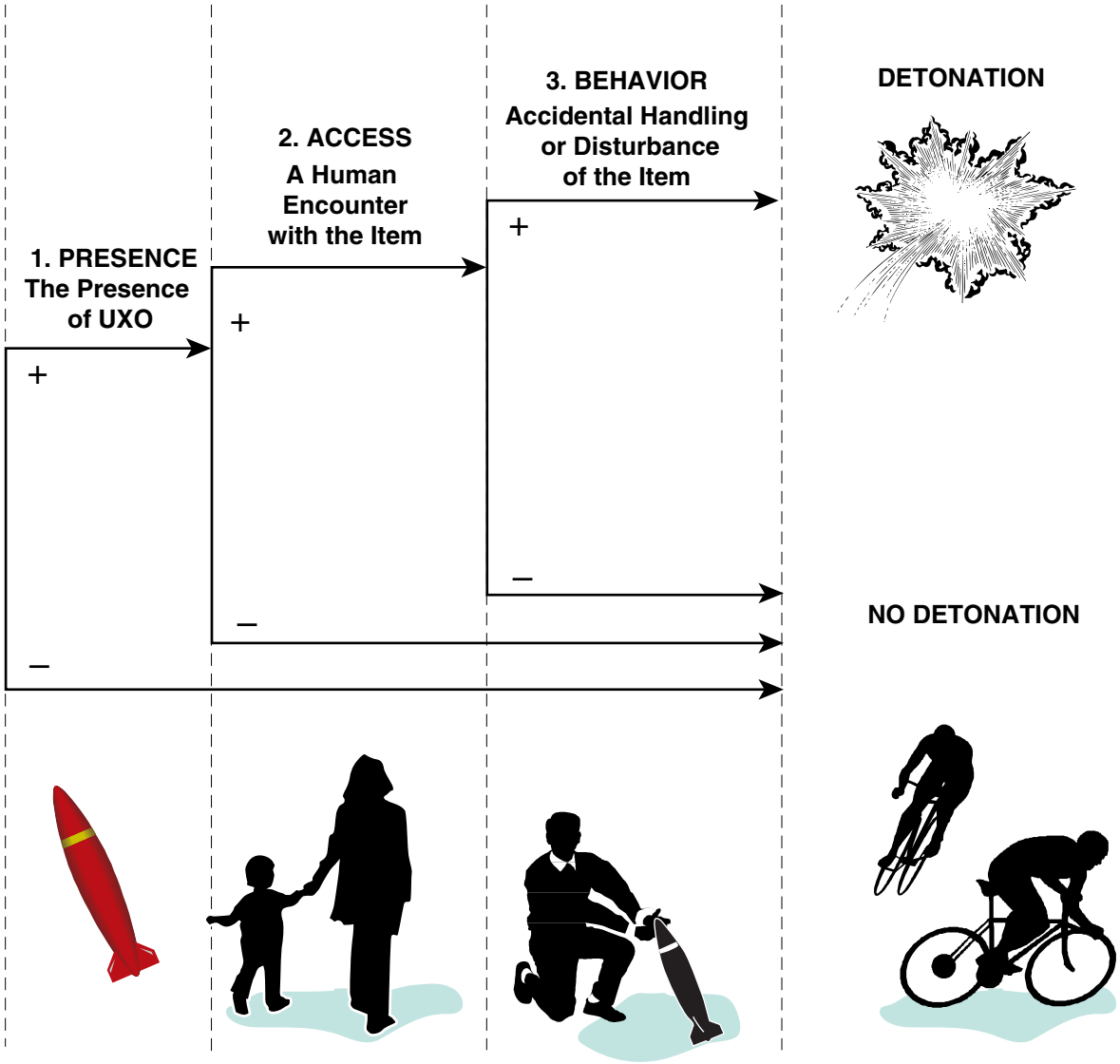
4.0 IDENTIFICATION AND ANALYSIS OF REMOVAL ACTION ALTERNATIVES

4.0.0.0.1 This section presents alternatives for conducting a non-time-critical removal action at East Elliott. CEHNC (1995) has classified removal actions into three types based on the circumstances surrounding the release or threat of release: emergency, time-critical, and non-time-critical. The removal actions recommended in this EE/CA for East Elliott have been determined to be non-time-critical because any on-site removal actions would take place more than six months after commencement of the planning period. However, a Time-Critical Removal Action was completed in February 1999 for Sector 4. The objective of the removal action is to achieve an acceptable level of risk to human health and the environment from potential exposure to UXO.

4.0.0.0.2 To evaluate the impact a removal action alternative will have on risk (i.e., the potential for a hazardous encounter with UXO to occur), the elements necessary to complete the exposure pathway and produce an adverse effect were considered. As shown on Figure 4-1, these elements include 1) PRESENCE - the presence of UXO, 2) ACCESS - a human encounter with the item, and 3) BEHAVIOR - handling or disturbance of the item. Risk can be reduced by deterring this exposure pathway. The PRESENCE of UXO can be reduced through the implementation of clearance or removal of OE. ACCESS and BEHAVIOR may be modified through the implementation of Institutional Controls. An acceptable level of risk may be achieved by deterring completion of the exposure pathway shown on Figure 4-1, while considering the practicality of the removal action with regard to cost, effectiveness, and implementability.

4.0.0.0.3 As specified in the sampling plan (QuantiTech, 1995b), East Elliott has been separated into four sectors based on proposed land use associated with each area, especially construction of city and county landfills. These sectors are described in Section 2.3. The removal alternatives are evaluated based on potential implementation in each of these sectors. Alternatives have also been “customized” for each sector where applicable (e.g., for institutional controls).

ELEMENTS NECESSARY TO COMPLETE EXPOSURE PATHWAY AND PRODUCE AN ADVERSE EFFECT



OE risk can be reduced by deterring this exposure pathway. The presence of UXO (Element 1) can be reduced through the implementation of clearance or removal of OE; access (Element 2) and behavior (Element 3) may be modified through the use of institutional controls.

Reference: Modified from Wilcox, 1997.
Institutional Controls for Ordnance Response at UXO Forum

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FORMER CAMP ELLIOTT (EAST ELLIOTT)
ORDNANCE EXPOSURE PATHWAYS

FIGURE 4-1

4.0.0.0.4 The remainder of this section is arranged as follows:

- Section 4.1 - Initial screening of the types of removal action alternatives that may be applicable to East Elliott
- Section 4.2 - Discussion of the criteria used to evaluate the removal action alternatives
- Section 4.3 - Descriptions and evaluations of the potential removal action alternatives for Sectors 1 through 4

4.1 SCREENING OF REMOVAL ACTION ALTERNATIVES

4.1.0.0.1 Removal action alternatives can generally be grouped into the following categories: no action, institutional controls, treatment, containment, and removal. Removal action alternatives for East Elliott were screened considering CEHNC guidance objectives, presumptive remedies at other UXO sites, site-specific characteristics, the conceptual model of potential exposure risk (Figure 4-1), and current and future land use and ownership. The rationale for eliminating or retaining removal action alternatives, as summarized by the general categories for East Elliott, is presented below and summarized in Table 4-1:

- An initial screening of all treatment, containment, and removal action alternatives has not been performed. Only those alternatives that are relevant to the EE/CA objectives and applicable to the site have been retained.
- Generally, the USEPA prefers the treatment of wastes (i.e., reduction of toxicity, mobility, or volume) over conventional containment or land disposal approaches. However, the vast area and dispersed nature of the OE at East Elliott does not accommodate conventional treatment or containment options. Therefore, treatment and containment technologies have been eliminated from further consideration.
- The *Draft OEW Risk Assessment Technical Bulletin* (Department of the Army, 1993a) discusses four appropriate alternatives for control or reduction of risk from OE. These include the following presumptive remedies: (1) no action, (2) fencing, (3) land use restrictions, and (4) removal of OE. No action, institutional controls (potentially including fencing and land use restrictions), and OE removal options are retained as "presumptive remedies."

TABLE 4-1

SCREENING OF REMOVAL ACTION ALTERNATIVES
FORMER CAMP ELLIOTT (EAST ELLIOTT)

Technology Options	Retained/Eliminated	Rationale
No Action	Retained	Requirement of NCP.
Institutional Controls	Retained	Institutional controls could reduce exposure to UXO and modify behavior of people who may come in contact with UXO. Implementation of institutional controls is technically feasible.
Treatment Technologies	Eliminated	Not applicable to site: Treatment of scattered UXO over large area is not technically or economically feasible.
Containment Technologies	Eliminated	Not applicable to site: Containment of scattered UXO over large area is not technically or economically feasible.
Removal Technologies	Retained	Partial or complete removal of UXO would reduce exposure to UXO and is technically feasible.

4.1.0.0.2 In the following analysis, five viable general response actions appropriate for East Elliott are identified and evaluated. They cover the spectrum of possible removal actions from the least protective to the most protective.

4.2 EVALUATION CRITERIA

4.2.0.0.1 The defined alternatives have been evaluated against the short- and long-term aspects of the three broad criteria: effectiveness, implementability, and cost. These criteria are explained in the following discussion.

4.2.1 Effectiveness

4.2.1.0.1 The effectiveness of an alternative refers to its ability to achieve the removal action objectives, to comply with ARARs, and to reduce the risk to the public. Effectiveness criteria may include long-term effectiveness and performance, short-term effectiveness, and substantial compliance with ARARs (CEHNC, 1995). The most important effectiveness criterion for East Elliott is the long-term effectiveness of the proposed removal action to protect the public and reduce the risk of a UXO encounter. The USACE also performs post-response monitoring to verify whether the assumptions made to evaluate long-term effectiveness were valid.

4.2.1.0.2 Specific to East Elliott, the effectiveness of a removal action alternative is defined by its ability to reduce the total expected annual exposures to UXO resulting from recreational and construction activities. The procedures for calculating the total expected annual exposures under different scenarios are further detailed in Appendix C. Section 2.5 summarizes the estimated number of annual exposures for the baseline risk assessment (i.e., risk present at the site prior to any removal action). Each exposure does not necessarily result in injury or death; many exposures, especially if the UXO is not disturbed, may occur without incident.

4.2.1.0.3 The risk reduction achieved by alternatives other than clearance activities (i.e., institutional controls) was estimated based on the effectiveness of the measure in other situations (e.g., in published literature on the effectiveness of signs in various situations) and on knowledge of site conditions in East Elliott gained during the site investigation. There was no literature available regarding the effectiveness of these measures specific to UXO sites. Therefore, the effectiveness of the various institutional controls was estimated or assessed qualitatively, with consideration for the current and future land use scenarios for each sector. The effectiveness of residual risk management measures to be implemented following OE removal actions has not been evaluated.

4.2.2 Implementability

4.2.2.0.1 Implementability is a function of the technical and administrative feasibility of a removal action, the availability of necessary equipment and services, and the potential for community acceptance of the removal action alternative. The EE/CA uses presumptive technologies that have been successfully implemented at former Camp Elliott (i.e., Tierrasanta and Mission Trails Regional Park) in the past. Each removal action alternative considered is implementable, so the evaluation of alternatives will focus primarily on effectiveness and cost. However, implementability issues related to each alternative and specific to each sector are discussed herein.

4.2.3 Cost

4.2.3.0.1 The cost to implement removal action alternatives have been estimated based on a 30-year present worth analysis of estimated direct and indirect capital costs, and recurring or post-removal site control (PRSC) costs including long-term monitoring, reporting, and maintenance activities. The discount rate (value of money) used for calculating present worth is 7 percent. Present-worth cost estimates for the removal action alternatives are presented in Section 4.3. Detailed cost estimates, cost assumptions, and backup data on cost estimates are in Appendices D and E.

4.3 DESCRIPTION AND ANALYSIS OF REMOVAL ACTION ALTERNATIVES

4.3.0.0.1 This section describes and evaluates the four proposed removal action alternatives for Sectors 1 through 4, and the No Action alternative. Each alternative is assessed independently, without consideration of the other alternatives, using the criteria of effectiveness, implementability, and cost described in Section 4.2. In general, all removal action alternatives are considered implementable to varying degrees and no differentiation between the four sectors is made when discussing the implementability of an alternative. Effectiveness and cost for an alternative may vary significantly between the four sectors because of differences in size of the sector, initial level of risk, and other sector-specific characteristics. Therefore, the effectiveness and cost of the alternatives are discussed separately for Sectors 1 through 4, as appropriate. Section 5.0 is a comparative analysis of the selected alternatives.

4.3.1 Alternative 1: No Action

4.3.1.0.1 As required by the CEHNC Removal Action Planning guidance (CEHNC, 1995), the No Action alternative is retained for evaluation to provide a baseline with which to compare the other alternatives. Under the No Action alternative, OE would not be removed and no additional efforts would be made to inform or to protect the public from the potential hazards associated with these items. The No Action alternative accepts the level of potential hazard that currently exists at the site.

4.3.1.0.2 Implementation of this alternative requires that both the probability and the severity of the maximum threat be low (Department of the Army, 1993a). Conditions in the four sectors defined within East Elliott which may make implementation of the No Action alternative acceptable are:

- Based on the results of the 1996 site investigation, only one UXO item was found in Sector 1, and no UXO was found in Sector 3.

- East Elliott is mostly undeveloped and some areas are not easily accessible. In addition, areas in the northern and western portions (primarily Sectors 1 and 3) of East Elliott are not heavily used. Therefore, in some areas, there is minimal chance that people would encounter UXO.

- Future land use scenarios are unlikely to result in either a significant expansion of the population that accesses the area. Residential development in East Elliott is limited by geological and ecological factors.

4.3.1.0.3 Conditions that may make the No Action alternative undesirable include the potentially severe nature of the threat. Any one encounter with UXO could potentially be fatal.

4.3.1.1 Effectiveness

4.3.1.1.1 Implementation of the No Action alternative would not reduce the amount of UXO at the site, would not minimize the opportunity for the public to encounter UXO, and would not minimize the likelihood that UXO would be disturbed or handled accidentally if encountered. Thus, the risk of completion of the exposure pathway shown on Figure 4-1 would not be changed from the risk present at this time. As shown by the risk assessment presented in Appendix C, the risk of an exposure to UXO would remain at 100 percent of the current level of risk. However, the alternative may be effective for Sector 3 where no UXO was found.

4.3.1.2 Implementability

4.3.1.2.1 The No Action alternative may be implemented at any time. No additional resources are required to implement the No Action alternative. However, implementation of this alternative is not likely to be perceived by the public as sufficiently protective of human health and safety, particularly for Sectors 1, 2, and 4, where OE was encountered on the ground surface during field investigation.

4.3.1.3 Cost

4.3.1.3.1 No additional costs are required to implement the No Action alternative.

4.3.2 Alternative 2: Institutional Controls

4.3.2.1 General Strategy for Institutional Control Implementation

4.3.2.1.1 Institutional controls include physical, educational, and legal actions designed either to reduce the chances of contact with UXO or to modify behavior of people who do encounter UXO. Unlike clearance alternatives, institutional controls do not attempt to reduce the presence of UXO at a site. Institutional controls can consist of a number of technologies (tools) or actions based on the needs of each individual site, or in the case of East Elliott, each individual sector. Implementation of institutional controls would require development of an institutional control plan, which would identify the institutional authorities responsible for implementing the proposed actions, roles for each participant, and resource requirements and commitments from voluntary participants. Development of an institutional control plan would be conducted outside of the framework of this EE/CA.

4.3.2.1.2 Prior to development of an institutional control plan, coordination with local institutions must occur. It is anticipated that the cities of San Diego and Santee would have a significant role in implementing institutional controls. For example, the City of San Diego may maintain the signs at East Elliott to warn people of the potential presence of UXO. The San Diego County Sheriff's Department would be the contact agency if suspected UXO were discovered by the public at East Elliott. The specific authorities, mission capabilities, and desire to cooperate would have to be determined for each institution prior to development of an institutional control plan.

4.3.2.2 Evaluation of Institutional Control Technologies

4.3.2.2.1 For the purposes of this EC/CA several technologies were initially screened to determine the optimal components of institutional controls for each sector, with consideration given to: 1) current and future land use, and 2) implementability. A further evaluation of these components in relation to effectiveness, implementability, and cost is then required to provide a

basis for comparison against other alternatives. The following types of technologies were considered for use as Institutional Controls at East Elliott:

- Fencing
- Warning Signs
- Display Boards
- Public Awareness Training
- Legal Controls
- Land Acquisition

4.3.2.2.2 **Fencing**. Fencing for perimeter applications typically consists of a 6-foot-high chain-link fence constructed to deny access to the area of concern. Six-foot-high chain-link fencing would meet the standard of perimeter fencing for many military applications (AFSC, 1996). Metal warning signs would be attached to the fence at 200-foot intervals.

4.3.2.2.3 Fencing would reduce the risk that a person would encounter UXO. However, according to the *Ordnance and Explosive Waste Risk Assessment Technical Bulletin* (Department of the Army, 1993a), "fencing is used to provide a small measure of site isolation from civilian trespassing." The document cited, however, does not distinguish between typical three-strand barbed wire range fencing and the chain-link fencing as proposed in Section 4.3.1. Chain-link fencing is highly effective in deterring entrance to the site by the segment of the population that is generally law-abiding, and/or the casual site visitor. For those who have a specific purpose to enter the site or do not respect fenced boundaries, fencing would be largely ineffectual. Because East Elliott is a popular location for many recreational activities such as rock climbing and ORV use, as well as illicit activities such as refuse dumping and under-age drinking, it is likely that the fencing would be cut or otherwise vandalized in some locations to provide access to the site, which would reduce the effectiveness of this technology. Also, installation of fencing would be difficult, given the rough terrain and dense vegetation at the site.

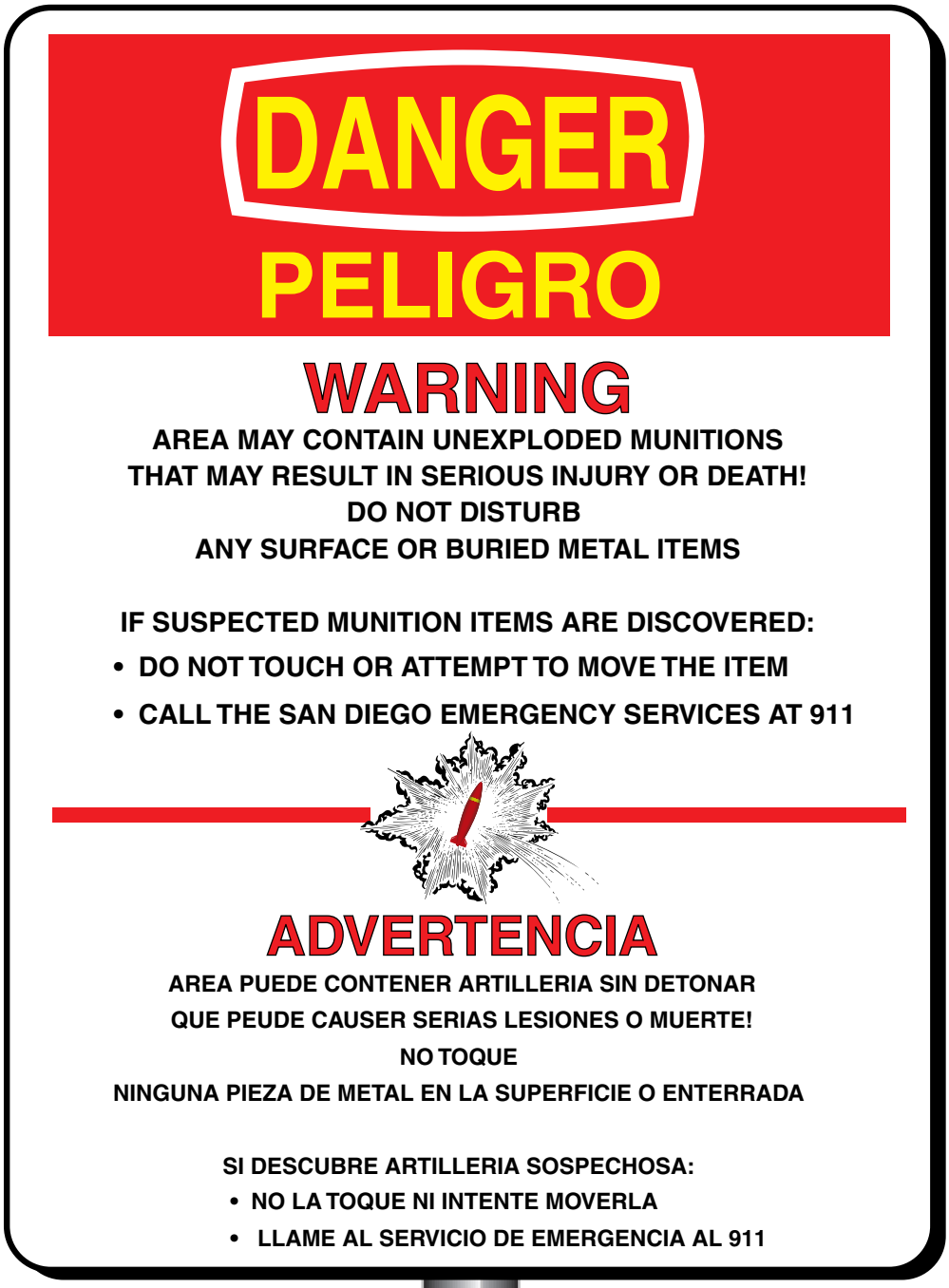
4.3.2.2.4 Fence lines would restrict access to private property owners as well as to people who currently use the area for recreational purposes. Thus, public reception to fencing is likely to be unfavorable and would likely incur legal challenges. Fencing would also restrict movement

of mammals and would likely require the development of an ecological assessment to address the impacts to area wildlife. In the MSCP, it is recommended that wildlife movement not be restricted, particularly within Oak and Spring canyons (Sectors 1 and 3). Wildlife (and people) can presently travel between Mission Trails Regional Park and East Elliott via underpasses beneath State Highway 52. Fencing may also restrict the ability to fight brush fires and may be deemed an unfavorable alternative by local fire fighting districts.

4.3.2.2.5 Because the establishment of perimeter fencing would require pre-construction surveying, installation, the use of UXO avoidance and brush clearance teams, and regular maintenance, the cost of fencing would be expected to be relatively high. Given the length of sector perimeters, the cost of fencing would be prohibitive, ranging from $1.3 to $2.1 million for each of the four sectors and $2.8 million for the site perimeter as a whole. Preliminary costs of fence installation and operation and maintenance (O&M) for all sectors is provided in Table D-1 of Appendix D.

4.3.2.2.6 Because of relatively low effectiveness, difficulty of implementation, and high cost, fencing is not considered an optimal component of the institutional controls at this site and is eliminated from further consideration.

4.3.2.2.7 **Warning Signs and Display Boards.** Warning signs would include clearly worded information to warn the public that UXO may be present, to emphasize the potential risk should UXO be encountered, to describe appropriate actions to prevent exposure, and to provide a point of contact for notification in case of the discovery of OE, or in case of accidental exposure. An example of a UXO warning sign is provided on Figure 4-2. Typical sign locations would include points at which dirt roads and trails cross the sector boundaries and high use areas. Because of the high degree of use and accessibility to East Elliott along the segment of Mast Boulevard near the southern boundary of Sector 4, signs would be posted at 200-foot intervals in this area. However, this proposed use of warning signs does not include signs at regular intervals around the entire sector perimeter. Based on a review of site maps and land use patterns, the



Approximate size: 24 inches x 18 inches

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FORMER CAMP ELLIOTT (EAST ELLIOTT)

WARNING SIGN EXAMPLE

FIGURE 4-2

estimated number of signs required for each sector (if each sector is addressed separately) is provided in Table 4-2.

TABLE 4-2

ESTIMATED NUMBER OF WARNING SIGNS POSTED BY SECTOR FORMER CAMP ELLIOTT (EAST ELLIOTT)

Sector	No. of Warning Signs to be Posted in High Use Areas
1	15
2	15
3	13
4	38

4.3.2.2.8 If the installation of warning signs were selected for all sectors of East Elliott, the need for warning signs at internal sector borders would be eliminated. This would reduce the overall number of warning signs needed at the site as a whole. Under this scenario, the estimated number of signs for each sector is provided in Table 4-3.

TABLE 4-3

ESTIMATED NUMBER OF WARNING SIGNS FOR ALL SECTORS FORMER CAMP ELLIOTT (EAST ELLIOTT)

Sector	No. of Warning Signs to be Posted in High Use Areas[a]
1	8
2	3
3	5
4	30
Total	46

[a] Number of signs posted in each sector is based on signs being posted in all sectors at East Elliott.

4.3.2.2.9 In addition to posting signs, display boards may be installed at or near main entrances of each sector and at locations of greatest public use within East Elliott, such as the area used by rock climbers in Sector 4. The display boards would contain more detailed

information than what is included in the warning signs. The displays would also convey such pictorial information as images of UXO and other OE that are the most likely to be encountered and simple maps showing areas of greatest concern. This information would be based on the results of the 1996 site investigation (CMS, 1997) and the risk analysis in Section 2.4 of this EE/CA. The large format of the display boards (probably 4 feet by 6 feet) and graphic nature would likely serve to convey the dangers of UXO more effectively than the standard warning signs. Figure 4-3 is an example of a display board. The estimated number of display boards required for each sector (if each sector is addressed separately) is provided in Table 4-4. The estimated number of display boards posted in each sector is based on a review of site maps and associated land use patterns.

TABLE 4-4

ESTIMATED NUMBER OF DISPLAY BOARDS TO BE CONSTRUCTED BY SECTOR FORMER CAMP ELLIOTT (EAST ELLIOTT)

Sector	No. of Display Boards to be Constructed in High Use Areas
1	1
2	2
3	1
4	9

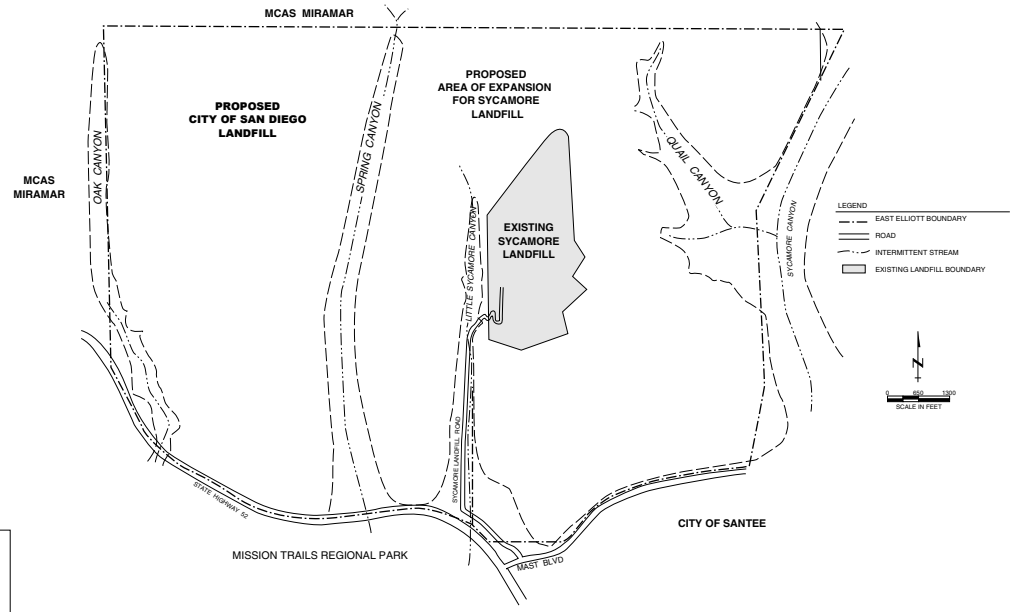
4.3.2.2.10 If the installation of display boards were selected for all sectors of East Elliott, the need for a display board at an internal border of Sector 4 would be eliminated. This would reduce the overall number of warning signs needed at the site as a whole by one board for a total of 12 boards.

4.3.2.2.11 Effectiveness, implementability, and cost of warning signs and display boards are discussed in Sections 4.3.2.2, 4.3.2.3, and 4.3.2.4, respectively. Because warning signs and display boards meet the evaluation criteria, these institutional control technologies are retained for further consideration in this EE/CA.

Unexploded Ordnance and Munitions Hazards at East Elliott

This area of San Diego known as East Elliott was once part of Camp Elliott. Camp Elliott was 30,050-acre Marine Corps Training Camp used by the Second Marine Division during World War II for activities that included artillery and tank training. At the height of World War II, in a period of a little over one year, 50,000 officers and enlisted men from Camp Elliott were dispatched to combat zones. During training exercises, weapons ranging from small arms to large artillery pieces were used.

Although encounters with unexploded shells (ordnance) at East Elliott are rare, there is still a chance of an encounter during any kind of activity at East Elliott. Unexploded ordnance buried beneath the ground surface could be exposed due to natural erosion or human-induced disturbance. Unexploded ordnance varies in size and shape and may be in rusty condition. Unexploded ordnance could still explode if handled, resulting in severe injury or death.



If any suspected ordnance items are discovered:

- Do not attempt to touch or move the item
- Call the San Diego Emergency services at 911

Si descubre artilleria sospechosa:

- No la toque ni intente moverla
- Llame al servicio emergencia al 911

[Note: Photographs of typical ordnance are to be included in the above space.]

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FORMER CAMP ELLIOTT (EAST ELLIOTT)
DISPLAY BOARD EXAMPLE

FIGURE 4-3

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4.3.2.2.12 Public Awareness Training. Public awareness training would consist of periodic public meetings in areas where potentially affected people live (i.e., population centers in the vicinity of East Elliott, West Hills Park, or Mission Trails Regional Park) or work (e.g., the Sycamore Landfill). These meetings would be offered free of charge to any interested parties and would explain the hazards associated with potential UXO at the site, identify procedures to limit potential exposure, and identify actions to be taken in case of discovery of or exposure to UXO. Awareness training for the general public would be held periodically based on the level of interest expressed and to address changes and shifts in population or land use. For the purpose of preparing a cost estimate (Section 4.3.2.4), it is assumed that awareness training for landfill workers and/or the general public would be held annually. Informational materials used for the public awareness training would be developed for each of the two target audiences, landfill workers and the general public. In addition, public awareness training for UXO hazards would be provided on a regular basis for the students of West Hills High School.

4.3.2.2.13 Effectiveness, implementability, and cost of awareness training are discussed in Sections 4.3.2.3, 4.3.2.4, and 4.3.2.5, respectively. Because awareness training meets the evaluation criteria, this institutional control technology is retained for further consideration in the EE/CA.

4.3.2.2.14 Legal Controls. Legal controls are non-physical methods to control access or use of properties suspected of containing UXO. Legal controls may include land use restrictions and deed notification.

4.3.2.2.15 Land use restrictions, such as changes in the current zoning, would limit use and development of properties. Land use restrictions could be enacted that specify that UXO clearance be conducted as construction support during property improvements or that bar improvements entirely. The limitation for each sector or portion of a sector would be identified based on the exposure pathways and density of OE identified at the site. The effectiveness of land use restrictions depends on state and local laws, and awareness and enforcement of the restrictions. Property disclosure requirements (deed notification) would stipulate that potential

purchasers of the land be informed of the UXO that may be present at the subject parcel and any restrictions on development and use of the parcel.

4.3.2.2.16 Land use restrictions that either ban development or change construction approaches (such as mandatory UXO clearance during intrusive activities) would reduce the potential of an encounter with subsurface UXO. Other means of reducing contact with UXO by the general public (such as fencing or UXO clearance) or changing the behavior or site users (such as signs, display boards, or awareness training) should be undertaken in conjunction with legal controls.

4.3.2.2.17 Implementing legal controls would restrict the rights of the private property owners and would probably result in legal challenges. Cooperation of local officials to enforce the legal controls would also be required in perpetuity, complicating implementation. Because of the wide range of legal challenges by property owners that may occur if legal controls are implemented, cost estimates of this institutional control action were not developed.

4.3.2.2.18 Because of relatively low effectiveness and likely extensive (and therefore costly) legal challenges, legal controls as a potential institutional control action is eliminated from further consideration in this EE/CA.

4.3.2.2.19 **Land Acquisition.** Land acquisition would consist of government entities acquiring the parcels of land constituting whole sectors or portions of sectors at fair market value. Per the MSCP Plan (Ogden Environmental, 1996), the estimated value of undeveloped land in the San Diego area ranges from $9,700 to $13,300 per acre. A review of San Diego County Assessor's Office parcel transaction records for East Elliott from January 1994 through May 1997 indicates a maximum per-acre price of $16,434. During this period, 31 (or 20 percent) of the 165 parcels that constitute East Elliott were sold.

4.3.2.2.20 Changes in land use through land acquisition would restrict intrusive activities such as construction, and therefore would reduce the potential of an encounter with subsurface

UXO. However, because land acquisition itself would have no effect on reducing access to or modifying behavior of the general public, other means of reducing contact with UXO (such as fencing or OE clearance) or modifying behavior (such as with signs, display boards, or awareness training) would be required in conjunction with land acquisition.

4.3.2.2.21 If sufficient funds are available, land acquisition by the government would be largely implementable, given the volume of recent property transactions at the site. This indicates that there are likely a large number of willing sellers at the site. However, complete acquisition of all parcels may require the government to exercise some legal means to force sales. This would likely result in legal challenges.

4.3.2.2.22 Assuming a per-acre cost of approximately $16,400 based on the maximum per-acre sales price of parcels sold from January 1994 through May 1997, acquisition of Sectors 3 and 4 would cost approximately $12,000,000 and $17,000,000, respectively. This assumes that parcel prices would not be affected by a focused effort to acquire entire sectors. Under this scenario, prices are likely to increase. The acquisition of some parcels in Sectors 1 and 2, which are not anticipated to be incorporated into landfills, would also be required. These areas in Sectors 1 and 2 total 50 and 150 acres, respectively. At the above per-acre costs, these unincorporated parcels in Sectors 1 and 2 would be worth $820,000 and $2,500,000, respectively.

4.3.2.2.23 Because of non-effectiveness (as a sole action) and high costs (which may increase with legal challenges), land acquisition as a institutional control action is eliminated from further consideration in this EE/CA.

4.3.2.3 Effectiveness

4.3.2.3.1 The overall effectiveness of institutional controls is based on the cumulative effect (Figure 4-1) of the three conditions required to complete the exposure pathway. These conditions are the presence of UXO; access to the UXO; and disturbance or handling of the UXO such that

detonation occurs. Institutional controls have the greatest effect on access to the UXO and the disturbance and handling of the UXO. The effectiveness of institutional controls is also impacted by the implementation of the institutional control plan that establishes the means and authorities by which the technologies will be implemented (Section 4.3.2.2). The effect of the retained institutional control technologies on each condition is discussed in the following paragraphs.

4.3.2.3.2 Institutional controls would not reduce the amount of OE present at the site; therefore the presence of UXO hazards would remain at 100 percent of the current level for the site.

4.3.2.3.3 **Warning Signs, Display Boards, and Awareness Training.** The installation of warning signs and display boards is primarily meant to change the behavior of people such that contact with OE is reduced and that any UXO encountered is not accidentally disturbed or handled. By conveying potential risk information by use of warning signs, display boards, and public awareness, people may choose not to enter the area and thereby minimize the opportunity for public encounter with UXO. This reduction in potential contact may be offset by the unwanted function of signs and display boards acting as an attractive nuisance, especially to children and young adults.

4.3.2.3.4 Little research has been done on the effectiveness of signs and training in preventing accidents or in initiating safe behavior (Haynes, 1981; Racicot and Wogalter, 1995; Wogalter and Young, 1991; Wogalter, et al., 1987; Friedmann, 1988; Wogalter, et al., 1989). Although this research did not specifically address the hazards associated with UXO, the general effectiveness of signs and training can be used to estimate the effectiveness of these measures in reducing the potential for UXO to be disturbed. Studies on the effectiveness of warning signs have shown varying results, indicating that a 15 percent to 75 percent compliance with warning signs may be experienced, although non-compliance does not indicate that an accident will occur. Some of the factors that may influence the effectiveness of warning include placement, social influences, severity of consequences for non-compliance, inclusion of pictorials, voice

accompaniment, and cost of compliance. Based on a conservative comparison between the situation at East Elliott and situations presented in various research articles, posting warning signs is estimated to reduce the risk of a person accidentally disturbing or handling UXO by about 20 percent. Estimated risk reduction for each of the sectors based on implementation of warning sign and display board technologies is presented in Table 4-5.

TABLE 4-5

ANTICIPATED RISK REDUCTION FOR ALL ACTIVITIES[a]
WARNING SIGNS AND DISPLAY BOARDS
FORMER CAMP ELLIOTT (EAST ELLIOTT)

Sector	No Action[a] (Exposures/Year)	Installation of Warning Signs and Display Boards (Exposures/Year)	Percent Risk Reduction[b]
1	12,618	10,094	20
2	15,968	12,774	20
3	0	0	- -
4	53,582	42,866	20
Total	82,168	65,734	20

[a] Includes estimated exposures for recreational and construction activities (Tables 2-8 and 2-9).
[b] Relative to No Action.

4.3.2.3.5 Awareness training reduces the frequency of potentially unsafe behavior by about 25 percent. However, attendance at public awareness training sessions is anticipated to be low relative to the estimated 50,000 annual visitors (Appendix C), and it would be effective only for those individuals who attended. Therefore, it is assumed that only an additional 5 percent reduction in risk is expected based on public awareness training (it is assumed that those people who do attend the training sessions are users of the area). Risk reduction for each of the sectors based on implementation of awareness training in addition to warning signs and display boards is presented in Table 4-6.

TABLE 4-6

ANTICIPATED RISK REDUCTION FOR ALL ACTIVITIES[a]
WARNING SIGNS, DISPLAY BOARDS, AND AWARENESS TRAINING
FORMER CAMP ELLIOTT (EAST ELLIOTT)

Sector	No Action[a] (Exposures/Year)	Installation of Warning Signs and Display Boards with Awareness Training (Exposures/Year)	Percent Risk Reduction[b]
1	12,618	9,464	25
2	15,968	11,976	25
3	0	0	- -
4	53,582	40,187	25
Total	82,168	61,627	25

[a] Includes estimated exposures for recreational and construction activities (Tables 2-8 and 2-9).
[b] Relative to No Action.

4.3.2.3.6 Attendance at mandatory awareness training at schools would be high, though the school training would likely be relatively less effective because attendance would be compulsory. Combining the effects of warning signs, display boards, and public awareness training, these technologies are estimated to result in an overall 25 percent reduction in the risk of OE (i.e., UXO exposure), to 75 percent of the current level of risk.

4.3.2.4 Implementability

4.3.2.4.1 The following sections outline the implementability of the retained institutional control technologies. Implementability consists of the technical and administrative feasibility, the availability of necessary equipment and services, and the potential for community acceptance of the institutional control technology in question, and is assessed on a qualitative basis.

4.3.2.4.2 Warning Signs and Display Boards. For any of the four sectors defined within East Elliott, installing signs and display boards would be easily implemented. The manufacture and installation of signs and display boards can be contracted to a local sign-making company, of which there are several in the area. The use of a UXO avoidance team would be necessary for clearing sign and display board locations because the installation of the signs and display boards

constitutes intrusive activity. Because warning signs and display boards would be installed along main trails and roads and in areas of greatest public use, no brush clearing would be necessary and most locations would likely be immediately accessible by vehicles. Routine maintenance of the display signs and boards would be necessary, but given the numbers of signs and display boards required for each sector (see Section 4.3.2), maintenance would be easily implemented. It is proposed that the signs and display boards be maintained by the City of San Diego as is being done in the Tierrasanta community. As an alternative, the City of Santee may be authorized to maintain warning signs in Sector 4 (adjacent to the City of Santee and West Hills High School). The responding agency for any reports of OE found by site visitors would be the San Diego County Sheriff's and/or Fire Department. The Sheriff's Department has already served in this capacity at East Elliott (Table 2-3).

4.3.2.4.3 Public Awareness Training. Developing and conducting public awareness training would be easily implemented. CESPL or a consultant could conduct the public awareness training, and materials for presentations are available from CEHNC. The presentation approach and materials would have to be developed to suit each target audience (e.g., the general public, high school students, and landfill workers). Facilities for the training courses would be provided by the Tierrasanta Branch Library, West Hills High School, and/or Sycamore Landfill. Presentation of the awareness training would have to be offered on a regular (i.e., annual) basis.

4.3.2.5 Cost

4.3.2.5.1 The following sections outline the costs of the retained institutional control technologies over a period of 30 years. Approximate costs for selected institutional control technologies are in Appendix D, Tables D-2 through D-4.

4.3.2.5.2 Warning Signs, Display Boards, and Public Awareness Training. The cost of designing, manufacturing, installing, and maintaining warning signs and display boards is low compared to the cost of access restrictions (i.e., fencing), mainly due to the relative ease of implementability and low number of items to be installed. Approximate costs of installation of

warning signs and display boards for all sectors are in Tables D-2 and D-3, respectively, in Appendix D. Costs for installation and maintenance of signs would be relatively low, ranging from approximately $12,000 to $31,000 per sector, and $37,000 for the entire site. The approximate cost of display boards would be higher, ranging from $15,000 to $90,000 per sector, and $118,000 for the entire site. Administrative costs for obtaining access agreements for the installation of these items would be approximately 10,000 per sign. Maintenance of warning signs and display boards would probably be required for a period of 30 years after installation. The cost of developing and conducting public awareness training is also relatively low, as shown in Table D-4. The cost to develop and present one course per year would be approximately $56,000. Awareness training currently provided to students at West Hills High School will likely continue to be offered by the school district (Walker, pers. comm., 1997a). Annual awareness training for workers at the Sycamore Landfill and for the general public will probably be conducted for 30 years.

4.3.2.6 Selection of Institutional Control Strategies

4.3.2.6.1 The above analysis focuses on the technologies that comprise part of an institutional control plan. As stated in Section 4.3.2.2.1, other components include identifying the roles of the local institutions. However, for the purposes of this EC/CA, and based on the information currently available, this analysis provides a basis for decisions regarding proposed actions at East Elliott. Based on the effectiveness, implementability, and costs associated with the retained institutional control technologies, a combination of warning signs and display boards is recommended as part of the institutional control strategy at all of the sectors. Because of the relatively higher density of OE and use by either the general public and high school students (Sector 4) or landfill workers (Sector 2), awareness training is also recommended for Sectors 2 and 4. Because the proposed City of San Diego landfill is still in the pre-planning phase, awareness training for future site workers in Sector 1 was not considered. The selected institutional control technologies for each sector are summarized in Table 4-7.

TABLE 4-7

SELECTION OF TECHNOLOGIES FOR SECTOR-SPECIFIC INSTITUTIONAL CONTROL STRATEGIES FORMER CAMP ELLIOTT (EAST ELLIOTT)

Sector	Fencing	Warning Signs	Display Boards	Awareness Training	Legal Controls	Land Acquisition
1		√	√			
2		√	√	√		
3		√	√			
4		√	√	√		

4.3.2.6.2 The overall effectiveness of Institutional Controls was estimated by adding the effective risk level for each technology (see Tables 4-5 and 4-6) contributing to the selected institutional control at each sector. Using institutional controls would reduce the effective risk to 20 percent of the current level of risk for Sectors 1 and 3, and 25 percent of the current level of risk for Sectors 2 and 4.

4.3.2.6.3 Table 4-8 summarizes the total cost to implement Institutional Controls at Sectors 1 through 4 (as presented in Table 4-7). Table D-5 in Appendix D presents the assumptions used to develop institutional control costs, and Tables D-6 through D-9 provide detailed breakdowns of the initial and recurring costs and assumptions associated with institutional controls at each sector. The accuracy of the cost estimate is +50 percent to -30 percent, which represents the cost range.

TABLE 4-8

SUMMARY OF COST ESTIMATES FOR THE SECTOR-SPECIFIC INSTITUTIONAL CONTROL STRATEGIES FORMER CAMP ELLIOTT (EAST ELLIOTT)

Sector	Initial Cost[a]	Recurring Costs ($/year)	Net Present Worth	Cost Range
1	$238,000	$1,560	$423,000	$296,000 - $635,000
2	$257,000	$3,560	$495,000	$347,000 - $742,000
3	$212,000	$1,390	$377,000	$264,000 - $566,000
4	$671,000	$7,610	$1,255,000	$879,000 - $1,883,000

4.3.3 Alternative 3: Surface Clearance

4.3.3.0.1 Surface Clearance consists of a thorough visual inspection of the ground surface to detect UXO so that it can be safely recovered and/or destroyed. In areas where visual inspection is impaired, as by dense vegetation or irregular terrain, geophysical instruments can be employed for surface clearance. Geophysical instruments may also be used in areas containing sensitive habitat (e.g., coastal sage scrub). OE items detected during a surface clearance are flagged and investigated by a UXO-certified technician. UXO may be detonated in place or, if it is safe, moved to an on-site area specifically designated for destruction of recovered UXO items.

4.3.3.0.2 Surface clearance activities are summarized below. Site-specific factors that affect surface clearance are also discussed.

- The first step is to survey the area and establish a grid system for detecting and flagging OE.
- Debris and trash must be removed prior to surface clearance.
- Once the grid system has been established, brush and vegetation are thinned. Dense surface vegetation hinders visual and geophysical detection methods, lowering the effectiveness of surface clearance.
- After brush thinning and trash removal, 5-foot-wide search lanes are established covering the entire search grid. The search lanes establish spatial boundaries for search operations of each locator team and ensure that sweep coverage is

optimized. The ground surface is visually inspected to locate OE (or suspected debris) on the surface. Magnetometers may be used to detect OE in areas of heavy grass and brush. Locator teams use pin flags to mark OE detected during surface sweeps.

- A UXO team follows each locator team. The UXO team is composed of UXO-certified or EOD technicians capable of identifying and handling OE safely. The UXO team hand-excavates partially buried OE, inspects OE or non-OE scrap, and conducts removal or in-place detonation of UXO, as necessary.

4.3.3.0.3 A major factor in the effective removal of OE is the presence of locally thick brush throughout East Elliott. The majority of the site is currently covered by grassland, mixed chaparral, and sage scrub. The Surface Clearance alternative would require the thinning of the existing vegetation in 15 percent of each sector to facilitate the surface clearance of OE from the site. Sectors 1 and 3 would require extensive thinning of the heavy underbrush in both sectors, while moderate brush thinning would be required in Sector 2 (mostly grassland and sage scrub) and Sector 4 (grassland and mixed chamise chaparral). Brush thinning may be conducted concurrent with the surface removal effort. Photographs showing OE clearance activities are in Appendix A-5.

4.3.3.0.4 East Elliott has been the location of illicit dumping of abandoned autos, household trash, etc., particularly within Sector 4. Removal of debris from the surface would be required before the clearance teams could remove any OE beneath it. Debris collected from the site would be sent to a local landfill and/or recycling facility, as appropriate. In addition to visual identification, UXO locator teams may use metal detection devices, such as magnetometers, to search for ordnance under the remaining vegetation or non-metallic surface refuse.

4.3.3.0.5 UXO recovered during the surface clearance would be detonated in place or, if it is safe, moved to an on-site area specifically designated for destruction of recovered UXO items. UXO would be detonated after establishing a 1,250-foot-radius (minimum) public safety exclusion zone. Inert OE and metal scrap would be taken to local recycling centers after the items have been vented to ensure no explosive residue or other hazard exists. Another option is

to have the USACE certify the OE as inert, which would allow the scrap metal to be turned in to a Defense Reutilization and Marketing Office (DRMO).

4.3.3.0.6 The Surface Clearance alternative assumes that CESPL would maintain an on-site biologist and an archaeologist (Sector 4 only) for consultation during the surface clearance and would be responsible for any species relocation or protection of archaeological sites. Public access to individual sectors would be denied during surface clearance.

4.3.3.0.7 Because surface clearance was implemented during previous removal action efforts at the former Camp Elliott, this option has been retained in the EE/CA. Cost estimates for implementing removal action alternatives include brush thinning.

4.3.3.1 Effectiveness

4.3.3.1.1 Protection of Human Health and the Environment. Tables 4-9 and 4-10 present risk reductions for recreational users and construction workers, respectively, that would be achieved by conducting a surface clearance in the four sectors at East Elliott.

TABLE 4-9

ANTICIPATED RISK REDUCTION FOR RECREATIONAL ACTIVITIES
SURFACE CLEARANCE
FORMER CAMP ELLIOTT (EAST ELLIOTT)

Sector	No Action (Exposures/Year)	Surface Clearance (Remaining Exposures/Year)	Percent Risk Reduction[a]
1	8,419	1,110	87
2	9,452	668	93
3	0	0	- -
4	50,180	2,888	94[b]
Total	68,051	4,666	93

[a] Relative to No Action.
[b] Includes estimated risk reduction achieved during recent Time-Critical Removal Action.

TABLE 4-10

ANTICIPATED RISK REDUCTION FOR CONSTRUCTION SCENARIO SURFACE CLEARANCE FORMER CAMP ELLIOTT (EAST ELLIOTT)

Sector	No Action (Exposures/Year)	Surface Clearance (Exposures/Year)	Percent Risk Reduction[a]
1	4,199	2,603	38
2	6,516	1,873	71
3	0	0	- -
4	3,402	1,075	68[b]
Total	14,117	5,551	61

[a] Relative to No Action.
[b] Includes estimated risk reduction obtained during the recent Time-Critical Removal Action.

4.3.3.1.2 Using the OECert risk analysis, Surface Clearance would significantly reduce the total expected annual exposures to recreational users in Sectors 1, 2, and 4 and construction workers in Sectors 2 and 4. This result can be attributed to the fact that most of the recreational activities in East Elliott (excluding ORV use) would not result in any disturbance of subsurface OE, and that most of the OE in Sectors 2 and 4 was found on the surface. However, Surface Clearance provides a limited reduction in risk to construction workers in Sector 1, the proposed landfill site. Table 4-11 shows cumulative risk reduction for both recreational users and construction workers. From an overall risk perspective, Surface Clearance would provide measurable protection of human health and the environment in Sectors 1, 2, and 4. It has already been completed in much of Sector 4 as a Time-Critical Removal Action (Section 2.4.2). No risk reduction is observed for Sector 3 due to the lack of surface OE encountered during OE sampling. Surface Clearance is not retained for Sector 3.

TABLE 4-11

ANTICIPATED RISK REDUCTION FOR ALL ACTIVITIES
SURFACE CLEARANCE
FORMER CAMP ELLIOTT (EAST ELLIOTT)

Sector	No Action (Exposures/Year)[a]	Surface OE Removal (Exposures/Year)	Percent Risk Reduction[a]
1	12,618	3,713	71
2	15,968	2,541	84
3	0	0	- -
4	53,582	3,963	93[b]
TOTAL	82,168	3,963	88

[a] Includes estimated exposures for recreational and construction activities.
[b] Includes estimated risk reduction obtained during the recent Time-Critical Removal Action.

4.3.3.1.3 Compliance with ARARs. The majority of the area encompassed by East Elliott is covered by the MSCP Plan. With regard to compliance with ARARs, a surface clearance would impact sensitive biological resources within East Elliott. The surface clearance would involve thinning of selected stands of vegetation to permit visual observation and use of magnetometers, as required. Brush thinning may reduce the current population of coastal sage scrub, which provides valuable habitat for the California gnatcatcher, a federal threatened species and California species of special concern. The coastal sage scrub habitat is one of the rarest and most endangered habitats in the state of California. Other sensitive plant species identified in the vicinity of East Elliott include the willowy monardella. In addition, OE removal operations must be scheduled around the nesting season of the California gnatcatcher.

4.3.3.1.4 Long-Term Effectiveness. The long-term effectiveness of this alternative appears to be high for Sectors 1, 2, and 4 where most of the surface OE was encountered. The majority of the OE discovered in Sectors 1, 2, and 4 is located on the ground surface and would be permanently removed by implementing Surface Clearance. Again, this alternative would not be effective in Sector 3 due to the lack of UXO. Implementation of Alternative 3 would not reduce the potential exposures resulting from subsurface UXO that may be present at East Elliott. Given the anticipated future land uses, long-term residual risk would remain at East Elliott with

surface clearance, particularly to construction workers and recreational users engaging in activities that disturb the surface.

4.3.3.1.5 Short-Term Effectiveness. Surface Clearance does not score high in terms of short-term effectiveness given that there is considerable potential for adverse effects to the environment during the surface removal. The implementation period of this alternative would not be short. Using multiple EOD teams, surface clearance at East Elliott could take 9 months to nearly 2 years per sector, depending on the sector where the alternative is implemented.

4.3.3.2 Implementability

4.3.3.2.1 Technical Feasibility. From a technical perspective, implementation of Surface Clearance is feasible. UXO clearance has been completed at the former Camp Elliott in the past.

4.3.3.2.2 Administrative Feasibility. The administrative feasibility (i.e., implementability) of this alternative is somewhat less straightforward. During the 1996 site investigation, recreational users (hikers, bikers, and rock climbers) at East Elliott were resistant to efforts made to keep them out of restricted areas during OE survey activities and disposal. This would cause the UXO contractor to expend additional effort in site control and security. However, East Elliott is not a designated park, and there are only a small number of people using the area compared to Mission Trails. Rights-of-entry must also be obtained to remove OE from private property. Conservation of ecological resources in all sectors and of the archeological site in Sector 4 must also be emphasized.

4.3.3.2.3 Availability of Services and Materials. Personnel and technology required to implement Alternative 3 are readily available. Power transmission lines required for implementation of this alternative are available at the site. Inert OE scrap can also be transported to the Sycamore Landfill recycling facility. All four sectors at East Elliott are accessible through existing roadways and off-road tracks.

4.3.3.3 Cost

4.3.3.3.1 Table 4-12 summarizes the costs to implement Surface Clearance at Sectors 1, 2, and 4. These include costs associated with surface clearance of 900 acres in Sector 4, which has already been implemented. Based on the OECert risk analysis, surface removal would not be effective in reducing potential exposures in Sector 3, so no costs are included. The accuracy of the cost estimate is +50 percent to -30 percent, which represented by the cost range in the table. Cost assumptions for all clearance alternatives are presented in Table E-1 of Appendix E. Tables E-2 through E-4 in Appendix E detail the initial and PRSC, or recurring, costs associated with Surface Clearance. This estimate is based on performing separate surface removals for the three sectors mentioned. If surface removals of these three sectors were accomplished at the same time and under one contract, some of the administrative costs could be pooled (e.g., work plans, final report, site setup, and mobilization/demobilization).

TABLE 4-12

SUMMARY OF COST ESTIMATES FOR SURFACE CLEARANCE FORMER CAMP ELLIOTT (EAST ELLIOTT)

Sector	Initial Cost	Recurring Costs ($/year)	Present Net Worth	Cost Range
1	$1,606,000	$150,000	$5,757,000	$4,030,000 - $8,636,000
2	$1,055,000	$87,400	$3,546,000	$2,482,000- $5,319,000
4	$2,200,000[a]	$210,000	$7,983,000 [a]	$5,588,000 - $11,975,000[a]

[a] Includes costs for surface OE removal performed during the Time-Critical Removal Action.

4.3.3.3.2 Brush thinning contributes significantly to the overall cost of removal action alternatives for each sector. Depending on the sector, costs for brush thinning account for 20 to 30 percent of the total cost of Surface Clearance.

4.3.4 Alternative 4: Surface and Subsurface Clearance to a Depth of 1 Foot

4.3.4.0.1 Alternative 4 consists of surface and subsurface clearance of OE to a depth of 1 Foot bgs. Subsurface clearance to 1 foot bgs was considered for the following reasons:

- The 1996 site investigation (CMS, 1997) indicated that the majority of OE encountered at East Elliott was either on the surface or within the top few inches below the ground surface (Appendix B).
- Subsurface disturbance is expected from ORV use, children's play, and construction activities (i.e., landfill or residential development).

4.3.4.0.2 Prior to clearance activities, brush thinning would be performed to provide the necessary visibility and access to effectively locate OE and UXO. To facilitate subsurface clearance, approximately 30 to 50 percent of the brush would be removed. Surface and subsurface clearance operations would then begin by establishing 100- by 100-foot grids within the sector and providing survey control. Each grid would be further subdivided into search lanes as described in Section 4.3.3. UXO-qualified teams would then use visual observation and geophysical instruments to sweep each lane for surface and subsurface OE. One UXO supervisor would be assigned to each 6-person team.

4.3.4.0.3 During the sweep, all visible surface OE and related scrap would be marked with color-coded pin flags. Additional surface OE and subsurface anomalies would also be located using geophysical instruments and flagged. Different geophysical methods are used to detect OE. Each method has its own advantages and limitations. Magnetometers measure the magnetic field produced by buried ferrous objects. They must be sensitive enough to distinguish between the relatively weak magnetic field of the ferrous object and the much stronger magnetic field produced by the earth. Gradiometers use two magnetic sensors to measure the difference in the magnetic field over a fixed distance, rather than the absolute magnetic field. Magnetometers and gradiometers are well suited to detecting ferrous munitions to depths of 6 to 10 feet (Young and Helms, 1997).

4.3.4.0.4 Following the sweep, UXO teams would subsequently conduct an intrusive investigation in which the anomalies identified by pin flags would be excavated. Earth-moving machinery may be used to remove soil and rocks from the vicinity of the OE to allow access for hand excavation. UXO found during the surface sweep and intrusive investigation would be relocated, if safe to move, or detonated in place.

4.3.4.0.5 Refuse collected from the site would be sent to a local landfill and/or recycling facility as appropriate. After detonation, inert OE and metal scrap would be taken to local recycling centers after the items have been vented to ensure no explosive residue or other hazard exists. Another option is to have the USACE certify the OE as inert, which would allow the scrap metal to be turned in to a local DRMO.

4.3.4.1 Effectiveness

4.3.4.1.1 Protection of Human Health and the Environment. Tables 4-13 and 4-14 present risk reductions for recreational users and construction workers, respectively, that would be achieved by conducting surface and subsurface clearance to 1 foot bgs in the four sectors at East Elliott.

TABLE 4-13

ANTICIPATED RISK REDUCTION FOR RECREATIONAL ACTIVITIES SURFACE AND SUBSURFACE CLEARANCE TO A DEPTH OF 1 FOOT FORMER CAMP ELLIOTT (EAST ELLIOTT)

Sector	No Action (Exposures/Year)	Surface and Subsurface Clearance (Remaining Exposures/Year)	Percent Risk Reduction[a]
1	8,149	441	95
2	9,452	301	97
3	0	0	- -
4	50,180	1,548	97[b]
Total	68,051	2,290	95

[a] Relative to No Action.
[b] Includes estimated risk reduction obtained during surface clearance performed during the recent Time-Critical Removal Action.

TABLE 4-14

ANTICIPATED RISK REDUCTION FOR CONSTRUCTION SCENARIO SURFACE AND SUBSURFACE CLEARANCE TO A DEPTH OF 1 FOOT FORMER CAMP ELLIOTT (EAST ELLIOTT)

Sector	No Action (Exposures/Year)	Surface and Subsurface Clearance (Remaining Exposures/Year)	Percent Risk Reduction[a]
1	4,199	278	93
2	6,516	370	94
3	0	0	- -
4	3,402	196	94[b]
Total	14,117	844	94

[a] Relative to No Action.
[b] Includes estimated risk reduction obtained during surface clearance performed during the recent Time-Critical Removal Action.

4.3.4.1.2 According to the OECert risk analysis, Surface and Subsurface Clearance to a Depth of 1 Foot is slightly more effective than Surface Clearance at reducing annual exposures to UXO (Tables 4-9 and 4-10). A 1-foot subsurface clearance would result in additional 13, 12, and 4 percent reductions in potential exposures in Sectors 1, 2, and 4, respectively. This is related to the predominance of OE encountered in the shallow subsurface and the limited depth of disturbance from recreational activities. The reduction in recreational risk is primarily related to ORV use. This alternative provides a larger (23 to 55 percent) increase in the risk reduction for construction workers. Table 4-15 shows the cumulative risk reduction for both recreational users and construction workers.

TABLE 4-15

ANTICIPATED RISK REDUCTION FOR ALL ACTIVITIES SURFACE AND SUBSURFACE CLEARANCE TO A DEPTH OF 1 FOOT FORMER CAMP ELLIOTT (EAST ELLIOTT)

Sector	No Action (Exposures/Year)[a]	Surface OE Removal (Exposures/Year)	Percent Risk Reduction[a]
1	12,618	719	94
2	15,968	671	96
3	0	0	- -
4	53,582	1,744	97[b]
Total	82,168	3,134	96

[a] Includes estimated exposures for recreational and construction activities.
[b] Includes estimated risk reduction obtained during surface clearance performed during the recent Time-Critical Removal Action.

4.3.4.1.3 Given that a 1-foot subsurface clearance results in additional protection of human health from exposures to UXO, Surface and Subsurface Clearance to a Depth of 1 Foot is retained for Sectors 1, 2, and 4. Again, no UXO was encountered in Sector 3, so this alternative is not retained for Sector 3 in this EE/CA. Section 5.0 discusses the cost-benefit analysis of implementing Surface and Subsurface Clearance to a Depth of 1 Foot.

4.3.4.1.4 Compliance with ARARs. This alternative is similar to Surface Clearance (Alternative 3) in terms of compliance with ARARs, but the greater damage to the environment due to OE excavation will make compliance with the requirements for preservation of ecological resources more difficult. However, approved brush thinning plans and consultation with an on-site biologist prior to implementing this alternative will most likely minimize the impacts to sensitive habitat and species. Also, brush thinning performed in late 1996 was only slightly visible during a site visit in July 1997. Significant revegetation had already occurred.

4.3.4.1.5 Long-Term Effectiveness. The long-term effectiveness of this alternative appears to be high for Sectors 2 and 4. The majority of the OE discovered in these sectors is

located within 1 foot of the ground surface and would be permanently removed by implementing subsurface clearance.

4.3.4.1.6 Short-Term Effectiveness. Surface and Subsurface Clearance to a Depth of 1 Foot (like Surface Clearance) does not provide much short-term effectiveness given that there is considerable potential for adverse effects to the environment during the 1-foot clearance. The implementation period of this alternative would be longer than that associated with surface removal. Surface and subsurface clearance at East Elliott would take approximately 1 to 3 years per sector, depending on the sector where the alternative is implemented and the number of teams used.

4.3.4.2 Implementability

4.3.4.2.1 Technical Feasibility. From a technical perspective, the implementation of a surface and subsurface clearance of the East Elliott sectors is feasible, as demonstrated by HFA, who conducted the Construction Support at the Sycamore Landfill in 1998.

4.3.4.2.2 Administrative Feasibility. The administrative feasibility of implementing Surface and Subsurface Clearance to a Depth of 1 Foot is the same as that for Surface Clearance, in that the recreational users may raise objections to temporarily restricting areas within East Elliott. This would increase cost to the ordnance contractor for security to control the public safety exclusion zone. However, East Elliott is not a designated park, and there are fewer people using the area than using Mission Trails Regional Park. Conservation of ecological resources and the archeological site in Sector 4 must also be emphasized.

4.3.4.2.3 Availability of Services and Materials. Personnel and technology required to implement Alternative 4 are readily available. Power lines and scrap metal recycling required for implementation of Surface and Subsurface Clearance to a Depth of 1 Foot are available at the site. Access to the site is available through existing roadways.

4.3.4.3 Cost

4.3.4.3.1 Table 4-16 summarizes the costs to implement Surface and Subsurface Clearance to a Depth of 1 Foot at Sectors 1, 2, and 3 at East Elliott. Tables E-5 through E-7 in Appendix E detail the initial and recurring costs associated with this alternative. The accuracy of the cost estimate is +50 percent to -30 percent, which is represented by the cost range in Table 4-16. This estimate is based on performing separate surface clearance and 1-foot subsurface removals for the three sectors mentioned. If removal actions at the three sectors were accomplished at the same time and under one contract, some of the administrative costs could be pooled (e.g., work plans, final report, site setup, and mobilization/demobilization). Cost assumptions are included in Table E-1.

TABLE 4-16

SUMMARY OF COST ESTIMATES FOR SURFACE AND SUBSURFACE CLEARANCE TO A DEPTH OF 1 FOOT FORMER CAMP ELLIOTT (EAST ELLIOTT)

Sector	Initial Cost	Recurring Costs ($/year)	Net Present Worth	Cost Range
1	$7,409,000	$150,000	$15,042,000	$10,530,000 - $22,563,000
2	$4,404,000	$87,400	$8,905,000	$6,233,000 - $13,358,000
4	$6,844,000[a]	$210,000	$15,413,000[a]	$10,789,000 - $23,120,000[a]

[a] Includes costs for surface OE removal performed during the Time-Critical Removal Action.

4.3.5 Alternative 5: Construction Support

4.3.5.0.1 This alternative involves surface and subsurface clearance of OE to support grading, construction, or other ground-disturbing activities such as landfill or building construction. The City of San Diego has identified Sector 1 as a potential site for a new landfill and construction plans are underway for expansion of the Sycamore Landfill in Sector 2. Because of the potential for excavation to occur in anticipation of this land use, the Construction Support alternative has been identified.

4.3.5.0.2 Clearance for Construction Support would be conducted in phases corresponding with the expansion phases of each landfill. Based on the current expansion underway at the Sycamore Landfill, expansion cells would be 50 to 100 acres each with associated access roads. Based on recent construction support activities elsewhere, construction support activities at East Elliott would be conducted to an estimated depth of 3 feet bgs.

4.3.5.0.3 The purpose of this action is to provide for safety of the construction workers from UXO-related incidents. Under this alternative, UXO support teams (two to four UXO-qualified personnel) would work directly with construction crews to clear the surface of OE, to perform UXO avoidance activities for borehole locations, to locate and to excavate subsurface anomalies, and to perform other OE-related activities prior to disturbing the ground during grading and excavating. Construction support would also include 30 to 50 percent brush removal as required. OE recovered during the surface clearance would be detonated in place by the UXO team if not safe to move to an on-site area specifically designated for destruction of recovered UXO items. Detonated OE and metal scrap would be taken to local recycling centers after the items have been vented to ensure no explosive residue or hazard exists. Another option would be to have the USACE certify OE as inert or scrap, which may then be taken to a local DRMO. Following surface clearance, UXO teams would be responsible for continuous detection of OE that may be present in subsurface soils as excavation proceeds. The UXO team would excavate each subsurface anomaly and detonate in place any UXO encountered. Only after an anomaly has been recovered and destroyed or identified as non-hazardous would the excavation work continue in the area.

4.3.5.0.4 The landfill operators would be responsible for proper disposal of excess soils excavated during landfill construction. Refuse collected from the site would be sent to a local landfill and/or recycling facility as appropriate.

4.3.5.0.5 The total expected sizes of the landfills in Sectors 1 and 2 are approximately 700 and 500 acres, respectively. Fifty acres in Sector 1 and 150 acres in Sector 2 would therefore

remain undeveloped. Because risks to recreational users and site workers traveling in these areas would remain, non-construction-related clearance within the undeveloped areas would be conducted in phases as construction proceeds. As an alternative, surface and/or subsurface clearance within these areas could be conducted in conjunction with removal actions in other sectors to reduce implementation costs.

4.3.5.0.6 Construction Support is not considered applicable to potential residential construction in Sector 4, and is not retained in this EE/CA because the degree to which this sector will be developed is uncertain. In addition, the area that would be used for residential development is a small portion of the sector, so significant risks to recreational users would remain. Construction Support is not retained for Sector 3 due to the absence of UXO there and the lack of foreseeable construction. Clearance for the remainder of the areas in Sectors 1 and 2 could be done at the same time as the landfill construction support. Further discussion is provided in the cost-benefit analysis in Section 5.0.

4.3.5.1 Effectiveness

4.3.5.1.1 Protection of Human Health and the Environment. Table 4-17 lists the net reduction in anticipated OE exposures for construction workers in Sectors 1 and 2 that can be realized through implementation of Construction Support. Construction Support is equally effective as Surface and Subsurface Clearance to a Depth of 1 Foot for risk reduction during construction activities because UXO was not observed deeper than 12 inches bgs.

TABLE 4-17

ANTICIPATED RISK REDUCTION FOR CONSTRUCTION SCENARIO
CONSTRUCTION SUPPORT
FORMER CAMP ELLIOTT (EAST ELLIOTT)

Sector	No Action Exposures/Year	Surface and Subsurface Clearance (Remaining Exposures/Year)	Percent Risk Reduction[a]
1	4,199	278	93
2	6,516	370	94
Total	10,715	648	94

[a] Relative to No Action.

4.3.5.1.2 Because OE removal operations are conducted on an "as needed" basis as new construction begins, the baseline risks to recreational users remain until the construction phase is complete. The cumulative risk reduction for both recreational users and construction workers is shown in Table 4-18. However, it must be emphasized that this risk reduction, which includes recreational users, is not achieved for 50 to 100 years until all landfill construction is complete. Therefore, the expected number of OE exposures will not be equal to the no action alternative prior to any further landfill expansion. The short-term effectiveness of this alternative for recreational users is therefore considered to be very low.

TABLE 4-18

ANTICIPATED RISK REDUCTION FOR ALL ACTIVITIES
CONSTRUCTION SUPPORT
FORMER CAMP ELLIOTT (EAST ELLIOTT)

Sector	No Action (Exposures/Year)[a]	Construction Support (Exposures/Year)	Percent Risk Reduction[a, b]
1	12,618	719	94
2	15,968	671	96
Total	28,586	1,390	95

[a] Includes estimated exposures for recreational and construction activities.
[b] The total risk reduction included for recreational users is achieved after all landfill construction is complete (i.e., 50 to 100 years).

4.3.5.1.3 Construction Support would entail brush removal and surface and subsurface clearance for OE. The compliance aspect with ARARs for Construction Support would thus be similar to Surface and Subsurface Clearance to a Depth of 1 Foot.

4.3.5.1.4 **Long-Term Effectiveness.** The long-term effectiveness of this alternative appears to be high for Sector 2 where most of the subsurface OE was encountered. All of the OE discovered in Sector 2 is located within 3 feet of the ground surface and would be permanently removed by implementing Construction Support.

4.3.5.1.5 **Short-Term Effectiveness.** Construction Support also does not score high in terms of short-term effectiveness given that there is potential for adverse effects to the environment during excavations. However, these environmental effects caused by clearance may be academic given the intrusive nature of construction that may follow clearance activities. The implementation period of this alternative would be longer than that associated with Surface and Subsurface Clearance to a Depth of 1 Foot. However, because landfill operations are expected to be implemented in phases over the next 25 to 100 years, this degree of short-term effectiveness may be acceptable in Sectors 1 and 2.

4.3.5.2 Implementability

4.3.5.2.1 Construction Support requires surface and potentially subsurface clearance for OE-related anomalies, which is similar to the implementability for Surface and Subsurface Clearance to a Depth of 1 Foot. However, wide-spread brush clearance and excavation operations would be completed by the construction contractors.

4.3.5.3 Cost

4.3.5.3.1 Table 4-19 summarizes the cost to implement construction support at the two sectors under consideration. Annual O&M costs associated with Construction Support primarily

include response to landfill operators encountering unexpected OE. Tables E-8 through E-10 in Appendix E detail the capital cost associated with Construction Support. The accuracy of the cost estimate is +50 percent to -30 percent, which is represented by the cost range in Table 4-19. Cost assumptions are included in Table E-1.

TABLE 4-19

SUMMARY OF COST ESTIMATES FOR CONSTRUCTION SUPPORT FORMER CAMP ELLIOTT (EAST ELLIOTT)

Sector	Initial Cost	Recurring Costs ($/year)	Present Net Worth	Cost Range
1	$6,177,000	$150,000	$13,071,000	$9,150,000 - $19,607,000
2	$4,226,000	$87,400	$8,738,000	$6,167,000 - $13,107,000

4.4 RESULTS OF ALTERNATIVES SCREENING

4.4.0.0.1 A detailed screening of the removal action alternatives considered for East Elliott is presented in Section 4.3. The three broad criteria used for evaluating the alternatives are implementability, effectiveness, and cost. Table 4-20 presents the summary and results of the alternatives screening for East Elliott, the primary criterion for an alternative selection, and the deciding factor for elimination of an alternative. Removal action alternatives that are not retained for further analysis are shaded. Note that the No Action alternative has been retained for baseline comparison.

TABLE 4-20

REMOVAL ACTION ALTERNATIVES SCREENING SUMMARY
FORMER CAMP ELLIOTT (EAST ELLIOTT)

Alternative	Sector 1	Sector 2	Sector 3	Sector 4
No Action	Not applicable due to high expected annual exposures; considered for baseline comparison purposes only	Not applicable due to high expected annual exposures; considered for baseline comparison purposes only	Applicable due to lack of UXO encountered in this sector; considered for baseline comparison purposes	Not applicable due to high expected annual exposures; considered for baseline comparison purposes only
Institutional Controls	Applicable as a temporary control method prior to landfill construction by the County of San Diego	Applicable as a temporary control method prior to landfill construction by the County of San Diego	Applicable - UXO not encountered in this sector during OE Sampling; however, some hazard may remain	Applicable in conjunction with removal action(s) to limit potential exposure to residual UXO within the sector
Surface Clearance	Applicable - would significantly reduce annual exposures to UXO through surface removal	Applicable - would significantly reduce annual exposures to UXO through surface removal	Not Applicable - UXO not encountered in this sector during OE Sampling	Applicable - would significantly reduce annual exposures to UXO through surface removal
Surface and Subsurface Clearance to Depth of 1 Foot	Applicable - would reduce annual exposures to UXO through surface removal and clearance to 1 foot bgs	Applicable - would reduce annual exposures to UXO through surface removal and clearance to 1 foot bgs	Not Applicable - UXO not encountered in this sector during OE Sampling	Applicable - would reduce annual exposures to UXO through surface removal and clearance to 1 foot bgs
Construction Support	Applicable - City of San Diego has preliminary plans to construct a new landfill in this sector	Applicable – Sycamore Landfill's plans to expand in this sector	Not Applicable - UXO not encountered in this sector during OE Sampling	Not applicable - would not provide risk reduction for recreational users

Removal actions not applicable to a sector are shaded.