REPORT TO COUNCIL
City of Sacramento

915 I Street, Sacramento, CA 95814-2671
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STAFF REPORT
November 8, 2005

Honorable Mayor and Members of the City Council

Subject: Trapshoot Club - Recommended Site Remediation Plan

Location: Haggin Oaks Golf Complex (District 2)

Recommendation:

Approve resolution directing staff to submit the preferred remediation plan to Sacramento County Environmental Management for the cleanup of the Sacramento Trapshoot Club property.

Contact: Dean Peckham, Sr. Project Manager, (916)808-7063

Presenter: Dean Peckham, Sr. Project Manager

Department: Economic Development

Division: None

Organization: 4453

Summary:

For the past 18 months, the City has been engaged in investigation, characterization, and preparation of a cleanup plan related to the environmental contamination at the Trapshoot Club site, located at the Haggin Oaks Golf Complex. The City has worked in consultation with the Sacramento County Environmental Management Department (EMD), which is the lead agency for purposes of site remediation, and the California Regional Water Quality Control Board (Board), which is an advisory agency. As the owner of the site, the City has a responsibility for site clean up. The contractor for the City, Baseline Environmental Services, has completed initial and supplemental analyses with the support of the EMD. The analysis found that the site is contaminated with lead, polyaromatic hydrocarbons (PAHs) and arsenic from the clay pigeons, which are disbursed over 17 acres of the site. The City and Baseline Environmental are now prepared to submit the final report and cleanup recommendation to EMD. The recommended cleanup alternative requires mining the lead shot, removal of clay pigeons, filling the site with clean soil and capping it with an impervious layer A complete copy of the Response Plan for the Sacramento Trapshoot Club dated August 2005 with an evaluation of all alternatives is provided as Attachment 2.

Committee/Commission Action: None

Background Information:

The City currently leases 21± acres of the Haggin Oaks Golf Complex land to the Sacramento Trapshoot Club, which has occupied the site since approximately 1915. The lease expired on September 30, 2004 and the Trapshoot Club now operates on the premises under a month to month arrangement.

Trapshooting at the site has resulted in the deposit of lead shot and clay pigeon debris over a relatively large area. Approximately 750,000 square feet (17 acres) are contaminated with lead, PAHs and arsenic. The PAHs are components of the tar used to bind the clay of the pigeons.

In 2002, the City Council directed staff to examine potential alternative uses for the site that would offer a compatible and productive use of the property and mitigate the existing environmental conditions.

To close the Trapshooting Club and prepare the site for other land uses, a cleanup of the existing contamination must be initiated since, depending on concentration, some are considered hazardous waste under federal and state law. In July 2004 the City initiated a process under the regulatory purview of the EMD, as the lead agency, and the Board, as an advisory agency, wherein the contamination of the site would be characterized and appropriate remediation would be developed and implemented.

The City and its consultant have completed investigation of contamination at the property in consultation with the EMD and the Board. The purpose of the investigation was to characterize the contamination and recommend the appropriate remediation of the site. The analysis and findings completed by Baseline have the support of the EMD. These findings are as follows:

- The site is contaminated with 70,000 pounds of lead shot which needs to be mined;
- The site contains 7.45 million pounds of clay pigeons which need to be removed;
- The clay pigeons are not a RCRA or California Hazardous Waste;
- Up to two feet of the on-site soils have been affected by lead, arsenic and certain PAHs above residential and industrial levels;
- In order to bring the site up to its existing elevation the City will need to import 86,000 cubic yards of fill after the top two feet of soil are removed;
- On-site lead and arsenic concentrations in soils found at a depth of two feet would not exceed water quality goals;
- Soil concentrations of arsenic at a depth of two feet on-site, are not significantly different from arsenic concentrations at background locations at a depth of two feet; and
- There has been no offsite migration of contaminants into the groundwater.

The final analysis evaluated seven alternatives for site remediation which would permit the reuse of the site. These alternatives were selected because they would reduce the toxicity and/or mobility of the contaminants of concern, reduce exposures, or allow for unrestricted use of the site.

- Alternative 1: No Action
- Alternative 2: Excavation and off-site disposal
- Alternative 3: Thermal desorption
- Alternative 4: Soil washing
- Alternative 5: Soil stabilization
- Alternative 6: Soil solidification
- Alternative 7: Institutional Controls and Engineering Controls ("IC/EC")
    - (7a) Import Clean Fill
    - (7b) Reuse of Clay Pigeons

The City is now prepared to submit the final report to the EMD with a preferred cleanup alternative (7a) which requires the following steps:

- Mining the lead shot by a commercial lead reclaimer;
- Removal of clay pigeons which would be hauled off-site to a permitted facility accepting non-hazardous waste;
- Filling the site with clean soil to the grade required for site development;
- Capping the site with an impervious layer;
- Deed restrictions recorded with the county to prohibit future residential development and sensitive land uses;
- Development of a Risk Management Plan (RMP) which would delineate health and safety requirements for construction, and protocols for management of soil that would be excavated below the clean fill (i.e., the residual contaminated soil containing arsenic, lead, and PAHs) in future utility corridors, including the require placement of clean fill in all utility trenches after installation of specific utilities.

This remediation would be implemented by using known technology in placement of fill and construction of a cap. The City is experienced in administering deed restrictions and risk management plans.

A complete copy of the Response Plan for the Sacramento Trapshoot Club dated August 2005 with an evaluation of all alternatives is provided as Attachment 2.

Financial Considerations:

Estimated site remediation cost is $6.27 million (Table 14 of Attachment 2). Over two-thirds of this estimated cost is the construction of the cap for the site and the balance is the cost required to haul off clay pigeons and import clean fill. It is estimated that future uses of the site will defray a substantial portion of the cleanup cost. Staff will return to

the Council in the near future requesting funding authorization for the remediation and selection of a remediation contractor.

Environmental Considerations:

The submittal of the recommended remediation plan to the Sacramento County Environmental Management Department is an integral element of the CEQA process and the City's consultation with responsible resource agencies. The City will continue to consult with responsible agencies as the remediation and the project proceeds through the environmental review process.

Policy Considerations:

This project is consistent with direction given by Council to find a compatible and productive use for the subject property. Remediation of the site will permit the site to be developed for more productive uses in keeping with surrounding land uses.

ESBD Considerations:

Baseline Environmental Consulting is an ESBD firm certified (BAE5075A30P) with the City of Sacramento.

Respectfully Submitted: _____
Wendy S. Saunders
Economic Development Director

Recommendation Approved:

_____
ROBERT P. THOMAS
City Manager

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RESOLUTION NO. 2005-XXXXX

Adopted by the Sacramento City Council
November 8, 2005

DIRECTING STAFF TO SUBMIT REMEDIATION PLAN FOR CLEANUP OF SACRAMENTO TRAPSHOOT PROPERTY

BACKGROUND:

A. The Sacramento Trapshoot Club has operated a shooting range at the present location within the Haggin Oaks Golf complex for approximately 90 years. Trapshooting results in the deposit of lead shot and clay pigeon debris over a relatively large area. Approximately 750,000 square feet (17 acres) are contaminated to some extent with elemental lead, arsenic and polyaromatic hydropcarbons (PAHs). Cleanup of these materials is required since, depending on concentration, some are considered hazardous waste under federal and state law.

B. In July 2004, the City initiated a process under the regulatory oversight of the County of Sacramento Environmental Management Department (EMD) and the California Regional Water Quality Board (Board) to characterize the contamination and develop a plan for remediation of the site.

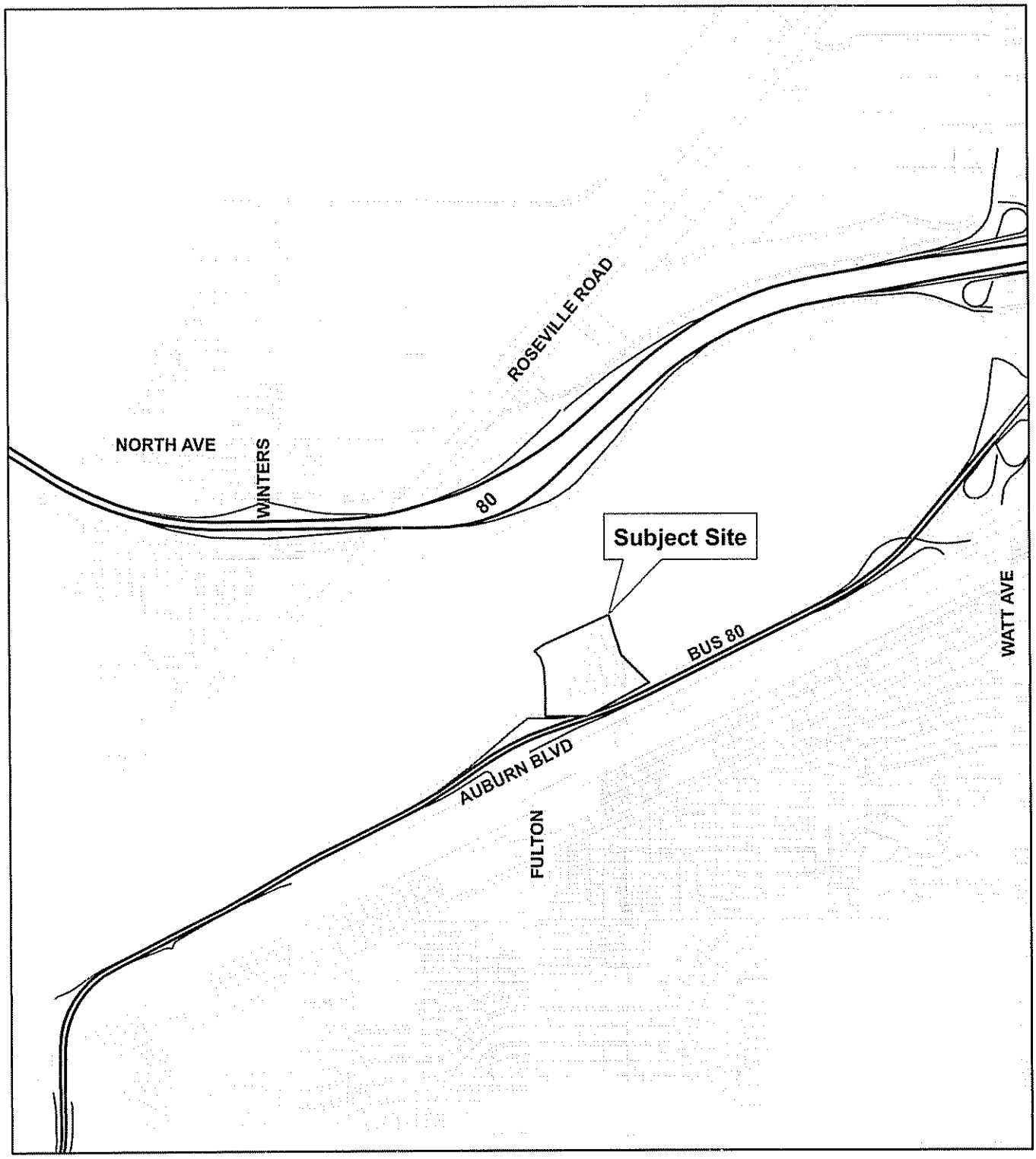
C. Following completion of the initial environmental remediation analysis of the site the Board and the EMD found gaps in the data collected regarding the extent of contamination. In response the City's consultant, Baseline has prepared and completed the second phase of the environmental remediation with the support and concurrence of the EMD. These findings are as follows:

- The site is contaminated with 70,000 pounds of lead shot which needs to be mined;
- The site contains 7.45 million pounds of clay pigeons which need to be removed;
- The clay pigeons are not a RCRA or California Hazardous Waste;
- Up to two feet of the on-site soils have been affected by lead, arsenic and certain PAHs above residential and industrial levels;
- In order to bring the site up to its existing elevation the City will need to import 86,000 cubic yards of fill after the top two feet of soil are removed;
- On-site lead and arsenic concentrations in soils found at a depth of two feet would not exceed water quality goals;
- Soil concentrations of arsenic at a depth of two feet on-site, are not significantly different from arsenic concentrations at background locations at a depth of two feet; and
- There has been no offsite migration of contaminants into the groundwater.

BASED ON THE FACTS SET FORTH IN THE BACKGROUND, THE CITY COUNCIL RESOLVES AS FOLLOWS:

Section 1. City staff is directed to submit the preferred remediation plan for the Sacramento Trapshoot Club to the Sacramento County Environmental Management Department following the institutional controls/environmental controls (IC/EC) with clean fill (Alt 7a) as outlined in the Response Plan for the Sacramento Trapshoot Club Report dated August 2005.

Rapton Honda Trapshoot Club Site



Map Contact
D. Peckham, Economic Development

June, 2006

0 0.1 0.2 0.4 0.6 0.8 Miles

Attachment 2

RESPONSE PLAN

SACRAMENTO TRAPSHOOTING CLUB

AUGUST 2005

FOR:
CITY OF SACRAMENTO
ECONOMIC DEVELOPMENT DEPARTMENT

Y4368

5900 Hollis Street, Suite D • Emeryville, California 94608 • (510) 420-8686

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1. BACKGROUND

This is a Response Plan ("Plan") prepared by BASELINE Environmental Consulting ("BASELINE") on behalf of the City of Sacramento ("City") for the Sacramento Trapshooting Club ("site") at 3701 Fulton Avenue in Sacramento. This Plan presents alternative remedies considered by the City for the Sacramento Trapshooting Club and recommends a response action that is protective of human health and the environment.

In 2004, the City initiated investigations at the site in response to future planned land uses. Specifically, the City is planning to convert the site use from recreational to commercial land uses; the current planned use is for an automobile dealership on all or portions of the site. As part of the planning process, the City submitted an application to the California Environmental Protection Agency Site Designation Committee requesting that Sacramento County Environmental Management Department ("SCEMD") become the regulatory agency providing oversight regarding site remediation. On 26 August 2004, the Site Designation Committee approved SCEMD as the oversight agency for the site.

BASELINE subsequently prepared a workplan for site characterization activities which was approved by SCEMD on 5 November 2004. BASELINE then prepared a *Site Assessment and Preliminary Response Report*, dated February 2005, describing the results of site characterization activities. The SCEMD requested that additional work be conducted: 1) off-site to evaluate potential effects of the trapshooting club's activities on surface soil quality outside the borders of the site; 2) off-site evaluation of background levels for arsenic; and 3) waste classification of on-site clay pigeon debris. BASELINE prepared a workplan for these activities, dated 1 June 2005, which was subsequently approved by SCEMD on 13 June 2005. This Plan includes the results of background sampling for arsenic and the clay pigeon waste classification activities that were undertaken in accordance with the approved workplan in June 2005. The results of the off-site sampling activities to determine effects on the trapshooting club on off-site soil quality is also included in this Plan; the City will submit a workplan separately from this Plan to assess the extent of off-site effects of the historic trapshooting activities, since that investigation is unrelated to the response actions for the site.

2. SITE CHARACTERIZATION

2.1 Site Location

The site, parcel number APN-254-0011-027, is located immediately north of the Interstate 80 Business Loop (I-80) and east of the entrance to the Haggin Oaks Golf Complex (Figures 1 and 2) at 3701 Fulton Avenue. The Haggin Oaks Golf Complex and the site are part of the greater Del Paso Park, a recreational area adjacent to Arcade Creek.

2.2 Site History

The approximately 20-acre site is owned by the City and has been leased to the Sacramento Trapshooting Club since the early 1900s. The Del Paso Park area was once a part of Rancho del Paso, a 40,000-acre ranch owned by Ben Ali Haggin and used for breeding racehorses. Historical maps indicate 828 acres (representing present day Del Paso Park) were reserved for a City park in 1910 and the City took ownership by 1916 (BASELINE, 2005). Aerial photographs from 1952 indicate that at least since that time, the alignment of the shooting stations and shooting range was the same as it is today (BASELINE, 2005).

2.3 Surrounding Land Use and Populations

Land uses surrounding the site are recreational, commercial, and transportation related. The immediate surrounding land is the golf course areas of Del Paso Park, consisting of fairways, putting greens, and parking to the north, east, and west; the I-80 right-of-way is to the south. The I-80 and I-80 business loop are located north and south of Del Paso Park, respectively. Watt Avenue and Roseville Road bracket the east and west sides of Del Paso Park. A Southern Pacific Railroad track is located adjacent to Roseville Road. Further from the site, land uses are industrial and commercial and residential to the west and south. Additional park lands are located along Arcade Creek to the east.

2.4 Current Site Description

The Trapshooting Club is open to the public and operates ten trapshooting stations where shooters can practice shooting aerial targets. Clay pigeons are launched from trap houses for participants to shoot at with shotguns. The shotguns are loaded with shells containing lead pellets, which are referred to as "shot." The shooting stations are located along the southwestern edge of the shooting range and face northeast (Figure 2). In addition to the trapshooting range, the site contains registration booths, restrooms, a paved parking area (about 2.5 acres), and a clubhouse, all located on the southwestern portion of the site.

2.5 Site Hydrogeology

The site is at an elevation of approximately 60 feet above sea level and generally slopes from south to north. There is a break in slope just east of the firing range at about six to eight feet. Arcade Creek is located approximately 900 feet to the north. The creek watershed is part of the South American River subbasin, which is part of the larger Sacramento River Basin. The South

American River subbasin consists of continental deposits of younger alluvium (flood basin deposits, dredge tailings and Holocene stream channel deposits), older alluvium, and Miocene/Pliocene volcanics. The permeability of flood deposits is low, while dredge trailing and stream channel deposits are highly permeable and older alluvium is characterized as moderately permeable (DWR, 2004). Department of Water Resources ("DWR") data from a nearby well indicate the depth to groundwater ranged at that location from 66.3 to 107.6 feet bgs between 1963 and 1995.

The surface of the shooting range is vegetated and most stormwater is absorbed into the shallow soil. A contour map of the site, produced by the City, indicates the surface runoff, if any, would flow north across the site and discharge into the downstream end of the drainage channel that traverses the property (BASELINE, 2005). The drainage channel was previously more centrally located on the site, but because of concerns about the channel providing a potential pathway for off-site migration of contaminants, the channel was moved further away and east from the trapshooting firing line. The channel also conveys surface water runoff from an area south of I-80 and surface runoff from the I-80 road surface (Versar, 1995). Beyond the site boundary to the north, the stormwater is conveyed through a subsurface storm drain that traverses the golf course area and discharges into Arcade Creek.

As part of the planning process for a change in land use, a wetlands delineation study was performed in 2005 by Gibson and Skordal, LLC. The delineation was performed in accordance with Army Corps of Engineers ("Corps") guidance. The study identified 0.6039 acre of waters and wetlands within the site. About 0.4045 of those acres were characterized as seasonal wetland swales and 0.1994 acre as excavated channel. The report concluded that these features may be considered potentially jurisdictional waters of the United States, subject to Corps determination.

2.6 Meteorology

Hot dry summers and mild rainy winters characterize the Mediterranean climate of the Sacramento Valley. During the year the temperature may range from 20 to 115 degrees Fahrenheit with summer highs usually in the 90s and winter lows occasionally below freezing. Average annual rainfall is about 20 inches with snowfall being very rare. The prevailing winds are moderate in strength and vary from moist clean breezes from the south to dry land flows from the north (SCMAQD, 2004).

2.7 Historic Use of Hazardous Materials

The site has been an active gun club since approximately 1915. The materials of concern used in trapshooting activities consist of lead shot and clay pigeons. The lead shot consists of lead with additions of arsenic, antimony, and nickel. Clay pigeons consist of crushed limestone and petroleum pitch, which typically include significant quantities of polynuclear aromatic hydrocarbons ("PAHs").

Little information is available on the volumes of materials used in the past. Based on clay pigeon usage between 30 August 2001 and 30 August 2003, it is estimated that trapshooting

activities resulted in the deposition onto the surface of the site of 85,000 pound of lead and 275,000 pound of clay pigeons per year (BASELINE, 2005).

In the past, removal of the lead shot[1] has been performed by rototilling and removing the top six inches of soil, removing the lead shot, which is recycled, and returning the soil to the site (Versar, 1995). According to the City, the reclamation activities occurred only on the areas with high amounts of lead shot on the surface. Previous investigations have indicated that lead reclamation took place in 1992 and 1995 (Versar, 1995). The Club has indicated that recycling also occurred in October 1998, 2001, and 2003. In 2003, 188,000 pounds of lead were recovered from the site. Records of the amount of reclaimed lead shot for the previous reclamation efforts are not available.

The Club has removed clay pigeon debris from the site since 2001 in an amount generally equal to annual usage. Clay pigeon debris accumulated from years prior to 2001 has not been removed. An average of 290,200 pounds per year of clay pigeon debris were removed from the site in 2001, 2002, and 2003.

2.8 Site Investigations Prior to 2005

Several investigations have been conducted at the site prior to BASELINE's comprehensive 2004 investigation. The analytical data obtained from the previous investigations conducted by others were presented in the *Site Assessment and Preliminary Response Option Report* (BASELINE, 2005). The analytical results and data interpretations for the BASELINE 2004 investigation were also presented in the BASELINE 2005 report. The conclusions from the BASELINE 2004 investigation indicated that:

- Antimony and arsenic, associated with lead shot, were present in the surface soils (up to a maximum of two feet below ground surface) in concentrations exceeding residential and/or industrial Preliminary Remediation Goals ("PRGs").

- Lead was present in surface soils at concentrations exceeding residential and industrial PRGs. The depth of affected soils was less than or equal to two feet below ground surface ("bgs") (except one location here lead exceeded the residential PRG at a depth of two feet).

- PAHs were present in surface soils (to about two feet in depth) at concentrations that equal or exceed residential and/or industrial PRGs in the western portion of the site.

- Leachable concentrations of lead, antimony, nickel, and PAHs did not appear to have the capacity to affect the quality of groundwater underlying the site at depth in excess of 63 feet bgs. Arsenic, present at depths of two feet bgs, was present at concentrations within background ranges for California. Using Central Valley Regional Water Quality Control Board ("RWQCB") conservative Designated Level Methodology, arsenic concentrations

[1] For the past 35 years, the maximum size shot allowed has been No. 7 ½ or 8 shot (2.39 and 2.26 millimeter in diameter, respectively); currently, No. 7 ½ shot is the maximum size allowed

from a depth of two feet bgs was estimated to have the potential to affect the groundwater in concentrations exceeding the water quality goal.

- Sediment samples from Arcade Creek at the point of discharge of runoff from the site, collected upstream and downstream from the discharge point, did not indicate impacts from historic land uses at the site.

- It is possible that PAHs could be present in concentrations exceeding residential and/or commercial/industrial PRGs off-site beyond the northwestern site boundary.

Following completion of the *Site Assessment and Preliminary Response Option Report*, BASELINE completed a fate and transport modeling effort to evaluate whether arsenic concentrations found in on-site soils at a depth of two feet would reach the groundwater underlying the site at concentrations exceeding the RWQCB water quality goals. The modeling was documented in a letter, dated 1 June 2005, from BASELINE to the SCEMD. The results of the modeling, using SESOIL, indicated that neither lead nor arsenic would leach to groundwater at concentrations exceeding RWQCB water quality goals.

2.9 BASELINE 2005 Investigation

In June 2005, BASELINE conducted field activities on and near the site in accordance with an approved workplan from SCEMD. The objectives of the additional sampling were to:

- Assess potential off-site effects from the historic trapshooting activities

- Assess background arsenic concentrations at a depth of two feet bgs and at the surface

- Classify the clay pigeon debris for potential off-site disposal purposes

The sampling locations for the off-site sampling and the background sampling are shown on Figures 3 and 4, respectively. The analytical work performed on each soil sample is presented in Table 1. The analytical results are summarized in Tables 2 through 5 and the laboratory reports are included on a CD in Appendix B. Below is a discussion of the analytical results.

2.9.1 Off-Site Sampling Activities

Twenty-one off-site surface soil samples were randomly collected within 100 feet from the site boundary (Figure 3). The surface soil samples were analyzed for total lead, total arsenic, PAHs, and moisture[2]. The samples along the western site boundary were collected adjacent to roadways and parking lots or landscaped areas along roadways; samples along the northern and eastern boundaries were collected from the "rough" areas of the fairways; and the samples to the south were collected from the landscaping adjacent to the I-80 Business Loop freeway.

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[2] All analytical results are reported in dry weight.

The **total lead** concentrations in the 21 samples ranged from 3.7 to 2,900 mg/kg. Nineteen of the samples had concentrations less than 800 mg/kg[3] while the remaining two samples contained total lead above 800 mg/kg (at 2,900 and 1,200 mg/kg, respectively). The two samples with the high total lead concentrations were collected along the northern site boundary at locations STCOS-05 and -06 (Figure 3). During the sampling activity, the BASELINE geologist observed lead shot on the surface at the location of STCOS-06.

Total arsenic concentrations at the 21 off-site locations ranged from 0.93 to 20 mg/kg. Two of the sampling locations, STCOS-05 and -06 had the highest concentrations of 20 and 10 mg/kg, respectively. Those two locations corresponded to the locations where the high total lead concentrations were encountered. The remaining samples had concentrations below 4.9 mg/kg. Those two locations appear to have been affected by the trapshooting club activities. All off-site surface arsenic concentrations exceeded the residential and industrial PRGs. A statistical evaluation of the off-site surface soil concentrations and surface background concentrations was conducted (see discussion in Section 2.9.2 and Appendix B).

All 21 off-site surface samples were also analyzed for **PAHs** (Table 3). The highest concentration of total PAHs was identified at location STCOS-05 (Figure 3), the same location which also had high total lead and arsenic concentrations. This suggests that the area around location STCOS-05 has been affected by trapshoot activities. Eleven of the 21 samples had concentrations of benzo(a)pyrene exceeding the residential PRGs and ten of the locations had concentrations exceeding the industrial PRGs.

The cumulative carcinogenic and non-carcinogenic human health risks were calculated for residential and industrial land use scenarios (Table 3), using the methodology described in U.S. Environmental Protection Agency ("U.S. EPA"), 2004. The cumulative excess carcinogenic risks for residential land uses at 20 of the sampling locations ranged from 9.9×10^{-5} to 1.1×10^{-7}, within the acceptable range of 1×10^{-4} to 1×10^{-6} developed by U.S. EPA. The cumulative excess risk for one of the locations, location STCOS-05, for residential land use was estimated to be 3.1×10^{-4}, in excess of the U.S. EPA target range. The cumulative excess carcinogenic risk for industrial land uses at all sampling locations were within the U.S. EPA target range. None of the non-carcinogenic risk exceeded a Hazard Index ("HI") of one for either residential or industrial land uses.

2.9.1.1 Conclusions

Location STCOS-05 and –06 had elevated concentrations of lead and arsenic and location STCOS-05 had elevated concentrations of PAHs. Lead, arsenic, and certain PAHs all exceeded industrial PRGs at the STCOS-05 and -06 locations. The elevated concentrations indicate that this area has been affected by trapshooting activities. Additional investigation(s) are warranted in this area north of the trapshoot club to further define the extent of the affected soil.

2.9.2 Background Sampling

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[3] The industrial PRG is 800 mg/kg. The residential PRG is 150 mg/kg.

Background samples were collected from eight locations around the project site within the adjacent golf course (Figure 4). Background samples were collected from the surface and from depths of 2.0 to 2.5 feet bgs. The samples were analyzed for total arsenic (Table 4).

The samples from a depth of 2.0 to 2.5 feet contained total arsenic ranging from less than reporting limits (0.92 mg/kg) to 8.1 mg/kg, and the surface background samples had concentrations ranging from 1.3 to 4.4 mg/kg.

2.9.2.1 Conclusions

The arsenic data collected from soils samples from a depth of two feet bgs on-site were statistically compared to arsenic data collected from two feet bgs at background sampling locations. The statistical evaluation (Appendix B) indicates that the arsenic concentrations on-site at two feet bgs are not different from background arsenic concentrations at two feet bgs.

The surface samples collected off-site around the site perimeter were also evaluated statistically to assess whether those arsenic concentrations could be considered as background.[4] The statistical evaluation indicates that the off-site surface samples analyzed for arsenic did not contain concentrations different from background surface samples.

2.9.3 Waste Classification of Clay Pigeon Debris

Five, five-gallon buckets of clay pigeon debris were randomly collected from the clay pigeon debris area on the site. The purpose of sample collection was to classify the debris for potential off-site disposal at a permitted facility to assess whether it was a non-hazardous waste, a California hazardous waste, or a Federal hazardous waste.

Initially, one bucket of debris was screened through a ¾-inch screen. Ninety percent of the debris passed the ¾-inch screen. The finer fraction was analyzed for total and soluble[5] lead and arsenic and PAHs, and the coarser fraction was analyzed for toxicity using a fish bioassay. The four remaining five-gallon buckets of debris were each analyzed for total, WET, and TCLP lead, and subjected to a fish bioassay. A composite of the four sample buckets were also analyzed for extractable hydrocarbons and Title 22 metals. A summary of the analytical results is presented in Table 5.

2.9.3.1 Conclusions

The analytical results indicate that the debris is not a Federal hazardous waste, nor a California hazardous waste. The debris is therefore a non-hazardous waste that could be disposed of off-site at a Class II or III facility, depending on the specific facility's waste acceptance criteria.

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[4] The statistical analysis did not include data from locations STOS-05 and –06, since those locations are known to have been affected by trapshooting activities.

[5] Soluble concentrations were identified using the Waste Extration Test ("WET") method and the Toxicity Characteristic Leaching Procedure ("TCLP").

3. EVALUATION OF ON-SITE RISKS

To evaluate the need for possible response options to accommodate future land uses at the site (excluding off-site locations), a screening level risk assessment was conducted for human health impacts for current and future site conditions.

The concentration of chemicals found in the soil at the site were compared to PRGs. The PRGs are risk-based screening levels for evaluating chemical impacts to a site assuming residential or industrial (which includes commercial workers) land uses. The PRGs use U.S. EPA toxicity values with accepted exposure factors to estimate contaminant concentration in environmental media (soil, air, and water) that the U.S. EPA considers protective of humans (including sensitive groups) over a lifetime. PRG concentrations are based on direct contact for which generally accepted methods, models, and assumption have been developed (i.e. ingestion, dermal contact, and inhalation) (U.S. EPA, 2004).

The PRGs are the concentration at which exposure to specific chemicals is not expected to result in an excess risk of one case of cancer in 1,000,000 individuals (i.e., 10^{-6}) exposed over a lifetime and a non-cancer HI of one, or the more stringent of the two.

The U.S. EPA has provided definitions of acceptable excess carcinogenic risks and non-carcinogenic risks in the National Contingency Plan ("NCP") (40 CFR 300.430). According to the NCP, an excess carcinogenic risk level within the range of 1×10^{-4} to 1×10^{-6} is considered protective of human health. The DTSC uses an excess carcinogenic risk of 1×10^{-6} as a point of departure for remediation as described in Preliminary Endangerment Assessment Guidance ("PEA") Manual, dated January 1994 and referenced in Chapter 6.8, Section 25319.5 of the Health and Safety Code ("HSC").

A non-carcinogenic risk level is measured using an HI. The HI is calculated by summing the hazard quotients for substances that affect the same target organ or organ system (e.g., respiratory system). The hazard quotient is the ratio of potential exposure to the substance and the level at which no adverse health effects are expected. An HI of less than 1 indicates no adverse health effects are expected as a result of exposure; an HI greater than 1 indicates adverse health effects are possible.

The contaminants on-site were evaluated against both residential and industrial PRGs, as described in Section 3.2, below and presented in Tables 6 and 7.

3.1 Conceptual Site Model

To evaluate the potential risk to human health from contaminants of concern, BASELINE developed a conceptual site model ("CSM") for the site. The contaminants of concern at the site are those contaminants associated with trapshooting activities and consist of antimony, arsenic, lead, nickel, and PAHs. The CSM relates contaminant sources, relevant fate and transport mechanisms, routes of exposure, and potential receptors to determine exposure pathways. A complete exposure pathway generally consists of four elements: 1) a source and mechanism of chemical release; 2) a retention or transport medium; 3) a point of potential contact between the receptor and the contaminated medium; and 4) an exposure route by which the receptor is

exposed to chemicals at the contact point. An exposure pathway is incomplete if any of the above-mentioned elements is missing.

Potential human health risks may be associated with the site in its current configuration as well as future configuration. Potential human receptors consist of current users of the trapshooting club, current employees, future site workers, and current and future construction/utility workers. Future risks to future receptors would be dependent on the level of remediation at the site; e.g., removal/treatment of contaminated soil or institutional and/or engineering controls.

Complete and incomplete exposure pathways are shown on Figure 5. Current complete exposure pathways are present for chemicals in the soil via ingestion, particulate inhalation, and dermal contact for current users of the site, current employees, and current utility workers. Complete exposure pathways in the future will depend on remedial actions performed at the site; however, irrespective of the remediation, the site will be paved; therefore, for future on-site workers there will be no complete pathway. For on-site utility workers there may be complete pathways, if residual contamination remains on-site.

3.2 Human Health Risk Screening

During the November 2004 BASELINE site assessment activities (BASELINE, 2005), soil samples were collected on-site at the locations shown on Figure 6. Samples were analyzed for lead, arsenic, antimony, nickel, and PAHs at various locations and depths. Tables 6 and 7 contain a summary of the metals and PAH results; these tables also include the residential and industrial PRGs. The tables indicate which analytical results exceed the residential and industrial PRGs.

Current users of the site (including trapshooters, on-site workers, and potential utility/construction workers) are exposed to lead, arsenic, antimony, and selected PAHs above the residential and industrial PRGs. The exposure may be through dermal contact, inhalation, and/or ingestion or soil and/or dust (Tables 6 and 7).

Future users of the site would be commercial workers and utility/construction workers. There would be no complete pathways for future commercial workers. Future utility/construction workers could be exposed to residual contaminants consisting of metals and PAHs, if those were present following remediation of the site; the potential pathways would be dermal contact, inhalation, and ingestion of contaminated soil and/or dust.

4. APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Analysis of remedial alternatives includes an evaluation of the applicable or relevant and appropriate requirements ("ARARs") of federal and state environmental statutes and regulations that pertain to each alternative. Applicable requirements are cleanup standards, standards of control, and other substantive requirements, criteria or limitations promulgated under federal environmental or state environmental or facility citing laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, or location. Relevant and appropriate requirements are laws or regulations, that, while not "applicable", address problems or situations sufficiently similar to those encountered that their use is well suited to the particular site. State requirements are ARARs only if they are more stringent than federal requirements.

In addition to ARARs, this analysis includes the evaluation of To-Be-Considered materials ("TBCs"). The TBCs are advisories, criteria, or guidance that may be considered for a particular action or specific issue, as appropriate. TBCs are not ARARs because they are neither promulgated nor enforceable and do not have to be achieved by remedial actions implemented at a site.

ARARs or TBCs may be chemical-, location-, or activity- specific. Chemical-specific ARARs or TBCs are usually health- or risk-based numerical values or methodologies used to determine acceptable concentrations of chemicals that may be found in, or discharged to, the environment. Location-specific ARARs or TBCs restrict actions or contaminant concentrations in certain environmentally sensitive areas. Examples of areas regulated under various federal laws include locations where endangered species or historically significant resources are present. Action-specific ARARs or TBCs are usually technology- or activity-based requirements, or limitations on actions or conditions involving specific chemicals of concern.

4.1 Chemical-Specific ARARs and TBCs

4.1.1 U.S. EPA Region IX Preliminary Remediation Goals

U.S. EPA Region IX PRGs are risk-based screening levels for evaluating a chemical's impacts to human health. The PRGs use U.S. EPA toxicity values with accepted exposure factors to estimate contaminant concentration in environmental media (soil, air, and water) that the agency considers protective of humans (including sensitive groups) over a lifetime. The PRG concentrations are based on direct contact pathways for which generally accepted methods, models, and assumption have been developed (i.e. ingestion, dermal contact, and inhalation) for specific land-use conditions; the PRGs do not consider impacts to groundwater or ecological receptors (U.S. EPA, 2004). The PRGs are or may be TBCs for this site.

4.1.2 RWQCB Recommended Numerical Limits

The document *A Compilation of Water Quality Goals*, (RWQCB, 2003) is a summary of generally applicable or relevant limits used to determine compliance with water quality standards. By determining applicable numerical water quality objectives from the RWQCB Water Quality Control Plan ("Basin Plan"), this list may be used to determine limiting values of

commonly encountered constituents and parameters necessary to protect beneficial uses of groundwater or surface water (RWQCB, 2004). This is or may be TBC for the site.

4.2 Location-Specific ARARs and TBCs

4.2.1 Clean Water Act

The Clean Water Act ("CWA") of 1972 is the principal federal law governing discharges to surface waters and adjoining shorelines. Even before passage of the CWA, the State of California was protecting its surface water and groundwater through enactment of the Porter-Cologne Water Quality Act ("Porter-Cologne") under the California Water Code in 1967. The SWRCB and nine regional boards are responsible for oversight of Porter-Cologne CWA requirements. Unlike the CWA, Porter-Cologne does not restrict water quality standards to surface waters and point source discharges authorized by National Pollutant Discharge Elimination System ("NPDES") permits. Porter-Cologne requires that each of the nine regional boards adopt Water Quality Control Plans, which are applicable to groundwater and non-point sources, as well. Water Quality Control Plans are often called Basin Plans because they apply to waters within specific watershed boundaries or drainage basins. The Basin Plan and SWRCB resolutions that have been promulgated to implement Porter-Cologne and CWA requirements, that pertain to the site, are discussed below.

4.2.2 RWQCB Water Quality Control Plan

Section 303 of the federal Clean Water Act requires states to adopt water quality standards, which "consist of the designated uses of the navigable waters involved and the water quality criteria for such waters based upon such uses" (RWQCB, 1998). The Basin Plan for the Central Valley Region defines the beneficial uses of surface waters and groundwater within the Sacramento River and San Joaquin River basins and sets water quality objectives to protect those uses. The Basin Plan is a regulatory reference for meeting the State and federal requirements for water quality control (RWQCB, 1998). This is or may be an applicable and relevant requirement.

4.2.3 California Toxics Rule

The U.S. EPA promulgated numeric water quality criteria for priority toxic pollutants and other water quality standards provisions to be applied to waters in the State of California. The California Toxics Rule is based on the U.S. EPA's determination that the numeric criteria are necessary in the State of California to protect human health and the environment. The U.S. EPA promulgated this rule to fill a gap in California water quality standards that was created in 1994 when a State court overturned the State's water quality control plans containing water quality criteria for priority toxic pollutants, leaving the State without numeric water quality criteria for many priority toxic pollutants as required by the CWA. These Federal criteria are legally applicable in the State for inland surface waters, enclosed bays and estuaries for all purposes and programs under the CWA. This is or may be an applicable requirement for this site

4.2.4 U.S. Army Corps Of Engineers Nationwide Permit 38

This permit allows specific activities that are performed, ordered, or sponsored by a legal regulatory government agency within designated wetlands, which are required to contain,

stabilize, or remove hazardous or toxic waste materials. The permittee is required to notify the Corps District Engineer in accordance with the general conditions of the permit, including a delineation of affected wetlands. This is or may be an applicable requirement.

4.2.5 Lake Or Streambed Alteration Agreement

Under CCR Title 14, Section 669.5, any person, governmental agency, or public utility proposing any activity that will divert or obstruct the natural flow or change the bed, channel or bank of any river, stream, or lake, or proposing to use any material from a streambed, must first notify the California Department of Fish and Game ("DFG") of such proposed activity. Generally speaking, the notification requirement applies to any work undertaken within the annual high-water mark of a wash, stream, or lake, which contains or once contained fish and wildlife or supports or once supported riparian vegetation. The DFG may propose reasonable modifications in the proposed construction to allow for the protection of the fish and wildlife resources. Lake or Streambed Alteration Agreements that pertain to a private applications are commonly referred to as "1603" Agreements. Agreements that pertain to public agency applications are called "1601" Agreements. This is or may be an applicable requirement.

4.3 Action-Specific ARARs and TBCs

4.3.1 SWRCB Resolution No. 92/49

Section 13304 of the CWC authorizes the Regional Boards "to require complete cleanup of all waste discharged and the restoration of affected water to background conditions (i.e., the water quality that existed before the discharge)." If background conditions of affected water cannot be attained, then the water shall be restored to the best quality that is reasonable. To assist Regional Boards with oversight of this law, SWRCB promulgated Resolution No. 92-49 - Policies and Procedures for Investigation and Cleanup and Abatement of Discharges under Water Code Section 13304. This resolution establishes policies and procedures for investigating and remediating chemical releases that affect or threaten water quality. Resolution No. 92-49 is an applicable requirement that is or may be relevant for the site.

4.3.2 Hazardous Waste Requirements Under CCR Title 22 and HSC Section 25157.8

The Resource Conservation and Recovery Act ("RCRA") Subtitle C (40 CFR Sections 260-299) sets forth criteria for defining federal hazardous wastes, and specifies minimum national requirements for facilities that generate, transport, store, or dispose of hazardous wastes. The DTSC has promulgated regulations in California Code of Regulations ("CCR") Title 22 that govern the management of wastes that are hazardous under RCRA or are hazardous under criteria specific to California. These latter types of hazardous wastes are referred to as non-RCRA hazardous wastes, and include wastes that may contain metals or organic compounds at concentrations greater than their respective Total Threshold Limit Concentration ("TTLC") or Soluble Threshold Limit Concentration ("STLC"), as measured by the Waste Extraction Test ("WET"). These definitions are or may be relevant and appropriate for certain remedial actions considered at the site.

Pursuant to HSC Section 25157.8, additional criteria pertain to the management of lead, copper, or nickel contaminated waste. Waste containing total lead greater than 350 mg/kg, copper greater than 2,500 mg/kg, or nickel greater than 2,000 mg/kg must be disposed of at a permitted hazardous waste management facility, unless the waste discharge requirements and solid waste facility permit of a non-hazardous waste management facility specifically allow for the disposal of these types of wastes. The HSC Section 25157.8 remains in effect until 1 July 2006, and as of that date is repealed unless a later statute is enacted that repeals or extends the 1 July 2006 sunset provision.

The federal and state waste classification and management provisions are or may be appropriate for this site.

4.3.3 Non-hazardous Waste Requirements Under CCR Title 27

RCRA Subtitle D (40 CFR Section 257-258) specifies minimum national requirements for municipal solid waste landfills that apply to new and existing waste management units that have received such wastes after 9 October 1991. The CCR Titles 14 and 23 were amended to incorporate RCRA Subtitle D and approved for implementation by U.S. EPA. California subsequently consolidated most of the requirements in Titles 14 and 23 that relate to non-hazardous wastes under CCR Title 27. Non-hazardous waste management requirements under CCR Title 27 are or may be relevant and appropriate for the site.

4.3.4 Cal/OSHA

Cal/OSHA requires that workers exposed to contaminants above permissible exposure limits at hazardous waste sites have undergone appropriate training (CCR Title 8 Section 5192). Workers involved in remedial activities that would get into contact with contaminated soil would be required to have the applicable training. In addition, CCR Title 8 Section 1532.1 applies to all construction work where an employee may be exposed to lead. These are applicable requirements that are or may be pertinent to the site.

4.3.5 California Environmental Quality Act

California Environmental Quality ACT ("CEQA") requires that a project receiving a discretionary permit by a permit-issuing agency must undergo environmental review in accordance with CCR Title 14 Sections 15000-515387. Remediation activities may be subject to CEQA review; this is or may be an appropriate and relevant requirement.

4.3.6 NPDES Permits

Federal regulations for controlling discharges of pollutants from municipal separate sewer systems, construction sites, and industrial activities, were brought under the NPDES permit process by the 1987 amendments to the CWA, and the subsequent 1990 promulgation of Federal storm water regulations issued by the U.S. EPA. The U.S. EPA regulations require municipal and industrial storm water discharges to comply with an NPDES permit. In California, the U.S. EPA delegated its authority to issue NPDES permits to the RWQCB.

Construction activity resulting in a land disturbance of one acre or more must obtain the Construction Activities Storm Water General Permit ("General Permit"). Remedial activities

may be subject to his requirement. A complete Notice of Intent ("NOI") application must be submitted to the RWQCB and a Storm Water Pollution Prevention Plan ("SWPPP") must be prepared in accordance with Section A of the General Permit prior to the commencement of soil disturbing activities. This is or may be an applicable and relevant requirement for the site.

4.3.7 Land Use Controls ("LUCs")

One or more of the alternatives evaluated in this document would result in residual contaminants in soil that will prevent unrestricted use of the site. As such, LUCs would need to be incorporated into the remedial alternatives to prevent or minimize exposure to the residual contaminants. The LUCs are physical or legal tools that can be implemented as part of a response action for an impacted site. The primary purposes of LUCs are to: 1) restrict activity at and/or access to properties in order to protect the public health and the environment from residual contamination after cleanup; 2) provide notice to interested parties regarding the presence of residual contamination and restrictions; and 3) specify long-term responsibilities to assure compliance with the restrictions.

In California, DTSC, through their management memo #EO-02-002-MM, "Response Action for Sites Where Future Use May Include Sensitive Uses", provides guidance for evaluating LUCs as part of remedial alternatives. The DTSC expects that any remedial alternative that includes leaving contaminants at levels not suitable for unrestricted use, include LUCs that protect human health and the environment. The guidance states that when evaluating incorporation of LUCs into a remedial alternative, an alternative of cleanup to unrestricted use must be developed and evaluated. The use of LUCs for the site is or may be a TBC.

5. EVALUATION OF REMOVAL ACTION ALTERNATIVES

This section presents alternative response options considered to protect human health. The data collection from the site and the evaluation of those data indicated that impacts to surface water and groundwater were not occurring as a result of trapshooting activities (BASELINE, 2005). The groundwater would not be expected to be affected by contaminants of concern and sediment sampling from Arcade Creek indicated that contaminants of concern were not accumulating in the creek.

The human health screening evaluation for the site indicated that the surface soil has been affected by lead, arsenic, and selected PAHs at concentrations above residential risk-based PRGs as well as industrial PRGs. The response alternatives presented below have been selected and evaluated to determine the most effective, implementable, and cost-effective alternative to reduce health risks to future site users, including future utility/construction workers, to acceptable levels. The comparison of the alternatives have been conducted in accordance with the following criteria:

> **Effectiveness.** Determination based on the alternative's ability to be protective of public health, protective of workers during implementation, and compliance with ARARs in the short and long term.
>
> **Implementability.** Evaluation based on the technical feasibility of the removal action, the availability of personnel and services needed to perform the removal action, and the administrative feasibility, such as permit requirements.
>
> **Costs.** Estimation of the capital costs to implement the alternative and the long-term costs, if any.

Seven response alternatives have been developed for evaluation. These alternatives were selected because they would reduce the toxicity and/or mobility of the contaminants of concern, reduce exposures, or allow for unrestricted use of the site.

- Alternative 1: No Action
- Alternative 2: Excavation and off-site disposal
- Alternative 3: Thermal desorption
- Alternative 4: Soil washing
- Alternative 5: Soil stabilization
- Alternative 6: Soil solidification
- Alternative 7: Institutional Controls and Engineering Controls ("IC/EC")

  7A: Imported clean fill
  7B: Reuse of clay pigeons

It should be noted that all alternatives, except the No Action Alternative includes reclamation of lead shot. Reclamation of lead shot would be conducted by a commercial recycler. There is no cost for reclamation, since the recycler will sell the lead shot to a smelter. Alternatives 2,3,4,5,6, and 7A include the removal of the clay pigeon debris to an off-site permitted facility. Table 8 summarizes the effectiveness, implementability, and cost for each alternative, which is discussed in further detail, below. The cost estimates are order-of-magnitude estimates for the purpose of comparing the alternatives, only.

5.1 Alternative 1: No Action

The No Action Alternative would result in the site not being remediated or having no engineering or institutional controls. The lead shot and clay pigeons would remain on the site, as would contaminated soils. The trapshooting activities may continue on the site which would result in the generation of additional clay pigeon debris and additional lead shot on the site. If the site were developed for another land use without remediation or engineering and institutional controls, future users of the site could be adversely affected by on-site contaminants, including lead, arsenic, and PAHs.

This alternative would not be effective in the short- or the long-term and would not be protective of public health (and possibly the environment). This alternative would be easily implementable and would have no cost (except for costs associated with any potential site development where workers would be required to work in accordance with site-specific health and safety plans and any off-site disposal of contaminated soils, required for development, would require special handling and management). It would not comply with chemical-specific ARARs.

5.2 Alternative 2: Excavation and Off-Site Disposal

This alternative consists of excavation and off-site disposal of the top two feet of on-site soil, which contains elevated levels of lead, arsenic, and/or PAHs. The volume of soil that would be excavated and off-hauled is approximately 53,000 cubic yards. In addition to soil, the clay pigeon debris, about 14,000 cubic yards, would be removed and disposed of off-site. The waste classification of the debris indicates that the debris is a non-hazardous waste and can be disposed of at Class II or III landfill.

This alternative would be protective of human health since contaminants of concern would be removed from the site. By excavating and relocating the soil and debris to a disposal site, the contaminated materials would be disposed of at a permitted facility. Regulations governing landfills would ensure no adverse impacts from these contaminants in the future. This alternative would also allow for unrestricted future use of the site.

Excavation and off-site disposal of contaminated soil/debris is a proven technology and can be readily implemented. There are a variety of construction companies in Northern California with experience in performing this kind of work, which can be performed using standard construction equipment. These firms have personnel with the appropriate training to perform hazardous waste cleanups.

The cost estimate assumes that the soil could be disposed of as non-RCRA hazardous waste and the debris as a non-hazardous waste, and that clean soil would be imported to bring the surface elevation of the property up to a level grade. The cost to excavate and dispose of soil and debris and then import soil to bring the site up to a level grade is estimated to be $8.18 million (Table 9). This does not include paving the site for development.

5.3 Alternative 3: Thermal Desorption

This technology involves processing the soil through a treatment unit that heats the soil to high temperatures to volatilize the organic contaminants. The resultant vapors may then be treated using granular activated carbon or thermal oxidation prior to discharge to the atmosphere. The air discharge would require a permit from the Sacramento Metropolitan Air Quality Management District. The technology could be used for removing the PAHs from the soil. It has been assumed that the top two feet of soil at 50 percent at the site, or approximately 26,500 cubic yards, would require excavation and handling through the treatment process. After treatment, verification samples would be collected to ensure the treatment obtained the treatment goals at residential PRGs. Assuming the treatment was successful, the soil would be acceptable for reuse on site, with respect to PAH levels, but would still contain elevated metals concentrations.

Thermal desorption has been successfully used at several Superfund sites to remediate PAHs in soil to below cleanup levels (FRTR, 2002). Thermal desorption systems have demonstrated the ability to clean over 20 tons of polluted soil per hour (U.S. EPA, 2001). The time it takes to clean up a site using thermal desorption depends on the amount of polluted soil, the moisture content of the soil, amount of debris in the soil, and the type and amounts of other chemicals present.

The cost to remediate soil using thermal desorption at three sites reviewed by the EPA ranged from $50 to $125 per ton (EPA, 2005). Using the median value of $87.50 per ton, the cost to remediate the PAHs at the site using thermal desorption is estimated to be $34.77 million (Table 10), not including IC/ECs.

This alternative would not be protective of human health unless it was used in conjunction with another technology since this alternative would only remove the PAHs from the shallow site soils, and not the metals. The alternative would not meet chemical-specific ARARs for metals for unrestricted or industrial use. IC/ECs would be required if the metals contaminated soils were to remain on-site (see Alternative 7).

5.4 Alternative 4: Soil Washing

This technology involves removal of contaminants from soil using leaching agents, surfactants, or chelating[6] agents. Physical separation of PAHs or metals from the soil matrix can be achieved by mixing the soil with a chemical agent that will flush out the contaminants. This process requires changes in the physical and chemical characteristics of the contaminants to increase their solubility. Different agents may be required for the organics and inorganics and pilot

[6] To combine a metal ion with a chemical compound to form a heterocyclic ring.

The cost estimate assumes that the soil could be disposed of as non-RCRA hazardous waste and the debris as a non-hazardous waste, and that clean soil would be imported to bring the surface elevation of the property up to a level grade. The cost to excavate and dispose of soil and debris and then import soil to bring the site up to a level grade is estimated to be $8.18 million (Table 9). This does not include paving the site for development.

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This alternative would not be protective of human health unless it was used in conjunction with another technology since this alternative would only remove the PAHs from the shallow site soils, and not the metals. The alternative would not meet chemical-specific ARARs for metals for unrestricted or industrial use. IC/ECs would be required if the metals contaminated soils were to remain on-site (see Alternative 7).

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[6] To combine a metal ion with a chemical compound to form a heterocyclic ring.

testing would be needed to determine the appropriate agents. After the contaminants are extracted in solution, they must be removed using precipitation, electrochemical exchange, or ion exchange systems. Contaminants have been successfully removed using different aqueous solutions at a U.S. EPA Superfund site (U.S. EPA, 1997).

Soil washing may also incorporate particle size separation during the washing process. Particle size separation is usually effective treatment step since many organic and inorganic contaminants have a tendency to bind to clay, silt, and organic soil particles. Washing separates fine clay and silt particles from the coarser sand and gravel, effectively separating and concentrating the contaminants into a smaller volume consisting of the clay and silt fraction. This fraction can be managed by further treatment or disposal. Additional treatment of the sand fraction through scrubbing, flotation, surfactant washing, density separation, magnetic separation or chemical extraction is used as needed to meet site-specific treatment standards. The cleaned sand and gravel fraction can be returned to the site.

This alternative would protective of human health since the soil contaminants would be removed from the site. The alternative would also allow for unrestricted future use of the property. This alternative would comply with chemical-, location-, and action-specific ARARs.

Assuming that 53,000 cubic yards, or 80,000 tons would require treatment, the cost to remediate the soil at the site using soil washing is estimated to be $8.1 million (Table 11). This cost does not include paving for site development.

5.5 Alternative 5: Soil Stabilization

Stabilization treatment processes convert contaminants to less mobile forms through chemical additives, most commonly a quicklime-sulfate salt treatment. Soil containing metals can be stabilized using trisodium phosphate. Soluble metals will precipitate into lead phosphate, which is insoluble in water. The addition of chemicals into the shallow soil at the site to stabilize metals may be performed in-situ using standard construction equipment.

Stabilization would provide reduced mobility of the metals in the soil; however, stabilization is not a technology used for the treatment of PAH impacted soil. Therefore, this alternative would not be protective of human health unless it was used in conjunction with another technology or IC/ECs were implemented to eliminate exposures to residual PAHs in the soils.

The U.S. ARC estimates that soil stabilization would be $230.04 per ton (U.S. ARC, 2003). The cost to remediate the soil at the site using soil washing is estimated to be $17.36 million (Table 12), without specific IC/ECs, but including paving of the site.

5.6 Alternative 6: Solidification

Solidification treatment processes change the physical characteristics of a soil to reduce the mobility of the contaminants. This process also acts to reduce the hydraulic conductivity of the

soil. Metals are commonly remediated by solidification with conventional pozzolans[7] such as Portland cement. The solidification process can also be effective in binding PAHs in the resulting matrix. The addition of chemicals into the shallow soil at the site may be performed ex-situ or in-situ using standard construction equipment. Because of the relatively shallowness of the impacted soil, for cost estimating, it was assumed that the process would be performed in-situ. The long-term stability of the solidified soil is uncertain, as the solidification agent may weather over time.

While this alternative would provide protection to the environment by limiting the ability of contaminants to migrate in the short term, the long-term effectiveness may be compromised by weathering of the solidification agent. Future construction/utility workers could therefore be exposed to contaminants of concern. This alternative would comply with applicable ARARs, but would require IC/ECs to protect future construction/utility workers.

The cost to remediate soil using solidification is estimated to cost $9.54 million (Table 13), not including specific IC/ECs, except paving the site.

5.7 Alternative 7: Institutional Controls and Engineering Controls

This alternative would entail the placement of IC/EC on the site to eliminate and/or control future users' exposure to contaminants. The soil affected by lead, arsenic, and PAHs would remain on-site, but exposure to the contaminants would be eliminated by placement of fill on top of the existing ground surface to level the site. On top of the fill, an asphalt cap would be constructed in areas not occupied by building foundations. Utility trenches, constructed as part of site development, would be backfilled with clean imported soil. In addition, a risk management plan ("RMP") would govern construction activities associated with site development and utility installations and maintenance. The RMP would provide procedures for breaching the cap to protect worker health and safety, soil management, and dust control. Further, a deed restriction would be placed on the site restricting future residential land uses or land uses associated with sensitive receptors, including hospitals, schools, senior centers, and day care facilities.

Two subalternatives for this IC/EC alternative were considered: A) Use of imported fill for placement directly on top of the existing ground surface after removal and off-site disposal of the clay pigeon debris and lead shot removal; and B) use of the clay pigeon debris as a fill layer (up to one foot in thickness) across most of the site on top of the existing soil surface followed by placement of clean fill to final grade.

5.7.1 Subalternative 7A: IC/EC with Clean Fill

This subalternative would consist of reclamation of lead shot by a commercial reclaimer (similar to other alternatives, except for the Alternative 1). The lead would be removed off-site for reclamation to a smelter. For cost estimating purposes, there would be no cost associated with

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[7] Any of various artificially produced substances resembling pozzuolana ash, a siliceous volcanic ash used to produce hydraulic cement

the removal of lead shot, since the lead shot would be sold and the revenues would be to the reclaimer.

The clay pigeon debris would be hauled off-site to a permitted facility accepting non-hazardous waste. In accordance with the characterization of the debris (discussed in Section 2 of this report), the debris is not a RCRA, nor a California hazardous waste. During removal of debris, an air monitoring strategy would be developed as part of and RMP to ensure that dust generation would not exceed specified thresholds.

Clean fill would be imported and placed on the site to the grade required for site development, and asphalt would be placed on top of the clean fill in areas not occupied by building foundations. The fill may reach up to five to six feet in depth in the eastern portion of the site and be shallower in the western portion of the site.

A deed restriction would be recorded with the County to prohibit future residential development and sensitive land uses. The deed restriction would run with the land. The City currently owns the land and current plans are to lease all or portions of the site for commercial development; the lease terms would likely be 30 years with options for renewal. There are no plans for the City to sell the property.

An RMP would be prepared for SCEMD review and approval prior to site development. The RMP would delineate health and safety requirements for construction workers breaching the cap. Depending on the final fill thicknesses, the RMP may provide specific requirements for areas underlain by different fill thicknesses. For example, if clean fill is up to five feet thick in certain areas of the site and utility workers were only placing utilities or irrigation lines at depths of two feet, the health and safety requirements would be different compared to workers placing utilities at depths greater than five feet, where residual contaminated soil could be encountered. The RMP would also delineate protocols for management of soil that would be excavated below the clean fill (i.e., the residual contaminated soil containing arsenic, lead, and PAHs) in future utility corridors and require placement of clean fill in all utility trenches after installation of specific utilities.

This subalternative would be effective in eliminating future commercial workers' exposure to site contaminants and would provide protection to future construction and utility workers through requirements for implementation of health and safety provisions in accordance with site-specific health and safety plans. This subalternative would be implementable by using known technology in placement of fill and construction of a cap. The City is experienced in administering deed restrictions and risk management plans. On other sites in the City where there are deed restrictions, the zoning map is amended with a "T" for the specific parcel(s), indicating "Toxics", and the City's parcel database is amended with "Permit Plus", indicating the presence of a deed restriction. This subalternative would comply with applicable ARARs. The cost for implementing this subalternative would be $6.27 million (Table 14); this estimate includes costs for implementing estimated RMP provisions for 20 years, including managing soils from utility excavation, cap inspections, and reporting to SCEMD.

5.7.2 Subalternative 7B: IC/EC with Reuse of Clay Pigeon Debris

This subalternative would be similar to subalternative 7A, except that the clay pigeon debris would not be transported off-site for disposal. The debris would be used as part of the fill to be placed immediately above the existing soil surface to a maximum thickness of one foot. The City has evaluated the suitability of the debris for use as engineered fill (Appendix C contains a report prepared by ENGEO, Inc on the suitability of the debris for use of fill). The geotechnical evaluation concluded that the debris, mixed at a ration of 3:1 (debris to soil) could be used as fill without increased future settlement of the constructed site surface. The placement of the debris and mixing with on-site soils would occur in accordance with the requirements of the RMP; the RMP would be submitted to the SCEMD for review and approval prior to construction.

This alternative's effectiveness and implementability would be similar to subalternative 7A. It would eliminate placement of wastes in an off-site permitted landfill, thereby increasing the life of the landfill. Future commercial workers would not be subject to increased risks from this alternative compared to Subalternative 7A since there would be no exposure. Future construction and utility workers would be protected from residual contaminants in accordance with the requirements of a site-specific health and safety plan. This Subalternative would comply with applicable ARARs. The cost for implementing this Subalternative would be $6.19 million.

6. CONCLUSIONS AND RECOMMENDATIONS

The investigations conducted by BASELINE in November 2004 and June 2005 were designed to characterize on-site contamination from the past and current trapshooting activities, assess whether surface waters were or could be affected, evaluate whether groundwater has been or could be affected by lead and arsenic concentrations in on-site soils at a depth of two feet, evaluate any off-site contamination from contaminants of concern, evaluate whether arsenic concentrations in the soils on-site at a depth of two feet were similar to background concentrations, evaluate whether off-site surface soil concentrations of arsenic were similar to background surface soil concentrations, and to classify the clay pigeon debris. Based on those data collection efforts, BASELINE evaluated the feasibility of alternative response actions to protect public health and the environment. The following conclusions have been made based on the data collection and data analyses:

- Up to two feet of the on-site soils have been affected by lead, arsenic and certain PAHs above residential and industrial PRGs.
- Sediment sampling in Arcade Creek and at the drainage channel traversing the site indicate no adverse impacts.
- Fate and transport modeling indicates that on-site lead and arsenic concentrations in soils found at a depth of two feet would not result in groundwater concentrations above the Basin Plan water quality goals.
- Surface soils within 100 feet of the site perimeter have not been affected by lead or PAHs above residential PRGs except at two locations along the northern site boundary.
- Surface soils within 100 feet of the site perimeter do not contain arsenic concentrations that are significantly different from background surface soil concentrations, except at two locations along the northern site perimeter.
- Soil concentrations of arsenic at a depth of two feet on-site, are not significantly different from arsenic concentrations at background locations at a depth of two feet.
- The clay pigeon debris is classified as a non-hazardous waste.

A comparison of seven response alternatives, including the No Action Alternative, was performed to determine the most effective, implementable, and cost-effective alternative that complied with applicable ARARs. Alternative 7B is the alternative that is effective in protection of public health. That alternative consists of institutional and engineering controls to be imposed on the site to protect public health and the environment. The response action consists of reclamation of lead shot from the site, reuse of clay pigeon debris (mixed with clean soil) as a layer of fill across the site on top of the existing soil surface, overlain by an average of five feet of clean imported soil, overlain by an asphalt cap in areas not covered by building foundations. Site development and future construction, maintenance, and/or utility work would be undertaken in accordance with the requirements of an RMP (which would include requirements for health and safety plans, soil management, dust control, annual cap inspection, and five-year reviews of

the adequacy of the response action). The RMP would be submitted to SCEMD for review and approval. In addition, a deed restriction would be placed on the site and recorded with the County to prohibit future residential development or development for sensitive land uses.

The investigation conducted at the site in June 2005 and described in this report, identified off-site effects of the trapshooting activities along the northern site perimeter. It is recommended that a workplan be submitted to the SCEMD for delineation of the extent and magnitude of of-site soil contamination and that the investigation be implemented after review and approval of the workplan by SCEMD.

7. LIMITATIONS

The conclusions presented in this report are professional opinions based on the indicated data described in this report. They are intended only for the purpose, site, and project indicated. Opinions and recommendations presented herein apply to site conditions existing at the time of our study. Changes in the conditions of the subject property can occur with time, because of natural processes or the works of man, on the subject sites or on adjacent properties. Furthermore, it would be extremely expensive and perhaps impossible, to conduct a site investigation which would ensure detection of materials which now or in the future might be considered hazardous substances. Our failure to discover hazardous substances through a reasonable and mutually agreed upon limited scope-of-work does not guarantee that hazardous substances do not occur in an area. Similarly, an area which in part is unaffected by hazardous substances at the time of our investigation, may later, due to natural phenomena or human intervention, become contaminated. Changes in applicable standards can also occur as the result of legislation or from the broadening of knowledge. Accordingly, the findings of this report may be invalidated, wholly or in part, by changes beyond our control.

8. REFERENCES

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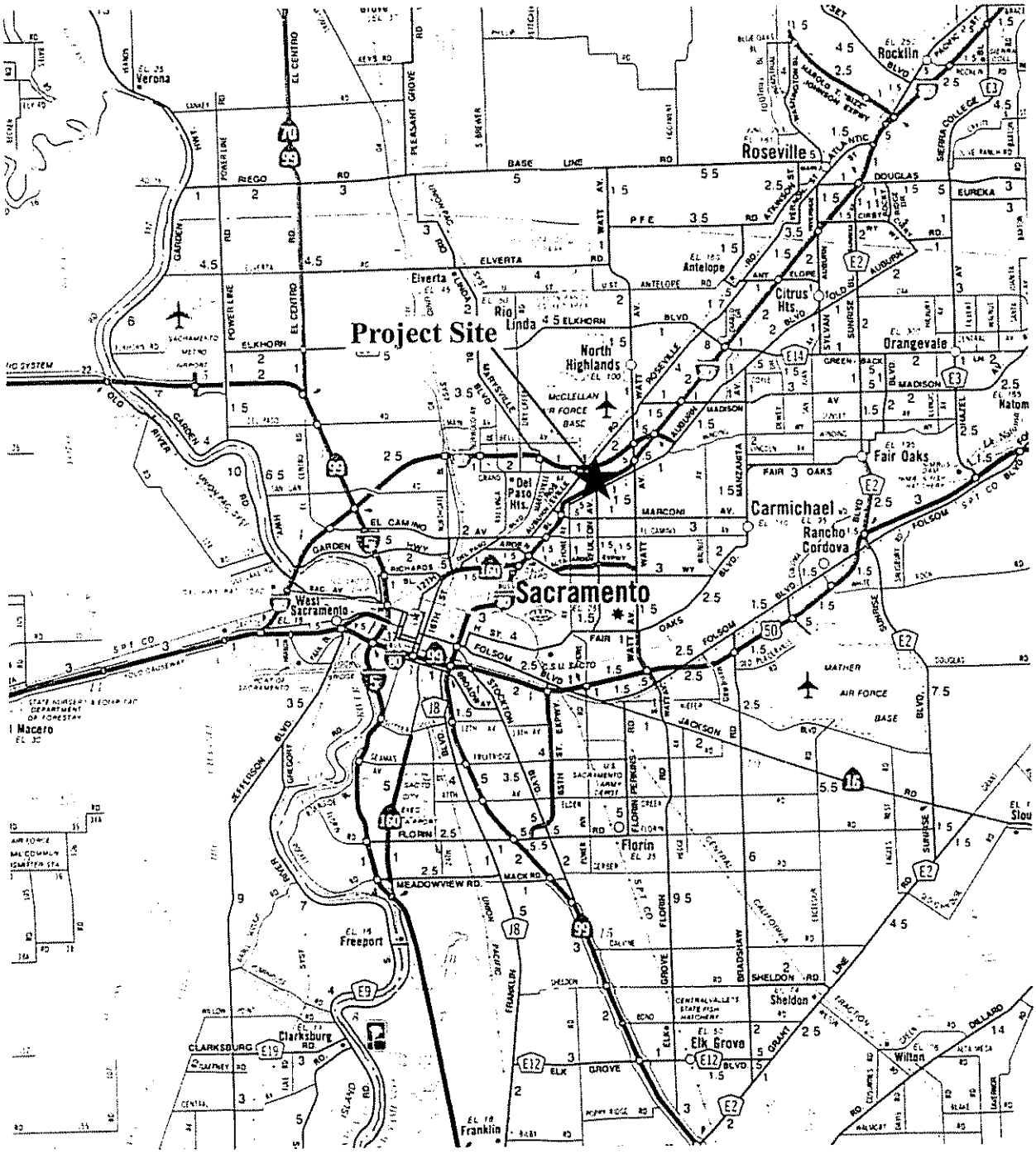
FIGURES

REGIONAL LOCATION

Figure 1



Sacramento Trapshooting Club
Sacramento, California

0 4 Miles

BASELINE

Y4368 00152 Fig1 RL cdr 7/15/05

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SITE MAP

Figure 2

Sacramento Trapshooting Club
Sacramento, California

Source: City of Sacramento, 2004.

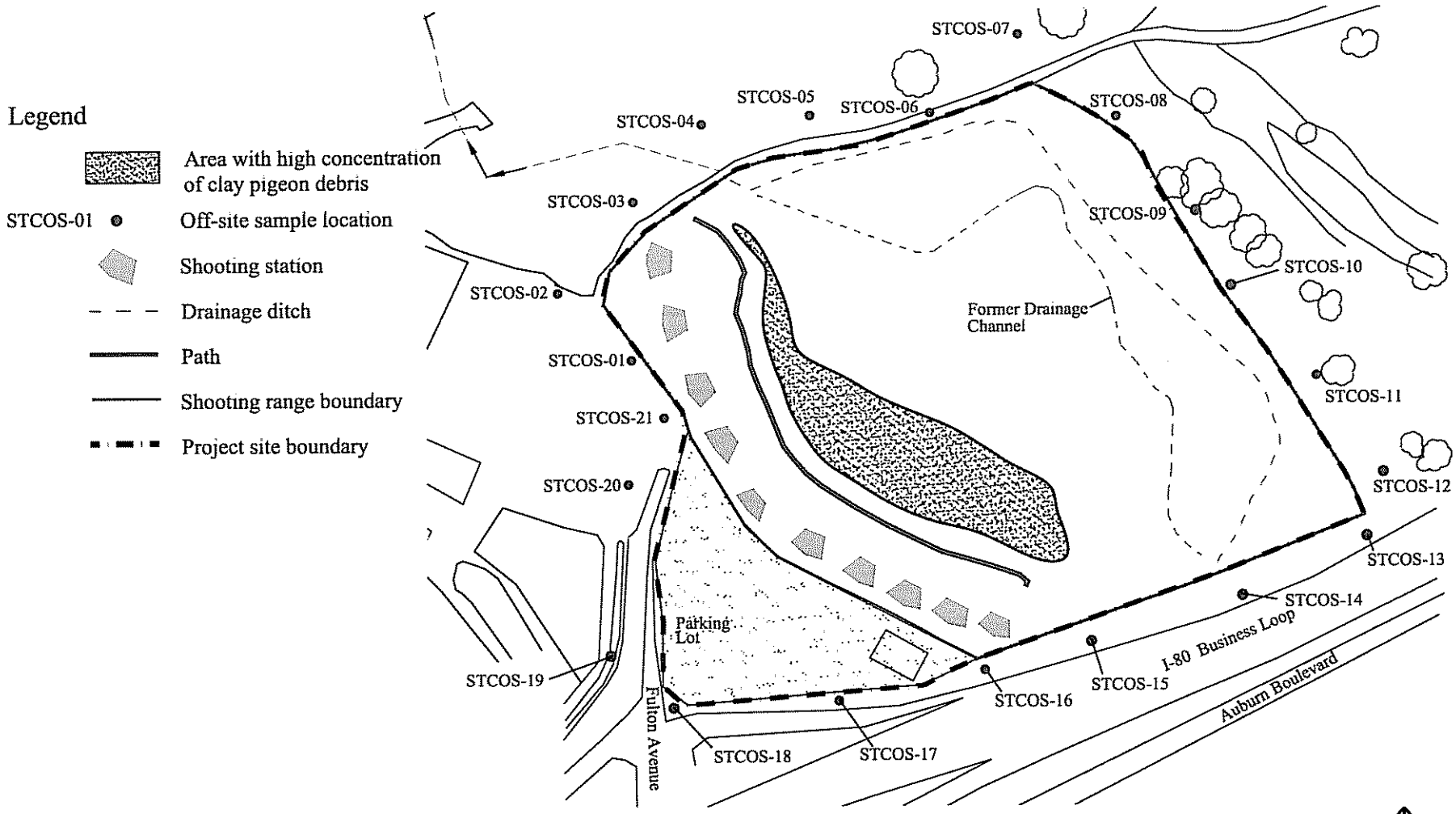
0 200 Feet

BASELINE

Y4368.00152 Fig2.cdr 7/15/05

OFF-SITE SAMPLE LOCATIONS

Figure 3



Sacramento Trapshooting Club
Sacramento, California

BASELINE

Y4368.00152.Fig3.dwg 7/15/05

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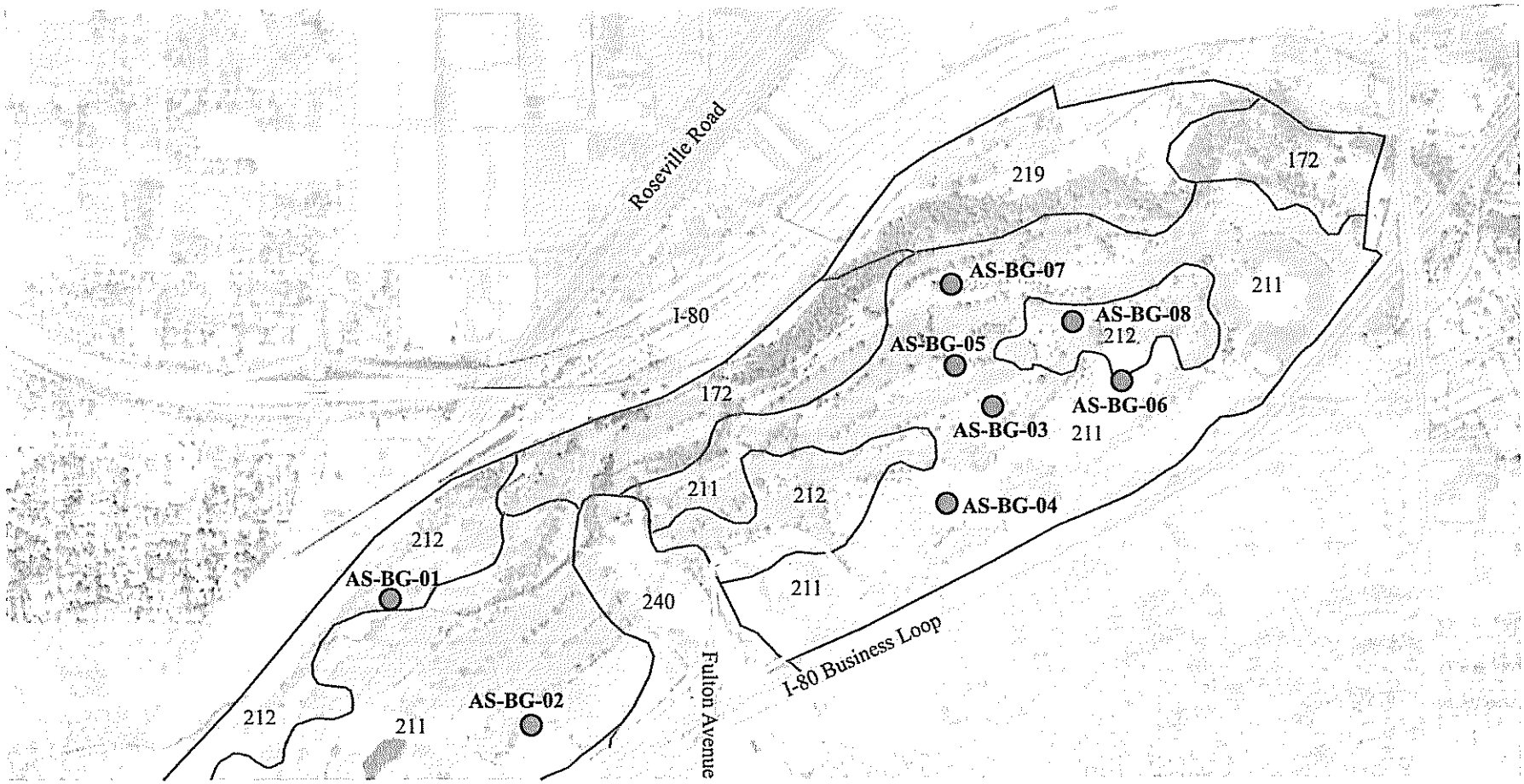
BACKGROUND ARSENIC SAMPLING LOCATIONS

Figure 4



Legend

- Sample Location
- Boundary of Soil Types
- Project Site Boundary

US Department of Agriculture Soil Types

149 - Fiddy-Urban land complex, 1 to 8 percent slope
172 - Liveoak sandy clay loam, 0 to 2 precent slope
211 - San Joaquin fine sandy loam, 0 to 3 percent slope
212 - San Joaquin fine sandy loam, 3 to 8 percent slope
229 - Urban land-xeraents-Fiddyment complex, 0 to 8 percent
240 - Xerarents-urban land-San Joaquin complex, 0 to 5 percent

Source
Aerial photograph: WWW.terrafly.com
Soil types: US Dept. of Agriculture, 1993, Soil Survey of Sacramento County

0 1525 Feet

BASELINE

Sacramento Trapshooting Club
Sacramento, California

Y4368.00152.Fig4.cdr 7/15/05

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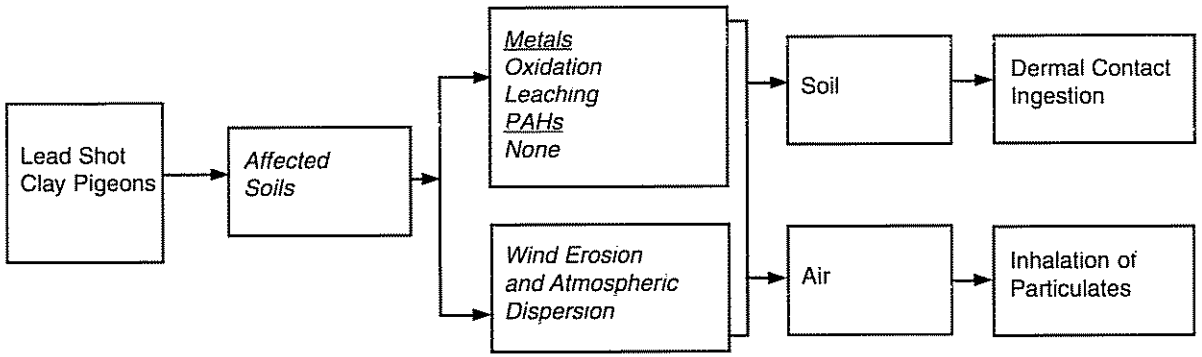
CONCEPTUAL SITE MODEL FOR HUMAN HEALTH

Figure 5



RECEPTORS	Trapshoot Users	On-site worker		On-site utility worker	
	C	C	F	C	F
Dermal Contact Ingestion	com	com	inc[1]	com	com/inc[2]
Ingestion	com	com	inc[1]	com	com/inc[2]
Inhalation of Particulates	com	com	inc[1]	com	com/inc[2]

[1] Exposure pathways for the future on-site worker would be incomplete either through removal of contaminated soil or through capping of the site.

[2] Exposure pathways for the future on-site utility worker could be complete if the contaminants were left in-place and the site capped; the pathway would be incomplete if contaminated soils were removed.

Legend
C = Current receptor
F = Future receptor
inc = Incomplete pathway
com = Compete pathway

Sacramento Trap Shooting Club
Sacramento, California

BASELINE

Y4368.00152.Fig5.ste.mdl-7/15/05

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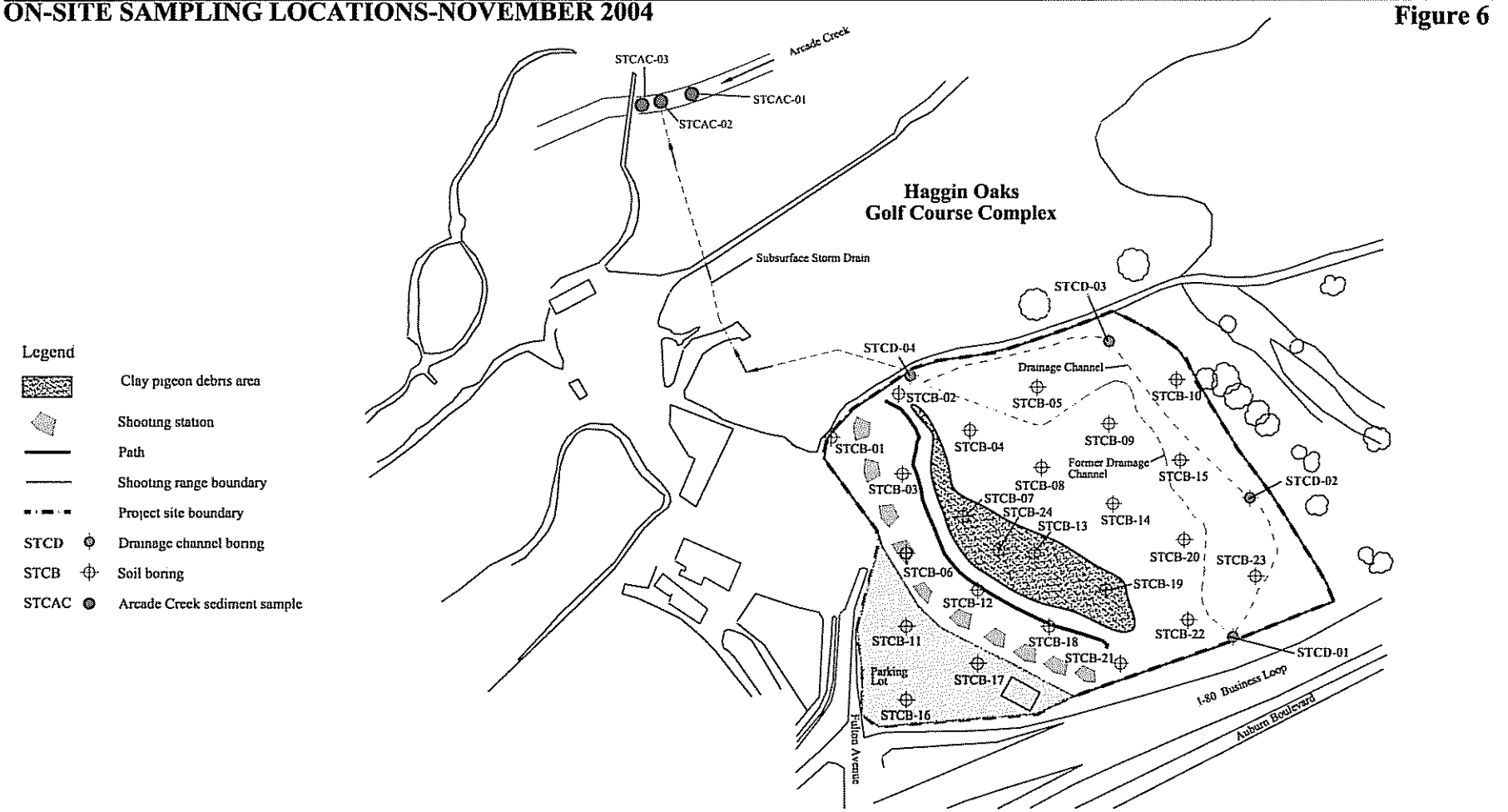
ON-SITE SAMPLING LOCATIONS-NOVEMBER 2004

Figure 6



Sacramento Trapshooting Club
Sacramento, California

BASELINE

Y4368.00152.Fig6 7/15/05

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TABLES AND APPENDICES

AVAILABLE AT THE OFFICE OF THE CITY CLERK