Appendix I
Summary of Terrestrial and Wildlife Observations

ASARCO LLC Hayden Plant Site

Summary of Ecological Evaluation Site Visit of April 27-28, 2006

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1. Introduction and Purpose

This technical memorandum presents the results of Task 3f from the *Final Workplan – Remedial Investigation at the ASARCO LLC Hayden Plant Site* (RI Workplan, CH2M HILL, 2005). The purpose of this task of the RI is to characterize the terrestrial and aquatic habitats in the project area. Additionally, the terrestrial and aquatic habitats in a reference area were characterized for comparison to the study area. These characterizations in the project and reference areas include general habitat mapping and wildlife observations, and were generally conducted according to guidance for ecological assessments provided by EPA (1997).

2. Participants

The site visit for the ecological evaluation occurred on April 27-28, 2006. Participants included Gary Santolo, Donna Roraback, and Allan Erickson from CH2M HILL (both days), Ned Black from the U.S. Environmental Protection Agency (EPA, April 27 only), Marc Dahlberg from Arizona Fish and Game (AFGD, April 27 only), Carrie Marr from the U.S. Fish and Wildlife Service (USFWS) (April 28 only), and Leucretia Holle from ASARCO (both days).

3. Field Equipment and Measurements

The equipment required for the ecological investigation, the calibration of this equipment, and the field measurements taken are described in the following subsections.

Equipment for Creating the Preliminary Habitat Maps

- High-resolution aerial photographs
- Topographic maps
- National Wetlands Inventory maps
- National Resources Conservation Service (NRCS) soil maps

Equipment for Walking Surveys/Habitat Characterization

- Digital camera
- Hand-held GPS unit
- Field parameter multi-meter
  - pH meter
  - Dissolved oxygen (DO) meter
  - Conductivity meter
  - Thermometer
  - Turbidity meter
- Tape measure
- Binoculars
- Diameter Breast-height (DBH) Tape
- Habitat assessment forms
- Wildlife observation forms

a. Calibration and Maintenance of Field Equipment

As indicated above, several instruments were used in the field effort, including a GPS instrument and field parameter meters (pH, conductivity, turbidity, thermometer, DO). To ensure that the instruments were operating properly and producing accurate and reliable data, routine calibration was performed prior to and during use in the field. Factory calibrations were performed at a frequency recommended by the manufacturer. Field calibrations were performed at least once per day, prior to instrument use. If field calibration revealed that the instrument was outside established accuracy limits, the instrument was serviced in the field. A backup instrument was available for each of the critical real-time instruments used in the field (e.g., multi-meter for measuring pH, DO, conductivity, temperature, and turbidity).

Preventive maintenance for field equipment was carried out in accordance with procedures and schedules outlined in the operation and maintenance handbook of each particular model. The maintenance responsibilities for field equipment were assigned collectively to the field team leader (Gary Santolo) and field team members (Donna Roraback and Allan Erickson). The field team using the equipment was responsible for checking the status of the equipment prior to use and reporting any problems encountered. The field team was also responsible for ensuring that critical spare parts were included as part of the field equipment checklist. Non-operational field equipment was removed from service and a replacement obtained[1].

All field instruments were properly protected against inclement weather conditions during the field investigation. Each instrument is specially designed to maintain its operating integrity during variable temperature ranges that are representative of ranges that were encountered during the working conditions. At the end of each working day, all field equipment was taken out of the field for overnight storage.

[1] Original equipment for water chemistry was not completely operational. Data were collected using equipment on loan from Arizona Fish and Game.

b. Field Measurements

Prior to beginning the field study, preliminary habitat maps were created using existing remote sensing data (i.e., recent, high-resolution aerial photographs of the area, topographic maps, National Wetlands Inventory maps, and NRCS soil maps). The resulting habitat maps were then verified by field surveys. Field measurements for each habitat type (terrestrial, aquatic – non-flowing systems, aquatic – flowing systems, and wetland) are outlined in the respective checklists included in the Checklist for Ecological Assessment/Sampling form from EPA (1997). This checklist for each site is provided in Appendix A. The checklist for each habitat type was used in the field for recording the field measurement data. A brief summary of the primary field measurements included in the field surveys are described below by basic habitat type.

Terrestrial Habitat Field Measurements

As part of the field survey within each delineated terrestrial habitat type at a selected location, a qualitative evaluation was conducted. The following primary measurements for terrestrial habitats were collected:

- Dominant plant species;
    - estimated percentage total vegetative cover
    - estimated vegetative cover height
- Any evidence of stressed vegetation (if present);
- Visual and auditory observations of wildlife species, as well as other indicators of wildlife use (e.g., burrows, tracks, scat, rubs, etc.);
- Digital photographs of each habitat type; and
- GPS coordinates of all locations for each habitat using a sub-meter accuracy GPS unit.

Additional information for terrestrial habitats were recorded as indicated in the terrestrial habitat checklist (Section II of the Checklist for Ecological Assessment/Sampling) provided in Appendix A. Examples of these additional measurements include percent cover, predominant tree size in wooded areas (Diameter at Breast Height; DBH), average scrub/shrub height, and average height of the dominant plant in open field habitat.

Aquatic Habitat Field Measurements

The qualitative evaluation for the aquatic habitats included the same primary measurements as outlined above for terrestrial habitats. In addition, the following measurements specific to aquatic habitats were recorded:

- Width and depth of water body (estimated)
- pH, temperature, DO, conductivity, and turbidity
- Flow velocity (if applicable)

Additional information for aquatic habitats was recorded as indicated in the aquatic habitat checklists (Section III and IV of the Checklist for Ecological Assessment/Sampling) provided in Appendix A. Examples of these additional measurements include general composition of the substrate (substrate types provided in checklist), source of water for non-flowing water bodies, and bank condition for flowing systems.

4. Ecological Investigation Field Procedures

The first steps for the field survey occurred prior to going into the field. These included determining the project and reference areas and creating preliminary habitat maps from aerial photographs of the project and reference areas. The procedures for these steps, along with the procedures for conducting the walking survey are described in this subsection.

a. Procedures for Determining the Project and Reference Area

The project area was defined in the RI Workplan (CH2M HILL, 2005) using available Site information. Generally, the project area includes all terrestrial and aquatic habitat within the rectangle trending northwest-southeast and superimposed over the Gila and San Pedro River valleys as shown in Figure 4-5 from the RI Workplan (attached). The project area spans five miles on both sides of a line extending from two miles east-southeast of Winkelman to northwest of Hayden about half way to the town of Kearny. This area also incorporates the towns of Hayden and Winkelman and associated ASARCO process facilities. Because little ecological habitat is expected in these residential and industrial areas, field surveys were not conducted within the towns or ASARCO facilities.

The reference area was selected from an area with similar terrestrial and aquatic habitats as the project area, and following guidance provided in EPA (1994). These included physical (water, sediment, soil, and habitat structure characteristics), climatic (regional and local), and biological (community characteristics) characteristics. A summary of these potential characteristics is presented in Table 1. These characteristics were considered in the selection of the reference area.

TABLE 1
Some Characteristics to Consider When Selecting Reference Locations

Category of Characteristic	Type of Characteristic	Characteristic Attributes
Physical	Water	Temperature, Chemistry, Depth, Flow
	Sediment	Total organic carbon; total acid-volatile sulfides; percent sand, silt, clay, water
	Soil	Particle size distribution, organic matter content, hydrologic regime, chemistry
	Habitat Structure	Stream/lake bottom structure, stream/lake-side cover, vertical stratification, horizontal variation, percent cover
Climatic	Regional	Latitude, proximity to mountains and large water bodies
	Local	Topography (valleys, hilltops), altitude, aspect (north- or south-facing slopes), solar radiation
Biological	Community Characteristics	Species abundance, species richness, diversity, trophic structure, history of species introductions

Notes: Table duplicated from EPA , 1997

b. Procedures for Creating Preliminary Habitat Maps from Aerial Photographs

Delineation of terrestrial and aquatic habitats was based primarily on existing remote sensing data. Initial habitat delineation was conducted using recent, high-resolution aerial photographs of the area, topographic maps, National Wetlands Inventory maps, and NRCS soil maps. Habitat types were classified broadly into four categories: river, stable riparian, ruderal (disturbed) riparian, and upland. The initial habitat delineation will be digitized into a GIS database and mapped on high resolution aerial photograph base maps.

c. Procedures for Conducting the Walking Survey

Limited field surveys were conducted to verify/ground-truth assigned terrestrial and aquatic habitat types as determined by the initial maps; to identify habitats in the vicinity of soil, sediment, and water sampling areas; and to record characteristic vegetation and general wildlife utilization patterns within the project area, as well as within a reference area (i.e., an area with similar vegetation, geology, slope, etc., but that is not impacted by the Site). Field surveys were planned to occur during the month of April, as this is a time when vegetation and wildlife, especially flowering plants and resident birds, would be most abundant. The time spent at each site was limited and wildlife observations were not systematic but opportunistic.

As part of the field survey within each delineated habitat type at a selected location, a qualitative evaluation was conducted in which the dominant plant species were identified, any evidence of stressed vegetation (if present) was recorded, and aquatic resources were qualitatively and quantitatively (to a limited extent) described. The data collected was in accordance with the terrestrial and aquatic habitat checklists provided in EPA (1997). This checklist was used in the field and completed checklists are reproduced in Appendix A. Photo-documentation of each habitat type was compiled for reference and documentation of future changes or improvements in habitat quality for the Site. The location of each habitat area was mapped using a sub-meter accuracy GPS unit.

As previously indicated, direct observation, calls, or sign of wildlife in the project area was recorded during the terrestrial and aquatic habitat characterization field surveys. This sampling was incidental to the habitat characterization efforts. No active survey techniques such as using kicknets to identify benthic invertebrates or searching under logs, rocks, and debris for herpetiles were used due to time constraints. Observations, including species, number present, observation, and remarks/comments, were recorded directly on the site checklist. Digital photos of sign were taken and locations of direct observations and sign were recorded directly on the site checklists. In addition to Site surveys, appropriate literature and database reviews and consultations with United States Fish & Wildlife Services (USFWS) and Arizona Game and Fish Department (AGFD) was conducted to determine the existence or potential utilization of the project area by species of special status, as designated by state or federal natural resource management agencies. Specifically, AGFD was contacted to request a query of the Natural Diversity Database prior to conducting surveys. This query identified protected species known to occur in the area. Observations of any special-status species or sensitive habitat areas observed during the field surveys were recorded.

GPS data collected in the field was exported into the habitat characterization GIS database for final mapping onto high resolution aerial photograph base maps. This task includes development of the initial Site map and collection of the GPS data for verifying the map. The final habitat characterization map will be developed as part of the Ecological Risk Assessment.

d. Procedures for Photograph Documentation

Documentation of the following information was digitally recorded for each photograph: date and time, name of the site and task, general description of the subject, location of the site photograph, and photograph number.

A copy of the photographs used for the Site descriptions will be placed in the project file with the information outlined above. A select set have been included to exemplify sites described in Appendix A.

5. Summary of Existing Information

The Gila-San Pedro River confluence area has been subject to considerable ecological characterization due to the presence of the southwestern willow flycatcher, a federally endangered species, in the area. The following list of flycatcher-related studies is available for use in the risk evaluations for this species:

- *Southwestern Willow Flycatcher Survey and Nest Monitoring Reports* for 2000 through 2003 (Paradzick et al., 2001; Smith et al., 2002; Smith et al., 2003; and Smith et al., 2004);
- *Southwestern Willow Flycatcher Breeding Site and Territory Summaries* for 2000 through 2002 (Sogge et al., 2001; Sogge et al., 2002; and Sogge et al., 2003);
- *Physiological Condition of Southwestern Willow Flycatchers in Native and Saltcedar Habitats* (Owen and Sogge, 2002);
- *A Quantitative Analysis of the Diet of Southwestern Willow Flycatchers in the Gila Valley, New Mexico* (DeLay et al., 2002);
- *Mapping and Monitoring Southwestern Willow Flycatcher Breeding Habitat in Arizona: A Remote Sensing Approach* (Dockens and Paradzick, 2004);
- *Banding and Population Genetics of Southwestern Willow Flycatchers in Arizona – 1997 Summary Report* (Paxton et al., 1997);
- *Food Habits of the Endangered Southwestern Willow Flycatcher* (Drost et al., 2001);
- *Survivorship and Movements of Southwestern Willow Flycatchers in Arizona – 2000* (Luff et al., 2000);
- *Survivorship and Movements of Southwestern Willow Flycatchers at Roosevelt Lake, Arizona – 2001 and 2003 reports* (Kenwood and Paxton, 2001; Newell et al., 2003);
- *Status, Ecology, and Conservation of the Southwestern Willow Flycatcher* (Finch and Stoleson, 2000);
- *Nestling sex ratio in the southwestern willow flycatcher* (Paxton et al., 2002); and
- *A multi-scaled model of southwestern willow flycatcher breeding habitat* (Hatten and Paradzick, 2003).

Additional ecological studies in the project area include a fish monitoring study being conducted by the AGFD (Voeltz, 2005), a herp (reptiles and amphibians) study being conducted by the Bureau of Reclamation (Messing, 2005), and the annual Christmas bird counts conducted in the area by the National Audubon Society (McCarthey, 2005). Brief descriptions of these three studies are provided below.

The AGFD is currently conducting a fish monitoring study that includes portions of the Gila River adjacent to and downstream of the Site and in areas within the San Pedro River (Voeltz, 2005). Two of the Gila River sites are located on ASARCO property, two are upstream of the property, two are downstream of the property, and one is upstream in the San Pedro River. This study is part of the annual sampling conducted in agreement with the Bureau of Reclamation to monitor 22 sites in the Gila River Basin. This study does not measure contaminant levels, but provides population/community data (e.g., species abundance and richness). It should be noted that the ASARCO property sites were dry during the November 2004 sampling, as were the sites in 2003. Information on species present in past years (1999 to 2002) is available.

The Bureau of Reclamation conducted a pilot study to compare the species diversity of herps (primarily lizards, but occasionally also toads) between mature Saltcedar habitat and mature cottonwood-willow habitat in southern Arizona (Messing, 2005). The Saltcedar site is located adjacent to the San Pedro River on ASARCO property and the cottonwood-willow habitat is located near The Nature Conservancy (TNC) preserve. There are three arrays (or sampling locations within each area). An array consists of a central five-gallon bucket dug into the ground and three outer buckets about 25 feet away connected by a drift fence. The arrays were checked every other day beginning in May-September 2004. A second collection effort was conducted May-September 2005, and some vegetation data was also collected. If approved by EPA, ASARCO, and TNC, metals analysis of surface soil and representative herps at each array (i.e., co-located soil and biota) would provide valuable information on chemicals of potential ecological concern (COPEC) concentrations in soil and biota in these areas, as well as limited information on contaminant uptake in reptiles. Arthropods (e.g., spiders) were also observed in the pitfall traps during the pilot study. Collection and chemical analysis of these terrestrial invertebrates is also recommended.

The National Audubon Society has been conducting nationwide Christmas bird counts in December and early January for over 100 years. For the past five years, Christmas bird counts have been done in the 15-mile radius area centered at Dudleyville, Arizona (McCarthey, 2005). This area includes the towns of Hayden and Winkelman and the ASARCO LLC Hayden properties. Volunteers survey for one day and the data is compiled for the entire area. This information is useful for documenting avian species in the general project area during the winter, but may not provide information specific to the project area.

Ecological information from the available studies will be assembled, summarized, and utilized to the extent possible to augment the more limited ecological surveys to be conducted as part of this RI.

6. Results

The locations of the sites surveyed and results of the cursory surveys conducted on April 27-28, 2006 are shown in Figure 2. The following descriptions recap the overall ecology of the site. Appendix A details the specific findings at each location:

The ASARCO Hayden Site is located in the Sonoran Basin and Range Ecoregion as delineated by EPA (2003). Soil conditions in this area strongly affect the distribution and composition of plant communities in this ecoregion and presumably at the site.

Large areas are dominated by shrubs such as cresote bush. Depending on the specific soil type and present in an area, common plant species my include paloverde (*Ceridium sp.*), and saguaro (*Carnegiea gigantea*). Aquatic and wash areas may include willows (*Salix sp.*), tamarisk, cottonwood, and cat's claw (*Acacia greggi*).

Because of the proximity of the site to the Gila and San Pedro Rivers, the site supports a variety of reptilian, mammalian, and avian species. The mammal community present at the site includes small herbivorous species (desert cottontail, pocket mouse, and antelope squirrel); a number of larger omnivores and predators (fox, bobcat, and coyote); and large herbivores (feral horse and mule deer). The bird community is diverse with particular bird communities associated with specific plant communities and seasons. Common herbivorous and insectivorous birds include a variety of sparrows and finches, phainopepla, red-winged blackbird, and cliff swallows. Birds of prey include Swainson's hawk and turkey vulture. Because the site is in close proximity to the Gila-San Pedro River confluence, the area is a breeding site for the federally endangered southwestern willow flycatcher.

Although no specific reptiles were observed during the site visit, the species diversity of reptiles at ASARCO is likely high, typical of the southwestern desert environment. Amphibians may also be abundant; however, amphibians are seasonal in their occurrence outside of the permanent rivers and streams.

Two sites, GR04 and GR10, showed signs of stressed upland vegetation. Dead cottonwoods were observed at GR-04 (see photo GR04-3 in Appendix A). They were upland and quite a distance from the river and were not included in the evaluation of the river. Other vegetation around the cottonwoods did not appear stressed and the cottonwoods may have been stressed by changes in their access to water. At GR10, multiple instances of shrubs with brown, chlorotic, or otherwise stressed foliage were observed. (see photo GR10-Stress1, GR10-Stress2, and GR10-Stress3 in Appendix A). Potential causes were not readily apparent.

7. References

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Fig. 1
ASARCO LLC Hayden Site
Herp Study Sample Locations
Habitat Characterization Project Area

CH2MHILL

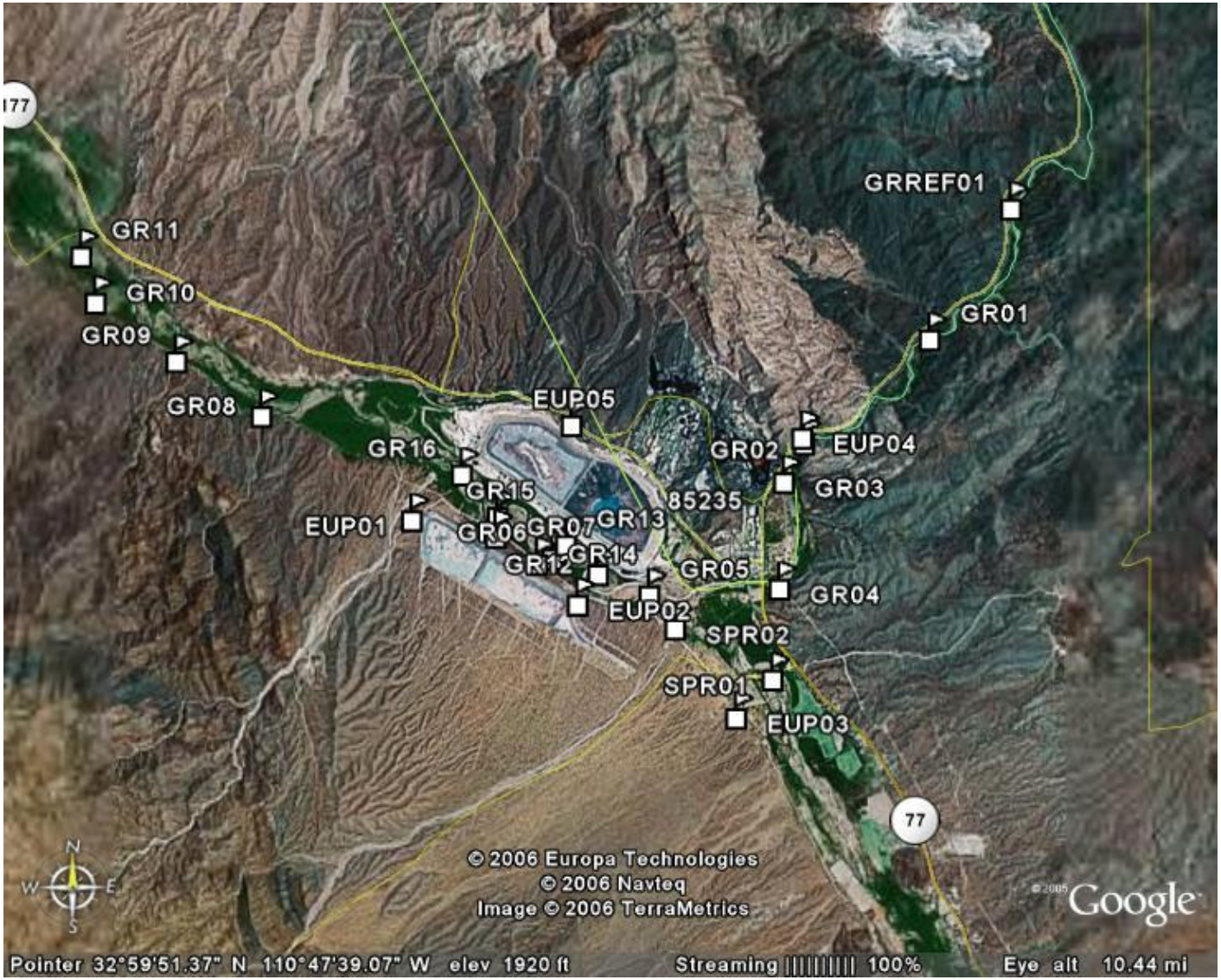

Figure 2. ASARCO surveys sites 27-28 April 2006