4.0 ORDNANCE AND EXPLOSIVES RISK IMPACT ASSESSMENT

This qualitative evaluation of OE risk for the Former Waikoloa Maneuver Area and Nansay Sites was developed following protocols defined in the Ordnance and Explosives Risk Impact Assessment (OERIA). OERIA uses direct analysis of site conditions and demographics to evaluate OE risk. The results of this risk assessment were used to help determine the most appropriate OE response action alternatives for the Former Waikoloa Maneuver Area and Nansay Sites (Chapter 8.0).

For purposes of conducting this qualitative risk evaluation, current and future land uses for the Former Waikoloa Maneuver Area and Nansay Sites were identified using the *General Plan* (County of Hawai'i, 1989) and information gathered during the Phase II EE/CA investigation. Land uses were categorized into three distinct groups based on the likelihood of public access and intrusive activities that would result in excavation of the soil, thereby potentially exposing the public to OE. The three land use groups are as follows:

- **Group I -** Land uses consisting of open areas (parks, recreation, and historic sites), conservation areas (forest and water reserves), and extensive agricultural areas (pastureland and ranchland).

- **Group II -** Land uses consisting of agricultural districts including intensive agricultural lands and other agricultural lands (low capacity for intensive cultivation).

- **Group III -** Land uses consisting of commercial areas, multiple residential areas (low- to high-density urban and proposed urban expansion), rural districts (small farms mixed with low-density residential lots with maximum 1/2-acre lots), industrial areas, and resort areas (e.g., golf courses).

Because the current and future land uses are not consistent throughout each sector (i.e., multiple land uses in a sector), sector boundaries were eliminated and the project site was resectorized using land use designations, property ownership boundaries, and the results of the Phase II EE/CA field investigation. Using this information, 20 individual risk evaluation areas (i.e., Areas A through T) were delineated (Figure 4-1) throughout the Phase II EE/CA investigation area so that the most effective OE response action alternatives could be recommended for the Former Waikoloa Maneuver Area and Nansay Sites. The graphic overlay on Figure 4-1 shows the transition from the 13 sectors (Chapter 3.0) to the 20 OERIA evaluation areas.

Sections 4.1 through 4.5 discuss the definition of risk factors and the approach and rationale used in this qualitative risk evaluation. Section 4.6 provides the qualitative risk assessment for the 20 OERIA evaluation areas shown on Figure 4-1 and Plate 4-1. Section 4.7 summarizes the results of the risk assessment for the Former Waikoloa Maneuver Area and Nansay Sites.

4.1 DEFINITION OF RISK FACTORS

The potential risk posed by OE at a site may be characterized qualitatively by evaluating the likelihood of exposure to OE, the severity of the exposure, and the likelihood of detonation. These three components can be further defined by a set of risk factors. For example, the type of OE and its sensitivity must be considered to evaluate the likelihood of detonation and severity of exposure. Similarly, the likelihood of exposure may be evaluated by considering the OE potential (based on results of the EE/CA field investigation), the number of people using the site, the type of activities conducted at the site, and the accessibility of the site. These risk factors are listed below and defined further in the following paragraphs.

- OE Factors (OE Type, OE Sensitivity, OE Potential, OE Depth Range)
- Site Characteristics Factors (Site Accessibility, Site Instability)
- Demographic Factors (Site Activities, Site Population).

4.2 ORDNANCE AND EXPLOSIVES FACTORS

4.2.1 Type of Ordnance and Explosives

The type of OE affects the likelihood of injury and the severity of an incident. There are four categories of OE type. These categories are presented in order from highest to lowest potential hazard in Table 4-1. The OE type for each evaluation area reflects the results of the Phase II EE/CA field investigation (Plate 4-1) as well as the results of previous investigations. When multiple categories of OE types were discovered in an OERIA evaluation area, the highest hazard category was used in the risk assessment.

Table 4-1. OE Type Risk Factor Definition

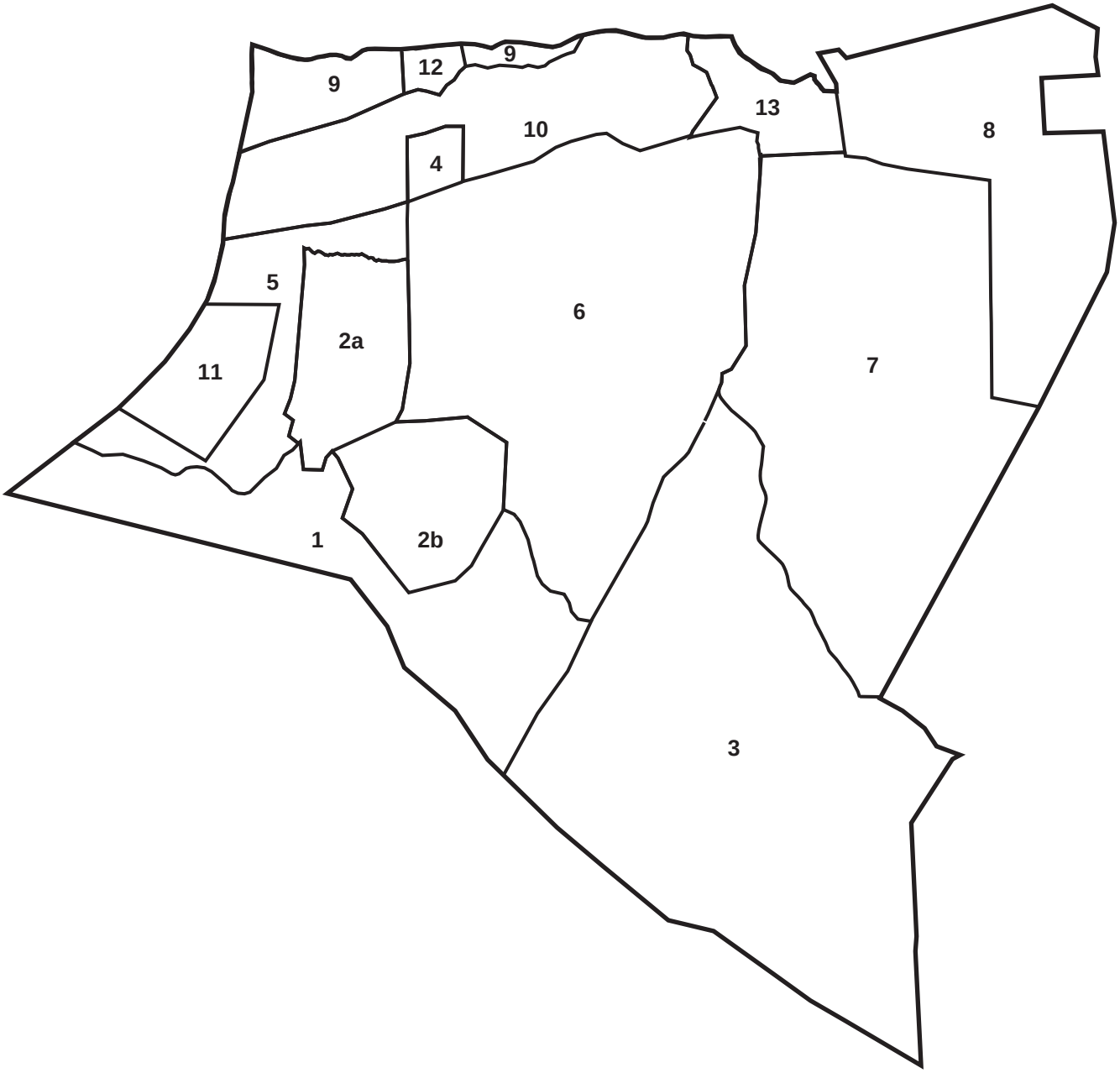
OE Impact	Qualitative Risk Level
OE that will kill an individual if detonated by an individual's activities	High
OE that will cause major injury to an individual if detonated by an individual's activities	Moderate
OE that will cause minor injury to an individual if detonated by an individual's activities	Low
Inert OE (i.e., OE scrap), will cause no injury	None

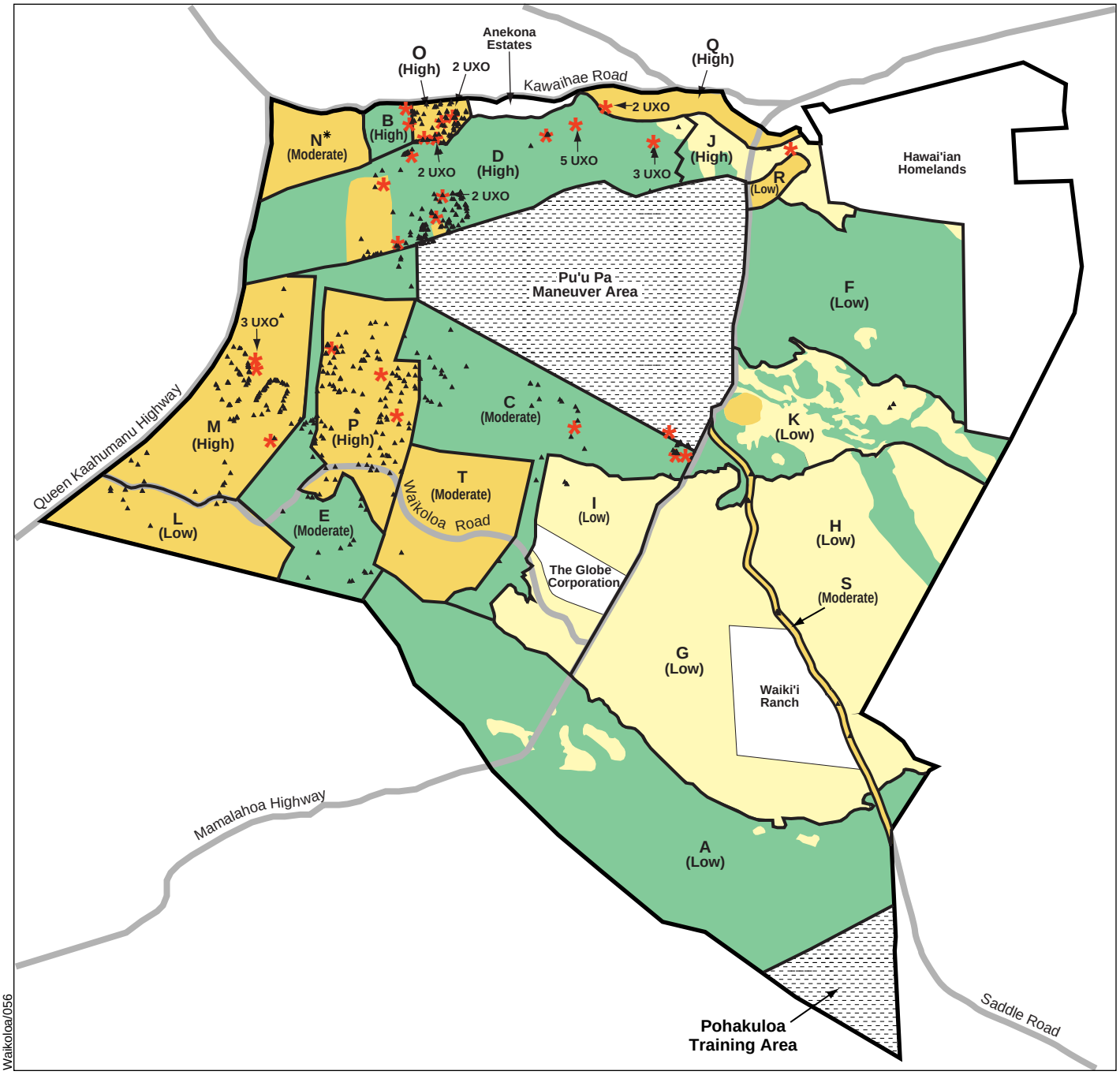
OE = ordnance and explosives

4.2.2 Sensitivity of Ordnance and Explosives

OE sensitivity affects the likelihood of detonation of OE. There are four categories of OE sensitivity (Table 4-2). These categories are presented in

Phase II EE/CA Sector Boundaries





EXPLANATION

- Phase II EE/CA Boundary
- * UXO recovered during Phase II EE/CA
- ▲ OE Scrap recovered during Phase II EE/CA
- A OERIA Evaluation Area
- (Low) OE Hazard Level (OERIA Results)

- Group I (land uses consisting of open areas, conservation areas, and extensive agricultural lands)
- Group II (land uses consisting of agricultural districts, and intensive and other agricultural lands)
- Group III (land uses consisting of commercial areas, multiple residential areas and rural districts, industrial areas, and resort areas)
- Active military training areas not investigated during the EE/CA
- No right-of-entry areas not investigated during the EE/CA

0 .75 1.5 3 Miles

*A 105mm projectile (UXO) was reportedly found near Area N during a previous investigation

Ordnance and Explosives Risk Impact Assessment (OERIA) Evaluation Areas and Results

Figure 4-1

order from highest to lowest sensitivity. The OE sensitivity of the types of OE recovered during the Phase II EE/CA field investigation and the resulting hazard they present (if detonated by an individual) are shown in Chapter 3.0 (see Table 3-16).

Table 4-2. OE Sensitivity Risk Factor Definition

OE Impact	Qualitative Risk Level
OE that is very sensitive	High
OE that is sensitive	Moderate
OE that may have functioned correctly or is unfuzed but has a residual risk.	Low
OE scrap (nonhazardous and, therefore, not sensitive)	None

OE = ordnance and explosives

4.2.3 Ordnance and Explosives Potential

The presence of UXO and/or OE scrap is directly related to the potential to encounter additional OE (i.e., OE Potential). There are three categories of OE Potential (Table 4-3). The OE Potential was assessed for purposes of this qualitative risk assessment based on the results of the Phase II EE/CA field investigation and previous investigations using the following methodology. If UXO was recovered in an area during the Phase II EE/CA field investigation or during previous investigations, the potential to find additional UXO in this area would be "High." If only OE scrap was recovered in an area during the Phase II EE/CA field investigation or during previous investigations, there would be a "Moderate" potential of finding additional OE scrap and possibly UXO. If there was no evidence of UXO or OE scrap found during the Phase II EE/CA field investigation or during previous investigations, the potential to find any UXO or OE scrap would be "Low." Based on past military use of the site, there will always be a potential for OE (although very low) in an area where there has been no evidence of OE.

Table 4-3. OE Potential Risk Factor Definition

Evidence of OE	OE Potential
UXO was recovered during the EE/CA field investigation or during previous investigations	High
Only OE scrap was recovered during the EE/CA field investigation or during previous investigations	Moderate
No evidence of UXO or OE scrap during the EE/CA field investigation or during previous investigations	Low

EE/CA = engineering evaluation/cost analysis
OE = ordnance and explosives
UXO = unexploded ordnance

4.2.4 Depth Range of Ordnance and Explosives

The depth of OE is directly related to the likelihood that an individual will be exposed to OE. The evaluated depth is based on the depth that OE is recovered during the Phase II EE/CA field investigation. For each area evaluated in Section 4.6, the depth range of UXO and OE scrap recovered during the Phase II EE/CA field investigation is provided in the column marked "OE Depth Range." In areas where no UXO and only OE scrap was found, the depth range of OE scrap is indicated. In areas where no UXO or OE scrap was found, the depth range of OE is "Not Defined."

4.3 SITE CHARACTERISTICS FACTORS

4.3.1 Site Accessibility

The accessibility of a site affects the likelihood of being exposed to OE. Structural barriers (e.g., fences, walls) or natural barriers (e.g., rough terrain, vegetation) can limit site accessibility. Both the structural (i.e., man-made) and natural barriers at the site are considered when evaluating the site accessibility risk factor. The three categories within this risk factor are presented from highest to lowest risk in Table 4-4.

Table 4-4. Site Accessibility Risk Factor Definition

Accessibility of Site	Description	Qualitative Risk Level
No restriction to site	No structural barriers; gently rolling terrain; no vegetation or water restricts access	High
Limited restriction to site	Remoteness of site; structural barriers; vegetation, water, or terrain restricts access	Moderate
Complete restriction to site	All points of entry are controlled; locked and gated	Low

4.3.2 Site Instability

Site instability affects the likelihood of coming into contact with OE by natural processes. These natural processes (as discussed in Chapter 2.0) include reoccurring natural events (e.g., wind erosion, water erosion by means of sheet wash/flash flooding, and soil movement) or extreme natural events (e.g., earthquakes, volcanic eruptions, and hurricanes). The three categories within this risk factor are presented from highest to lowest risk in Table 4-5.

Table 4-5. Site Instability Risk Factor Definition

Site Instability	Site Description	Qualitative Risk Level
OE most likely to be exposed by natural events	Unstable	High
OE may be exposed by natural events	Moderately Stable	Moderate
OE not likely to be exposed by natural events	Stable	Low

OE = ordnance and explosives

4.4 DEMOGRAPHIC FACTORS

4.4.1 Site Activities

The likelihood of coming into contact with OE is related to activities that may be generally classified as recreational (e.g., hiking, camping, biking) or occupational (e.g., farming, industrial, construction) and are directly related to the depth of OE in an area. There are three potential risk factors within this category that take into account the depth of OE and the type of activities at the site. For example, at a site where OE is at the surface, all activities that can affect OE at the surface have a high level of risk associated with OE exposure. Conversely, if all OE is situated at depths greater than 1 foot bgs and only surface impact activities are being performed, the activities are considered as low impact activities with very little risk associated with OE exposure. Table 4-6 presents the definitions for this risk factor.

Table 4-6. Site Activities Risk Factor Definition

Activities	Depth at which Activities Affect OE	Depth of OE (inches bgs)	Qualitative Risk Level
Child play, short cuts, hunting, hiking, jogging, off-road driving, mountain biking, horseback riding, motor biking	Surface	0-6	High
		6-12	Moderate
		> 12	Low
Picnicking, camping, ranching, surveying, metal detecting (i.e., treasure hunting)	Surface/ Subsurface up to 1 foot bgs	0-12	High
		12-24	Moderate
		> 24	Low
Archaeology, crop farming, construction	Surface/ Subsurface greater than 1 foot bgs	0-24	High
		24-48	Moderate
		> 48	Low

> = greater than
bgs = below ground surface
OE = ordnance and explosives

4.4.2 Site Population

The population of the site affects the likelihood of whether OE will be encountered. There are three categories within this risk factor. These categories are presented from highest to lowest risk in Table 4-7.

Table 4-7. Site Population Risk Factor Definition

Number of People Using Site	Qualitative Risk Level
Public attraction such as park, beach, other tourist sites (i.e., golf courses)	High
Public has access to land, but not an attraction to the public	Moderate
Public land use restricted; landowners sole users of land	Low

4.5 RISK EVALUATION

Tables 4-8a and 4-8b show the evaluation of the risk level associated with each of the three risk factors for two separate example evaluation areas, following the protocols outlined in Sections 4.2, 4.3, and 4.4. The OE Potential in each evaluation area was determined using the methodology described in Section 4.2.3. Depth of ordnance recovered during the Phase II EE/CA field investigation also affects the risk hazard posed by OE. The OE Depth Range is considered in the evaluation summary table. In the first example evaluation area (Table 4-8a), UXO and OE scrap was recovered at depths ranging from 0 to 6 inches bgs. The OE Potential, because UXO was found in this example area, is "high." In the second example evaluation area (Table 4-8b), the OE Depth Range is "not defined" as no UXO or OE scrap were discovered. For the column marked "Ordnance Type" and "Ordnance Sensitivity," areas where UXO was not recovered during the EE/CA field investigation or during previous investigations would be assigned a risk level of "none" for these two criteria (see Table 4-8b). An area where UXO was recovered during the Phase II EE/CA field investigation or during previous investigations, depending on its type and sensitivity, would rank either as "low," "moderate," or "high." The process of evaluating each of these criteria (as defined in Sections 4.2, 4.3, and 4.4) continues until all of the risk factors have been independently assessed (as shown in Tables 4-8a and 4-8b). Once all of the criteria have been individually rated, an overall OE hazard level for each risk evaluation area can be qualitatively assessed. This level of OE hazard is then used to help determine the most appropriate OE response action alternatives (evaluated in Chapter 8.0 of this EE/CA report) for the Former Waikoloa Maneuver Area and Nansay Sites.

Table 4-8a. Evaluation of Risk Factors - Example A

OE Potential	OE Depth Range (inches bgs)	Risk Level	Ordnance		Site		Demographic	
			Type	Sensitivity	Access	Instability	Activity	Population
High	0 - 6	High	X	X			X	
		Moderate			X			X
		Low				X		
		None						

bgs = below ground surface
OE = ordnance and explosives

Table 4-8b. Evaluation of Risk Factors - Example B

OE Potential	OE Depth Range (inches bgs)	Risk Level	Ordnance		Site		Demographic	
			Type	Sensitivity	Access	Instability	Activity	Population
Low	ND	High					X	
		Moderate			X			X
		Low				X		
		None	X	X				

bgs = below ground surface
ND = Not defined. No UXO or OE scrap was recovered in this area during the EE/CA field investigation.
OE = ordnance and explosives

4.6 EVALUATION OF THE FORMER WAIKOLOA MANEUVER AREA AND NANSAY SITES

This risk evaluation for the Former Waikoloa Maneuver Area and Nansay Sites uses data collected from the Phase II EE/CA field investigation, data from previous investigations, documented reports of discovered OE, current and future land uses, and the decision criteria discussed in Sections 4.2, 4.3, and 4.4, to qualitatively assess the overall OE hazard level in each of the 20 OERIA evaluation areas shown on Figure 4-1 and Plate 4-1.

Table 4-9 summarizes for each risk evaluation area: total area evaluated, number of UXO and OE scrap recovered during the Phase II EE/CA field investigation, the potential for OE, and the rationale for determining the level of OE potential for each OERIA evaluation area (following the methodology described in Section 4.2.3).

Table 4-9. Estimating Potential for Ordnance and Explosives

OERIA Evaluation Area	Total Area (Acres)	UXO Recovered During EE/CA	OE Scrap Recovered During EE/CA	OE Potential[(a)]	Rationale for Level of OE Potential
Group I (open areas, conservation areas, extensive agricultural areas)					
Area A	15,752	--	--	Low	No evidence of OE
Area B	518	2	6	High	UXO recovered during EE/CA
Area C	6,438	4	87	High	UXO recovered during EE/CA
Area D	8,519	15	542	High	UXO recovered during EE/CA
Area E	4,140	--	116	Moderate	OE scrap recovered during EE/CA
Area F	7,982	--	--	Low	No evidence of OE
Group II (agricultural districts)					
Area G	13,527	--	--	Low	No evidence of OE
Area H	8,335	--	--	Low	No evidence of OE
Area I	4,513	--	3	Moderate	OE scrap recovered during EE/CA
Area J	1,607	1	1	High	UXO recovered during EE/CA
Area K	5,535	--	2	Moderate	OE scrap recovered during EE/CA
Group III (commercial, residential, industrial, rural, and resort areas)					
Area L	2,907	--	11	Moderate	OE scrap recovered during EE/CA
Area M	4,940	5	283	High	UXO recovered during EE/CA
Area N	1,541	--[(b)]	--	High	UXO previously reported
Area O	493	6	179	High	UXO recovered during EE/CA
Area P	4,186	3	918	High	UXO recovered during EE/CA
Area Q	1,114	2	--	High	UXO recovered during EE/CA
Area R	360	--	--	Low	No evidence of OE
Area S	86	--	11	Moderate	OE scrap recovered during EE/CA
Area T	3,791	--	1	Moderate	OE scrap recovered during EE/CA

Notes: (a) OE Potential is one of the four OE Factors used in this qualitative risk assessment to determine the Overall OE Hazard Level for each of the 20 OERIA evaluation areas (see Table 4-30 for Overall OE Hazard Level).
(b) A 105mm projectile (unexploded ordnance) was reportedly found near Area N during a previous investigation.
EE/CA = engineering evaluation/cost analysis
OE = ordnance and explosives
OERIA = Ordnance and Explosives Risk Impact Assessment
UXO = unexploded ordnance

4.6.1 Area A Risk Evaluation

Results of the evaluation of Area A are summarized in Table 4-10. A discussion of each risk factor for Area A is presented in the following subsections.

Table 4-10. Summary of Risk Factors - Area A

OE Potential	OE Depth Range (inches bgs)	Risk Level	Ordnance		Site		Demographic	
			Type	Sensitivity	Access	Instability	Activity	Population
Low	ND	High						
		Moderate					X	
		Low			X	X		X
		None	X	X				

bgs = below ground surface
ND = Not defined. No UXO or OE scrap was recovered in this area during the EE/CA field investigation.
OE = ordnance and explosives

4.6.1.1 OE Factors (OE Type, OE Sensitivity, OE Potential, OE Depth Range)

OE Type. There is no risk associated with OE Type in Area A. There were no UXO or OE scrap recovered in this area during the EE/CA field investigation. The only ordnance item that was recovered in Area A was an expended M22 (guided missile and rocket) simulator, which was used during military training maneuvers conducted at the Pohakuloa Training Area. The presence of this item is not a result of training activities relating to the former maneuver area; therefore, this item is not shown on Figure 4-1 and is not included in this risk assessment.

OE Sensitivity. There is no risk associated with OE Sensitivity in this area because there was no UXO recovered in Area A during the EE/CA field investigation.

OE Potential. There was no evidence of UXO or OE scrap in this area during the EE/CA field investigation; therefore, the potential for OE in Area A is low.

OE Depth. The depth of OE is not defined as no UXO or OE scrap was recovered in Area A during the EE/CA field investigation.

4.6.1.2 Site Characteristics Factors (Site Accessibility, Site Instability)

Site Accessibility. The perimeter of this area is easily accessible via state highways and other paved roads; however, fences with locked gates built around the perimeter of Area A limit access to the area. Points of entry to the area are controlled by the Parker Ranch. The interior of the area is accessible through a few dirt roads. Numerous fences separate pasturelands thereby limiting access into some of the interior regions of the area. The accessibility of the interior regions of the area is also limited due to their remoteness (i.e., areas not near dirt roads). Natural barriers are not present in Area A; the topography is flat to gently rolling hills, which does not prevent access to the area. Individuals participating in recreational activities in Area A are trespassing on Parker Ranch property. Based on this information and the site accessibility criteria defined in Table 4-4, the site accessibility risk factor for this area is low.

Site Instability. The ground surface in Area A varies from relatively flat to gently rolling hills and grasslands. Soils and vegetation are well developed throughout the area, which decreases the possibility that OE would be exposed through natural events (e.g., wind and/or water erosion). The soils (Waimea-Kikoni-Naalehu Association) can typically be found deeper than 48 inches bgs in some areas. If OE were present at depth in this area, natural events (i.e., wind erosion or earthquakes) would likely not expose OE potentially in the subsurface. Based on this information, and the site instability criteria defined in Table 4-5, the site instability risk factor for Area A is low.

4.6.1.3 Demographics (Site Activities, Site Population)

Site Activities. Area A is privately owned by the Parker Ranch. Current and future land use for this area is characterized as pastureland and ranchland with minor areas of intensive agricultural lands. Limited intrusive activities associated with ranching (e.g., ground breaking to build a fence) occur in this area. Other activities that take place currently, or could take place in Area A include horseback riding, hiking, hunting, mountain biking, and archaeological studies/digs. The activities expected to take place in this area could affect the ground surface at depths up to 12 inches bgs. OE, if present in this area, has the potential to be buried at relatively shallow depths and could be disturbed if intrusive activities were conducted in this area. Based upon this information and the site activities criteria defined in Table 4-6, the site activities risk level for Area A is moderate.

Site Population. Landowners are currently the predominant users of the land in Area A; the area is not a tourist attraction. Based upon this information and the site population criteria defined in Table 4-7, the site population risk level for Area A is low.

4.6.1.4 Overall OE Risk Impact Assessment - Area A.

The likelihood of exposure to OE in Area A is low because there were no UXO or OE scrap items recovered in this area during the EE/CA field investigation. Although the site activity risk factor carries a moderate risk level, the low OE potential and low risk level for the site population and site accessibility risk factors indicate that the risk of OE exposure in Area A is also low. However, given the past military use of the area, there will always be a residual risk associated with OE in Area A. Based on the evaluation of the OERIA risk factors, the overall OE hazard level for Area A is low.

4.6.2 Area B Risk Evaluation

Results of the evaluation of Area B are summarized in Table 4-11. A discussion of each risk factor for Area B is presented in the following subsections.

Table 4-11. Summary of Risk Factors - Area B

OE Potential	OE Depth Range (inches bgs)	Risk Level	Ordnance		Site		Demographic	
			Type	Sensitivity	Access	Instability	Activity	Population
High	Surface	High	X	X		X	X	
		Moderate			X			X
		Low						
		None						

bgs = below ground surface
OE = ordnance and explosives

4.6.2.1 OE Factors (OE Type, OE Sensitivity, OE Potential, OE Depth Range)

OE Type. The OE type risk level for Area B is high. Two UXO items were found on the surface near the east boundary of this area during the Phase II EE/CA field investigation. Two UXO items were found in the same area during the 1999 site visit conducted by Earth Tech. The South Kohala Police District reported that grass fires in 1998 resulted in the detonation of OE in this area. The types of UXO found in this area are likely to kill an individual if detonated by an individual's activities. There were six OE scrap items (inert and nonhazardous) recovered in the east region of this area during the EE/CA field investigation. Field crews observed additional OE scrap throughout this area during the EE/CA field activities.

OE Sensitivity. The types of UXO found in Area B were 81mm mortars, 2.36-inch rockets, and Mk2 hand grenades. These items are very sensitive and have the potential to detonate and cause fatal injury with simple touch and/or movement. Based upon this information, and the OE sensitivity criteria defined in Table 4-2, the OE sensitivity risk level in this area is high.

OE Potential. The presence of UXO in this area suggests a high potential for OE in Area B.

OE Depth. All of the UXO and OE scrap items recovered in Area B were found on the surface. The OE that were destroyed in the 1998 grass fires were most likely on the surface or very near to the surface.

4.6.2.2 Site Characteristics Factors (Site Accessibility, Site Instability)

Site Accessibility. Fences do not limit access on the perimeter of Area B. The rough terrain and thick vegetation in the area precludes easy access throughout the area and acts as a deterrent. Based on the natural barriers that limit access into this area, and the site accessibility criteria defined in Table 4-4, the site accessibility risk level for Area B is moderate.

Site Instability. The soils (Kawaihae Series) found in this area are extremely fine. Soils are not well developed in this area as soil depth is generally less than 6 inches bgs. Although vegetation in this area helps to stabilize soils, OE (if present) at the near surface could be exposed by wind and/or water erosion due to unstable a'a lava rocks in the area and very fine shallow soils. Based on the

potential for OE to become uncovered in this area, and the site instability criteria defined in Table 4-5, the site instability risk factor for Area B is high.

4.6.2.3 Demographics (Site Activities, Site Population)

Site Activities. Area B is used for child play activities by residents of the adjacent residential area (O'uli Parcel) to the east. Additional activities that occur in this area include hiking, hunting, mountain biking, and archaeological investigations around the historic rock wall. The activities expected to occur in this area impact the ground surface and near surface. Because OE are most likely to be found on the surface in Area B (based on shallow soil conditions and results of the EE/CA field investigation), and based upon the site activities criteria defined in Table 4-6, the site activities risk level for Area B is high.

Site Population. Landowners are currently the most predominant users of the land in Area B, in addition to residents of recently developed homes (east of Area B) who utilize the area to participate in recreational activities such as hiking and child play. The area is not considered a tourist attraction, but is easily accessible to the public. Based upon this information and the site population criteria defined in Table 4-7, the site population risk level for Area B is moderate.

4.6.2.4 Overall OE Risk Impact Assessment - Area B.

Due to the number and depth (i.e., surface) of UXO recovered in this area and the types of activities occurring in Area B, an individual entering the area is likely to be exposed to OE. Since the level of risk associated with the type of OE and the sensitivity of the OE are high, the OE hazard to the exposed individual is also high. Although the site population risk factor is currently ranked at a moderate risk level, the number of people entering the area is likely to increase as the residential parcel to the east and the area designated for urban expansion to the west are developed. If the increased population uses for Area B include recreational activities, the likelihood of OE exposure will also increase. Based on the evaluation of the OERIA risk factors, the overall OE hazard level for Area B is high.

4.6.3 Area C Risk Evaluation

Results of the evaluation of Area C are summarized in Table 4-12. A discussion of each risk factor for Area C is presented in the following subsections.

Table 4-12. Summary of Risk Factors - Area C

OE Potential	OE Depth Range (inches bgs)	Risk Level	Ordnance		Site		Demographic	
			Type	Sensitivity	Access	Instability	Activity	Population
High	0 - 6	High	X	X		X	X	
		Moderate			X			
		Low						X
		None						

bgs = below ground surface
OE = ordnance and explosives

4.6.3.1 OE Factors (OE Type, OE Sensitivity, OE Potential, OE Depth Range)

OE Type. The OE type risk level for Area C is high. Three UXO items were found in this area during the EE/CA field investigation. One additional UXO item was found north of Area C in the adjacent Pu'u Pa Maneuver Area, which continues to be used for military training exercises. The types of UXO items found in this area could kill an individual if detonated by an individual's activities. Additionally, 87 OE scrap items (inert and nonhazardous) were found in Area C during the EE/CA field investigation. Field crews also observed OE scrap throughout this area during the EE/CA field activities.

OE Sensitivity. The UXO items recovered from Area C were an 81mm mortar (very sensitive), a 4.5-inch barrage rocket (very sensitive), and an unfuzed 105mm projectile (residual risk). Two of these UXO items are very sensitive and have the potential to detonate and cause fatal injury with simple touch and/or movement. Because very sensitive UXO items were found in Area C, the OE sensitivity risk level is considered high for the entire area. Based upon this information, and the OE sensitivity criteria defined in Table 4-2, the OE sensitivity risk level in this area is high.

OE Potential. The presence of UXO in this area suggests a high potential for OE in Area C.

OE Depth. The three UXO items recovered from Area C during the EE/CA field investigation were found on the surface and shallowly buried (i.e., 0 to 6 inches bgs). Almost all of the 87 OE scrap items (99 percent) were also found on the surface; the deepest depth OE scrap was recovered was 6 inches bgs.

4.6.3.2 Site Characteristics Factors (Site Accessibility, Site Instability)

Site Accessibility. Area C is fenced and patrolled by the Parker Ranch; however, not all points of entry are controlled. The rough terrain and thick vegetation (i.e., kiawe and tall grass) limit access to some of this area. Based on the strong natural and physical barriers that limit access into this area, and the site accessibility criteria defined in Table 4-4, the site accessibility risk level for Area C is moderate.

Site Instability. The ground surface in Area C is stable to moderately stable. In the central and northeast portions of the area, soil and vegetation are well developed, decreasing the likelihood that OE would be exposed through natural events such as wind erosion. Deeply eroded gullies and washes in this area indicate that OE could be exposed through water erosion (i.e., flash flooding, sheet wash). A'a lava flows covered with thick vegetation characterize the west portion of the area; however, the ground surface is unstable. A small event (such as someone walking) or a large event (such as an earthquake) could potentially uncover OE that may lie in the shadow of the a'a lava rock. One of the UXO items recovered in this area was found lying on the tank road (dirt road), partially buried below the surface, where vehicles had driven over the item unaware that it

was there. If OE were present in this area, it may still lie partially buried in the road, only to become uncovered by repeated driving in the area. Based upon this information and the site instability criteria defined in Table 4-5, the site instability risk factor for Area C is high.

4.6.3.3 Demographics (Site Activities, Site Population)

Site Activities. Current and future land use for Area C is characterized as open space, pastureland, and ranchland. Area C is used for ranching and grazing by the Parker Ranch. The area supports some recreational activities, such as hunting and horseback riding, which would affect the ground surface and near surface. Construction or repair of fences and/or water well development would involve ground intrusive activities at depths greater than 12 inches bgs. OE (if present) on the surface or buried at shallow depths would pose a high risk of OE exposure to individuals participating in these activities. Based upon this information, and the site activities criteria defined in Table 4-6, the site activities risk level for Area C is high.

Site Population. Landowners are currently the most predominant users of the land in Area C; the area is not a tourist attraction. Based upon this information and the site population criteria defined in Table 4-7, the site population risk level for Area C is low.

4.6.3.4 Overall OE Risk Impact Assessment - Area C.

Although the level of risk associated with the type and sensitivity of OE found in Area C is high, the likelihood of exposure to OE is moderate given restricted access to the area, and the small number of people using the area. The types of activities performed in Area C carry a high level of risk associated with OE exposure. However, considering the moderate risk level associated with site access, the actual risk of being exposed to OE for an individual participating in these activities is moderate. Based on the evaluation of the OERIA risk factors, the overall OE hazard level in Area C is moderate.

4.6.4 Area D Risk Evaluation

Results of the evaluation of Area D are summarized in Table 4-13. A discussion of each risk factor for Area D is presented in the following subsections.

Table 4-13. Summary of Risk Factors - Area D

OE Potential	OE Depth Range (inches bgs)	Risk Level	Ordnance		Site		Demographic	
			Type	Sensitivity	Access	Instability	Activity	Population
High	0 - 20	High	X	X			X	
		Moderate			X	X		X
		Low						
		None						

bgs = below ground surface
OE = ordnance and explosives

4.6.4.1 OE Factors (OE Type, OE Sensitivity, OE Potential, OE Depth Range)

OE Type. The OE type risk level for Area D is high. Fifteen UXO items were found in this area during the Phase II EE/CA field investigation. The types of UXO items recovered from Area D could kill or inflict serious injury to an individual if detonated by an individual's activities. Additionally, 542 OE scrap items (inert and nonhazardous) were recovered in this area during the EE/CA field investigation. Field crews observed additional OE scrap throughout this area during the EE/CA field activities.

OE Sensitivity. The types of UXO recovered from Area D were 60mm mortars, 81mm mortars, 75mm projectiles, 155mm projectiles, 2.36-inch rockets, Mk2 hand grenades, and M9 rifle grenade fuzes. All of these items, except the M9 rifle grenade fuze, are very sensitive and have the potential to detonate and cause fatal injury with simple touch and/or movement. The M9 rifle grenade fuze is sensitive; however, it will likely cause only minor injury if detonated by an individual's activities. Based upon this information and the OE sensitivity criteria defined in Table 4-2, the overall OE sensitivity risk level in this area is high.

OE Potential. The presence of UXO in this area suggests a high potential for OE in Area D.

OE Depth. The 15 UXO items recovered from Area D during the EE/CA field investigation were found on the surface. A majority of the 542 OE scrap items were also found on the surface; the deepest depth OE scrap was recovered was 20 inches bgs.

4.6.4.2 Site Characteristics Factors (Site Accessibility, Site Instability)

Site Accessibility. Portions of Area D are accessible via state highways and jeep trails. The perimeter of this area is fenced (with the exception of the west and northwest portions); however, not all points of entry are controlled. Numerous fences have been erected to separate pasturelands that limit access into the east region of the area. The accessibility of the interior regions of the area is also decreased due to their remoteness (i.e., areas not near dirt roads). Terrain in the area varies from steep, rocky hills to relatively flat grasslands. Based on the physical barriers and the site accessibility criteria defined in Table 4-4, the site accessibility risk level for Area D is moderate.

Site Instability. The ground surface in Area D is moderately stable. The soils (Kawaihae Series) found in the west side of this area are extremely stony, very fine sandy loam, are not well developed, and are typically less than 20 inches bgs. Although vegetation in this area helps to stabilize soils, OE (if present) buried at the near surface could be exposed by wind erosion. In the east side of this area, soils are well developed and are typically 24 to 40 inches bgs. Vegetation on the east side protects soils from wind and water erosion. Deeply eroded gullies and washes throughout Area D indicate that OE has the potential to become exposed by water erosion (i.e., flash flooding, sheet wash). Based on

the potential for OE to become uncovered in this area, and the site instability criteria defined in Table 4-5, the site instability risk factor for Area D is moderate.

4.6.4.3 Demographics (Site Activities, Site Population)

Site Activities. The majority of Area D is state-owned pastureland used for ranching and grazing. Children play in the areas adjacent to the recently developed residential homes (O'uli Parcel) to the north. Activities in this area that affect the ground surface include child play; activities affecting depths up to and including 12 inches bgs include archaeological activities and construction of fences. A small parcel in Area D is slated for urban expansion (see Plate 4-1). Future activities in this area may include construction of homes, golf courses, or commercial and industrial areas, which will affect the ground surface at depths greater than 12 inches bgs. Because UXO was found on the surface, all of the activities occurring or expected to occur in the area pose a high risk of OE exposure to individuals participating in these activities. The Lalamilo Ventures Wind Farm occupies a small area east of the area slated for residential development (see Plate 4-1). Activities in this area are related to the operation and maintenance of the wind farm. Based upon this information, and the site activities criteria defined in Table 4-6, the site activities risk level for Area D is high.

Site Population. Landowners are currently the predominant users of the land in Area D. Residents of the adjacent residential parcel enter the area to participate in recreational activities such as child play and hiking. The area is not considered a tourist attraction, but is accessible to those who live in the area. Portions of Area D may be transferred to the Department of the Hawai'ian Homelands, which would create a residential population in Area D. Based upon this information and the site population criteria defined in Table 4-7, the site population risk level for Area D is moderate.

4.6.4.4 Overall OE Risk Impact Assessment - Area D.

Due to the number (15 total) and depth of UXO (all recovered on the surface) and the types of activities occurring in Area D, an individual entering the area is likely to be exposed to OE. Since the level of risk associated with the type of OE and the sensitivity of the OE are high, the OE hazard presented to the exposed individual is also high. Although the site population risk factor is currently ranked at a moderate risk level, the number of people entering the area is likely to increase as the residential parcels to the north and east and the area designated for urban expansion to the west are developed. If the increased population uses Area D for recreational and occupational activities, the likelihood of OE exposure will also increase. Based on the evaluation of the OERIA risk factors, the overall OE hazard level in Area D is high.

4.6.5 Area E Risk Evaluation

Results of the evaluation of Area E are summarized in Table 4-14. A discussion of each risk factor for Area E is presented in the following subsections.

Table 4-14. Summary of Risk Factors - Area E

OE Potential	OE Depth Range (inches bgs)	Risk Level	Ordnance		Site		Demographic	
			Type	Sensitivity	Access	Instability	Activity	Population
Moderate	0 - 2	High				X	X	
		Moderate						X
		Low			X			
		None	X	X				

bgs = below ground surface
OE = ordnance and explosives

4.6.5.1 OE Factors (OE Type, OE Sensitivity, OE Potential, OE Depth Range)

OE Type. No UXO was found in Area E; however, 116 OE scrap items were recovered during the EE/CA field investigation. Field crews observed additional OE scrap throughout this area during the EE/CA field activities. Because OE scrap is inert and nonhazardous, there is no risk based on OE type.

OE Sensitivity. There is no risk associated with OE sensitivity in this area because there were no UXO recovered in Area E during the EE/CA field investigation.

OE Potential. The presence of OE scrap in this area suggests a moderate potential for OE in Area E.

OE Depth. The OE scrap items recovered in Area E were found predominantly on the surface; the deepest depth OE scrap was recovered was 2 inches bgs.

4.6.5.2 Site Characteristics Factors (Site Accessibility, Site Instability)

Site Accessibility. The south side of Area E is accessible by Waikoloa Road (main access road). The interior regions of Area E are accessible via dirt roads from the Waikoloa Village and Queen Kaahumanu Highway, though locked gates restrict access to some areas. The gate to the wastewater treatment plant is generally unlocked during business hours. Fences limit access to the north region of the area. The terrain in this area acts as a significant deterrent to the public. The rough a‘a lava flows limit recreational use of the area, such as hiking and motor biking. Based on the physical and strong natural barriers that limit access into this area and the site accessibility criteria defined in Table 4-4, the site accessibility risk level for Area E is low.

Site Instability. The ground surface in Area E is composed of unstable a‘a lava rock. Soil development over the a‘a lava rock is poor with soil thickness typically less than 6 inches bgs. Several deeply eroded gullies and washes cut through Area E, indicating that OE (if present) could be exposed through water erosion (i.e., flash flooding, sheet wash). Due to the unconsolidated state of the a‘a lava rock, which easily shifts under pressure, a small event (such as someone walking) or a large event (such as an earthquake) could uncover OE that may lie

in the shadow (partially buried) of the a'a lava rock. Based on the potential for OE to become uncovered in this area and the site instability criteria defined in Table 4-5, the site instability risk factor for Area E is high.

4.6.5.3 Demographics (Site Activities, Site Population)

Site Activities. The current and future land use for Area E is open space. Portions of the area are used for child play by the residents of Waikoloa Village. Tourists have been seen hiking into the lava flow to place graffiti on the basalt rocks near Waikoloa Road. The activities in this area affect the ground surface. The depth of OE scrap recovered in this area ranged from 0 to 2 inches bgs. If OE were present in this area, it would likely be on the surface or near the surface, based on the lack of soil development in this area. Based upon this information, and the site activities criteria defined in Table 4-6, the site activities risk level for Area E is high.

Site Population. Landowners are currently the predominant users of the land in Area E; small localized areas near Waikoloa Road are accessed by tourists. Although the public has access to the area, it is not considered a tourist attraction. Based upon this information and the site population criteria defined in Table 4-7, the site population risk level for Area E is moderate.

4.6.5.4 Overall OE Risk Impact Assessment - Area E.

Although there is no risk associated with the type and sensitivity of OE found in Area E (only inert nonhazardous OE scrap was recovered), there is always the potential for UXO to be present in this area based on the OE scrap recovered in this area and past military use. Additionally, three UXO items were found within one-half mile west, north, and east of the boundaries of this area. Heavy concentrations of OE scrap were found in the areas surrounding Area E, indicating the potential for UXO to be present in this area. The UXO items found near Area E (one 75mm projectile and two 155mm projectiles) are very sensitive and have the potential to kill an individual if detonated by an individual's activities. Based on the evaluation of the OERIA risk factors, the overall OE hazard level for Area E is moderate.

4.6.6 Area F Risk Evaluation

Results of the evaluation of Area F are summarized in Table 4-15. A discussion of each risk factor for Area F is presented in the following subsections.

Table 4-15. Summary of Risk Factors - Area F

OE Potential	OE Depth Range (inches bgs)	Risk Level	Ordnance		Site		Demographic	
			Type	Sensitivity	Access	Instability	Activity	Population
Low	ND	High						
		Moderate					X	
		Low			X	X		X
		None	X	X				

bgs = below ground surface
ND = Not defined. No UXO or OE scrap was recovered in this area during the EE/CA field investigation.
OE = ordnance and explosives

4.6.6.1 OE Factors (OE Type, OE Sensitivity, OE Potential, OE Depth Range)

OE Type. There is no risk associated with OE type in Area F. No UXO or OE scrap (inert and nonhazardous) items were found in Area F during the EE/CA field investigation.

OE Sensitivity. There is no risk associated with OE sensitivity in this area because there were no UXO recovered in Area F during the EE/CA field investigation.

OE Potential. There was no evidence of UXO or OE scrap in this area during the EE/CA field investigation; therefore, the potential for OE in Area F is low.

OE Depth. The depth of OE is not defined as no UXO or OE scrap was recovered in Area F during the EE/CA field investigation.

4.6.6.2 Site Characteristics Factors (Site Accessibility, Site Instability)

Site Accessibility. Area F is currently fenced and patrolled by the Parker Ranch; all points of entry are controlled. The terrain and vegetation in the area are characterized by rolling hills and grasslands that do not act as a barrier for access into this area. Based on fencing and patrolling that limit access into this area and the site accessibility criteria defined in Table 4-4, the site accessibility risk level for Area F is low.

Site Instability. The ground surface in Area F is relatively flat with rolling hills and grasslands. The soils (Waimea-Kikoni-Naalehu Association) in this area are well developed and generally deeper than 48 inches bgs. Vegetation is well developed throughout the area, which decreases the possibility that OE could be exposed through natural events (e.g., wind and/or water erosion). If OE were present in this area, it would most likely be buried at relatively shallow depths (12 to 48 inches bgs) and would not be easily exposed by natural events such as wind erosion and/or earthquakes. Based upon this information and the site instability criteria defined in Table 4-5, the site instability risk factor for Area F is low.

4.6.6.3 Demographics (Site Activities, Site Population)

Site Activities. Current and future land use for Area F is characterized as extensive agriculture with minor areas designated for intensive agriculture. Activities under this land use include ranching and grazing with limited intrusive activities (e.g., ground breaking to build a fence). West Hawai‘i Concrete operates a cinder quarry at the base of Pu‘u Holoholoku. The activities expected to occur in this area would affect the ground surface at depths up to and including 12 inches bgs. OE, if present in this area at depth, would pose a moderate risk to individuals participating in these activities. Based upon this information and the site activities criteria defined in Table 4-6, the site activities risk level for Area F is moderate.

Site Population. Landowners are currently the predominant users of the land in

Area F; the area is not a tourist attraction. Public access to the area is limited by the Parker Ranch. Based upon this information and the site population criteria defined in Table 4-7, the site population risk level for Area F is low.

4.6.6.4 Overall OE Risk Impact Assessment - Area F.

The likelihood of exposure to OE is low in Area F given that no UXO or OE scrap were found and the small number of people using the area. Given the past military use of the area, there will always be a residual risk associated with OE in Area F. Based on the evaluation of the OERIA risk factors, the overall OE hazard level for Area F is low.

4.6.7 Area G Risk Evaluation

Results of the evaluation of Area G are summarized in Table 4-16. A discussion of each risk factor for Area G is presented in the following subsections.

Table 4-16. Summary of Risk Factors - Area G

OE Potential	OE Depth Range (inches bgs)	Risk Level	Ordnance		Site		Demographic	
			Type	Sensitivity	Access	Instability	Activity	Population
Low	ND	High						
		Moderate					X	
		Low			X	X		X
		None	X	X				

bgs = below ground surface
ND = Not defined. No UXO or OE scrap was recovered in this area during the EE/CA field investigation.
OE = ordnance and explosives

4.6.7.1 OE Factors (OE Type, OE Sensitivity, OE Potential, OE Depth Range)

OE Type. No UXO was found in this area during the EE/CA field investigation; however, one ordnance item was found in the south region of Area G during the EE/CA field investigation. The item was an expended 40mm grenade that resulted from unauthorized firing of a munition into this area during military training maneuvers conducted in 1999 and did not result from activities relating to the former maneuver area; therefore, this item is not shown on Figure 4-1 and is not included in this risk assessment.

OE Sensitivity. There is no risk associated with OE sensitivity in this area because there were no UXO or OE scrap recovered in Area G during the EE/CA field investigation.

OE Potential. There was no evidence of UXO or OE scrap in this area during the EE/CA field investigation; therefore, the potential for OE in Area G is low.

OE Depth. The depth of OE is not defined as no UXO or OE scrap was recovered in Area G during the EE/CA field investigation.

4.6.7.2 Site Characteristics Factors (Site Accessibility, Site Instability)

Site Accessibility. Fences are present along the paved roads around Area G, which limit access to the area. All points of entry are controlled. The interior of the area is accessible through a few dirt roads. Many fences erected to separate pasturelands limit access into the interior regions of the area. The accessibility of the interior regions of the area is decreased due to their remoteness (i.e., areas not near dirt roads). The topography is flat to gently rolling hills that do not act as a barrier for access into this area. Based upon this information, and the site accessibility criteria defined in Table 4-4, the site accessibility risk level for Area G is low.

Site Instability. The ground surface in Area G is stable. The area is characterized by rolling hills and grasslands. Soils are well developed throughout this area and typically range from 12 to 48 inches bgs (deeper in some areas). Vegetation is also predominant throughout the area, which stabilizes the soil and decreases the possibility that OE could be exposed through natural events (e.g., wind and/or water erosion). Based upon this information, and the site instability criteria defined in Table 4-5, the site instability risk factor for Area G is low.

4.6.7.3 Demographics (Site Activities, Site Population)

Site Activities. The primary land use in Area G is intensive agricultural with some small, private ranches (extensive agricultural and residential land uses). Ground intrusive activities associated with ranching and farming, such as fence construction and tilling of the land, occur in Area G. These activities have the potential to affect the ground surface at depths up to and including 12 inches bgs. Hunting also occurs in Area G. OE, if present at depth in this area, would pose a moderate risk to individuals participating in intrusive activities. Based upon this information, and the site activities criteria defined in Table 4-6, the site activities risk level for Area G is moderate.

Site Population. Landowners are currently the predominant users of the land in Area G. While the public has limited access to Area G (by permission of the landowners), it is not a tourist attraction. Based upon this information and the site population criteria defined in Table 4-7, the site population risk level for Area G is low.

4.6.7.4 Overall OE Risk Impact Assessment - Area G.

All of the OERIA risk factors for Area G ranked low to moderate. The likelihood of exposure to OE is low given that there was no evidence of OE in this area during the EE/CA field investigation and the small population of people using the area. Given the past military use of the area, there will always be a residual risk associated with OE in Area G. Based on the evaluation of the OERIA risk factors, the overall OE hazard level for Area G is low.

4.6.8 Area H Risk Evaluation

Results of the evaluation of Area H are summarized in Table 4-17. A discussion of each risk factor for Area H is presented in the following subsections.

Table 4-17. Summary of Risk Factors - Area H

OE Potential	OE Depth Range (inches bgs)	Risk Level	Ordnance		Site		Demographic	
			Type	Sensitivity	Access	Instability	Activity	Population
Low	ND	High						
		Moderate						
		Low			X	X	X	X
		None	X	X				

bgs = below ground surface
ND = Not defined. No UXO or OE scrap was recovered in this area during the EE/CA field investigation.
OE = ordnance and explosives

4.6.8.1 OE Factors (OE Type, OE Sensitivity, OE Potential, OE Depth Range)

OE Type. There is no risk associated with OE type in Area H. No UXO or OE scrap (inert and nonhazardous) were recovered in this area during the EE/CA field investigation.

OE Sensitivity. There is no risk associated with OE sensitivity in this area because there was no UXO recovered in Area H during the EE/CA field investigation.

OE Potential. There was no evidence of UXO or OE scrap in this area during the EE/CA field investigation; therefore, the potential for OE in Area H is low.

OE Depth. The depth of OE is not defined because no UXO or OE scrap was recovered in Area H during the EE/CA field investigation.

4.6.8.2 Site Characteristics Factors (Site Accessibility, Site Instability)

Site Accessibility. Area H is fenced and patrolled by the Parker Ranch; all points of entry are controlled. Public access to Area H is granted by the Parker Ranch in limited numbers. The terrain and vegetation in the area are characterized by rolling hills and grasslands that do not act as natural barriers to this area. Based on the physical barriers (i.e., fencing and patrolling) that limit access into this area, and the site accessibility criteria defined in Table 4-4, the site accessibility risk level for Area H is low.

Site Instability. The ground surface in Area H is stable. The area is characterized by rolling hills and grasslands. Soils are well developed throughout this area and typically range from 12 to 48 inches bgs (deeper in some areas). Vegetation is also predominant throughout the area, which stabilizes the soil and decreases the possibility that OE (if present) could be exposed through natural events (e.g., wind and/or water erosion). Based upon this information, and the

site instability criteria defined in Table 4-5, the site instability risk factor for Area H is low.

4.6.8.3 Demographics (Site Activities, Site Population)

Site Activities. The primary land use in Area H is intensive agricultural use with an area of ranchland (i.e., extensive agriculture land use). Ground intrusive activities associated with ranching and farming, such as fence construction and tilling of the land, occur in Area H. These activities have the potential to affect the ground at depths up to and including 12 inches bgs. Other activities that take place currently, or could take place in Area H include horseback riding and hunting. There were no UXO or OE scrap recovered in this area during the EE/CA field investigation; therefore, there is a low risk of OE exposure to individuals participating in ground intrusive activities in this area. Based upon this information and the site activities criteria defined in Table 4-6, the site activities risk level for Area H is low.

Site Population. Landowners are currently the predominant users of the land in Area H. The public does not have access to the land (unless permission is obtained through the Parker Ranch) and the area is not considered a tourist attraction. Based upon this information and the site population criteria defined in Table 4-7, the site population risk level for Area H is low.

4.6.8.4 Overall OE Risk Impact Assessment - Area H.

All of the OERIA risk factors for Area H ranked low. The likelihood of exposure to OE is low given that there were no UXO or OE scrap recovered in this area during the EE/CA field investigation and the small population of people using the area. Given the past military use of the area, there will always be a residual risk associated with OE in Area H. Based on the evaluation of the OERIA risk factors, the overall OE hazard level for Area H is low.

4.6.9 Area I Risk Evaluation

Results of the evaluation of Area I are summarized in Table 4-18. A discussion of each risk factor for Area I is presented in the following subsections.

Table 4-18. Summary of Risk Factors - Area I

OE Potential	OE Depth Range (inches bgs)	Risk Level	Ordnance		Site		Demographic	
			Type	Sensitivity	Access	Instability	Activity	Population
Moderate	Surface	High						
		Moderate					X	X
		Low			X	X		
		None	X	X				

bgs = below ground surface
OE = ordnance and explosives

4.6.9.1 OE Factors (OE Type, OE Sensitivity, OE Potential, OE Depth Range)

OE Type. No UXO and only three OE scrap items were found in Area I during

the EE/CA field investigation. Because OE scrap is inert and nonhazardous, there is no risk based on OE type.

OE Sensitivity. There is no risk associated with OE sensitivity in this area because there were no UXO and only OE scrap recovered in Area I during the EE/CA field investigation.

OE Potential. The presence of OE scrap in this area suggests a moderate potential for OE in Area I.

OE Depth. The OE scrap items recovered in Area I were found on the surface in the northeast region of this area.

4.6.9.2 Site Characteristics Factors (Site Accessibility, Site Instability)

Site Accessibility. Area I is accessible from major paved roads. The perimeter of the area is fenced, limiting access to the area; all points of access are controlled. Interior fences are present between individual parcels/plots. In some areas, the terrain and vegetation act as a barrier. Based on the physical barriers (i.e., fencing) and terrain that limit access into this area, and the site accessibility criteria defined in Table 4-4, the site accessibility risk level for Area I is low.

Site Instability. The ground surface in Area I is predominantly stable. Soils and vegetation are well developed throughout the area, which decreases the possibility that OE (if present) would be exposed through natural events (e.g., wind erosion). Deeply eroded gullies and washes in this area indicate that OE could be exposed through water erosion. Based upon this information and the site instability criteria defined in Table 4-5, the site instability risk factor for Area I is low.

4.6.9.3 Demographics (Site Activities, Site Population)

Site Activities. The primary land use in Area I is intensive agricultural and ranching. Ground intrusive activities associated with ranching and farming, such as fence construction and tilling of the land, occur in Area I. These activities have the potential to affect the ground at depths up to and including 12 inches bgs. Other activities that take place currently, or could take place in Area I, include horseback riding and hiking. Because OE scrap was recovered in this area during the EE/CA field investigation, there is a moderate potential for OE in this area. Surface and ground intrusive activities would pose a moderate risk to individuals participating in these activities. Based upon this information, and the site activities criteria defined in Table 4-6, the site activities risk level for Area I is moderate.

Site Population. Landowners are currently the most predominant users of the land in Area I. The general public does have limited access to the area; however, the area is not a tourist attraction. Small, private ranches with homes are planned for Area I. Based upon this information and the site population criteria defined in Table 4-7, the site population risk level for Area I is moderate.

4.6.9.4 Overall OE Risk Impact Assessment - Area I.

All of the OERIA risk factors for Area I ranked low to moderate. The likelihood of exposure to OE is low given the type and sensitivity of OE (i.e., only nonhazardous OE scrap) and the small number of people using the area. Given the past military use of the area, there will always be a residual risk associated with OE in Area I. Based on the evaluation of the OERIA risk factors, the overall OE hazard level for Area I is low.

4.6.10 Area J Risk Evaluation

Results of the evaluation of Area J are summarized in Table 4-19. A discussion of each risk factor for Area J is presented in the following subsections.

Table 4-19. Summary of Risk Factors - Area J

OE Potential	OE Depth Range (inches bgs)	Risk Level	Ordnance		Site		Demographic	
			Type	Sensitivity	Access	Instability	Activity	Population
High	Surface	High	X	X	X		X	
		Moderate						X
		Low				X		
		None						

bgs = below ground surface
OE = ordnance and explosives

4.6.10.1 OE Factors (OE Type, OE Sensitivity, OE Potential, OE Depth Range)

OE Type. The OE type risk level for Area J is high. One UXO item was found on the surface near the east boundary of this area during the EE/CA field investigation. The UXO item found in this area could kill an individual if detonated by the individual's activities. Additionally, one OE scrap (inert and nonhazardous) item was recovered in this area during the EE/CA field investigation.

OE Sensitivity. The type of UXO found in Area J was a Mk2 hand grenade. This item is very sensitive and has the potential to detonate and cause fatal injury with simple touch and/or movement. Based upon this information, and the OE sensitivity criteria defined in Table 4-2, the OE sensitivity risk level in this area is high.

OE Potential. The presence of UXO in this area suggests a high potential for OE in Area J.

OE Depth. The UXO and OE scrap item recovered in Area J during the EE/CA field investigation were both found on the surface.

4.6.10.2 Site Characteristics Factors (Site Accessibility, Site Instability)

Site Accessibility. Almost all of Area J is fenced by the Parker Ranch, who controls access to the area. There are few natural barriers limiting access to Area J. The area is accessible to the public and is characterized by relatively flat grasslands. Evidence of child play near the Historic Parker Ranch Homes was

found in this area during the EE/CA field investigation. Based on the lack of strong natural barriers in this area, the population size of the adjacent areas, and the site accessibility criteria defined in Table 4-4, the site accessibility risk level for Area J is high.

Site Instability. The ground surface in Area J is stable. Soils and vegetation are well developed throughout the area, which decreases the possibility that OE would be exposed through natural events (e.g., wind and/or water erosion). Soils in this area generally range from 12 to 48 inches bgs (deeper in some areas). Based upon this information and the site instability criteria defined in Table 4-5, the site instability risk factor for Area J is low.

4.6.10.3 Demographics (Site Activities, Site Population)

Site Activities. The primary land use in Area J is intensive agricultural with some ranchland areas (extensive agricultural land use). Ground intrusive activities associated with ranching and farming, such as fence construction and tilling of the land, occur in Area J. These activities have the potential to affect the ground at depths greater than 12 inches bgs. Other activities that take place currently, or could take place in Area J, include horseback riding, hiking, mountain biking, and archaeology. OE (if present) on the surface or shallow subsurface would pose a high risk of OE exposure to individuals participating in these activities. Based upon this information and the site activities criteria defined in Table 4-6, the site activities risk level for Area J is high.

Site Population. Landowners are currently the most predominant users of the land in Area J; however, residents of the adjacent residential areas utilize portions of this area for recreational activities such as hiking and child play. The area supports the Historic Parker Ranch Homes, which are a tourist attraction. Based upon this information and the site population criteria defined in Table 4-7, the site population risk level for Area J is moderate.

4.6.10.4 Overall OE Risk Impact Assessment - Area J.

Due to the type and depth of UXO (surface) recovered in this area and the types of activities occurring in Area J, an individual entering the area has the potential to be exposed to OE. Since the level of risk associated with the type of OE and the sensitivity of the OE are high, the OE hazard presented to the exposed individual is also high. Although the site population risk factor is currently ranked at a moderate risk level, the number of people entering the area is likely to increase as development in Waimea expands. If the increased population uses Area J for recreational and occupational activities, the likelihood of OE exposure will also increase. Based on the evaluation of the OERIA risk factors, the overall OE hazard level for Area J is high.

4.6.11 Area K Risk Evaluation

Results of the evaluation of Area K are summarized in Table 4-20. A discussion of each risk factor for Area K is presented in the following subsections.

Table 4-20. Summary of Risk Factors - Area K

OE Potential	OE Depth Range (inches bgs)	Risk Level	Ordnance		Site		Demographic	
			Type	Sensitivity	Access	Instability	Activity	Population
Moderate	Surface	High						
		Moderate			X		X	
		Low				X		X
		None	X	X				

bgs = below ground surface
OE = ordnance and explosives

4.6.11.1 OE Factors (OE Type, OE Sensitivity, OE Potential, OE Depth Range)

OE Type. There were no UXO and only two OE scrap (inert and nonhazardous) items recovered in this area during the EE/CA field investigation. Because OE scrap is inert and nonhazardous, there is no risk based on OE type.

OE Sensitivity. There is no risk associated with OE sensitivity in this area because there were no UXO and only OE scrap recovered in Area K during the EE/CA field investigation.

OE Potential. The presence of OE scrap in this area suggests a moderate potential for OE in Area K.

OE Depth. The two OE scrap items recovered in this area during the EE/CA field investigation were found on the surface.

4.6.11.2 Site Characteristics Factors (Site Accessibility, Site Instability)

Site Accessibility. Area K is accessible from Mamalahoa Highway, which borders the west side of this area. This area is fenced and patrolled by the Parker Ranch; almost all points of entry are controlled. Area K can be entered through the West Hawai‘i Concrete access road. The terrain and vegetation in the area are characterized by rolling hills and grasslands that do not limit access to the area. Based upon this information and the site accessibility criteria defined in Table 4-4, the site accessibility risk level for Area K is moderate.

Site Instability. The ground surface in Area K is relatively flat with rolling hills and grasslands. Soils and vegetation are well developed throughout the area, which decreases the possibility that OE (if present) would be exposed through natural events (e.g., wind and/or water erosion). The soils (Waimea-Kikoni-Naalehu Association) in this area generally range from 12 to 48 inches bgs and can be deeper in some areas. If OE were present at depth, it would most likely not be exposed by natural events such as wind/water erosion and/or earthquakes. Based upon this information and the site instability criteria defined in Table 4-5, the site instability risk factor for Area K is low.

4.6.11.3 Demographics (Site Activities, Site Population)

Site Activities. The primary land use in Area K is intensive agricultural with

minor ranchland areas (extensive agricultural land use) and industrial land use (i.e., West Hawai'i Concrete). Ground intrusive activities, such as fence construction, occur in Area K. These activities have the potential to affect the ground surface at depths up to and including 12 inches bgs. Other activities that take place currently, or could take place in Area K include horseback riding, hiking, hunting, and mountain biking. The West Hawai'i Concrete plant is situated in the west side of Area K next to Mamalahoa Highway. Activities in this area are those associated with operation of the concrete plant, including use of semi-trucks to transport gravel and cinders from the mining pits to the concrete plant. These activities typically do not intrude the ground surface at depths greater than 12 inches bgs. Because OE scrap was recovered in this area during the EE/CA field investigation, there is a moderate potential for OE in this area. Surface and ground intrusive activities would pose a moderate risk to individuals participating in these activities. Based upon this information, and the site activities criteria defined in Table 4-6, the site activities risk level for Area K is moderate.

Site Population. Landowners are currently the most predominant users of the land in Area K. Based upon this information and the site population criteria defined in Table 4-7, the site population risk level for Area K is low.

4.6.11.4 Overall OE Risk Impact Assessment - Area K.

All of the OERIA risk factors for Area K ranked low to moderate. The likelihood of exposure to OE is low given the type and sensitivity of OE found in the area (i.e., only nonhazardous OE scrap) and the small population of people using the area. Given the past military use of the area, there will always be a residual risk associated with OE in Area K. Based on the evaluation of the OERIA risk factors, the overall OE hazard level for Area K is low.

4.6.12 Area L Risk Evaluation

Results of the evaluation of Area L are summarized in Table 4-21. A discussion of each risk factor for Area L is presented in the following subsections.

Table 4-21. Summary of Risk Factors - Area L

OE Potential	OE Depth Range (inches bgs)	Risk Level	Ordnance		Site		Demographic	
			Type	Sensitivity	Access	Instability	Activity	Population
Moderate	Surface	High				X	X	
		Moderate			X			X
		Low						
		None	X	X				

bgs = below ground surface
OE = ordnance and explosives

4.6.12.1 OE Factors (OE Type, OE Sensitivity, OE Potential, OE Depth Range)

OE Type. No UXO and only 11 OE scrap items were found in Area L during the EE/CA field investigation. Field crews observed additional OE scrap throughout this area during the EE/CA field activities. Because OE scrap is inert and nonhazardous, there is no risk based on OE type.

OE Sensitivity. There is no risk associated with OE sensitivity in this area because there were no UXO and only OE scrap recovered in Area L during the EE/CA field investigation.

OE Potential. The presence of OE scrap in this area suggests a moderate potential for OE in Area L.

OE Depth. All of the OE scrap items recovered in Area L were found on the surface on the a‘a lava rock on the west side of the area where there is little soil development.

4.6.12.2 Site Characteristics Factors (Site Accessibility, Site Instability)

Site Accessibility. Area L is accessible via Queen Kaahumanu Highway, Waikoloa Road, and well-maintained dirt service roads. There are no physical barriers (i.e., fences) limiting access to Area L; however, the rough unstable terrain acts as a strong natural barrier to the internal regions of this area. The rough unstable a‘a lava flows are hazardous to anyone walking in the area, limiting the distance one can safely travel throughout this area. Based on the strong natural barriers that limit access into this area and the site accessibility criteria defined in Table 4-4, the site accessibility risk level for Area L is moderate.

Site Instability. The ground surface in Area L is composed of unstable a‘a lava rock. Soil development over the a‘a lava rock is poor with soil thickness typically less than 3 inches bgs. These conditions indicate that if OE were present in this area, it would most likely be found on the surface or in the shadow of the lava rock. Due to the unconsolidated state of the a‘a lava rock, which easily shifts under pressure, a small event (such as someone walking) or a large event (such as an earthquake) could uncover OE that may lie in the shadow of the a‘a lava rock. Based upon this information, and the site instability criteria defined in Table 4-5, the site instability risk factor for Area L is high.

4.6.12.3 Demographics (Site Activities, Site Population)

Site Activities. Blue Hawai‘i Helicopter Tours is situated at the intersection of Queen Kaahumanu Highway and Waikoloa Road in Area L. Tourists have been seen hiking into the lava flow to place graffiti on the basalt rocks, an activity that directly impacts the ground surface. Maintenance crews access Area L to service the power lines and other utilities that bisect the area. These activities affect the ground surface and near surface. According to the General Plan, Area L is slated for urban expansion, which would include ground intrusive activities required to construct residential, commercial, and industrial buildings, golf courses, and resort areas. Crushing and/or moving the lava rock in specified areas up to depths potentially greater than 12 inches bgs is likely to be required for future urban development in this area. Any potential OE present in Area L could be disturbed and/or moved during these activities. Because there is little soil development in this area (i.e., OE would likely be found on the surface or in the shadow of the a‘a lava rock), individuals participating in these activities have the potential to become exposed to OE (if present in this area). OE scrap recovered in this area during the EE/CA field investigation indicates a moderate potential for

OE in this area. Based upon this information, and the site activities criteria defined in Table 4-6, the site activities risk level for Area L is high.

Site Population. Landowners are currently the most predominant users of the land in Area L. Although the desire to place graffiti on the lava flow attracts some tourists near the west and north perimeter of Area L, the area as a whole is not a tourist attraction. Based upon this information and the site population criteria defined in Table 4-7, the site population risk level for Area L is moderate.

4.6.12.4 Overall OE Risk Impact Assessment - Area L.

The likelihood of exposure to OE in this area is low given that only OE scrap (nonhazardous) was recovered during the Phase II EE/CA field investigation, and that natural terrain features act as a barrier to the internal regions of this area. Although the area is frequented by tourists, the area utilized is very localized and close to major roads. Based on the evaluation of the OERIA risk factors, the overall OE hazard level for Area L is low.

4.6.13 Area M Risk Evaluation

Results of the evaluation of Area M are summarized in Table 4-22. A discussion of each risk factor for Area M is presented in the following subsections.

Table 4-22. Summary of Risk Factors - Area M

OE Potential	OE Depth Range (inches bgs)	Risk Level	Ordnance		Site		Demographic	
			Type	Sensitivity	Access	Instability	Activity	Population
High	Surface	High	X	X		X	X	
		Moderate			X			X
		Low						
		None						

bgs = below ground surface
OE = ordnance and explosives

4.6.13.1 OE Factors (OE Type, OE Sensitivity, OE Potential, OE Depth Range)

OE Type. The OE type risk level for Area M is high. Five UXO items were found on the surface near the east boundary of this area during the EE/CA field investigation. At least two UXO items have been found in this area during previous investigations of the Puako Parcel (Donaldson Enterprises Inc., 1993). All of the UXO items found in this area have the potential to kill an individual if detonated by an individual‘s activities. Additionally, there were 283 OE scrap (inert and nonhazardous) items recovered in this area during the EE/CA field investigation. Field crews observed additional OE scrap throughout this area during the EE/CA field activities.

OE Sensitivity. The types of UXO recovered in Area M include 75mm projectiles and 155mm projectiles. These items are very sensitive and have the potential to detonate and cause fatal injury with simple touch and/or movement. Based upon

this information and the OE sensitivity criteria defined in Table 4-2, the OE sensitivity risk level in this area is high.

OE Potential. The presence of UXO in this area suggests a high potential for OE in Area M.

OE Depth. The 5 UXO items and all of the 283 OE scrap items recovered in Area M during the EE/CA field investigation were found on the surface.

4.6.13.2 Site Characteristics Factors (Site Accessibility, Site Instability)

Site Accessibility. The perimeter of Area M is easily accessible via Queen Kaahumanu Highway and Waikoloa Road. Points of entry are not controlled. A well-maintained service road leads into the central portion of the area where lava rock is currently being quarried and crushed. The remainder of the area is inaccessible due to the rough unstable a‘a lava flow and areas of dense vegetation (i.e., kiawe), which limit recreational use of the area. Based on the strong natural barriers that limit access into this area and the site accessibility criteria defined in Table 4-4, the site accessibility risk level for Area M is moderate.

Site Instability. The ground surface in Area M is composed of unstable a‘a lava flows. Soil development over the a‘a lava is poor with soil thickness typically less than 6 inches bgs in most areas. These conditions indicate that OE, if present in this area, would likely be on the surface or in the shallow subsurface and could be exposed through wind erosion. Due to the unconsolidated state of the a‘a lava rock, which easily shifts under pressure, a small event (such as someone walking) or a large event (such as an earthquake) could uncover OE that may lie in the shadow of the a‘a lava rock. Based upon this information and the site instability criteria defined in Table 4-5, the site instability risk factor for Area M is high.

4.6.13.3 Demographics (Site Activities, Site Population)

Site Activities. At the west perimeter of Area M, along Queen Kaahumanu Highway and Waikoloa Road, individuals hike into the lava flow to place graffiti on the basalt rocks. This area is planned to be developed as a golf course community and ground disturbing activities are underway. Other urban development projects in this area will include construction of residential, commercial, and industrial buildings, golf courses, and resort areas that require ground intrusive activities. Crushing of the lava rock is currently underway to develop the golf course community and for future urban development in this area. Any OE present in this area has the potential to become exposed and/or disturbed during these activities. Because UXO have been found on the surface in this area, individuals hiking or working in the area have a high risk of exposure to OE. Based upon this information and the site activities criteria defined in Table 4-6, the site activities risk level for Area M is high.

Site Population. Landowners are currently the most predominant users of the land in Area M. Although the desire to place graffiti on the lava flow attracts some

tourists on the west perimeter of Area M, the area as a whole is not a tourist attraction. However, as the planned golf course community and other urban development is completed, the population will dramatically increase in this area (i.e., tourists and residential families). Based upon this information and the site population criteria defined in Table 4-7, the site population risk level for Area M is moderate.

4.6.13.4 Overall OE Risk Impact Assessment - Area M.

The likelihood of exposure to OE in this area is high given the type and sensitivity of OE recovered during the Phase II EE/CA field investigation and during previous investigations, the OE potential for the area (see Table 4-22), and the types of activities, population, lack of access restrictions, and instability of the site. Based on the evaluation of the OERIA risk factors, the overall OE hazard level for Area M is high.

4.6.14 Area N Risk Evaluation

Results of the evaluation of Area N are summarized in Table 4-23. A discussion of each risk factor for Area N is presented in the following subsections.

Table 4-23. Summary of Risk Factors - Area N

OE Potential	OE Depth Range (inches bgs)	Risk Level	Ordnance		Site		Demographic	
			Type	Sensitivity	Access	Instability	Activity	Population
High	ND	High	X	X			X	
		Moderate			X	X		X
		Low						
		None						

bgs = below ground surface
ND = Not defined. No UXO or OE scrap was recovered in this area during the EE/CA field investigation.
OE = ordnance and explosives

4.6.14.1 OE Factors (OE Type, OE Sensitivity, OE Potential, OE Depth Range)

OE Type. Although there were no UXO or OE scrap recovered in this area during the Phase II EE/CA field investigation, a 105mm projectile (UXO) was reportedly found near this area during a previous investigation. The exact location of this item is unknown; however, it was reportedly found to the immediate west of this area. Because of the close proximity of this item to Area N, the OE type risk level for Area N is high.

OE Sensitivity. The type of OE reportedly found near Area N during a previous investigation was a 105mm projectile. This item is very sensitive and has the potential to detonate and cause fatal injury with simple touch and/or movement. Based on this information and the OE sensitivity criteria defined in Table 4-2, the OE sensitivity risk level in this area is high.

OE Potential. There were no UXO or OE scrap recovered in this area; however, the UXO item reportedly found very close to Area N would indicate a potential for

OE to be in this area. For purposes of this qualitative risk analysis, it is assumed that the OE potential in this area would be high.

OE Depth. The depth of OE is not defined as no UXO or OE scrap was recovered in Area N during the Phase II EE/CA field investigation; however, a previous report of OE near Area N indicates ordnance (if present in this area) may lie on the surface or very close to the surface.

4.6.14.2 Site Characteristics Factors (Site Accessibility, Site Instability)

Site Accessibility. The terrain in Area N is characterized by rocky hills covered in kiawe; however, the area is accessible to recreational uses such as hiking. Based on the physical and natural barriers that limit access into this area and the site accessibility criteria defined in Table 4-4, the site accessibility risk level for Area N is moderate.

Site Instability. The ground surface in Area N is moderately stable. The soils (Kawaihae Series) found in this area are extremely stony, very fine sandy loam. Soils are not well developed in this area as soil depth is typically less than 10 inches bgs. Although vegetation in this area helps to stabilize soils, OE (if present in this area) could be shallowly buried and exposed by wind erosion. Due to the unconsolidated state of the a‘a lava rock in some regions of this area, which easily shifts under pressure, a small event (such as someone walking) or a large event (such as an earthquake) could uncover OE that may lie in the shadow of the a‘a lava rock. Based upon this information and the site instability criteria defined in Table 4-5, the site instability risk factor for Area N is moderate.

4.6.14.3 Demographics (Site Activities, Site Population)

Site Activities. The Hapuna Prince Beach Hotel Golf Course is situated in the southwest corner of Area N. This area is used for recreational activities such as hiking and golfing. Area N is slated for urban expansion, large-scale construction activities, and ground intrusive activities to depths greater than 12 inches bgs. OE (if present in this area) is likely to pose a high risk of exposure to individuals participating in recreational and construction activities in this area. Based upon this information, and the site activities criteria defined in Table 4-6, the site activities risk level for Area N is high.

Site Population. Landowners, local residents, and hotel guests are the predominant users of the land in Area N. Based upon this information and the site population criteria defined in Table 4-7, the overall site population risk level for Area N is moderate.

4.6.14.4 Overall OE Risk Impact Assessment - Area N.

Although there was no UXO recovered in Area N during the Phase II EE/CA field investigation, there is a likelihood of exposure to OE in this area given the type and sensitivity of OE reportedly found near this area, and the types of activities, population, and lack of access restrictions in this area. Based on the evaluation of the OERIA risk factors, the overall OE hazard level for Area N is moderate.

4.6.15 Area O Risk Evaluation

Results of the evaluation of Area O are summarized in Table 4-24. A discussion of each risk factor for Area O is presented in the following subsections.

Table 4-24. Summary of Risk Factors - Area O

OE Potential	OE Depth Range (inches bgs)	Risk Level	Ordnance		Site		Demographic	
			Type	Sensitivity	Access	Instability	Activity	Population
High	0 - 3	High	X	X	X		X	
		Moderate				X		X
		Low						
		None						

bgs = below ground surface
OE = ordnance and explosives

4.6.15.1 OE Factors (OE Type, OE Sensitivity, OE Potential, OE Depth Range)

OE Type. The OE type risk level for Area O is high. Six UXO items were recovered in this area during the EE/CA field investigation. Two UXO items were recovered near the west boundary of this area during the 1999 site visit (Earth Tech, 1999b), and two UXO were recovered near the south boundary (Donaldson Enterprises, Inc., 1993). The types of UXO found in this area have the potential to kill an individual if detonated by an individual's activities. Additionally, there were 179 OE scrap items (inert and nonhazardous) recovered in Area O during the Phase II EE/CA field investigation. Field crews also observed OE scrap throughout this area during the EE/CA field activities.

OE Sensitivity. The types of UXO found in Area O include 60mm and 81mm mortars, 2.36-inch rockets, Mk2 hand grenades, and an unfuzed 37mm projectile (residual risk). These items are very sensitive (with the exception of the unfuzed 37mm projectile), and all have the potential to detonate and cause fatal injury with simple touch and/or movement. Based upon this information and the OE sensitivity criteria defined in Table 4-2, the OE sensitivity risk level in this area is high.

OE Potential. The presence of UXO in this area suggests a high potential for OE in Area O.

OE Depth. The six UXO items recovered in Area O during the EE/CA field investigation and the four UXO items recovered in this area during a previous investigation were found on the surface (one of the UXO items was found at a depth of 2 inches bgs). Almost all of the 179 OE scrap items were also found on the surface; the deepest depth OE scrap was recovered was 3 inches bgs.

4.6.15.2 Site Characteristics Factors (Site Accessibility, Site Instability)

Site Accessibility. Area O is accessible by foot from primary public roads serving the communities of Waimea, Kawaihae, and Kohala Peninsula. Site access within the area is by means of several unpaved jeep trails and is also

possible by foot along or off the jeep trails. Limited fencing and controlled access does not preclude entry and residential homes in this area make the region easily accessible to people living/visiting this area. Based upon this information and the site accessibility criteria defined in Table 4-4, the site accessibility risk level for Area O is high.

Site Instability. The ground surface in Area O is moderately stable. The soils (Kawaihae Series) found in this area are extremely stony, very fine sandy loam. Soils are not well developed in this area as soil depth is generally less than 20 inches bgs. Although vegetation in this area helps to stabilize soils, OE (if present in this area), would most likely be on the surface or shallowly buried and could be exposed by wind erosion. Due to the unconsolidated state of the a'a lava rock in most of this area, which easily shifts under pressure, a small event (such as someone walking) or a large event (such as an earthquake) could uncover OE that may lie in the shadow of the a'a lava rock. Based upon this information and the site instability criteria defined in Table 4-5, the site instability risk factor for Area O is moderate.

4.6.15.3 Demographics (Site Activities, Site Population)

Site Activities. Nansay Hawai'i, Inc., has already developed residential lots and housing in Area O and construction continues. Although most of the homes are near Kawaihae Road (near the north boundary of this area), residential expansion is underway with additional development planned in the central and south portion of Area O. Activities that occur throughout this area are child play, surveying, construction, small-scale agricultural activities, and recreational activities. These activities affect the ground surface at depths up to and including 12 inches bgs. UXO has been found on the surface in this area (and in one case shallowly buried), which poses a high risk of exposure to OE for individuals participating in recreational and construction activities. Based upon this information and the site activities criteria defined in Table 4-6, the site activities risk level for Area O is high.

Site Population. Area O is not a tourist attraction; however, residents have access to the land for various recreational activities and construction crews utilize this area for development of planned residential parcels. This area will not become a tourist attraction; however, as development continues in this area the population will grow, increasing the chance of OE exposure in this area. Based upon this information and the site population criteria defined in Table 4-7, the site population risk level for Area O is moderate.

4.6.15.4 Overall OE Risk Impact Assessment - Area O.

The likelihood of exposure to OE in Area O is high given the type and sensitivity of OE recovered during the Phase II EE/CA field investigation, the OE potential for the area (see Table 4-24), and the types of activities, population, and lack of access restrictions in this area. Based on the evaluation of the OERIA risk factors, the overall OE hazard level for Area O is high.

4.6.16 Area P Risk Evaluation

Results of the evaluation of Area P are summarized in Table 4-25. A discussion of each risk factor for Area P is presented in the following subsections.

Table 4-25. Summary of Risk Factors - Area P

OE Potential	OE Depth Range (inches bgs)	Risk Level	Ordnance		Site		Demographic	
			Type	Sensitivity	Access	Instability	Activity	Population
High	0 - 12	High	X	X	X		X	X
		Moderate				X		
		Low						
		None						

bgs = below ground surface
OE = ordnance and explosives

4.6.16.1 OE Factors (OE Type, OE Sensitivity, OE Potential, OE Depth Range)

OE Type. The OE type risk level for Area P is high. Three UXO items were found on the surface in Area P during the Phase II EE/CA field investigation. One UXO item was found by children on a school playground prior to the EE/CA field investigation. The types of UXO found in this area could kill an individual if detonated by an individual's activities. There were 918 OE scrap (inert and nonhazardous) items recovered throughout this area during the EE/CA field investigation. Field crews also observed OE scrap throughout the areas surrounding the residential parcels during the EE/CA field activities.

OE Sensitivity. The types of UXO found in Area P include 75mm and 105mm projectiles. These items are very sensitive and have the potential to detonate and cause fatal injury with simple touch and/or movement. Based upon this information and the OE sensitivity criteria defined in Table 4-2, the OE sensitivity risk level in this area is high.

OE Potential. The presence of UXO in this area suggests a high potential for OE in Area P.

OE Depth. All three UXO items recovered in this area were found on the surface and almost all of the 918 OE scrap items were also found on the surface; the deepest depth OE scrap was recovered was 12 inches bgs.

4.6.16.2 Site Characteristics Factors (Site Accessibility, Site Instability)

Site Accessibility. Developed areas of Area P are very accessible to residents, tourists, and the general public by means of a network of paved roads and well-maintained dirt roads. In undeveloped areas, the tall grass, deep gulches, and rough, rocky terrain can limit access to Area P, especially in the east region of this area due to the unstable terrain of the a'a lava rock and dense vegetation. Undeveloped areas around the Waikoloa Village are frequented by residents hiking and biking in the area. This area is not adequately fenced and there is a potential for the public to be exposed to OE by wandering through the undeveloped areas surrounding the Waikoloa Village where UXO has been found

and large concentrations of OE scrap were observed by field crews during the EE/CA field investigation. This area is not considered a tourist attraction but it is an attractive area for the residents of the area and some area guests to enjoy the land that surrounds the community. Based upon this information and the site accessibility criteria defined in Table 4-4, the site accessibility risk level for Area P is high.

Site Instability. The ground surface in Area P varies from stable to unstable. Developed areas are paved (e.g., roads, parking lots, and driveways) or landscaped (e.g., fairways and private yards) and are considered extremely stable. Undeveloped areas are rocky with moderate soil development and thick vegetation and are considered moderately stable. Deeply eroded washes and gullies and undeveloped areas within the Waikoloa Village are also moderately stable. On the east side of Waikoloa Village, soils are well developed, generally reaching depths up to 48 inches bgs (deeper in some areas). Vegetation in this region protects the soil from wind and water erosion. On the west side of the Waikoloa Village, unstable a‘a lava flows are present throughout this region. OE, if present in this area, could lie in the shadow of the a‘a lava rock and could be exposed by a small event (such as someone walking) or a large event (such as an earthquake). Based upon this information and the site instability criteria defined in Table 4-5, the site instability risk factor for Area P is moderate.

4.6.16.3 Demographics (Site Activities, Site Population)

Site Activities. A wide range of activities take place in Area P including, but not limited to: child play, biking, hiking, jogging, surveying, and construction, all of which have the potential to disturb the ground surface at depths up to and including 12 inches bgs. Construction of new homes is ongoing in the central and north regions of Area P, allowing ground disturbance at depths greater than 12 inches bgs. Ground intrusive activities and population will increase as urban development in the south and east areas of Area P continues. Because UXO in this area has been found on the surface, risk of exposure to OE is high to individuals working and participating in recreational/construction activities in the area. Based upon this information, and the site activities criteria defined in Table 4-6, the site activities risk level for Area P is high.

Site Population. Local residents are currently the most predominant users of the land in Area P; however, vacation condominiums, shopping, and golf courses in Area P attract an increased population of tourists into this area. Construction of new homes has also brought construction crews into this area. Based upon this information and the site population criteria defined in Table 4-7, the site population risk level for Area P is high.

4.6.16.4 Overall OE Risk Impact Assessment - Area P.

The likelihood of exposure to OE in Area P is high given the type and sensitivity of OE recovered in this area, the OE potential for the area (see Table 4-25), and the types of activities, population, and lack of access restrictions in this area. Based on the evaluation of the OERIA risk factors, the overall OE hazard level for Area P is high.

4.6.17 Area Q Risk Evaluation

Results of the evaluation of Area Q are summarized in Table 4-26. A discussion of each risk factor for Area Q is presented in the following subsections.

Table 4-26. Summary of Risk Factors - Area Q

OE Potential	OE Depth Range (inches bgs)	Risk Level	Ordnance		Site		Demographic	
			Type	Sensitivity	Access	Instability	Activity	Population
High	Surface	High	X	X			X	
		Moderate			X			X
		Low				X		
		None						

bgs = below ground surface
OE = ordnance and explosives

4.6.17.1 OE Factors (OE Type, OE Sensitivity, OE Potential, OE Depth Range)

OE Type. The OE type risk level for Area Q is high. Two UXO items were found on the surface in Area Q during the Phase II EE/CA field investigation. The type of UXO items found in this area could kill an individual if detonated by an individual's activities. There were no OE scrap (inert and nonhazardous) items recovered in this area during the EE/CA field investigation.

OE Sensitivity. The types of UXO found in Area Q include M9 rifle grenades and Mk2 hand grenades. These items are very sensitive and have the potential to detonate and cause fatal injury with simple touch and/or movement. Based upon this information and the OE sensitivity criteria defined in Table 4-2, the OE sensitivity risk level in this area is high.

OE Potential. The presence of UXO in this area suggests a high potential for OE in Area Q.

OE Depth. The UXO items recovered in Area Q during the EE/CA field investigation were found on the surface in the northwest region of this area.

4.6.17.2 Site Characteristics Factors (Site Accessibility, Site Instability)

Site Accessibility. Area Q is a low-medium density urban area accessible via primary and secondary roads. Individual lots within this area are fenced. Developed areas support businesses with paved parking lots. Undeveloped areas are accessible by unpaved trails. Based on the lack of natural and physical barriers that limit access into this area and the site accessibility criteria defined in Table 4-4, the site accessibility risk level for Area Q is moderate.

Site Instability. The ground surface in Area Q is stable. Soils and vegetation are well developed throughout the area, which decreases the possibility that OE would be exposed through natural events (e.g., wind and/or water erosion). Depth of soil to bedrock in the area is typically 12 to 36 inches bgs. If OE were

present in this area, it would most likely be buried at relatively shallow depths and would not be exposed by natural events such as wind erosion and/or earthquakes. Based upon this information and the site instability criteria defined in Table 4-5, the site instability risk factor for Area Q is low.

4.6.17.3 Demographics (Site Activities, Site Population)

Site Activities. A wide range of activities take place in Area Q including, but not limited to: child play, biking, hiking, agriculture, grazing, surveying, and construction of new homes, all of which have the potential to disturb the ground surface at depths up to and including 12 inches bgs. Residents of the O'uli Parcel to the east of this area utilize this area for recreational activities and consider it part of their surrounding community structure. Because UXO items have been found on the surface near the east side of this area (adjacent to developing residential homes and increased population), risk of exposure to OE is high to individuals working and participating in recreational/construction activities in this area. Based upon this information, and the site activities criteria defined in Table 4-6, the site activities risk level for Area Q is high.

Site Population. Landowners are currently the most predominant users of the land in Area Q; however, the east area of this region is utilized by nearby residents for recreational activities. This area is not a tourist attraction. Based upon this information and the site population criteria defined in Table 4-7, the site population risk level for Area Q is moderate.

4.6.17.4 Overall OE Risk Impact Assessment - Area Q.

The likelihood of exposure to OE in Area Q is high given the type and sensitivity of OE recovered in this area, the OE potential for the area (see Table 4-26), and the types of activities and lack of access restrictions in this area. Based on the evaluation of the OERIA risk factors, the overall OE hazard level for Area Q is high.

4.6.18 Area R Risk Evaluation

Results of the evaluation of Area R are summarized in Table 4-27. A discussion of each risk factor for Area R is presented in the following subsections.

Table 4-27. Summary of Risk Factors - Area R

OE Potential	OE Depth Range (inches bgs)	Risk Level	Ordnance		Site		Demographic	
			Type	Sensitivity	Access	Instability	Activity	Population
Low	ND	High						
		Moderate						
		Low			X	X	X	X
		None	X	X				

bgs = below ground surface
ND = Not defined. No UXO or OE scrap was recovered in this area during the EE/CA field investigation.
OE = ordnance and explosives

4.6.18.1 OE Factors (OE Type, OE Sensitivity, OE Potential, OE Depth Range)

OE Type. There is no risk associated with OE type in Area R. No UXO or OE scrap (inert and nonhazardous) items were found in this area during the EE/CA field investigation.

OE Sensitivity. There is no risk associated with OE sensitivity in this area because there were no UXO recovered in Area R during the EE/CA field investigation.

OE Potential. There was no evidence of UXO or OE scrap in this area during the EE/CA field investigation; therefore, the potential for OE in Area R is low.

OE Depth. The depth of OE is not defined as no UXO or OE scrap was recovered in Area R during the EE/CA field investigation.

4.6.18.2 Site Characteristics Factors (Site Accessibility, Site Instability)

Site Accessibility. This area, which supports the Waimea-Kohala Airport, is fenced. The public has access to the area, but the area is not a public or tourist attraction. Based on the physical barriers that limit access into this area and the site accessibility criteria defined in Table 4-4, the site accessibility risk level for Area R is low.

Site Instability. The ground surface in Area R is stable. It is highly unlikely that natural events could uncover OE (if present) beneath the pavement. Based upon this information and the site instability criteria defined in Table 4-5, the site instability risk factor for Area R is low.

4.6.18.3 Demographics (Site Activities, Site Population)

Site Activities. Area R is being developed and ground breaking activities are in progress. There were no UXO or OE scrap items recovered in this area during the Phase II EE/CA field investigation. Based upon this information and the site activities criteria defined in Table 4-6, the site activities risk level for Area R is low.

Site Population. Landowners are currently the predominant users of the land in Area R. Based upon this information and the site population criteria defined in Table 4-7, the site population risk level for Area R is low.

4.6.18.4 Overall OE Risk Impact Assessment - Area R.

The likelihood of exposure to OE is low given that there were no UXO or OE scrap items recovered in this area during the Phase II EE/CA field investigation and the small population of people using the area. Given the past military use of the area, there will always be a residual risk associated with OE in Area R. Based on the evaluation of the OERIA risk factors, the overall OE hazard level for Area R is low.

4.6.19 Area S Risk Evaluation

Results of the evaluation of Area S are summarized in Table 4-28. A discussion of each risk factor for Area S is presented in the following subsections.

Table 4-28. Summary of Risk Factors - Area S

OE Potential	OE Depth Range (inches bgs)	Risk Level	Ordnance		Site		Demographic	
			Type	Sensitivity	Access	Instability	Activity	Population
Moderate	Surface	High			X			X
		Moderate					X	
		Low				X		
		None	X	X				

bgs = below ground surface
OE = ordnance and explosives

4.6.19.1 OE Factors (OE Type, OE Sensitivity, OE Potential, OE Depth Range)

OE Type. No UXO and only 11 OE scrap items were recovered in this area during the Phase II EE/CA field investigation. Because OE scrap is inert and nonhazardous, there is no risk based on OE type.

OE Sensitivity. There is no risk associated with OE sensitivity in this area because there were no UXO recovered in Area S during the EE/CA field investigation.

OE Potential. The presence of OE scrap in this area suggests a moderate potential for OE in Area S.

OE Depth. The OE scrap items recovered in Area S were found on the surface adjacent to Saddle Road (roadway easement).

4.6.19.2 Site Characteristics Factors (Site Accessibility, Site Instability)

Site Accessibility. Area S is an 80-foot buffer area adjacent to the portion of Saddle Road that lies within the former maneuver area. This area is accessible by Mamalahoa Highway and the portion of Saddle Road to the south. There are no natural or physical boundaries limiting access to the area. Based on the lack of physical barriers in this area and the site accessibility criteria defined in Table 4-4, the site accessibility risk level for Area S is high.

Site Instability. The ground surface in Area S is stable. Soils are well developed throughout this area and typically range from 12 to 48 inches bgs (deeper in some areas). Vegetation is also predominant throughout the area, which stabilizes the soil and decreases the possibility that OE (if present) could be exposed through natural events (e.g., wind and/or water erosion). Based upon this information and the site instability criteria defined in Table 4-5, the site instability risk factor for Area S is low.

4.6.19.3 Demographics (Site Activities, Site Population)

Site Activities. Saddle Road is traveled daily by residents and tourists who use the road for driving, mountain biking, or sightseeing. Property owners also utilize this area for low-intensity subsurface activities (i.e., fence post installation). Based upon this information and the site activities criteria defined in Table 4-6, the site activities risk level for Area S is moderate.

Site Population. Area S comprises a portion of Saddle Road, which is used daily by residents and tourists. Based upon this information and the site population criteria defined in Table 4-7, the site population risk level for Area S is high.

4.6.19.4 Overall OE Risk Impact Assessment - Area S.

The likelihood of exposure to OE is low given the type and sensitivity of OE found in the area (i.e., only inert nonhazardous OE scrap) and that the area is predominantly paved and already developed. However, given that OE scrap was recovered adjacent to Saddle Road and that the area is frequented daily by tourists who utilize this area for off-road sight-seeing, there is a risk of exposure if OE is present in this area. Additionally, considering the past military use of the area, there will always be a residual risk associated with OE in Area S. Based on the evaluation of the OERIA risk factors, the overall OE hazard level for Area S is moderate.

4.6.20 Area T Risk Evaluation

Results of the evaluation of Area T are summarized in Table 4-29. A discussion of each risk factor for Area T is presented in the following subsections.

Table 4-29. Summary of Risk Factors - Area T

OE Potential	OE Depth Range (inches bgs)	Risk Level	Ordnance		Site		Demographic	
			Type	Sensitivity	Access	Instability	Activity	Population
Moderate	Surface	High					X	X
		Moderate			X	X		
		Low						
		None	X	X				

bgs = below ground surface
OE = ordnance and explosives

4.6.20.1 OE Factors (OE Type, OE Sensitivity, OE Potential, OE Depth Range)

OE Type. No UXO items and only one OE scrap item was found in Area T during the EE/CA field investigation. Field crews also observed OE scrap throughout this area during the EE/CA field activities. Because OE scrap is inert and nonhazardous, there is no risk based on OE type.

OE Sensitivity. There is no risk associated with OE sensitivity in this area because there were no UXO and only OE scrap recovered in Area T during the EE/CA field investigation.

OE Potential. The presence of OE scrap in this area suggests a moderate potential for OE in Area T.

OE Depth. The OE scrap item recovered in Area T during the EE/CA field investigation was found on the surface.

4.6.20.2 Site Characteristics Factors (Site Accessibility, Site Instability)

Site Accessibility. The tall grass, deep gulches, and rough, rocky terrain can limit access to Area T, especially in the northeast region of this area due to the unstable terrain of the a‘a lava flows. This area is fenced to prevent access to the land and almost all points of entry are controlled. Based on the natural barriers that limit access into this area, and the site accessibility criteria defined in Table 4-4, the site accessibility risk level for Area T is moderate.

Site Instability. On the west side of Area T, soils are well developed, generally reaching depths up to 48 inches bgs (deeper in some areas). Vegetation in this region protects the soil from wind and water erosion. Deeply eroded washes and gullies in this area are moderately stable. A‘a lava flows covered with thick vegetation characterize the northeast portion of the area; however, the ground surface in this region is unstable. A small event (such as someone walking) or a large event (such as an earthquake) could potentially uncover OE (if present) that may lie in the shadow (partially buried) of the a‘a lava rock. Based upon this information and the site instability criteria defined in Table 4-5, the site instability risk factor for Area T is moderate.

4.6.20.3 Demographics (Site Activities, Site Population)

Site Activities. Area T is southeast of the Waikoloa Village area and is currently slated for rural, urban expansion, and open space land uses, which would include ground intrusive activities required to construct rural and urban residential communities and golf courses. Intrusive activities to depths greater than 12 inches bgs are likely to be required for future development in this area. Any potential OE present in Area T could be disturbed and/or moved during these activities. Individuals participating in these activities are likely to be exposed to OE (if present). Based upon this information and the site activities criteria defined in Table 4-6, the site activities risk level for Area T is high.

Site Population. Landowners are currently the most predominant users of the land in Area T and the area is currently not a tourist attraction. However, as rural and urban residential communities and golf courses are completed, the population will dramatically increase in this area (i.e., tourists and residential families), increasing the likelihood that an individual will be exposed to OE (if present). Portions of this area will develop as a tourist attraction (e.g., golf courses). Based upon this information and the site population criteria defined in Table 4-7, the site population risk level for Area T is high.

4.6.20.4 Overall OE Risk Impact Assessment - Area T.

The likelihood of exposure to OE in this area is low given the type and sensitivity of OE (only inert nonhazardous OE scrap) recovered during the Phase II EE/CA field investigation (see Table 4-29). Although there is low risk in this area

associated with OE, activities in this area would include ground disturbance activities and the population will dramatically increase as portions of this area slowly develop into tourist attractions (e.g., golf courses). Additionally, considering the past military use of the area, there will always be a residual risk associated with OE in Area T. Based on the evaluation of the OERIA risk factors, the overall OE hazard level for Area T is moderate.

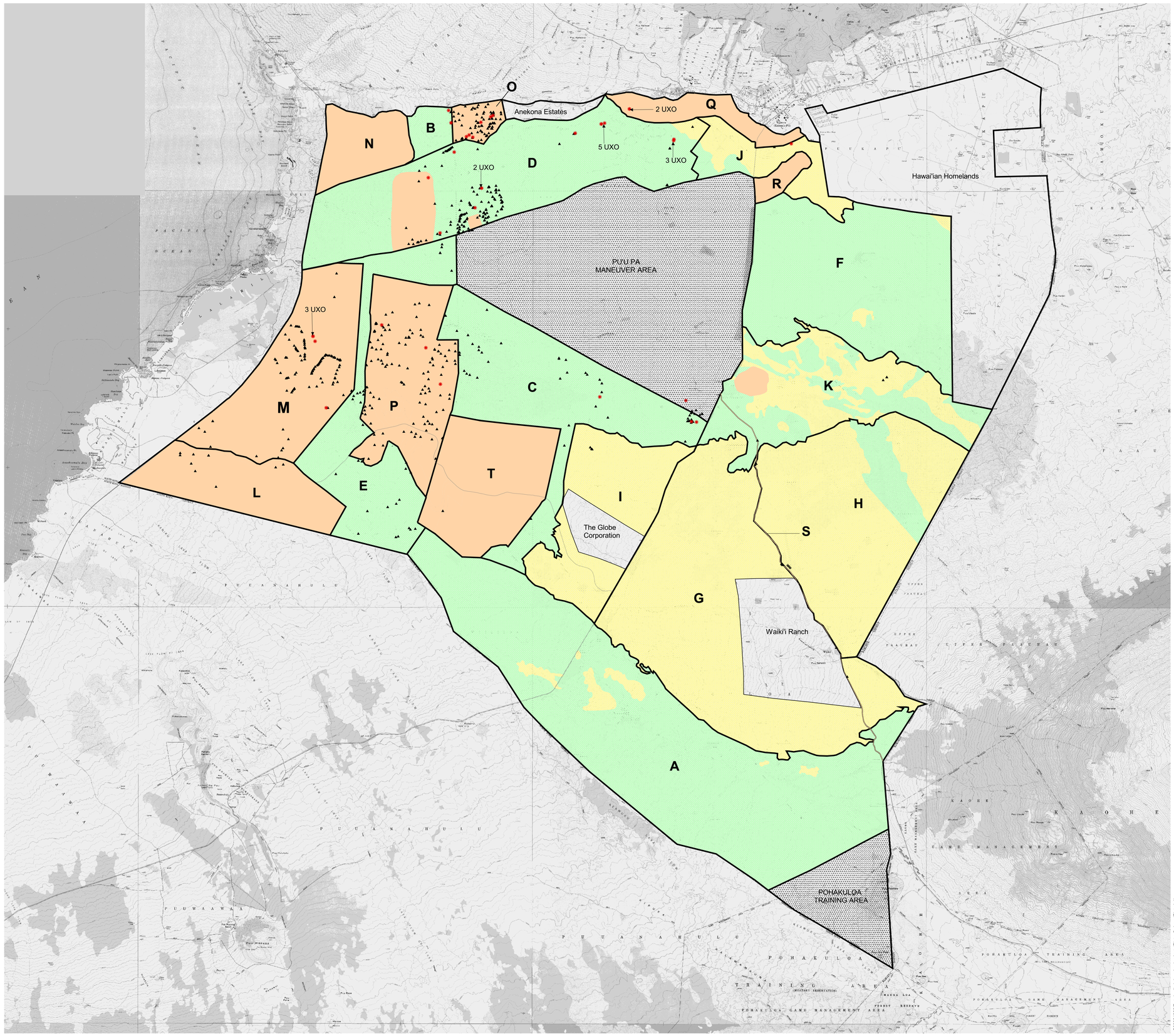
4.7 RESULTS OF ORDNANCE AND EXPLOSIVES RISK IMPACT ASSESSMENT

Table 4-30 summarizes the individual rankings of the OERIA risk factors evaluated for the Former Waikoloa Maneuver Area and Nansay Sites. For each OERIA evaluation area (i.e., Areas A through T), the overall OE hazard level, as determined in Sections 4.6.1 through 4.6.20, is provided. The overall OE hazard level was qualitatively assessed using the rankings of the individual risk factors. This overall OE hazard level, determined for each OERIA evaluation area, is used in the analysis of the four OE response action alternatives evaluated in Chapter 8.0 of this EE/CA report.

Table 4-30. Results of OERIA for the Former Waikoloa Maneuver Area and Nansay Sites

OERIA Evaluation Area	UXO Recovered During EE/CA	OE Scrap Recovered During EE/CA	Ordnance Factors				Site Factors		Demographic Factors		Overall OE Hazard Level[c]
			Potential	Depth Range[a]	Type	Sensitivity	Access	Instability	Activity	Population	
Group I (open areas, conservation areas, extensive agricultural areas)											
Area A	--	--	L	--	--	--	L	L	M	L	Low
Area B	2	6	H	Surface	H	H	M	H	H	M	High
Area C	4	87	H	0-6	H	H	M	H	H	L	Moderate
Area D	15	542	H	0-20	H	H	M	M	H	M	High
Area E	--	116	M	0-2	--	--	L	H	H	M	Moderate
Area F	--	--	L	--	--	--	L	L	M	L	Low
Group II (agricultural districts)											
Area G	--	--	L	--	--	--	L	L	M	L	Low
Area H	--	--	L	--	--	--	L	L	L	L	Low
Area I	--	3	M	Surface	--	--	L	L	M	M	Low
Area J	1	1	H	Surface	H	H	H	L	H	M	High
Area K	--	2	M	Surface	--	--	M	L	M	L	Low
Group III (commercial, residential, industrial, rural, and resort areas)											
Area L	--	11	M	Surface	--	--	M	H	H	M	Low
Area M	5	283	H	Surface	H	H	M	H	H	M	High
Area N	--[b]	--	H	--	H	H	M	M	H	M	Moderate
Area O	6	179	H	0-3	H	H	H	M	H	M	High
Area P	3	918	H	0-12	H	H	H	M	H	H	High
Area Q	2	--	H	Surface	H	H	M	L	H	M	High
Area R	--	--	L	--	--	--	L	L	L	L	Low
Area S	--	11	M	Surface	--	--	H	L	M	H	Moderate
Area T	--	1	M	Surface	--	--	M	M	H	H	Moderate

Notes: (a) Depth Range shown in inches below ground surface.
(b) A 105mm projectile (UXO) was reportedly found near Area N during a previous investigation.
(c) Justification for the Overall OE Hazard Level for each OERIA evaluation area can be found in Sections 4.6.1 through 4.6.20.
EE/CA = engineering evaluation/cost analysis
H = high
L = low
M = moderate
OE = ordnance and explosives
OERIA = Ordnance and Explosives Risk Impact Assessment
UXO = unexploded ordnance



LEGEND

- Group I Land Use (open areas, conservation areas, and extensive agricultural areas)
- Group II Land Use (agricultural districts including intensive agricultural lands and other agricultural lands)
- Group III Land Use (commercial areas, multiple residential areas, rural districts, industrial areas, and resort areas)
- Active military training areas not investigated during the EE/CA
- No right-of-entry areas not investigated during the EE/CA
- Unexploded Ordnance (UXO)
- Ordnance and Explosives (OE) Scrap
- A OERIA Evaluation Area

N

4,000 0 4,000 8,000 12,000 Feet

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Revisions			
Symbol	Description	Date	Approved

EARTH TECH

PLATE 4-1

Designed by: Earth Tech
Drawn by: Earth Tech
Checked by: CEHNC and CEPOH
Reviewed by: CEHNC and CEPOH
Approved by: Earth Tech

US Army Corps of Engineers

Ordnance and Explosives Risk Impact Assessment (OERIA) Former Waikoloa Maneuver Area and Nansay Sites, Hawai'i

Scale: 1" = 4,000'
Date: January 2002
Sheet reference number:

Contract No. 0017
Task Order: 29
Sheet 1 of 1