restricted from foot maneuvers. One population/occurrences in the southern portion of the action area has a low threat from foot traffic trampling (Figure 10.n). There is no threat from munitions landing in the locations where *A. mustelina* occurs (Figure 10.b). These results suggest that *A. mustelina* populations/occurrences are vulnerable to alien plant introductions and possibly fire, and population/occurrences outside the impact area in the south may be vulnerable to trampling from foot traffic as a result of military activities in the SBMR AA.

Scientific name: ***Lasurius cinereus*** **spp.** ***semotus***

Common name: Opeapea; Hawaiian Hoary Bat
Family: Vespertilionidae (Common bat family)
Federal status: Endangered

Description and biology: The Hawaiian hoary bat weighs 14 to 22 g (0.5 to 0.8 ozs), forearm lengths average between 48.5 to 50.5 mm (1.9 to 2.0 in), and wingspan is 26.9 to 34.6 cm (10.5 to 13.5 in) (Jacobs 1993a; USFWS 1998c). Their rounded ears are short and thick, and edged with black. Hawaiian hoary bats have dense brown and gray fur that is tinged with white (USFWS 1998c).

The Hawaiian hoary bat makes seasonal elevational migrations, as well as inter-island movements (USFWS 1998c). Kepler and Scott (1990) note most observations of Hawaiian hoary bats are recorded from August through December. They suggest that reduced activity might be because bats enter torpor (a dormant state with reduced metabolic rates) during the cooler winter months. Increased fall activity in bats might be due to the appearance of newly volant (flying) young. Kramer (1971) suggested Hawaiian hoary bats might undergo a limited seasonal inter-island migration, while Jacobs (1994) suggested that seasonal variation in bat activity occurs over a wide range of elevations and geographic conditions. Findley and Jones (1964) found geographical separation of the sexes occurs in the North American hoary bat. Whether this pattern occurs in the Hawaiian hoary bat is unknown (USFWS 1998c).

Males may be fertile year-round in Hawaii, but breeding probably occurs between September and December, with parturition (birth of young) in May or June. Lactating females have been documented between late June and early August. Females examined between September and December were post-lactating. The Hawaiian hoary bat produces two young (USFWS 1998c). In most temperate insectivorous bats, adults breed in the fall and sperm is stored in the reproductive tract of the female until spring, when ovulation and fertilization occurs. This reproductive pattern is presumed in the mainland form of this species, but has not been confirmed for the Hawaiian species (USFWS 1998c).

Known Distribution: The Hawaiian hoary bat has been reported from the islands of Hawaii, Maui, Oahu, Kauai, and Molokai, but may be resident on only Hawaii, Kauai, and Maui. Observations of the Hawaiian hoary bat were apparently widespread on Hawaii and Kauai between 1939 and 1986. A large population/occurrence was reported from Oahu prior to the early nineteenth century, but this was based on a single observation of an unknown number of bats from an unknown location (Tomich 1986c). Most studies of Hawaiian hoary bat distributions have examined only portions of one island during certain times of the year, so limited distribution may be in part an artifact of localized search efforts by researchers. In addition, seasonal, geographical, and temporal variations may exist. Therefore, inferences regarding the current distribution of the Hawaiian hoary bat should be drawn with caution (USFWS 1998c).

Population Trends: According to the USFWS (1998b) the decline of the Hawaiian hoary bat has been largely inferred, due to the lack of accurate population estimates for this species and because historical information of past occupied areas are lacking, thus the magnitude of any population decline is not known (USFWS 1998c). Pregnant bats have been documented on Hawaii and Kauai, but have not been recorded from the other islands.

Current Status: Information on population abundance of the Hawaiian hoary bats is lacking, but Stone and Pratt (1994) and Tomich (1969) estimated there are a few thousand, while Altonn (1960) estimated hundreds remain on all islands, but these estimates are not based on systematic surveys. Presently, the largest populations/occurrences are thought to be on Kauai and Hawaii. No studies have been conducted that directly address population size of this species (Findley 1993). The sparse distribution and limited distribution records of the Hawaiian hoary bat makes population predictions and inferences on distribution of this species difficult to determine (Tomich 1986b; Findley 1993). There was one recorded observation of a hoary bat made in the SBMR AA in 1988, a few miles from Kolekole Pass (Figure 10.l) (HINHP 2002).

Habitat: Most observations of Hawaiian hoary bats have been between sea level and 2,286 m (7,500 ft) elevation on Hawaii. This may reflect a relative lack of effort placed in locating bats at higher altitudes because bats have been seen at elevations as high as 4,023 m (13,200 ft) (Baldwin 1950; Tomich 1974; Fujioka and Gon 1988; and Kepler and Scott 1990). They occur in both wet and dry areas of the island, but are probably more abundant on the drier leeward side (Jacobs 1994). Fullard (1989) found the Hawaiian hoary bat on Kauai primarily in open wet areas near forests and in ocean outlets of forested rivers. Jacobs (1994) found that Hawaiian hoary bats are more frequently associated with native vegetation, and in particular native *Metrosideros polymorpha* (ohia) trees on Hawaii (Jacobs 1993a). In contrast, Reynolds et al. (1997/1998) found no significant difference in the number of bats detected in native, mixed, or alien forest types in the Puna district on Hawaii. Roosting has been documented in numerous tree species, including *Pandanus tectorius* (hala), *Aleurites moluccana* (kukui), *Styphelia tameiameiae* (pukiawe), and *Syzygium cumini* (Java plum) (Baldwin 1950; Bryan 1955; and Kramer 1971). Tomich (1986c) suggested that the Hawaiian hoary bat is not selective in the species of tree it chooses for roosting, and that the replacement of native trees with introduced species may not affect populations/occurrences. It feeds on insects at night and can best be seen at dusk.

The Hawaiian hoary bat is solitary and roosts among foliage in trees. Jacobs (1993b) observed two radio-tagged hoary bats returned to the same roosting area each night and possibly to the same tree over a two-week period. Kunz (1982) suggested that the association to a territory may be stronger than that to a specific roost among foliage roosting bats; and that roost site fidelity may also vary seasonally and with reproductive condition. The Hawaiian hoary bat has been observed foraging in open fields near native and nonnative vegetation, off the shore of ocean bays, over lava flows, and at streams and ponds. They have been observed foraging 1 to >150 m (3.3 to >492 ft) above the ground or water (Baldwin 1950; Fujioka and Gon 1988; and Kepler and Scott 1990; Jacobs 1993a, 1994, Reynolds et al. 1997/1998). Belwood and Fullard found the Hawaiian hoary bat feeds primarily on moths on Kauai.

Taxonomic Background: The Hawaiian hoary bat is the only native terrestrial mammal in Hawaii and it is endemic to the islands. According to Koopman (1993), the genus *Lasiurus* includes seven species (five in North America). Jones, Jr. et al. (1992) recognized seven North American species north of Mexico, and Nowak (1994) recognized 13 total species in the genus. There are two other hoary bat species recognized: *Lasiurus cinereus* spp. *cinereus* found in North America and *Lasiurus cinereus* spp. *vilosissimus* found in South America (Hall 1981). Morales and Bickham (1995) suggested the Hawaiian hoary bat may have derived from the North American species.

Current Threats: Bat Conservation International (1991) included habitat loss, pesticides, predation, and roost disturbance as potential bat threats. Roost site availability is believed to be the primary limiting factor in the distribution and abundance of many bat species (Fenton 1970; Fenton and Barclay 1980; Humphery 1975; Kunz 1982). According to Tomich (1986b) and Nowak (1994), the decline of the Hawaiian hoary bat may be a result of reduced tree cover from historic times. Pesticide use may have had an indirect impact on *L. cinereus* spp. *semotus* populations by reducing or otherwise altering prey populations (USFWS 1998c). Clark et al. (1978) suggested at least two federally endangered insectivorous bat species have suffered mortality due to pesticide ingestion, thus direct effects from pesticide contamination could be a factor that has affected Hawaiian hoary bat populations. The introduction of alien insects could also have altered prey availability. Predation is not believed to be a significant threat to the mainland populations (Shump and Shaump 1982), but could be a more significant factor for the Hawaiian species.

Potential Threats from Army Training and Transformation: Fire is the most significant threat to *L. cinereus semotus* populations/occurrences from current military training and SBCT transformation activities in the SBMR AA. Fire can destroy bat colonies killing young and destroying habitat. The fire threat is very high where the species was reported in the SBMR impact area (Figure 10.m). Also, the threat of munitions landing on the species is moderate there (Figure 10.b).

Scientific Name: ***Chasiempis sandwichensis*** **spp.** ***ibidis***

Common Name: Oahu elepaio
Family: Monarchidae
Federal Status: Endangered

Description and Biology: The Oahu elepaio is a small forest bird approximately 12.5 g (0.44 oz) in weight and 15 cm (5.9 in) in length (VanderWerf 1998). It is dark brown above and white below, with light brown streaks on the breast. The tail is long and often held up at an angle. Adults have conspicuous white wing bars, a white rump, and white tips on the tail feathers. Juveniles and sub-adults are reddish above, with a white belly and rusty wing bars. Elepaio feed on a variety of invertebrates (e.g., arachnids, chilopods, diplopods, and some mollusks) by foliage gleaning, bark-picking, and aerial sallies below the forest canopy (Conant 1977; Pratt et al. 1987). Oahu elepaio are socially monogamous and approximately 63% of pairs remain together each year (VanderWerf unpubl. data).

Oahu elepaio breed between mid-January and mid-June, and most breed within their first year (Conant 1977). Conant (1977) found 32 nests, which were most commonly placed in the forks of non-native trees and sometimes on the lateral branches. The distance from nest to the ground was variable. The nests were composed of large amounts of spiderwebs, spider egg cases, lichens, liverworts, tree ferns, grass, fine rootlets, and animal hair. The average clutch size for the Oahu elepaio is reported at 2 eggs. Incubation lasts for approximately 14 to 18 days, during which the eggs are incubated 96% of the day and all night (Berger 1981; Conant 1977). Both parents participate in incubating the eggs during the day, but only females incubate at night (VanderWerf 1998). Both parents participate in brooding nestlings, and nestlings fledge after 16 days (Berger 1981).

Known Distribution: Historically, the elepaio were widespread and abundant on Oahu. According to Bryan (1905) the Oahu elepaio was the most abundant native species observed, from sea level to mountainous regions.

Population Trends: Since human settlement, the Oahu elepaio has dramatically declined and disappeared from many areas where it was once common (Shallenberger 1977; Shallenberger and Vaughn 1978; Williams 1987; VanderWerf et al. 1997).

Current Status: An estimated 1,974 Oahu elepaio remain in the wild (VanderWerf et. al. 2001). The USFWS estimates that 342 elepaio exist throughout Schofield Barracks West Range (Eric VanderWerf, USFWS, pers. comm. 2003). All elepaio current range in West Range overlaps with SBMR AA. In addition, 2 elepaio are known from Palikea Gulch at Mt. Kaala NAR, which brings the total to 344 individuals in the AA (Figure 10.o). This represents approximately 17 % of the estimated number of remaining Oahu elepaio. Of the 344 Oahu elepaio found in the SBMR AA, an estimated 310 birds are in the breeding population.

Critical Habitat: Critical habitat information was complied from the USFWS. *Chasiempsis sandwicensis* spp. *ibidis* is the only species from SBMR for which critical habitat has been designated. Elepaio critical habitat was overlaid on the SBMR AA, and an analysis of the effect of the action on it was conducted. A total of 774 ha (1913 ac) of designated elepaio critical habitat within SBMR West Range overlap with the SBMR AA (Figure 10.o). This represents 2.9% of the total acreage designated as critical habitat for Oahu elepaio.

Habitat: The Oahu elepaio occurs in a variety of forest types, but is most common in riparian habitat along stream beds and in mesic forest with a tall canopy and a well-developed under-story (Shallenberger and Vaughn 1978; VanderWerf et al. 1997). Forest structure appears to be more important to elepaio than plant species composition, and unlike many Hawaiian forest birds, the elepaio has adapted relatively well to forests composed mostly of introduced plants (Conant 1977; VanderWerf 1998; VanderWerf et al. 1997). Plant species composition in elepaio habitat varies considerably depending on location and elevation. Some of the more common native plants in areas where elepaio occur are: *Antidesma platyphyllum, Diospyros sandwichensis* (lama)*, Metrosideros polymorpha*, *Pipturus albidus* (mamaki)*, Pisonia umbellifera* (papala kepau), *Pouteria sandwicensis*, and *Sapindus oahuensis* (lonomea). Some of the more common introduced plants are *Aleurites moluccana* (kukui), *Cordyline fruticosa* (ti), *Mangifera indica* (mango), *Psidium cattleianum* (strawberry guava)*, Psidium guajava* (guava), and *Schinus terebinthifolius* (Christmasberry).

Taxonomic Background: Three elepaio species, each found only on a single island, are recognized: the Oahu elepaio (*C. sandwichensis* spp. *ibidis),* the Hawaii elepaio (*C.* spp. *sandwichensis*), and the Kauai elepaio (*C.* spp. *sclateri*). The forms on different islands are similar in ecology and behavior but differ somewhat in coloration and vocalizations (Conant 1977; van Riper 1995; VanderWerf 1998). The island forms are formally regarded as separate species.

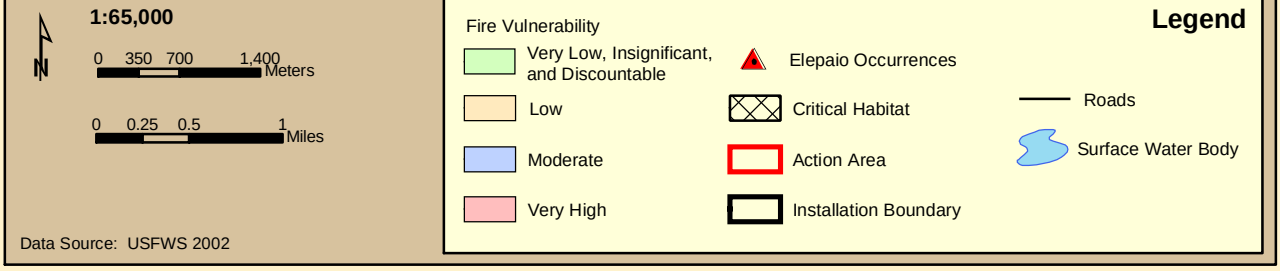
Current Threats: The decline of the Oahu elepaio is due to high adult mortality and low reproductive success (VanderWerf 1998). The main cause for the reduction of adult survival is *Avipox* sp. virus (avian pox), which is transmitted by *Culex quinquefasciatus* (the mosquito). The effect of avian malaria on the Oahu elepaio is not yet known, but it may also be significant (VanderWerf 1998). The primary reason for low reproductive success of Oahu elepaio is nest predation by introduced mammals. *Rattus rattus* (black rats) is the main threat to Oahu elepaio, but *R. exulans* and *R. norvegicus* (Polynesian and Norway rat) also impact the species. Other potential threats to Oahu elepaio include competition with introduced birds such as the *Zosterops japonicus* (Japanese white-eye), *Pycnonotus cafer* and *P. jocosus* (red-vented and red-whiskered bulbuls), and *Copsychus malabaricus* (white-rumped shama); predation by other introduced mammals such as *Felis domesticus* (domestic cat) and *Herpestes auropunctatus* (small Indian mongoose); population fragmentation; military activities; and inbreeding depression (VanderWerf et al. 1997). Habitat loss has played a role in the decline of the Oahu elepaio as well as other forest birds, but it

Oahu Elepaio Occurrences and Critical Habitat

SBMR Action Area, Oahu

Figure 10o

Maps to sensitive resources have been removed from this document
Contact sjoe@hawaii.edu to request access



is not the primary cause of its recent decline. Recent reductions in Manoa and Palolo Valley populations where development has not increased during this period of decline, suggest other causes might be more likely. Furthermore, elepaio have disappeared from large sections of the northern Koolau Range that still have primarily native forest (VanderWerf et al. 1997). Therefore, habitat loss cannot fully explain the current distribution of Oahu elepaio.

Potential Threats from Army Training and Transformation: Fire is the most significant threat to *C. sandwichensis* spp. *ibidis* populations/occurrences and critical habitat from current military training and SBCT transformation activities in the SBMR AA. Fire can destroy eggs and kill juveniles in nests. The fire threat is mostly low, but moderate in a few locations where *C. sandwichensis* spp. *ibidis* has been reported in the SBMR action area (Figure 10.o). There is about 577 ha (1425 ac) of elepaio critical habitat with a low threat from fire and 70 ha (173 ac) with a moderate threat from fire in SBMR AA. In addition, there is a moderate threat to adult elepaio and their nests from artillery above the firebreak road in the impact area and a low threat within the Surface Danger Zones (Figure 10.p). These results suggest that *C. sandwichensis* spp. *ibidis* is vulnerable to fire and munitions as a result of military activities in the SBMR AA.

10.5.3 Potential non-military uses of the action area

There are non-military uses at SBMR that have the potential to negatively impact federally listed species. They are current actions that are not controlled by the Army. This include hiking at SBMR (CEMML 2001).Two hiking trails exist in Schofield Barracks Military Reservation. The Puu Kalena Trail and the Puu Hapapa (Kolekole) Trail are both owned and managed by the Army. Permits are required both from DPW-Real Property and DPW Environmental. If accessing either trail through non-Army lands, hikers are required to obtain permission from the appropriate landowners. Hiking the Puu Kalena Trail also requires permission from the landowners on the west side of SBMR along the trail (CEMML 2001). Beyond the recreational benefits of trails, hiking trails also provide access for natural resources management, fire management, and education and outreach projects.

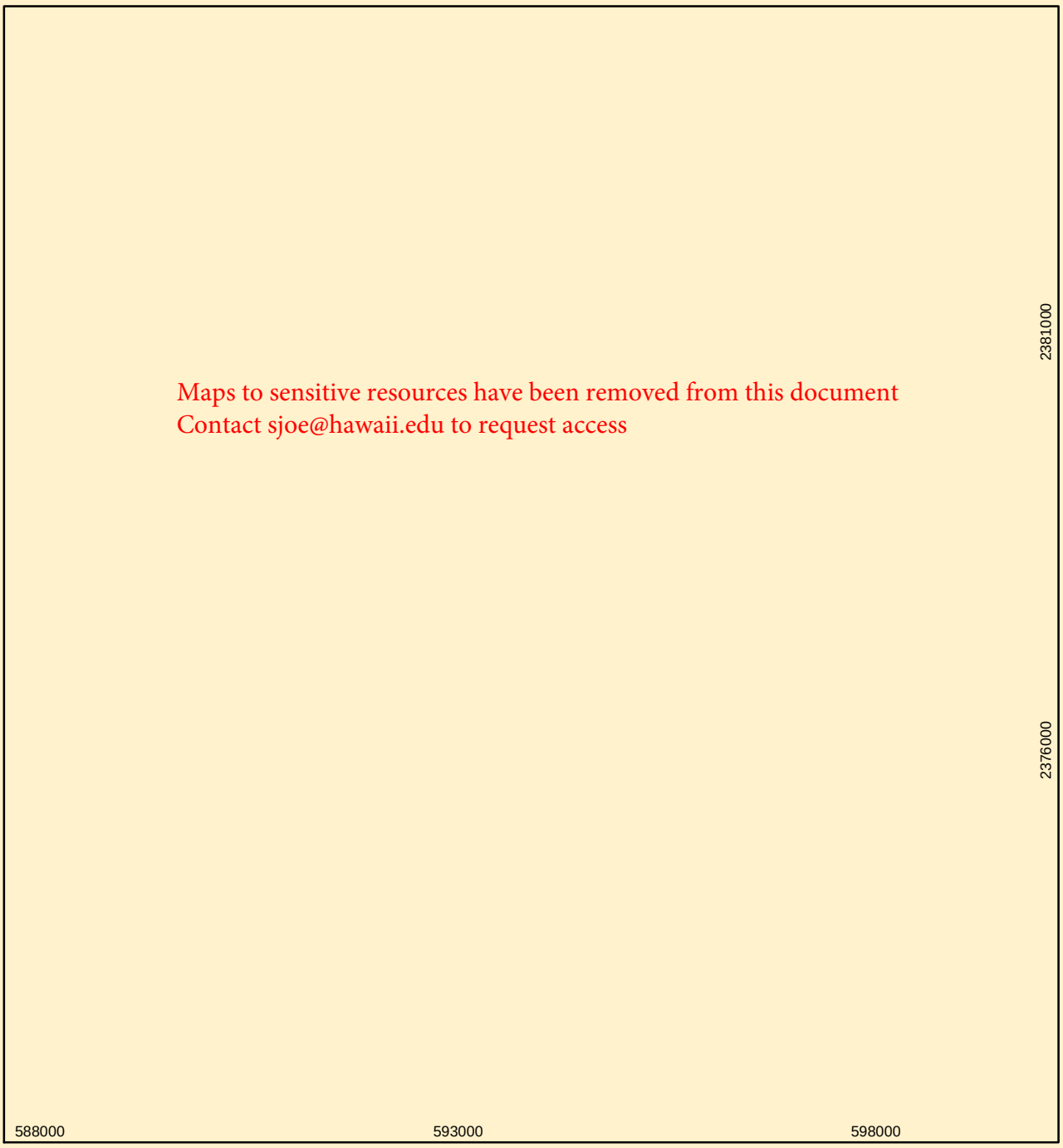
10.6 Minimization of Potential Negative Effects of the Action

To quantify the beginning threat level for each potential effect of the action and the remaining threat following minimization action, a relative numerical threat value system is used. Threat values assigned to each potential effect are 0 = none, 1 = very low, insignificant and discountable, (1-10% vulnerability), 2 = low, (11-25% vulnerability), 3 = moderate, (26-50% vulnerability), 4 = high, (51-75% vulnerability), and 5 = very high, (>75% vulnerability). These threat values have been developed for use in our discussion as a means of comparing threats posed to threatened and endangered species in portions of the action area relative to other portions of the action area. They measure the risk of each event occurring in a given area. The reasoning behind the assignment of each value is discussed under each section below.

Minimizing the potential negative effects of Army training and SBCT transformation activities involves implementing actions to lessen the amount of negative impact that the action may cause. Minimization is important for reducing the potential negative impact to listed species, but it also can work to reduce the size of the action area, which in turn can reduce the number of species affected by the action. The potential negative effects of Army training and SBCT transformation at Schofield Barracks Military Reservation that received threat values greater than (1) very low, insignificant and discountable are discussed along with proposed minimization actions. Minimization actions may result in the modification of the threat values downward. Table 10.j at the end of this section, summarizes the resulting (modified) threat values following minimization actions. Modified threat values of less than low (2) are **not likely to adversely affect any federally-listed species or adversely modify critical habitat in the action area**. Potential effects, which are assigned modified threat values greater than or equal to low (2) are **likely to**

Oahu Elepaio Occurrences in Impact Area and Landing Zones,Schofield Barracks Military Reservation, Oahu

Figure 10p



1:75,000

0 250 500 1,000 Meters

0 0.25 0.5 1 Miles

Data Source: USFWS 2002

Legend

- Landing Zones (Open)
- Elepaio Occurrences
- Threats from Indirect Fire Munitions
  - None
  - Low
  - Moderate
- Roads
- Action Area
- Installation Boundary
- Surface Water Body

adversely affect federally-listed species or adversely modify critical habitat and these are in **bold** type in Table 10.j.

10.6.1 Direct Effects

10.6.1.1 Impact Area and Landing Zones used in Current Military Training

All munitions are fired directly into an impact area. There are no federally listed plants or invertebrates know to occur within the impact area, but there is an elepaio recorded within the impact area (Figure 10.p) and the only Hawaiian hoary bat observation is from within the impact area (Figure 10.b). The risk of munitions landing on a federally listed species within the impact area would be **moderate (3).** Surface Danger Zones depict the potential ranges of indirect fire weapons. They consists of the target area, impact area, ricochet area, secondary danger areas on all sides of the primary danger area, and other associated areas (HQDA 1983). Although the threat is **low (2)**, there is a chance a round could accidentally land outside the impact area within the SDZs (surface danger zones), and on a federally-listed species (Figure 10.b and Figure 10.p). The threat to federally listed species outside the SDZs from munitions landing on them would be **very low (1) insignificant or discountable**. This type of an impact has never been observed at Schofield Barracks or Makua Military Reservation in any population which is regularly monitored by Army Natural Resource Staff. The impact of noise from munitions on the vertebrate species is discussed separately below.

There are nine open landing zones (LZs) and 1 open landing/drop zone (LZ/DZ) in the SBMR action area. The closest federally listed species to any of these zones (elepaio) is 860 m (2820 ft) (Figure 10.p). No federally listed species are directly affected by this military training in SBMR AA.

10.6.1.2 SBCT Construction Projects

There are six Army transformation projects planned for Schofield Barracks Military Reservation. The specific location of these facilities has not yet been finalized, but the general location where the construction will occur has been defined and was discussed earlier (section 10.3.1). All these projects are small foot prints in lower elevation areas dominated by alien species, in the eastern portion of the AA. No federally listed species will be impacted by this construction (Figure 10.c).

Fixed Tactical Internet Antennas. There are seven fixed tactical internet antennas included in the SBMR AA. The construction would include a 6.1 x 7.6 m (20 x 25 ft) area, and existing roads would be used to access the antennas. The closest federally listed species (*Cyanea acuminata*) to any of these antenna construction locations, including a 25 m construction buffer, is about 165 m (575 ft) to the Mt. Kaala East Antenna (Figure 10.i). Thus, no listed species will be directly affected by this SBCT construction of the fixed tactical internet antennas. The antennas will be inspected monthly for electrical and physical damage and will be repaired as needed. If there are any specific actions that may affect listed species, the Army will consult with the USFWS.

The threats of SBCT construction to federally listed species is (0) none.

10.6.1.3 Fire from Current Military Training and SBCT Transformation

Ignition sources at SBMR are dominated by those associated with live fire exercises. Additional sources of ignition include smoking, sparks from construction activities and equipment, and catalytic converters. Fuels in the impact area and much of south range are composed of *Panicum maximum* (guinea grass), *Melinus minutiflora* (molasses grass), various species of *Eucalyptus*, and *Schinus terebinthifolius* (Christmas berry). Higher elevation fuels consist of two species of *Psidium* (guava), and *Metrosideros polymorpha* (Ohia). Rainfall at SBMR ranges from roughly 50 inches per year near range CR-1, to over

80 inches at Mt. Kaala (Giambelluca *et al.* 1986). Most of the live fire ranges fall into the drier end of the spectrum. Winds are usually dominated by trades out of the northeast. Average wind speed is 4.3 mph, and the average maximum wind speed is 8.2 mph. Average temperature is 71 degrees F and average maximum and average minimum temperatures are 80 and 61 degrees F, respectively. Average relative humidity is 81% and average maximum and average minimum relative humidity's are 95% and 57%, respectively.

For the purposes of this BA, fire vulnerability is defined as the risk of fire ignition combined with the risk of fire spread as determined by characteristics of the vegetation and climate. SBMR can be divided into four fire vulnerability areas (Figure 10.m).

Impact Area – This is located within the impact area firebreak road and is almost entirely vegetated by alien species. It is also the target for all live fire at SBMR. Many military weapons, notably tracer ammunition and certain types of artillery rounds, are highly fire prone. In the past, fires have been frequent in this area, with occasional large, intense incidents. The fire vulnerability of this area is **very high (5)**.

Non-Target Training Areas – This includes South Range and the rest of the areas used for training, not including the impact area. Some live fire occurs here, but all of it is targeted into the impact area and the frequency of live fire exercises is far lower than that of the impact area. Fire history indicates that few fires have occurred here in the past. The vegetation is mostly flammable alien species, but with fewer ignition sources, this area is only **moderately (3) vulnerable** to fire.

Flammable Non-Training Areas – These are areas dominated by flammable vegetation that are not used for training. Flammable vegetation is defined here as all grasslands, eucalyptus, or ironwood dominated communities. The likelihood of ignition is low, since little or no training takes place in these areas, but it is still possible from overshot rounds, fires escaping the firebreak road, or other mishaps. These areas are also **moderately (3) vulnerable** to fire.

Non-Flammable Non-Training Areas – These areas are not typically used for training and are dominated by less flammable vegetation. Ignitions are unlikely and fire spread, should it occur at all, is slow. Fire vulnerability in these areas is considered to be **low (2)**.

Other Areas – Several locations within the impact area do not fall into any of the above categories. The first is OP-Halo, located just outside the proposed firebreak in South Range. Restrictions will be emplaced ensuring that there is no smoking or use of any pyrotechnics or weapons of any kind. Observation will be the only activity allowed. OP-Halo has a **low (2) vulnerability** to fire. OP-Kolekole is located on the SBMR ridgeline southeast of Kolekole pass. The same kind of training and the same restrictions as OP-Halo apply. Therefore, it also has a **low (2) vulnerability** to fire. The westernmost areas of SBMR have a **very low, insignificant, or discountable (1) vulnerability** to fire. There is no training of any kind here and the only human access that occurs is that of DPW Environmental staff. Additionally, over 80 inches of rain falls in this area annually, making it too wet to support fire for the majority of the year. Finally, fires that may escape the firebreak road, are not expected to reach this elevation on the mountain. Because it represents the farthest a fire would reach under a worst case scenario, the modeling used to determine fire buffer distances (see section 3.1) demonstrates that fires escaping the firebreak road or starting within the more flammable fuels (those rated at a moderate fire vulnerability) at elevations just above the firebreak would not reach as high as this area. The fire buffer distance of 521 meters defines the boundary between the area designated as at moderate fire vulnerability from that designated as very low, insignificant, or discountable.

Methods to minimize the negative effects of fires on threatened and endangered species will be documented in the finalized Wildland Fire Management Plan, Pohakuloa and Oahu Training Areas, scheduled to be completed by September, 2003. Components of the WFMP important in Section 7 consultations with the USFWS are included in the BA (Fire History, Protected Species, Firebreak System, Fuels Management, Enforcement, Ignition Control, Fire Danger Rating System, Fire Reporting and Notification Procedures, Records and Fire Reports and Departmental Responsibilities). The fire management plan defines the responsibilities of Range Control personnel and military training units for the prevention and suppression of fires at SBMR. This plan also outlines the prevention and suppression measures that must be carried out to train at SBMR. Actions to minimize impacts will include implementing a fire danger rating system that will restrict training according to weather and fuel conditions, moving targets that are close to the firebreak road further into the impact area to reduce the likelihood of overshot rounds landing outside the firebreak, improving the firebreak road around the MF ranges to the same standards as the impact area firebreak road, and managing the fuels on the ridge leading to Puu Pane as per the recommendations in Beavers and Burgan 2001. Fuels management may be considered elsewhere as well, including chemical and mechanical means of fuel reduction and prescribed burning. Maintenance will be performed as specified in chapter 4 of the WFMP. Fires outside the firebreak road will be considered first priority until they are extinguished. Training will be halted or altered to the extent necessary to facilitate achieving this goal in the SBMR AA. The Army will reinitiate consultations with the USFWS if any fire escapes the installation boundary OR escapes or starts outside any of the firebreaks.

After these fire minimization actions are implemented, threats are projected to be reduced from **moderate (3) to low (2) in the non-target training areas and flammable non-training areas, and from low (2) to very low (1) insignificant or discountable in non-flammable non-training areas** of the action area (Table 10.j).

10.6.1.4 Alien Plant Introductions via Current Military Training and SBCT Transformation

The probability of alien plants becoming established depends on the type of weed species being introduced (e.g., dry, mesic, or wet forest species) and the proximity of suitable environments and/or plant communities to the action area or point of introduction of the species. The SBMR action area contains nonnative, dry, mesic, and wet forest. **Dry and nonnative forest species have a high threat level (4), mesic forest species have a moderate threat level (3), and wet forests species have a low (2) to moderate (3) threat level of becoming established.** This is because dry and nonnative forests are generally lower and closer to training activities, so the distance between the point of introduction and the location of similar forest type would be small compared to that of wetter forests. Also, there is a greater chance of a weed impacting dry and nonnative forests than wet forests because training areas are located in habitat with conditions more similar to dry forests. Training occurs at elevations between 700 - 1,000 ft with moderate rainfall at SBMR.

This threat should be reduced from high (4) to moderate (3) for dry and nonnative forests, moderate (3) to low (2) for mesic forests, and from low (2) or moderate (3) to low (2) for wet forest species by doing the following:

- The Army will prevent any weeds brought in by training activities from becoming established by rigorously monitoring using transects and roadside surveys and eradicating new weeds using the most effective means known specific to each of the invasive species. Refer to the pest management sections of the Oahu INRMP (CEMML 2001) for possible treatments for eradication. Detailed methods for the monitoring and eradication of alien plants will be developed as part of the Oahu IP.

- The Army will wash vehicles in the wash rack facility at SBMR prior to leaving the training areas, to remove any weed seeds and large clumps of soil, and minimize the spread of weeds that may have accumulated on the vehicles during maneuvers.
- The Army will provide education regarding cleaning vehicles and field gear (these education materials will be Service approved).
- The Army will wash vehicles in the wash rack facility prior to returning to Oahu from the Pohakuloa Training Area (PTA), to minimize weeds (e.g., fountain grass).
- Persons and equipment coming from foreign countries must go through U. S. Department of Agriculture and U.S. Customs inspections before coming into the United States.
- The Army will train and require soldiers to clean their gear and vehicles when first arriving in Hawaii and prior to moving from installation to installation on Oahu, as well as when moving from Oahu to the island of Hawaii or vice versa.

10.6.1.5 Alien Animal Introduction via Current Military Training and SBCT Transformation

The chance of an introduced animal establishing a viable population would be lower than for plants since they would require at least two reproductive viable individuals or a single impregnated female individual to be introduced. **The threat of an alien animal species being introduced at SBMR from Army training and transformation is moderate (3).**

This threat should be reduced from moderate (3) to low (2) by doing the following:

- To minimize animals (e.g., invertebrates) from coming back to Oahu from the Pohakuloa Training Area (PTA), the Army will wash vehicles in the wash rack facility at PTA prior to returning.
- Persons and equipment coming from foreign countries must go through U. S. Department of Agriculture and U.S. Customs inspections before coming into the United States.
- The Army will provide education regarding cleaning vehicles and field gear. ITAM provides a pocket card outlining environmental awareness issues. Briefings on environmental stewardship and conservation of natural/cultural resources are provided through Senior Soldier Leadership Training.
- The Army will brief soldiers on alien reptilian species and request that all snake and lizard sightings be reported to the Army Environmental office.
- The Army has developed and distributed brown tree snake response and alert posters which inform the public about the potential for a brown tree snake introduction with rapid response measures and numbers to call in case of a sighting.
- The Army established the Brown Tree Snake Response Plan for rapid response to and interdiction of brown tree snakes introduced to Army Lands on Oahu.
- The Army is a member and will continue active participation in the Oahu Invasive Species Committee (OISC). This is a voluntary partnership of private, governmental and non-profit organizations and individuals united to prevent new invasive species infestations on the island of Oahu, to eradicate incipient invasive species, and to stop established invasive species from spreading.
- Herpetofauna certification program will be developed as part of the implementation process for plant material purchased by the Department of Defense, to prevent incidental introductions of herpetofauna to the island of Oahu.
- Establish the phytosanitation certification program developed in the Draft Makua IP (Makua Implementation Team 2002).
- Coordinate/collaborate with the Toxicants Working Group in an effort to determine a safe toxicant for controlling populations of newly established invertebrates.
- Use environmentally safe toxicants for alien species control or eradication associated with military operations or natural resource management.

- If a new introduction of an alien animal is found, the source and time of the introduction will be identified, and the area will searched and treated with an appropriate environmentally safe toxicant to eradicate any other individuals of the target species that may be present. In addition, an area deemed adequate to cover the potential dispersal distance of the new alien animal will be searched and treated as well.
- Pursue support, implementation and funding for the licensing and application of a more toxic rodenticide, and towards broad scale distribution of rodenticides to improve rat control in remote areas, especially in areas with threatened and endangered species.

10.6.1.6 Trampling from Current Military Training and SBCT Transformation

Trampling of threatened and endangered species, particularly plants and invertebrates on Oahu, is a potential risk during training exercises when soldiers or troops move through native habitats with listed species. However, the threat of destruction or degradation from trampling by troops will be lower than what one would expect by chance because infantry soldiers are trained to leave no evidence or trace of their presence. For the purposes of this BA, we used percent slope and distance from roads to estimate the frequency of use by foot traffic as a measure of potential trampling intensity. We categorized areas into high, moderate, low, and very low insignificant or discountable threats from trampling based on the predicted use of lands adjacent to the roads and trails in SBMR AA. This was done under the assumption that lower slopes and areas on or close to roads are used with greater frequency than the contrary (Figure 10.n).

The threat of trampling varies from high (4) for areas <10 m from roads or trails; moderate (3) for areas 10-1000 m from roads or trails with 0-30% slope, or 10-100 m from roads or trails with 30-60% slope; low (2) for areas 10-100 m from roads or trails with >60% slope, or 100-1000 m from roads or trails with >30% slope, or >1000 m from roads or trails with < 60% slope; and very low (1), insignificant or discountable for areas >1000 m from roads or trails and with >60% slope.

The risk to mature trees or shrubs getting trampled by foot traffic is very low, insignificant and discountable. Only the seedlings of trees and shrubs, and herbaceous plants are at risk of being trampled. **The threat of a listed plant or invertebrate being crushed and killed would be reduced by one from those predicted above (Table 10.j) by doing the following:**

- The Army will brief each set of new soldiers on avoidance of trampling of endangered species.
- Establish LCTA (ITAM) plots to monitor impact of foot traffic trampling by infantry soldiers.
- Fencing of federally listed species populations near roads or trails that have been determined to be impacted by military foot traffic, will be addressed by the implementation team.
- Establishing signage to identify areas that are off limits due to the presence of federally listed species, will be addressed by the implementation team.

10.6.1.7 Noise from Current Military Training and SBCT Transformation

Noise is an unwanted sound. It is generated from a source (e.g., explosion) as a wave of energy, which diminishes with distance. The only potential concern related to noise from military training and SBCT transformation activities is the potential effect on vertebrate species or the elepaio and bat at SBMR. VanderWerf et al. (2000) demonstrated that there is no adverse impact to Oahu elepaio from the noise generated from military training at Schofield Barracks. **Therefore, a threat value of very low (1), insignificant or discountable is assigned to the noise generated by Army training and transformation activities at Schofield Barracks, and requires no further minimization.**

10.6.2 Direct Interrelated Action and Effect

10.6.2.1 Soil Erosion by Wind

Prevailing winds are northeasterly trade winds from 4 to 12 miles per hour (mph) in the warmer summer months, and lighter southeasterly winds prevail in winter months at SBMR. The majority of the dust producing military activity is >300 m from threatened and endangered species populations at SBMR **Therefore, the threat values for dust generation on federally listed species is very low (1), insignificant or discountable, and requires no further minimization.**

10.6.2.2 Soil Erosion by Water

Soil erosion processes modify habitats by removing or adding soil from one location to another. Soil erosion is locally significant in areas where natural drainage and gulches occur. However, dry climate and lack of permanent streambeds may reduce the risk of erosion, as well as in areas where soils are not well developed because of exposed lava. Military activity and construction can have an effect on erosion rates and sedimentation, especially in areas where activity is concentrated. These disturbances are commonly in association with roads, LZ/PZ/DZ areas, and off-road maneuver and recreational areas (e.g., motorcycle trespass). Sources of water quality degradation on SBMR include denuded training and impact areas, and roads and other concentrated flow sites. **The ITAM LRAM program is actively working to minimize erosion and control sediment on SBMR using a variety of techniques and structures. Therefore, the effect of soil erosion and sedimentation on federally listed species is considered low (2).**

The effect of soil erosion and sedimentation on federally listed species should be further reduced from low (2) to very low (1), insignificant or discountable by doing the following:

- Establish a project review process headed by ITAM and including USAG-HI DPW, G3/DPTM, and Range Control, to optimize watershed protection and rehabilitation (e.g., road construction and maintenance, storm water management, etc.).
- Establish GIS support headed by ITAM, to develop project data layers, analyze data, and display results.
- Participate in future watershed partnership initiatives to facilitate watershed protection and conservation projects, maximize available resources, and optimize information exchange and learning.

10.6.2.3 Ground Water Degradation

Ground water may be impacted by military training and SBCT transformation activities, especially in areas where the ground water is relatively close to the surface and in areas where activity is concentrated. This occurs when materials such as oil, gasoline, and explosive by-products migrate down to the water table and spread out to other areas in the groundwater. These disturbances are commonly in association with roads, LZ/PZ/DZ areas, and off-road maneuver and recreational areas (e.g., motorcycle trespass). The immediate effect of low levels of ground water contamination resulting from routine military training and SBCT activities on threatened and endangered species is unclear. The immediate concern is when water close to the surface becomes contaminated and threatened and endangered fauna are exposed to the contaminants in the surface water. The only threatened and endangered species potentially at risk in the SBMR AA is the elepaio. However, ground water contamination is not considered a risk to this species there because most of the water sources are well below the surface and most of the these birds reside in areas upslope and far away from potential sources of ground water contaminating activities. Also, it is believed that elepaio drink primarily from water drops on vegetation (Eric VanderWerf, USFWS, pers. comm. 2003). Minimization of watershed impacts from Army training and SBCT transformation

activities is achieved through a number of institutional procedures including the ITAM training requirement integration (TRI) program, ITAM Sustainable Range Awareness (SRA), range regulations, and training and policies provided by DPW Environmental Division. **Therefore, the effect of reduced water quality on federally listed species is considered very low (1), insignificant or discountable.**

10.6.3 Direct Interdependent Actions and Effects

10.6.3.1 Fire Control by Prescribed Burning

Prescribed burning is a proven method to reduce vegetative fuel loading under controlled, planned burning procedures, thereby minimizing the risk of a large wildfire burning out of control. The Army has successfully done prescribed burning within firebreak roads in the past. **This threat is assigned a moderate (2) threat value since it is done within firebreak roads and under planned conditions and there are beneficial or positive impacts to species if fuel loading is reduced.**

The advantage of prescribed burning is that one can plan for all the necessary resources to keep the fire under control. Today there are more and better fire fighting resources (e.g., HUMMER fire trucks). However, there is always a potential for prescribed burns to burn out of control. To minimize the chance of a prescribed burn going out of control, any prescribed burning is done in small sections, one at a time. The U.S. Fish and Wildlife Service will be consulted before each prescribed burn. **This will greatly minimize the chance of a fire escaping control and should bring the threat value down from moderate (2) to low (1).**

10.6.3.2 Range Maintenance and Construction

Range development projects are interdependent actions with interdependent effects. These projects have a similar potential of affecting listed species through alien introductions as do other Army activities, because they occur in the same areas. **Therefore, the threat values for alien species introductions via range maintenance and construction is moderate (3).**

Most of the range construction is done in-house by the Army and involves road construction and maintenance with crushed rock from the Kolekole Rock Crushing Quarry at Schofield Barracks. Since the rock is obtained from Schofield Barracks, the likelihood of a weed species foreign to Hawaii being in the material is negligible. However, sometimes sand is purchased for different projects and the sand could introduce new weeds. The Army will minimize this threat by conducting weed monitoring using transects and roadside surveys and eradicating new weeds using the most effective means known specific to each of the invasive species. Refer to the pest management sections of the Oahu INRMP (CEMML 2001) for possible treatments for eradication. Detailed methods for the monitoring and eradication of alien plants will be developed as part of the Oahu IP. **Therefore, the threat value should be reduced from moderate (3) to low (2) for mesic and wet forest species (Table 10.j).**

10.6.3.3 Integrated Training Area Management (ITAM) Program

This program is designed to monitor and mitigate erosion and loss of vegetative cover, which is essential for human safety and realism in training. ITAM workers revegetate areas, which have been heavily used for training. The ITAM program has the potential to introduce alien plant and animal species to Schofield Barracks via this work. **The initial threat value assigned to the ITAM program projects is low (2), because of the overall beneficial nature of the work they conduct, and because they work mostly in areas already heavily impacted by human development, dominated by alien plant species, and far away from federally listed species (including roadsides, LZ's, and maneuver areas).**

ITAM staff coordinate with Army Natural Resource Staff to select native species for outplanting. They purchase plants from native plant nurseries on Oahu. The plants are not delivered until the day before they are planted, to reduce the risk of contamination by alien species. Native plants are always the first alternative because they have the greatest likelihood of successful establishment. In some cases native species are not commercially available, more specifically grasses for Landing Zones. In those cases they coordinate with Army Natural Resource Staff to select something non-invasive, naturalized, and which already occur near the outplanting site. Detailed methods for the monitoring and eradication of alien plants will be developed as part of the Oahu IP.

This potential threat will be further reduced by doing the following:

- Get weed free certification from native plant nurseries for all plants purchased by ITAM for revegetation.
- When using grass seed to revegetate an area, ITAM will periodically monitor these areas for invasive weeds, and remove all non-target introductions from the area before establishment.

In light of the precautions that are taken in choosing revegetation material and proposed actions to reduce the risk of a new introduction, the modified threat value assigned to the ITAM program projects is very low (1), insignificant and discountable.

10.6.3.4 Natural Resources Program

The Army's Natural Resources component of the Ecosystem Management Program provides protection to the listed species at SBMR in conjunction with military training there. Ecosystem level management at SBMR includes surveys, monitoring, propagation, storage, and reintroduction of rare plants; surveys, monitoring, and protection of rare invertebrates; surveys and monitoring of rare vertebrates; ungulate, weed, and rodent control, and control of alien invertebrates and associated diseases. Natural resource workers could potentially introduce weed species via field vehicles or gear during management. Landing zone and disturbance corridor surveys are also conducted in areas where there is a high potential for alien species introduction via their program. **These potential adverse impacts are assigned an initial value of low (2).**

However, NRS workers are trained to be very conscious and careful of the weed threats, and take precautions such as cleaning gear and vehicles prior to entry into the field. **Therefore, the initial threat value assigned to the natural resources program was modified to very low (1), insignificant and discountable.**

10.6.3.5 Alien Species Introduction by Recreational Use

Alien Animal Introduction. Open public access to the installation, public access on roads outside the installation boundaries, and non-military personnel with daily access to the installation are all potential non-military points of animal introductions at SBMR. Alien animal species may also disperse (usually by flying) into new uninhabited areas within the subinstallation or action area or the smaller species may be blown in by winds. Non-military users must adhere to the conditions of their hiking permit, which is issued by DPW and states that they must clean all gear prior to entry. The likelihood of human-induced introductions via recreation activities is lower than from military sources because of the lower frequency of use of the area for these purposes. **The threat of alien animal introduction by recreational use is therefore very low (1), insignificant and discountable and requires no further minimization.**

Alien Plant Introduction. Public access along the Puu Kalena Trail and the Puu Hapapa (Kolekole) Trail increases the risk of alien introductions along these trails. They are both owned and managed by the Army. **The threat of alien plant introduction by recreational use is therefore low (2).**

This threat should be reduced from low (2) to very low (1), insignificant and discountable by doing the following:

- Monitoring trail use by requiring permits from DPW-Real Property and DPW Environmental for access to hike the Puu Kalena and Puu Hapapa (Kolekole) Trails, and permission is required from the appropriate landowners if accessing either trail through non-Army lands.
- The Army will prevent any weeds brought in by recreationalists from becoming established by monitoring trails used for these purposes within and adjacent the SBMR AA. Methods for monitoring will be developed as part of the Oahu IP.
- Require that hikers clean all gear prior to entry.
- Due in part to a complicated permit system, hiking use has been limited.
- Develop and place signage at appropriate places along SBMR boundaries and trail locations to notify users of resource management issues, boundaries, and trail issues.
- Develop maps of the Puu Kalena and Puu Hapapa (Kolekole) Trails for distribution with access permits, including the level of difficulty, and natural resources issues (e.g., weed distribution concerns, endangered species information, the importance of staying on the trail).

10.6.3.6 Mission Support Training Facility (MSTF) and Information System Facility (ISF)

This project consists of the construction of two adjacent buildings and accompanying parking area in the vicinity where Trimble Road intersects Beaver Road in the cantonment area on Schofield Barracks. This construction project is considered a mission essential requirement for Legacy training. One of the buildings will function as a MSTF and the other as an ISF. They are needed to provide combat simulation training, and high-tech information systems facilities capable of supporting the dynamic mission essential requirements for training. The MSTF will provide battle simulations and distance learning, and the ISF will provide communications capabilities and interfaces between tactical and non-tactical, highly complex telecommunications essential to support constructive, virtual and information requirements. There are no listed species or critical habitat at or adjacent to the site. In January 2003 the USFWS concurred with the Army's determination that the proposed project will not affect any federally listed species or critical habitat. This project can also be considered as an interrelated action.

10.6.3.7 Installation Information Infrastructure Architecture (I3A)

This project consists of the construction of an I3A within the cantonment areas of Schofield Barracks and Wheeler Army Air Field. The project will consist of the installation of underground concrete-encased ducts, and appurtenant manholes, which will house fiber optic cabling to interconnect cantonment areas, ranges, motor pools, and other facilities within these two installations. The I3A will provide needed upgrades to the existing installation infrastructure to accommodate advances in information technology. The Army has determined that this project will not affect any federally listed species or critical habitat and that consultation with the USFWS is not necessary. This project can also be considered as an interrelated action.

10.6.4 Indirect Effects

10.6.4.1 Spread of Alien Species by Fire into Native Dry and Nonnative Forests

The threat values for secondary weed spread are based on the assumption that fire occurs in the area, and are similar to those described above for direct weed introductions from military training and SBCT transformation activities in dry and nonnative communities, high (4).

This indirect threat from military training and SBCT transformation activities at Schofield Barracks should be reduced from high (4) to moderate (3) as a result of the following:

- The Army will prevent secondary weed spread from fire by rigorously monitoring and eradicating newly dispersed weeds. Detailed methods for the monitoring and eradication of alien plants will be developed as part of the Oahu IP.

10.6.4.2 Spread of Alien Species by Fire into Mesic Forest

The threat values for secondary weed spread are based on the assumption that fire occurs in the area, and are similar to those described above for direct weed introductions from military training and SBCT activities in mesic forests, moderate (3).

This indirect threat from military training and SBCT activities at SBMR should be reduced from moderate (3) to low (2) as a result of the following:

- The Army will prevent secondary weed spread from fire by rigorously monitoring and eradicating newly dispersed weeds. Detailed methods for the monitoring and eradication of alien plants will be developed as part of the Oahu IP.

10.6.4.3 Spread of Alien Species by Fire into Wet Forest

The threat values for secondary weed spread are based on the assumption that fire occurs in the area, and are similar to those described above for direct weed introductions from military training and SBCT activities in wet forests, low (2) to moderate (3).

This indirect threat from Army activities at SBMR should be reduced from low (2) or moderate (3) to very low (1) or low (2) for wet forest species as a result of the following:

- The Army will prevent secondary weed spread from fire by rigorously monitoring and eradicating newly dispersed weeds. Detailed methods for the monitoring and eradication of alien plants will be developed as part of the Oahu IP.

10.6.4.4 Army Regulated Hunting

McCarthy Flats ranges MF 2, 3, and 4 at Schofield Barracks Military Reservation allow hunting for game birds in season (November through January) when the area is not in use for military training (weekends, federal holidays). Eligible users are active duty, reserve, retired military personnel and authorized family members, and DoD civilian employees and their civilian guests. Only shotguns smaller than 12 ga. and larger than 6 ga. are permitted. Dogs are permitted, but must be restrained except when actually hunting. Hunters may take ring-neck pheasant/green pheasant (three per hunter, cocks only; any combination of species is acceptable); Erckels francolin (three birds of either sex per hunter); barred dove (20 birds of either sex per hunter); and spotted dove (10 birds of either sex per hunter). One small group (two to six persons) is allowed in the area at a time and permits are issued on a first-come, first-served basis. Areas with high grass or near government property (including earth berms, targets) are off-limits (CEMML 2001).

There is no potential threat to federally listed species from hunting at SBMR because there are no known listed species near the designated hunting areas. **Therefore, a threat value of none (0) is assigned to Army regulated hunting at SBMR AA.**

Table 10.j. Potential Effects of Army Activities at Schofield Barracks Military Reservation, Hawaii.

Effect Type	Potential Effect/Threat[1]	Initial Threat Value	Modified Threat Value with Minimization[2]
Direct	**Munitions landing on listed species in the impact area**	3	3
Direct	**Munitions landing on listed species outside the impact area, but in the SDZs**	2	2
Direct	**Fires from military activities in the impact area of the AA**	5	5
Direct	**Fires from military activities in Non-Target Training Areas of the Action Area**	3	2
Direct	**Fires from military activities in Flammable Non-Training Areas of the Action Area**	3	2
Direct	**Fires from military activities at OP-Halo and OP-Kolekole**	2	2
Direct	Fires from military activities in Non-Flammable Non-Training Areas of the Action Area	2	1
Direct	**Alien Plant Introduction to native dry and nonnative forest**	4	3
Direct	**Alien Plant Introduction to mesic forest**	3	2
Direct	**Alien Plant Introduction to wet forest**	2-3	2
Direct	**Alien Animal Introduction**	3	2
Direct	**Trampling from foot traffic in areas <10 m from roads or trails**	4	3
Direct	**Trampling from foot traffic in areas 10-1000 m from roads or trails**	3	2
Direct	Trampling from foot traffic in areas >1000 m from roads or for areas with 30-60% slope	2	1
Direct Interrelated Action and Effect	Erosion by water	2	1
Direct Interdependent	Fire Control by Prescribed Burning	2	1
Direct Interdependent	**Range Maintenance and Construction, Plant Introduction**	3	2
Direct Interdependent	Integrated Training Area Management	2	1
Direct Interdependent	Natural Resources Program	2	1
Direct Interdependent	Alien Plant Introduction by Recreational Use	2	1
Indirect effects	**Spread of Alien Species by Fire into native dry and nonnative forest**	4	3
Indirect effects	**Spread of Alien Species by Fire into mesic forest**	3	2
Indirect effects	**Spread of Alien Species by Fire into wet forest**	2-3	1-2

[1] Potential effects in bold type are those which are assigned modified threat values ≥ to low (2). These are likely to adversely affect federally-listed species or adversely modify critical habitat.

[2] Modified threat values of less than low (2) are not likely to adversely affect any federally-listed species or adversely modify critical habitat in the action area. Potential effects assigned modified threat values greater than or equal to low (2) are likely to adversely affect federally-listed species or adversely modify critical habitat.

10.7 Other Army Consultations for Listed Species at SBMR

10.7.1 Rock Crusher Unit and Quarry Expansion

In 1995, the Army informally consulted with the USFWS on a project to replace its existing rock crusher with a new, mobile crusher, and upgrade the existing quarry near Kolekole Pass. Listed plant species closest to the project site were *Alectryon macrococcus* var. *macrococcus, Diellia falcata, Platydesma cornuta* var. *decurrens,* and *Pteralyxia macrocarpa.* Species of concern plants closest to the site were *Lipochaeta tenuis,* and *Schidea lingustrina.* One endangered species of Oahu tree snail (*Achatinella mustelina*) was also consulted on. The Army believed that the species were sufficiently distant from the project site to ensure that they would not be adversely affected by the proposed project. The USFWS agreed with this conclusion.

10.7.2 Review of Planning Documents

The Army has requested USFWS review of Natural Resource planning documents over the years. The USFWS in April of 1996 reviewed the Army's draft Endangered Species Management Plan Report for Oahu Training Areas which was finalized and in place in 1997. In July of 1997 the USFWS sent comments to the Army regarding selected chapters of the Oahu Ecosystem Management Plan Report which was finalized and in place in 1998. In August of 2001 the USFWS sent the Army their review comments for the draft Integrated Natural Resources Management Plan which is the action document for review, guidance, and implementation of Army natural resource activities for 2002-2006 at Oahu Army Installations.

10.7.3 Prescribed Burns

Prescribed burning is a proven management tool for keeping the fuel load down, thereby minimizing the risk of starting wildfires. The Army has shown that it is capable of conducting successful prescribed burns within the existing perimeter fuel break.

In 1998 the Army consulted with the USFWS on two small prescribed burns that would allow explosive ordnance detachment personnel to certify that the areas were surface-cleared of any unexploded ordnance. The closest listed plants were *Dissochondrus biflorus* and *Neraudia angulata* var. *angulata.* The closest animal was the Oahu tree snail (*Achatinella mustelina*). The Army believed that the species were sufficiently distant from the project site to ensure that they would not be adversely affected by the proposed project. The USFWS agreed with this conclusion. The Army conducted the prescribed burns successfully.

In 1999, the Army consulted with the USFWS on a small prescribed burn at the MF-5 Engineer Qualification Course. The purpose of the burn was to reduce the fuel hazard in case of wildfires and to provide ground visibility essential to conduct surface clearance of any unexploded ordnance. The closest species to the burn site were the listed plants *Isodendrion longifolium* and *Dellisea subcordata* located in the state's Mount Kaala Natural Area Reserve, the listed snail *Achatinella mustelina*, and the then proposed endangered bird *Chasiempis sandwichensis* ssp. *ibidis*. All species were located from three to five kilometers away. The Army believed that the species were sufficiently distant from the project site to ensure that they would not be adversely affected by the proposed project. The USFWS agreed with this conclusion. The Army conducted the prescribed burn successfully.

10.8 Cumulative Effects

Cumulative effects include the effects of future state, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the Endangered Species Act.

10.8.1 Future State Actions

There are no known future state actions that are reasonably certain to occur within the proposed action area.

10.8.2 Future Private Actions

There are no known future state actions that are reasonably certain to occur within the proposed action area.

11. South Range Acquisition Area (SRAA)

11.1 General Description of Area

The South Range Acquisition Area (SRAA) is located in central Oahu (Figure 1.a). SRAA is bordered on the north by Schofield Barracks Military Reservation (SBMR), to the east by SBMR and Wheeler Army Air Field (WAAF), to the south by Del-Monte Fields and TNC Honouliuli Preserve, and to the west by the Waianae Mountains. Non-military uses include guided hikes and environmental education by The Nature Conservancy of Hawaii on the Honouliuli Preserve portion of the parcel.

11.2 Current Military Training

The South Range Acquisition Area is a proposed new land acquisition. No military training by Legacy forces has previously occurred. All SBCT construction and training activities will be the first military use of this land; however, a portion of the existing Schofield Barracks South Range is included in the SRAA AA. For a complete description of current military training at Schofield Barracks South Range go to Current Military Training (**Section 10. 2**).

11.3 Proposed Transformation Actions at SRAA

11.3.1 Construction

The following two projects will be located on the South Range Acquisition Area south of SBMR:

South Range Multi-Purpose Qualification Range (QTR2)(57462). This complex supports qualification for:

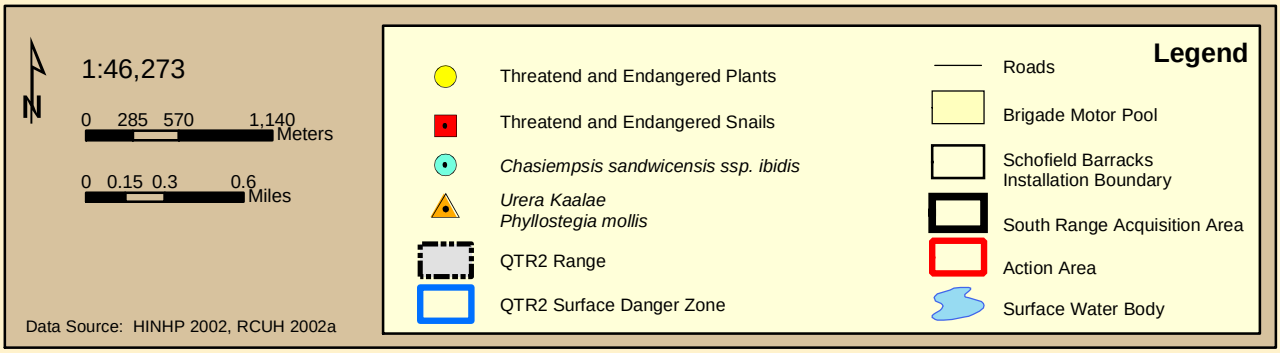
- Pistol (38 cal, 9mm, 45 cal)
- Shotgun and rifle (M16, M4, M14 sniper rifle)

This project will construct a qualification training range (QTR) complex to support marksmanship training of the 25th ID (L) (Figure 11.a). No tracer ammunition will be used at the proposed QTR2 or on South Range Acquisition Area. Ten lanes will be for modified record fire, and 16 lanes will be standard automated combat pistol qualification course, for a total of 26 firing points. Primary facilities include all construction within the perimeter of the range complex, and a control tower, maintenance building, a latrine, a bleacher enclosure, personnel and vehicle firing positions, vehicle range access and target service roads, target maintenance trails, limit markers, lane markers, site improvements, earthwork, site drainage, range flagpole, erosion control, and information systems. Supporting facilities include all construction outside the perimeter of the range complex and consist of electric service, security fencing, area and security lighting; electrical transformers; storm drainage; information systems; and site improvements.

This project is required to provide weapons qualification training to units of the 25th ID (L). Units utilizing this type of range are Active Army, National Guard and Reserve. No facility of this type currently exists at any Army installation on the islands of Oahu or Hawaii. The Range and Training Land

Proposed Location of Qualification Training Range (QTR) and Brigade Motor Pool, South Range Acquisition Area, Oahu	Figure 11a

Maps to sensitive resources have been removed from this document
Contact sjoe@hawaii.edu to request access



Program Development Plan (RTLP DP) for the 25th ID(L) identifies a required throughput of 184,000 soldiers for M16 qualification, and 55,200 soldiers for combat pistol qualification course training. This project, in conjunction with QTR1 at McCarthy Flats (PN 57461) will support the required throughput as defined in the Range Development Plan (RDP).

Training at QTR2 is anticipated to disturb approximately 49 ha (120 ac). The proposed range would be used between 180 and 240 days per year. No combat vehicles would be used. Five to ten support vehicles would be used per training event per day.

Brigade Motor Pool (55269). This project will construct a brigade consolidated maintenance facility consisting of standard organizational and direct support vehicle maintenance shops (Figure 11.a). The facility includes new tactical equipment maintenance shops with repair bays and separate administrative area, shop control, overhead cranes; petroleum, oil and lubricants (POL) facilities; deployment equipment storage facilities; oil-water separators; hardstand and organizational vehicle parking areas. Supporting facilities include: water, sanitary sewer, storm drainage, electric service, exterior lighting, fire protection and alarm systems, telephone, paving, walks, curbs, gutters, parking, roadways, information systems, and site improvements. Construction of these new facilities is required to bring the motor pools up to current army standards and also to accommodate the future needs of the Army's Transformation mission. The vehicle maintenance shop will support maintenance personnel and parking for the unit's estimated 1354 vehicles.

11.3.2 Live-Fire Range Use

All live-fire activities will take place at the new qualification training range (QTR2). Live-fire use will be ball ammunition with small arms. All tracers are prohibited due to fire risk and 5.56 and 9mm ball ammunition have a very low potential for starting fires. Table 11.a presents proposed ammunition usage by range for SRAA. Since the QTR2 is a backup range for direct fire weapons, it would not be used as much as the proposed QTR1 range at Schofield Barracks. The frequency of use for the QTR2 would be approximately 150 days per year. Since there would be no dud-producing munitions used on this range, approximately 210 days would remain for the QTR2 SDZ to be accessed freely for natural resources management. In accordance with the description of proposed training at the QTR2 and considerations associated with the QTR2 SDZ, the Nature Conservancy of Hawaii (TNC) would be able to have unlimited and continuous access to the Honoluliuli Preserve via the future proposed firebreak.

Table 11.a. Proposed Ammunition Usage by Range for SRAA*.

	FY 05 Projection Transformed			Net Difference With Transformation
Range and Ammunition Type	1 Legacy Brigade & 1 SBCT	Other Units	Total	All Rounds
QTR2				
5.56mm	1,159,760	0	1,159,760	not applicable
9mm	17,613	0	17,613	not applicable

* This comparison of current and transformed ammunition usage is projected for FY 05 based on Draft STRAC (Standards in Training Commissions) information. (John Gallup and Associates product 10/16/02).

The following rules for allowable and prohibited live fire and pyrotechnics use would apply at SRAA[39]:
Restrictions

- No tracers would be allowed at SRAA; ammunition is restricted to ball only.
- Weapons to be fired on the QTR2 range would be only direct-fire weapons (rifles, pistol, shotgun).
- No indirect fire weapons (howitzer canons (artillery), mortars) would be used.
- No training, including mounted and dismounted maneuvers, would be allowed outside of the future planned firebreak road.
- All training would be regulated by the fire danger rating system for SRP.
- Under the lowest fire danger category all weapons authorized for use at SRP would be allowed.
- Ball ammunition would be allowed on the QTR2 range under the highest fire danger category because the range will be heavily manicured to minimize the spread and intensity of any fire and ball ammunition has an extremely low ignition probability.
- Smoking would be restricted to designated areas away from vegetation fuels next to the forest.

Pyrotechnics

- Pyrotechnics would be restricted under the middle category, and all ignition sources including smoking and cooking/warming fires, but not including ball ammunition, will be restricted under the highest fire danger rating system.

11.3.3 Non Live-Fire Maneuver and Other Training Activities

The South Range Acquisition Area primarily supports qualification range usage and the proposed brigade motor pool. No other facilities are currently planned for construction. Non live-fire training activities in the proposed parcel include mounted and dismounted maneuvers, the use of maneuver corridors, and small unit activities such as bivouac, and combat service support operations in agricultural areas at lower elevations. Areas would be accessed using existing roads and trails, and limited off-road maneuvers may occur.

11.3.4 Summary of Changes in Training Activities as a Result of Transformation

Small-arms, live-fire qualification range and non live-fire activities will be concentrated at lower elevations, with potential for dismounted maneuvers and small unit activities all within the proposed future firebreak. No tracer ammunition will be used at the proposed range. Vehicular access above the developed (formerly agricultural) area is nonexistent.

11.4 Delineation of the Action Area

11.4.1 Approach to Delineating the Action Area

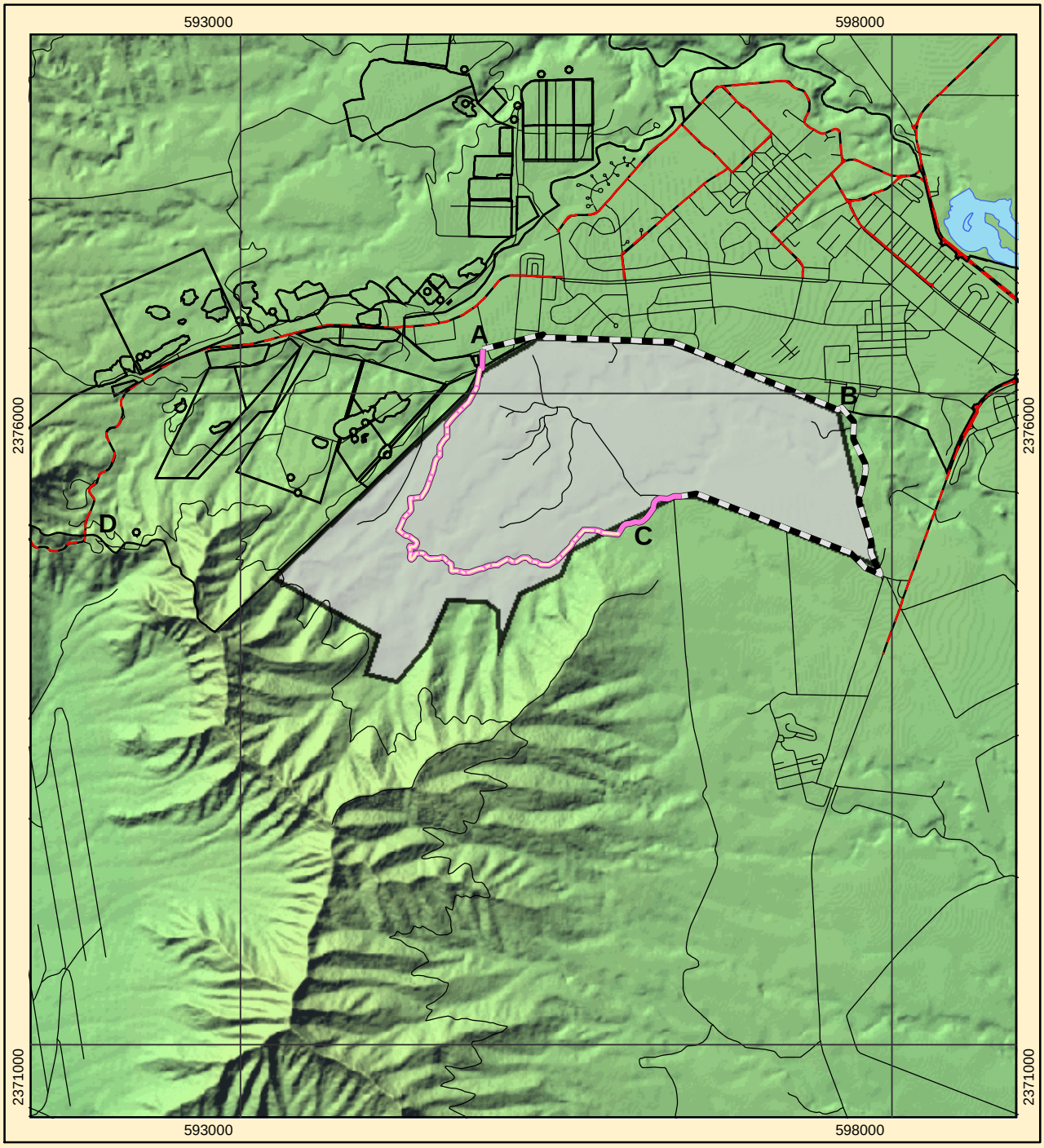
The action area for the SRAA was determined entirely by the impact of fire. While other impacts may occur due to trampling, dust, noise and other factors, fire is the most far reaching of any of these because of its ability to move across the landscape. For this reason, the action area was delineated using barriers to fire as the primary criteria (Figure 11.b). The only factor considered in delineation of the SRAA action area is man-made barriers to fire. These include several agricultural roads, a proposed firebreak on the west side of the parcel, and Lymann Road. Access to all areas of the perimeter is facilitated by roads.

[39] Discussed at Action Area meeting for the SRAA held February 25, 2003 and attended by Army, FWS, and CEMML

Action Area Delineation

South Range Acquisition Area, Oahu

Figure 11b



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0 400 800 1,600 Meters

0 0.25 0.5 1 Miles

Data Source: Center for Environmental Management of Military Lands

Action Area Inputs

Firebreak

Roads

Schofield Barracks Ranges

South Range Acquisition Area

Legend

Firebreak

Primary Roads

Other Roads

Surface Water Body

Ignition sources are limited to muzzle flash, smoking, and pyrotechnics. No tracers will be allowed at SRAA. All training will be subject to the same FDRS as implemented at SBMR.

11.4.2 Sections of the Action Area

The factors considered in delineation of the SRAA action area are man-made and topographic barriers. The man-made barriers include several agricultural roads, the South Range perimeter road, and Lymann Road.

11.4.3 Description of Action Area

Points listed below appear in Figure 11.b:

A to B – The action area follows Lyman Road east until the intersection with a primary agricultural road that continues to the east. These are both well established roads that provide solid barriers to fire and excellent access to all forms of firefighting equipment.

B to C – From point B, the action area follows a primary agricultural road to the south until an intersection with another agricultural road that heads to the west. It then follows a secondary agricultural road to the south until it ends. The land bordering the South Range Acquisition Area in this area is currently used for pineapple plantations, which are not flammable. Should this land go out of use and become overgrown, the Army will improve these border roads to the same standards as the SBMR impact area firebreak road (20 to 30 feet wide).

C to A – The action area follows a proposed firebreak road that will encompass all of the area within SRAA that will be used for training. No training will occur outside of the firebreak (pers. comm., Ron Borne). The firebreak will be built to standards as outlined in the WFMP. The majority of the break will follow existing agricultural roads and will, for the most part, separate the grassy benches from the forest. The firebreak will be completed prior to the first day of training. It will continue across the entire western boundary of the action area until it reaches point A.

11.5 Description of the Affected Biological Environment and Affected Species

Although Army training and transformation to a Stryker Brigade Combat Team takes place within the boundaries defined in the introduction (section 1.2), for purposes of this BA, and consistent with USFWS recommendations, the “action area” is considered the biological environment affected by either direct, indirect, or interrelated/interdependent effects of the proposed action.

11.5.1 Ecological Zones Affected by the Action

There are no native natural community types found in the South Range Acquisition Area. The area is dominated by alien vegetation with no native ecosystems remaining (Figure 11.c).

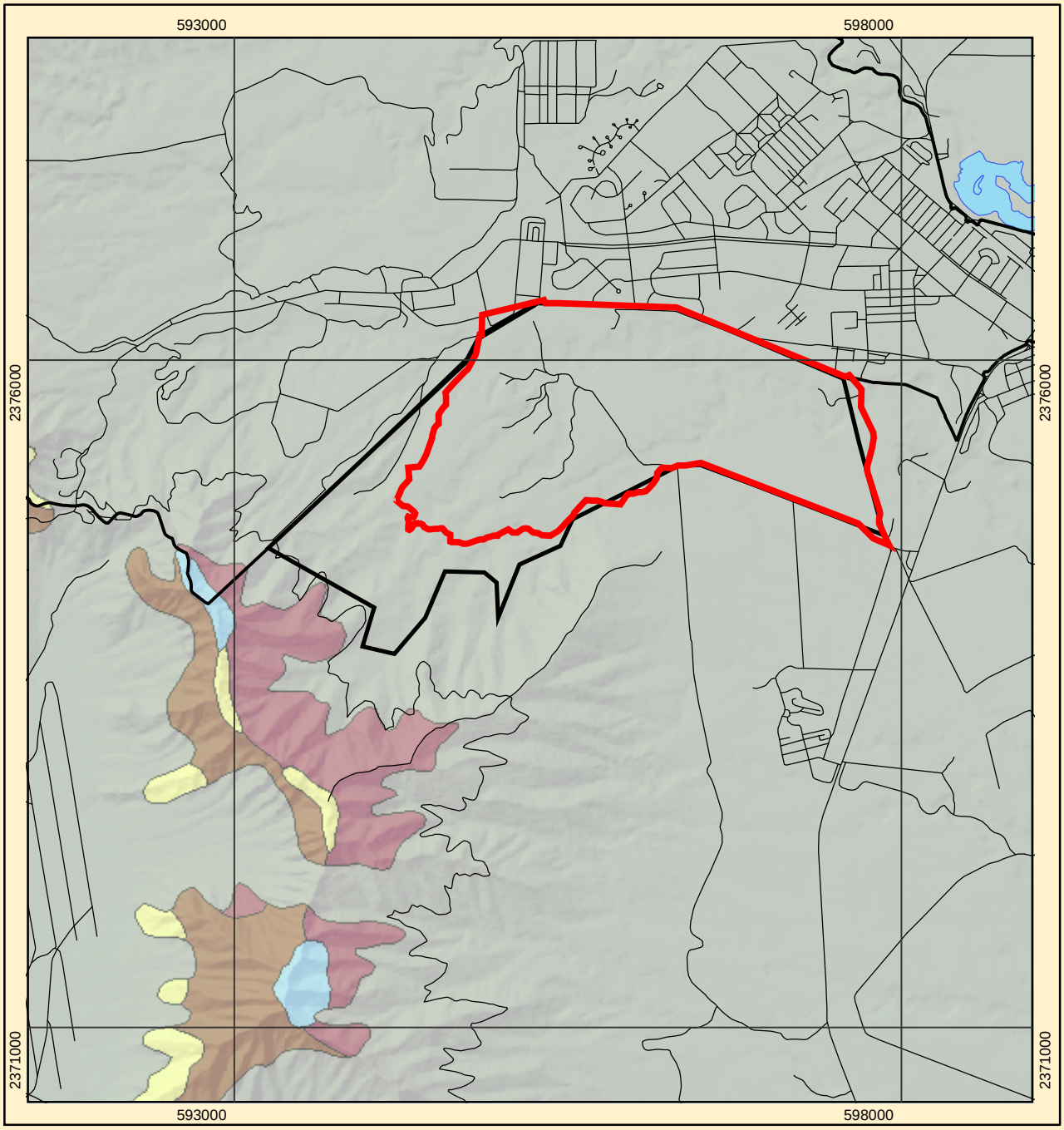
11.5.2 Federally-listed Species Affected by the Action

The first step in determining which species may be affected by military training and SBCT transformation activities at the South Range Acquisition Area was to compile available rare species occurrence data for Army Lands on Oahu. The resources for this data included the Army Natural Resource Geographic Information System (GIS), the Hawaii Natural Heritage Program (HINHP) Database, the USFWS recovery plans, the Research Corporation - University of Hawaii (RCUH) 2001 final report, the Makua Military Reservation Implementation Plan Draft documents and information from biological experts.

Ecological Zones

South Range Acquisition Action Area, Oahu

Figure 11c



N

1:47,000

0 250 500 1,000 Meters

0 0.25 0.5 1 Miles

Data Source: HINHP 2002, RCUH 2002a

Legend

- Roads
- Schofield Barracks Installation Boundary
- South Range Acquisition Area
- Action Area
- Surface Water Body
- Dry Cliff
- Lowland Dry Shrubland & Grassland
- Lowland Mesic Forest & Shrubland
- Lowland Wet Forest & Shrubland
- Nonnative

Army Natural Resource Staff conducts rare plant, invertebrate, and vertebrate surveys annually to confirm existing population numbers and locate unreported populations. The most current and detailed data available was used from these various sources. Once compiled, these data were sorted by area, and a new list included only those threatened and endangered species within the designated South Range Acquisition Area action area. No federally listed species currently or historically have been found in the SRAA action area.

11.6 Minimization of Potential Negative Effects of the Action

To quantify the beginning threat level for each potential effect of the action and the remaining threat following minimization action, a relative numerical threat value system is used. Threat values assigned to each potential effect are 0 = none, 1 = very low, insignificant and discountable (1-10% vulnerability), 2 = low (11-25% vulnerability) 3 = moderate (26-50% vulnerability) 4 = high (51-75% vulnerability) and 5 = very high (>75% vulnerability). These threat values have been developed for use in our discussion as a means of comparing threats posed to threatened and endangered species in portions of the action area relative to other portions of the action area. They measure the risk of each event occurring in a given area. The reasoning behind the assignment of each value is discussed under each section below.

Minimizing the potential negative effects of military training and SBCT transformation activities involves implementing actions to lessen the amount of negative impact that the action may cause. Minimization is important for reducing the potential negative impact to listed species, but it also can work to reduce the size of the action area, which in turn can reduce the number of species affected by the action. The potential negative effects of military training and SBCT transformation at South Range Acquisition Area AA that received threat values greater than (1) very low, insignificant and discountable are discussed along with proposed minimization actions. Minimization actions may result in the modification of threat values downward. Table 11.b at the end of this section, summarizes the resulting (modified) threat values following minimization actions. Modified threat values of less than low (2) are **not likely to adversely affect any federally-listed species or adversely modify critical habitat in the action area**. Potential effects which are assigned modified threat values greater than or equal to low (2) are **likely to adversely affect federally-listed species or adversely modify critical habitat** and these are in **bold** type in Table 11.b.

11.6.1 Direct Effects

11.6.1.1 SBCT Construction Projects

South Range Multi-Purpose Qualification Range. The primary facilities associated with this project are small foot prints in lower elevation areas dominated by alien species (Figure 11.a). The QTR range itself is the closest of the facilities to any federally listed species. It is about 1.2 km from the closet elepaio record, 1.5 km to the closest *Achatinella mustelina* population/occurrence, and about 1.6 km to the closest listed plants (*Urera kaalae* and *Phyllostegia mollis*). Thus, no federally listed species will be impacted by this construction.

Brigade Motor Pool. The brigade motor pool is located in the northern portion of the SRAA AA, in lower elevation areas dominated by alien species (Figure 11.a). Elepaio is the closest federally listed species, which is about 2.25 km away.

11.6.1.2 Fire from Current Military Training and SBCT Transformation

Ignition sources at SRAA include pyrotechnics, smoking, muzzle flash (from ball ammunition), sparks from construction activities and equipment, and catalytic converters. Though live fire exercises will occur

at SRAA, no tracers will be authorized. Rainfall averages approximately 50 inches per year (Giambelluca *et al.* 1986), with winter months typically wetter than the summer. Winds are usually dominated by trades out of the northeast. Average wind speed as measured at the SBMR RAWS is 4.3 mph, and the average maximum wind speed is 8.2 mph. Average temperature is 71 degrees F and average maximum and average minimum temperatures are 80 and 61 degrees F, respectively. Average relative humidity is 81% and average maximum and average minimum relative humidity's are 95% and 57%, respectively.

Fire vulnerability is defined as the risk of fire ignition combined with the risk of fire spread as determined by characteristics of the vegetation and climate (Figure 11.d). All of SRAA is considered to be at **moderate (3) vulnerability** to fire. The vegetation is composed almost exclusively of the fire prone grasses and eucalyptus. However, training will be restricted to ball ammunition live fire exercises, and all training will occur within the bounds of the SRAA firebreak reducing the chance of damaging fire significantly.

Methods to minimize the negative effects of fires on threatened and endangered species will be documented in the finalized Wildland Fire Management Plan, Pohakuloa and Oahu Training Areas, scheduled to be completed by September, 2003. Components of the WFMP important in Section 7 consultations with the USFWS are included in the BA (Fire History, Protected Species, Firebreak System, Fuels Management, Enforcement, Ignition Control, Fire Danger Rating System, Fire Reporting and Notification Procedures, Records and Fire Reports, and Departmental Responsibilities). The fire management plan defines the responsibilities of Range Control personnel and military training units for the prevention and suppression of fires at the SRAA. This plan also outlines the prevention and suppression measures that must be carried out to train at the SRAA. The Army will reinitiate consultation with the USFWS if a fire escapes the installation boundary OR the action area OR escapes or starts outside the firebreak. The main action at SRAA to minimize impacts will be the implementation of a fire danger rating system that will restrict training according to weather and fuel conditions. This fire danger rating system will be the same as that employed at SBMR. Fuels management may be considered as well, including chemical and mechanical means of fuel reduction and prescribed burning.

After these fire minimization actions are implemented, threats are projected to be reduced from moderate (3) to low (2) in SRAA AA (Table 11.b).

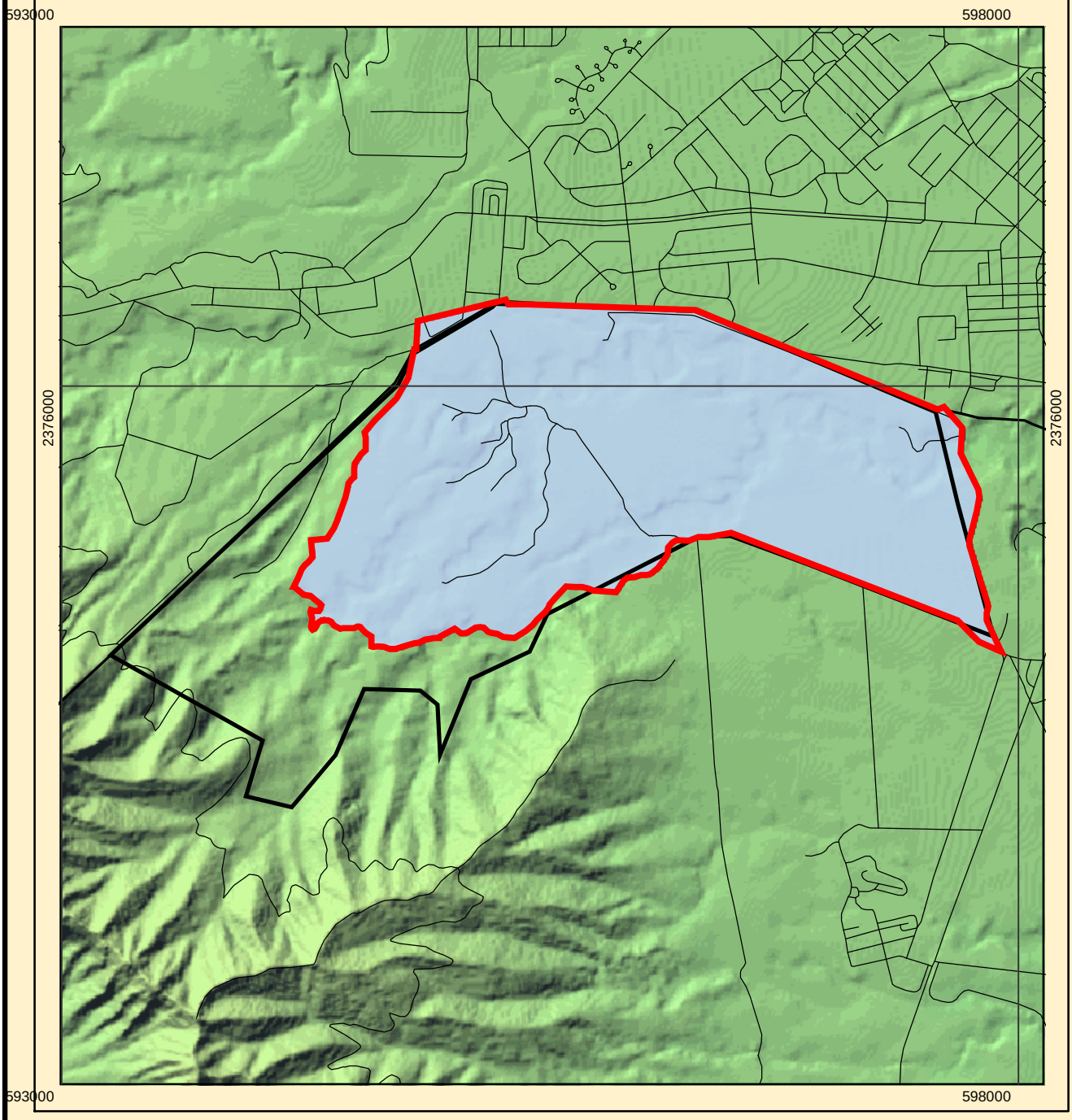
11.6.1.3 Alien Plant Introductions via Current Military Training and SBCT Transformation

The probability of alien plants becoming established depends on the type of weed species being introduced (e.g., dry, mesic, or wet forest species) and the proximity of suitable environments and/or plant communities to the action area or point of introduction of the species. The SRAA action area contains only alien dominated areas. **The dry alien dominated areas have a high threat level (4) of alien species becoming established.** This is because alien dominated areas are generally lower and closer to training activities, so the distance between the point of introduction and the location of a similar habitat type would be small compared to wetter habitats. Also, there is a greater chance of a weed becoming established that would impact dry forests than mesic forests, and mesic vs. wet forests because training areas are located in habitat more similar to the xeric environments.

Fire Vulnerability Areas

South Range Acquisition Action Area, Oahu

Figure 11d



1:32,000

0 280 560 1,120 Meters

0 0.125 0.25 0.5 Miles

Data Source: Center for Environmental Management of Military Lands

Legend

Fire Vulnerability

- Moderate
- Action Area
- Surface Water Body
- Roads
- Schofield Barracks Military Reservation
- South Range Acquistion Area

This threat should be reduced from high (4) to moderate (3) for alien dominated areas by doing the following:

- The Army will prevent any weeds brought in by training activities from becoming established by rigorously monitoring using transects and roadside surveys and eradicating new weeds using the most effective means known specific to each of the invasive species. Refer to the pest management sections of the Oahu INRMP (CEMML 2001) for possible treatments for eradication. Detailed methods for the monitoring and eradication of alien plants will be developed as part of the Oahu IP.
- The Army will provide education regarding cleaning vehicles and field gear (these education materials will be Service approved).
  The Army will wash vehicles in the wash rack facility prior to returning to Oahu from the Pohakuloa Training Area (PTA), to minimize weeds (e.g., fountain grass).
- Persons and equipment coming from foreign countries must go through U. S. Department of Agriculture and U.S. Customs inspections before coming into the United States.
- The Army will train and require soldiers to clean their gear and vehicles when first arriving in Hawaii and prior to moving from installation to installation on Oahu, as well as when moving from Oahu to the island of Hawaii or vice versa.

11.6.1.4 Alien Animal Introduction via Current Military Training and SBCT Transformation

The chance of an introduced animal establishing a viable population would be lower than for plants since they would require at least two reproductive viable individuals or a single impregnated female individual to be introduced. **The threat of an alien animal species being introduced at SRAA from Army training and transformation is moderate (3).**

This threat should be reduced from moderate (3) to low (2) by doing the following:

- To minimize animals (e.g., invertebrates) from coming back to Oahu from the Pohakuloa Training Area (PTA), the Army will wash vehicles in the wash rack facility at PTA prior to returning.
- Persons and equipment coming from foreign countries must go through U. S. Department of Agriculture and U.S. Customs inspections before coming into the United States.
- The Army will provide education regarding cleaning vehicles and field gear.
- The Army will brief soldiers on alien reptilian species and request that all snake and lizard sightings be reported to Army Environmental office.
- The Army has developed and distributed brown tree snake response and alert posters which inform the public about the potential for a brown tree snake introduction with rapid response measures and numbers to call in case of a sighting.
- The Army established the Brown Tree Snake Response Plan for rapid response to and interdiction of brown tree snakes introduced to Army Lands on Oahu.
- The Army is a member and will continue active participation in the Oahu Invasive Species Committee (OISC). This is a voluntary partnership of private, governmental and non-profit organizations and individuals united to prevent new invasive species infestations on the island of Oahu, to eradicate incipient invasive species, and to stop established invasive species from spreading.
- Herpetofauna certification program will be developed as part of the implementation process for plant material purchased by the Department of Defense, to prevent incidental introductions of herpetofauna to the island of Oahu.
- Establish the phytosanitation certification program developed the Draft Makua IP (Makua Implementation Team 2002).

- Coordinate/collaborate with the Toxicants Working Group in an effort to determine a safe toxicant for controlling populations of newly established invertebrates.
- Use environmentally safe toxicants for alien species control or eradication associated with military operations or natural resource management.
- If a new introduction of an alien animal is found, the source and time of the introduction will be identified, and the area will searched and treated with an appropriate environmentally safe toxicant to eradicate any other individuals of the target species that may be present. In addition, an area deemed adequate to cover the potential dispersal distance of the new alien animal will be searched and treated as well.
- Pursue support, implementation and funding for the licensing and application of a more toxic rodenticide, and towards broad scale distribution of rodenticides to improve rat control in remote areas, especially in areas with threatened and endangered species.

11.6.1.5 Trampling from Current Military Training and SBCT Transformation

Trampling of threatened and endangered species is presently not a concern in the SRAA because there are none known in the area. **Therefore, a threat value of none (0) is assigned to trampling by military sources at SRAA AA.**

11.6.1.6 Noise from Current Military Training and SBCT Transformation

Noise is an unwanted sound. It is generated from a source (e.g., explosion) as a wave of energy, which diminishes with distance. The only potential concern related to noise from Army activities is the potential effect on vertebrate species. Since there are presently no listed vertebrates in the SRAA AA, noise is not a concern in this area. **Therefore, a threat value of none (0) is assigned to noise from military sources at SRAA AA.**

11.6.2 Direct Interrelated Action and Effect

None in SRAA action area

11.6.3 Direct Interdependent Actions and Effects

11.6.3.1 Range Maintenance and Construction Alien Plant Introductions

Range development projects are interdependent actions with interdependent effects. These projects have a similar potential of affecting listed species through alien introductions as do other Army activities, because they occur in the same areas. **Therefore, the threat values for alien species introductions via range maintenance and construction is moderate (3).**

Most of the range construction is done in-house by the Army and involves road construction and maintenance with crushed rock from the Kolekole Rock Crushing Quarry at Schofield Barracks. Since the rock is obtained from Schofield Barracks, the likelihood of a weed species foreign to Hawaii being in the material is negligible. However, sometimes sand is purchased for different projects and the sand could introduce new weeds. The Army will minimize this threat by conducting weed monitoring using transects and roadside surveys and eradicating new weeds using most effective means known specific to each of the invasive species. Refer to the pest management sections of the Oahu INRMP (CEMML 2001) for possible treatments for eradication. Detailed methods for the monitoring and eradication of alien plants will be developed as part of the Oahu IP. **Therefore, the threat value should be reduced from moderate (3) to low (2) for mesic and wet forest species (Table 11.b).**

11.6.3.2 Integrated Training Area Management (ITAM) Program

This program is designed to monitor and mitigate erosion and loss of vegetative cover, which is essential for human safety and realism in training. ITAM workers revegetate areas, which have been heavily used for training. The ITAM program has the potential to introduce alien plant and animal species to South Range Acquisition Area via this work. **The initial threat value assigned to the ITAM program projects is low (2), because of the overall beneficial nature of the work they conduct, and because they work mostly in areas already heavily impacted by human development, dominated by alien plant species, and far away from federally listed species (including roadsides, LZ's, and maneuver areas).**

ITAM staff coordinate with Army Natural Resource Staff to select native species for outplanting. They purchase plants from native plant nurseries on Oahu. The plants are not delivered until the day before they are planted, to reduce the risk of contamination by alien species. Native plants are always the first alternative because they have the greatest likelihood of successful establishment. In some cases native species are not commercially available, more specifically grasses for Landing Zones. In those cases they coordinate with Army Natural Resource Staff to select something non-invasive, naturalized, and which already occur near the outplanting site. Detailed methods for the monitoring and eradication of alien plants will be developed as part of the Oahu IP.

This potential threat will be further reduced by doing the following:

- Get weed free certification from native plant nurseries for all plants purchased by ITAM for revegetation.
- When using grass seed to revegetate an area, ITAM will periodically monitor these areas for invasive weeds, and remove all non-target introductions from the area before establishment.

In light of the precautions that are taken in choosing revegetation material and proposed actions to reduce the risk of a new introduction, the modified threat value assigned to the ITAM program projects is very low (1), insignificant and discountable.

11.6.3.3 Natural Resources Program

The Nature Conservancy currently provides protection to the listed species in the Honouliuli Preserve portion of SRAA, which will eventually be purchased by the Army. The Army's Natural Resources component of the Ecosystem Management Program provides protection to the listed species at SBMR in conjunction with military training there. Ecosystem level management at SBMR includes surveys, monitoring, propagation, storage, and reintroduction of rare plants; surveys, monitoring, and protection of rare invertebrates; surveys and monitoring of rare vertebrates; ungulate, weed, and rodent control, and control of alien invertebrates and associated diseases. Natural resource workers could potentially introduce weed species via field vehicles or gear during management. Landing zone and disturbance corridor surveys are also conducted in areas where there is a high potential for alien species introduction via their program. **These potential adverse impacts are assigned an initial value of low (2).** However, NRS workers are trained to be very conscious and careful of weed threats, and take precautions such as cleaning gear and vehicles prior to entry into the field. **Therefore, the initial threat value assigned to the natural resources program was modified to very low (1), insignificant and discountable.**

11.6.3.4 Alien Species Introduction by Recreation Use

Alien Animal Introduction. Public access to the preserve, access to the preserve by TNC employees and by other land managers (i.e., Estate of James Campbell, Del Monte, Inc., ranchers), and public access on roads outside the preserve boundaries are all potential non-military points of animal introductions at SRAA. Also, alien animal species may disperse (usually by flying) into new uninhabited areas within the

subinstallation or action area, or the smaller species may be blown in by winds. The likelihood of human-induced introductions via recreation activities is lower than from military sources because of the lower frequency of use of the area for these purposes. **The threat of alien animal introduction by recreational use is therefore very low (1), insignificant and discountable, and requires no further minimization.**

Alien Plant Introduction. Volunteer-guided hikes on trails in the Honouliuli Preserve increase the risk of alien introductions along these trails. However, TNC limits numbers and educates hikers about low impact use of the preserve, including protocols to prevent alien species introductions. Also, the Hawaiian Trail and Mountain Club and the Sierra Club are allowed access without a TNC sponsor. These clubs are given access because they have demonstrated responsible trail use of the area even before TNC was managing it. They also have hike leaders that assume responsibility for the groups. These limitations and hiking restrictions on the preserve should keep the negative impact from human use low. **The threat of alien plant introduction by recreational use is therefore very low (1), insignificant and discountable, and requires no further minimization.**

11.6.4 Indirect Effects

11.6.4.1 Spread of Alien Species by Fire into Dry (nonnative) Communities

The threat values for secondary weed spread are based on the assumption that fire occurs in the area, and are similar to those described above for direct weed introductions from military training and SBCT transformation in dry (nonnative) communities, high (4).

This indirect threat from military training and SBCT transformation at SRAA should be reduced from high (4) to moderate (3) as a result of the following:
The Army will prevent secondary weed spread from fire by rigorously monitoring and eradicating newly dispersed weeds. Detailed methods for the monitoring and eradication of alien plants will be developed as part of the Oahu IP.

11.6.4.2 Potential increased impacts from pigs in SRAA

There are potential short-term increased impacts from pigs initially in the higher elevation areas to the west of the SRAA. This will be a result of noise from use of the small arms QTR2 range (rifle, shotgun, and pistol) for an estimated 150 days per year. Noise from initial use of the QTR2 range may scare pigs into higher elevations, but the pigs will likely become acclimated to the noise over time and less disturbed by the noise. The use of the QTR2 range will also mean that natural resource management activities, including feral ungulate control, will not be conducted within the SDZ for the QTR2 range for 150 days each year. The SDZ for the QTR2 range will not extend into the Honouliuli Preserve and therefore, pig control can continue in this area. This increased threat is considered low (2) given that the initial impact would be short-lived, and there would still be 215 days a year to control pigs in the area of the QTR2 range SDZ.

This threat should be reduced from low (2) to very low (1), insignificant and discountable by doing the following:

- Establish and evaluate permanent ungulate monitoring transects and determine where pig activity is the greatest to the west of the SRAA.
- Monitor listed species populations to the west of the SRAA for ungulate activity.
- Coordinate ungulate monitoring results with The Nature Conservancy of Hawaii's ungulate monitoring.

- Apply pig control to the areas to the west of the SRAA to significantly reduce the pig populations prior to the use of the QTR2 Range.
- Continue pig control in the SRAA area and in managed areas around rare plant populations during the 215 days available for pig control.
- Establish exclosures around populations of rare plants prior to construction of any planned fence units, if monitoring determines it is necessary.

Table 11.b. Potential Effects of Army Activities at South Range Acquisition Area, Hawaii.

Effect Type	Potential Effect/Threat[1]	Initial Threat Value[2]	Modified Threat Value with Minimization[3]
Direct	**Fires from military activities**	3	2
Direct	**Alien plant introduction to nonnative communities**	4	3
Direct	**Alien animal introduction**	3	2
Direct Interdependent	**Range maintenance and construction, plant introduction**	3	2
Direct Interdependent	Integrated Training Area Management	2	1
Direct Interdependent	Natural Resources Program	2	1
Indirect effects	**Spread of alien species by fire into nonnative communities**	4	3

[1] Potential effects in bold type are those which are assigned modified threat values ≥ to low (2). These are likely to adversely affect federally-listed species or adversely modify critical habitat.
[2]0 = none, 1 = very low, insignificant and discountable (1-10% vulnerability), 2 = low, (11-25% vulnerability), 3 = moderate, (26-50% vulnerability), 4 = high, (51-75% vulnerability), and 5 = very high, (>75% vulnerability)
[3]Modified threat values of less than low (2) are not likely to adversely affect any federally-listed species or adversely modify critical habitat in the action area. Potential effects assigned modified threat values greater than or equal to low (2) are likely to adversely affect federally-listed species or adversely modify critical habitat.

11.7 Other Army Consultations for Listed Species at SRAA

The parcel is only proposed for purchase, so there are no other Army consultations to date.

11.8 Cumulative Effects

Cumulative effects include the effects of future State local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the Endangered Species Act.

11.8.1 Future State Actions

There are no known future state actions that are reasonably certain to occur within the proposed action area.

11.8.2 Future Private Actions

Future private actions at SRAA AA include:

- The purchase of South Range Acquisition Area for military use, thereby removing this land from management by The Nature Conservancy.

SRAA Action Area will not be addressed further in this BA because it has been determined that the area is already heavily impacted by human development and dominated by alien plant species, and there are no federally-listed species there.

12. Other Transformation Project Locations

The following Army Transformation projects are located within highly developed, disturbed, currently paved, and/or urbanized areas on several DoD facilities on Oahu.

Wheeler Army Airfield (WAAF)

Wheeler Army Airfield (WAAF) is located in central Oahu on the Schofield Plateau between SBMR and East Range. Primary access is via the H-2 Freeway and Kamehameha Highway. WAAF is bordered to the east by the East Range, to the north by private lands, to the west by SBMR and the Kunia Field Station (KFS), and to the south by Waikakalaua Ammo Storage Tunnels Site (WASTS), private, and state lands. WAAF ranges from 220 to 255 m (720 to 835 ft) in elevation (Shallenberger 1977).

WAAF consists of 1,389 acres, providing administration, housing, maintenance, training, and flight facilities for peacetime mission requirements, including security and law enforcement support. Additionally, the Directorate of Logistics, Munitions Branch operates an ammunition supply point at WAAF. Army and Air Force use the upper airfield at WAAF for aviation activities. It is also a storage and maintenance site for Army helicopters. The lower airfield is abandoned (Environmental Impact Study Group 1977). An Environmental Impact Statement for U.S. Army Support Command Hawaii was conducted in 1977 and included botanical surveys of the Wheeler subinstallation (Environmental Impact Study Corporation 1977). The WAAF site was described as highly disturbed and cultivated. The vegetation as a result did not depict any native vegetation communities in Hawaii (Environmental Impact Study Corporation 1977). These botanical surveys were intended to describe the flora and major vegetation zones, and to locate any rare and endangered plants present. No federally protected plant species were discovered in these surveys at WAAF. The 25th Infantry Division Aviation Brigade consists of two aviation battalions, one reconnaissance squadron, one medical evacuation company, and one aviation intermediate maintenance company. The Aviation Brigade is equipped with 108 helicopters, 280 land vehicles, and 1,000 soldiers who work at WAAF and are housed there and at SBMR (USACE 1994).

Upgrade Wheeler Army Airfield for C-130 Operations (Project 57405)
The proposed project would repair the existing 212-meter by 255-meter (694-foot by 837-foot) aircraft parking apron. Repair would strengthen the apron to accommodate C-130 aircraft staging operations for the proposed life cycle of WAAF. Strengthening the taxiway and parking pad for WAAF are included in this project. An apron is roughly an airfield equivalent to a shoulder on a roadway. The apron, like a roadway shoulder, frees the runway for continuous use during loading and unloading. This proposed project would be sited on the apron on the west side of WAAF just north of Airdrome Road. Apron pavement at Wheeler AAF is currently deteriorated due to age and usage. C-130 transport aircraft currently use the facility in support of the SBCT, 25th ID(L) training and rapid deployment. The apron areas are structurally inadequate for loading C-130 aircraft. The present condition of the pavement restricts and renders costly airfield operations.

Multiple Deployment Facility at Wheeler Army Airfield (Project 57422)
The proposal is to construct a Multiple Deployment Facility (MDF) to support deployments from multiple airfields. The current facilities are temporary structures and are not efficient for deploying troops to combat from multiple airfields. The facility would be approximately 90,697 square feet in size. The facility includes a deployment marshalling area, pre-fabricated guardhouses and document control station, wash rack, de-fuel shed, scale houses, joint inspection area, vehicle maintenance shelter, vehicle holding area, alert holding area (AHA) and contingency warehouse. An additional ammunition supply point (ASP) scale area is provided to support Stryker vehicles that are processed through the MDF and proceed

to the ASP site to be loaded with ammunition. These vehicles are re-weighed at the ASP scale area, and the information is processed at the existing Building 1551 and transmitted to the AHA facility. Three existing buildings will be demolished as part of this project. Supporting facilities include; water, sanitary sewer, storm drainage, electric service, exterior lighting, fire protection alarm systems, telephone, paving, fencing, parking, information systems and site improvements. Much of the sewer, water, and storm drain lines are new. Sustainable design elements will be incorporated in the facility. This proposed facility would be on a previously disturbed site south of Airdrome Road on an abandoned airstrip at WAAF.

Hickham Air Force Base (HAFB)
Hickham Air Force Base is on the south side of Oahu approximately nine miles west of downtown Honolulu. It consists of 2,850 acres of land and facilities, sharing its runways with adjacent Honolulu International Airport (HIA). HAFB and HIA constitute a single airport complex operated under a joint-use agreement. Currently, the Army uses Building 1138 at HAFB to conduct military troop rigging as part of joint deployment training.

Troop Rigger Facility (Hickam Air Force Base) (Project 56691)
This project funds the Army portion of a jointly funded Army/Air Force Joint Mobility Complex (JMC) at Hickam Air Force Base, which is a main southern strategic airlift base. The project would construct a 10,872 square foot two-story troop rigging facility as an integral component of the JMC. It would include parachute packing, parachute repair, rig supply and equipment, drying tower, administration and storage room facilities. This proposed facility would be sited on HAFB between the existing taxiway and an existing football field along Moffet Street.

For these projects at Wheeler Army Airfield and Hickham Air Force Base, it has been determined that the SBCT Transformation will not result in any changes to the areas affected by construction or result in any adverse affects to federally listed species. These areas are already heavily impacted by human development, are dominated by alien plant species, and there are no known federally listed species present.

13. Stabilization Actions

13.1 Determining Action Area Taxa Requiring Stabilization

The U.S. Fish and Wildlife Service defined stabilization as the point at which a taxon has adequate numbers and populations, to either halt the decline, or increase the existing numbers and/or populations. What is required for stabilization, depends on the life history and type of organism in question. However, the criteria for stabilizing a species are less stringent than the criteria for delisting (recovering) a species. Refer to the Draft Implementation Plan (IP) for Makua Military Reservation (Makua Implementation Team 2002) for criteria for recovery. Stabilization of a taxon will be conducted for species that are determined to be of special consideration. There are different thresholds used to determine whether plant, snail and bird taxa covered in the BA are of special consideration. These thresholds are based on the number of individuals of the taxon in the action area, the percentage of the total remaining individuals this number represents, and the status of the taxon outside the action area. The criteria and thresholds for stabilization are discussed in the section that follows.

13.1.1 Determining Plant Taxa Requiring Stabilization

Plant taxa are considered to be of special consideration if they meet criterion 1 and/or 2 below. The U.S. Fish and Wildlife Service established these criteria for plants, which were set forth in the Makua Military Reservation Biological Opinion 1999. These are the general criteria, but each species will be assessed individually and the criteria may change. Additional factors may need to be considered for certain species such as severe threat levels and life history characteristics (obligate outcrossing, dioecy, vegetative reproduction, infrequent or inconsistent flowering, large percentage of non-flowering or non-fruiting plants, low seed set or poor seed viability, tendency for large declines or fluctuations in population size, persistence of the seed bank, or other taxon-specific considerations), which will increase the likelihood of some plant species requiring stabilization.

Criterion 1
Less than three populations of the taxon exist, consisting of 25 (for long-lived perennials), 50 (for short-lived perennials), or 100 (for annuals) reproductive individuals each and each population is naturally reproducing.

And/Or

Criterion 2
More than 50% of known individuals occur within the action area regardless of stability.

*Exception: Taxa with less than 1% of known individuals occurring within the action area do not require stabilization.

For plant taxa, stabilization involves securing three populations, which consist of 25 reproducing individuals (for long-lived perennials) and 50 reproducing individuals (for short-lived perennials). These populations must be naturally reproducing, must have all major threats controlled and must be fully represented in an *ex situ* collection.

13.1.2 Determining Which Animal Taxa Require Stabilization

While the stabilization trigger for plants is clear-cut based on past consultations with the U.S. Fish and Wildlife Service, such guidelines are not available for animal species. There are no available guidelines

for determining stability of animal populations, or if and what animals require special consideration due to Army training and transformation impacts. The Draft Makua Implementation Plan (IP) (Makua Implementation Team 2002) requires that there be 10 populations of 300 snails to consider *A. mustelina* stable. These 10 populations represent the 8 evolutionarily significant units identified through genetic analysis. None of the *Achatinella* spp. are close to being stable given these criteria. They suffer from severe predation and have extremely low reproductive rates. In addition, they are difficult and costly to captively propagate. Consequently, the stabilization trigger to determine if *Achatinella* spp. require special consideration should be more stringent than that used for plants. Similarly, the stabilization trigger for the Oahu elepaio should consider other important ecological attributes for assessing the stability of populations, including available critical habitat and distribution patterns. While a stabilization strategy for elepaio should include stable populations or metapopulations on the windward and leeward sides of both the Ko`olau and Wai`anae Mountains, and there should be no loss of habitat supporting these populations, the size of the population necessary to be considered stable must still be determined.

13.1.3 Stabilization Summary

The information in Table 13.a below was used to determine which taxa require stabilization. This table summarizes taxon status in and out of the action areas and statewide. The table also notes whether three stable populations of the taxon exist out of the action areas. It also presents the percentage of individuals of each taxon occurring in each of the action areas. **Species of special consideration indicated in bold type in Table 13.a must be stabilized by the Army to offset any potential negative impacts from military training and SBCT transformation activities on Oahu**. The final two columns indicate which taxa require stabilization from the Makua Military Reservation Section 7 Consultation for Routine Training and which require stabilization as a result Section 7 Consultation on Routine Training and Army Transformation at Dillingham Military Reservation (DMR), Kahuku Training Area (KTA), Kawailoa Training Area (KLOA), Schofield Barracks East Range (SBER), Schofield Barracks Military Reservation (SBMR), and South Range Acquisition Area (SRAA). Ten species from this consultation overlap with Makua stabilization taxa (nine from SBMR and one from KLOA). The stabilization strategies from the Makua BA will be implemented for these species, thus reducing the energy and financial burden involved in stabilizing these species. However, these ten species were analyzed for stabilization needs before the action areas for the other six Oahu installations were identified. Four of these species (*Cyanea grimesiana* ssp. *obatae*, *Flueggea neowawraea*, *Phyllostegia kaalaensis*, and *Schiedea kaalae*) may require additional conservation measures, since one or more of the population units identified for management for the Makua IP now occur within an action area that was not included in the assessment of impacts in the Makua consultation, and therefore will now receive less credit (see Table 13.b for credit summary). Thirty taxa require stabilization that are unique to this consultation including three species from KTA, 21 species from KLOA, 16 species from SBER, and nine species for SBMR.

13.2 Population Units for Plant Taxa

This consultation adopts the use of the term “population unit” as it is used for the Draft Makua IP (Makua Implementation (IP) Team 2002). The population unit (PU) is used in lieu of a population because of the lack of basic biological information to determine what constitutes a population for each of the federally-listed plant species from the action areas. A population unit is briefly defined in the Makua IP glossary as: individuals of a target taxon occurring at a discrete site separated by significant topographic barriers or habitat discontinuities from other individuals of that taxon, or occurring >1000 m (3280 ft) apart (Makua IP Team 2002). A PU can be comprised of one or more element occurrences found within 1000 m (3280 ft) of each other. Generally, members of a PU share a common habitat and are equally subject to impacts from fire, alien species, as well as major climatic events such as hurricanes that may affect that local habitat. The Draft Makua IP also investigates the possibility of conducting minimum viable population analyses for the target taxa, but there is simply not enough biological information available to do so.

Table 13.a. Endangered Species Status and Stabilization on Oahu Army Lands, Hawaii[1].

Species Name	Action Area	Number of individuals in AA	Number of individuals in subinstallation portion of AA[2]	Number of individuals on other lands in AA[3]	Total # individuals in all Oahu Army training and transformation AAs	Number of individuals statewide	Number of stable populations outside AA (For plants only HPPRCC standards)	% of remaining known individuals in AA (rounded to nearest %)	Makua AA stabilization species	Oahu Army training and transformation AA stabilization species
Plants:										
Abutilon sandwicense	**MMR**	**4**	**1**	**3**	**14**	**<300**	**1**	**5%**	**No**	**Yes**
Abutilon sandwicense	**SBMR**	**10**	**0**	**10**						
Alectryon macrococcus* var. *macrococcus	**MMR**	**71**	**17**	**54**	**93-96**	**329-334**	**0**	**28-29%**	**Yes**	**Yes**
Alectryon macrococcus* var. *macrococcus	**SBMR**	**22-25**	**20-22**	**2-3**						
Alsinidendron trinerve	**SBMR**	**72**	**72**	**0**	**72**	**87-89**	**0**	**81-83**	**No**	**Yes**
Chamaesyce rockii	**KLOA**	**416**	**386**	**30**	**441**	**561-621**	**1**	**71-79%**	**No**	**Yes**
Chamaesyce rockii	**SBER**	**25**	**5**	**20**						
Cyanea acuminata	**KLOA**	**20-25**	**19-24**	**1**	**84-89**	**100**	**0**	**84-89%**	**No**	**Yes**
Cyanea acuminata	**SBER**	**2**	**2**	**0**						
Cyanea acuminata	**SBMR**	**62**	**62**	**0**						
Cyanea crispa	**KLOA**	**5**	**5**	**0**	**5**	**29**	**0**	**17%**	**No**	**Yes**
Cyanea grimesiana* ssp. *Obatae	**MMR**	**8**	**8**	**0**	**9**	**18**	**0**	**50%**	**Yes**	**Yes**
Cyanea grimesiana* ssp. *Obatae	**SBMR**	**1**	**0**	**1**						
C. humboldtiana	KLOA	2	2	0	2	175-325	2	0.6-1.1%	No	No
Cyanea koolauensis	**KTA**	**4**	**4**	**0**	**36**	**80**	**0**	**45%**	**No**	**Yes**
Cyanea koolauensis	**KLOA**	**23**	**23**	**0**						
Cyanea koolauensis	**SBER**	**9**	**9**	**0**						
Cyanea st. johnii	**KLOA**	**4**	**4**	**0**	**4**	**48**	**0**	**8%**	**No**	**Yes**
Cyrtandra dentata	**KLOA**	**71**	**71**	**0**	**423**	**423**	**0**	**100%**	**Yes**	**Yes**

Table 13.a. Endangered Species Status and Stabilization on Oahu Army Lands, Hawaii[1].

Species Name	Action Area	Number of individuals in AA	Number of individuals in subinstallation portion of AA[2]	Number of individuals on other lands in AA[3]	Total # individuals in all Oahu Army training and transformation AAs	Number of individuals statewide	Number of stable populations outside AA (For plants only HPPRCC standards)	% of remaining known individuals in AA (rounded to nearest %)	Makua AA stabilization species	Oahu Army training and transformation AA stabilization species
Cyrtandra dentata	**MMR**	**352**	**352**	**0**						
Cyrtandra subumbellata	**SBER**	**6**	**6**	**0**	**6**	**108**	**1**	**6%**	**No**	**Yes**
Cyrtandra viridiflora	**KLOA**	**28**	**28**	**0**	**29**	**52-53**	**0**	**55-56%**	**No**	**Yes**
Cyrtandra viridiflora	**SBER**	**1**	**1**	**0**						
Delissea subcordata	**MMR**	**15**	**15**	**0**	**19**	**44**	**0**	**43%**	**Yes**	**Yes**
Delissea subcordata	**SBMR**	**4**	**2**	**2**						
Diellia falcata	MMR	332-352	212	120-140	403-425	5,540	>3	7-8%	No	No
Diellia falcata	SBMR	71	61	10						
Eugenia koolauensis	**KTA**	**154**	**129**	**25**	**154**	**158**	**0**	**97%**	**No**	**Yes**
Flueggea neowawraea	**MMR**	**8**	**8**	**0**	**11**	**93-117**	**0**	**9-12%**	**Yes**	**Yes**
Flueggea neowawraea	**SBMR**	**3**	**1**	**2**						
Gardenia mannii	**KTA**	**2**	**2**	**0**	**52**	**70-100**	**0**	**52-74%**	**No**	**Yes**
Gardenia mannii	**KLOA**	**44**	**44**	**0**						
Gardenia mannii	**SBER**	**2**	**2**	**0**						
Gardenia mannii	**SBMR**	**4**	**4**	**0**						
Hesperomannia arborescens	**KLOA**	**70**	**70**	**0**	**120**	**127**	**0**	**94%**	**No**	**Yes**
Hesperomannia arborescens	**SBER**	**46**	**46**	**0**						
Hesperomannia arborescens	**SBMR**	**4**	**0**	**4**						
Isodendrion longifolium	SBER	10	10	0	21	<1,000	3	2%	No	No
Isodendrion longifolium	SBMR	11	0	11						
Labordia cyrtandrae	**SBMR**	**14**	**14**	**0**	**14**	**18**	**0**	**78%**	**No**	**Yes**
Lepidium arbuscula	MMR	80	80	0	140	<900	3	16%	No	No

Table 13.a. Endangered Species Status and Stabilization on Oahu Army Lands, Hawaii[1].

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Lepidium arbuscula	SBMR	60	60	0						
Lobelia gaudichaudii* ssp *koolauensis	**SBER**	**50-80**	**50-80**	**0**	**50-80**	**<280**	**2**	**18-29%**	**No**	**Yes**
Lobelia oahuensis	MMR	1	1	0	2	110	0	<1%	No	No
Lobelia oahuensis[4]	SBMR	1	1	0						
Melicope lydgatei	**KLOA**	**39**	**39**	**0**	**39**	**39**	**0**	**100%**	**No**	**Yes**
Myrsine juddii	KLOA	5	5	0	5	500-3000	1	<1%	No	No
Phlegmariurus nutans	**KLOA**	**4**	**3**	**1**	**5**	**7**	**0**	**71%**	**No**	**Yes**
Phlegmariurus nutans	**SBER**	**1**	**1**	**0**						
Phyllostegia hirsuta	**KLOA**	**10**	**8**	**2**	**104**	**150-200**	**0**	**52-69%**	**No**	**Yes**
Phyllostegia hirsuta	**SBER**	**21**	**21**	**0**						
Phyllostegia hirsuta	**SBMR**	**73**	**73**	**0**						
Phyllostegia kaalaensis	**MMR**	**14-19**	**14-19**	**0**	**24-29**	**30-35**	**0**	**80-83%**	**Yes**	**Yes**
Phyllostegia kaalaensis	**SBMR**	**10**	**0**	**10**						
Phyllostegia mollis	**SBMR**	**1**	**1**	**0**	**1**	**35**	**0**	**3%**	**No**	**Yes**
Plantago princeps	**MMR**	**26**	**26**	**0**	**46**	**146-196**	**1**	**23-32%**	**Yes**	**Yes**
Plantago princeps	**SBMR**	**20**	**20**	**0**						
Pteris lidgatei	**KLOA**	**5**	**5**	**0**	**18**	**33**	**0**	**55%**	**No**	**Yes**
Pteris lidgatei	**SBER**	**13**	**13**	**0**						
Sanicula purpurea	**KLOA**	**18**	**8**	**10**	**40**	**181-261**	**1-2**	**15-22%**	**No**	**Yes**
Sanicula purpurea	**SBER**	**22**	**22**	**0**						
Schiedea hookeri	MMR	50-55	50-55	0	65-70	220-330	3	20-32%	No	No
Schiedea hookeri	SBMR	15	5	10						
Schiedea kaalae	**MMR**	**3**	**0**	**3**	**4**	**23-24**	**0**	**17%**	**Yes**	**Yes**

Table 13.a. Endangered Species Status and Stabilization on Oahu Army Lands, Hawaii[1].

Species Name	Action Area	Number of individuals in AA	Number of individuals in subinstallation portion of AA[2]	Number of individuals on other lands in AA[3]	Total # individuals in all Oahu Army training and transformation AAs	Number of individuals statewide	Number of stable populations outside AA (For plants only HPPRCC standards)	% of remaining known individuals in AA (rounded to nearest %)	Makua AA stabilization species	Oahu Army training and transformation AA stabilization species
Schiedea kaalae	**SBMR**	**1**	**1**	**0**						
Tetraplasandra gymnocarpa	KTA	4	4	0	20	<200	5	10%	No	No
Tetraplasandra gymnocarpa	KLOA	13	13	0						
Tetraplasandra gymnocarpa	SBER	3	1	2						
Viola chammisoniana* ssp. *chammisoniana	**MMR**	**250**	**250**	**0**	**269**	**370**	**1**	**73%**	**Yes**	**Yes**
Viola chammisoniana* ssp. *chammisoniana	**SBMR**	**19**	**19**	**0**						
Viola oahuensis	**KLOA**	**92**	**92**	**0**	**97**	**180**	**2**	**54%**	**No**	**Yes**
Viola oahuensis	**SBER**	**5**	**5**	**0**						
Snails:										
Achatinella apexfulva	**KLOA**	**1**	**1**	**0**	**1**	**1**	**NA**	**100%**	**No**	**Yes**
Achatinella byronii/decipiens	**KLOA**	**300**	**298**	**2**	**314**	**324**	**NA**	**97%**	**No**	**Yes**
Achatinella byronii/decipiens	**SBER**	**14**	**10**	**4**						
Achatinella curta	**KLOA**	**5**	**5**	**0**	**5**	**5**	**NA**	**100%**	**No**	**Yes**
Achatinella leucorraphe	**SBER**	**1**	**1**	**0**	**1**	**1**	**NA**	**100%**	**No**	**Yes**
Achatinella lila	**KLOA**	**27**	**3**	**24**	**27**	**50**	**NA**	**54%**	**No**	**Yes**
Achatinella livida	**KLOA**	**141**	**39**	**102**	**141**	**141**	**NA**	**100%**	**No**	**Yes**
Achatinella pulcherrima	**KLOA**	**3**	**3**	**0**	**3**	**3**	**NA**	**100%**	**No**	**Yes**
Achatinella sowerbyana	**KLOA**	**265**	**195**	**70**	**266**	**266**	**NA**	**100%**	**No**	
Achatinella sowerbyana	**SBER**	**1**	**1**	**0**				**<1%**		**Yes**
Achatinella mustelina	**MMR**	**430**			**605**	**950**	**NA**	**64%**	**Yes**	**Yes**
Achatinella mustelina	**SBMR**	**175**	**168**	**7**						

Table 13.a. Endangered Species Status and Stabilization on Oahu Army Lands, Hawaii[1].

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Chasiempis Sandwichensis* spp. *ibidis	**SBMR**	**306**	**304**	**2**	**306**	**1,974**	**NA**	**15%**	**No**	**Yes**
Mammals:										
Lasiurus cinereus semotus	SBMR	1	1	0	1	unknown	unknown	unknown	No	No

[1]Bold text identifies species that the Army needs to stabilize to offset potential impacts from military training and SBCT transformation related activities. Makua action area stabilization species were included in this table

[2]Refers to the number of individuals on the fixed bases on Oahu Army lands (DMR, KTA. KLOA, SBER, SBMR, SRAA), within each action area.

[3]Number refers to those individuals within the boundary of the action area, but outside the subinstallation or Army land.

[4]Indivividual is extirpated.

13.3 Stabilization Strategies

Possible strategies available for stabilization include: protection of extant populations/occurrences, augmentation, reintroduction, introduction, and translocation (U.S. Army 1998). Of these alternatives, the Service has indicated to the Army that it considers only protection of extant populations/occurrences, augmentation, and reintroduction to be acceptable stabilization strategies for species in this consultation. They do not endorse the translocation of plants because it carries the highest risk of failure. They cannot endorse introduction because the establishment of a species outside its historic range is contrary to USFWS policy. Thus, for populations/occurrences that are currently stable (consisting of 25 reproducing individuals for long-lived perennials and 50 reproducing individuals for short-lived perennials), stabilization is limited to protecting and managing these populations and their surrounding habitat. For populations/occurrences that are not currently stable, augmentation may be necessary to buffer against environmental, demographic, and genetic stochasticity (U.S. Army 1998). The decision to augment carries significant biological drawbacks and benefits. It must be made after weighing both risks and benefits for each specific population in question. In other cases where there are not enough populations/occurrences to create three stable populations, reintroduction will be necessary. Each stabilization strategy varies in terms of time and money required, likelihood of success, and biological integrity. The decision of what strategy(s) to use will be difficult and will be finalized in the Oahu Army Training and Transformation Implementation Plan with Service approval. Until otherwise indicated in the implementation plan, the Army will adhere to the USFWS's guidelines in Table 13.b.

Stabilization actions for the action area taxa are already underway on Army training lands on Oahu and these are described below by individual taxon under the current management section. To achieve species stabilization, many additional stabilization actions must be implemented off site. The stabilization actions of species that overlap between Makua and this BA, were taken from the draft stabilization plan in the Draft Makua IP (Makua Implementation Team 2002). For taxa not found at Makua, the current management and a general description of the stabilization requirements are presented below, and an implementation team will write a detailed stabilization plan (implementation plan).

A population credit system is adopted as means of assessing the number of stable populations of a given plant species that are present and how many are required for stabilization. As mentioned above the U.S. Fish and Wildlife Service determined that three stable plant populations (population credits) are required for a species to be considered stabilized. Table 13.b prioritizes each type of population management action and assigns population credits based on: (1) the likelihood of success of each and (2) risk from Army training and transformation to a population/occurrence based on its location (inside or outside the action area). The total population credits should equal a minimum of three. The management of extant populations/occurrences with stable numbers and their habitat is given highest priority, followed by the management, possible augmentation, and habitat management of extant populations with less than 25 (for long lived perennials) or 50 (for short lived perennials) reproducing individuals. Reintroduction is usually the lowest priority. There is presently no assurance that fires or other threats associated with the Army activities will not reach or otherwise threaten populations/occurrences of listed species in the action areas. Consequently, populations/occurrences outside the action areas will be more likely to survive than similar populations/occurrences inside the action areas. A managed population and its habitat inside an action area will receive one-half of the population credits than a similar population outside the

Table 13.b. Plant Species Stabilization Guidelines.

Abundance Threshold	Management Method	Population Credits Action Area	
		Inside[1]	Outside[2]
Perennials Long-lived (25 individuals) Short-lived (50 individuals)	Manage Habitats and Threats	½ (0.5)	1.0
Perennials Long-lived (1 to 24 individuals) Short-lived (1 to 49 individuals)	Augment (if necessary), Manage Habitat and Threats	1/4 (0.25)	1/2 (0.50)
No populations	Reintroduce, Manage Habitat and Threats	1/6 (0.17) [3]	1/3 (0.33)
Total Population Credits		**>3.0**	

[1] Must total no more than 1 population credit in the Action Area (AA), but not 0.
[2] Must total at least 2 population credits outside of the AA.
[3] Least preferred alternative

action area (Table 13.b). This will help adjust for a difference in risk from within the action area compared to outside the action area. In addition, the Service will consider designating population units in portions of the action areas that are at lower risk from Army activities for mid-credit value toward stabilization. Army activities at higher risk to negatively impact T&E species include, but are not limited to, high fire risk activities and vehicle maneuvers. This assessment of potential mid-credit areas will be done during either the formal consultation or during the implementation process with input from the implementation team of experts and the Army's fire expert consultant.

The following discussion should help clarify Table 13.b. A population with stable numbers occurring outside the action area carries one full population credit toward the total of three stable populations (credits) required, provided the population and its habitat is protected and managed. If such a stable population were to occur within the action area it would require similar management, yet carry only one-half population credits to reflect the risk of being impacted by Army training and transformation activities. A population having numbers less than those required for stability and occurring outside the action area would require protection and habitat management and may possibly require augmentation. Such a population would carry one-half a population credit. A similar population occurring within the action area (and thus at risk) would require similar management but would carry only one-fourth a population credit. In cases where there are not enough wild populations to constitute three stable population credits, reintroduction within historic range becomes necessary. A review of past reintroduction efforts for stabilization indicates that 30% or fewer reintroduction projects are successful (U.S. Army 1998). To adjust for such risk, a reintroduced population in managed habitat occurring outside the action area would only be granted one-third credit. Reintroducing populations within the action area is the least preferred alternative as it is doubly risky, since the low success rate of reintroduction is combined with the risk to the population due to Army training and transformation impacts. Such a population only carries one-sixth credit. In all cases, the habitat of a reintroduced population will be managed and protected. Due to the risk of the Army training and transformation, no

more than one population credit for a given species can come from within the action area; the remainder must come from outside the action area and together must total a minimum of three population credits for successful stabilization.

The Army will establish multiple populations at once rather than in succession as part of a USFWS requirement. The reason for this requirement is that as a genetic advantage to the species, it provides a buffer against catastrophic environmental changes, because there is a lack of knowledge regarding the microsite needs of each species, and because of the length of time needed to determine a successful outcome (U.S. Army 1998).

These stabilization actions will be continued by the Army until all species requiring stabilization in Table 13.b have met their stabilization goals, and all other species in the action area have viable populations, or until the Army has minimized its actions on-site sufficiently to avoid all impacts to listed species.

13.4 Oahu Army Training and Transformation Implementation Plan

An implementation plan will be written to outline the specific details of the conservation actions required to balance the impacts of military training and SBCT transformation to listed species on Oahu, referred to as the Oahu IP through the remainder of this document. This plan will be developed by the Army in consultation with the USFWS. Experts will be consulted for their knowledge of habitat management and/or population biology/genetics in Hawaii. Military training/readiness requirements will be considered when planning species conservation actions. The Army will give the implementation plan to the USFWS for approval and the implementation of the plan would depend on agreement between the Army and the USFWS.

The implementation plan will include at a minimum: (1) time frame for completion of implementation; (2) identification of priority species and areas; (3) definitions of success for listed species population management and habitat management; (4) methods for collection, site selection and size, propagation, population reintroduction, and habitat management; (5) methods for monitoring, data tracking, analysis, and feedback; (6) a gross scale estimate of minimum viable population for each stabilization species (if sufficient information about target taxon biology exists); and (7) a cost estimate for implementing the plan (Makua Implementation Team 2002). One of the first actions the Implementation Team will undertake is to identify the urgent actions that the Army will implement during the planning process, to reduce the risk of impact from training activities for those populations in the highest risk areas. Many of these items have been investigated for the Makua Implementation Plan (IP) and any information overlaps should be used for the Oahu IP. The Army will develop and complete the plan within two years of the completion of the USFWS's biological opinion. The advisory implementation team will review progress annually, and make recommendations to the Army as needed to make adaptive management changes. Habitat management will occur concurrently with species-specific stabilization actions. The USFWS will have final approval as to whether changes will meet the goals of the consultation.

The implementation team will assist in identifying areas suitable for off-site stabilization actions and needed management actions within each area. Additional surveys within the subinstallations and potential off-site areas may lead to finding more suitable areas for habitat management and population reintroduction than those identified here. Surveys may discover additional populations and/or individuals of some of the listed species in this consultation. If found, changes in species status will be considered when appropriate stabilization sites and actions are identified by the implementation team. Many of the protocols, guidelines and general descriptions from the Draft Makua IP will also be used for the Oahu IP. Any deviation from the Makua IP will be justified biologically.

13.5 Protocols for Species Specific Stabilization

The detailed protocols for the species-specific stabilization put together for the Draft Makua IP will be adopted for the Oahu IP. The following protocols or guidelines are available from the Draft Makua IP: (1) intermediate and final definitions of success; (2) collection protocols to achieve the highest possible genetic representation that can be sampled within the Waianae Range; (3) outplanting protocols, including determining the adequate number of individuals to outplant to reach success, number of populations, size or life stage distribution of the population, how to achieve the highest number of individuals possible within a population, contamination issues, timing of outplanting, and site selection; and (4) monitoring and adaptive management to incorporate lessons learned (Makua Implementation Team 2002). Many of the issues regarding site selection, including habitat quality and quantity (larger for species that are more scattered), will be addressed in the implementation plan as part of the general habitat management, as appropriate for the given threats in each area.

Rare plant monitoring for existing populations/occurrences in the action areas will be done using the protocol developed by the Hawaii Rare Plant Restoration Group (HRPRG). Collection of material for propagation, storage, and population reintroduction also follows the HRPRG collection protocols. Propagation will be carried out at Lyon Arboretum, DOFAW's NIKE site in the Pahole Natural Area Reserve, the National Tropical Botanical Garden, and the Army facility at Schofield (RCUH 1998).

13.6 Taxa Stabilization Discussions

The following section describes species stability requirements on a general level. Although some specific suggestions are made for stabilization, the intention is that the Oahu Implementation Team will develop a detailed stabilization plan for the areas affected by Army training and SBCT transformation. Current status for each taxon was presented earlier in Sections 6.5, 7.5, 10.5 and 11.5, Description of the Affected Biological Environment and Affected Species.

Plants

Abutilon sandwicense

Stabilization
This taxon must be stabilized because only one stable population exists outside of the Army action areas (MMR and SBMR) at Makaha. To be considered stable, *Abutilon sandwicense* must meet the criteria required for stability of a short-lived perennial (USFWS 1998a). The Oahu Implementation Team must develop a stabilization plan for this taxon that outlines 3.0 units of credit to be conducted to achieve three stable populations and the Army must implement the plan. The management work will be conducted from Makaleha Valley east to Palikea Gulch, south to Nanakuli Valley, and Makaha-Waianae Kai Ridge in Waianae Mountains, in an area about 8 by 16 km (5 x 10 mi) (HHP 1997). The majority of the remaining individuals are from very small (<10 individuals remaining) population/occurrences (USFWS 1998a). These should be targeted in conservation efforts.

Current Management Actions
Statewide. The Nature Conservancy has been monitoring and controlling alien plants around one population of 11 *A. sandwicense* in Honouliuli Preserve at Huliwai Gulch, where they are threatened by huehue haole as well as human activity on an adjacent trail (USFWS 1998a). *A. sandwicense* has been targeted for outplanting by DOFAW at Pahole Natural Area Reserve (NAR) and has been successfully propagated at the National Tropical Botanical Garden and the Waimea Arboretum (USFWS 1998a).

Makua and Schofield Barracks Action Areas. No Army conservation actions were noted (RCUH 2001; CEMML 2001).

Additional Stabilization Needs
1) The Army will construct enclosures to protect populations against feral pigs and immature plants from military foot traffic where these threats are identified as significant. A commitment will be developed for long-term stewardship and conservation of these areas once they have been enclosed. Populations that have only a few remaining individuals will be emphasized in these efforts. 2) The Army will control competing alien plant species within enclosures, including *Schinus terebinthifolius* (Christmasberry), *Syzygium cumini* (Java plum), Koster's curse, molasses grass, and huehue haole and monitor for new introductions of alien plant species. These efforts will prioritize populations that have only a few remaining individuals (<10 remaining), which is the majority of the remaining population/occurrences, including Mt. Kaala, Puuiki Ridge, Huliwai Gulch, Makaleha, Kaawa Gulch, Waianae Kai, and Lualualei. 3) The Army will provide protection from fire as outlined in the Fire Management Plan (25th ID(L) and USARHAW 2003), where these threats are identified as significant. 4) The Army will conduct surveys for additional populations focusing on similar habitats they are known from and implement protective measures if necessary. 5) The Army will implement control measures for the black twig borer, based on further research into methods.

Alectryon macrococcus* var. *macrococcus

Stabilization
This taxon must be stabilized because no stable populations exist outside of the Army action areas (MMR and SBMR). To be considered stable, *Alectryon macrococcus* var. *macrococcus* must meet the criteria required for stability of a long-lived perennial (USFWS 1998d). The stabilization plan for this taxon from the Draft Makua IP (Makua Implementation Team 2002) must be implemented to achieve three stable populations.

Current Management Actions
Statewide. The U.S. Navy is working to control alien plants in areas where individuals of *Alectryon macrococcus* var. *macrococcus* are located at Naval Magazine Lualualei. The Navy also allows recreational hunting on its lands to control the feral pig population (USFWS 1997).

Makua and Schofield Barracks Military Reservation. Within the Makua and Schofield Barracks Military Reservation, the Army is conducting the following species-specific actions: (1) Controling rats around populations to protect mature fruit, (2) increase number of individuals represented ex-situ by collecting from other trees, (3) propagating with cuttings, air layering and grafting for genetic storage and reintroduction purposes, (4) collecting fruit for seed storage trials at the National Seed Storage Lab, (5) monitoring known populations/occurrences and protecting fruiting trees, (6) identify locations to cultivate these trees in the long-term so they can be managed for fruit production, (7) surveying for additional populations/occurrences in suitable habitats, and (8) testing insecticides effectiveness against the Black Twig Borer and support research of control methods for the Black Twig Borer and the associated fungus.

Alsinidendron trinerve

Stabilization
This taxon must be stabilized because no stable populations exist outside of the Schofield Barracks Military Reservation action areas, and because > 50% of the known remaining individuals occur within Army AAs. To be considered stable, *Alsinidendron trinerve* must meet the criteria required for stability of a short-lived perennial (USFWS 1998a). The Oahu Implementation Team must develop a stabilization plan for this taxon that outlines 3.0 units of credit to be conducted to achieve three stable populations and the Army must implement the plan. Stabilization of *A. trinerve* should include conducting additional surveys within and outside the action areas, and management efforts should focus on all extant population/occurrences remaining because of the highly concentrated distribution, small number remaining, and lack of stable populations.

Current Management Actions
Statewide. *A. trinerve* were outplanted in a fenced and managed area in the Mt. Kaala NAR in 1996, but these plants were in poor health, probably due to oversaturation and low pH in the soil (USFWS 1998a). There were >300 seedlings growing at the mid-elevation nursery at the Nike missile site in 1997 (USFWS 1998a). *A. trinerve* has been propagated at the Lyon Arboretum and the National Tropical Botanical Garden, and the Waimea Arboretum (USFWS 1998a).

Schofield Barracks Military Reservation Action Area. The Army is conducting (or planning to conduct) the following species-specific actions in the Schofield Action Area: 1) continued collection from these plants to ensure complete ex-situ representation from all known mature wild individuals, 2) monitoring known populations/occurrences and protecting fruiting trees, 3) reintroduce plants into the Mt. Ka`ala NAR with State NARS staff, 4) fence plants located between Ka`ala and Pu'u Kalena if goat control in the area does not significantly lessen the threat to this species, 5) conduct surveys for additional population/occurrences in preferred habitat, 6) contributing efforts towards long-term seed storage (RCUH 2001; CEMML 2001).

Additional Stabilization Needs
1) The Army will weed and protect all extant populations of *A. trinerve* from competing alien plant species, including possible biocontrol options for *Rubus argutus* (prickly Florida blackberry. 2) According to the USFWS (1995), fencing of individual populations is not feasible because of the steep slopes. The Army will consider strategic fencing of large areas to protect populations against feral pigs and from military foot traffic, and where enclosures are not feasible due to topography, other means of ungulate control such as hunting and snaring will be employed.

Chamaesyce rockii

Stabilization
This taxon must be stabilized because only one stable population exists outside of the Army action areas (KLOA and SBER) in the Kaluanui vicinity and because > 50% of the known remaining individuals occur within Army AAs. To be considered stable, *Chamaesyce rockii* must meet the criteria required for stability of a short-lived perennial (USFWS 1998a). The Oahu Implementation Team must develop a stabilization plan for this taxon that outlines 3.0 units of credit to be conducted to achieve three stable populations and the Army must implement the plan. Most of the management work will be conducted in KLOA and SBER in Koolau Mountains because most individuals of this taxon occur there.

Current Management Actions
Statewide. *Chamaesyce rockii* has been successfully propagated at the Lyon Arboretum (USFWS 1998a).

Kawailoa and Schofield East Range Action Areas. *Chamaesyce rockii* is represented ex-situ at the Army nursery. The Army Natural Resource Staff collected propagules for germination trials. The Helemano fence will protect many of the *Chamaesyce rockii* individuals from ungulates in KLOA when it is completed (RCUH 2001; CEMML 2001).

Additional Stabilization Needs
1) The Army will construct enclosures to protect populations against feral pigs and from military foot traffic where these threats are identified as significant. These efforts will prioritize immature plants and populations that have only a few remaining individuals (South of Puu Pauao (1 individual), North Kaukonahua (1 individual), Kawaiiki mid-reach (4 individuals)). A commitment will be developed for long-term stewardship and conservation of these areas once they have been enclosed. 2) The Army will control competing alien plant species within enclosures, including *Psidium cattleianum* (strawberry guava) and *Clidemia hirta* (Koster's curse) and monitor for new introductions of alien plants species. 3) The Army will increase number of individuals represented ex-situ by collecting from plants not represented.

Cyanea acuminata

Stabilization
This taxon must be stabilized because three stable populations do not exist outside of the Army action areas (KLOA and SBER) and because > 50% of the known remaining individuals occur within Army AAs. To be considered stable, *Cyanea acuminata* must meet the criteria required for stability of a short-lived perennial (USFWS 1998a). The Oahu Implementation Team must develop a stabilization plan for this taxon that outlines 3.0 units of credit to be conducted to achieve three stable populations and the Army must implement the plan. Stabilization of *C. acuminata* should include conducting additional surveys within and outside the action areas, and management efforts should focus on all extant population/occurrences remaining because of the highly concentrated distribution, small number remaining, and lack of stable populations.

Current Management Actions
Statewide. *C. acuminata* has been successfully propagated at the Lyon Arboretum and seeds are stored at National Tropical Botanical Garden (USFWS 1998a).

Kawailoa, Schofield East Range, and Schofield Barracks Military Reservation Action Areas. The Army is conducting (or planning to conduct) the following species-specific actions in the Schofield Action Area: 1) Erect fences around populations of *Cyanea acuminata* (RCUH 2001; CEMML 2001).

Additional Stabilization Needs
1) The Army will construct enclosures to protect populations against feral pigs and from military foot traffic where these threats are identified as significant. These efforts will prioritize immature plants and populations that have only a few remaining individuals (Kahuku (1 individual), Kawaiiki (1 individual), North of Poamoho trail (5 individuals), Helemano (1 individual), North Kaukonahua (2 individuals), South Kaukonahua (2 individuals)). Where enclosures are not feasible due to topography, other means of ungulate control such as hunting and snaring will be employed. A commitment will be established for long-term stewardship and conservation of these areas once they have been enclosed. 2) The Army will control competing alien plant species within enclosures, including *Rubus argutus* (prickly Florida

blackberry) and *Psidium cattleianum*. Again, the populations that have only a few remaining individuals will be emphasized in these efforts. 3) The Army will provide protection from fire as outlined in the Fire Management Plan (25th ID(L) and USARHAW 2003), where these threats are identified as significant (SBER AA). 4) The Army will develop and implement a rat control plan to protect existing population/occurrences of *C. acuminata*.

Cyanea crispa

Stabilization
This taxon must be stabilized because three stable populations do not exist outside of the KLOA action areas. To be considered stable, *Cyanea crispa* must meet the criteria required for stability of a short-lived perennial (USFWS 1998a). The Oahu Implementation Team must develop a stabilization plan for this taxon that outlines 3.0 units of credit to be conducted to achieve three stable populations and the Army must implement the plan. Stabilization of *C. crispa* should include conducting additional surveys within and outside the action areas, and management efforts should focus on all extant population/occurrences remaining because of the highly concentrated distribution, small number remaining, and lack of stable populations.

Current Management Actions
Statewide. *C. crispa* is being propagated at the Lyon Arboretum and the National Tropical Botanical Garden (USFWS 1998a). The Division of Forestry and Wildlife has been controlling pigs in Hidden Valley, however site visits have revealed abundant pig sign with many individuals of *Cyanea crispa* defoliated or dead (USFWS 1998a).

Kawailoa Action Area. The Army is conducting (or planning to conduct) the following species-specific actions in the Kawailoa Action Area: 1) *C. crispa* has been collected and is represented ex-situ, 2) collecting mature fruit from unrepresented individuals to build up ex-situ stock, 3) determine if rat bait stations established to protect snails in the area are adequate to protect fruiting plants and if not increase rat control efforts, 4) identify locations for future reintroductions, 5) replicate propagules at Lyon for future reintroduction (RCUH 2001; CEMML 2001).

Additional Stabilization Needs
1) The Army will construct enclosures to protect populations against feral pigs and from military foot traffic where these threats are identified as significant. These efforts will prioritize immature plants and populations that have only a few remaining individuals (Aihualama (1 individual), Maakua (1 individual), Kawaipapa (3 individuals), and Kaipapau (5 individuals). Where enclosures are not feasible due to topography, other means of ungulate control such as hunting and snaring will be employed. A commitment will be established for long-term stewardship and conservation of these areas once they have been enclosed. 2) The Army will control competing alien plant species within enclosures, including kukui, Koster's curse, and strawberry guava (USFWS 1996a). Again, the populations that have only a few remaining individuals will be emphasized in these efforts. 3) The Army will develop and implement a rat control plan to protect existing population/occurrences of *C. crispa,* 4) The Army will increase number of individuals represented ex-situ by collecting from plants not represented.

Cyanea grimesiana* ssp. *obatae

Stabilization
This taxon must be stabilized because three stable populations do not exist outside of the SBMR action areas. To be considered stable, *Cyanea grimesiana* ssp. *obatae* must meet the criteria required for stability of this short-lived perennial (USFWS 1998a). The stabilization plan in the Draft Makua IP (Makua Implementation Team 2002) must be implemented to stabilize this taxon.

Current Management Actions
Statewide. The Army and State fenced the single individual of *C. grimesiana* ssp. *obatae* in Palikea Gulch, Mt. Kaala NAR. TNCH fenced a population of 8 plants in Ekahanui Gulch and is controlling alien weeds and monitoring this population. The Department of Fish and Wildlife (DOFAW) is growing *C. grimesiana* ssp. *obatae* at the mid-elevation Nike missile site in the Waianae Mountains for planting in the Honouliuli TNCH preserve (USFWS 1998a). This species is also being successfully propagated at the National Tropical Botanical Garden and the Lyon Arboretum (USFWS 1998a).

Makua and Schofield Barracks Military Reservation. The Army with the State fenced the single individual of *Cyanea grimesiana* ssp. *obatae* in Palikea Gulch, Mt. Kaala NAR. The Army is conducting surveys for additional populations/occurrences in suitable habitat.

C. humboldtiana

This taxon will not be stabilized across its range because less than one percent of the known individuals occur in the Army AAs (KLOA). The Oahu Implementation Team may propose additional species-specific stabilization actions such as collection for genetic storage. This species may benefit from habitat level management for other Schofield and South Range Acquisition Area target taxa.

Cyanea koolauensis

Stabilization
This taxon must be stabilized because three stable populations do not exist outside of the Army action areas (KTA, KLOA, and SBER). To be considered stable, *Cyanea koolauensis* must meet the criteria required for stability of a short-lived perennial (USFWS 1998a). The Oahu Implementation Team must develop a stabilization plan for this taxon that outlines 3.0 units of credit to be conducted to achieve three stable populations and the Army must implement the plan. Stabilization of *C. koolauensis* should include conducting additional surveys within and outside the action areas, and management efforts should focus on all extant population/occurrences remaining because of the highly concentrated distribution, small number remaining, and lack of stable populations.

Current Management Actions
Statewide. No specific conservation measures have been undertaken for *C. koolauensis* statewide by other agencies (USFWS 1998a). There are no representatives of this species ex-situ (RCUH 2001).

Kahuku, Kawailoa, and Schofield East Range Action Areas. The Army monitors *C. koolauensis* population/occurrences for threats and some benefit from ungulate and weed removal in the area (RCUH 2001; CEMML 2001).

Additional Stabilization Needs
1) The Army will construct enclosures to protect populations against feral pigs and from military foot traffic where these threats are identified as significant. These efforts will prioritize immature plants and populations that have only a few remaining individuals (Lower Peahinaia trail (4 individuals), North of Kahuku Cabin Koolau summit trail (4 individuals), North Kawaiiki (5 individuals), Opaeula stream midreach (3 individuals), Helemano (3 individuals), Poamoho trail midreach (2 individuals), South Kawaiiki (2 individuals), Upper Kawailoa trail (2 individuals), Opaeula exclosure (2 individuals), South Kaukonahua (9 individuals)). Where enclosures are not feasible due to topography, other means of ungulate control such as hunting and snaring will be employed. A commitment will be established for long-term stewardship and conservation of these areas once they have been enclosed. 2) The Army will provide protection from fire as outlined in the Fire Management Plan (25th ID(L) and USARHAW 2003), where these threats are identified as significant (SBER AA). 3) The Army will control competing alien plant species within enclosures, including *Clidemia hirta*-Koster's curse and *Psidium cattleianum*-strawberry guava. Again, the populations that have only a few remaining individuals will be emphasized in these efforts. 4) The Army will collect propagation material from *C. koolauensis* population/occurrences to initiate *ex situ* propagation, emphasizing populations that have only a few remaining individuals. 5) The Army will determine the threat of rat predation on *C. koolauensis* and develop and implement a rat control plan to protect existing population/occurrences if deemed necessary.

Cyanea st. johnii

Stabilization
This taxon must be stabilized because three stable populations do not exist outside of the KLOA action areas. To be considered stable, *Cyanea st. johnii* must meet the criteria required for stability of a short-lived perennial (USFWS 1998a). The Oahu Implementation Team must develop a stabilization plan for this taxon that outlines 3.0 units of credit to be conducted to achieve three stable populations and the Army must implement the plan. Stabilization of *C. st. johnii* should include conducting additional surveys within and outside the action areas, and management efforts should focus on all extant population/occurrences remaining because of the highly concentrated distribution, small number remaining, and lack of stable populations.

Current Management Actions
Statewide. No specific conservation measures have been undertaken for *C. st. johni* statewide by other agencies (USFWS 1998a).

Kawailoa Action Area. The Army is conducting (or planning to conduct) the following species-specific actions for *C. st. johnii* in the Kawailoa Action Area: 1) collection of *Cyanea st. johnii* to build-up ex-situ stock, 2) closely monitor the population, 3) collect propagules for genetic storage and propagation (RCUH 2001; CEMML 2001).

Additional Stabilization Needs
1) The Army will construct enclosures to protect populations against feral pigs and from military foot traffic where these threats are identified as significant. Where enclosures are not feasible due to topography, other means of ungulate control such as hunting and snaring will be employed. A commitment will be established for long-term stewardship and conservation of these areas once they have been enclosed. 2) The Army will control competing alien plant species around all extant population/occurrences of *Cyanea st. johnii*, particularly *Clidemia hirta* (Koster's curse), *Axonopus fisifolius* (narrow leaved carpet grass), and *Sacciolepis indica* (glenwood grass). 3) The Army will collect propagation material from *Cyanea st. johnii* population/occurrences to initiate *ex situ* propagation,

emphasizing populations that have only a few remaining individuals. 4) The Army will reduce the threat of rat predation on *Cyanea st. johnii* through the development and implementation of a rat control plan to protect existing population/occurrences. 5) The Army will collect propagation material from *Cyanea st. johnii* population/occurrences to initiate *ex situ* propagation, emphasizing populations that have only a few remaining individuals.

Cyrtandra dentata

Stabilization
This taxon must be stabilized because three stable populations do not exist outside of the Army action areas (KLOA and MMR) and because > 50% of the known remaining individuals occur within Army AAs. To be considered stable, *Cyrtandra dentata* must meet the criteria required for stability of a short-lived perennial (USFWS 1998a). The stabilization plan in the Draft Makua IP (Makua Implementation Team 2002) must be implemented to stabilize this taxon.

Current Management Actions
Statewide. Populations in Pahole drainage were fenced and feral pigs were removed by DOFAW in 1997 (USFWS 1998a). Control by weeding of strawberry guava, Christmas berry, and Koster's curse is conducted in these and surrounding areas. *C. dentata* is propagated at the Lyon Arboretum (USFWS 1998a).

Kawailoa and Makua Action Areas. The Army is conducting (or planning to conduct) the following species-specific actions for *C. dentata* in the Kawailoa and Makua Action Areas: 1) has fenced all the known individuals of this species in MMR. This resulted in an observable increase in all size-classes (seedlings, juveniles, and mature plants) at the site. 2) weeding within the MU at Makua, with emphasis on *Clidemia hirta,* 3) monitoring for additional threats or changes in the population structure, 4) the realigning of targets and establishing firebreaks at Makua Military Reservation (WFMP, Appendix), may aid in protecting the two individuals at Kahanahaiki Gulch from the threat of fire, 5) the Kawaiiki population may benefit from construction of an exclosure for the reintroduction of *Stenogyne sherfii,* otherwise, no management actions have occurred for *C. dentata* in KLOA AA (RCUH 2001; CEMML 2001).

Cyrtandra subumbellata

Stabilization
This taxon must be stabilized because only one stable population exists outside of the SBER action area, in Punaluu Rim. To be considered stable, *Cyrtandra subumbellata* must meet the criteria required for stability of a short-lived perennial (USFWS 1998a). The Oahu Implementation Team must develop a stabilization plan for this taxon that outlines 3.0 units of credit to be conducted to achieve three stable populations and the Army must implement the plan. Since there is only one stable population of *C. subumbellata* known and those individuals remaining are confined to three population/occurrences in the North and Central Ko`olau Mountains, it is important that intensive management efforts focus on all extant populations.

Current Management Actions
Statewide. *C. subumbellata* is propagated at the Lyon Arboretum and the National Tropical Botanical Garden (USFWS 1998a).

Schofield East Range Action Area. The Army is conducting (or planning to conduct) the following species-specific actions in the Schofield Action Area: 1) Erect fences around populations of *Cyanea acuminata* (RCUH 2001; CEMML 2001).

Additional Stabilization Needs
1) The Army will control competing alien plant species (including *Clidemia hirta* (Koster's curse)) around all population/occurrences, and monitor for new introductions of alien plant species. 2) The Army will provide protection from fire as outlined in the Fire Management Plan (25th ID(L) and USARHAW 2003), where these threats are identified as significant (SBER AA). This will include developing and implementing a coordinated fire protection plan for endangered plant species on State (Kaukonahua) and private lands (Puu Ohuluhule). 3) The Army will construct enclosures to protect populations from foot traffic trampling where these threats are identified as significant. These efforts will prioritize immature plants in these areas.

Cyrtandra viridiflora

Stabilization
This taxon must be stabilized because three stable populations do not exist outside of the Army action areas (KLOA and SBER), and because > 50% of the known remaining individuals occur within Army AAs. To be considered stable, *Cyrtandra viridiflora* must meet the criteria required for stability of a short-lived perennial (USFWS 1998a). The Oahu Implementation Team must develop a stabilization plan for this taxon that outlines 3.0 units of credit to be conducted to achieve three stable populations and the Army must implement the plan. Stabilization of *C. viridiflora* should include conducting additional surveys within and outside the action areas, and management efforts should focus on all extant population/occurrences remaining because of the highly concentrated distribution, small number remaining, and lack of stable populations.

Current Management Actions
Statewide. *C. viridiflora* is propagated at the Lyon Arboretum (USFWS 1998a).

Kawailoa and Schofield East Range Action Areas. The Army has made collections from these plants and deposited them the Lyon Arboretum. This species benefits dramatically from the ` pae`ula Watershed Protection Project Fence, which surrounds nearly all the known individuals of this species in KLOA. The Army is conducting (or planning to conduct) the following species-specific actions for *C. viridiflora* in the Kawailoa and Schofield East Range Action Areas: 1) removal of pigs from pae`ula Watershed Protection Project Fence area., 2) Monitor populations of *C. viridiflora* at KLOA and SBER to determine if reintroduction is necessary to maintain viable populations and to determine other threats and address them as necessary, 3) Reintroduce populations of *C. viridiflora* (RCUH 2001; CEMML 2001).

Additional Stabilization Needs
1) The Army will construct enclosures to protect *C. viridiflora* populations against feral pigs and from military foot traffic where these threats are identified as significant. Where enclosures are not feasible due to topography, other means of ungulate control such as hunting and snaring will be employed. A commitment will be established for long-term stewardship and conservation of these areas once they have been enclosed. 2) The Army will provide protection from fire as outlined in the Fire Management Plan (25th ID(L) and USARHAW 2003), where these threats are identified as significant (SBER AA). 3) The Army will control competing alien plant species within enclosures, including *Clidemia hirta*-Koster's curse and *Psidium cattleianum*-strawberry guava. All extant population/occurrences will be weeded and monitored for new introductions of alien plants species. 4) The Army will reduce the threat of rat

predation on *C. viridiflora* through the development and implementation of a rat control plan to protect existing population/occurrences.

Delissea subcordata

Stabilization
This taxon must be stabilized because three stable populations do not exist outside of the Army action areas (MMR and SBMR). To be considered stable, *Delissea subcordata* must meet the criteria required for stability of a short-lived perennial (USFWS 1998a). The stabilization plan in the Draft Makua IP (Makua Implementation Team 2002) must be implemented to stabilize this taxon.

Current Management Actions
Statewide. Four individuals were outplanted in a fenced exclosure in Kaluaa Gulch in the Honouliuli Preserve in November 1994. Three survive, with two producing flowers and fruit, yet no recruitment has been observed. Individuals in Palawai Gulch within the Honouliuli Preserve are fenced in an exclosure that The Nature Conservancy constructed (USFWS 1998a).

Makua and Schofield Barracks Military Reservation Action Areas. The Army reintroduced *D. subcordata* to several sites within the MU at Makua in 1999. The Army is conducting (or planning to conduct) the following species-specific actions in the Makua and Schofield Action Areas: (1) continue collecting and propagating this taxon for genetic storage and reintroduction purposes, (2) monitoring known populations/occurrences, (3) surveying for additional populations/occurrences in suitable habitat, (4) constructing an ungulate-proof fence to protect the population in South Mohiakea, (5) develop and implement slug threat control at reintroduction sites and elsewhere where deemed necessary, (6) control rats around the reintroduced individuals and other population/occurrences where necessary.

Diellia falcata

This taxon will not be stabilized across its range because fifty percent of the known individuals do not occur in the Army action areas, and there are at least three stable populations of this taxon known outside the action areas (Makua and Schofield Barracks). The Oahu Implementation Team may propose additional species-specific stabilization actions such as collection for genetic storage. This species may benefit from habitat level management for other Makua and Schofield Military Reservation target taxa.

Eugenia koolauensis

Stabilization
This taxon must be stabilized because three stable populations do not exist outside of the Army action areas (KTA), and because > 50% of the known remaining individuals occur within KTA AA. To be considered stable, *Eugenia koolauensis* must meet the criteria required for stability of a long-lived perennial (USFWS 1998a). The Oahu Implementation Team must develop a stabilization plan for this taxon that outlines 3.0 units of credit to be conducted to achieve three stable populations and the Army must implement the plan. Much of the management work will be conducted in the Kahuku Training Area of the northern Koolau Mountains because most individuals of this taxon occur there. The one disjunct population is in the southeastern Koolau Mountains must also be a high priority for protection because of the potential for environmental adaptations unique to the populations.

Current Management Actions
Statewide. *Eugenia koolauensis* has been successfully propagated at the Waimea Arboretum. The Lyon Arboretum has attempted propagation, but has had no success (USFWS 1998a).

Kahuku Action Area. The Army is controlling *Ardisia elliptica* (shoebutton) near the *Eugenia koolauensis* population in KTA and has also attempted to reroute mountain bike trails away from the population (USFWS 1998a). NRS is hopeful that by removing *A. elliptica* they might promote in-situ recruitment of *E. koolauensis* in these populations. NRS is conducting (or planning to conduct) the following species-specific actions in Kahuku Training Area: (1) collection for genetic storage, (2) monitoring known populations/occurrences, (3) weed control efforts, (4) surveying for additional populations/occurrences in suitable habitat, (5) erect fences around populations of *Eugenia koolauensis* at KTA, (6) coordinate the education of motocross users and the enforcement of regulations between DPW, DLNR, and lessee (RCUH 2001; CEMML 2001).

Additional Stabilization Needs
1) The Army will control competing alien plant species (including *Schinus terebinthifolius* (Christmas berry), *Psidium cattelianum*, *Clidemia hirta*, *Ardisia elliptica* (shoebutton ardisia), and *Lantana camara* (lantana)) and monitor for new introductions of alien plants species, targeting populations that have only a few remaining individuals (Papali loop trail (1 individual) and Hanaimoa (3 individuals)). 2) The Army will provide protection from fire as outlined in the Fire Management Plan (25th ID(L) and USARHAW 2003), where these threats are identified as significant (KTA AA). 3) The Army will construct enclosures to protect populations against feral pigs and from military foot traffic where these threats are identified as significant. These efforts will prioritize immature plants and populations that have only a few remaining individuals (listed above). Where enclosures are not feasible due to topography, other means of ungulate control such as hunting and snaring will be employed. A commitment will be established for long-term stewardship and conservation of these areas once they have been enclosed.

Flueggea neowawraea

Stabilization
This taxon must be stabilized because three stable populations do not exist outside of the Army action areas (MMR and SBMR). To be considered stable, *Flueggea neowawraea* must meet the criteria required for stability of a long-lived perennial (USFWS 1999b). The stabilization plan in the Draft Makua IP (Makua Implementation Team 2002) must be implemented to stabilize *F. neowawraea*.

Current Management Actions
Statewide. One of the *F. neowawraea* plants on the Navy's Lualualei Naval Reservation has been fenced for protection from cattle and feral pigs, and alien plant removal is ongoing within the exclosure (USFWS 1999b).

Makua and Schofield Barracks Military Reservation Action Area. The Army has been experimenting with treatments to combat the Black Twig Borer on *F. neowawraea* at MMR. They also have been working with a horticulturist at the UH to root cut and graft Makua material onto a tree from Kaua`i. Fruit and cuttings from trees in Makua have been collected and deposited in the Lyon Arboretum Micro-propagation Lab and the Volcano Nursery in Hilo. The Army is conducting (or planning to conduct) the following species-specific actions: (1) propagating *F. neowawraea* for genetic storage and reintroduction purposes; (2) monitoring known populations/occurrences and, (3) surveying for additional populations/occurrences in suitable habitat, (4) attempting to hand-pollinate the Makua and Fluggea Gulch females to increase the number of fertile fruit produced, (5) continue to collect propagation

material from *F. neowawraea* population/occurrences to build-up ex-situ representation, (6) continue to control goats where they impact these trees.

Gardenia mannii

Stabilization
This taxon must be stabilized because three stable populations do not exist outside of the Army action areas (KTA, KLOA, SBER, and SBMR), and because > 50% of the known remaining individuals occur within Army AAs. To be considered stable, *Gardenia mannii* must meet the criteria required for stability of a short-lived perennial (USFWS 1998a). The Oahu Implementation Team must develop a stabilization plan for this taxon that outlines 3.0 units of credit to be conducted to achieve three stable populations and the Army must implement the plan. Much of the management work will be conducted in the Kawailoa Training Area of the Koolau Mountains because many of the populations of this taxon occur there. The only two populations located in the Waianae Mountains (Kaluaa Gulch, Honouliuli Preserve and SBMR) must also be a high priority for protection because of the potential for environmental adaptations unique to the populations.

Current Management Actions
Statewide. The Lyon Arboretum and the National Tropical Botanical Garden have successfully propagated *G. mannii,* and seeds are in storage at the National Tropical Botanical Garden (USFWS 1998a).

Kahuku, Kawailoa, Schofield East Range, and Schofield Barracks Military Reservation Action Areas. *G. mannii* has benefited from ungulate removal in the past by Army Natural Resource Staff (NRS) in the Lower Pe`ahin i`a MU at KLOA where the majority of known trees are found. Collections have been made from this population and 8% are represented ex-situ by about 25 individuals (RCUH 2001). Other species-specific actions in Kawailoa Training Area include: (1) collection for genetic storage, (2) monitoring known population/occurrences, (3) weed control efforts in the MU, (4) surveying for additional population/occurrences in suitable habitat, and (5) identify location to hold ex-situ collections so they are close to appropriate habitat and accessible to managers (RCUH 2001). The Army experimented with leg snaring to control pig populations in areas adjacent to *Gardenia mannii* individuals in Schofield Barracks Military Reservation, West Range because of the impossibility of hunting due to dangers associated with unexploded ordnance there (USFWS 1998a). Current management in Schofield includes the following species-specific actions: (1) propagating this taxon for genetic storage, (2) monitoring known populations/occurrences, and (3) surveying for additional populations/occurrences in suitable habitat ((RCUH 2001; CEMML 2001; RCUH 2002c).

Additional Stabilization Needs
1) The Army will construct enclosures to protect *G. mannii* populations against feral pigs and immature plants from military foot traffic where these threats are identified as significant (Kahuku, Kawailoa, Schofield East Range). These efforts will prioritize immature plants and populations that have only a few remaining individuals (including Mid-reach Poamoho (1 individual), Lower Peahinaia trail (8 individuals), Kawailoa trail (10 individuals), Upper Poamoho trail (3 individuals), Upper Kawainui (1 individual), Lower Helemano (10 individuals), South Kaukonahua (2 individuals), and Haleauau (4 individuals) in the Army action areas. A commitment will be developed for long-term stewardship and conservation of these areas once they have been enclosed. Populations that have only a few remaining individuals will be emphasized in these efforts. 2) The Army will control competing alien plant species within enclosures, including *Psidium cattleianum* (strawberry guava), *Clidemia hirta* (Koster's curse), *Rubus argutus* (prickly Florida blackberry), and *Schinus terebinthifolius* (Christmasberry); and monitor for new introductions of alien plants species. These efforts will also prioritize the populations that have

only a few remaining individuals. 3) The Army will provide protection from fire as outlined in the Fire Management Plan (25th ID(L) and USARHAW 2003), where these threats are identified as significant (SBER and SBMR). 4) The Army will implement control measures for the black twig borer, using the most current and affective methods available, 5) The Army will reduce the threat of rat predation on *G. mannii* through the development and implementation of a rat control plan to protect existing population/occurrences.

Hesperomannia arborescens

Stabilization
This taxon must be stabilized because three stable populations do not exist outside Army action areas (KLOA, SBER, and SBMR), and because > 50% of the known remaining individuals occur within Army AAs. To be considered stable, *Hesperomannia arborescens* must meet the criteria required for stability of a long-lived perennial (USFWS 1998a). The Oahu Implementation Team must develop a stabilization plan for this taxon that outlines 3.0 units of credit to be conducted to achieve three stable populations and the Army must implement the plan. Much of the management work will be conducted in the Kawailoa and Schofield Barracks East Range Training Areas of the Koolau Mountains because most individuals of this taxon occur there. The one disjunct population in Palikea Gulch of the Waianae Mountains must also be a high priority for protection because of unique morphological characteristics and potential for environmental adaptations unique to the population.

Current Management Actions
Statewide. *Hesperomannia arborescens* has been successfully propagated at the National Tropical Botanical Garden and the Lyon Arboretum (USFWS 1998a). The State of Hawaii has conducted periodic weed removal at the Laie population. The Maui Division of Forestry and Wildlife fenced four individuals in West Maui to protect them from pigs (USFWS 1998a).

Kawailoa, Schofield East Range, and Schofield Barracks Military Reservation Action Areas. The Army has been working with the Botany Department at UH Manoa, to provide samples of this species for pollen viability and genetic studies. The Schofield population/occurrences benefit from ungulate removal in the area. The Army is conducting (or planning to conduct) the following species-specific actions for *Hesperomannia arborescens*: (1) Erect fences around populations to protect from pigs where feasible, (2) Establish ex-situ stock of *Hesoerimannia arborescens* (RCUH 2001; CEMML 2001).

Additional Stabilization Needs
1) The Army will control competing alien plant species (including Hilo grass, Koster's curse, strawberry guava, *Tibouchina herbacea*) and monitor for new introductions of alien plants species, targeting populations that have only a few remaining individuals (Poamoho (1 individual), North Kaukonahua midreach (1 individual), North Kaukonahua upper reach (4 individuals), Kawailoa trail near Puu Kainapuaa (4 individuals), Kamananui (5 individuals), North of Kahuku cabin Koolau summit trail (1 individual), and a few in Wailua-Waiehu Ridge on Molokai and Lanilili and Keahikauo valleys on Maui. 2) The Army will provide protection from fire as outlined in the Fire Management Plan (25th ID(L) and USARHAW 2003), where these threats are indentified as significant (SBER and SBMR AA). 3) The Army will construct enclosures to protect populations against feral pigs and from military foot traffic where these threats are indentified as significant (KLOA and SBER AA). These efforts will target all known populations of *Hesperomannia arborescens*. Where enclosures are not feasible due to topography, other means of ungulate control such as hunting and snaring will be employed. A commitment will be established for long-term stewardship and conservation of these areas once they have been enclosed.

Isodendrion longifolium

This taxon will not be stabilized across its range because fifty percent of the known individuals do not occur in the AA, and there are at least three stable populations of this taxon known outside the Army action areas (Schofield Barracks east and west ranges). The Oahu Implementation Team may propose additional species-specific stabilization actions such as collection for genetic storage. This species may benefit from habitat level management for other Schofield Barracks target taxa.

Labordia cyrtandrae

Stabilization
This taxon must be stabilized because three stable populations do not exist outside of the Army action areas (SBMR), and because > 50% of the known remaining individuals occur within SBMR AA. To be considered stable, *Labordia cyrtandrae* must meet the criteria required for stability of a short-lived perennial (USFWS 1998a). The Oahu Implementation Team must develop a stabilization plan for this taxon, which outlines 3.0 units of credit to be conducted in order to achieve three stable populations and the Army must implement the plan. Stabilization for *L. cyrtandrae* must include conducting additional surveys within and outside the Schofield Barracks action area, and management efforts must focus on all extant population/occurrences remaining because of the highly concentrated distribution, small number remaining, and lack of stable populations. It will most likely include conducting stabilization measures in both the Koolau and Waianae Mountains based on the current status information for this taxon.

Current Management Actions
Statewide. Currently, the National Tropical Botanical Garden is conducting the only management for this species outside the action area. They have visited the Koolau Mountains population of *L. cyrtandrae* to collect propagules for genetic storage (USFWS 1998a).

Schofield Barracks Military Reservation Action Area. There have been no seedlings observed in these populations, but there was one juvenile (RCUH 2001). Nearby blackberry threatens the populations and ungulates threaten the accessible plants in the SBW where fencing is not yet allowed. Fencing and weeding are both difficult on the steep sides of Mt. Kaala where the remaining plants of this species are found. The Army has successfully collected propagules and the Lyon Arboretum facility has successfully grown the propagules from the populations of this species at Kaala. Individuals have also successfully been reintroduced to Mt. Kaala NAR. Management actions being conducted for this taxon by the Army include the following species-specific actions: 1) propagating this taxon for genetic storage and reintroduction purposes; 2) monitoring known populations/occurrences, 3) surveying for additional populations/occurrences in suitable habitat; and 4) outplanting into appropriate habitat (RCUH 2001; CEMML 2001).

Additional Stabilization Needs
1) The Army will construct enclosures around all remaining *L. cyrtandrae* populations to protect them against feral pigs. Where enclosures are not feasible due to topography, other means of ungulate control such as hunting and snaring will be employed. A commitment will be established for long-term stewardship and conservation of these areas once they have been enclosed. 2) The Army will control competing alien plant species within enclosures (including Christmas berry, Koster's curse, prickly Florida blackberry, and strawberry guava). All extant population/occurrences will be weeded and monitored for new introductions of alien plants species. 3) The Army will provide protection from fire as outlined in the Fire Management Plan (25th ID(L) and USARHAW 2003), where these threats are

identified as significant in SBMR AA. 4) The Army will reduce the threat of rat predation on *L. cyrtandrae* through the development and implementation of a rat control plan to protect existing population/occurrences, especially during fruiting season. 5) The Army will conduct research to develop successful methods of *ex situ* propagation of *L. cyrtandrae*. 6) The Army will collect propagation material from *L. cyrtandrae* population/occurrences to initiate *ex situ* propagation, emphasizing populations that have only a few remaining individuals.

Lepidium arbuscula

This taxon will not be stabilized across its range because fifty percent of the known individuals do not occur in the AA, and there are at least three stable populations of this taxon known outside the Army action areas (MMR and SBMR). The Oahu Implementation Team may propose additional species-specific stabilization actions such as collection for genetic storage. This species will benefit from habitat level management for other Makua and Schofield Barracks Reservation target taxa.

Lobelia gaudichaudii* ssp *koolauensis

Stabilization
This taxon must be stabilized because three stable populations do not exist outside of the Army action areas (SBER). To be considered stable, *Lobelia gaudichaudii* ssp *koolauensis* must meet the criteria required for stability of a short-lived perennial (USFWS 1998a). The Oahu Implementation Team must develop a stabilization plan for this taxon that outlines 3.0 units of credit to be conducted to achieve three stable populations and the Army must implement the plan. This management work will be conducted in the central Koolau Mountains (in the Manana Ridge system) where all the four known remaining small populations occur (USFWS 1998a).

Current Management Actions
Statewide. *Lobelia gaudichaudii* ssp *koolauensis* has been successfully propagated at the National Tropical Botanical Garden (USFWS 1998a).

Schofield East Range Action Area. This population/occurrence is located in a very rare area which is susceptible to damage and may be targeted for large-scale protection in the future (RCUH 2001). The Army NRS is conducting (or planning to conduct) the following species-specific actions in the Schofield East Range Action Area: (1) Monitor plants annually during the flowering season, (2) Collect fruit and plant material from remaining wild population for propagation, and increase ex-situ stock of *Lobelia gaudichaudii koolauensis*, (3) Reintroduce populations of *Lobelia gaudichaudii koolauensis* in suitable habitat areas from ex-situ stock and closely monitor the success of the reintroductions, and (4) Erect fence around population of *Lobelia gaudichaudii koolauensis* (RCUH 2001; CEMML 2001).

Additional Stabilization Needs
1) The Army will construct enclosures around all remaining *L. gaudichaudii koolauensis* populations to protect them against feral pigs and from military foot traffic. Where enclosures are not feasible due to topography, other means of ungulate control such as hunting and snaring will be employed. A commitment will be established for long-term stewardship and conservation of these areas once they have been enclosed. 2) The Army will control competing alien plant species within enclosures (including Koster's curse, narrow leaved carpet grass, and glenwood grass). All extant population/occurrences of *L. gaudichaudii koolauensis* will be weeded and monitored for new introductions of alien plants species. 3) The Army will provide protection from fire as outlined in the Fire Management Plan (25th ID(L) and

USARHAW 2003), where these threats are identified as significant (KLOA AA). 4) The Army will collect propagation material from *L. gaudichaudii koolauensis* population/occurrences to initiate *ex situ* propagation from all remaining populations.

Lobelia oahuensis

Stabilization is not required for this species under this consultation because it no longer occurs in the action area (Kawelo, U.S. Army, pers. comm. 2003; Lau, HINHP, pers. comm. 2003), and therefore will not be affected by the proposed action.

Melicope lydgatei

Stabilization
This taxon must be stabilized because three stable populations do not exist outside of the Army action areas (KLOA), and because > 50% of the known remaining individuals occur within KLOA AA. To be considered stable, *Melicope lydgatei* must meet the criteria required for stability of a long-lived perennial (USFWS 1998a). The Oahu Implementation Team must develop a stabilization plan for this taxon that outlines 3.0 units of credit to be conducted to achieve three stable populations and the Army must implement the plan. Stabilization of *M. lydgatei* should include conducting additional surveys within and outside the action areas, and management efforts should focus on all extant population/occurrences remaining because of the highly concentrated distribution, small number remaining, and lack of stable populations. All of the management work will be conducted in KLOA Koolau Mountains because all individuals of this taxon occur there.

Current Management Actions
Statewide. *M. lydgatei* is being propagated at the Lyon Arboretum (USFWS 1998a).

Kawailoa Action Area. The Army is conducting (or planning to conduct) the following species-specific actions in the Kawailoa Action Area: 1) monitoring populations for signs of further aphid damage and for any new threats, 2) ungulate and weed removal in the area, 3) collect fruit and plant material from remaining wild populations for propagation, and to increase ex-situ stock of *M. lydgatei*, 4) identify locations for future reintroductions, 5) collection and reintroduction (RCUH 2001; CEMML 2001).

Additional Stabilization Needs
1) The Army will conduct additional surveys for this species emphasizing areas that have not been thoroughly searched, including areas outside of action areas. 2) If no additional population/occurrences are found, the Army will conduct reintroductions outside of Army action areas. 3) The Army will construct enclosures around all remaining unfenced *M. lydgatei* populations to protect them against feral pigs and from military foot traffic. Where enclosures are not feasible due to topography, other means of ungulate control such as hunting and snaring will be employed. A commitment will be established for long-term stewardship and conservation of these areas once they have been enclosed. 4) The Army will control competing alien plant species within enclosures (including strawberry guava and Koster's curse). All extant population/occurrences of *M. lydgatei* will be weeded and monitored for new introductions of alien plants species. 5) The Army will implement control measures for the black twig borer, using the most current and affective methods available.

Phlegmariurus nutans

Stabilization
This taxon must be stabilized because three stable populations do not exist outside of the Army action areas (KLOA and SBER), and because > 50% of the known remaining individuals occur within Army AAs. To be considered stable, *Phlegmariurus nutans* must meet the criteria required for stability of a short-lived perennial (USFWS 1998a). The Oahu Implementation Team must develop a stabilization plan for this taxon, which outlines 3.0 units of credit to be conducted in order to achieve three stable populations and the Army must implement the plan. Stabilization for *P. nutans* must include conducting additional surveys within and outside the Kawailoa and Schofield East Range action areas, and management efforts must focus on all extant population/occurrences remaining because of the highly concentrated distribution, small number remaining, and lack of stable populations. Stabilization will emphasize the three sites within its historical range (Kaukonahua Ridge, Kaukonahua Gulch, and along Waikane-Schofield Trail) where in is found on Oahu.

Current Management Actions
Statewide. Propagation was attempted at the National Tropical Botanical Garden but was (USFWS 1998a).

Kawailoa and Schofield East Range Action Areas. The Army is conducting (or planning to conduct) the following species-specific actions for *P. nutans*: 1) surveying for new population/occurrences in suitable habitat, 2) update GIS database with new locations, 3) collection to understand and improve cultivation techniques, 4) propagate for genetic storage and reintroduction purposes (RCUH 2001; CEMML 2001).

Additional Stabilization Needs
1) The Army will construct enclosures around all remaining unfenced *P. nutans* populations to protect them against feral pigs and from military foot traffic. Where enclosures are not feasible due to topography, other means of ungulate control such as hunting and snaring will be employed. A commitment will be established for long-term stewardship and conservation of these areas once they have been enclosed. 2) The Army will control competing alien plant species within enclosures (including Koster's curse and strawberry guava). All extant population/occurrences of *P. nutans* will be weeded and monitored for new introductions of alien plants species. 3) The Army will provide protection from fire as outlined in the Fire Management Plan (25th ID(L) and USARHAW 2003), where these threats are identified as significant (SBER AA).

Phyllostegia hirsuta

Stabilization
This taxon must be stabilized because three stable populations do not exist outside of the Army action areas (KLOA, SBER, and SBMR), and because > 50% of the known remaining individuals occur within Army AAs. To be considered stable, *Phyllostegia hirsuta* must meet the criteria required for stability of a short-lived perennial (USFWS 1998a). The Oahu Implementation Team must develop a stabilization plan for this taxon that outlines 3.0 units of credit to be conducted to achieve three stable populations and the Army must implement the plan. Much of the management work will be conducted in Waianae Mountains, but the six populations located in the Koolau Mountains should also be a high priority for protection because of the potential for environmental adaptations unique to the populations. The ranges of *P. hirsuta* in both regions are drastically reduced from historic levels.

Current Management Actions
Statewide. One accession of seeds was made from plants on State lands in the Koolau Mountains in 1997. More than 70 individuals flowered in July in the mid-elevation Nike facility in the Waianae Mountains as a result of this effort (USFWS 1998a). The Lyon Arboretum and the National Tropical Botanical Garden have propagated this species, and seeds are in storage at the National Tropical Botanical Garden (USFWS 1998a).

Kawailoa, Schofield East Range, and Schofield Barracks Military Reservation Action Areas. Ungulates (goats and pigs) have threatened *P. hirsuta* at SBMR. Goats are being controlled but no fencing can be built because of unexploded ordnance (UXO) concerns. The Army is conducting (or planning to conduct) the following species-specific actions: (1) Establish a healthy stock of ex-situ *Phyllostegia hirsuta* for reintroduction, (2) Erect fences around populations of *Phyllostegia hirsuta* where feasible and where the threat from ungulates is the greatest, (3) Monitor populations for ungulate activity and if it becomes too invasive, then remedial measures will be implemented to reduce grazing pressure on these plants, and (4) Control weeds to favor fruit production of *Phyllostegia hirsuta* (RCUH 2001; CEMML 2001).

Additional Stabilization Needs
1) The Army will construct enclosures to protect *P. hirsuta* populations against feral pigs and military foot traffic where these threats are identified as significant (foot maneuvers in Kawailoa and Schofield East Range). These efforts will prioritize populations that have only a few remaining individuals (including South Haleauau (3 individuals), Kawaiiki (2 individuals), Opaeula (2 individuals), Helemano (2 individuals), Upper Poamoho (1 individual), North Kaukonahua (2 individuals), and Lower Peahinaia trail (1 individual) in the Army action areas. A commitment will be developed for long-term stewardship and conservation of these areas once they have been enclosed. Populations that have only a few remaining individuals will be emphasized in these efforts. 2) The Army will control competing alien plant species within enclosures, including Christmas berry, Koster's curse, lantana, prickly Florida blackberry, and strawberry guava; and monitor for new introductions of alien plants species. These efforts will also prioritize the populations that have only a few remaining individuals. 3) The Army will provide protection from fire as outlined in the Fire Management Plan (25th ID(L) and USARHAW 2003), where these threats are identified as significant (SBER and SBMR).

Phyllostegia kaalaensis

Stabilization
This taxon must be stabilized because three stable populations do not exist outside of the Army action areas (MMR and SBMR). To be considered stable, *Phyllostegia kaalaensis* must meet the criteria required for stability of a short-lived perennial (USFWS 1998a). The stabilization plan in the Draft Makua IP (Makua Implementation Team 2002) must be implemented to stabilize this taxon.

Current Management Actions
Statewide. A population of this taxon is protected within the State's Pahole Natural Area Reserve ungulate exclosure. The State has also collected cuttings from the populations of this taxon that lie within the Pahole NAR, and has them in cultivation at the Pahole mid-elevation propagation facility. In addition, a historical location of this taxon is within an exclosure constructed by the Nature Conservancy of Hawaii at Ekahanui Gulch. There are no known extant individuals at this site. The Waimea Arboretum and the National Tropical Botanical Garden have propagated this species (USFWS 1998a).

Makua and Schofield Barracks Military Reservation Action Area. There is no ongoing management for *Phyllostegia kaalaensis* in the SBMR action area because there are no extant populations or any historical records of this taxon from the SBMR portion of the action area. The following are proposed species-specific actions the Army may use for the benefit of existing population/occurrences of *Phyllostegia kaalaensis*: 1) Construct enclosures to protect populations against feral pigs, 2) Control competing alien plant species within enclosures, 3) Provide protection from fire (USFWS 1998a).

Phyllostegia mollis

Stabilization
This taxon must be stabilized because three stable populations do not exist outside of the Army action areas (SBMR). To be considered stable, *Phyllostegia mollis* must meet the criteria required for stability of a short-lived perennial (USFWS 1998a). The Oahu Implementation Team must develop a stabilization plan for this taxon that outlines 3.0 units of credit to be conducted to achieve three stable populations and the Army must implement the plan. Stabilization of *Phyllostegia mollis* should include conducting additional surveys within and outside the Schofield Barracks action area, and management efforts should focus on all extant population/occurrences remaining because of the highly concentrated distribution, small number remaining, and lack of stable populations. *Phyllostegia mollis* has already been extirpated from two Hawaiian islands and the Koolaus on Oahu.

Current Management Actions
Statewide. The Palawai population is located within the boundaries of a fenced exclosure built by TNCH (USFWS 1998a). No other on-the-ground management actions are known for this species outside of the work that Army NRS is doing in Schofield Barracks. This species is being successfully propagated at the Lyon Arboretum and the National Tropical Botanical Garden (USFWS 1998a).

Schofield Barracks Military Reservation Action Area. There are two sites with *P. mollis* in Schofield (RCUH 2001). One at SBW had six individuals, but one was uprooted by pigs in 2001. There was also a spider mite infestation discovered in 2000. Spider mites are considered non-lethal in the wild, but there is no known method of controlling these arthropods in a forest area setting, making this threat difficult to manage against. There is also one population of two individuals known from SBS. This population is not fenced and pig sign has been noted in the past. Weeds are considered a high threat due to the multiple canopy and understory weeds around the plants. Falling rocks also have been noted as a potential threat. Plants at the Lyon Arboretum are from four of the known individuals on Schofield. The Army is conducting (or planning to conduct) the following species-specific actions: (1) establish exclosures for controlling pigs, (2) protect *P. mollis* from the threat of arthropods, (3) collect fruit and plant material from unrepresented individuals and increase ex-situ stock of *P. mollis,* (4) propagating *P. mollis* using different alternative propagation techniques for genetic storage and reintroduction purposes, and (5) consider reintroducing part of the ex-situ stock including cuttings from extirpated plants to augment these populations once they are protected from ungulates (RCUH 2001; CEMML 2001).

Additional Stabilization Needs
1) The Army will control competing alien plant species (including Christmas berry) and monitor for new introductions of alien plants species, targeting populations that have only a few remaining individuals (including South Mohiakea (1 individual and 5 seedlings), North Waieli (4 individuals), Huliwai (6 individuals), South Waieli (2 individuals), Kaluaa (5 individuals), North Pualii (5 individuals), Ekahanui (5 individuals) and North Palawai (5 individuals). 2) The Army will provide protection from fire as outlined in the Fire Management Plan (25th ID(L) and USARHAW 2003), where these threats are identified as significant (SBMR AA). 3) Conduct genetic/taxonomic research to determine the genetic differences between the Oahu and Maui populations of *P. mollis*.

Plantago princeps* var. *princeps

Stabilization
This taxon must be stabilized because three stable populations do not exist outside of the Army action areas (MMR and SBMR). To be considered stable, *Plantago princeps* var. *princeps* must meet the criteria required for stability of a short-lived perennial (USFWS 1998a). The stabilization plan in the Draft Makua IP (Makua Implementation Team 2002) must be implemented to stabilize this taxon.

Current Management Actions
Statewide. A long-range management plan for the Honouliuli Preserve includes control and management of alien plants, ungulates, fire, and small mammals; collection of seeds, fruit, and/or cuttings for propagation and/or storage; reintroduce taxa after threats are controlled; and native habitat restoration. It is expected that these actions will benefit *P. princeps* var. *princeps* within the preserve (USFWS 1999b; TNCH 2001). In addition, several miles of pig-proof fencing was slated for construction in Palawai Gulch in 1999 that would enclose approximately 35 hectares (90 acres) of rare plant habitat including the *Plantago princeps* population/occurrence (USFWS 1999b).

Makua and Schofield Barracks Military Reservation Action Area. The Schofield population is threatened by a large population of goats north of the range that has been moving in (RCUH 2001). Ungulates are controlled using contracted USDA hunters and snares. The Army Natural Resource Staff (NRS) also collected dozens of fruit for seed storage trials at Lyon. The Micropropagation Lab has plants from the Makua population but none from Schofield. The Army NRS is conducting (or planning to conduct) the following species-specific actions in the Schofield Action Area: (1) Gain access to high hazard areas to intensify the monitoring and management of *P. princeps* var. *princeps*, (2) Collect propagules of *P. princeps* var. *princep*s for seed storage and to begin propagation efforts for storage and reproduction, (3) Control *Erigeron karvinskianus* around populations of *P. princeps* var. *princeps*, and (4) Continue controlling goat populations using contract USDA hunters at SBMR, until fencing becomes a viable option (RCUH 2001; CEMML 2001).

Pteris lidgatei

Stabilization
This taxon must be stabilized because three stable populations do not exist outside of the Army action areas (KLOA and SBER), and because > 50% of the known remaining individuals occur within Army AAs. To be considered stable, *Pteris lidgatei* must meet the criteria required for stability of a short-lived perennial (USFWS 1999b). The Army Transformation Implementation Team must develop a stabilization plan for this taxon, which outlines 3.0 units of credit to be conducted to achieve three stable populations and the Army must implement the plan. Stabilization of *P. lidgatei* should include conducting

additional surveys within and outside the action areas, and management efforts should focus on all extant population/occurrences remaining from West Maui and the Koolau Mountains of Oahu, because of the highly concentrated distribution, small number remaining, and lack of stable populations.

Current Management Actions
Statewide. Currently, no on-the-ground management actions are known for this species outside of the work that Army NRS is doing.

Kawailoa and Schofield Barracks East Range Action Areas. The Army is conducting (or planning to conduct) the following species-specific actions: (1) surveying for additional populations/occurrences in historic locations, (2) monitor *P. lygatei* at KLOA and determine what the most significant threats are to the population, (3) collect *P. lygatei* and establish a healthy ex-situ stock (RCUH 2001; CEMML 2001).

Additional Stabilization Needs
1) The Army will construct enclosures to protect *P. lygatei* populations against feral pigs and military foot traffic where these threats are identified as significant. All extant population/occurrences deemed to be at risk will be fenced. A commitment will be developed for long-term stewardship and conservation of these areas once they have been enclosed. 2) The Army will control competing alien plant species around *P. lygatei*. All extant population/occurrences of *P. lygatei* will be weeded and monitored for new introductions of alien plants species. 3) The Army will provide protection from fire as outlined in the Fire Management Plan (25th ID(L) and USARHAW 2003), where these threats are identified as significant (SBER).

Sanicula purpurea

Stabilization
This taxon must be stabilized because three stable populations do not exist outside of the Army action areas (KLOA and SBER). To be considered stable, *Sanicula purpurea* must meet the criteria required for stability of a short-lived perennial (USFWS 1999b). The Army Transformation Implementation Team must develop a stabilization plan for this taxon that outlines 3.0 units of credit to be conducted to achieve three stable populations and the Army must implement the plan. This management work will be conducted in the central Koolau Mountains (in the Manana Ridge system) where all the four known remaining small populations occur (USFWS 1998a). Concentrated management efforts should focus on all remaining 7 populations from West Maui Mountains and the Koolau Mountains of Oahu.

Current Management Actions
Statewide. Currently, the only on-the-ground management actions of *Sanicula purpurea* outside of the work the Army NRS is doing, is on the Puu Kukui watershed owned by the Maui Pineapple Company, West Maui. The plants are fenced there for ungulate control, a boardwalk is established around the plants to reduce the risk of humans trampling individuals, and entry into the watershed is restricted to reduce the risk of alien plant introductions.

Kawailoa and Schofield Barracks East Range Action Area. Seedlings and juveniles have been located and mature fruit has been germinated by NRS. Several successful collections have resulted in an ex-situ stock ready for reintroduction. The Army is conducting (or planning to conduct) the following species-specific actions: (1) control weeds to combat the high threat levels (especially from *Axonopus fisifolius*) and to favor fruit production, (2) fencing of populations for ungulate control, (3) continue to collect to build up ex-situ stock (4) reintroductions of the species (RCUH 2001; CEMML 2001).

Additional Stabilization Needs
1) The Army will construct enclosures to protect *S. purpurea* populations against feral pigs and military foot traffic where these threats are identified as significant. These efforts will prioritize populations that have only a few remaining individuals (including South of Puu Pauao (8 individuals) and Poamoho summit (10 individuals) in the Army action areas). A commitment will be developed for long-term stewardship and conservation of these areas once they have been enclosed. 2) The Army will control competing alien plant species within enclosures, (including narrow-leaved carpetgrass) and monitor for new introductions of alien plants species. These efforts will also prioritize the populations that have only a few remaining individuals.

Schiedea hookeri

This taxon will not be stabilized across its range because fifty percent of the known individuals do not occur in the AA, and there are at least three stable populations of this taxon known outside the Army action areas (MMR and SBMR). The Oahu Implementation Team may propose additional species-specific stabilization actions such as collection for genetic storage. This species will benefit from habitat level management for other Makua and Schofield Barracks Reservation target taxa.

Schiedea kaalae

Stabilization
This taxon must be stabilized because three stable populations do not exist outside of the Army action areas (MMR and SBMR). To be considered stable, *Schiedea kaalae* must meet the criteria required for stability of a short-lived perennial (USFWS 1998a). The stabilization plan in the Draft Makua IP (Makua Implementation Team 2002) must be implemented to stabilize this taxon. Stabilization of *S. kaalae* should include conducting additional surveys within and outside the action areas, and management efforts should focus on all extant population/occurrences remaining from Waianae Mountains and the northern Koolau Mountains of Oahu, because of the highly concentrated distribution, small number remaining, and lack of stable populations.

Current Management Actions
Statewide. Ungulate control measures were conducted by DOFAW in July 1997, in the Pahole Drainage to protect *S. kaalae* populations. This included fencing and removal of feral pigs (USFWS 1998a). In addition, removal of competing alien plants (e.g., strawberry guava, Christmas berry, and Koster's curse) is conducted in the surrounding areas (USFWS 1998a). The Nature Conservancy Hawaii also constructed a fenced exclosure in the Palawai area to protect the *S. kaalae* individuals and other taxa reported from this area (USFWS 1998a). One seed accession was completed in 1997 from the Kaawa site, producing 130 individuals that were stored at the mid-elevation Nike site for outplanting (USFWS 1998a). This species has also been successfully propagated at the National Tropical Botanical Garden, the Lyon Arboretum, and the Waimea Arboretum (USFWS 1998a).

Makua and Schofield Barracks Military Reservation Action Area. No Army conservation actions were noted (RCUH 2001; CEMML 2001).

Tetraplasandra gymnocarpa

This taxon will not be stabilized across its range because fifty percent of the known individuals do not occur in the AA, and there are at least three stable populations of this taxon known outside the Army action areas (KTA, KLOA, and SBER). The Oahu Implementation Team may propose additional species-specific stabilization actions such as collection for genetic storage. This species will benefit from habitat level management for other Kahuku, Kawailoa, and Schofield Barracks East Range target taxa.

Viola chamissoniana* ssp. *chamissoniana

Stabilization
This taxon must be stabilized because three stable populations do not exist outside of the Army action areas (MMR and SBMR), and because > 50% of the known remaining individuals occur within Army AAs. To be considered stable, *Viola chamissoniana* ssp. *chamissoniana* must meet the criteria required for stability of a short-lived perennial (USFWS 1998a). The stabilization plan in the Draft Makua IP (Makua Implementation Team 2002) must be implemented to stabilize this taxon.

Current Management Actions
Statewide. Alien plant control, population reintroduction, and fire control and management, are management actions for three plants by the Navy in the Halona management area on Lualualei Naval Magazine (U.S. Navy 1997). This species is being successfully propagated at the National Tropical Botanical Garden (USFWS 1998a).

Makua and Schofield Barracks Military Reservation Action Areas. The Army NRS is conducting (or planning to conduct) the following species-specific actions: (1) propagating this taxon for genetic storage and reintroduction, (2) monitoring known populations/occurrences, (3) surveying for additional populations/occurrences in suitable habitat, (4) Collect fruit and plant material from remaining wild population and increase ex-situ stock of *Viola chamissoniana chamissoniana* (5) outplanting into appropriate habitat, (6) ungulate control, (7) Develop and implement control efforts for *Melinus minutiflora* where it most significantly impacts *Viola chamissoniana chamissoniana* (CEMML 2001; RCUH 2001, 2002c).

Viola oahuensis

Stabilization
The Army must stabilize this taxon because three stable populations do not exist outside of the Army action areas (KLOA and SBER), and because > 50% of the known remaining individuals occur within Army AAs. To be considered stable, *Viola oahuensis* must meet the criteria required for stability of a long-lived perennial (USFWS 1998a). The Army Transformation Implementation Team must develop a stabilization plan for this taxon that outlines 3.0 units of credit to be conducted to achieve three stable populations and the Army must implement the plan. The remaining populations are confined to an area of about 20 km (12 mi), and although it includes two stable populations, all others remaining contain fewer than 10 individuals. Due to the highly concentrated distribution and small fragmented populations remaining, stabilization of *V. oahuensis* should include conducting additional surveys within historic range and in other areas of ideal habitat, and management efforts should focus on all extant population/occurrences remaining.

Current Management Actions
Statewide. Currently, no on-the-ground management actions are known for *Viola oahuensis* outside of the work that Army NRS is doing in Kawailoa, where the majority or the extant populations occur. Some of the plants are protected from ungulates and weeds within the Opaeula Watershed Protection Project fence. In addition, the proposed Helemano fence will protect many more plants from ungulates. This species is propagated at the National Tropical Botanical Garden (USFWS 1998a).

Kawailoa and Schofield Barracks East Range Action Area. The Army NRS is conducting (or planning to conduct) the following species-specific actions: (1) participate in an inter-agency working group targeting goat populations in the Wai`anae Mountains. Other landowners are being encouraged to assess and control goat populations, (2) Control weeds within fenced areas around *V. oahuensis* individuals at KLOA, (3) Establish ex-situ stock of *V. oahuensis*, (4) Establish ex-situ stock of *Viola oahuensis.*

Additional Stabilization Needs
1) The Army will construct enclosures to protect *V. oahuensis* populations against feral pigs and military foot traffic where these threats are identified as significant. These efforts will prioritize populations that have only a few remaining individuals (including South of Puu Pauao (8 individuals) and Poamoho summit (10 individuals) in the Army action areas). A commitment will be developed for long-term stewardship and conservation of these areas once they have been enclosed. 2) The Army will control competing alien plant species within enclosures, (including *Schinus terebinthifolius, Erigeron karvinskianus* (Daisy fleabane)*, Ageratina adenophora* (Maui pamakani)*, A.riparia* (Hamakua pamakani)*, Paspalum conjugatum* (hilo grass)*, Psidium cattleianum* and *Melinis minutiflora*) and monitor for new introductions of alien plants species. These efforts will also prioritize the populations that have only a few remaining individuals. 3) The Army will provide protection from fire as outlined in the Fire Management Plan (25th ID(L) and USARHAW 2003), where these threats are identified as significant (SBER).

Snails

Although tree snail surveys have been conducted by Army Natural Resource Staff (NRS), the present status of tree snails not seen since 1982 on military lands is uncertain. These Army surveys and all other survey information needs to be evaluated to assess the status of these tree snails on military lands. In the implementation process, chosen experts will review the information and decide which species have been adequately surveyed and which species need more work. This group will identify locations and intensity of surveys necessary to establish the status of the snails on military lands. The surveys will be limited to military lands and will be part of the Army's management obligations. Any new locations for all tree snail species will be included in the management actions designated by the implementation process. Species accounts will be prepared for new species when populations are discovered.
The following species are not currently known in the wild but will be surveyed for in their historic ranges and within other potential habitats (*A. apexfulva* (SBER), *A. bulimoides* (KTA, KLOA, SBER), *A. caesia* (KTA, KLOA, SBER), *A. curta* (KTA, KLOA), *A. decora* (KLOA), *A. decipiens* (KLOA, SBER), *A. dimorpha* (KTA, KLOA, SBER), *A. elegans* (KTA, KLOA, SBER), *A. juncea* (KLOA), *A. leucorraphe* (KLOA), *A. lila* (SBER), *A. livida* (SBER), *A. papracea* (KLOA, SBER), *A. pulcherrima* (KLOA, SBER), *A. rosea* (KLOA, SBER), *A. sowerbyana* (KTA, SBER), *A. swiftii* (KLOA, SBER), *A. spaldingi* (SBMR), *A. thaanumi* (SBMR), and *A. valida* (KTA, KLOA)).

This following species have been observed in the past 20 years (since 1982), and are assumed to be alive in the wild:

Achatinella apexfulva

Stabilization
To be considered stable, threats to *Achatinella apexfulva* must be controlled and the species must be represented in the wild by a minimum of ten managed populations representing the ecologically significant units, determined by genetic analysis. The Oahu Implementation Team will develop a stabilization plan for this taxon to achieve ten managed populations and the Army must implement the plan. The historical range of *A. apexfulva* comprises parts of the KLOA, but in recent years it has only been found along the Poamoho Trail. It is considered extremely rare and its present range is very restricted (RCUH 2001). Search efforts should continue and be intensified in unexplored regions of preferred habitat, within the historic range in KLOA. Although this species in not currently known in the wild, it is included here because it has been found recently (2001), and collected for captive rearing.

Current Management Actions
Statewide. Currently, no on-the-ground management actions are known for this species outside of the work that Army Natural Resources staff (NRS) is doing. Only eight snails of this species are known and they are kept at the captive rearing facility at University of Hawaii.

Kawailoa and Schofield Barracks East Range Action Area. NRS is conducting (or planning to conduct) the following species-specific actions: (1) surveying for population/occurrences in suitable habitat within historic ranges, and (2) monitor and collect *A. apexfulva* for captive rearing and reintroduction program in KLOA (RCUH 2001; CEMML 2001).

Additional Stabilization
The following will be implemented by the Army upon locating *A. apexfulva* individuals in the wild: 1) The Army will construct enclosures to protect *A. apexfulva* populations against feral pigs and military foot traffic where these threats are identified as significant. A commitment will be developed for long-term stewardship and conservation of these areas once they have been enclosed. 2) The Army will control alien plant species that compete with host plants within enclosures and monitor for new introductions of alien plants species. 3) The Army will protect all population/occurrences from predators using techniques such as poison rat baits, snap trapping of rats, manually killing any cannibal snails, (4) The Army will increase genetic stock of *A. apexfulva* and reintroduce species when stock is stable (RCUH 2001; CEMML 2001). Management of this taxon may require funding research to refine predator exclosure designs that minimize the impact of using exclosures within the area micro-climate. Stabilization of this taxon may also involve conducting research for the development of control techniques of the cannibal snail *Euglandina rosea.*

Achatinella byronii/decipiens

Stabilization
To be considered stable, threats to *Achatinella byronii* must be controlled and the species must be represented in the wild by a minimum of ten managed populations representing the ecologically significant units, determined by genetic analysis. The Oahu Implementation Team will develop a stabilization plan for this taxon to achieve ten managed populations and the Army must implement the plan. New populations of *A. byronii* individuals have recently been discovered, as searchers are becoming more familiar with preferred habitat of the species (RCUH 2001). Search efforts should continue and be intensified in unexplored regions of preferred habitat, within the historic range along the southern boundary of KLOA and south.

Current Management Actions
Statewide. Currently, no on-the-ground management actions are known for this species outside of the work that Army Natural Resources staff (NRS) is doing.

Kawailoa and Schofield Barracks East Range Action Area. NRS collected eight individuals from the original population of 66, which have grown to a population of 20+ at the University of Hawaii snail laboratory. NRS is conducting (or planning to conduct) the following species-specific actions: (1) monitor known populations/occurrences to ensure that rats and *E. rosea* do not decimate them, (2) surveying for additional populations/occurrences in suitable habitat within historic ranges, (3) protecting populations Schofield Barracks East Range from predators using techniques such as poison rat baits, snap trapping of rats, manually killing any cannibal snails, (4) consider construction of predator exclosure fences, and (5) increase genetic stock of *Achatinella byronii* and *Achatinella decipiens* and reintroduce species when stock is stable. (RCUH 2001; CEMML 2001).

Additional Stabilization
1) The Army will construct enclosures to protect *A. byronii* and *A. decipiens* populations against feral pigs and military foot traffic where these threats are identified as significant. A commitment will be developed for long-term stewardship and conservation of these areas once they have been enclosed. 2) The Army will control alien plant species that compete with host plants within enclosures and monitor for new introductions of alien plants species. 3) The Army will provide protection from fire as outlined in the Fire Management Plan (25th ID(L) and USARHAW 2003), where these threats are identified as significant (SBER). Management of this taxon may require funding research to refine predator exclosure designs that minimize the impact of using exclosures within the area micro-climate. Stabilization of this taxon may also involve conducting research for the development of control techniques of the cannibal snail *Euglandina rosea.*

Achatinella curta

Stabilization
To be considered stable, threats to *Achatinella curta* must be controlled and the species must be represented in the wild by a minimum of ten managed populations representing the ecologically significant units, determined by genetic analysis. The Oahu Implementation Team will develop a stabilization plan for this taxon to achieve ten managed populations and the Army must implement the plan. *A. curta* was historically found throughout KLOA and in the southeastern corner of KTA (Pilsbry and Cooke 1912-1914). Only five snails has been identified in the past 20 years, at Paalaa Uka on the ridge south of Opaeula Gulch and Peahinaia Trail in the Kawailoa Forest Reserve, and on the Kawailoa Trail in the Koolau Mountains (HINHP 2002). *A. curta* is known to thrive in lower elevations where *E. rosea* first invaded and it may be extinct (RCUH 2001; 2002c).

Current Management Actions
Statewide. Currently, no on-the-ground management actions are known for this species outside of the work that Army Natural Resources staff (NRS) is doing.

Schofield Barracks East Range Action Area. NRS have conducted numerous searches in former *A. curta* locations using plotted GPS points, but have not been successful locating any *A. curta.* NRS is conducting (or planning to conduct) the following species-specific actions: (1) surveying for population/occurrences in suitable habitat within historic ranges, (2) collect *A. curta* individuals for captive rearing in an attempt to save the species from extinction (RCUH 2001; CEMML 2001).

Additional Stabilization
The following will be implemented by the Army upon locating *A. curta* individuals in the wild: 1) The Army will construct enclosures to protect all *A. curta* populations located against feral pigs and military foot traffic where these threats are identified as significant. A commitment will be developed for long-term stewardship and conservation of these areas once they have been enclosed. 2) The Army will control alien plant species that compete with host plants within enclosures and monitor for new introductions of alien plants species. 3) The Army will protect all population/occurrences from predators using techniques such as poison rat baits, snap trapping of rats, manually killing any cannibal snails. 4) The Army will increase genetic stock of *A. curta* and reintroduce species when stock is stable (RCUH 2001; CEMML 2001). Management of this taxon may require funding research to refine predator exclosure designs that minimize the impact of using exclosures within the area micro-climate. Stabilization of this taxon may also involve conducting research for the development of control techniques of the cannibal snail *Euglandina rosea*.

Achatinella leucorraphe

Stabilization
To be considered stable, threats to *Achatinella leucorraphe* must be controlled and the species must be represented in the wild by a minimum of ten managed populations representing the ecologically significant units, determined by genetic analysis. The Oahu Implementation Team will develop a stabilization plan for this taxon to achieve ten managed populations and the Army must implement the plan. Historically, *A. leucorraphe* is known from SBER and further south. Only one snail has been identified in the past 14 years, near the Schofield Waik ne Trail. *A. leucorraphe* is considered critically rare and may only be surviving in very fragmented habitat (RCUH 2001). This species may be extinct because it was known to thrive in lower elevations where *E. rosea* first invaded.

Current Management Actions
Statewide. Currently, no on-the-ground management actions are known for this species outside of the work that Army Natural Resources staff (NRS) is doing.

Schofield Barracks East Range Action Area. Army NRS have searched SBER habitats, including in *A. leucorraphe* historical habitat but none were found. NRS is conducting (or planning to conduct) the following species-specific actions: (1) surveying for population/occurrences in suitable habitat within historic ranges, (2) collect *A. leucorraphe* individuals for captive rearing in an attempt to save the species from extinction (RCUH 2001; CEMML 2001).

Additional Stabilization
The following will be implemented by the Army upon locating *A. leucorraphe* individuals in the wild: 1) The Army will construct enclosures to protect all *A. leucorraphe* populations against feral pigs and military foot traffic where these threats are identified as significant. A commitment will be developed for long-term stewardship and conservation of these areas once they have been enclosed. 2) The Army will control alien plant species that compete with host plants within enclosures and monitor for new introductions of alien plants species. 3) The Army will provide protection from fire as outlined in the Fire Management Plan (25th ID(L) and USARHAW 2003), where these threats are identified as significant (SBER). 4) The Army will protect all population/occurrences from predators using techniques such as poison rat baits, snap trapping of rats, manually killing any cannibal snails. 5) The Army will increase genetic stock of *A. leucorraphe* and reintroduce species when stock is stable (RCUH 2001; CEMML 2001). Management of this taxon may require funding research to refine predator exclosure designs that minimize the impact of using exclosures within the area micro-climate. Stabilization of this taxon may

also involve conducting research for the development of control techniques of the cannibal snail *Euglandina rosea*.

Achatinella lila

Stabilization
To be considered stable, threats to *Achatinella lila* must be controlled and the species must be represented in the wild by a minimum of ten managed populations representing the ecologically significant units, determined by genetic analysis. The Oahu Implementation Team will develop a stabilization plan for this taxon to achieve ten managed populations and the Army must implement the plan. This species is historically known from the Schofield Waik ne Trail, Poamoho Trail and connecting Summit Trail areas, but currently population/occurrences are only known from the more northern portions of this range, north of the Poamoho Trail and Summit Trail junctions. It is considered to be uncommon with very restricted range (RCUH 2001).

Current Management Actions
Statewide. Currently, no on-the-ground management actions are known for this species outside of the work that Army Natural Resources staff (NRS) is doing.

Kawailoa Action Area. *A. lila* has been recorded in the vicinity of the Pe`ahin i`a Trail and Summit junction and south of the Poamoho/summit junction on NRS surveys in the past three years. Some of this known habitat is now protected within the ` pae`ula Watershed Project fence exclosure. NRS is conducting (or planning to conduct) the following species-specific actions: (1) monitor known population/occurrences to ensure that rats and *E. rosea* do not decimate them, (2) survey historic habitat and other adjacent optimal habitat for additional populations of *A. lila* (upon returning to an area, survey boundaries are expanded and new unexplored terrain is searched by NRS), (3) when predators are discovered, protect populations using techniques such as poison rat baits, snap trapping of rats, manually killing any cannibal snails, and (4) conduct captive propagation, increase genetic stock, and reintroduce *Achatinella* when stock is stable. (RCUH 2001; CEMML 2001).

Additional Stabilization
1) The Army will construct enclosures to protect *A. lila* populations against feral pigs and military foot traffic where these threats are identified as significant. A commitment will be developed for long-term stewardship and conservation of these areas once they have been enclosed. 2) The Army will control alien plant species that compete with host plants within enclosures and monitor for new introductions of alien plants species. Management of this taxon may require funding research to refine predator exclosure designs that minimize the impact of using exclosures within the area micro-climate. Stabilization of this taxon may also involve conducting research for the development of control techniques of the cannibal snail *Euglandina rosea.*

Achatinella livida

Stabilization
To be considered stable, threats to *Achatinella livida* must be controlled and the species must be represented in the wild by a minimum of ten managed populations representing the ecologically significant units, determined by genetic analysis. The Oahu Implementation Team will develop a stabilization plan for this taxon to achieve ten managed populations and the Army must implement the plan. *A. livida* was historically found throughout KLOA and in the north central portions of Schofield

Barracks East Range (Pilsbry and Cooke 1912-1914). *A. livida* is currently found predominantly in the Ko`olau Summit region along the summit trail.

Current Management Actions
Statewide. Currently, no on-the-ground management actions are known for this species outside of the work that Army Natural Resources staff (NRS) is doing.

Kawailoa Action Area. Two populations/occurrences are managed by Natural Resource Staff (NRS) from which 12 and 36 individuals were captured in mark/recapture studies, from an estimated population of 102 individuals in 2001. NRS is conducting (or planning to conduct) the following species-specific actions: (1) monitor known population/occurrences to ensure that rats and *E. rosea* do not decimate them, (2) survey historic habitat and other adjacent optimal habitat for additional populations of *A. livida* (upon returning to an area, survey boundaries are expanded and new unexplored terrain is searched by NRS), (3) protect populations using techniques such as poison rat baits, snap trapping of rats, manually killing any cannibal snails, and (4) conduct mark and recapture of *A. livida* populations using waterproof coating for markings. (RCUH 2001; CEMML 2001).

Additional Stabilization
1) The Army will construct enclosures to protect *A. livida* populations against feral pigs and military foot traffic where these threats are identified as significant. A commitment will be developed for long-term stewardship and conservation of these areas once they have been enclosed. 2) The Army will control alien plant species that compete with host plants within enclosures and monitor for new introductions of alien plants species. Management of this taxon may require funding research to refine predator exclosure designs that minimize the impact of using exclosures within the area micro-climate. Stabilization of this taxon may also involve conducting research for the development of control techniques of the cannibal snail *Euglandina rosea.*

Achatinella mustelina

Stabilization
Achatinella mustelina must be stabilized. To be considered stable, threats to *Achatinella mustelina* must be controlled and the species must be represented in the wild by a minimum of 10 managed populations representing the ecologically significant units, which were determined by genetic analysis. To stabilize this taxon, the Army must implement the stabilization plan in the Draft Makua IP (Makua Implementation Team 2002).

Current Management Actions
Statewide. The Nature Conservancy of Hawaii and the State of Hawaii are conducting management for this taxon. The State of Hawaii funded the construction of two predator exclosures at Pahole NAR and Makua Military Reservation. The Army is conducting monitoring of known populations and is protecting these populations from predators at Makua.

Makua and Schofield Barracks Military Reservation Action Areas. The Army has conducted surveys to identify populations of *Achatinella mustelina* for management. The Army NRS is conducting (or planning to conduct) the following species-specific actions: (1) monitor known populations/occurrences to ensure that rats and *Euglandina rosea* do not decimate them, (2) survey for additional population/occurrences within historic ranges and in other unexplored suitable habitat, (3) evaluate and implement predator control options using techniques such as poison rat baits, snap trapping of rats, construction of tree snail exclosures, and manual killing of any cannibal snails, and (4) support

development of a safe and effective broadcast application of rodenticide for rat control and molluscicide to control the cannibal snail and slugs, (5) determine the cause of the *Myrsine lessertiana* tree dieback and plant new populations of this tree to replace the sick and dying individuals, (6) maintain and monitor snail enclosures.

Under the Makua IP, the Army will be protecting a population at Schofield from predators using techniques such as poison rat baits, snap trapping of rats, manual killing of any cannibal snails and the construction of a predator exclosure fence to protect a North Haleauau population of this taxon.

Achatinella pulcherrima

Stabilization
To be considered stable, threats to *Achatinella pulcherrima* must be controlled and the species must be represented in the wild by a minimum of ten managed populations representing the ecologically significant units, determined by genetic analysis. The Oahu Implementation Team will develop a stabilization plan for this taxon to achieve ten managed populations and the Army must implement the plan. *A. pulcherrima* was historically found throughout KLOA and in the north central portions of Schofield Barracks East Range (Pilsbry and Cooke 1912-1914). Only three snails has been identified in the past 10 years, along the Summit trail and on the Peahinaia Trail near the Summit Trail (HINHP 2002). *A. pulcherrima* population/occurrences have never been located by the Army Natural Resource Staff. (RCUH 2001; 2002c).

Current Management Actions
Statewide. Currently, no on-the-ground management actions are known for this species outside of the work that Army Natural Resources staff (NRS) is doing.

Schofield Barracks East Range Action Area. NRS have conducted numerous searches in former *A. pulcherrima* locations, but have not been successful locating any individuals. NRS is conducting (or planning to conduct) the following species-specific actions: (1) surveying for population/occurrences in suitable habitat within historic ranges (RCUH 2001; CEMML 2001).

Additional Stabilization
The following will be implemented by the Army upon locating *A. pulcherrima* individuals in the wild: 1) The Army will construct enclosures to protect all *A. pulcherrima* populations located against feral pigs and military foot traffic where these threats are identified as significant. A commitment will be developed for long-term stewardship and conservation of these areas once they have been enclosed. 2) The Army will control alien plant species that compete with host plants within enclosures and monitor for new introductions of alien plants species. 3) The Army will protect all population/occurrences from predators using techniques such as poison rat baits, snap trapping of rats, manually killing any cannibal snails. 4) The Army will increase genetic stock of *A. pulcherrima* and reintroduce species when stock is stable (RCUH 2001; CEMML 2001). Management of this taxon may require funding research to refine predator exclosure designs that minimize the impact of using exclosures within the area micro-climate. Stabilization of this taxon may also involve conducting research for the development of control techniques of the cannibal snail *Euglandina rosea*.

Achatinella sowerbyana

Stabilization
To be considered stable, threats to *Achatinella sowerbyana* must be controlled and the species must be represented in the wild by a minimum of ten managed populations representing the ecologically significant units, determined by genetic analysis. The Oahu Implementation Team will develop a stabilization plan for this taxon to achieve ten managed populations and the Army must implement the plan. *A. sowerbyana* was historically found throughout KLOA and SBER (Pilsbry and Cooke 1912-1914), but currently populations are restricted to the leeward side of the Koolau Mountains at Castle Trail, Poamoho Trail, and Schofield Barracks East Range (RCUH 2001). It is considered to be the most commonly found *Achatinella* species on Oahu after *A. mustelina*.

Current Management Actions
Statewide. Currently, no on-the-ground management actions are known for this species outside of the work that Army Natural Resources staff (NRS) is doing.

Kawailoa and Schofield Barracks East Range Action Area. Trees are marked where sightings are made and these areas are visited annually as part of the monitoring program by the Army. While conducting rat control efforts, it is not uncommon to trap 2-3 rats a night near populations of *A. sowerbyana.* NRS is conducting (or planning to conduct) the following species-specific actions: (1) monitor known population/occurrences to ensure that rats and *E. rosea* do not decimate them, (2) survey for additional population/occurrences within historic ranges and in other unexplored suitable habitat, (3) protect populations using techniques such as poison rat baits, snap trapping of rats, manually killing any cannibal snails, and (4) conduct mark and recapture of *A. sowerbyana* populations (RCUH 2001; CEMML 2001).

Additional Stabilization
1) The Army will construct enclosures to protect *A. sowerbyana* populations against feral pigs and military foot traffic where these threats are identified as significant. A commitment will be developed for long-term stewardship and conservation of these areas once they have been enclosed. 2) The Army will control alien plant species that compete with host plants within enclosures and monitor for new introductions of alien plants species. 3) The Army will provide protection from fire as outlined in the Fire Management Plan (25th ID(L) and USARHAW 2003), where these threats are identified as significant (SBER). Management of this taxon may require funding research to refine predator exclosure designs that minimize the impact of using exclosures within the area micro-climate. Stabilization of this taxon may also involve conducting research for the development of control techniques of the cannibal snail *Euglandina rosea*.

Birds

Chasiempis sandwichensis* ssp. *ibidis

Stabilization
Oahu elepaio must be stabilized. The Army must work with the Oahu Implementation Team to develop a stabilization plan for this taxon and the Army must implement the plan. There is no information available on the necessary population size for the Oahu elepaio to reach stabilization. Species experts will assist in determining the biological definition of stability for this taxon.

Current Management Actions
Statewide. The Nature Conservancy of Hawaii and the State of Hawaii are conducting predator control during the elepaio nesting season to protect eggs and nestlings in Honouliuli Preserve and in the Southern Koolau Mountains, respectively.

Schofield Action Area. NRS is conducting (or planning to conduct) the following species-specific actions: (1) survey south and west range populations of *Chasiempis sandwichensis ibidis* for new individuals and nests, (2) band all unmarked *C. sandwichensis ibidis* individuals at SBMR, (3) monitor *C. sandwichensis ibidis* nests SBMR, (4) Control rats, focusing on established *C. sandwichensis ibidis* territories and around any located nests.

Additional Stabilization
1) The Army will provide protection from fire as outlined in the Fire Management Plan (25th ID(L) and USARHAW 2003), where these threats are identified as significant. 2) The Army will monitor nesting populations for threats from munitions. There is no information available on a stable population size for the taxon. Species experts will be recruited in order to determine the biological definition of stability for Oahu elepaio. Aside from the impacts to individual birds of this taxon, the Implementation Team must determine what management actions need to be taken to manage critical habitat.

Mammals

Lasiurus cinereus* spp. *semotus

This taxon will not be stabilized across its range because of lack of information in historical records and on current distribution and abundance of the species. The decline of the bat has been largely inferred. There was one observation recorded in SBMR in 1988 and there was one report of a possible large population/occurrence from Oahu prior to the early nineteenth century, but this is based on a single observation of an unknown number of bats at an unknown location (USFWS 1998c). The Oahu Implementation Team may propose additional species-specific stabilization actions because of the lack of existing data on the species, such as extensive surveys in possible habitat areas on Oahu.

13.7 Threat Control Required For Stabilization

To stabilize the target taxa from the action areas, population unit and habitat level management must be conducted. To prioritize management, NRS have delineated management units (MUs) within each training area. These units are chosen based on two criteria, the density of rare species and the degree to which the native habitat is intact. NRS implement habitat level management in these areas. The Army must stabilize the target taxa for the long-term and for as long as they continue to train in the areas and manner described in this Biological Assessment. The Army already has identified and begun to implement numerous actions for the management of fire, weeds, feral ungulates, small mammals, alien invertebrates and specific listed species in Army training areas in Hawaii. The most significant threats to target taxa are discussed below. Specific actions for each management unit and population unit for listed species in the BA will be developed by the Oahu Implementation Team. These management actions will be conducted in management units outside action areas as well. A control mechanism for each to meet stabilization requirements is described in the last paragraph of each section. Table 13.c below, summarizes threat control requirements for stabilization. This table is taken directly from the Draft Makua IP (Makua Implementation Team 2002).

Table 13.c. Stabilization Threat Control Requirements.

Threats	Proximity of Individuals (2 m radius)	Proximity of PUs (50 m buffer)	Within the MU or MU subunit
Fire	zero incidence	zero incidence	zero incidence
Feral Ungulates	total removal	total removal	total removal
Incipient invasive weeds	total removal	total removal	total removal
Percent cover of other weeds	0%	25%	50%
Small mammals[1]	total removal	total removal	NA
Euglandina rosea[1]	total removal	total removal	NA
Other invertebrates[1]	total removal	NA	NA
Human impacts (other than management)	no impact	no impact	no impact

[1] Control only if threatening target taxon.

13.7.1 Feral Ungulates

Feral ungulates pose a major threat to native Hawaiian ecosystems. Their adaptive abilities allow them to thrive in foreign environments, altering native habitats and heavily impacting the species these habitats support. Pig (*Sus scrofa*) sign is widespread throughout most of the action areas (HINHP 1994a, 1994b, 1994c, 1995). Feral goats populations are not reported in any of the AAs partly as a result of eradication efforts on Oahu in the early to mid-1900s. Feral pigs (*Sus scrofa*) have a significant impact on natural communities in the action areas. They inhabit areas up to 3,050 m (10,000 ft), but are more common in forested regions from 450 to 2,100 m (1,500 - 7,000 ft), and are known to use dry and wet areas dominated by native or introduced vegetation (Kramer 1971; van Riper and van Riper 1982; Tomich 1986). They feed heavily on native hapa`u ferns (*Cibotium* spp.*),* and several exotic fruits including guava *(Psidium* spp.*)* and passion fruit *(Passiflora* spp.*),* which aids in the seed dispersal of these and other exotic species. In addition to feeding, their digging and rooting activities often decimate native species, open up areas for opportunistic exotic plants, increase the risk of erosion, and create habitat for avian malaria (*Plasmodium rilictam*) carrying mosquitoes (*Calex quinquefasciatus*). Control methods for feral ungulates include fencing, hunting and snaring.

Kahuku Action Area. *Sus scrofa* (feral pig) sign is widespread throughout KTA (HINHP 1994a), but there are no ungulate monitoring transects there. The source of most of the ungulate information at KTA comes from incidental observations of pig sign around rare species, recorded during surveys. The only mechanism for ungulate control underway is the Division of Forestry and Wildlife's public hunting program, which is administered by the State of Hawaii's DLNR. The proposed building of fences around *Bobea timonioides* and *Eugenia koolauensis* individuals will control pigs from disturbing these plants at KTA.

Kawailoa Action Area. *Sus scrofa* (feral pig) have a significant impact on natural communities at KLOA (HINHP 1994b). The ungulate monitoring program is used to assess the impacts of ungulates on natural communities and to determine the effectiveness on the ungulate control measures at KLOA. Ungulate control measures at KLOA are specific to each Management Unit (MU) and include fencing, snaring, and hunting. The overall goal is to ensure that feral pigs are not impacting rare and endangered resources within the MU.

Schofield Barracks East Range Action Area. Pigs have a major impact on native herbs and shrubs, particularly rare herb species such as *Lycopodium nutans* and *Pteris lidgatei,* and the shrub *Lobelia oahuensis* at SBER (HINHP 1994c; R.M. Towill Corporation 1997b). Ungulate control in SBER has been limited because pig threats are considered a low priority relative to other subinstallations. The ruggedness of the terrain and the close proximity of the area to recreational trails also limit the control effort at SBER.

Schofield Barracks Military Reservation Action Area. *Sus scrofa* (pigs) and *Carpa hircus* (goats) are both present at SBMR. Pigs are common in steep areas in lowland mesic forests of SBMR. They have a major impact on native herbs and shrubs, particularly rare herb species such as *Diellia falcata* and *Lipochaeta lobata* var. *leptophylla,* and the shrubs *Alsindendron trinerve* and *Lobelia oahuensis* at SBMR (HINHP 1994c). Thousands of feral goats and *Bos taurus* (cattle) once infested the Waianae Mountains, but the feral cow has since been eradicated on Oahu and goat populations were dramatically reduced from historic highs in the early 1900s. The prohibition against hunting in certain areas over many years due to unexploded ordnance hazards has again however, allowed ungulate populations to expand. Goat numbers have been on the increase and they were observed in northern SBMR near Puu Pane (HINHP 1994c). According to NRS, goats may have escaped from ranches in the Waianae Mountains onto Army lands. No active ungulate control program is in place at SBMR because monitoring data suggest that feral pig activity is low at West Range and goat activity is nonexistent within the two management units at SBMR. There has been a volunteer community hunt at South Range.

The Army will ensure that the impacts of feral ungulates are monitored and eliminated if they ever become significant in the population units and in the habitat designated for management in the implementation plan. The following are some of the threat control measures that will be used to minimize the impacts to listed species from feral ungulates:

- Establish and evaluate permanent ungulate monitoring transects where ungulate activity is the greatest.
- Monitor ungulate activity within Management Units emphasizing areas where feral ungulate populations are nearby, and within fenced areas around listed populations.
- Monitor ungulate movements using radio-telemetry.
- Establish GIS to maintain location data on monitoring transects and control areas.
- Coordinate ungulate control efforts with U.S. Department of Agriculture and DLNR Natural Area Reserve (NARS).
- Establish and maintain exclosures around isolated populations of listed plants.
- Use contract hunters or public hunters to control pigs within exclosures and around other intact native habitat areas.
- Maintain hunting database.
- Establish pig control groups in remote areas to control pigs.
- Control pigs in managed areas around rare plant populations, checking areas quarterly.

The Oahu Implementation Team will develop or review all methodology to ensure that it adequately assesses and addresses the impacts from feral ungulates.

13.7.2 Alien Plant Species

The threat of colonization of new and aggressive weeds is an ongoing threat in the action area. They have the potential to displace native vegetation if not controlled. These incipient species pose the single most significant threat to native natural communities and rare taxa in the action areas (HINHP 1994a, 1994b, 1994c, 1995; and Army Natural Resources Staff, per. comm.). Alien plant species management projects are prioritized by Natural Resources staff (NRS) according to the invasiveness and abundance of the alien

species, and their proximity to native vegetation. Control of alien species that were recently introduced and are not yet well established is given a high priority because there is a good chance to eradicate these species. Once introduced, the exceptionally aggressive incipient alien species have the potential to displace native vegetation if not controlled.

Invasive incipient plants in the action areas include *Acacia confusa, Ageratina riparia, Aleurites moluccana, Andropogon virginicus, Angiopteris evecta, Ardisia elliptica*, *Arthrostema ciliatum, Asystasia gangetica, Caesalpinia decapetala*, *Callitris* spp., *Chrysophyllum oliviforme, Erigeron karvinskianus, Hedychium coronarium, Hedychium gardnerianum, Juniperus* spp., *Melochia umbellata, Morella faya, Pennisetum setaceum, Triumfetta semitriloba.* Other well-established ecosystem altering alien plant species that are widespread in the action areas include *Melinus minutiflora, Psidium cattleianum, Schinus terebinthifolius,* and *Setaria palmifolia.*

To stabilize Oahu taxa, the Army must control alien plant species in the population unit vicinity and in the habitat designated for management in stabilization plans. Specific goals for alien plant control can be found in Table 13.c. The following are some threat control measures the Army will use to minimize the impacts to listed species from alien plants:

- Map incipient and established weed populations
- Control weeds using the weed control plan
- Monitor weed plots
- Monitor weed control trials
- Conduct weed control in the various management units using a combination of various manual, chemical, and biological techniques to effectively control alien plant species with minimal secondary effects on native species.
- Use the weed monitoring program to assess the effectiveness of weed control measures in restoring and improving native habitats and to measure any secondary effects on native species.

The Oahu Implementation Team will develop or review all methodology to ensure that it adequately assesses and addresses the impacts from alien plant species.

13.7.3 Alien Small Mammals

The small mammals found in the action areas include: *Rattus norvegicus* (Norway rat), *R. rattus* (European black rat), *R. exulans* spp. *hawaiiensis* (Polynesian rat), *Mus musculus* (house mouse), *Herpestes auropunctatus* (small Indian mongoose), and *Felis catus* (cats). All prey on endemic tree snail populations and on the eggs and nestlings of native birds. Cats (found primarily in KLOA) also prey on adult native birds, and rodents have been found to have a major impact on fruit/seeds of native plant species, especially plants in the lobelia, palm, and African violet families (Cuddihy and Stone 1990; U.S. Army 1998). Monitoring for small mammal predation (mostly rats) includes periodic rare species site visits, and control methods include poison baiting, snap trapping and live trapping.

Management of rodent populations in the action areas has emphasized areas where they directly impact rare species like *Achatinella byronii/decipiens, A. lila, A. livida, A. mustelina, A. sowerbyana, Amastra micans*, and *Laminella sanguinea.*

The Army will eliminate small mammal impacts on the taxa requiring stabilization. The following are some threat control measures the Army will use to minimize the impacts to listed species from alien small mammals:

- Monitor for rat predation doing periodic rare species site visits.

- Determine the impact of rat predation on native species.
- Control rodent populations in areas where they directly impact rare species using the most effective means available (i.e. traps and poison bait stations).
- Evaluate the extent of feral cat and mongoose populations in the action areas and determine the degree they impact threatened and endangered species.
- Remove feral cats and mongooses impacting threatened and endangered species.

The Oahu Implementation Team will develop or review all methodology to ensure that it adequately assesses and addresses the impacts from alien small mammals.

13.7.4 Alien Invertebrates

Howarth (1985) estimated that there are over 2,000 introduced insect species in the Hawaiian Islands. According to Howarth, there are a rash of dramatic impacts that these species can have on native populations, including predation on native plants and animals, transmission of diseases, alteration of soils, and hybridization with similar native species. Some of the more threatening alien invertebrates found in the action areas include *Xylosandrus compactus* (black twig borer), *Sophonia rufofascia* (two-spotted leafhopper), *Euglandina rosea* (carnivorous snail), and *Culex quinquefasciatus* (mosquitoes).

The female black twig borer burrows into branches, introduces a pathogenic fungus as food for its larvae, and lays its eggs. This minute beetle was discovered in 1961 and is now widespread in Hawaii (Nelson and Davis, 1972). The physical damage caused by tunneling, coupled with the introduction of pathogens, often results in the death of the twigs. Chronic infestation leads to a gradual weakening of the tree and eventual premature death. In the Hawaiian Islands, the black twig borer has many hosts, disperses easily, and is probably present at most elevations up to 670 m (2,500 ft) (Howarth 1985). It is known to infest a wide variety of common plant taxa (Davis 1970). *Sophonia rufofascia* (two-spotted leafhopper) is a species that commonly affects both native and nonnative plants. The saliva of this insect species is suspected of causing yellowing of leaves and reduced vigor in many native and exotic plant species found in the action areas, and economic damage to crops and ornamental plants in Hawaii (HINHP 1994a, 1995). *Euglandina rosea* has been by far the most damaging of invertebrates to native Hawaiian ecosystems. It was introduced in 1958 by the Department of Agriculture to control *Achatina fulica* (African snails). It is a significant threat to native land snails (Hadfield 1986) and has been observed eating native land snails within most of the action areas (HINHP 1995).

Insect-borne diseases are thought to be a factor in the decline of native birds throughout Hawaii, including the endangered Oahu creeper and Oahu elepaio. The reduction and extinction of many Hawaiian forest birds is, in part, the result of avian malaria, a protozoan-caused disease (*Plasmodium rilictam*), and avian pox, which is viral. Mosquitoes, especially *Culex quinquefasciatus*, which can be found from sea level to elevations of over 1,585 m (5,200 ft), transmit malaria. Avian pox is spread by contact with infected birds and possibly through mosquitoes. The degree to which Hawaiian native birds on Army lands are affected by these diseases is not certain.

Kahuku Action Area. Although the presence of *Xylosandrus compactus* (black twig borer) at KTA was not confirmed by HINHP (1994a), it infects species common to the subinstallation including species from *Melicope*, *Hedyotis*, *Nestegis*, *Bobea*, and *Psychotria* genera. HINHP (1994a) also observed *Sophonia rufofascia* (two-spotted leafhopper) throughout KTA, particularly in mesic areas. Two-spotted leafhoppers have a major impact on native species, especially during times of extreme drought. It is suspected of causing severe dieback of the native fern *Dicranopteris linearis* (uluhe) which are common to KTA (RCUH 2002c). HINHP (1994a) observed *Euglandina rosea* at KTA, and hundreds of shells from prey snails were seen in Oio Gulch. Other introduced invertebrates at KTA include *Diomus notescens* and *Orcas australasiae* (beetles), *Salina celebensis* (springtail), *Allograpta exotica*,

Atrichopogon jacobsoni, and *Leptocera* spp. undetermined (flies), *Heteropsylla mimosae* (planthopper*)*, *Diadegma* spp., *Opogona* spp. undetermined (moth or butterfly species), and *Elimaea punctifera* (grasshopper*)* (HINHP 1994a). In addition, flatworms, amphipods, isopods, and thairid snails were observed in Paumalu Stream on KTA (Hawaii Stream Assessment database 1991).

Kawailoa Action Area. Although the presence of *Xylosandrus compactus* (black twig borer) at KLOA was not confirmed by HINHP (1994c), it infects species common to the subinstallation including species from *Melicope*, *Hedyotis*, and *Psychotria* genera. HINHP (1994b) also observed *Sophonia rufofascia* (two-spotted leafhopper) throughout KLOA, particularly in mesic areas. The saliva of this insect species is suspected of causing yellowing of leaves and reduced vigor in many native and exotic plant species, including ferns like *Pteris lidgatei* and *Lycopodium nutans* at KLOA (HINHP 1994b). It is also suspected of causing severe dieback of the native fern *Dicranopteris linearis* (uluhe) which is common to KLOA (RCUH 2002c). HINHP (1994b) observed *Euglandina rosea* along the Koolau summit ridge north of Peahinaia Trail and along Poamoho Trail. *Euglandia rosea* can heavily impact native mollusk populations if not controlled, including *Achatinella apexfulva, A. byronii/decipiens, A. lila, A. livida, and A. sowerbyana* at KLOA (Hadfield 1986). Introduced aquatic invertebrates found on primary drainages of KLOA tributaries include three crustaceans: *Macrobrachium lar* (Tahitian prawn), *Macrobrachium rosenbergii* (Malaysian prawn), and *Procambarus clarkii* (crayfish) (Hawaii Stream Assessment database 1989-2000).

Schofield Barracks East Range Action Area. *Xylosandrus compactus* (black twig borer) parasitized all observed individuals of the endangered plants *Alectryon macrococcus* var. *macrococcus* and *Fluggea neowawraea* at SBER (HINHP 1994c). Also common at SBER is *Sophonia rufofascia* (two-spotted leafhopper). The saliva of this insect species is suspected to cause yellowing of leaves and reduced vigor in many native and exotic plant species, including *Metrosideros polymorpha* at SBER. It is also suspected of causing severe dieback of the native fern *Dicranopteris linearis* (uluhe) that is common to SBER (RCUH 2002c). HINHP (1994d) observed the *Euglandina rosea* at SBER and they suggested it is distributed throughout the subinstallation. *Euglandina rosea* can heavily impact native mollusk populations, including *A. byronii/decipiens* and *A. sowerbyana* at SBER (Hadfield 1986). Other alien invertebrates potentially found at SBER include *Orthodera burmeisteri* (praying mantid), *Elimaea puntifera* (katydid), *Pseudonirvana* sp. (leafhopper), and *Apis mellifera* (honeybee) (HINHP 1994c). Introduced aquatic invertebrates potentially occurring at SBER include *Macrobrachium lar* (tahitian prawn) and *Procambarus clarkii* (crayfish*).* (Hawaii Stream Assessment database for Kaukonahua (Kiikii) Stream and Poamoho on KLOA 1989-2000).

Schofield Barracks Military Reservation Action Area. *Xylosandrus compactus* (black twig borer) parasitized all observed individuals of the endangered plants *Alectryon macrococcus* var. *macrococcus* and *Fluggea neowawraea* at SBMR (HINHP 1994c). Other plants that are potentially affected by these insects and that occur in SBMR are species of the *Melicope* genera. Also common at SBMR is *Sophonia rufofascia* (two-spotted leafhopper). The saliva of this insect species is suspected of causing yellowing of leaves and reduced vigor in many native and exotic plant species, including *Metrosideros polymorpha* at SBMR. It is suspected of causing severe dieback of the native fern *Dicranopteris linearis* (uluhe), which is common to SBMR (RCUH 2002c). In addition, HINHP (1994d) observed *Euglandina rosea* (carnivorous snail) at SBMR, and they suggested it is distributed throughout the subinstallation. This snail predator can heavily impact native mollusk populations, including *Achatinella mustelina* at SMBR. Other alien aquatic invertebrates potentially found at SBMR include *Cricotopus bicintus, Mesovelia amonea, Ischnura posita,* and *Cheumatopsyche pettiti* (insects)*, Procambarus clarkii* (crayfish), and *Corbicula fluminea* (asiatic clam) (Hawaii Stream Assessment database for Waikele Stream on SBMR 1992-93).

The Army's activities are unlikely to increase the spread of any of these alien invertebrates other than through activities that may weaken or stress individuals through alteration of habitat, which increases

their susceptibility to pests. Control methods for most invertebrates are not available for forestry settings. **The Army will minimize alien invertebrate impacts to the taxa requiring stabilization.** The following are some threat control measures the Army will use to minimize the impacts to listed species from alien invertebrates:

- Control *Xylosandrus compactus* and *Sophonia rufofascia* infestations where they impact threatened and endangered species.
- Identify and test alternative insecticides to combat *Xylosandrus compactus*.
- Determine the extent of *Euglandia rosea* predation on threatened and endangered species and instigate the appropriate predator control measures of the species.
- Coordinate/collaborate with the Toxicants Working Group in an effort to determine a safe toxicant for controlling populations of *Euglandia rosea.*

The Oahu Implementation Team will develop or review all methodology to ensure that it adequately assesses and addresses the impacts from alien invertebrates.

13.7.5 Rare Plant Monitoring

Management of rare species entails monitoring to examine population health, the collection of propagules for ex-situ propagation, and the identification of threats to these populations. The Natural Resources staff (NRS) uses the survey and monitoring data collected to prioritize species according to their rarity and threats such as weeds, rats, ungulates, invertebrates, and fire. NRS has coordinated these efforts with the Center for Plant Conservation (CPC) to standardize the collection and recording of rare plant data and to develop guidelines for the reintroduction of rare plant species. This collaborative effort includes participation in the Hawaii Rare Plant Restoration Group (HRPRG). As part of the Genetic Safety Net Program established by the Center for Plant Conservation, the Army will continue to monitor the health of existing populations of plants including *Abutilon sandwicense, Alectryon macrococcus* var. *macrococcus, Alsinidendron trinerve, Chamaesyce rockii, Cyanea acuminata, C. crispa, C. grimesiana* ssp. *obatae, C. humboldtiana, C. koolauensis, C. st. johnii, Cyrtandra dentata, C. subumbellata, C. viridiflora, Delissea subcordata, Diellia falcata, Eugenia koolauensis, Flueggea neowawraea, Gardenia mannii, Hesperomannia arborescens, Isodendrion longifolium, Labordia cyrtandrae, Lepidium arbuscula, Lobelia gaudichaudii ssp. koolauensis, Melicope lydgatei, Myrsine juddii, Phlegmariarus nutans (Lycopodium nutans), Phyllostegia hirsuta, Phyllostegia kaalaensis, Phyllostegia mollis, Plantago princeps, Pteris lidgatei, Sanicula purpurea, Schiedea hookeri, Schiedea kaalae, Tetraplasandra gymnocarpa, Viola chammisoniana* ssp. *chammisoniana,* and *Viola oahuensis* in the action areas.

In addition, monitoring will be conducted to ensure that the above state threat control goals are met. There is already an extensive monitoring section written in the Draft Makua IP that can be adopted for listed species in this BA.

13.7.6 Management Units

In the Draft Makua Implementation Plan, a very detailed plan for managing the habitat of the target taxon was developed and the same will be done in the Oahu IP. The goals for control of alien species on the habitat level have been designated in the Draft Makua IP, and management conducted under the Oahu IP must use those same targets (see Table 13.c for the target management levels). The Oahu IP will overlap significantly with the Makua IP in designated management areas (management units), but will include additional management units on Oahu and possibly a few new units on outer islands due to the distribution of taxa affected by Army training and transformation. The Oahu Implementation Team will

develop or review all methodology to ensure that it adequately assesses and addresses all habitat management concerns.

13.7.7 Fire

As previously stated in the description of potential effects of the action, fire can have numerous negative effects on vegetation, soils, hydrology, and air quality. Effects to specific threatened or endangered species are almost entirely unknown. Anecdotal evidence strongly suggests that fires in tropical island environments generally kill native species and replace them with exotics, unless aggressive native seeding programs are used to minimize alien colonization. The threat control actions required for stabilization are the same as those required to minimize the potential negative effects of Army training and transformation activities. **The Army will minimize the fire impacts to the taxa requiring stabilization.** In addition to training restrictions and other actions the Army is taking to minimize the potential negative effects of training, the following are some threat control measures the Army will use to minimize the impacts to listed species from fire:

- Maintain and update list of qualified personnel who meet the standards of the Incident Command System (ICS) for the management of wildfire and prescribe burns.
- Prepare and maintain education materials on fire hazards and preventative measures for troops and other persons who use the action areas.
- Clear vegetation from fire access roads and maintain, improve and establish new firebreaks where needed.
- Establish GIS to maintain firebreak location data and map wildfires.

The Oahu Implementation Team will develop or review all methodology to ensure that it adequately assesses and addresses the impacts from fire.

14. Conclusions

The objectives of this BA were to:

- Determine in programmatic fashion how routine military training on Oahu potentially affects listed species or species proposed for listing in the future and designated critical habitat.

- Determine the potential effects of the transformation of the 2nd Brigade, 25th Infantry Division to a Stryker Brigade Combat Team (SBCT) on listed threatened and endangered species and/or critical habitat.

- Determine the potential additive effects of the SBCT with the continuing mission of the 3rd Brigade of the 25th Infantry Division.

- Determine how the U.S. Army will minimize negative effects associated with routine military training and SBCT transformation implementation, and stabilize species to offset impacts that cannot be minimized to zero, or very low, insignificant, or discountable levels.

None of the live-fire impact areas used in routine military training on Oahu has any direct impact on listed species there.

Of the projects proposed for SBCT--Island of Oahu facilities, none of the SBCT construction, or use of any of the new facilities, will directly affect listed species on Oahu.

Even though there was no direct overlap of vehicle maneuver areas with threatened and endangered species occurrences, the presence of federally-listed species was considered a site restriction for off-road vehicle maneuver areas. Additional maneuver areas not presented in this document will be surveyed and results reviewed by the USFWS to determine if reinitiation of Section 7 consultation is appropriate.

Other military training and transformation effects determined to potentially adversely affect listed species include, fire, alien species introductions, foot traffic trampling, water erosion, and ground water degradation.

Minimization measures of potential negative effects of Army training and transformation are proposed and bring many of the potential threats to a level the Army believes will have no adverse affects on listed species. Although, some of the adverse effects cannot be minimized to insignificant or discountable levels, or be eliminated through minimization, none of these adverse effects will jeopardize the continued existence of federally listed species or adversely affect Oahu elepaio critical habitat because of species stabilization actions that will be implemented .

The Army proposes actions to stabilize 40 federally-listed threatened and endangered species including: feral ungulate monitoring, control and removal; incipient weed monitoring, control and removal; rodent monitoring, control and removal; invertebrate monitoring and control; and genetic banking, propagation, outplanting, and fencing of listed plants. Other mitigation efforts include habitat level management actions and protection of populations off-site from various threats.

15. Contributions from Recognized Experts

The following table shows individuals who contributed information, which helped in preparing this Biological Assessment. The Army is very grateful for their assistance.

Table 15.a List of Contributors and Information Contributed

Individual	Position/Title and Organization	Information Contributed
Patrice Ashfield	Biologist, USFWS, Hawaii	Endangered species
Andrew Beavers	Fire Behavior Specialist, Center for Environmental Management of Military Lands, Colorado State University	Fire expertise
Ron Borne	Transformation Director U.S. Army Garrison, Schofield Barracks, Hawaii	Transformation information
Marie Bruegmann	Botanist, USFWS, Hawaii	Species information
Alvin Char	Chief of Environmental Office, Schofield Barracks, Hawaii	Installation information
Patrick Costales	Oahu District Forester, Oahu Division of Forestry and Wildlife, State of Hawaii	Fire control and area of affect from potential fires
Vincent Costello	Natural Resource Specialist, Research Corporation of the University of Hawaii	Status and biology of *Achatinella* spp.
Gayland Enriques	Wildland Fire Manager, Schofield Barracks, Hawaii	Fire expertise
Joel Goedfrey	Natural Resources Mangager, Biologist, Environmental Divison, Schofield Barracks, Hawaii	Installation information
Michael Hadfield	Malacologist, Department of Zoology, University of Hawaii	Status and biology of *Achatinella mustelina*
Roy Kam	Data Manager, Hawaii Natural Heritage Program, Hawaii	Species information
Kapua Kawelo	Environmental Protection Specialist, U.S. Army Garrison, Hawaii	Status and biology of target taxa
Matthew Keir	Natural Resource Specialist, Research Corporation of the University of Hawaii	Status and biology of plants
Steven Kim	Point of Contact, USACE, Honolulu District, Hawaii	Installation and transformation information
James Kwon	Biologist, USFWS, Hawaii	Endangered species
Joel Lau	Botanist, Hawaii Heritage Program - The Nature Conservancy of Hawaii	Status and biology of plants
Dr. Steven Miller	Ecosystem Conservation Coordinator, USFWS, Hawaii	Species information
Jobriath Rohrer	Natural Resource Specialist, Research Corporation of the University of Hawaii	Status and biology of target taxa
Talbert Takahama	Biologist, Oahu Division of Forestry and Wildlife, State of Hawaii	Biological information on species at Pahole Natural Area Reserve, State of Hawaii
Gordon Weith	U.S. Army Training Support Center, Fort Eustis, Virginia	Transformation information
Eric VanderWerf	Ornithologist, U.S. Fish and Wildlife Service	Information on Oahu elepaio

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APPENDICES

Appendix A. Legacy and SBCT Vehicles, Weapon Systems, and Ammunition (on CD)

Appendix B. Rare Species Currently and Historically Observed Within Action Area Boundaries on Oahu

Appendix C. Federally Listed Threatened and Endangered Species Impacted by Routine Military Training and Transformation on Oahu, and included in the BA

Appendix D. Components of Species Descriptions

Appendix E. List of Acronyms

Appendix B. Rare Species Currently and Historically Observed Within Action Area Boundaries on Oahu.[1]

Scientific Name	Common Name	Federal Status	Heritage Global Rank	Date Recorded	Action Area[2]
Plants:					
Hibiscus kokio ssp. *kokio*	KOKI`O `ULA`ULA	SOC	G2T1	2002	DMR
Adenophorus periens		LE	G1	1913	KTA
Bidens campylotheca spp. *campylotheca*	KO`OKO`OLAU, KOKO`OLAU	SOC	G2T2	1900's	KTA, KLOA
Botrychium subbifoliatum	MAKOU	SOC	GH	1800's	KTA
Chamaesyce rockii		LE	G1	1948	KTA
Cyanea grimesiana spp. *grimesiana*	`OHA, HAHA, `OHA WAI	LE	G1T1	1941	KTA
Cyanea koolauensis		LE	G1	2002	KTA, KLOA, SBER
Cyanea lancelota spp. *calycina*	`OHA, HAHA, `OHA WAI	C	G1Q	1926	KTA
Cyanea sessilifolia	`OHA, HAHA, `OHA WAI		GH	1960	KTA
Eugenia koolauensis	NIOI	LE	G1	2002	KTA
Gardenia mannii	NANU, NA`U	LE	G1	2002	KTA, KLOA, SBER, SBMR
Hesperomannia arborescens		LE	G1	1977	KTA
Lindsaea repens var. *macraeana*			G5T2	1961	KTA
Nesoluma polynesicum	KEAHI	SOC	G2	2002	KTA
Phyllostegia hirsuta		LE	G1	1938	KTA
Platydesma cornuta var. *cornuta*	PILO KEA	C	G1T1	1947	KTA
Pteralyxia macrocarpa	KAULU	C	G1	2002	KTA
Tetraplasandra gymnocarpa		LE	G1	2002	KTA, KLOA, SBER
Zanthoxylum dipetalum	HEA`E, A`E	SOC	G2	2002	KTA
Chamaesyce rockii		LE	G1	2002	KLOA, SBER
Cyanea acuminata	`OHA, HAHA, `OHA WAI	LE	G2	2002	KLOA, SBER, SBMR
Cyanea crispa	`OHA, HAHA, `OHA WAI	LE	G1	2002	KLOA
Cyanea grimesiana spp. *grimesiana*	`OHA, HAHA, `OHA WAI	LE	G1T1	1949	KLOA
Cyanea humboldtiana	`OHA, HAHA, `OHA WAI	LE	G1	2002	KLOA
Cyanea lancelota spp. *calycina*	`OHA, HAHA, `OHA WAI	C	G1Q	2002	KLOA, SBER
Cyanea lancelota spp. *lancelota*	`OHA, HAHA, `OHA WAI	C	G1Q	2002	KLOA
Cyanea longiflora	`OHA, HAHA, `OHA WAI	LE	G1	1800's	KLOA

Scientific Name	Common Name	Federal Status	Heritage Global Rank	Date Recorded	Action Area[2]
Cyanea sessilifolia	`OHA, HAHA, `OHA WAI		GH	1931	KLOA
Cyanea st. johnii	`OHA, HAHA, `OHA WAI	LE	G1	2002	KLOA
Cyrtandra dentata	HA`IWALE, KANAWAO KE`OKE`O	LE	G1	2002	KLOA
Cyrtandra viridiflora	HA`IWALE, KANAWAO KE`OKE`O	LE	G1	2002	KLOA, SBER
Cyrtandra waiolani	HA`IWALE, KANAWAO KE`OKE`O	SOC	G1	1938	KLOA
Delissea subcordata	`OHA, HAHA, `OHA WAI	LE	G1	1800's	KLOA
Doodia lyonii			G1	1997	KLOA
Eugenia koolauensis	NIOI	LE	G1	1952	KLOA
Eurya sandwicensis	ANINI, WANINI	SOC	G2	1940	KLOA
Exocarpos gaudichaudii	HEAU	SOC	G1	2002	KLOA, SBER
Hedyotis elatior		SOC	G2	1910	KLOA
Hedyotis fluviatilis		C	G1	2002	KLOA
Hesperomannia arborescens		LE	G1	2002	KLOA, SBER, SBMR
Hibiscus kokio spp. *kokio*	KOKI`O `ULA`ULA	SOC	G2T1	1999	KLOA
Joinvillea ascendens ssp. *ascendens*	`OHE	C	G5T1	2002	KLOA, SBMR
Labordia cyrtandrae	KAMAKAHALA	LE	G1	1935	KLOA
Lindsaea repens var macraeana			G5T2	1998	KLOA
Lobelia gaudichaudii spp. *gaudichaudii*	`OHA, HAHA, `OHA WAI	C	G1T1	2002	KLOA
Lobelia gaudichaudii spp. *koolauensis*	`OHA, HAHA, `OHA WAI	LE	G1T1	2002	KLOA, SBER
Lobelia hypoleuca	`OPELU, LIUA, MO`OWAHIE		G3	2002	KLOA
Lobelia oahuensis	`OHA, HAHA, `OHA WAI	LE	G1	1926	KLOA
Melicope hiiakae		C	G1	2002	KLOA
Melicope lydgatei	ALANI	LE	G1	2002	KLOA
Myrsine fosbergii	KOLEA	C	G1	1995	KLOA
Myrsine juddii	KOLEA	LE	G1	1997	KLOA
Phlegmariarus nutans (Lycopodium nutans)		LE	G1	2002	KLOA, SBER
Phyllostegia hirsuta		LE	G1	2002	KLOA, SBER
Plantago princeps var. *longibrachteata*	ALE	LE	G2T1	1976	KLOA
Platanthera holochila		LE	G1	1938	KLOA
Platydesma cornuta var. *cornuta*	PILO KEA	C	G1T1	2002	KLOA, SBER
Psychotria hexandra var *hosakana*	KOPIKO, `OPIKO		G4TH	1911	KLOA

Scientific Name	Common Name	Federal Status	Heritage Global Rank	Date Recorded	Action Area[2]
Psychotria hexandra var *oahuensis*	KOPIKO, `OPIKO	C*	G4T1	2002	KLOA
Pteralyxia macrocarpa	KAULU	C	G1	1999	KLOA
Pteris lydgatei		LE	G1	2002	KLOA, SBER
Sanicula purpurea		LE	G1	2002	KLOA, SBER
Stenogyne kaalae spp. *sherffii*		SOC	G3T1	2002	KLOA
Thelypteris boydiae		C	G1	2002	KLOA
Viola oahuensis		LE	G1	2002	KLOA, SBER
Zanthoxylum oahuense	HEA`E, A`E	C*	G1	2002	KLOA
Cyanea longiflora	`OHA, HAHA, `OHA WAI	LE	G1	1916	SBER
Cyrtandra subumbellata	HA`IWALE, KANAWAO KE`OKE`O	LE	G1	2002	SBER
Doodia lyonii			G1	2002	SBER
Isodendrion longifolium	AUPAKA	LT	G2	2002	SBER, SBMR
Joinvillea ascendens ssp. *ascendens*	`OHE	C	G5T1	1930	SBER
Lobelia hypoleuca	`OPELU, LIUA, MO`OWAHIE		G3	1993	SBER
Abutilon sandwichense		LE	G1	2002	SBMR
Alectryon macrococcus var. *macrococcus*	`ALA`ALAHUA, MAHOE	LE	G1T1	2002	SBMR
Alsinidendron trinerve		LE	G1	2002	SBMR
Bobea sandwicensis	`AHAKEA		G1	1988	SBMR
Cenchus agrimonioides var agrimonioides	KAMANOMANO, KUMANOMANO	LE	G1T1	1912	SBMR
Cyanea grimesiana spp. *obatae*	`OHA, HAHA, `OHA WAI	LE	G1T1	2002	SBMR
Cyanea lancelota spp. *calycina*	`OHA, HAHA, `OHA WAI	C	G1Q	2002	SBMR
Cyanea membranacea	`OHA, HAHA, `OHA WAI	SOC	G2	2002	SBMR
Delissea subcordata	`OHA, HAHA, `OHA WAI	LE	G1	2002	SBMR
Diellia falcata		LE	G2	2002	SBMR
Dissochondrus biflorus		SOC	G2	2002	SBMR
Dubautia sherffiana	NA`ENA`E	SOC	G1	2002	SBMR
Exocarpos gaudichaudii	HEAU	SOC	G1	2002	SBMR
Flueggea neowawraea	MEHAMEHAME	LE	G1	2002	SBMR
Hibiscus brackenridgei spp. *mokuleianus*	MA`O HAU HELE	LE	G1T1	1950	SBMR
Labordia cyrtandrae	KAMAKAHALA	LE	G1	2002	SBMR
Labordia kaalae	KAMAKAHALA	SOC	G1	2002	SBMR
Lepidium arbuscula	`ANAUNAU, NAUNAU, KUNANA	LE	G1	2002	SBMR

Scientific Name	Common Name	Federal Status	Heritage Global Rank	Date Recorded	Action Area[2]
Lipochaeta tenuis	NEHE	SOC	G2	2002	SBMR
Lobelia niihauensis	PANAUNAU	LE	G1	2002	SBMR
Lobelia oahuensis	`OHA, HAHA, `OHA WAI	LE	G1	2002	SBMR
Lobelia yuccoides	PANAUNAU	SOC	G2	2002	SBMR
Lobelia spp.	PANAUNAU		G2	2002	SBMR
Melicope chrisophersenii	ALANI	C	G1	2002	SBMR
Melicope cinerea	ALANI		G1	2002	SBMR
Melicope pallida	ALANI	LE	G1	1970	SBMR
Melicope sandwicensis	ALANI		G2	1993	SBMR
Neraudia angulata var. *angulata*	MA`ALOA, MA`OLOA, `OLOA	LE	G1T1	2002	SBMR
Neraudia melastomifolia	MA`ALOA, MA`OLOA, `OLOA	SOC	G2	2002	SBMR
Nototrichium humile	KULU`I	LE	G2	1933	SBMR
Nothocestrum latifolium	KULU`I	SOC	G2	2002	SBMR
Panicum beecheyi			G2	1997	SBMR
Phyllostegia hirsuta		LE	G1	2002	SBMR
Phyllostegia kaalensis		LE	G1	2002	SBMR
Phyllostegia mollis		LE	G1	2002	SBMR
Plantago princeps		LE	G1	2002	SBMR
Platydesma cornuta var decurrens	PILO KEA	C	G1T1	2002	SBMR
Pleomele forbesii	HALAPEPE	C*	G1	1987	SBMR
Pteralyxia macrocarpa	KAULU	C	G1	2002	SBMR
Schiedea hookeri		LE	G1	2002	SBMR
Schiedea kaalae		LE	G1	2002	SBMR
Schiedea ligustrina			G2	2002	SBMR
Schiedea nuttallii		LE	G1	1936	SBMR
Schiedea pentandra		SOC	G2	1992	SBMR
Schiedea pubescens var. *purpurascens*		SOC	G2	2002	SBMR
Sicyos lanceoloideus	`ANUNU, KUP	SOC	G1	2002	SBMR
Solanun sandwicense	POPOLO`AIAKEAKUA	LE	G1	1924	SBMR
Strongylodon ruber		SOC	G1	2002	SBMR
Tetramolopium lepidotum spp. *lepidotum*	LEPIDOTUM	LE	G1T1	1924	SBMR
Urera kaalae	OPUHE	LE	G1	1936	SBMR

Scientific Name	Common Name	Federal Status	Heritage Global Rank	Date Recorded	Action Area[2]
Viola chamissoniana spp. *chamissoniana*	PAMAKANI	LE	G4T1	2002	SBMR
Zanthoxylum dipetalum var. *dipetalum*	HEA`E, A`E	SOC	G2	2002	SBMR
Invertebrates: snails					
Achatinella curta	OAHU TREE SNAIL, PUPU KUAHIWI	LE	G1	1946	KTA
Achatinella dimorpha	OAHU TREE SNAIL, PUPU KUAHIWI	LE	GH	1967	KTA, KLOA
Achatinella sowerbyana	OAHU TREE SNAIL, PUPU KUAHIWI	LE	G1	1952	KTA
Achatinella valida	OAHU TREE SNAIL, PUPU KUAHIWI	LE	GH	1951	KTA
Auriculella perpusilla	ACHATINELLID LAND SNAIL		G1	1967	KTA, KLOA
Auriculella pulchra	ACHATINELLID LAND SNAIL		G1	1978	KTA
Achatinella apexfulva	OAHU TREE SNAIL, PUPU KUAHIWI	LE	G1	1998	KLOA
Achatinella byronii/decipiens	OAHU TREE SNAIL, PUPU KUAHIWI	LE	G1	2002	KLOA, SBER
Achatinella curta	OAHU TREE SNAIL, PUPU KUAHIWI	LE	G1	1989	KLOA
Achatinella leucorraphe	OAHU TREE SNAIL, PUPU KUAHIWI	LE	G1	1960	KLOA
Achatinella lila	OAHU TREE SNAIL, PUPU KUAHIWI	LE	G1	2002	KLOA
Achatinella livida	OAHU TREE SNAIL, PUPU KUAHIWI	LE	G1	2002	KLOA
Achatinella pulcherrima	OAHU TREE SNAIL, PUPU KUAHIWI	LE	G1	1993	KLOA
Achatinella rosea	OAHU TREE SNAIL, PUPU KUAHIWI	LE	G1	1949	KLOA
Achatinella sowerbyana	OAHU TREE SNAIL, PUPU KUAHIWI	LE	G1	2002	KLOA
Auriculella pulchra	ACHATINELLID LAND SNAIL		G1	1987	KLOA
Leptachatina sp 8	AMASTRID LAND SNAIL	SOC	G1	1974	KLOA
Achatinella apexfulva	OAHU TREE SNAIL, PUPU KUAHIWI	LE	G1	1953	SBER
Achatinella leucorraphe	OAHU TREE SNAIL, PUPU KUAHIWI	LE	G1	1989	SBER
Achatinella lila	OAHU TREE SNAIL, PUPU KUAHIWI	LE	G1	1974	SBER
Achatinella sowerbyana	OAHU TREE SNAIL, PUPU KUAHIWI	LE	G1	1989	SBER
Achatinella swiftii	OAHU TREE SNAIL, PUPU KUAHIWI	LE	G1	1970's	SBER
Auriculella perpusilla	ACHATINELLID LAND SNAIL		G1	1953	SBER
Auriculella ambusta	ACHATINELLID LAND SNAIL		G1	1948	SBMR
Achatinella mustelina	OAHU TREE SNAIL, PUPU KUAHIWI	LE	G1	2002	SBMR
Invertebrates: crustaceans					
Atyoida bisulcata	COMMON STREAM SHRIMP, `OPAEKALA`OLE		G4?	1989	KTA
Invertebrates: insects					

Scientific Name	Common Name	Federal Status	Heritage Global Rank	Date Recorded	Action Area[2]
Megalagrion oceanicum	OCEANIC MEGALAGRION DAMSELFLY	C	G2	1928	KTA
Megalagrion leptodemas	CRIMSON HAWAIIAN DAMSELFLY	C	G1	1979	KLOA
Megalagrion nigrohamatum var. *nigrolineatum*	BLACKHOOK HAWAIIAN DAMSELFLY	C	G4T2	1997	KLOA
Megalagrion oahuense	OAHU MEGALAGRION DAMSELFLY	SOC	G3	1980	KLOA
Megalagrion oceanicum	OCEANIC MEGALAGRION DAMSELFLY	C	G2	1978	KLOA
Megalagrion pacificum	PACIFIC MEGALAGRION DAMSELFLY	C	G2	1901	KLOA
Megalagrion leptodemas	CRIMSON HAWAIIAN DAMSELFLY	C	G1	1996	SBER
Megalagrion oahuense	OAHU MEGALAGRION DAMSELFLY	SOC	G3	1958	SBER
Nesopeplus serratus	SOURING BEETLE		GH	1954	SBMR
Vertebrates: fish					
Awaous guamensis	`O`OPU NAKEA		G4	1989	KTA
Lentipes concolor	`O`OPU ALAMO`O		G3	1997	KLOA
Vertebrates: birds					
Anas wyvilliana	HAWAIIAN DUCK, KOLOA	LE	G1	1986	DMR
Fulica alai	`ALAE KE`OKE`O, HAWAIIAN COOT	LE	G2	1993	DMR
Gallinula chloropus spp. *sandvicensis*	HAWAIIAN GALLINULE, `ALAE-`ULA	LE	G5T2	1988	DMR
Himantopus mexicanus spp. *knudseni*	HAWAIIAN STILT, AE`O	LE	G5T2	1989	DMR
Asio flammeus spp. *sandwichensis*	HAWAIIAN OWL, PUEO (OAHU ONLY)	SOC	G5T3	1969	KLOA
Chasiempis sandwichensis spp. *ibidis*	OAHU `ELEPAIO	LE	G4T1T2	1991	KLOA
Loxops coccineus spp. *wolstenholmi*	OAHU `AKEPA, `AKEPEU`IE		G1TX	1893	KLOA
Paroreomyza maculata	O`AHU `ALAUAHIO, O`AHU CREEPER	LE	GH	1991	KLOA
Vestiaria coccinea pop 2	`I`IWI (OAHU ONLY)		G4T1	1993	KLOA
Chasiempis sandwichensis spp. *ibidis*	OAHU `ELEPAIO	LE	G4T1T2	1989	KTA
Chasiempis sandwichensis spp. *ibidis*	OAHU `ELEPAIO	LE	G4T1T2	1992	SBER
Loxops coccineus spp. *wolstenholmi*	OAHU `AKEPA, `AKEPEU`IE		G1TX	1976	SBER
Vestiaria coccinea pop 2	`I`IWI (OAHU ONLY)		G4T1	1978	SBER
Asio flammeus spp. *sandwichensis*	HAWAIIAN OWL, PUEO (OAHU ONLY)	SOC	G5T3	1901	SBMR
Chasiempis sandwichensis spp. *ibidis*	OAHU `ELEPAIO	LE	G4T1T2	2002	SBMR
Paroreomyza maculata	O`AHU `ALAUAHIO, O`AHU CREEPER	LE	GH	1961	KLOA
Vestiaria coccinea pop 2	`I`IWI (OAHU ONLY)		G4T1	1977	SBMR

Scientific Name	Common Name	Federal Status	Heritage Global Rank	Date Recorded	Action Area[2]
Vertebrates: mammals					
Lasiurus cinereus spp. *semotus*	`OPE`APE`A, HAWAIIAN HOARY BAT	LE	G5T2	1976	KLOA
Lasiurus cinereus spp. *semotus*	`OPE`APE`A, HAWAIIAN HOARY BAT	LE	G5T2	1988	SBMR

[1]Records are from the Hawaii Natural Heritage Program data set (HINHP 2002).
[2] DMR=Dillingham Military Reservation, KTA=Kahuku Training Area, KLOA=Kawailoa, SBER=Schofield Barracks East Range, SBMR=Schofield Barracks Military Reservation, SRAA= South Range Acquisition Area.

Appendix C. Federally Listed Threatened and Endangered Species Impacted by Army Training and Transformation on Oahu, and included in the BA.[1]

Species	Taxa	Location Found[2]	Federal Status
Abutilon sandwichense	Plant	SBMR	E
Alectryon macrococcus* var. *macrococcus	Plant	SBMR	E
Alsinidendron trinerve	Plant	SBMR	E
Chamaesyce rockii	Plant	KLOA, SBER	E
Cyanea acuminata	Plant	KLOA, SBER, SBMR	E
Cyanea crispa	Plant	KLOA	E
Cyanea grimesiana* spp. *obatae	Plant	SBMR	E
Cyanea humboldtiana	Plant	KLOA	E
Cyanea koolauensis	Plant	KTA, KLOA, SBER	E
Cyanea st. johnii	Plant	KLOA	E
Cyrtandra dentate	Plant	KLOA	E
Cyrtandra subumbellata	Plant	SBER	E
Cyrtandra viridiflora	Plant	KLOA, SBER	E
Delissea subcordata	Plant	SBMR	E
Diellia falcata	Plant	SBMR	E
Eugenia koolauensis	Plant	KTA	E
Flueggea neowawraea	Plant	SBMR	E
Gardenia mannii	Plant	KTA, KLOA, SBER, SBMR,	E
Hesperomannia arborescens	Plant	KLOA, SBER, SBMR	E
Isodendrion longifolium	Plant	SBER, SBMR	T
Labordia cyrtandrae	Plant	SBMR	E
Lepidium arbuscula	Plant	SBMR	E
Lobelia gaudichaudii* spp. *koolauensis	Plant	SBER	E
Lobelia oahuensis[3]	Plant	SBMR	E
Melicope lydgatei	Plant	KLOA	E
Myrsine juddii	Plant	KLOA	E
Phlegmariarus nutans (Lycopodium nutans)	Plant	KLOA, SBER	E
Phyllostegia hirsuta	Plant	KLOA, SBER, SBMR	E
Phyllostegia kaalensis	Plant	SBMR	E
Phyllostegia mollis	Plant	SBMR	E
Plantago princeps	Plant	SBMR	E
Pteris lidgatei	Plant	KLOA, SBER	E
Sanicula purpurea	Plant	KLOA, SBER	E
Schiedea hookeri	Plant	SBMR	E
Schiedea kaalae	Plant	SBMR	E
Tetraplasandra gymnocarpa	Plant	KTA, KLOA, SBER	E
Viola chamissoniana* spp. *chamissoniana	Plant	SBMR	E
Viola oahuensis	Plant	KLOA, SBER	E
Chasiempis sandwichensis* spp. *ibidis	Vertebrate	SBMR	E
Lasiurus cinereus* spp. *semotus	Vertebrate	SBMR	E
Achatinella apexfulva[3]	Invertebrate	KLOA	E

Species	Taxa	Location Found[2]	Federal Status
Achatinella byronii/decipiens	Invertebrate	KLOA, SBER	E
Achatinella curta[3]	Invertebrate	KLOA	E
Achatinella leucorraphe[3]	Invertebrate	SBER	E
Achatinella lila	Invertebrate	KLOA	E
Achatinella livida	Invertebrate	KLOA	E
Achatinella mustelina	Invertebrate	SBMR	E
Achatinella pulcherrima[3]	Invertebrate	KLOA	E
Achatinella sowerbyana	Invertebrate	KLOA	E

[1] Only includes species with recent (post 1982) occurrence records.
[2] KTA=Kahuku Training Area, KLOA=Kawailoa, SBER= Schofield Barracks East Range, SBMR=Schofield Barracks Military Reservation, SRAA= South Range Acquisition Area.
[3]Possibly already extirpated.

Appendix D. Components of Species Descriptions

Image: a photograph of the target taxon.
Scientific name: genus and species, with specific epithets as necessary, and author.
Hawaiian name: if available.
Family: name of the family to which the target taxon belongs, followed by its common name.
Federal status: official USFWS published status designation (*e.g.*, listed endangered)
Description and biology: habit (*e.g.*, tree, shrub, etc.), life-span (*e.g.*, annual, perennial, short-lived), followed by any details on the biology of the taxon, including pollination biology, dispersal, and specific environmental requirements (if known). This section is largely based on Wagner *et al*. (1990).
Known distribution: the recorded historic range of the taxon, according to HINHP.
Population trends: the trends in the numbers and status of the taxon, according to HINHP.
Current status: the current distribution of the taxon and numbers of known plants, according to HINHP. The population unit (PU) was used to determine the current status of each species (i.e. the number of known populations and stable populations remaining). It is defined as individuals of a target taxon occurring at a discrete site separated by significant topographic barriers or habitat discontinuities from other individuals of that taxon, or occurring >1000 m (3280 ft) apart (Makua Implementation Team 2002).
Habitat: typical elevation, moisture, and habitat details (Lau, Kawelo, Rohrer, Yoshioka, Takahama, pers. comm.).
Taxonomic background: variation in morphology and nomenclature, and any issues or ambiguities in taxonomy taken mainly from Wagner *et al*. (1990)
Threats: known threats to the target taxon are listed, including feral ungulates, rats, predators, insect pests, diseases, fire, and human disturbance, as applicable. Largely based on USFWS recovery plans.
Outplanting considerations (only for plant taxa): concerns regarding unwanted hybridization with closely related taxa or other potential hybridization relationships are discussed.

Appendix E. List of Acronyms

Acronym/Symbol	Meaning
AA	action area
AAR	after-action review
ALOC	administrative-logistics operations center
ARTEP	Army Training and Evaluation Program
ASIP	Army stationing installation plan
AT	anti-tank
ATSC	Army Training Support Center
ATTACC	army training and testing area carrying capacity
BA	biological assessment
BAAF	Bradshaw Army Airfield
BAX (or BAC)	Battle Area Complex
BCT	brigade combat team
BN	battalion
BO	biological opinion
BSA	brigade support area, biologically sensitive area
BSB	brigade support battalion
CALFEX	combined arms live-fire exercise
CAMTF	Combined Arms Military Training Facility
CEMML	Center for Environmental Management of Military Lands
CFR	Code of Federal Regulations
CO	Company, Colorado
CS	combat support
CSG	corps support group
CSS	combat service support
CSSC	combat service support company
DA	Department of Army
DISCOM	Division Support Command
DMR	Dillingham Military Reservation
DOFAW	Department of Fish and Wildlife
DPTM	Directorate of Plans, Training and Mobilization
DPW	Department of Public Works
DZ	drop zone
EA	environmental awareness
EIS	environmental impact statement
ESA	Endangered Species Act
FM	field manual
FP	firing point
FR	Federal Register
FRTC	Full Range Training Cartridge
FTI	Fixed tactical internet
FTX	field training exercise
FY	fiscal year
G3	operations, plans, and training staff at Corps and Division

Acronym/Symbol	Meaning
GIS	geographic information system
HE	high explosive
HEDP	high-explosive, dual-purpose
HEMMT	heavy expanded mobility tactical truck
HHC	headquarters and headquarters company
HINHP	Hawaii Natural Heritage Program
HMA	Hawaii Motor Sports Association
HMMWV/HUMVEE	high mobility multipurpose wheeled vehicle (also known as 'Humvee')
HMR	Helemano Military Reservation
HQ	headquarters
HQDA	Headquarters, Department of the Army
HUMINT	human intelligence
IAV	interim armored vehicle (Stryker)
ICV	infantry carrier vehicle
ID(L)	Infantry Division (Light)
ILLUM	illumination
IN	infantry
INRMP	Integrated Natural Resources Management Plan
IP	implementation plan
IPBC	infantry platoon battle course
ISBC	infantry squad battle course
ISR	intelligence, surveillance and reconnaissance
ITAM	integrated training area management
ITOE	improved tables of organization and equipment
KLOA	Kawailoa Training Area
KMWP	Koolau Mountains Watershed Partnership
KSBE	Kamehameha Schools Bishop Estate
KTA	Kahuku Training Area
LAV	light armored vehicle
LAW	light anti-tank weapon
LFX	live-fire exercise
LMTV	light medium tactical vehicle
LRAM	land rehabilitation and maintenance
LURS	land use requirement study
LZ	landing zone
MAC	military assault course
METL	mission essential task list
MGS	mobile gun system
MI	military intelligence
MILES	multiple integrated laser engagement system
MIM	maneuver impact miles
MMR	Makua Military Reservation
MOUT	military operations on urban terrain
MTOE	modified table of organization and equipment
MTP	mission training plan

Acronym/Symbol	Meaning
MTV	medium tactical vehicle
NAR	Natural Area Reserve
NBC	nuclear, biological, chemical
NEPA	National Environmental Policy Act
NFFL	Northern Forest Fire Laboratory
NOE	nap of the earth
NRS	natural resources staff
O&O	operations and organization
POL	petroleum, oil, and lubricants
PTA	Pohakuloa Training Area
PZ	pick up zone
QTR	Qualification Training Range
RAWS	Remote Automated Weather Station
RDH	Range Division-Hawaii
RDP	range development plan
ROD	record of decision
RSTA	reconnaissance, surveillance, and target acquisition
RTLP	Range and Training Land Program
RTLP DP	Range and Training Land Program Development Plan
S3	operations and training (office/officer)
SAW	squad automatic weapon
SBCT	Stryker Brigade combat team
SBER	Schofield Barracks East Range
SBMR	Schofield Barracks Military Reservation
SDZ	surface danger zone
SMAW	shoulder-launched multipurpose assault weapon
SMK	smoke
SOP	standing operating procedure
SRAA	South Range Acquisition Area
SRTA	short-range training ammunition
STRAC	standards in training commissions
STX	situational training exercise
TC	training circular
TNC	The Nature Conservancy
TOC	tactical operations center
TOW	tube-launched, optically-tracked, wire-guided (missile)
TP	training pamphlet
TRI	training requirement integration
UAV	unmanned aerial vehicle
USACE	U.S. Army Corps of Engineers
USAG-HI	U.S. Army Garrison, Hawaii
USAMPBH	US Army Military Police Brigade Hawaii
USARHAW	U.S. Army, Hawaii
USC	United States Code
USDA	U. S. Department of Agriculture

Acronym/Symbol	Meaning
USFWS	U. S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USMC	U.S. Marine Corps
UXO	unexploded ordnance
WAAF	Wheeler Army Air Field
WFMP	Wildland Fire Management Plan
WP	white phosphorus