

In the event of a large fire, additional ground forces, including red-carded Army Natural Resources Staff and firefighters from cooperating agencies are likely to be assigned to provide on-site protection to the Kaluakauila and Kahanahaiki management units and other areas. For pre-planning purposes, to maintain daily preparedness for a large fire outside the firebreak road, one fireline supervisor will be pre-assigned to coordinate suppression actions at the Kaluakauila Management Unit and another will be pre-assigned to direct suppression actions at the Kahanahaiki Management Unit. The assigned Incident Commander will document equipment, firefighter, pilot, and helicopter assignments on the Daily Staffing Worksheet.

The five Army wildland fire personnel assigned to staff Makua will rotate among the following positions: (1) one will be posted at all times during live-fire training on the top platform of the Range Control tower to watch for fire starts and document the times and locations of all rounds impacting outside the firebreak road (only grenades, mortars, artillery, AT-4, SMAW, 2.75-caliber rockets, Javelin, and TOW are likely to be visible enough to easily make determinations about impact locations); (2) one will be in the Range Control office confirming that WIMS is operating properly, confirming that actual weather is consistent with forecasted weather (and requesting an update to the forecast if there is a significant deviation), and confirming for the Incident Commander that Range Control staff are applying weapons restrictions properly in their radio communications with commanding officers conducting exercises down-range; (3) one will be in direct communication with all of the on-site helicopter pilots so that when a fire ignites, the helicopter response will not be delayed; and (4) the other two will work in the fire cache, and on equipment and local fuels projects.

When a wildland fire ignites, fire suppression will take precedence over training. If the fire is inside the firebreak road, the Incident Commander will determine when and for how long the range needs to be closed for fire suppression work to be conducted down-range. If the fire is outside the firebreak road, training will not commence until the fire is declared 100 percent contained by the Incident Commander. No fire outside the firebreak road will be declared 100 percent contained until the outer 60 m (197 ft) of the burned area is 100 percent mopped up and out. Thermal cameras mounted on Unmanned Aerial Vehicles may be used to determine fire containment. Because most of the area contains unexploded ordinance, containment will usually require substantial helicopter bucket work. At a minimum, an NWCG-qualified, pack tested, red-carded Incident Commander Type 4, plus one Type 2 Firefighter will remain on scene and on duty at Makua between 6 a.m. and 9 p.m. on all days when any fire is burning, inside or outside the firebreak road, until the fire is 100 percent contained. At a minimum, an NWCG-qualified, pack-tested, red-carded Incident Commander Type 5, plus one Type 2 Firefighter will remain on site at Makua overnight whenever there is a fire outside the firebreak road that has not been declared out. Once the fire is 100 percent contained, a minimum of one NWCG qualified, pack-tested, red-carded Incident Commander Type 5 or higher Army staff person will be on site and on duty at Makua between 6 a.m. and 9 p.m. on all days when any fire is burning inside or outside the firebreak road, until the fire is declared 100 percent out. No fire will be declared 100 percent out until a full 48 hours have passed since the last heat or smoke was found. Training will not occur on any day when there is not adequate fire resource staffing available to work during the entire duration of any potential fire suppression operation, including weekends and extended hours. Fires outside the firebreak road will only be declared out by the Army Wildland Fire Management Officer or Assistant Wildland Fire Management Officer. Fires inside the firebreak road will only be declared out by a red-carded, pack-tested U.S. Army Firefighter with

minimum qualifications of NWCG Incident Commander Type 4. This will virtually eliminate “restart” as an ignition source at Makua. Helicopter resources will be assigned to exercises in accordance with a newly developed helicopter staffing protocol. All Incident Commanders assigned to live-fire training at Makua will know the locations of listed species and critical habitat and will have the authority to order any additional firefighting resources necessary to prevent the fire from burning those areas. The Incident Commander will have the authority to order additional helicopter support from cooperating agencies and private contractors.

The two Type 6 engines staffing Makua will be tested to ensure that they are running reliably and that they are pumping 100 psi water pressure on demand (within 5 minutes of beginning to pump with the engine) prior to initiation of live-fire training at Makua. A tested and operational engine or pump must be on site at Makua prior to initiating any training that requires fire suppression staffing. The water handling system on the two Type 6 engines will not be older than 15 years since its manufacture date. Engines and helicopters may apply foam and fire retardants in their fire suppression and containment operations, but these substances will not be applied within 100 m (328 ft) of streams, ponds, or the ocean.

### **3.3 Fire Suppression Helicopter/Aircraft Staffing**

Helicopters or other aircraft will be used for both fire suppression and fire detection at Makua. Fire containment with air resources depends on the ability to perform at a pace in excess of the fire’s rate of perimeter increase. Therefore, total combined continuous fireline productivity of on-site and total assigned helicopters will vary by season, forecasted fire weather and scheduled training activities.

Fire suppression helicopter staffing protocols have been designed for training and prescribed burns (Appendix D) based on the successful containment of guinea grass fires as determined by the CONTAIN module of BehavePlus fire behavior model (see Project Description, Section 9). The total combined continuous fireline productivity of on-site and standby fire suppression helicopters will vary by season, forecasted fire weather, and scheduled training activities. To provide for changes in the configuration of fire suppression aircraft staffing, as availability of various contract and military aircraft is affected by deployments and other factors, the total productivity of assigned aircraft is specified, rather than the type and number of particular helicopters.

Productivity rate estimates, designating the average rate of contiguous fire perimeter extinguished in an hour, have been established for various aircraft proposed for use at Makua (Table PD 4). The productivity rate in Table PD 4 are based on fire suppression capabilities demonstrated by Blackhawks, Hughes 500, and UH-1H Huey aircraft, extrapolated to other aircraft based on water capacity. Helicopter productivity is rated in chains/hour. A chain (ch) is a forestry measurement term utilized by the fire behavior software; one chain is 20.1 m (66 ft).

Table PD 4. Daytime Productivity Rates to be Used for Helicopters Assigned for Fire Suppression Staffing at Makua.

| Day Time Aircraft Productivity Estimates for Fire Suppression at Makua Military Reservation |                       |                |                                    |   |  |
|---|-----------------------|----------------|------------------------------------|---|--|
| Aircraft Type   | Pilot Type            | Water Capacity | Not Fueled at Makua                | Fueled at Makua   |  |
|   |                       |                | All Pilots and All Wind Conditions | 20-foot wind speed 11 mph or higher OR No "F"-Type WIMS forecast for wind speed for all hours of scheduled use OR Pilots not yet approved by Army and Fish and Wildlife Service for Higher Productivity | 20-foot wind speed "F"-type WIMS forecast: 10 mph or lower for current and next three hours AND Expert Pilots Approved by Army and Fish and Wildlife Service at These Productivity Rates |
| CL415   | Contractor            | 1,800 gallons  | n.a.                               | 57 chains/hr  | 171 chains/hr  |
| S61N or similar   | Contractor            | 1,000 gallons  | 13 chains/hr                       | 45 chains/hr  | 135 chains/hr  |
| S61N or similar   | Contractor            | 800 gallons    | 10 chains/hr                       | 36 chains/hr  | 108 chains/hr  |
| CH-47 Chinook   | Military / Contractor | 2000 gallons   | 9 chains/hr                        | 35 chains/hr  | n.a.   |
| UH-60 Blackhawk   | Military              | 660 gallons    | 9 chains/hr                        | 30 chains/hr  | n.a.   |
| CH-46 Sea Knight  | Military              | 400 gallons    | 5 chains/hr                        | 18 chains/hr  | n.a.   |
| CH-53 Sea Stallion  | Military              | 400 gallons    | 5 chains/hr                        | 18 chains/hr  | n.a.   |
| Bell 210  | Contractor            | 350 gallons    | 5 chains/hr                        | 17 chains/hr  | 51 chains/hr   |
| UH-1H Huey/ Bell 205 or 212   | Contractor            | 340 gallons    | 5 chains/hr                        | 16 chains/hr  | 48 chains/hr   |
| Bell 407  | Contractor            | 210 gallons    | 3 chains/hr                        | 10 chains/hr  | 30 chains/hr   |
| Bell 206 Long Ranger  | Contractor            | 200 gallons    | 3 chains/hr                        | 10 chains/hr  | 20 chains/hr   |
| Bell Jet Ranger   | Contractor            | 120 gallons    | 2 chains/hr                        | 6 chains/hr   | 19 chains/hr   |
| Hughes 500  | Contractor            | 110 gallons    | 2 chains/hr                        | 6 chains/hr   | 18 chains/hr   |

Historically, difficulties have resulted when helicopters have not had access to fuel on-site at Makua. For a particular helicopter's productivity to be assessed as having on-site fueling capability, a fuel tank or fuel truck will be placed at Makua with enough of the appropriate fuel on board to provide 10 hours of flight time for that helicopter. The fuel truck or tank will be compatible with the helicopter, and all Army and contract requirements will be finalized prior to initiation of training or prescribed burning so refueling will be immediately available as needed during the helicopters assigned shift and it will not take longer than 15 minutes to accomplish. If multiple helicopters will be fueling from the same truck or tank, the truck or tank will have, at the beginning of the fire, enough fuel on-site for 10 hours of flight time of all of the helicopters that the truck is supporting. In fire situations when visibility at the Range Control helipads is poor, an alternate on-site refueling area may be established at another location within 5 km (3 mi) of the Makua Range Control helipads.

To ensure that productivity rates in the table would be met by all pilots, productivity rates for the least productive pilots are used as a basis for rating particular classes of aircraft. Therefore, the rates in Table PD 4 are expected to be conservative. Army will document by video recording, still photography, or other method that enables independent verification, the fire suppression

helicopter productivity, in grass fuels, during the first hour of all wildland fires occurring outside the firebreak road at Makua. Office of Aircraft Services – Certified pilots, and other pilots with fire suppression experience may be given the higher productivity rates listed in Table PD 4 with the approval of the Army and the Service. The Army may develop and submit revised fire suppression aircraft productivity ratings for individual pilots or classes of aircraft for specific fuel moisture and wind conditions. Individual pilots or classes of aircraft may be given ratings higher than those in Table PD 4 if sufficient documentation is available to substantiate the assignment of the revised rates. The revised rates and supporting documentation will be submitted to the Service for review prior to the replacement of the rates listed in Table PD 4 for use satisfying fire suppression staffing requirements at Makua. Given the approval of the Service’s Field Supervisor, updated rates may be appended to the Biological Opinion for use satisfying the fire suppression helicopter staffing requirements specified in this Project Description.

Fire suppression staffing for live-fire training will meet or exceed the minimum requirements listed in Table PD 5. Helicopter staffing will be based on two fire weather parameters documented in WIMS for Makua Range weather station number 490301: (1) live herbaceous fuel moisture for the previous day, and (2) National Weather Service “F” type observations of wind speed for all hours of training and for the one to two hourly observations immediately following each period of training. General fire weather forecasts and spot fire weather forecasts issued by National Weather Service forecasters will not be used to make determinations about helicopter fire suppression staffing. Hourly “F” type WIMS observations input by the National Weather Service forecaster into WIMS must be used. If no “F” type WIMS observation is available, helicopters will be staffed for wind speeds of 16 mph or higher

Response times for standby helicopters are maximum estimates. Standby helicopters will often be called in to support suppression actions on larger fires inside the firebreak road. The Army Incident Commander assigned to the fire will release standby helicopters as they are no longer needed. Often, the spread of a fire outside the firebreak road will be successfully halted by the on-site helicopters and standby helicopters will be cancelled prior to their arrival on the fire.

When blanks are fired from designated mowed areas which are separated from patches of tall grass by a bare mineral soil firebreak, wide enough to stop a fire burning in the mowed grass fuels, no helicopter staffing will be required. When blanks are fired from areas which are not mowed or which are not separated from taller grass fuels by a firebreak, fire suppression helicopters will be staffed pursuant to fire suppression helicopter staffing guidelines specified for 5.56 SRTA (Table PD 5).

Table PD 5 (On Following Page). Helicopter Staffing: Minimum Helicopter Fire Suppression Capability Assigned to Daytime Live-fire Training at Makua by Time of Year and Potential Fire Ignition Location.

| Wind Directions N, NNE, NE, ENE, E, and ESE Only: Fire Suppression Helicopter (Aircraft) Staffing Requirements <sup>(1)</sup> : Minimum Fire Suppression Capability <sup>(2)</sup> of Fire Suppression Helicopters Assigned for Water Drops During Exercises at Makua <sup>(3)</sup> <sup>(4)</sup> <sup>(5)</sup> <sup>(6)</sup>   |   |  |  |   |  |  |  |   |
|---|---|--|--|---|--|--|--|---|
| Maximum 10-minute average 20-foot windspeed and direction for WIMS station # 490301, Makua Range, for all WIMS "F" Type Observations issued by Nat'l Weather Serv. for all hours of training and the one or two hourly observations immediately following completion of training <sup>(7)</sup> .   | Live Herbaceous Fuel Moisture - WIMS Calculated on Previous Day |  |  |   |  |  |  |   |
|   | 200 % or higher <sup>(5)</sup>                                  | 150 % - 199 % <sup>(5)</sup>           | 120 % - 149 %                          | 100 % - 119 %                           | 80 % - 99 %                              | 70 % - 79 %                              | 60 % - 69 %                              | 50 % - 59 % (Blanks/Ball Ammo Only <sup>(6)</sup> ) |
| <b>5 mph or less, Direction N through ESE Only</b>  | 17 chains/hr (9 on-site / 8 standby)                            | 21 chains/hr (11 on-site / 10 standby) | 25 chains/hr (13 on-site / 12 standby) | 41 chains/hr (21 on-site / 20 standby)  | 71 chains/hr (30 on-site / 41 standby)   | 78 chains/hr (30 on-site / 48 standby)   | 87 chains/hr (30 on-site / 57 standby)   | 97 chains/hr (30 on-site/ 67 standby)               |
| <b>6 - 10 mph, Direction N through ESE Only</b>   | 26 chains/hr (13 on-site / 13 standby)                          | 31 chains/hr (16 on-site / 15 standby) | 37 chains/hr (19 on-site / 18 standby) | 63 chains/hr (30 on-site / 33 standby)  | 113 chains/hr (30 on-site / 83 standby)  | 124 chains/hr (30 on-site / 94 standby)  | 138 chains/hr (30 on-site / 108 standby) | 154 chains/hr (60 on-site/ 94 standby)              |
| <b>11 - 15 mph, Direction N through ESE Only</b>  | 35 chains/hr (18 on-site / 17 standby)                          | 44 chains/hr (22 on-site / 22 standby) | 52 chains/hr (26 on-site / 26 standby) | 90 chains/hr (30 on-site / 60 standby)  | 164 chains/hr (30 on-site / 134 standby) | 180 chains/hr (30 on-site / 150 standby) | 200 chains/hr (60 on-site / 140 standby) | 224 chains/hr (60 on-site / 164 standby)            |
| <b>16 mph or higher (or if no NWS "F" Type Observation WIMS Forecast Issued for All Hours of Training)</b>  | 42 chains/hr (10 on-site / 32 standby)                          | 52 chains/hr (13 on-site / 39 standby) | 62 chains/hr (30 on-site / 32 standby) | 107 chains/hr (30 on-site / 77 standby) | 197 chains/hr (60 on-site / 137 standby) | 217 chains/hr (60 on-site / 157 standby) | 241 chains/hr (181 standby)              | 270 chains/hr (90 on-site / 180 standby)            |
| For Wind Directions other than E, NE, and E forecasted in WIMS "F"-Type forecast  |   |  |  |   |  |  |  |   |
| Maximum 10-minute average 20-foot windspeed for WIMS station # 490301, Makua Range, for all WIMS "F" Type Observations issued by Nat'l Weather Serv. for all hours of training and the one or two hourly observations immediately following completion of training <sup>(7)</sup> .   | Live Herbaceous Fuel Moisture - WIMS Calculated on Previous Day |  |  |   |  |  |  |   |
|   | 200 % or higher <sup>(5)</sup>                                  | 150 % - 199 % <sup>(5)</sup>           | 120 % - 149 %                          | 100 % - 119 %                           | 80 % - 99 %                              | 70 % - 79 %                              | 60 % - 69 %                              | 50 % - 59 % (Blanks/Ball Ammo Only <sup>(6)</sup> ) |
| <b>5 mph or less: Wind Direction Not Specified</b>  | 22 chains/hr (11 on-site / 11 standby)                          | 28 chains/hr (14 on-site / 14 standby) | 34 chains/hr (17 on-site / 17 standby) | 56 chains/hr (28 on-site / 28 standby)  | 98 chains/hr (30 on-site / 68 standby)   | 108 chains/hr (30 on-site / 78 standby)  | 120 chains/hr (30 on-site / 90 standby)  | 135 chains/hr (60 on-site/ 75 standby)              |
| <b>6 - 10 mph Wind Direction Not Specified</b>  | 33 chains/hr (17 on-site / 16 standby)                          | 42 chains/hr (21 on-site / 21 standby) | 49 chains/hr (25 on-site / 24 standby) | 86 chains/hr (30 on-site / 56 standby)  | 150 chains/hr (30 on-site / 120 standby) | 165 chains/hr (30 on-site / 35 standby)  | 183 chains/hr (153 standby)              | 206 chains/hr (90 on-site/ 116 standby)             |
| <b>11 - 15 mph Wind Direction Not Specified</b>   | 41 chains/hr (21 on-site / 20 standby)                          | 50 chains/hr (25 on-site / 25 standby) | 60 chains/hr (30 on-site / 30 standby) | 104 chains/hr (30 on-site / 74 standby) | 182 chains/hr (30 on-site / 152 standby) | 201 chains/hr (60 on-site / 141 standby) | 223 chains/hr (60 on-site / 163 standby) | 250 chains/hr (90 on-site / 160 standby)            |
| <b>16 mph or higher (or if no NWS "F" Type Observation WIMS Forecast Issued for All Hours of Training)</b>  | 42 chains/hr (21 on-site / 21 standby)                          | 52 chains/hr (26 on-site / 26 standby) | 62 chains/hr (30 on-site / 32 standby) | 107 chains/hr (30 on-site / 77 standby) | 197 chains/hr (60 on-site / 137 standby) | 217 chains/hr (60 on-site / 157 standby) | 241 chains/hr (181 standby)              | 270 chains/hr (90 on-site / 180 standby)            |
| <p>(1) Table indicates total fire suppression helicopter staffing assigned to Makua, including on-site and standby resources. On-site helicopters will have buckets attached and tested so that their first full load of water is dropped on the fire's perimeter within 15 minutes of the fire's ignition. The other assigned helicopters will be positioned so that their first full load of water is dropped on the fire perimeter within one hour of any fire's ignition outside the firebreak road. The assigned incident commander will maintain a list of additional unassigned helicopters which are likely to be available to support fire suppression efforts at Makua, with two hour response times, in the event of a need for contingency resources.</p> <p>(2) Fire suppression capability, or fireline construction rate of all fire suppression helicopters is rated in chains/hour. Chains/hour indicates the continuous helicopter fireline construction rate (third hour of production) in dense, long-unburned guinea grass at Makua and is a function of turnaround time, length of fire perimeter each water drop extinguishes, and percent of time that is unproductive due to refueling. Refer to Helicopter Productivity Table or individual pilot qualifications card for helicopter productivity rates.</p> <p>(3) No helicopters required - rain and blanks in designated areas: No fire suppression helicopter staffing is required when the most recent hourly WIMS-calculated 1-hr and 10-hr fuel moisture values for all three of the Makua WIMS weather stations (490301, 490302, and 490303) are 35 percent or higher as a result of documented precipitation registered at all three weather stations. When only blanks are being fired from firing points in mowed objectives which are separated from tall grass areas by a bare mineral soil firebreak, no helicopter staffing is required.</p> <p>(4) Reduced Total Helicopter Staffing for 5.56 SRTA Ball Ammo: When the grass within 60 meters along the inside edge of the south lobe of the firebreak road is mowed to one foot height or less, and the SRTA firing points are separated from unmowed grass areas by a bare mineral soil break, only 30 chains/hr of total fire suppression helicopter support is required to be on-site. No additional standby helicopters are required. A list of available contingency helicopters will be kept by the incident commander, but because these aircraft will not be assigned to Makua until after a fire ignition, response times for contingency aircraft are likely to be several hours.</p> <p>(5) No on-site helicopter: When Live Herbaceous Fuel Moisture at WIMS Station 490301 is 150 percent or higher Ball Ammunition, Demolitions and Hand Grenades and Smoke Grenades in designated pits or designated bare mineral soil areas inside the south lobe of the firebreak road may be used with no on-site helicopter. Full fire suppression helicopter staffing would be assigned to Makua with a one hour response time. The grass within 60 meters along the inside edge of the south lobe of the firebreak road is mowed to one foot height or less (or live herbaceous fuel moisture measured within the past week is 200 percent or greater) in order for the on-site helicopter requirement to be waived for these weapons.</p> <p>(6) The following reduced on-site fire suppression helicopter staffing applies only when the grass within 60 meters along the inside edge of the south lobe of the firebreak road is mowed to one foot height or less: When ball ammunition, hand grenades or demolitions are being used only in designated grass-free pits in Green fire danger rating conditions, on-site fire suppression staffing may be reduced to one half of the staffing level shown in the table. Total helicopter staffing would not be affected. The helicopter(s) which would have been on-site would respond, along with the other standby helicopters assigned to Makua so their first full load of water would be dropped on the fire perimeter within one hour of any fire's ignition outside the firebreak road.</p> <p>(7) If no "F" type observation is available in WIMS for each hour of training and for the hour following training, helicopters will be staffed for windspeeds of 16 mph or higher. If training is occurring in the yellow, helicopter staffing will be determined based on the highest wind speed and worst-case wind direction forecasted in an "F" type forecast during all hours of training and for the two hourly "F" type hourly observations immediately following the end of all periods of training. For training which is scheduled to occur only during green fire danger periods, helicopter staffing will be determined based on the highest wind speed and worst wind direction forecasted in an "F" type forecast during all hours throughout the period of scheduled training and for the hourly "F" type observation immediately following all periods of training.</p> |   |  |  |   |  |  |  |   |
| Green and Yellow Fire Danger conditions suitable for training rarely occur in grey shaded boxes.  |   |  |  |   |  |  |  |   |

Regardless of whether fueling will be done on-site or back at Wheeler, the on-site assigned fire suppression helicopters standing by during exercises at Makua will maintain enough fuel on board to provide one hour of continuous fire bucket operation in addition to any fuel needed to fly to the refueling site after the first hour of work is done. On-site fire suppression helicopters may fly missions in Makua valley during their assigned standby time as long as their buckets remain attached after testing and they maintain the minimum fuel necessary to always fulfill their one-hour minimum fire suppression flight time requirement. If an on-site fire suppression helicopter's fuel falls below the minimum required one-hour fuel level, live-fire training will be suspended until the helicopter is adequately fueled.

Helicopter staffing for prescribed burns is specified in Prescribed Burn Plan MMR 06-03 (see Appendix D). Until all Kaluakauila Management Unit fire minimization measures (see Project Description Section 3.1.4.2) are completed, all assigned fire suppression helicopters, including standby helicopters, will be located on-site at Makua when prescribed burning is conducted inside the north lobe of the firebreak road. Fire minimization measures are scheduled to be completed prior to implementation of Column C weapons restrictions, or within the first five years after the completion of this Biological Opinion.

Currently, the Army does not utilize helicopters for fire suppression at Makua after legal twilight, which occurs approximately 30 minutes after sunset. To minimize the risk of a fire ignition so late in the day that the fire would be left to burn without this fire suppression resource overnight, weapon use will be curtailed prior to sunset. As long as the fire danger rating recorded by WIMS for the Makua Range weather station is Green, weapon use may continue until one hour prior to legal twilight. When the fire danger rating is Yellow, weapon use will stop two hours prior to legal twilight. Night productivity rates for helicopters conducting fire suppression operations have not been determined, but are likely to be low. Night productivity rates for helicopters will be determined when the Army allows nighttime helicopter fire suppression. The Army will submit proposed night productivity rates to the Service for approval, and the new rates will be appended to this Biological Opinion prior to the implementation of night live-fire training at Makua. If limitations are placed on the number of helicopters permitted for use at one time on a fire suppression assignment in Makua valley, then the helicopter staffing requirements will be met with the use of higher productivity aircraft. More productive aircraft are likely to be necessary for fire suppression work when live herbaceous fuel moistures are lower.

Of the 40 new fuel models described in Scott and Burgan (2005), guinea grass has a greater total fuel load than all except for the four slash fuel models and four other heavy fuel models (SH7 Chaparral, SH9 Florida Scrub, TU5 and TL9 heavy forest understory or litter). Guinea grass fuel load estimates range from 8.8 to 11 tons per acre with fuel bed depth estimates between 1.88 and 5 feet (Beavers 2001; Wright et al 2002; Scott and Burgan 2005). Anticipated fire behavior, lack of barriers to fire spread, the high value of resources at risk, and the otherwise scarce availability of aircraft necessitate confirmation of availability of fire suppression helicopters to suppress a fire or spot fire occurring at any location in Makua on days when live-fire training is scheduled. Fire suppression helicopter staffing requirements are based on the performance of helicopters in relation to predicted growth of fires burning in guinea grass. Examples of predicted fire acreages are presented in Section 9. As the guinea grass fuel model is refined and researchers gain a more

thorough understanding of rate of spread of headfires burning in mature stands of guinea grass under various live herbaceous fuel moisture, dead fuel moisture, and wind conditions, adjustments may be made to the Makua fire suppression helicopter staffing guidelines so that the fire sizes predicted by the CONTAIN module of BehavePlus remain equal to or are smaller than the acreages predicted by this fire spread model, utilizing the current guinea grass fuel model parameters and the current helicopter staffing guidelines. Changes in the guinea grass fuel model may result in either increases or decreases in the fire suppression helicopter staffing requirements. Updated helicopter staffing requirements, agreed to in writing by the Service Field Supervisor, will be appended to the Biological Opinion and will replace the requirements currently specified in Table PD 5. Updated helicopter staffing guidelines will not be instituted at Makua without this prior written approval of the Service Field Supervisor.

### **3.4 Fire Reconnaissance**

In accordance with the requirements specified in Table PD 5, at least one fire suppression helicopter will be on site at Makua during, and for one hour following live-fire training activities except when 2.75-caliber rockets, Javelin, and TOW weapons are fired, in which case, the on-site helicopter(s) will remain on site for two hours following the use of these types of ammunition. When 2.75-caliber rockets, a Javelin, or a TOW has been fired at Makua, all wildland fire ground forces and at least one on-site fire suppression helicopter will remain on site for two hours after the last round from one of these weapons is fired to better ensure that all fires outside the firebreak road are able to grow large enough to be identified and extinguished. The helicopter(s) will take the assigned Incident Commander (and, if there are multiple aircraft available, the Engine Bosses) for a one-hour reconnaissance flight over the surface danger zones of the weapons fired so that the area, particularly the forested area, can be thoroughly checked for fire ignitions.

### **3.5 Dip Site and Water Supply**

The upper dip site must be supplied with enough water to continuously keep half of the total assigned helicopters operating at full productivity. Within the next five years, the existing 4 cm (1.5 in) pipe distributing water from the city's water meter will be upgraded to provide increased flow capacity, the water storage tank at the Makua Range office will be upgraded to hold 227,000 liters (60,000 gallons), and an overhead stand pipe fill station will be added to ease engine refill.

### **3.6 Wildland Fire Reporting**

Several wildland fire reporting requirements will be implemented. First, at the commencement of firefighter and helicopter staffing periods, the assigned Army Incident Commander will document the names, qualifications, and equipment types of each of the firefighters and pilots staffing Makua. On any day when wind speeds greater than 16 mph are forecasted, the availability of contingency helicopter(s) with two-hour availability will be documented. This form will be faxed or emailed to the Service's Makua Biological Opinion Implementation Biologist within one hour of the beginning of each daily or nightly period that Makua is staffed for fire suppression. An example of the Makua Daily Staffing worksheet is shown in PD 12 (see Pages 49 and 50).

Makua Fire Suppression Daily Staffing Worksheet - Day Shift. Date: \_\_\_/\_\_\_/2007

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**Helicopter Productivity Worksheet:**

|  |   |
|--|---|
| A. What is the Live Herbaceous Fuel Moisture %, Calculated for Makua Range Weather Station (WIMS Station # 490301) for the Previous Day:   | _____ %   |
| Has the National Weather Service Fire Weather Forecaster Issued an F-Type WIMS Observation for all hours of training?  | Yes / No  |
| What is the Maximum 10-minute Average 20-Foot Wind Speed Forecasted in WIMS "F" Type National Weather Service for all hours of training and for the the hour immediately following completion of training (If F-Type Observations incomplete, use 16 mph)?   | _____ Miles/Hour  |
| What is the Total Fire Suppression Helicopter Productivity Required (Chains/hour):   | _____ Total chains/hour   |
| What is the regular on-site helicopter fire suppression force required (Chains/hour)?  | _____ On-site chains/hour   |
| Is the 60 meters along the inside edge of the south lobe of the firebreak road mowed to 1 foot height?   | Yes / No  |
| Are blanks, ball ammunition, and demolitions, hand grenades, and smoke grenades in designated pits or designated bare mineral soil areas the only weapons being used?  | Yes / No  |
| Reduced on-site helicopter staffing: If Blanks, ball ammunition, and/or demolitions and hand grenades in designated grass-free pits are the ONLY things being used, and the 60 meter area inside the south lobe of the firebreak road is mowed to a height of 1 foot or less, then 1/2 of the regular on-site helicopter fire suppression force may be assigned.               | Blanks, Ball Ammo, Demolitions, Hand Grenades, Smoke Grenades<br>1/2 on-site: _____ ch/hr                                       |
| No on-site helicopter staffing: Is Live Herbaceous Fuel Moisture 150 percent or higher? Is the 60 meters along the inside edge of the south lobe of the firebreak road mowed to 1 foot height? If answer is yes to all three questions, no helicopter is required to be on-site. All helicopter staffing will respond within one hour of fire ignition outside firebreak road. | Live Herbaceous 150 Percent and Higher:<br>Blanks, Ball Ammo, Demolitions, Hand Grenades, Smoke Grenades<br>on-site _____ ch/hr |

Use these results to assign individual helicopters for training at Makua on table on page 2

| Wind Directions N, NNE, NE, ENE, E, and ESE Only: Fire Suppression Helicopter (Aircraft) Staffing Requirements(*1): Minimum Fire Suppression Capability (*2) of Fire Suppression Helicopters Assigned for Water Drops During Exercises at Makua (*3)(*4)(*5)(*6)                       |   |  |  |   |  |  |  |  |  |
|--|---|--|--|---|--|--|--|--|--|
| Maximum 10-minute average 20-foot windspeed and direction for WIMS station # 490301, Makua Range, for all WIMS "F" Type Observations issued by Nat'l Weather Serv. for all hours of training and the one or two hourly observations immediately following completion of training (*7). | Live Herbaceous Fuel Moisture - WIMS Calculated on Previous Day |  |  |   |  |  |  |  |  |
|  | 200% or higher (*5)   | 150% - 199% (*5)                       | 120% - 149%                            | 100% - 119%                             | 80% - 99%                                | 70% - 79%                                | 60% - 69%                                | 50% - 59% (Blanks/Ball Ammo Only (*6))   |  |
|  | 5 mph or less, Direction N through ESE Only                     | 17 chains/hr (9 on-site / 8 standby)   | 21 chains/hr (11 on-site / 10 standby) | 25 chains/hr (13 on-site / 12 standby)  | 41 chains/hr (21 on-site / 20 standby)   | 71 chains/hr (30 on-site / 41 standby)   | 78 chains/hr (30 on-site / 48 standby)   | 87 chains/hr (30 on-site / 57 standby)   | 97 chains/hr (30 on-site / 67 standby)   |
|  | 6 - 10 mph, Direction N through ESE Only                        | 26 chains/hr (13 on-site / 13 standby) | 31 chains/hr (16 on-site / 15 standby) | 37 chains/hr (19 on-site / 18 standby)  | 63 chains/hr (30 on-site / 33 standby)   | 113 chains/hr (30 on-site / 83 standby)  | 124 chains/hr (30 on-site / 94 standby)  | 138 chains/hr (30 on-site / 108 standby) | 154 chains/hr (60 on-site / 94 standby)  |
|  | 11 - 15 mph, Direction N through ESE Only                       | 35 chains/hr (18 on-site / 17 standby) | 44 chains/hr (22 on-site / 22 standby) | 52 chains/hr (26 on-site / 26 standby)  | 90 chains/hr (30 on-site / 60 standby)   | 164 chains/hr (30 on-site / 134 standby) | 180 chains/hr (30 on-site / 150 standby) | 200 chains/hr (60 on-site / 140 standby) | 224 chains/hr (60 on-site / 164 standby) |
| 16 mph or higher (or if no NWS "F" Type Observation WIMS Forecast Issued for All Hours of Training)  | 42 chains/hr (10 on-site / 32 standby)                          | 52 chains/hr (13 on-site / 39 standby) | 62 chains/hr (30 on-site / 32 standby) | 107 chains/hr (30 on-site / 77 standby) | 197 chains/hr (60 on-site / 137 standby) | 217 chains/hr (60 on-site / 157 standby) | 241 chains/hr (60 on-site / 181 standby) | 270 chains/hr (90 on-site / 180 standby) |  |
| For Wind Directions other than E, NE, and E forecasted in WIMS "F"-Type forecast   |   |  |  |   |  |  |  |  |  |
| Maximum 10-minute average 20-foot windspeed for WIMS station # 490301, Makua Range, for all WIMS "F" Type Observations issued by Nat'l Weather Serv. for all hours of training and the one or two hourly observations immediately following completion of training (*7).               | Live Herbaceous Fuel Moisture - WIMS Calculated on Previous Day |  |  |   |  |  |  |  |  |
|  | 200% or higher (*5)   | 150% - 199% (*5)                       | 120% - 149%                            | 100% - 119%                             | 80% - 99%                                | 70% - 79%                                | 60% - 69%                                | 50% - 59% (Blanks/Ball Ammo Only (*6))   |  |
|  | 5 mph or less: Wind Direction Not Specified                     | 22 chains/hr (11 on-site / 11 standby) | 28 chains/hr (14 on-site / 14 standby) | 34 chains/hr (17 on-site / 17 standby)  | 56 chains/hr (28 on-site / 28 standby)   | 98 chains/hr (30 on-site / 68 standby)   | 108 chains/hr (30 on-site / 78 standby)  | 120 chains/hr (30 on-site / 90 standby)  | 135 chains/hr (60 on-site / 75 standby)  |
|  | 6 - 10 mph Wind Direction Not Specified                         | 33 chains/hr (17 on-site / 16 standby) | 42 chains/hr (21 on-site / 21 standby) | 49 chains/hr (25 on-site / 24 standby)  | 86 chains/hr (30 on-site / 56 standby)   | 150 chains/hr (30 on-site / 120 standby) | 165 chains/hr (30 on-site / 35 standby)  | 183 chains/hr (30 on-site / 153 standby) | 206 chains/hr (90 on-site / 116 standby) |
|  | 11 - 15 mph Wind Direction Not Specified                        | 41 chains/hr (21 on-site / 20 standby) | 50 chains/hr (25 on-site / 25 standby) | 60 chains/hr (30 on-site / 30 standby)  | 104 chains/hr (30 on-site / 74 standby)  | 182 chains/hr (30 on-site / 152 standby) | 201 chains/hr (60 on-site / 141 standby) | 223 chains/hr (60 on-site / 163 standby) | 250 chains/hr (90 on-site / 160 standby) |
| 16 mph or higher (or if no NWS "F" Type Observation WIMS Forecast Issued for All Hours of Training)  | 42 chains/hr (21 on-site / 21 standby)                          | 52 chains/hr (26 on-site / 26 standby) | 62 chains/hr (30 on-site / 32 standby) | 107 chains/hr (30 on-site / 77 standby) | 197 chains/hr (60 on-site / 137 standby) | 217 chains/hr (60 on-site / 157 standby) | 241 chains/hr (60 on-site / 181 standby) | 270 chains/hr (90 on-site / 180 standby) |  |

Makua Fire Suppression Daily Staffing Worksheet - Day Shift. Date: \_\_\_\_/\_\_\_\_/2007

Page 2 of 2

**Ground Resources Assigned:**

|  |   |
|--|---|
| <b>Staff Position:</b>   | <b>NWCG-Qualified Person Assigned</b>               |
| <b>NWCG-qualified IC Type 4</b> (or other person approved by Service):                     |   |
| <b>NWCG Engine Boss (#1)</b> (ENOP until 1/1/2009):  |   |
| Type 6 (or larger) Engine Equip #:   | Assigned to Kaluakauila or Kahanahaiki (circle one) |
| Firefighter Type 2:  |   |
| <b>NWCG Engine Boss (#2)</b> (ENOP until 1/1/2009 and after 1/1/09 with Service approval): |   |
| Type 6 (or larger) Engine Equip #:   | Assigned to Kaluakauila or Kahanahaiki (circle one) |
| Firefighter Type 2:  |   |
| <b>Water Tender Number:</b>  |   |

|  |                              |
|--|------------------------------|
| Required On-Site combined Helicopter Productivity (from page 1):                         | On-site _____ ch/hr          |
| <b>Required Total helicopter productivity (On-site + Standby) from tables on Page 1:</b> | <b>Total _____ chains/hr</b> |

|   |                           |                      |                              |
|---|---------------------------|----------------------|------------------------------|
| <b>Helicopters Assigned to Satisfy Staffing Requirements:</b>             |                           |                      | See                          |
| productivity table below or highly skilled pilot's "red card" for rating. |                           |                      |                              |
| <b>Tail #</b>   | <b>Pilot Name, Phone#</b> | <b>Fuel on site?</b> | <b>Helo. Productivity</b>    |
| On-site:  |                           | Yes / No             | _____ chains/hr              |
| On-site:  |                           | Yes / No             | _____ chains/hr              |
| On-site:  |                           | Yes / No             | _____ chains/hr              |
| On-site:  |                           | Yes / No             | _____ chains/hr              |
| Subtotal: On-site chains/hour   |                           |                      | On-site total _____ ch/hr    |
| Standby:  |                           | Yes / No             | _____ chains/hr              |
| Standby:  |                           | Yes / No             | _____ chains/hr              |
| Standby:  |                           | Yes / No             | _____ chains/hr              |
| Standby:  |                           | Yes / No             | _____ chains/hr              |
| Subtotal: standby helicopter productivity (chains/hour):                  |                           |                      | Standby subtotal _____ ch/hr |
| <b>Total helicopter productivity assigned (On-site + Standby):</b>        |                           |                      | <b>Total _____ chains/hr</b> |

**Day Time Aircraft Productivity Estimates for Fire Suppression at Makua Military Reservation**

| Aircraft Type               | Pilot Type            | Water Capacity | Not Fueled at Makua                | Fueled at Makua   |  |
|-----------------------------|-----------------------|----------------|------------------------------------|---|--|
|                             |                       |                | All Pilots and All Wind Conditions | 20-foot wind speed 11 mph or higher OR No "F"-Type WIMS forecast for wind speed for all hours of scheduled use OR Pilots not yet approved by Army and Fish and Wildlife Service for Higher Productivity | 20-foot wind speed "F"-type WIMS forecast: 10 mph or lower for current and next three hours AND Expert Pilots Approved by Army and Fish and Wildlife Service at These Productivity Rates |
| CL415                       | Contractor            | 1,800 gallons  | n.a.                               | 57 chains/hr  | 171 chains/hr  |
| S61N or similar             | Contractor            | 1,000 gallons  | 13 chains/hr                       | 45 chains/hr  | 135 chains/hr  |
| S61N or similar             | Contractor            | 800 gallons    | 10 chains/hr                       | 36 chains/hr  | 108 chains/hr  |
| CH-47 Chinook               | Military / Contractor | 2000 gallons   | 9 chains/hr                        | 35 chains/hr  | n.a.   |
| UH-60 Blackhawk             | Military              | 660 gallons    | 9 chains/hr                        | 30 chains/hr  | n.a.   |
| CH-46 Sea Knight            | Military              | 400 gallons    | 5 chains/hr                        | 18 chains/hr  | n.a.   |
| CH-53 Sea Stallion          | Military              | 400 gallons    | 5 chains/hr                        | 18 chains/hr  | n.a.   |
| Bell 210                    | Contractor            | 350 gallons    | 5 chains/hr                        | 17 chains/hr  | 51 chains/hr   |
| UH-1H Huey/ Bell 205 or 212 | Contractor            | 340 gallons    | 5 chains/hr                        | 16 chains/hr  | 48 chains/hr   |
| Bell 407                    | Contractor            | 210 gallons    | 3 chains/hr                        | 10 chains/hr  | 30 chains/hr   |
| Bell 206 Long Ranger        | Contractor            | 200 gallons    | 3 chains/hr                        | 10 chains/hr  | 20 chains/hr   |
| Bell Jet Ranger             | Contractor            | 120 gallons    | 2 chains/hr                        | 6 chains/hr   | 19 chains/hr   |
| Hughes 500                  | Contractor            | 110 gallons    | 2 chains/hr                        | 6 chains/hr   | 18 chains/hr   |

Figure PD 12. Two page Makua Daily Fire Suppression Staffing Worksheet to be completed and faxed to the Service each day that Makua is staffed by fire suppression personnel.

The Army will inform the Service's Makua Biological Opinion Implementation Biologist, via telephone, within one hour of any fire burning outside the firebreak road at Makua. Subject to updates, contact information for the Service's Makua Biological Opinion Implementation Biologist is: Dawn Greenlee, phone (808) 792-9469, cell phone (808) 927-4602, fax (808) 792-9580. In order to substantiate the productivity rates and helicopter staffing guidelines proposed in this Project Description, the Army will document by video recording, still photography, or other method that enables independent verification, the fire rate of spread and fire suppression helicopter productivity during the first hour of all wildland fires burning grass areas outside the firebreak road at Makua. Complete, unedited copies of all video or other data will be provided to the Service. Service staff may view any military activities or fires at Makua from the vicinity of the tower at the Range Control office at any time. Service staff may obtain additional information about any fires or activities at Makua from Army Department of Public Works staff or personnel designated by Department of Public Works to provide information to Service staff. The Army will provide the Service with copies of fire reports for all, regardless of location or cause, wildland fires occurring at Makua on a quarterly basis. A list of the date, time, and location of all munitions impacting outside the south lobe of the firebreak road will also be provided to the Service each quarter.

The Army will invite the Service to a meeting or After Action Review regarding all fires that occur outside the firebreak road at Makua or that burn on-site or off-site Makua Implementation Plan management units within 10 days of the incident. The Army will provide the Service with complete copies of video or other data taken during the fire and evaluation of the fire suppression response and final fire acreage of all fires in relation to the fire size predicted by the CONTAIN module of the BehavePlus fire behavior model.

### **3.7 Prescribed Burning**

The Army may conduct prescribed burns within the north and south lobes of the firebreak roads to reduce fuels, prepare sites for unexploded ordinance clearance, or for other purposes, in accordance with the Prescribed Burn Plan MMR 06-03 in Appendix D. The prescription that will be used to conduct such burns at Makua is included in this Project Description (Section 9). No prescribed burn will be conducted without an on-site observer from the Service, without the prior approval of the Service. In summary, the burns will be conducted only when live herbaceous fuel moisture is 100 percent or higher, under cool burning conditions with minimum one-hour fuel moistures of eight percent under most conditions, with highly skilled staff, and with adequate on-site and standby fire suppression forces assigned to contain spot fires. Helicopter staffing for prescribed burns is specified in Prescribed Burn Plan MMR 06-03 (see Appendix D). Until all Kaluakauila Management Unit fire minimization measures (see Project Description Section 3.1.4.2) are completed, all assigned fire suppression helicopters, including standby helicopters, will be located on-site at Makua when prescribed burning is conducted inside the north lobe of the firebreak road. Fire minimization measures are scheduled to be completed prior to implementation of Column C weapons restrictions, or within the first five years after the completion of this Biological Opinion. Live-fire training and prescribed burning

will be suspended, after five years of the completion of this Biological Opinion, unless the fuelbreaks and firebreaks specified in this Project Description are completed and maintained. The fire suppression helicopter staffing requirements specified in Prescribed Burn Plan MMR 06-03 will be updated, with the approval of the Service, as the guinea grass fuel model is updated to incorporate new fire rate of spread data. Alterations, which do not increase the fire risk to endangered species and critical habitats, may be made to Prescribed Burn Plan MMR 06-03, with the approval of the Service. Prescribed Burn Plan MMR 06-03 (see Appendix D) is the only prescribed burn prescription covered under this Biological Opinion. The Army will conduct separate consultations with the Service for any prescribed burns at Makua which are not covered by Prescribed Burn Plan MMR 06-03.

### **3.8 WIMS Weather Observations**

Range use restrictions are driven by indices calculated by the National Fire Danger Rating System (NFDRS) calculator in WIMS for the Makua Range weather station number 490301. Three NFDRS remote automated weather stations, maintained in accordance with NWCG National Fire Danger Rating System Weather Station Standards, PMS 426-3, May 2005 ([http://www.fs.fed.us/raws/standards/NFDRS\\_final\\_revmay05.pdf](http://www.fs.fed.us/raws/standards/NFDRS_final_revmay05.pdf)), using NFDRS fuel model N, Climate Class 2, 1978 model, will be maintained at their current locations at Makua. Once each year, when cured grass starts to turn green again (approximately November 1), the stations will be “greened up” in WIMS. Activities with higher risk of igniting wildland fires are restricted to periods of low and medium fire danger when fires will be less likely to ignite and easier to suppress. Weapons restrictions in Table PD 2 are color coded based on the maximum fire danger, based on the burning index calculated by WIMS, under which the weapon will be used.

Weather observations are collected automatically each hour by the weather station and transmitted via satellite to servers that automatically disseminate the information to WIMS, which is accessed via internet. Weather observations are automatically taken at two minutes before the hour and are available for viewing in WIMS by 7 to 10 minutes after the hour. Once the data becomes available in WIMS, it takes an additional minute for Army staff to enter the current “state of the weather” and to query WIMS for the indices calculated from that hourly, type “S” (special) observation. Per NFDRS standards, fuels may be wet flagged, or state of the weather may be set to 5, 6, or 7 only when it is raining over the entire valley, or when the 10-hour fuel moisture reading at all three Makua stations is 20 percent or higher as a result of recent rain. Heavy dew is unusual at Makua. The hourly “state of the weather” observations and calculated indices are archived by WIMS and can be viewed by all interagency WIMS users. The 10:58 a.m. weather reading is displayed in WIMS as observation time “10.” Weapons restrictions are summarized in Table PD 2. Hourly fire danger ratings are viewed by Range Control staff, and notifications of weapons restrictions are made in such a way that it ensures that no detonations of restricted weapons occur after 15 minutes after the hour. For example, if the burning index, calculated in WIMS from the weather sample taken at 10:58 am is in the Red, no weapon or detonation will occur any later than 11:15 am. If the WIMS system is not maintained properly and operating so that the burning index can be calculated by WIMS, no live fire, blanks, or demolitions will be conducted at Makua. There is no acceptable alternative way to calculate the burning index other than WIMS. If the weather station does not transmit a particular hour’s weather data, including 10-minute average wind speed, via the Automated Sorting, Conversion and Distribution System (ASCADS <http://www.fs.fed.us/raws/book/ascads/>) to WIMS, the fire

danger will be assumed to be in the Red and range restrictions will be applied accordingly. Instantaneous query of station weather readings or use of algorithms or FireFamily Plus or WeatherPro to fill in for missing data is not sufficient to calculate the hourly burning index for range use. To reduce the station's down time, which results from an instrument or data logger being out of service, the Army may maintain a full set of replacement parts, including the data logger for the Makua Range weather station. The Wildland Fire Management Officer is responsible for ensuring the weather station and WIMS is maintained, operating, and applied properly and that inputs are being made correctly. The NFDERS fuel model will not be changed, weapons restrictions will not be changed, a station will not be "greened up" in WIMS more frequently than once each year and no "green up" date will be within nine months of the previous "green up" date without the written approval of the Service Field Supervisor.

### **3.9 Critical Habitat Restoration**

If any area of plant critical habitat is burned, the Army will restore it to its pre-fire percent cover of plant species. Burned plant critical habitat restoration work will likely require erosion control, outplanting of native understory and overstory plants, and intensive weed control. Because the Army's greenhouse facilities are limited, a contractor may need to be hired to propagate common native plants, from appropriate founders, for outplanting in burned areas. Restoration may occur on steep slopes where rappelling will be necessary. A successful weed control program will be instituted immediately following the fire. At no time following an Army-caused fire in plant critical habitat, will the percent cover of any non-native plant species be higher than the pre-fire cover of that plant species. Pre-fire cover will be determined based on the most recent vegetation map, or on-site photographs or vegetation monitoring data available. The Army will provide the Service with a post-fire revegetation plan and annual updates on the status of restoration of the burned area. The timeline for complete vegetation restoration is site specific, but it is anticipated that pre-fire percent cover of species will take approximately 10 years to accomplish. Some areas may require weed control for a longer period of time.

If any area of Oahu elepaio critical habitat within the Makua installation boundary is burned in a wildland fire, or if any area of Oahu elepaio critical habitat within the Makua action area is burned as a result of military activities, the Army will work to encourage shrubs to recolonize the site. The Army will herbicide the burned Oahu elepaio critical habitat five times per year with an appropriate herbicide to discourage grasses and favor shrub recolonization. If unexploded ordinance is a concern, the herbicide work will be done aerially. The Army will ensure that pre-fire percent cover of grass will be less than or equal to pre-fire grass percent cover at five years post-fire in burned Oahu elepaio critical habitat areas. If, after five years, the site has not recovered its pre-fire percent cover of shrubs and trees, shrub and tree seeding will be done, to augment the grass control in the burned Oahu elepaio critical habitat area. If, after 10 years, the burned Oahu elepaio critical habitat has not returned to its pre-fire overstory cover, the site will be cleared of unexploded ordinance, and shrub and tree propagules will be outplanted on the site. The Army is developing techniques for controlling grass and restoring shrubs in various management units. Native and non-native shrubs are successfully recruiting from seed on sites where guinea grass is controlled in the Lower Ohikilolo and Kaluakauila management units. Elepaio critical habitat areas occupied by non-native shrub and forest species prior to burning will not necessarily be restored to native shrub and forestland.

Implementation of the post-fire revegetation plan or other post-fire emergency actions may not delay or negatively impact implementation of other actions identified in the Makua Implementation Plan. Remediation cannot prevent the Army's ability to implement other Makua Implementation Plan activities.

Researchers from the U.S. Forest Service and the Center for Environmental Management of Military Lands are seeking substantial funding to develop methods to restore guinea grass, molasses grass, and buffel grass slopes to less flammable and eventually native forest vegetation. The Army is developing expertise in guinea grass restoration, through the work being done at the Lower Ohikilolo Management Unit weed control areas. The Army will develop and submit to the landowner and Service for approval a preliminary post-fire restoration plan for critical habitat within one year from the date of this Biological Opinion. The plan will be appended to the Makua Implementation Plan and will include the following: (1) a list of common native species suitable for post-fire restoration by habitat type and a list of approved sources of propagules for common species for each critical habitat unit in the action area, (2) an estimated timeline for various aspects of restoration of burned areas, (3) an estimated budget for outplanting, erosion control, and other management actions associated with restoration, per acre, for each critical habitat unit, and (4) any additional fuel modification recommended to prevent critical habitat loss and associated costs. A more detailed emergency stabilization and restoration plan will be drafted in the event of a fire in designated critical habitat. The emergency stabilization and restoration plan would be completed by the Army within 30 days of the day that the fire is declared out. The emergency stabilization and restoration plan will include the following: (1) a detailed map of the pre-fire vegetation and species composition in the burned area of critical habitat, (2) a detailed fire intensity map of the burned critical habitat area, (3) a high-resolution aerial photograph of the burned critical habitat area, (4) monitoring protocol and high-resolution photographs of the burned critical habitat area taken from the ground, (5) grass control plans to ensure that fire risk does not increase upslope, (6) species being collected and propagated, source of labor for propagule production and outplanting (contract greenhouse or in-house), and (7) budget for first three years. Annual progress updates, including the results of monitoring which indicate the percent cover of grass and other species, during all months, will be submitted to the Service.

### **3.10 Army Fire Suppression Assistance to State and City and County**

Training at Makua is contingent upon the successful augmentation and threat control of endangered species populations within management units outside the Makua installation boundary. The Army has an interest in preventing fires from burning forested areas and areas containing endangered species in the Waianae Mountains (Figure PD 13).

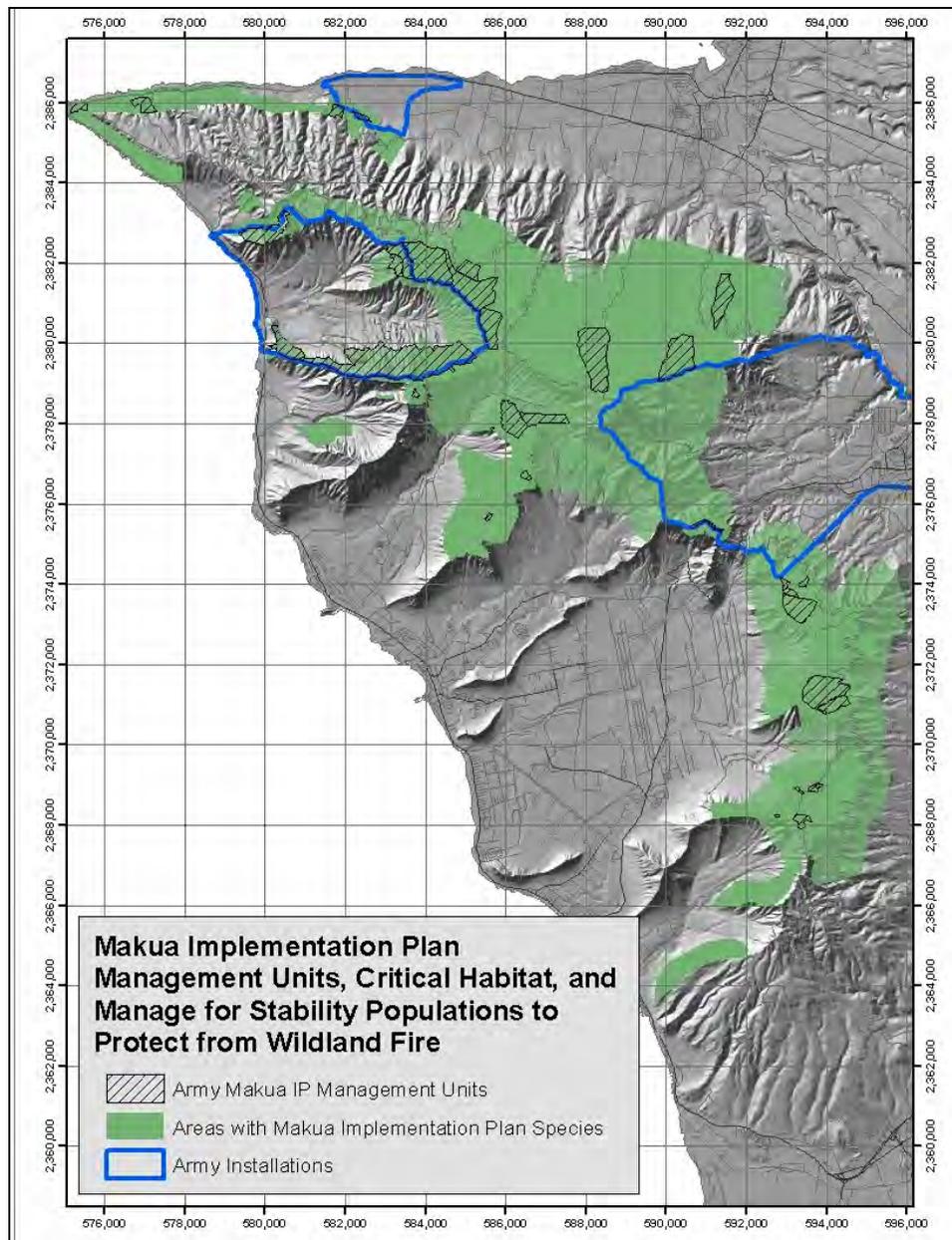


Figure PD 13. Areas of Army fire protection interest which contain listed species and critical habitats. Any fire burning into the areas shaded in green may affect the Army's ability to train at Makua.

Fire suppression and the construction and maintenance of firebreaks and shaded fuelbreaks is necessary to control the threat of fire to the Makua Implementation Plan management units. The Army is working with the interagency wildland fire and land management community to design and implement a system of shaded fuelbreaks and firebreaks to ensure that the management units are protected from fire. Historically the Army has provided firefighter and fire suppression helicopter support to fires threatening these off-site Army interests. As funding and fire suppression resources are available, the Army will continue to assist the other Federal agencies, the State, and the City and County with the suppression of fires which threaten the management units. The use of Army-funded aerial and ground firefighting resources will be authorized on a

case-by-case basis within the designated Fire Response Area (Figure PD 14, by the Army Wildland Fire Management Officer, Army Wildland Fire Assistant Fire Management Officer, Department of Public Works Natural Resources Manager, their supervisors in the chain of command, or the Federal Fire Department Unified Command Incident Commander.

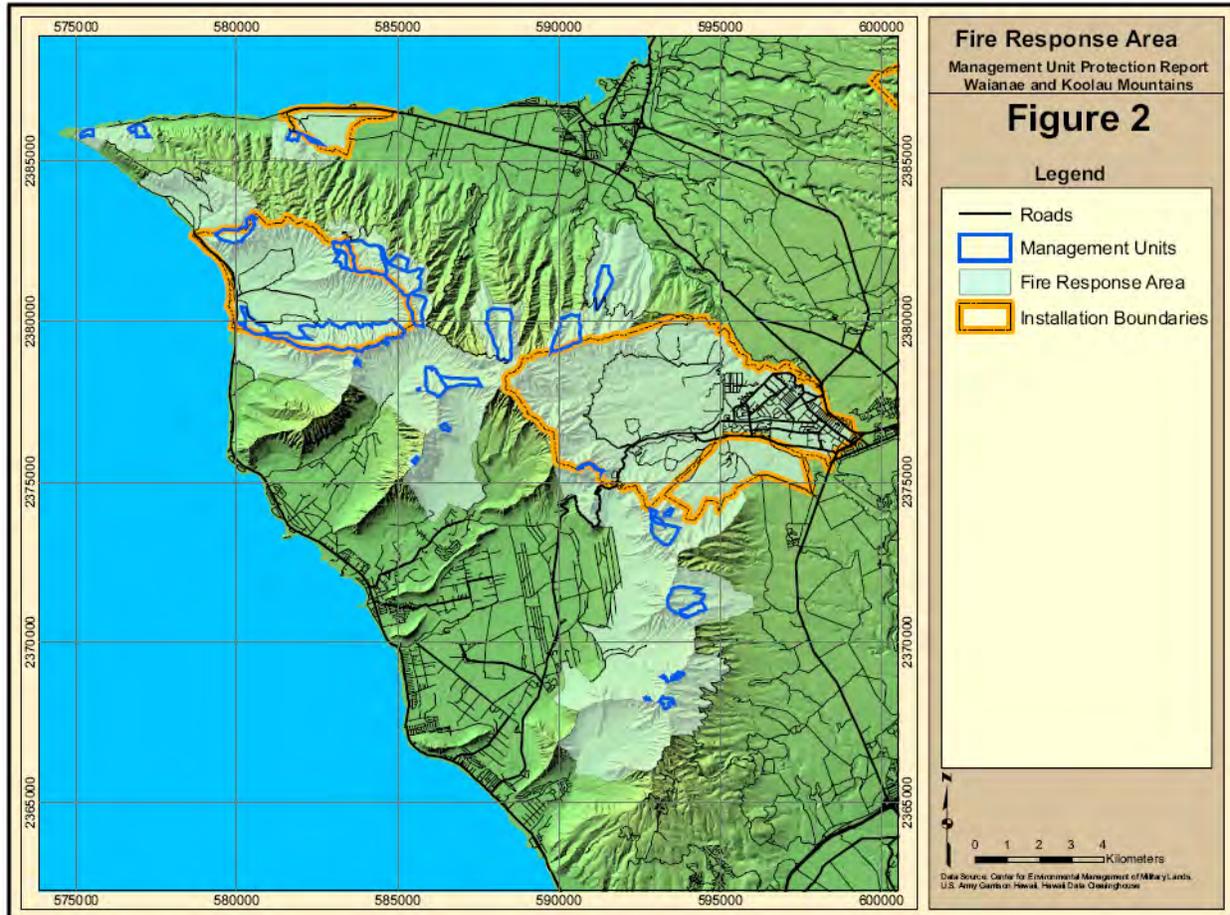


Figure PD 14. The Army will maintain a cooperative agreement or Memorandum of Understanding with the State of Hawaii, which will enable the rapid deployment of Army helicopter fire suppression forces and ground firefighting forces to assist with fire suppression activities within the shaded fire response area (Figure 2, Beavers 2007 b).

Full stabilization will require the control of the fire threat to the management units. Many of the units occur in locations of high fire threat. Grass control within 3 to 5 m (10 to 16 ft) of stabilization plant species will ensure their protection from fire. The Army will work with the Service to determine for which sites the full 5 m (16 ft) of grass clearance is necessary.

#### 4. Range Management

The Range and Training Land Program is the program under which the Army conducts range operations and maintenance on lands where Soldiers train in the field. A range is an area that is normally equipped for practice in weapons delivery and/or shooting at targets. The Range and Training Land Program provides a military-centered framework for land management since

Army lands are primarily classified for military use. Range Division implements the Range and Training Land Program, operates firing ranges, and regulates use of training and ordnance impact areas. In addition, Range Division regulates access to training areas and ranges. The key Range and Training Land Program planning device is an installation range development plan, which defines the range and training land requirements. This plan is incorporated into the USARHAW Real Property Master Plan, the Integrated Natural Resources Management Plan, and the Integrated Cultural Resources Management Plan. These efforts, together with the Integrated Training Area Management work plan described below, produce a sound approach for consistent and proactive management of training land while balancing mission, infrastructure, and environmental stewardship.

## **5. Integrated Training Area Management (ITAM)**

The integrated training area management program is the Army's formal strategy for ensuring the sustainable use of training and testing lands. The intent of the ITAM program is to systematically provide uniform training land management capability across Army lands to ensure that the carrying capacity of the training lands is maintained over time. The Army manages its lands to minimize loss of training capabilities to support current and future training and mission requirements. The integration of stewardship principles into training land and conservation management practices ensures that the Army's lands remain viable to support future training and mission requirements. Integrated training area management integrates elements of operational, environmental, master planning, and other programs that identify and assess land use alternatives. The ITAM program also supports sound natural and cultural resources management practices and stewardship of its land assets while sustaining land attributes conducive to supporting training, testing, and other installation missions. These management requirements are as follows: integrate training requirements with training land management; conduct annual monitoring and analysis of resources and ranges; conduct repair and maintenance of training land; enhance mobility, maneuverability, access, and availability in training areas; and train Soldiers in sustainable range awareness to minimize training land damage. These requirements are applicable at all training areas. The following ITAM programs are being implemented at Makua: combat trail maintenance including drainage and erosion control repair; culvert maintenance, embankment repair, hydroseeding of drainage swales; installation of energy dissipaters in swales, sedimentation and detention basins, and erosion control blankets; and archaeological site capping, which includes the use of sandbags to protect sites, and installation of concertina fencing.

## **6. Environmental Management and Programs**

The Army manages two major environmental programs: natural resources management and cultural resources management. The natural resources management program is focused on protecting endangered species. The cultural resources management program is focused on monitoring and protecting areas of traditional importance, as required. The cultural resources management program at USARHAW has a staff that includes a Cultural Resources Manager, four Cultural Resource Specialists, and an Architectural Historian. Managing the resources includes the following tasks: maintaining a cultural site database, including GIS mapping; conducting field survey and site evaluation, location, verification, and monitoring before, during,

and after training activities; site preservation; conducting Native Hawaiian consultation; and coordinating with other regulatory agencies. The natural resource program has a staff that includes the following: (1) Natural Resources Manager, (2) Natural Resources Biologist, (3) Monitoring Program Manager, (4) an Makua Implementation Plan and Oahu Implementation Plan Project Manager, (5) Senior Natural Resources Management Coordinator, (6) three Natural Resources Management Coordinators, (7) one Natural Resources Management Coordinator/Rare Plant Program Manager, (8) Horticulturist, (9) Plant Propagation Assistant, (10) Research Specialist, (11) Propagule Management Specialist, (12) Natural Resources Database Specialist, (13) Natural Resources GIS/GPS Technician, (14) Natural Resources Management Specialist, and (15) ten Natural Resources Management Technicians. Managing natural resources includes the following tasks: surveying and mapping rare species and native habitats, determining what protection these species and habitats require, obtaining baseline rare species data in an access and geodatabase, and implementing natural resource protection (rat control, ungulate fencing and control, invasive plant control, alien invertebrate control and habitat restoration).

### 6.1 Makua Implementation Plan – Stabilization Overview

The concept of stabilization was developed during the 1999 Makua consultation process to offset the adverse impacts of military training to 41 listed species in the Makua action area (as it was then delineated). The Service's 1999 non-jeopardy Biological Opinion was based on certain restrictions to military training, including elimination of tracers and TOWs in the 2001 Supplement to the Opinion, and preparation and implementation of a Wildland Fire Management Plan. In addition, to avoid jeopardizing listed species in the action area, the Army's proposed action included conservation measures to improve the status of certain unstable taxa that occur within the action area. The Army agreed to manage 13 endangered plant taxa that would be minimally impacted by Army training, and to prepare and implement a plan to stabilize 27 target plant taxa and the Oahu tree snail *Achatinella mustelina*. A plant taxon was designated for stabilization if certain numerical demographic criteria were not met and if at least 50 percent of all its individuals were located within the action area. The specific stabilization activities for all 28 target taxa (plants and tree snail) are detailed in the Final Implementation Plan for Makua Military Reservation (Makua Implementation Team 2003). Of the 28 target taxa, 16 plant taxa and the Oahu tree snail are identified for stabilization in this Biological Opinion. In addition, 11 target plant taxa and an additional plant species in the new action area (*Gouania vitifolia*) are identified for expedited stabilization (see Section 6.4, Expedited Stabilization, below). Stabilization target taxa include the following:

|   |   |
|---|---|
| <i>Achatinella mustelina</i>                            | <i>Hesperomannia arbuscula</i>                        |
| <i>Alectryon macrococcus</i> var. <i>macrococcus</i>    | <i>Hibiscus brackenridgei</i> ssp. <i>mokuleianus</i> |
| <i>Cenchrus agrimonioides</i> var. <i>agrimonioides</i> | <i>Melanthera tenuifolia</i>                          |
| <i>Chamaesyce celastroides</i> var. <i>kaenana</i>      | <i>Neraudia angulata</i>                              |
| <i>Chamaesyce herbstii</i>                              | <i>Nototrichium humile</i>                            |
| <i>Cyanea grimesiana</i> ssp. <i>obatae</i>             | <i>Phyllostegia kaalaensis</i>                        |
| <i>Cyanea longiflora</i>                                | <i>Plantago princeps</i> var. <i>princeps</i>         |
| <i>Cyanea superba</i> ssp. <i>superba</i>               | <i>Tetramolopium filiforme</i>                        |
| <i>Cyrtandra dentata</i>                                | <i>Pritchardia kaalae</i>                             |
| <i>Delissea subcordata</i>                              | <i>Sanicula mariversa</i>                             |

|   |  |
|---|--|
| <i>Dubautia herbstobatae</i>                  | <i>Schiedea kaalae</i>                               |
| <i>Flueggea neowawraea</i>                    | <i>Schiedea nuttallii</i>                            |
| <i>Gouania vitifolia</i>                      | <i>Schiedea obovata</i>                              |
| <i>Hedyotis degeneri</i> var. <i>degeneri</i> | <i>Viola chamissoniana</i> ssp. <i>chamissoniana</i> |
| <i>Hedyotis parvula</i>                       |  |

The methodology for endangered species stabilization was four years in development and involved a Makua Implementation Team composed of experts from the Army, Service, State of Hawaii, Hawaii Natural Heritage Program, The Nature Conservancy of Hawaii, U.S. Geological Survey, University of Hawaii, and Berry Botanic Garden (Portland, Oregon). The Makua Implementation Plan incorporates stabilization standards recommended to the Service by the Hawaii and Pacific Plant Recovery Coordinating Committee in July 1994 and adopted as interim recovery measures in all subsequent plant recovery plans (including Service 1999a, 1998a, 1995a). Based on these recommended standards, the Service determined that a plant taxon may be considered stabilized when all of the following conditions are met: (1) all populations are naturally reproducing, (2) at least three populations each have a minimum number of mature, reproducing individuals (25 for long-lived perennials, 50 for short-lived perennials, and 100 for annuals), (3) all major threats have been controlled, (4) each population is fully represented in an *ex situ* collection (not naturally occurring *in situ* [in the wild]), and (5) fulfillment of genetic storage goals.

Stabilizing a taxon requires maintaining enough populations to ensure long-term viability, and this is the first step toward eventual recovery. Army actions may potentially jeopardize a taxon's continued existence in the wild if numbers in the action area decline to such a level that the entire taxon falls below stability throughout its range (Makua Implementation Team 2003). Ideally, stability would be based on the minimum viable population size needed for persistence of a taxon over time. However, the demographic information needed to estimate minimum viable population size does not exist for most of the covered taxa. Instead, the Makua Implementation Plan is based on the assumption that demographic and environmental conditions are of greater immediate concern than population size per se. Taxon and habitat management within the population units, rather than attainment of a certain population size (e.g., minimum viable population), is considered more likely to increase the probability of population stability in the short term (Schemske et al 1994; Makua Implementation Team 2003).

Many of the stabilization actions for improving the baseline status of target taxa depend on how "population" is defined. Identifying the individuals that comprise a given population is often difficult owing to the lack of basic biological information for most endangered Hawaiian plants. Therefore, the term "population unit" is used as the fundamental geographic and demographic unit of the Makua Implementation Plan Addendum. Population units are defined according to geographic separation and the presence of barriers to dispersal and gene flow. Population units consist of individuals of a taxon at discrete sites, which are separated from other individuals of the taxon by topographic barriers or habitat discontinuities, or that occur more than 1,000 m (3,280 ft) apart (Makua Implementation Team 2003). Thus, a population unit is a manageable grouping of plants that may or may not be a viable population (Hawaii and Pacific Rare Plant Recovery Coordinating Committee 2007). The population units of each target taxon are described in the Makua Implementation Plan (Makua Implementation Team 2003).

Stabilization criteria for plant taxa in the Makua Implementation Plan are defined according to the Hawaii and Pacific Plant Recovery Coordinating Committee recommendations described above. In addition, two population units must be managed for stability outside the action area's high fire risk zone. If two population units are designated for stabilization within the action area, one of them must be within the high fire risk zone. The fire risk zones delineated in previous Service Biological Opinions for Makua and used for development of the Makua Implementation Plan differ from those evaluated in this opinion (see General Effects). Nonetheless, the general criteria for designating population units to be managed for stability still apply to the current proposed action and the current action area, except as modified in the Makua Implementation Plan Addendum (U.S. Army Garrison 2005a).

The Makua Implementation Plan outlined a sequenced approach of actions to be implemented over 33 years to achieve stabilization of the target taxa. Specific biological criteria to evaluate success (e.g., minimum viable population size for each taxon) could not be predicted due to lack of demographic and genetic data. Therefore, the Service originally intended to assess success in the short-term by verifying the Army's implementation of management actions according to a schedule stipulated in the Makua Implementation Plan. However, the Makua Implementation Team recognized that delaying certain actions would adversely affect some population units and perhaps significantly reduce the likelihood of successful stabilization. Therefore, this Biological Opinion includes expedited stabilization measures to protect those plant taxa most at risk from training-related wildfire while management for long-term stabilization is being implemented as outlined in the Makua Implementation Plan (see Expedited Stabilization below).

Stabilization strategies include protection of existing population units, augmentation (supplementing existing plant populations with additional individuals), reintroduction (reestablishing a population at a location previously occupied by the species), introduction (establishing a plant population where it was previously not known to occur), and translocation (moving plants from an existing location to a new one). For population units that currently meet stabilization goals for numbers and reproductive success, management may be limited to protecting the plants and controlling threats in their surrounding habitat. For population units that do not meet stabilization criteria for minimum plant numbers, augmentation or reintroduction may be necessary to buffer against the effects of environmental, demographic, and genetic stochasticity in small populations. To achieve this, full genetic representation in *ex situ* collections (such as propagation facilities, seed storage banks, and botanical gardens) will be required for many, if not all, of the existing *in situ* (naturally occurring) population units.

For the Oahu tree snail *Achatinella mustelina*, genetically similar populations are designated as "evolutionarily significant units" based on assessment of intra-population genetic divergence. The results of genetic analyses conducted since completion of the Makua Implementation Plan indicate the presence of six evolutionarily significant units, two of which are comprised of two habitat "eco-types" (Holland and Hadfield 2004). Based on this new data, the Army will implement actions to stabilize eight *A. mustelina* field populations that are geographically spread throughout the Waianae Mountains to protect the maximum genetic diversity of the species. Stability criteria for *A. mustelina* are defined as at least 300 snails in each evolutionarily significant unit, maintenance of captive populations for each recognized evolutionarily

significant unit, and control of all threats at each managed field location. Field locations are defined in the Makua Implementation Plan.

The goal of the Makua Implementation Plan is to stabilize species that otherwise would be jeopardized by military training in the Makua action area. Stability is not synonymous with recovery (i.e., delisting) (Makua Implementation Team 2003). Owing to limited knowledge of the life history requirements for short-term and long-term survival of endangered plants, Service recovery plans specify interim objectives to recovery that involve stabilization of all existing populations (Service 1999b, 1998 a). Sustaining a population unit at the minimum number of reproducing individuals for stability over the short-term can prevent extirpation by ensuring adequate regeneration. Recruitment of younger individuals into subsequent generations of mature, reproducing plants likely will improve a species' probability of survival. Stabilization alone, however, is inadequate over the long-term to achieve full recovery.

The Makua Implementation Plan incorporates the stabilization objectives outlined in Service recovery plans, and is based on conservation actions recommended for recovery. These actions include fencing all known occurrences; controlling non-native ungulates and plants; augmenting existing occurrences and establishing new ones; protecting occurrences from fire; investigating and implementing methods to control non-native slugs, snails, and insects; maintaining *ex situ* collections; and conducting research on pollinators. Numerical criteria for stabilizing a species are less stringent than those recovering (delisting) a species. Recovery criteria require eight to ten populations of 100 mature, reproducing individuals for long-lived perennials, 300 for short-lived perennials, and 500 for annuals (Service 1999a, 1998a, 1997). Stabilization approximates conditions necessary for survival of a species in the wild and is a prerequisite for recovery. Achieving stabilization, therefore, will enable the Army to comply with the Endangered Species Act jeopardy standard by avoiding or minimizing actions that will reduce appreciably a species' likelihood of both survival and recovery in the wild. Although recovery is the ideal, the Army is only expected to stabilize, not fully recover, species in order to avoid the likelihood of jeopardy resulting from military activities.

A population unit designated as "manage for stability" usually occurs in habitat that is relatively intact or restorable, and where threat control is expected to encourage natural regeneration. The Makua Implementation Plan designated, on average, six population units to be managed for stability for each target taxon, with the intent that at least three of the population units would be successful. Thus, monitoring to determine the response of target taxa to management is critical to achieving stability. If the number of individuals in a population unit declines, monitoring allows the Makua Implementation Team to adapt management actions to deal with the likely causes of decline through additional threat control actions and/or augmentation/reintroduction. Threat management includes control, as needed, of ungulates, weeds, rats, slugs, and insects. Ungulate control typically requires construction and maintenance of fenced exclosures. Within fenced population units, aggressive control of understory weeds is required within a 2-m (6.6-ft) radius of target taxon individuals. Long-term threat management goals include eradication of incipient invasive weeds at the population unit scale (within a 50-m (164-ft) radius of target plants). For other weeds, long-term weed control goals require eradication of up to 25 percent of existing weed cover in the proximity of population units and up to 50 percent total weed cover across the management unit or subunit.

A population unit designated as “manage for genetic storage collection” generally contains few individuals of the target taxon and poor conditions for regeneration or habitat rehabilitation. The purpose of genetic storage is to achieve adequate, appropriate *ex situ* storage of genetic material as insurance against loss of a population unit or reintroduced individuals. Options include seed storage, *in vitro* tissue storage through micropropagation, and living collections of cultivated plants in greenhouses and botanical gardens. For each population unit, at least 50 seeds will be collected from each of 50 individuals (but no more than 20 percent of all seeds produced each year), or three clones will be maintained in micropropagation, or three cultivated plants will be maintained in the greenhouse. For population units with fewer than 10 individuals, at least 20 percent of all seeds produced will be collected during the initial years, until sufficient material is collected for storage and augmentation/reintroduction needs. For species that can be propagated vegetatively, cuttings will be collected from non-fruiting plants. For very small population units of fewer than five individuals, each individual also will be represented as a living collection, typically as a potted plant in a greenhouse.

## 6.2 Makua Implementation Plan Addendum

For this consultation, the Army revised the Makua Implementation Plan to address the logistical difficulties of off-site conservation management and to reduce the cost of species stabilization actions. The Army’s proposed Makua Implementation Plan Addendum for Makua Military Reservation outlines actions to attain three stabilized, naturally reproducing population units for each target taxon (U.S. Army Garrison Hawaii 2005a). Instead of managing up to six population units per taxon to ensure that at least three eventually are stabilized, as recommended by the Makua Implementation Plan, the Makua Implementation Plan Addendum focuses management efforts on the three (or in a few cases, four) most viable prospects for success. Four population units will be managed for stability for species present in the action area of both Makua and Schofield Barracks Military Reservation, for certain species occurring in the high fire risk zone of the Makua action area, and for certain species for which stabilization will rely greatly on reintroduction. Accordingly, the Makua Implementation Plan Addendum addresses management for approximately 92 plant population units, instead of the 188 plant population units included for management in the Makua Implementation Plan. The purpose of additional population units in the Makua Implementation Plan was to provide future “back-ups” if any population units within the action area were extirpated before stabilization could be achieved; this option is no longer maintained under the Makua Implementation Plan Addendum. In addition, under the Makua Implementation Plan Addendum, the Army will focus the collection of genetic material primarily on those species that are most threatened by fire and that exist in very low numbers, with the purpose of supporting augmentation of population units and ensuring the availability of genetic material for future efforts. The Makua Implementation Plan provided for collection of genetic material from all *in situ* population units.

The projected time frame for the Makua Implementation Plan was 33 years; the projected time frame for the Addendum is 20 years. Like the Makua Implementation Plan, the Makua Implementation Plan Addendum includes population unit actions for each stabilization taxon and management unit actions to improve habitat on an ecosystem basis, as well as an implementation schedule and budget. The Army will provide an annual progress report that lists and describes the species specific management actions completed to date as they relate to the actions identified

in the Makua Implementation Plan. This report will be organized in a manner agreed upon by the Service to ensure that the progress meets the goals of the consultation. The Makua Implementation Team will conduct an annual assessment of management results by reviewing monitoring data to determine the Army's progress toward achieving stabilization of the target taxa within a reasonable time frame. The annual review also will allow for modification of stabilization strategies as needed, using an adaptive management approach.

### 6.3 Management Units

In addition to designating population units for stabilization management of target taxa, the Makua Implementation Plan also designated larger management units for ecosystem-level habitat management and threat control. The geographic scope of the Makua Implementation Plan included the entire action area (as then delineated) plus portions of the natural geographic ranges of the target taxa considered necessary to achieve their stability. Thirty-one management units were designated, based on the location of *in situ* population units and potential reintroduction areas for the target taxa. Together the management units covered 2,571 ha (6,353 ac) and were intended to define a large, contiguous landscape of habitat for the target taxa. In general, the management units encompassed most of the population units to be managed for stability or reintroduced for stability. Most management units would be fenced, and ungulates and other threats, such as non-native invasive plants, would be controlled. These actions also would benefit critical habitat for endangered plants and the Oahu elepaio within the management units.

The Makua Implementation Plan Addendum retains the basic implementation program of the Makua Implementation Plan while reducing the number of population units managed for stabilization, and the number and area of management units managed for ecosystem restoration. Six management units were eliminated and most of the remaining ones were reduced in area. The Makua Implementation Plan Addendum identifies 23 "priority management units" encompassing approximately 934 ha (2,307 ac) of "priority habitat." This area represents a 64 percent reduction from the area designated for the 31 management units in the Makua Implementation Plan. By reducing the number of population units managed for stability, and the number and area of management units to control ecosystem-level threats, the Army expects to reduce average annual costs to approximately \$3.3 million instead of \$8 million needed to implement the Makua Implementation Plan (U.S. Army Garrison 2005a). Chapter 2 of the Makua Implementation Plan Addendum describes the conservation actions the Army will implement within each management unit, and Chapter 3 describes the modified management units.

The 23 priority management units are located in the Waianae Mountains and Koolau Mountains of Oahu where the most important wild populations of the target taxa occur (see Figure 1). These management units are located on lands owned by the Army, State of Hawaii, City and County of Honolulu Board of Water Supply, and private entities. Cooperation through memoranda of agreement with landowners will be required before the Army can initiate management actions at non-Army sites. Eight management units are located on Army lands or within the Makua action area: Kahanahaiki, Kaluakauila, Lower Ohikilolo, and Ohikilolo are located on Makua Military Reservation; the Keaau and Makaha management unit is located on State lands within the action area; and the Pahole, Upper Kapuna, and West Makaleha

management units are located on State lands that are partially within the action area. Some of the management units on non-Army lands, such as Pahole (which is operated by the State of Hawaii as a Natural Area Reserve) and Ekahanui, Kaluaa and Waieli, and Palikea (which are operated by The Nature Conservancy of Hawaii as part of Honouliuli Preserve), are already being managed to varying degrees to protect sensitive species.

Table PD 6 lists the 23 priority management units identified in the Makua Implementation Plan Addendum and how they have been modified from those designated in the Makua Implementation Plan. Table PD 7 lists seven management units or subunits that are fenced, 22 management units or subunits that are planned to be fenced by 2015, and eight management units or subunits that will not be fenced. Dates of future construction are subject to change. Thus, about 32.8 percent of the total proposed management unit area is now fenced, 63.6 percent will be fenced over the next 10 years, and 3.6 percent will not be fenced. Ungulate control, where necessary, includes a combination of monitoring, fencing, hunting, and snaring. Weed control is conducted primarily in the most intact native habitats, for example within the seven management units with ecosystem-level fences and at five unfenced sites where ungulates are not a threat owing to the presence of topographical barriers. In general, weed control effort is prioritized to areas of high native plant cover, around target taxa individuals, and at potential augmentation/reintroduction sites. Over the last two years, Army Natural Resources Staff has established “weed control areas” in the management units and have begun to standardize weed monitoring and reporting (U.S. Army Garrison 2006c). Most of the weed control areas contain population units of target stabilization taxa and surrounding native habitat, and weeds within a 15-m (50-ft) radius around the population units are removed directly around the target plants (U.S. Army Garrison 2005c).

Other conservation management actions the Army is implementing to varying degrees in the management units include rat control, propagule collection, outplanting of target plant taxa, research on slug and insect control, and maintenance of two small fenced exclosures to protect Oahu tree snails. In addition, fire management plans for the management units have been completed. Actions including grass clearance from within 3 to 5 m (10 to 16 ft) of stabilization plants, and Army fire suppression assistance on fires threatening management units will be completed in order for the fire threat to be considered to be adequately controlled by the Army. Additional fuelbreaks, firebreaks, or other fire protection systems necessary to ensure that the habitat in the management units is not burned by a wildland fire, will be a necessary stabilization action. Army annual reports describe all ongoing actions implemented for conservation of target taxa within population units and management units (U.S. Army Garrison 2004a, 2005c, 2006c). Army actions within action area management units are briefly described below (M. Mansker, U.S. Army Garrison, pers. comm. 2006).

The Kahanahaiki, Kaluakauila, Lower Ohikilolo, and Ohikilolo management units are located on Makua that is generally considered goat-free, but pigs still have access to some areas. The Kahanahaiki Subunit I Management Unit is fenced, and both pigs and goats have been removed. Subunit II is not fenced but snaring reduces pig impacts on native communities in that subunit and on the subunit I fence. Management actions within the fenced Kahanahaiki subunit I include outplanting of target taxa, Oahu tree snail management, rat and weed control, monitoring of plants and tree snails, propagule collection, and research on slug damage and control measures.

Table PD 6. Priority Management Units in Makua Action Area (U.S. Army Garrison 2005a, Makua Implementation Team 2003).

| <b>Management Units<br/>(Addendum)</b> | <b>Acres</b> | <b>Management Units<br/>(Makua Implementation Plan)</b> | <b>Acres</b> |
|--|--------------|---|--------------|
| 1. East Makaleha                       | 231          | 1. Central and East Makaleha                            | 823          |
| 2. Ekahanui                            | 203          | 2. Ekahanui   | 221          |
| 3. Haili to Kealia                     | 30           | 3. Haili to Kawaihapai                                  | 161          |
|  |              | 4. Huliwai (deleted)                                    | 118          |
|  |              | 5. Kaahole to Paaiki (Kauai; deleted)                   | 468          |
| 4. Kaena                               | 52           | 6. Kaena and Keawaulu                                   | 103          |
| 5. Kahanahaiki                         | 94           | 7. Kahanahaiki  | 97           |
| 6. Kaimuhole                           | 100          | 8. Alaiheihe to Palikea Gulch                           | 619          |
| 7. Kaluaa and Waieli                   | 127          | 9. Kaluaa and Waieli                                    | 342          |
| 8. Kaluakauila                         | 104          | 10. Kaluakauila   | 152          |
| 9. Kamaileunu                          | 5            | 11. Kamaileunu  | 86           |
|  |              | 12. Kauaopuu (deleted)                                  | 19           |
|  |              | 13. Kaumoku Nui (deleted)                               | 213          |
|  |              | 14. Kawaiiki (Koolau; deleted)                          | 44           |
| 10. Keaau and Makaha                   | 5            | 15. Keaau and Makaha                                    | 5            |
| 11. Lower Kahana (Koolau; new)         | 3            |   |              |
|  |              | 16. Lower Kahanahaiki (deleted)                         | 32           |
|  |              | 17. Lower Kapuna (deleted)                              | 266          |
| 12. Lower Ohikilolo                    | 70           | 18. Lower Ohikilolo                                     | 70           |
| 13. Lower Opaepala (Koolau)            | 17           | 19. Lower Opaepala (Koolau)                             | 65           |
| 14. Makaha                             | 162          | 20. Makaha  | 172          |
| 15. Manuwai                            | 166          | 21. Mt. Kaala Natural Area Reserve                      | 166          |
|  |              | 22. Mohiakea (deleted)                                  | 19           |
| 16. Ohikilolo                          | 200          | 23. Ohikilolo   | 578          |
| 17. Pahole                             | 215          | 24. Pahole  | 215          |
| 18. Palikea                            | 45           | 25. Palikea   | 127          |
| 19. Puu Kumakalii                      | 28           | 26. Puu Kumakalii                                       | 28           |
| 20. Upper Kapuna                       | 182          | 27. Upper Kapuna  | 225          |
|  |              | 28. Upper Keaau (deleted)                               | 10           |
| 21. Waianae Kai                        | 9            | 29. Waianae Kai   | 125          |
| 22. Waiawa (Koolau)                    | 124          | 30. Waiawa (Koolau)                                     | 75           |
| 23. West Makaleha                      | 93           | 31. West Makaleha                                       | 255          |
| <b>Total</b>                           | <b>2,307</b> |   | <b>6,353</b> |

Table PD 7. Fencing Status in Management Units, Makua Action Area (U.S. Army Garrison 2005b, 2005c).

| Existing Fence                       | Acres      | Fence Construction (target year)              | Acres       | No Plans to Fence          | Acres     |
|--------------------------------------|------------|---|-------------|----------------------------|-----------|
| Ekahanui Subunit I                   | 44         | East Makaleha (2008)                          | 231         | Haili to Kealia Subunit I  | 20        |
| Kahanahaiki Subunit I                | 63         | Ekahanui Subunit II (2007)                    | 159         | Haili to Kealia Subunit II | 10        |
| Kaluaa and Waiele Subunit III        | 107        | Kahanahaiki Subunit II (2008)                 | 31          | Kaena Subunit I            | 16        |
| Kaluakauila (UA1)                    | 104        | Kaimuhole (2010)-not an option right now      | 100         | Kaena Subunit II           | 36        |
| Lower Ohikilolo (UA1)                | 70         | Kaluaa and Waiele Subunit IIB (2015)          | 11          | Palikea Subunit IV         | 9         |
| Ohikilolo (Ridgeline)                | 162        | Kamaileunu (2007 or 2008)                     | 2           | Palikea Subunit V          | 4         |
| Pahole                               | 215        | Keaau and Makaha (2009)                       | 5           | Puu Kumakalii              | 28        |
| Kaluaa and Waieli Subunits IIA + IIC | 24         | Lower Kahana (2014)                           | 3           |                            |           |
|                                      |            | Lower Opaepala (2007)                         | 17          |                            |           |
|                                      |            | Makaha Subunit I (2007)                       | 96          |                            |           |
|                                      |            | Makaha Subunit II (2009)                      | 66          |                            |           |
|                                      |            | Makaha Subunit III (2009)                     | 1           |                            |           |
|                                      |            | Manuwai (2012)                                | 166         |                            |           |
|                                      |            | Ohikilolo (Lower Makua) (2011)                | 38          |                            |           |
|                                      |            | Palikea Subunit IA (2009)                     | 21          |                            |           |
|                                      |            | Palikea Subunit IB (2009)                     | 11          |                            |           |
|                                      |            | Upper Kapuna Subunit I (2006-2007)            | 182         |                            |           |
|                                      |            | Upper Kapuna Subunits II, III, IV (2008-2009) | 42          |                            |           |
|                                      |            | Waianae Kai (2011)                            | 9           |                            |           |
|                                      |            | Waiawa (2013)                                 | 124         |                            |           |
|                                      |            | West Makaleha (2009 (estimated))              | 93          |                            |           |
| <b>Total</b>                         | <b>757</b> |   | <b>1467</b> |                            | <b>83</b> |

The Kaluakauila Management Unit is fenced and ungulate-free. Management actions include weed control, alien grass control for fuels management, outplanting of native plants, and rare plant surveys.

The Lower Ohikilolo and Ohikilolo management units are bordered by the Ohikilolo perimeter ridgeline fence and are goat-free. The Lower Ohikilolo Management Unit contains a small strategic fence to protect an occurrence of *Melanthera tenuifolia*. Native plants predominate in this management unit owing to intensive control of alien grasses around occurrences of *Chamaesyce celastroides* var. *kaenana*, *Hibiscus brackenridgei* ssp. *mokuleianus*, and *Spermolepis hawaiiensis* (a listed species that is not being managed for stability). In the Ohikilolo Management Unit, actions include weed control, rat control around certain rare plants, propagule collection and outplanting of target taxa, Oahu tree snail management within a small fenced enclosure, and snail habitat restoration through outplanting of common, native host trees. This management unit also contains small fences around occurrences of *Neraudia angulata* and *Pritchardia kaalae*. Lower portions of the Ohikilolo Management Unit are inaccessible to Army Natural Resources staff due to the presence of unexploded ordnance.

The Pahole, Upper Kapuna, and West Makaleha management units are located on State lands that are partially within the action area; the Keaau and Makaha Management Unit is entirely within the action area. Most conservation actions in these management units are implemented by State personnel, with varying degrees of assistance from Army Natural Resources Staff. The Pahole Management Unit is fenced and ungulate-free; management actions include some weed control, outplanting, and propagule collection. In the Upper Kapuna Management Unit, the State is working on fencing subunit I and has built two small fences around reintroduced occurrences of *Phyllostegia kaalaensis*. The Army also assists with goat monitoring and removal and weed control, and will assist in future construction of fences around the three other Upper Kapuna subunits. The West Makaleha Management Unit is scheduled for fencing in 2006 or 2007 and already contains two small fences protecting occurrences of *Cyanea grimesiana* ssp. *obatae* and *Schiedea obovata*. The Army assists the State with goat monitoring and control, weed control, outplanting, and propagule collection. The Keaau and Makaha Management Unit is located on non-Federal lands within the State Keaau Game Management Area and will be fenced in 2009.

The Makaha Management Unit is located on city/county lands outside the action area and is critical for reintroduction of stabilization population units of several target taxa. Fence construction is currently being completed at Makaha subunit I and for the two other subunits in 2009. The Army currently assists the Board of Water Supply with rare plant surveys, intensive weed control, rat control in Oahu elepaio territories, and monitoring experiments for invasive plant control. The Army also funds a full-time field employee to assist The Nature Conservancy of Hawaii in conservation management of target taxa in the privately owned Honouliuli Preserve, which contains the Ekahanui, Kaluaa and Waieli, and Palikea management units.

## 6.4 Expedited Stabilization

The Makua Implementation Team recognized that full stabilization likely would not be achieved for the original 27 target plant taxa within the 33 years projected by the Makua Makua Implementation Plan. The Army's proposed Makua Implementation Plan Addendum covers a 20-year planning horizon that likewise does not guarantee target taxa will be stabilized within a specified timeframe. The Service originally intended to assess the success of stabilization in the short term by verifying the Army's implementation of management actions according to the schedule outlined in the Makua Implementation Plan. However, certain taxa at greatest risk from training impacts (i.e., those with very low numbers and/or those located within the high fire risk zone) were intended to receive all needed management during the first phase of implementation (years 1 to 13) (Makua Implementation Team 2003). The Army's proposed action for this Biological Opinion takes a similar approach by incorporating an expedited stabilization plan for 12 taxa identified as most at-risk from training-related wildfire in the action area. Stabilization plans for 11 of these at-risk taxa are already included in the Makua Implementation Plan and Makua Implementation Plan Addendum; *Gouania vitifolia* will be added due to its presence in the new action area for this consultation. In addition to expedited stabilization of these 12 at-risk taxa, the Army will continue to manage for full stabilization of all target taxa as outlined in the Makua Implementation Plan Addendum. The 12 target taxa identified for expedited stabilization include the following:

|   |   |
|---|---|
| <i>Chamaesyce herbsti</i>                   | <i>Hibiscus brackenridgei</i> ssp. <i>mokuleianus</i> |
| <i>Cyanea grimesiana</i> ssp. <i>obatae</i> | <i>Neraudia angulata</i>                              |
| <i>Cyanea longiflora</i>                    | <i>Phyllostegia kaalaensis</i>                        |
| <i>Cyanea superba</i> ssp. <i>superba</i>   | <i>Sanicula mariversa</i>                             |
| <i>Delissea subcordata</i>                  | <i>Schiedea nuttallii</i>                             |
| <i>Gouania vitifolia</i>                    | <i>Schiedea obovata</i>                               |

Expedited implementation of a modified stabilization plan is intended to protect the 12 at-risk taxa from jeopardy over the next 10 years while actions toward full stabilization for all target taxa are being implemented. The purpose of expedited stabilization is to ensure that stabilized, or near-stabilized, population units are established both inside and outside the action area as quickly as possible. Stabilization of population units outside the action area where they will not be at risk of training-related wildfire is particularly critical. The expedited stabilization plan for the 12 at-risk taxa modifies certain priorities and numerical criteria for conservation actions outlined in the Makua Implementation Plan Addendum. Until these at-risk species have attained expedited, modified stabilization levels, the Army will not fire tracers, 2.75-caliber rockets, or Javelin missiles, or implement Column D weapons restrictions. In addition, other weapons systems and munitions will be used only in accordance with NFDRS and live fuel moisture conditions, and with the adequate fire suppression staffing specified in the Project Description evaluated for this opinion (see Table PD 2).

After attainment of expedited stabilization for the 12 at-risk taxa, the Army may begin training with the weapons systems and munitions cited above (note that full stabilization of all 12 at-risk taxa and all 16 stabilization target taxa are required before the Army may begin training with TOW missiles). However, certain restrictions will be imposed on continued use of those weapons systems and munitions if a fire is ignited outside the firebreak road or spreads outside

the firebreak road from an ignition within the training impact area. If such a fire occurs, the Army will immediately cease all live-fire training and focus on suppressing the fire. The Army will cease using the weaponry that caused the fire and will meet with the Service within 10 calendar days to discuss the incident. If the Service and Army agree that the fire ignition and suppression actions occurred as anticipated, training with that particular weapon or munition may resume.

Expedited implementation of a modified stabilization plan for the 12 at-risk taxa will be realized over the next 10 years through conservation measures summarized in Tables PD 8 and 9. The expedited actions are intended to increase the baselines of the 12 taxa inside and outside of the action area as rapidly as possible. In general, these expedited stabilization measures are based on continuing management of all *in situ* population units for all target taxa identified as “manage for stability” in the Makua Implementation Plan Addendum, with prioritization of activities to stabilize population units of at-risk taxa inside and outside the action area. For some at-risk taxa, this will require initiating establishment of new population units through reintroductions on State, city/county, or private lands on an accelerated schedule. Meanwhile, the Army will continue to implement activities intended to achieve full stabilization of all target taxa according to the schedule outlined in the Makua Implementation Plan Addendum. The Army and the Service will annually review monitoring data to assess the Army’s progress towards achieving full stabilization of all 29 target taxa (including 16 target plant taxa, 12 at-risk plant taxa, and the Oahu tree snail *Achatinella mustelina*). The annual review also will allow for modification of stabilization actions as needed, using an adaptive management approach.

For all stabilization population units of at-risk taxa (at least three per taxon), the Army will ensure that adequate numbers of individuals are outplanted and maintained to conform to modified numerical criteria for stability. For example, if a taxon’s numerical stabilization goal is 50 mature, reproducing individuals per population unit, the Army will establish and continue to maintain *in situ* at least 50 individuals of outplanting size per stabilization population unit, regardless of reproductive maturity. These numerical goals must be maintained or increased for at least two years before the designated weapons systems and munitions can be used. All outplanted plants will be of sufficient size and vigor to survive in the wild. The ability to maintain numerical criteria and protect plants in the wild will require fencing some of the management units encompassing the expedited population units as soon as possible. Expedited stabilization of certain species vulnerable to infestation by slugs and insects also will require investigation of appropriate pest control measures.

Expedited stabilization also will require measures be taken to better ensure that the stabilization population units are protected from the risk of training-related wildfire. Expedited stabilization population units not protected by intact vegetation (i.e., 200 m (656 ft) of shrub/forest), or strategically placed firebreaks or fuelbreaks will be protected with localized fuel treatments around individual plants. Three to five m (9.8 to 16.4 ft) of fuel clearance will be completed around individual expedited stabilization plants that are not otherwise protected by fire protection systems. Expedited stabilization plants occurring within the potential ignition areas of the Javelin or TOW will also receive this localized fuel treatment. Plant level fuel management may be waived on a case-by case basis for plants occurring on cliffs where fuels are discontinuous, with the approval of the Service. Management unit level fuelbreak and firebreak

completion is not an expedited stabilization measure, but will be completed in order to meet full stabilization implementation habitat protection goals. Once these fuels treatments are completed by the Army and expedited stabilization is completed for the 12 at-risk taxa, the Army may begin training with tracers and long-range weapons. Accordingly, an important component of the expedited, modified stabilization plan for the 12 at-risk taxa is annual monitoring to ensure survival of the minimum number of plants in the stabilization population units. Once all stabilization population units are established at expedited, modified goals for the 12 at-risk taxa, the Army will continue to implement standard conservation management of the population units and the management units in which they are located in order to attain full stabilization, as outlined in the Makua Implementation Plan Addendum.

The Army estimates that expedited stabilization can be achieved, with adequate funding, within 10 to 15 years for most of the 12 at-risk taxa. One species with periodic dormancy, *Sanicula maritima*, may require a longer timeline because preliminary monitoring must be conducted and evaluated to determine appropriate goals and techniques for stabilization. Successful achievement of expedited, modified stabilization for these species will not occur without full funding for the Makua Implementation Plan Addendum, the Wildland Fire Management Plan, and the wildland fire suppression and fuels management sections of this Project Description. The Service expects the Army will guarantee funding for these features to ensure expedited stabilization for the 12 at-risk taxa, so that training with the proposed weapons systems and munitions can take place at Makua.

Table PD 8. Conservation Activities in Management Units (U.S. Army Garrison 2005 a, b).

| Management Unit   | Area (acres) | Fence Schedule  | Ungulate Control Status                | Weed Control Areas (acres) |
|-------------------|--------------|---|--|----------------------------|
| East Makaleha     | 231          | Construct in 2008   | Limited goat control in adjacent areas | None                       |
| Ekahanui          | 203          | Subunit I (44 acres) fenced   | Subunit I ungulate free                | 9.8 ac                     |
|                   |              | Subunit II (159 ac) construct in 2007                                   |  |                            |
|                   |              | Small PU fences for <i>Delissea subcordata</i> , <i>Schiedea kaalae</i> |  |                            |
| Haili to Kealia   | 30           | None  | None                                   | 3.3 ac                     |
| Kaena             | 52           | None  | None                                   | 3.01 ac                    |
| Kahanahaiki       | 94           | Subunit I (63 ac) fenced  | Subunit I ungulate free                | 48.12 ac                   |
|                   |              | Subunit II (31 ac) construct in 2008                                    |  |                            |
| Kaimuhole         | 100          | Construct in 2010   | None                                   | None                       |
| Kaluaa and Waieli | 127          | Subunit IIA (9 ac) construct in 2006                                    | Subunit III ungulate free              | 2.9 ac                     |
|                   |              | Subunit IIB (11 ac) construct 2015                                      |  |                            |
|                   |              | Subunit IIC (8 ac) construct 2005                                       |  |                            |
|                   |              | Subunit III (99 ac) fenced  |  |                            |
| Kaluakauila       | 104          | Fenced  | Ungulate free                          | 11.92 ac                   |
| Kamaileunu        | 5            | None  | None                                   | None                       |
| Keaau and Makaha  | 5            | Construct in 2009   | None                                   | None                       |
| Lower Kahana      | 3            | Construct in 2014   | None                                   | None                       |
| Lower Ohikilolo   | 70           | Fenced  | Ungulate free                          | 7.99                       |
| Lower Opaeula     | 17           | Construct in 2007   | None                                   | None                       |
| Makaha            | 162          | Subunit I (96 ac) construct in 2006                                     | None                                   | 22.38 ac                   |
|                   |              | Subunit II (66 ac) construct in 2009                                    |  |                            |
|                   |              | Subunit III (1 ac) construct in 2009                                    |  |                            |
| Manuwai           | 166          | Construct 2012  | Goats controlled in adjacent areas     | None                       |
| 16. Ohikilolo     | 200          | Majority (162 ac) fenced  | Most goats removed                     | 7.43 ac                    |
|                   |              | Lower Makua (38 ac) construct in 2011                                   |  |                            |
|                   |              | Small PU fences for particular species                                  |  |                            |
| 17. Pahole        | 215          | Fenced  | Ungulate free                          | 32.4 ac                    |
| 18. Palikea       | 45           | Subunit IA (21 ac) construct in 2009                                    | Pigs controlled in subunits IA and IB  | 4.61 ac                    |
|                   |              | Subunit IB (11 ac) construct in 2009                                    |  |                            |
|                   |              | Subunit IV (9 ac) none  |  |                            |
|                   |              | Subunit V (4 ac) none   |  |                            |
|                   |              | Small PU fences   |  |                            |
| 19. Puu Kumakalii | 28           | None  | None                                   | None                       |
| 20. Upper Kapuna  | 182          | Subunit I (182 ac) construct in 2006                                    | None                                   | 6.33 ac                    |
|                   |              | Subunits II, III, IV (42 ac) construct in 2008-2009                     |  |                            |
|                   |              | Small PU fences for <i>Phyllostegia kaalaensis</i>                      |  |                            |
| 21. Waianae Kai   | 9            | Construct in 2011   | None                                   | None                       |
|                   |              | Small PU fences for particular species                                  |  |                            |
| 22. Waiawa        | 124          | Construct in 2013   | None                                   | None                       |
| 23. West Makaleha | 93           | Construct in 2006   | Goats controlled in adjacent areas     | 3.3 ac                     |
|                   |              | Small PU fences for <i>Schiedea</i>                                     |  |                            |

Table PD 9. Conservation Measures for Expedited, Modified Stabilization of 12 At-Risk Taxa at Population Units (PUs) to be Managed for Expedited Stabilization and Management Units (MUs) in which They are Located. (Scientific names of taxa are abbreviated by combining the first three letters of the genus and species names.)

| Conservation Measures                                     | Chaher | Cyagri | Cyalon | Cyasup | Delsub | Gouvit | Hibbra | Nerang | Phykaa | Sanma | Schnut | Schobo |
|---|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|--------|--------|
| Manage 3-4 <i>in situ</i> PUs                             | 3      | 3      | 3      | 4      | 4      | 3      | 4      | 4      | 3      | 3     | 3      | 3      |
| Attain numerical stability at 1-3 PUs outside action area | 2      | 2      | 1      | 3      | 3      | 2      | 3      | 3      | 2      | 1     | 1      | 1      |
| Initiate reintroduction of PUs outside action area        | 2      |        |        | 2      |        | 1      | 1      | 1      | 2      |       | 1      | 1      |
| Implement rat, slug, insect control as needed             |        | X      | X      | X      | X      |        | X      |        |        |       | X      | X      |
| Construct fence   |        |        |        |        |        |        |        |        |        |       |        |        |
| Upper Kapuna MU West Makaleha MU                          | X      |        | X      | X      | X      |        |        |        | X      |       | X      |        |
| Makaha MU   | X      | X      | X      |        |        |        |        |        | X      |       |        |        |
| Other MUs   | X      |        |        | X      |        |        |        | X      | X      |       | X      | X      |
|   |        | X      | X      | X      |        | X      | X      | X      | X      | X     |        |        |
| Control weeds   | X      | X      | X      | X      | X      | X      | X      | X      | X      | X     | X      | X      |
| Implement additional fire management and                  | X      | X      | X      | X      | X      | X      | XXX    | X      | X      | X     | X      | X      |
| Obtain cooperative agreements                             | X      | X      | X      | X      | X      |        | X      | X      | X      | X     | X      | X      |
| Conduct additional monitoring                             | X      | X      | X      | X      | X      | X      | X      | X      | X      | X     | X      | X      |
| Conduct population dynamics research                      |        |        |        |        |        |        |        |        |        | X     |        |        |
| Develop stabilization plan                                |        |        |        |        |        | X      |        |        |        |       |        |        |

## 7. Conservation Measures

### Funding:

- 1) The Makua Implementation Plan Addendum will be fully funded to ensure that all training activities at Makua are in conformance with the Biological Opinion. This funding shall be in place prior to any live-fire training activities occurring at Makua.
- 2) The Wildland Fire Management Plan will be updated to incorporate the requirements specified by this Biological Opinion, will be fully funded, and all precautions will be followed as outlined in this Opinion for any live-fire training to occur at Makua.

### Training:

- 1) Range operations staff will be fully trained in WIMS and will have a thorough understanding of weapons restrictions based on fire danger, fuels project completion, and locations and status of endangered species at Makua.
- 2) The Army will not use Kaena Point trail for any training activities.
- 3) If any Army training-related fire ignites outside of the firebreak road (designated impact area), use of all weapons will cease and the Service will be notified within one hour. The Army will provide the Service with a briefing detailing the cause of the fire, forecasted and actual fire weather, forecasted and actual fire behavior, and predicted and actual helicopter productivity. The briefing will include video or other fire behavior and helicopter productivity data taken during the first hour of fire suppression. The range will be reopened for training only after the Service has determined that the Army actions that contributed to the fire and resulted in its suppression were conducted in accordance with the requirements of the Biological Opinion. If the Army is unable to identify and/or correct the problem, then further use of that weaponry will be prohibited until full stabilization, as outlined in the Makua Implementation Plan Addendum, is achieved.
- 4) If a prescribed burn or military training fire burns any portion of a management unit or designated critical habitat, the Army will meet with the Service to determine if there is a need to strengthen the fuelbreak and firebreak system, increase weapon restrictions, or augment fire suppression staffing to prevent a similar fire in the future.
- 5) Smoking is permitted only in the administrative bivouac site or near the Makua Range Control Building but no further than the gate into the actual valley.
- 6) All ordnance fired at Makua will be aimed to fall within the south firebreak road.
- 7) Targets will be placed to minimize the possibility of ammunition going outside the firebreak road.
- 8) No live-fire training (of any kind) will be allowed when fire danger is red (high).
- 9) C-Ridge will not be used for any training purpose.

- 10) No illumination rounds will be permitted at Makua.
- 11) All live-fire training will take place on existing training ranges (southern lobe impact area) and will not land outside of the surface danger zones.
- 12) Open fires are not allowed anywhere at Makua including bivouac sites.
- 13) There will be no off-road vehicular activity at Makua.
- 14) Before night training at Makua is conducted, helicopters must be authorized to be used for fighting night fire suppression.

#### Kuaokala Trail Conservation Measures:

- 1) Smoking will not be allowed during road or trail marches.
- 2) Soldiers would be restricted to the established trail or roads when on marches, and marching formation would conform to the width of the trail.
- 3) The trail will be surveyed before and after each march by a qualified Natural Resources Staff person capable of determining if there has been damage to the trail and the surrounding flora and fauna that would contribute to species and habitat deterioration. Any such deterioration will be reported to the Service within 48 hours and use of the trail will be suspended until the Army and Service can meet to discuss further conservation measures to prevent future damage.

## 8. Weapons Used at Makua

### Small Arms

Blank Ammunition: There is the potential for hot shell casings to ignite fires close to the firing point during the firing of blank ammunition. Therefore, the range will be staffed by ground fire suppression forces including a NWCG-qualified Incident Commander, two engines, a water tender and standby helicopters. Unlike helicopter staffing requirements for all other weapons under most other conditions, none of the fire suppression helicopters need to be on-site at Makua when blank ammunition is being fired. They will all be assigned to the training, but with a one-hour response time to a fire occurring outside the firebreak road. Flash suppressors and blank adapters will always be used on weapons firing blanks at Makua, preventing hot residue from exiting the muzzle. Blanks will not be fired when live herbaceous fuel moisture is 49 percent or lower, or when the Fire Danger Rating is in the Red.

Ball Ammunition Training: All ball ammunition qualification and demolition training will take place within the current impact area, the southern lobe of the firebreak road. The qualification training involves using small arms (rifles, pistols, machine guns, or shot guns), with .308, .38, .45, or .50-caliber; 5.56, 7.62, or 9 mm; 12 gauge; or 40 mm target practice rounds shooting at either pop-up targets or fixed targets. The fixed firing points are elevated on a two-foot platform to decrease the chance of fire ignition from a muzzle flash or hot casings, and are located in a mowed area.

Small Arms Weapons Mounted on Helicopters: These weapons will not be discharged while the helicopter is outside the south lobe of the firebreak road to ensure that any fire ignited from a hot casing falling from the helicopter starts inside the firebreak road. Tracer fire from helicopters is prohibited.

### **Demolitions**

Demolitions training at Makua will take place at the ordnance impact area and may include a range of activities such as: (1) use of low levels of explosives to destroy wood or steel structures, (2) gaining entry to buildings, (3) placement and detonation of shape charges at the ordnance impact area (shape charges are composed of C4 plastic and would be used as 6.8-kilogram (kg) (15-pound (lb)) charges (80 times a year) and 18-kg (40-lb) charges (36 times a year), and (4) detonation of cratering charges at the ordnance impact area following the detonation of the shape charge (the M039 cratering charge) filled with ammonium nitrate (placed within the hole created by the shape charge). The typical maximum amount of ammonium nitrate that would be used at any one time would be 68 kg (150 lbs) and possibly up to 136 kg (300 lbs). All demolitions training will be conducted in areas of bare ground or exploded within metal drums to reduce the risk of fire.

Special Demolitions and Demolition Munitions: These munitions will be used for specific purposes at Makua such as unexploded ordnance disposal or by Soldiers training to clear mines, breach doors or overcome obstacles. Demolition munitions contain ordnance capabilities and are used to assist the Soldier in battle situations. The only demolitions materials that will be used at Makua are C4, TNT, detonation cord, blasting caps, time fuses, cratering charges, shaped charges, and bangalore torpedoes. Procedures for the safe use of many of these weapons, including explosives such as TNT or composition C4, require use to be limited to excavated demolition pits surrounded by a sand bag barrier. No more than 136 kg (300 lb) net explosive weight will be detonated in any demolition at Makua. To minimize the chance of a fire igniting outside the firebreak road, demolitions will be oriented, when possible, in a way that directs hot gasses or blast fragments toward the interior of the south lobe of the firebreak road.

Unexploded Ordnance Disposal: Unexploded ordnance disposal activities may be conducted within the valley, outside the south lobe of the firebreak road, when live herbaceous fuel moisture, calculated in the WIMS for the Makua Range weather station (number 490301) is 100 percent or higher and the burning index is 20 or lower (fire danger rating Green/Low). Fire suppression ground and helicopter resources will be fully staffed in accordance with the fire suppression staffing guidelines used for live-fire training.

### **Restrictions**

Unexploded ordnance may be detonated at locations 100 m (328 ft) or greater inside the south lobe of the firebreak road and within designated demolition training areas only when the burning index is 20 or lower and when live herbaceous fuel moisture is 60 percent or higher. This will only be allowed after grass has been removed from within 3 m (2 ft) of all *Hibiscus brackenridgei* ssp. *mokuleianus* and *Chamaesyce herbstii* plants within the Lower Ohikilolo Management Unit. Fire suppression helicopter staffing will be assigned to demolitions training

and unexploded ordinance activities in accordance with the helicopter staffing guidelines in Table PD 5.

### **M79 and M203 Grenade Launchers**

Only M79 and M203 grenade launchers will be used at Makua. The maximum range for the M79 and M203 grenade launchers is 400 m (1,312 ft).

#### **Restrictions**

Use of these weapons will be restricted to mowed areas and Green fire danger rating conditions.

### **MK19 Grenade Launcher**

The maximum range for blast fragments from the MK19 grenade launcher is 2.4 km (1.5 mi). It can fire 40 mm grenades, smoke grenades, and other grenades (Figure PD 15).

#### **Restrictions**

Only M385A1 inert rounds, with cartridge cases that detach from the projectile so that they land within 100 m (328 ft) of the firing point, will be used in Yellow fire danger rating conditions. Inert rounds that meet this specification may be fired when live herbaceous fuel moisture is 60 percent and higher. No other rounds will be fired from the MK19 grenade launcher until after the Kaluakauila, Kahanahaiki and Ohikilolo fuelbreaks and firebreaks are constructed and the expedited stabilization of three endangered plant species is completed (see Table PD 2). To minimize the areas where fires may be ignited by this weapon, the MK19 will not be fired east of the 580,900 m UTM line.

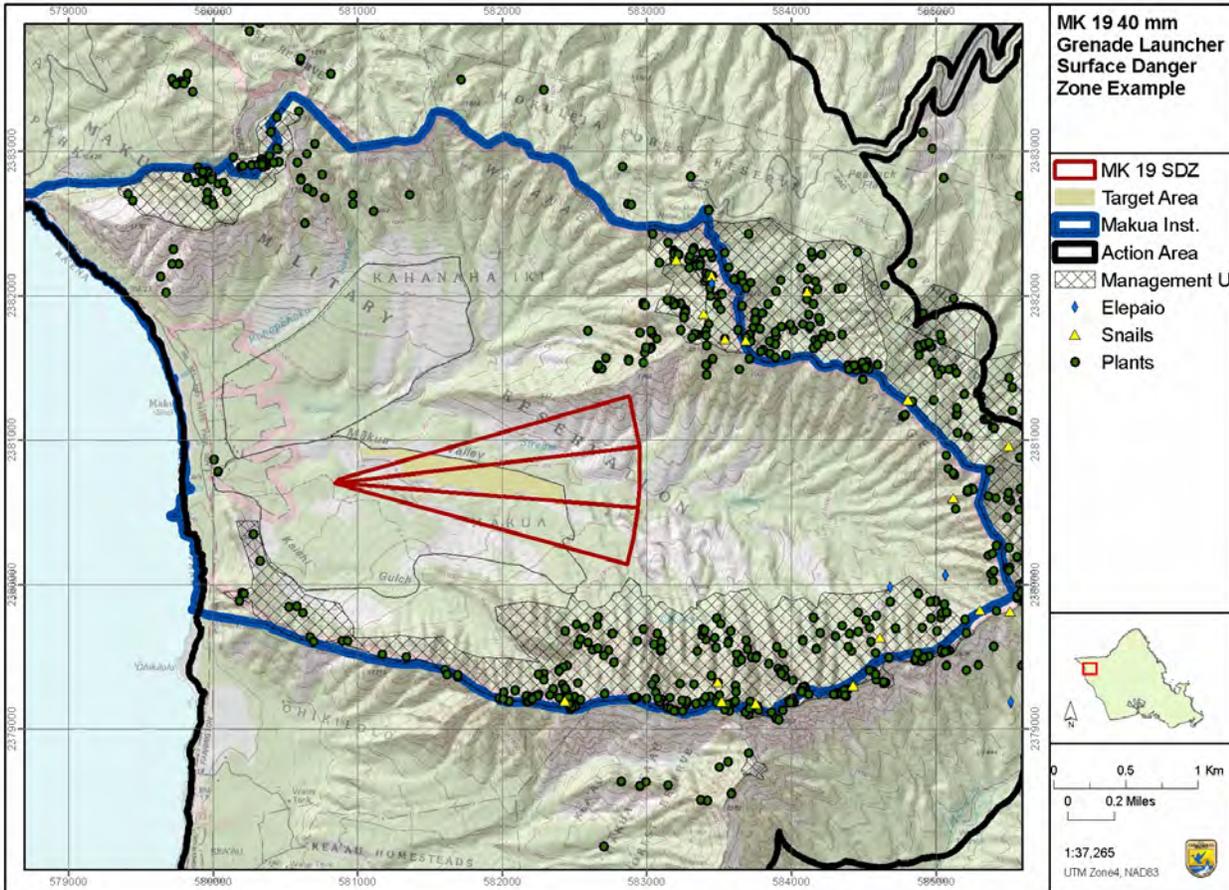


Figure PD 15. MK19 grenade launcher surface danger zone.

**Simulators, Mines and Grenades**

Explosive charges are used to simulate detonation of mines and incoming artillery projectiles, mortars, and bombs during training exercises. All use of these types of devices will be in accordance with Army Regulation 385-63, *Range Safety Manual*. Procedures for the safe use of many of these weapons, including explosives such as TNT or composition C4, require use to be limited to excavated demolition pits surrounded by a sand bag barrier. When Area F (which generally has a 30-m (98-ft) radius) is designated on the surface danger zone for the particular weapon, it will be cleared of flammable vegetation. To minimize the chance of a fire igniting outside the firebreak road, simulators, mines, and grenades will be oriented, when possible, in a way that directs hot gasses or blast fragments toward the interior of the south lobe of the firebreak road.

**60 mm Mortars**

Sixty mm mortars are used for indirect fire and support of troops. Mortar rounds are shot from a launch tube attached to a base plate, using 60 mm high explosives, 60 mm short-range training ammunition, or 60 mm inert ammunition. The 60 mm inert round has no explosion upon impact; the short-range training ammunition has a flash, bang, and smoke on impact, while the high explosive cartridge has a large explosion. The M720 and M888 high explosive cartridges have high fragmentation steel loaded with Composition B explosive that explodes on

impact. The M720 cartridge is equipped with the M734 multi-option fuse, which can be set to function in the proximity, near surface burst, impact, or delay mode. The M766 short-range practice cartridge is designed for use with the M224 60 mm mortar system and provides realistic, cost effective training. The M766 is similar to the 60 mm high explosive cartridge in exterior configuration and operation. It reduces the cost of training and permits training in areas with limited range space. The M766 is equipped with the M779 practice fuse, which is a facsimile M734 multi-option fuse. Maximum range of the short-range training ammunition is 530 m (1,739 ft). The rounds are propelled by doughnut charges. The maximum range of the high explosive and inert mortars is 3,500 m (11,483 ft). The number of charges and firing angles will be limited so that the weapon’s maximum range or “Distance X” on the developed surface danger zone is 760 m (2,493 ft) at Makua. The maximum distance the 60 mm round can travel at Makua will be limited to 760 m (2,493 ft) or less by enforcing strict limits on the charge used and the angle that the weapon is fired (Figure PD 16).

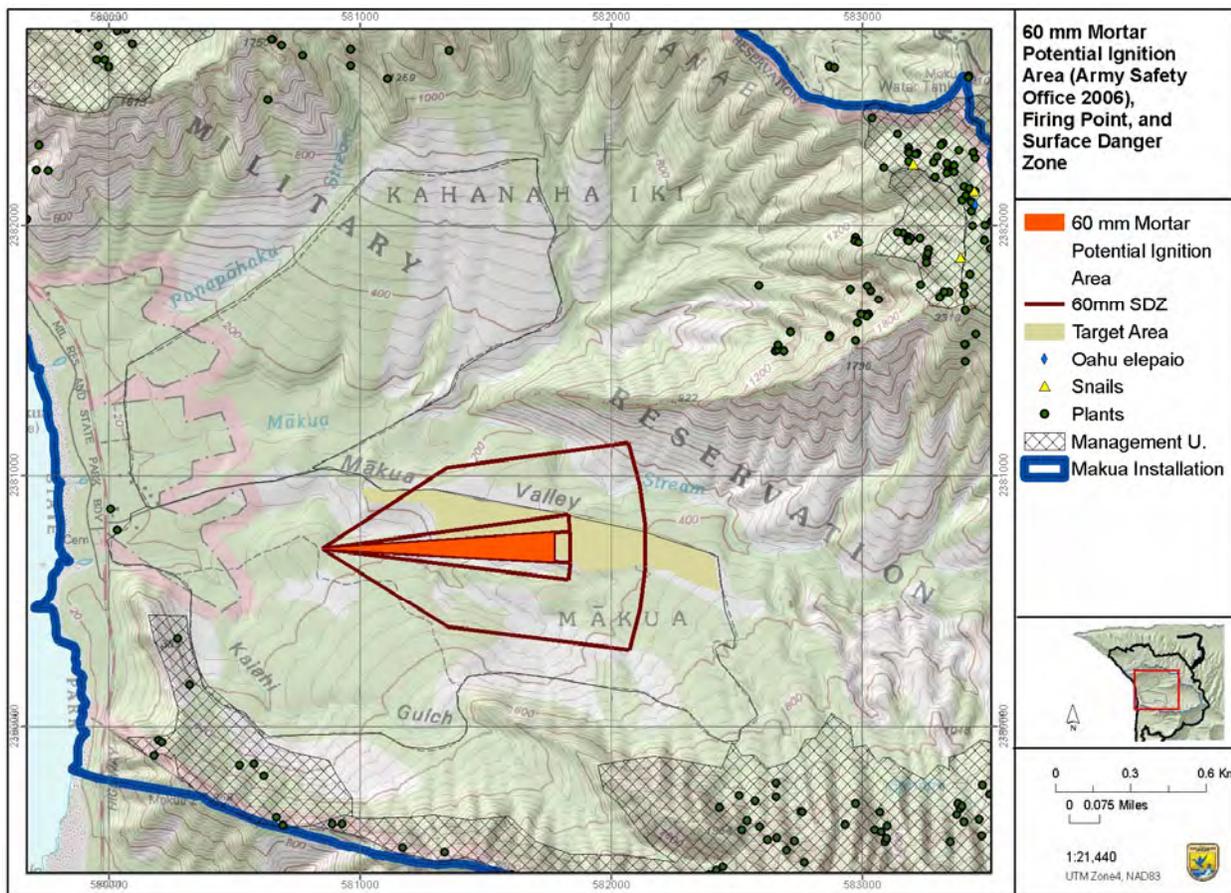


Figure PD 16. Potential ignition area and surface danger zone for 60 mm mortar.

### 81 mm Mortars

Similar to the 60 mm, this weapon consists of a launch tube mounted on a base plate. It is used for indirect fire support of troops. It fires 81 mm high explosive mortar and 81 mm target practice inert mortars. The 81 mm inert round has no explosion upon impact while the 81 mm high explosive has a large explosion. High explosive cartridges are designed for use against personnel, bunker and light materiel targets. The high fragmentation steel projectile is loaded with Composition B explosive. Maximum and sustained rates of fire are 15 to 30 rounds per minute. The rounds are propelled by doughnut charges. This 81 mm weapon has a maximum possible range of 5,900 m (19,357 ft). The number of charges and firing angles will be limited so that the weapon's maximum range or "Distance X" on the developed surface danger zone is 1,760 m (5,774 ft) or less at Makua. The maximum distance the 81 mm round can travel at Makua will be limited to 1,760 m (5,774 ft) or less by enforcing strict limits on the charge used and the angle that the weapon is fired (Figure PD 17).

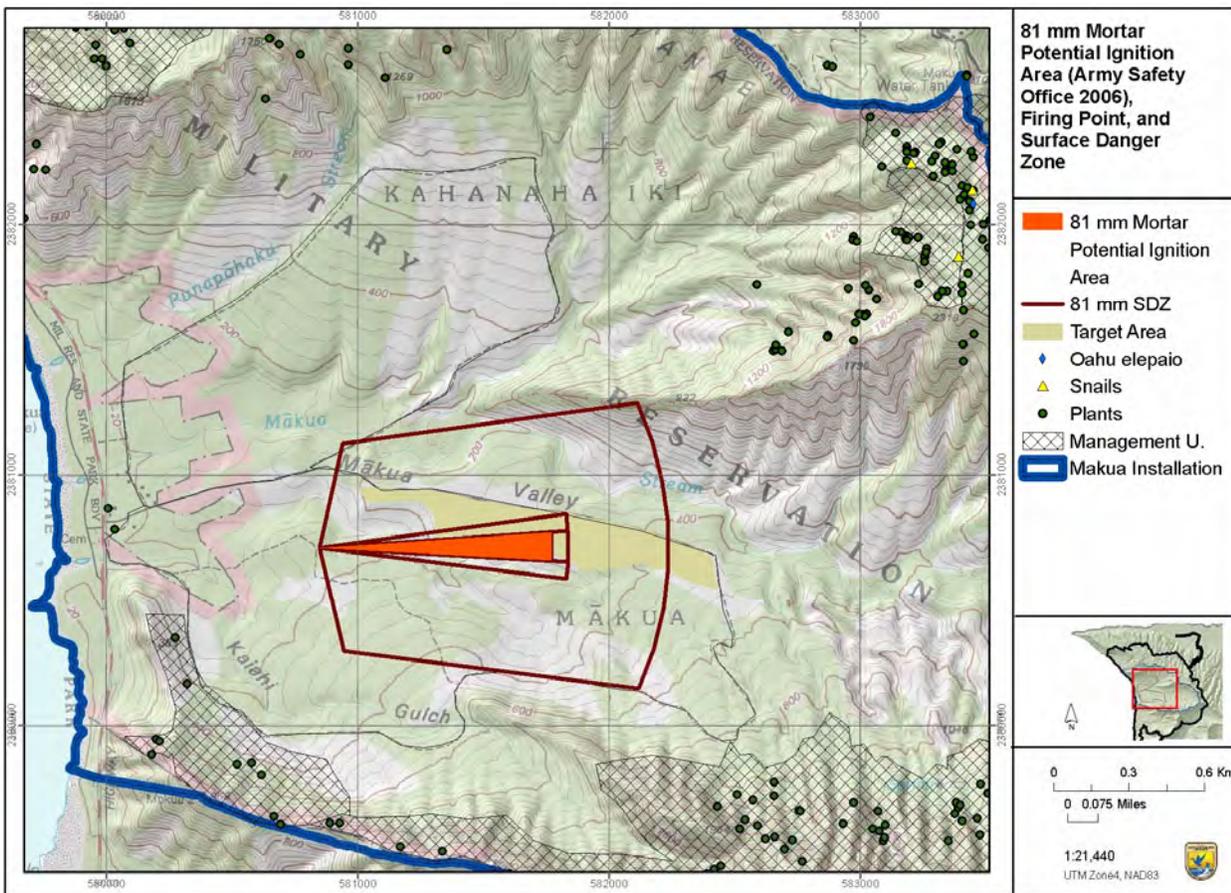


Figure PD 17. Potential ignition area and surface danger zone for 81 mm mortar.

### 120 mm Mortars

The 120 mm mortar consists of a tube mounted on a trailer or vehicle (Figure PD 18). It is used for indirect fire support of troops. It generally fires a fin-stabilized, 120 mm high explosive mortar from a smooth bore. It can also be fitted with a sleeve so that it can fire 81 mm projectiles. The M120 mortar system consists of the M298 cannon assembly, M190 bipod assembly, M9 baseplate, and M1100 trailer. The 120 mm high explosive has a large explosion. Only high explosive cartridges will be fired from the M120. The M933/934 high explosive cartridges are designed for use with the M120 and M121 120 mm mortar systems and are used against personnel, bunker and light materiel targets. The 1090 steel projectile is loaded with Composition B explosive. The M934 is equipped with the M734 multi-option fuse that can be set to function in the proximity, near surface burst, impact, or delay mode. The rounds are propelled by charge bags. This weapon has a maximum possible range of 7.2 km (4.5 mi). The number of charges and firing angles will be limited so that the weapon's maximum range or "Distance X" on the developed surface danger zone is less than 1.6 km (5,249 ft) at Makua. The maximum distance the 120 mm round can travel at Makua will be limited to 1.6 km (5,249 ft), enforcing strict limits on the charge used and the angle that the weapon is fired (Figure PD 19). The maximum and sustained rates of fire are 16 rounds/min for the first minute and 4 rounds/min thereafter.



Figure PD 18. The 120 mm mortar may be fired from Stryker or other vehicles or from the ground using a mortar plate (Photos: Global Security.org).

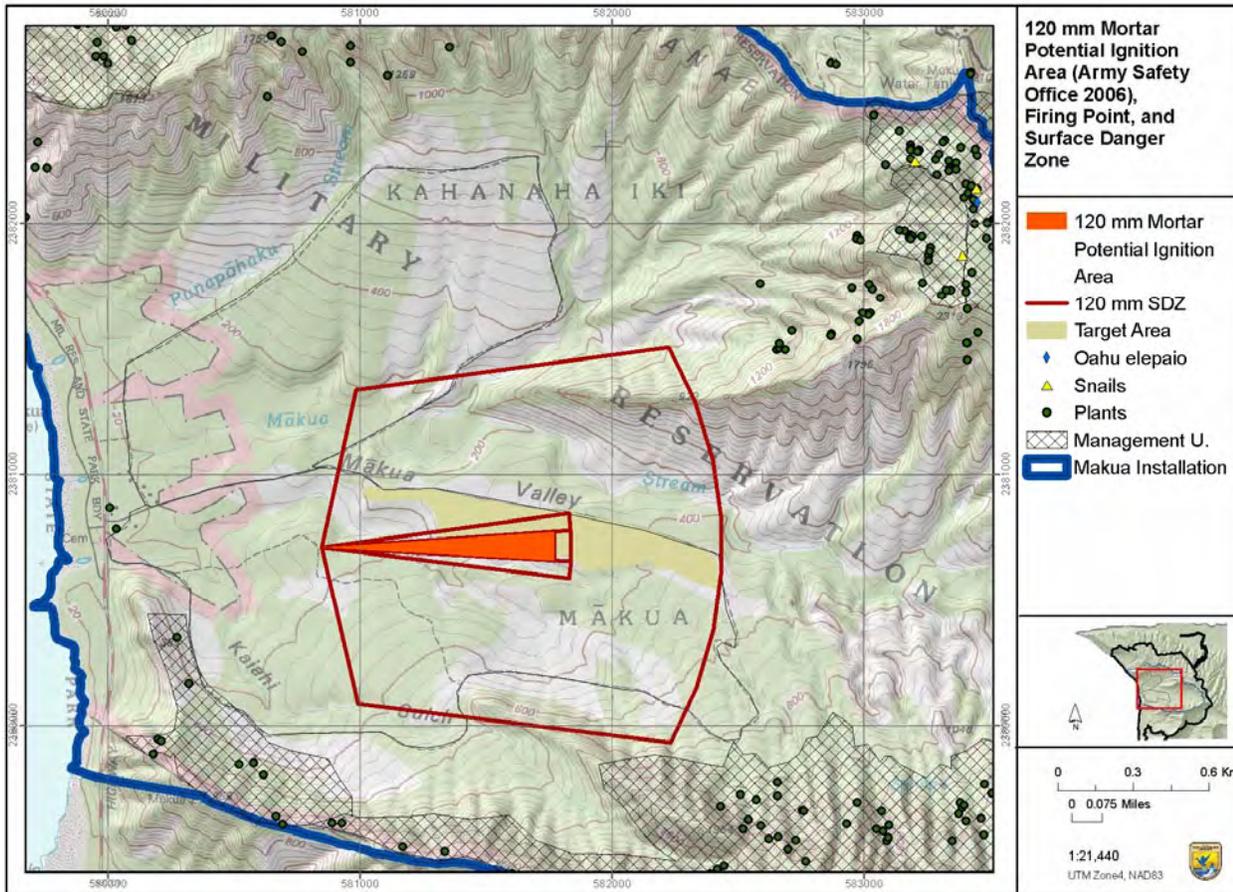


Figure PD 19. 120 mm mortar potential ignition area, firing point, and surface danger zone.

Restrictions for all Mortar Training

Mortars will only be fired from the designated spot in the mowed area (EJ 8085-8071) known as Coyote on the maps in this Project Description. Mortars will only be targeted at Objective Deer (EJ 8190-8070). Historically, the first round fired from a mortar would sometimes land outside the impact area because the force from this first shot is used to seat the mortar plate into its firing position. The number of charge bags used are closely controlled, counted out separately and inserted in the tube, and double checked prior to firing the weapon by at least four different personnel. At Mākua, all mortar plates will be seated into place with a sledge hammer prior to firing the first round in order to better ensure accuracy of all mortar rounds fired.

No infrared, illumination or smoke cartridges will be used at Mākua because of their increased fire risk.