

**AERIAL PHOTOGRAPH REVIEW**

**Prepared By: ERM and ERI**

**(As originally presented in RI/FS Work Plan – Appendix J; CSC, 2004)**



## TABLE OF CONTENTS

J.1 OBJECTIVES	J-1
J.2 CHRONOLOGY OF THE PHOTO REVIEW ACTIVITIES	J-3
J.3 SCOPE AND METHODS OF THE ADDITIONAL EVALUATION	J-4
J.4 PHOTOGRAPH NOTATIONS	J-5

### **TABLES**

Table J-1                      Historical Aerial Photograph Review

### **PHOTO PLATES (one for each photo year)**

### **ATTACHMENTS**

Attachment J-1              Resumes for Photo Review Analysts  
Attachment J-2              ERI Letter Regarding Photoregistration



## APPENDIX J

### AERIAL PHOTOGRAPH REVIEW

This appendix provides detailed descriptions of aerial photographs of the Casmalia site that were taken between 1956 and 2002. These photographs represent the best available images in terms of coverage and scale of this area within this timeframe from the following photo sources: the University of California, Santa Barbara, Map and Image Library (UCSB MIB); Pacific Western Aerial Surveys (PW), Intrasearch (Intra), Environmental Protection Agency (EPA), and Golden State Aerial Surveys (GS). Most of the images reviewed were available as 9-inch x 9-inch diapositives and the scale of the photographs varies widely.

Ten oversize photographs (from approximately 20-inches square to approximate 36-inches square) also were gathered from the site. All but one of the oversize photos (which appear to be from the 1985/1986 timeframe) had identifying information (such as date and source). The CSC obtained the 9-inch by 9-inch contact prints and diapositives of each image (with the exception of the 1985/1986 photo – source unknown) from the referenced oversize photos to complete the set of contact prints and images used to complete the aerial photograph review. The oversize prints were valuable in clearly identifying various site features during the disposal site development. Copies of each image at a uniform scale, cropped to fit an 8.5-inch x 11-inch page, are included within this appendix.

This appendix presents the objectives for the aerial photograph evaluation and describes the chronology for the various photo review tasks completed to date. The body of the appendix describes summary information gleaned from each photograph. The results of the aerial photograph review were used in conjunction with written records regarding the site history, topographic reviews (see Appendix L), and agency interviews (see Appendix M) to finalize the sampling plan described in Section 4.7 of the RI/FS Work Plan. Appendix N of this Work Plan identifies how the aerial photograph review results were used to define potential contamination sources and augment the data collection program for the RI/FS.

#### J.1 OBJECTIVES

The CSC completed an aerial photograph review to identify features that needed to be more clearly identified in order to complete the RI/FS. To achieve the overall goal, the CSC collected and catalogued all available photographs and prepared a summary of the features identified in the photographs. Note that documentation on the majority of the former waste management and treatment units was available in text and figures from historical reports. In some cases, the photos were used to clarify discrepancies between various written records for the site.

The CSC completed the photograph review in concert with the historical records review and information provided by former site personnel to more fully describe the operational site history in the main text of the Work Plan (see Section 2). As such, this appendix is limited to identifying the various features of interest in text format and does not describe the significance of the observations. Rather, the salient information gleaned from the review is folded back into the Work Plan in either the site history text, tables, and figures (see Section 2 of the Work Plan), the

initial site evaluation (Section 3 of the Work Plan) ,or in the sampling program text, tables, and figures (see Section 4 of the Work Plan).

The CSC's identified a number of objectives for the aerial photograph review task, including but not limited to the general objectives and specific goals listed below:

#### General Objectives

- Identify the presence and limits of all waste management units (WMUs) and the interaction between those WMUs including but not limited to landfills, surface impoundments, evaporation pads, waste spreading areas, injection wells, disposal trenches and other burial units.
- Identify the presence and limits of any natural and man-made physical features that may have controlled or influenced the transport of site contaminants.
- Note the occurrence and limits of all remediation activities.
- Note the occurrence and limits of other human activities that may or may not be related to waste disposal activities including those that may be mistaken for waste disposal activity.

#### Specific Goals

- Identify the RCRA Canyon spreading areas, ponded areas or impoundments, and the adjacent spray areas to assure that the sampling program adequately addresses the extent of these features.
- Identify the locations of tanks in the Liquids Treatment Area and the associated liquid unloading areas to ensure that these locations are represented in the sampling program.
- Locate former haul roads used during the disposal period and identify any stained areas for potential sampling.
- Confirm that excavation took place in all former ponds and pads (during the pond closure period) and that interior berms and roads also were removed during the process. (Note that Appendix L contains additional quantitative information regarding the pond closure activities.)
- Identify to the location of the P/S Landfill clay barrier to scope the additional investigations planned for the toe of the P/S Landfill.
- Identify the limits of the trenches and the locations of the wells in the Burial Trench Area.
- Identify on-site tanks or other features that may have been used to treat or store hazardous wastes or fuel.
- Trace the lineations of the former primary on-site drainage canyons to assess potential subsurface contaminant migration pathways.
- Identify the locations of off-site trenches that were excavated during the operational period to obtain off-site materials for clay barrier construction.

As part of linking the photographic review results to the investigation (see Appendix N), the CSC mapped the locations of the features identified for additional investigation. The CSC used fixed site features (such as the water tanks on the northern site hill, the Liquids Treatment Building, the 4 tanks that were historically located outside the Liquids Treatment Building, and the Maintenance Shed) to map the locations of various features of interest (such as stained soils, stacked drums and temporary tanks) using triangulation techniques. For the most part, however, the locations of various site features of interest in the sampling program were identified on available topographic maps.

For ease in reviewing details within the various study areas at the Casmalia facility, all of the following aerial photograph descriptions are organized with headings that correlate with those found in Table 2-14. Analyses of the photographs from the site's operational years including overlays are provided in the *Aerial Photographic Analysis* report, prepared by Environmental Research, Inc., dated April 27, 2001 (ERI, 2001) and the *Supplemental Aerial Photographic Analysis* report, prepared by Environmental Research, Inc., dated August 2003 (ERI, 2003b).

Note that the waste management unit chronology presented in Table 2-14 of the Work Plan was generated based on the observations from the 2001 and 2003 ERI aerial photograph reviews augmented with written information regarding the operational timeline for the site.

## J.2 CHRONOLOGY OF THE AERIAL PHOTOGRAPH REVIEW ACTIVITIES

The following information is useful in understanding the evolution of aerial photograph review activities for the Casmalia site:

- EPA commissioned the initial photo review report entitled *Aerial Photographic Analysis, Casmalia Disposal Site*. The work was completed by Environmental Research, Inc. (ERI), and is presented in a report dated April 27, 2001.
- The CSC reviewed the 2001 ERI report and, finding the evaluation to be comprehensive for key disposal years, prepared a summary of observations for the years that ERI initially evaluated in addition to all other photo years that were available at the time. The CSC's photo review, which was presented in the prior version of this appendix, was prepared by the CSC to specifically respond to EPA comments on the Draft RI/FS Work Plan (CSC, June 3, 2002).
- Appendix J of the revised RI/FS Work Plan (CSC, March 2003), was focused on specific aspects of the site and was not intended to be a comprehensive review such as the one completed by ERI in 2001. The relevant findings of the photo review were accounted for in preparing the sampling basemap presented on Figures 4-1 through 4-6 of the Work Plan. The photo analysis presented in the March 2003 Work Plan was completed by ERM West and qualifications of project personnel are included in Attachment J-1.
- The EPA reviewed the CSC's March 2003 RI/FS Work Plan and identified concerns on the level and quality of the analysis that was performed to interpret the aerial photos. The EPA also expressed concerns that the results of the evaluation were not clearly linked to the initial evaluation of the site and the technical approach to data collection.
- The EPA commissioned a second ERI report to specifically focus on the Burial Trench Area, P/S Landfill Barrier, and pre-site drainages. The report entitled *Aerial Photographic Analysis of the Burial Trench Area, P/S Landfill Barrier, and Pre-Site Drainages, Casmalia Disposal Site* was issued by ERI in May 2003 (ERI, 2003a). The results of this evaluation are accounted for in the plans for site investigation.
- To address USEPA comments on the March 2003 Work Plan, the CSC requested that ERI perform additional detailed photographic analysis (see ERI, 2003b) and revise Appendix J for this present version of the RI/FS Work Plan. The scope and methods ERI used to complete the additional evaluation are detailed below. Qualifications of ERI project personnel are presented in Attachment J-1.

### J.3 SCOPE AND METHODS OF THE ADDITIONAL EVALUATION

To address EPA comments regarding the level and quality of the technical analysis, ERI evaluated additional photographs for the operational years (1974 through 1991). Note that photographs for seven of the site's operational years (1974, 1975, 1978, 1981, 1984, 1987 and 1989) were previously evaluated (ERI, 2001). ERI used the methods previously used in the 2001 study to assess the additional photos for the years 1977, 1979, 1980, 1981, 1982, 1983 and 1988 (ERI, 2003b).

Specifically, ERI's analyst reviewed monoscopic or stereo diapositives (depending on availability) on a backlit light table, made observations using a stereoscope capable of up to 60 times the size of the feature on the diapositive, noted observations on summary tables for each photo reviewed, and prepared acetate overlays indicating the locations of various features noted.

The CSC reviewed the summary tables and overlays in preparing the sampling plan described in the RI/FS Work Plan. Table J-1 summarizes the photographs reviewed along with additional pertinent information related to methods used and the scale of the photos reviewed. Note that ERI reviewed additional photographs (dated 6-18-81, 12-16-81, and 11-22-88); these photos not reviewed in the previous version of Appendix J.

ERI augmented the photo notations made below with observations made during their review. Because the ERI also looked at the area within a 1-mile radius of the site, the paragraphs below include notation of observations made for Zone 2.

As described earlier in this appendix, ERI identified the locations of specific features (such as the site drainages, disposal well and trenches, stained areas in the Maintenance Shed Area, ponded areas in the RCRA Canyon, etc. using photoregistration techniques. This method is believed to yield more accurate results than using georeferencing techniques as described in ERI's letter included as Attachment J-2 to this appendix.

The results of the supplemental work performed by ERI were used to locate new sampling locations and/or relocate previously scoped samples. Specifically, NAPL assessment sampling locations were adjusted to coincide with the drainages in areas where drainage tracings were adjusted. The locations of certain samples in the Burial Trench Area were moved (either to be within or beyond the trenches themselves, depending on the type of sample being collected). New sampling locations were added in the stained areas identified in the Maintenance Shed Area and new sampling locations were included in former ponded areas in the RCRA Canyon Area. Note that the results of prior ERI and CSC aerial photos reviews were used to locate many of the investigation locations in the initial sampling program. Refer to Table N-1 of Appendix N for complete details regarding how the results of all air photo reviews are accounted for in the sampling plan.

### J.4 PHOTOGRAPH NOTATIONS

The CSC used the following headings to make observations regarding activities on the site (Zone 1) for the various photographs:

- Landfills

- Storage / Evaporation Ponds
- Evaporation Pads
- Oil Field Waste Spreading Areas
- Waste Disposal Wells
- Waste Disposal Trenches
- Treatment Units
- Other

ERI updated the evaluations for each year and added notations for off-site activities under the category Zone 2.

These on-site headings are consistent with those presented in Table 2-14 which chronicles historical waste management and treatment unit development and notes remediation activities completed to date. Table 2-14 was generated first based on the photograph observations. The information on that table was then cross checked with written records of site development and the CSC modified the notations, as necessary to construct an accurate representation of site development. Note that the photograph descriptions below specify the number of ponds / pads that were active, and that Table 2-14 identifies which ponds and pads were observed to be active.

**03/28/1956 – Source: UCSB MIB; Flight #HA-AN, Frame #6-103, Scale 1”=800’**

The resolution and quality of this black and white photo is good and allowed for the determination that, although there is a structure and possible agricultural activities in the vicinity of future Ponds 2 and 3, there was no disposal site activity at this time. The main site access road (NTU Road) is visible and follows the current road alignment. There is a stand of trees in the locations of future Pond 13. The drainage patterns within the future site limits are clearly visible.

**06/18/1970 – Source: UCSB MIB, Flight #HB-RF, Frame #136(print), #135-138, 141-144 (diapositives), Scale 1”=1,000’**

The resolution and quality of these black and white photos is good and allowed for the determination that there was no disposal site activity at this time. The structures noted in the previous photo are gone. NTU Road is still visible.

**05/20/74 – Source: UCSB MIB, Flight #AF-74-9, Frame #280 (print), 278-282, 798-802, 203-206 (diapositives), Scale 1”=1,200’**

The resolution and quality of these black and white photos is good. The features at the site could be recognized with a good degree of certainty and are listed below:

Storage/Evaporation Ponds

- 13 waste ponds active
- Pond 2 is composed of several ponded areas

Evaporation Pads

- One evaporation pad active
- Pad 4A drains to Pond 2 area

Waste Disposal Trenches

- Two waste disposal trenches appear active

Other

- Area graded for the future Maintenance Building
- Minimal site activity; grading for expansion
- One water tank on northern site knob
- A trailer is noted at the former site entrance near Pond 10

## Zone 2

- No significant activity is observed in this area
- A tank associated with ranching is noted west of the then site boundary

**06/18/1975 – Source: Pacific Western Aerial Surveys (PW), Flight #5048, Frame #4 print and diapositive), Scale 1"=2,000'**

The resolution and quality of these color photographs is good and allowed the features at the site to be recognized with a good degree of certainty and are listed below:

Storage/Evaporation Ponds

- 17 waste ponds active
- Pond 2 is composed of several ponded areas

Evaporation Pads

- One evaporation pad active
- Pad 4A drains to the Pond 2 area

Waste Disposal Trenches

- Two waste disposal trenches appear active

Other

- Active excavations to accommodate more ponds
- Maintenance Building visible
- Access road to top of future Acids Landfill; access road to the bottom of the future Caustic/Cyanide Landfill
- Liquids and staining appear off new road in vicinity of future Ponds 10 and 11

## Zone 2

- Staining is visible along primary access road southeast of site

**07/29/1977 – Source: PW, Flight #SM2, Frame #9 (print and diapositive), Scale 1"=2,000'**

The resolution and quality of these color photographs is good and allowed the features at the site to be recognized with a good degree of certainty and are listed below:

Storage/Evaporation Ponds

- 23 waste ponds active
- Pond M is two separate ponds; upper pond is draining to Pond T
- Liquids spray noted toward Pond A
- Dark roadway along the main entrance road extending into the center of the site (near Pond M); dark roadway along the road just above Ponds 16, D and C
- Extensive excavation between Pond 13 and the main road
- Ponding noted between Ponds D, C and L (possible upper part of Pond L forming)

Evaporation Pads

- One evaporation pad noted
- Pad 4A drains to Pond 2 area

Waste Disposal Trenches

- Two waste disposal trench areas appear active

Other

- Active grading for expansion (east side of site) and into future Acids Landfill and Heavy Metals Landfill
- Lincation in the vicinity of A Drainage (possible source for B Drainage barrier material)
- Gray/brown tank (hidden in the trees) northwest of the Maintenance area and southeast of Pond P (better noted in 1978 photo)
- Two water tanks on northern site knob
- Oil Recovery Tank noted west of Pond S; a probable pipe extends to the unit from Pond B; a drainage channel north of the tank leads to Pond S
- A trailer is noted south of Pond M
- Entrance trailer moved to the east from Pond 10 location
- Three above-ground horizontal tanks noted south of the Maintenance Shed

## Zone 2

- No environmentally significant activity noted in this area

**03/14/1978 – Source: PW, Flight #7301, Frame #1 (print), Frames #1, 2 (diapositives), Scale 1"=1,000'**

The resolution, quality and larger scale of these color photos is good. The features at the site could be identified with a good degree of certainty and are listed below:

Landfills

- Grading in southern limit of Pesticides/Solvents Landfill north of the Maintenance Shed
- Ponding in future Metals Landfill area in a bermed area noted at head of canyon drainage
- Grading / ground scars on the pad to the south of the Caustic/Cyanide Landfill
- Grading / grubbing in the Acids Landfill

Storage/Evaporation Ponds

- 29 waste ponds active

- Discolored soil along the road and roadside in the vicinity of Pond R; Pond 2 (three separate ponds here) draining along the road towards Pond 10
- Oil recovery tank noted west of Pond S; A probable pipe extends to the unit from Pond B; a drainage channel north of the tank leads to Pond S
- Ponding remains between Ponds D, C and L (possible upper part of Pond L forming)

#### Evaporation Pads

- One evaporation pad active
- Pad 4A drains toward Pond 2.
- Grading noted in future locations of Pads 10B and 10C

#### Waste Disposal Trenches

- Four waste disposal trenches appear active

#### Waste Disposal Wells

- Two injection wells visible

#### Other

- Active grading and excavations for site expansion
- Temporary roads graded in the expansion area
- Active dozing along the west side of Pond 13
- One structure (initial Administration Building) present in the entrance area
- Spread materials south of Ponds 14 and P
- Discoloration along short sections of the road in the vicinity of the Maintenance Area, liquid and staining visible north of the Maintenance Building
- Oil Recovery Tanks between ponds M, T and S visible
- Ground scars noted in RCRA Canyon area
- Graded area noted west of site near C-Drainage and future location of A-Series ponds

#### Zone 2

- No environmentally significant activity noted in this area

#### **07/18/1979 – Source: PW, Flight #9118, Frame #1 (print and diapositive), Enlargement Scale 1”=130’, Scale diapositive 1”=500’**

This is good quality, enlarged, color photo, approximately 3’X4’, with good resolution. ERI examined this print as well as the diapositive. The resolution of the diapositive was excellent. The features were very clearly identified and are listed below:

#### Landfills

- Excavation and possible waste disposal in PCB, Pesticides/Solvents, Metals, Acids, and Caustic/Cyanides Landfills
- Grading in northern and southern Pesticides/Solvents Landfill
- Drums visible in PCB Landfill

Storage/Evaporation Ponds

- 29 waste ponds active
- Minor ponding between Ponds A, S and 7

Evaporation Pads

- One sludge pond active
- Pad 4A drains toward Pond 2
- Construction (excavation/grading) activity continues for several pads (10A, 10B, 10C, 10E, 10F, and 10G)

Waste Disposal Wells

- Four injection wells visible

Waste Disposal Trenches

- One waste disposal trench appears active

Other

- Minor dozing in and around Pond 13
- One scale in entrance area adjacent to the initial Administration Building
- Outer perimeter roads being graded
- Piping route for water supply being excavated and pipes laid out along eastern perimeter road
- Two additional Oil Recovery Tanks between ponds M, T and S
- Pipe and hose lead to Pond B and possibly Pond A
- Trailer noted south of Administration Building in this year only
- Erosion gullies noted in RCRA Canyon area
- Graded area noted west of site near future location of A-series ponds expanded
- Asphalt mix noted in are of current fuel USTs north of the Maintenance Shed

## Zone 2

- No environmentally significant activity noted in this area

**09/15/1980 – Source: PW, Flight #10708, Frame #1 (print and diapositive), Scale 1”=800’**

The resolution, quality and larger scale of this color photo is good. ERI examined the diapositive for this year as well. The resolution of the diapositive was excellent. The features at the site could be identified, with a high degree of certainty and are listed below:

Landfills

- Drums visible in the Pesticides/Solvents Landfill
- Waste disposal in the PCB, Metals, Acids, and Caustics/Cyanides Landfills
- Spray / liquids management in future pads between landfills
- Ponding at toe of Metals Landfill

Storage/Evaporation Ponds

- 30 waste ponds active
- Pond 16 is draining to Pond D, which is draining to Pond L

- Pad 4A is draining to Pond 2 (two separate ponds here)
- Material spread out around Pond R
- Significant spreading / earthwork within Pond T

#### Evaporation Pads

- Five evaporation pads appear active
- One sludge pond active

#### Waste Disposal Wells

- Eight injection wells visible; active grading in the same vicinity

#### Oil Field Waste Spreading Areas

- Spreading Area 1 is visible east and west of Pond 6
- Two excavated areas are noted in the future Spreading Area 6

#### Waste Disposal Trenches

- One waste disposal trench appears active

#### Other

- Material spread along the west side of Pond 6 (coincident with Spreading Area 1)
- Two lineations in the vicinity of A Drainage barrier
- Truckers' waiting trailer added to initial Administration Building; new trailer present in entrance area
- Initial construction of the road around RCRA canyon visible
- Trailer addition to the north side of the Maintenance Shed
- Ponding / possible excavation north of the Maintenance Shed in location of future underground fuel tanks
- Possible test pit excavations in RCRA Canyon and off-site area north of the site
- Regrading in Liquids Treatment Area

#### Zone 2

- Graded area noted west of site near C-Drainage is now vegetated
- Two graded areas are noted east of the Administration Building Area

06/18/1981 – Source: USDA, Flight 615070, Frame: 1480: 61, 62 (diapositives), Scale: 1"=3,333'

Although the scale of this black and white photography is small and the resolution fair, most of the features site could be identified, to some extent, and are listed below:

#### Landfills

- A pit with liquid in it and a probable tanker truck backed up to it is noted in Pesticides/Solvents Landfill
- An impoundment noted previously at the Heavy Metals Landfill no longer contains liquid and possibly contains light-toned material
- Continued excavation northward noted in the Caustics/Cyanide Landfill

#### Storage/Evaporation Ponds

- 33 ponds visible
- Pond 16 drains to Pond D
- Drainage near oil recovery tanks leads to Pond S

#### Evaporation Pads

- Six evaporation pads are active
- One sludge pond active
- Pad 4A drains to Pond 2

#### Oil Field Waste Spreading Areas

- Two excavated areas noted previously in Spreading Area 6 remain visible
- Spreading Area 3 is visible and a ponded area is noted within the area
- Spreading Area 1 remains visible west and east of Pond 6

#### Waste Disposal Wells

- Cannot determine activity in this area

#### Other

- Erosion gullies remain visible in the RCRA Canyon Area
- Larger administration / truckers' waiting facility, trailer gone and a new structure / shed in the Administration Building Area
- Staining noted on road west of Pond J and on both roads on either side of Pond 10

#### Zone 2

- No significant activity visible.

#### **08/25/1981 – Source: PW, Flight #SM3, Frame #108 (print), 107-109 (diapositive) Scale 1"=2,000'**

Although the scale of this photo is small, the quality and resolution is good and allowed the features at the site to be recognized with a good degree of certainty. ERI also examined the diapositives for this year. The findings are listed below:

#### Landfills

- Refuse with probable drums and an excavation in the PCB Landfill
- No ponding in Metals Landfill
- Waste placement continues in landfills identified in previous photo

#### Storage/Evaporation Ponds

- 29 waste ponds active
- Pond 16 draining across the berm to Pond D
- Pond D drains to Pond L via a pipe under the berm
- Excavations in the future A-series pond locations
- Stained soil along main entrance road up to Pond 3
- Stained soil along road winding around Pad 10B and Pond 19
- Pond A drains to Pond S
- Three trenches are noted north of Pond 12, grading is noted east of this area

Evaporation Pads

- Six evaporation pads active
- One sludge pond active
- Pad 4A draining to Pond 2

Waste Disposal Wells

- Eight injection wells visible; vegetated and graded

Oil and Waste Field Spreading areas

- Spreading Area 1 remains active
- Two excavated areas remain in Spreading Area 6
- Grading and fill activity noted in Spreading Area 2
- Light-toned material or light-toned liquid or sludge noted in Spreading Area 3
- Light-toned material noted in Spreading Area 4
- ASTs south of the Maintenance Shed gone (replaced by USTs north of the Maintenance Shed)

Other

- Grading / grubbing in the RCRA Canyon Drainage in future Pond A-5 location
- Excavation / borrow activities in the A Drainage
- Lineation of the C Drainage Barrier (barrier reportedly constructed of clay material excavated adjacent to the site boundary and A Drainage)
- Dark gray lineation in the vicinity of the P/S Clay Barrier; active dozing in the same area
- An area of erosion gullies with light-toned material at the top of the hill is noted in the RCRA Canyon Area
- Objects noted on a pad at the Drum Loading Dock

## Zone 2

- No significant activity noted in this area.

12/16/81 – Source: EPA, Flight #82009, Frame #1-7, Scale 1"=600'

The resolution, quality and large scale of this color photo is excellent. The features at the site could be identified with a high degree of certainty and are listed below:

## Landfills

- Drums are noted in all but the PCB Landfill

## Storage/Evaporation Ponds

- Construction continues in future A-Series ponds location

Evaporation Pads

- Six evaporation pads active
- One sludge pond active
- Pad 4A draining to Pond 2

## Treatment Units

- Grading continues in the Liquids Treatment Area

#### Oil and Waste Field Spreading Areas

- Spreading Area 1 remains active
- Two small impoundments noted in Spreading Area 6
- Liquid is noted in Spreading Area 2
- Liquid and/or staining is noted in Spreading Area 3, liquids or materials from Spreading Area 3 runs off downgradient to the southeast along an access road

#### Other

- An area of erosion gullies remains visible in the RCRA Canyon Area
- Staining is noted in the Maintenance Shed Area
- Grading is noted in the future transportation yard
- Ponding is noted south of Sludges 1, in the future Pad 7A area
- Two excavations remain in the northern RCRA Canyon Area
- Grading is noted northeast of Pond A-5, in the future West Canyon Spray Area

#### Zone 2

- No significant activity is noted in this area

#### **06/02/1982 – Source: PW, Flight #13449, Frame #3, 4 and 5 (prints) #1-15 (diapositives), Scale 1"=500'**

The resolution, quality and large scale of these color photos is excellent. The features at the site could be identified with a high degree of certainty and are listed below:

#### Landfills

- Drums in the Caustic/Cyanide Landfill
- Drums in the Pesticides/Solvents Landfill
- Drums in the Acids Landfill
- Waste placement continues in other landfills identified in previous photo

#### Storage/Evaporation Ponds

- 36 waste ponds active
- Staining on the road and roadsides next to Pond 5, emanating from a pipe that leads to it from the north
- Two pipes lead into Pond 19

#### Evaporation Pads

- Six evaporation pads active
- One sludge pond active

#### Oil Field Waste Spreading Areas

- Waste in Spreading Areas 2, 3 and 4
- Spreading Area 1 remains active
- Ponding in Spreading Area 2
- Grading in area of Spreading Areas 5 and 6 (northern RCRA Canyon Area)
- Grading noted south of Sludges 1 in future Pad 7A

Waste Disposal Wells

- Five injection wells visible; vegetated and graded

Treatment Units

- Liquids Treatment Area graded
- 4-pack area graded
- Grading in the CNS Area

Other

- Grading in area of future transportation yard
- Stacked drums stored in Maintenance Shed Area

Zone 2

- An excavated area is noted south of site near newly constructed access roads south of Pond 13
- Graded area east of site is vegetated

**10/06/1983 – Source: PW, Flight #16566, Frame #1 (print and diapositive), Scale 1”=600’**

The resolution, quality and larger scale of this color photo is good. ERI examined the diapositive for this year. The resolution of the diapositive is excellent. The features at the site could be identified with a high degree of certainty and are listed below:

Landfills

- Possible excavation in RCRA Landfill (difficult to distinguish because of the spreading activities in RCRA Canyon)
- Access road to RCRA Landfill area
- Waste placement continues in the landfills identified in the previous photo; drums noted in the Heavy Metals, PCB, Caustics/Cyanide and Acids landfills
- Spray activity in future pad areas between landfills dozed

Storage/Evaporation Ponds

- 38 waste ponds active
- Small square pond between Ponds 17 and 18
- Pond near Pond T
- Waste is trailed onto the roads from Ponds 16, D, C, B and A
- Discolored soil along the road around Ponds 14 and P

Evaporation Pads

- Five evaporation pads active
- One sludge pond active
- Grading at Pad 4A

Oil Field Waste Spreading Areas

- Waste in Spreading Areas 1, 2, 3, 5 and 6

- Terraces in Spreading Areas 5 and 6 located in the RCRA Canyon Area; the southernmost terrace in Spreading Area 6 is an impoundment
- Ponding noted in Spreading Area 5 and at base of RCRA Canyon

#### Waste Disposal Wells

- Two injection wells visible; area graded

#### Treatment Units

- Liquids Treatment Area contains a building, Zimpro WAO unit and paved area
- 4-pack structure visible
- Single tank north of Liquids Treatment Building visible

#### Other

- Radial spraying in the western portion of RCRA Canyon North and in Pad 18 area
- No change to the Administration Area from the previous photo
- Tank lying on its side just north of the Maintenance Shed Area (possibly the gray/brown tank previously identified)
- Discolored soil along sidewall west of water tanks – possible seep or concentrate from RO unit associated with water supply tanks on hill (noted also in subsequent photos)
- Drums are noted in the Maintenance Shed Area

#### Zone 2

No significant activity noted in this area.

#### **07/06/84– Source: PW, Flight #18505, Frame #1 (print), Enlargement Approximate Scale 1”=300’ (print); Diapositive 1”=1,000**

The resolution, quality and large scale of this color photo is good. ERI examined the diapositive for this year. The resolution of the diapositive is excellent. The features at the site could be identified with a high degree of certainty and are listed below:

#### Landfills

- Waste placement continues in the landfills identified in the previous photo (drums visible in all landfills)
- Probable grading in RCRA Landfill

#### Storage/Evaporation Ponds

- 39 waste ponds active
- Spray evaporation evident along sidewalls of Ponds A-1, A-2, A-3, A-4, A-6, Ponds 9, V and 8
- Pond 15 draining to 17
- Pond 16 drains to Pond D, Pond D drains to Pond L

#### Evaporation Pads

- 4 evaporation pads active
- One sludge pond active
- Pad 4A graded and removed

Oil Field Waste Spreading Areas

- Waste in Spreading Areas 5 and 6
- Ponding in Spreading Area 6
- Two areas of ponding in Spreading Area 5
- Ponding in RCRA Canyon to the southeast of Spreading Area 5 in the vicinity of the WCCB

Treatment Units

- Two tanks now visible north of the Liquids Treatment Area
- Staining noted in the Maintenance Shed Area

Other

- No change to the Administration area from the previous photo
- Gray/brown tank northwest of in Maintenance Shed gone (possibly moved to water tank hill)
- Staining noted on road east of Pond 8

## Zone 2

- Dark staining on entrance road
- Graded light-colored material noted west of the site
- Disturbed ground and probable liquid or staining is noted near entrance

**1985/1986 – Source unknown, Enlargement Approximate Scale 1”=120’**

The resolution and quality of this enlarged, mounted photo was excellent. The characteristics of the disposal site could be positively identified, and are listed below:

Landfills

- RCRA Landfill remained as it was in the previous photo but now partly vegetated
- Waste disposal continues in landfills identified in previous photo (drums noted in PCB, Pesticides/Solvents, and Acids Landfills)

Storage/Evaporation Ponds

- 39 waste ponds active
- Pond 14 waste draining across berm to Pond P
- Staining along roads adjacent to Ponds 16, D, C, B and A

Evaporation Pads

- 9 evaporation pads active
- Both sludge ponds active
- Liquids draining from Pad 18 to Pond 18
- Pond 7 gone; now in its place there is a road and Pads 9A & 9B

Oil Field Waste Spreading Areas

- Waste in Spreading Areas 5 and 6; dark waste draining down slope in Spreading Area 6
- Grading activities on all other spreading areas
- WCCB impoundment contains liquid

Treatment Units

- Grading in the vicinity of the CNS
- No other changes to the Liquids Treatment Area from the previous photo

Other

- Transportation yard surfaced / possibly paved
- Above-ground diesel fuel tank on concrete pad in transportation yard
- Darkened soil along the outer perimeter road from Sludges 1 to the top of the P/S Landfill and again from the bottom of the PCB Landfill, around RCRA Canyon down to Pond A-5
- Drums (approximately 80) are stored at the Drum Loading Dock
- A new parking area (the transportation yard) is visible south of Pond A-1

## Zone 2

- No significant activity noted in this portion of the site

**04/06/1987 – Source: PW, Flight #26570, Frame #9, Scale 1"=2,000' Enlargement  
Approximate Scale 1"=200', Diapositive Scale 1"=2,000'**

There were two copies of this color photo: one was from the source listed above and the other was an enlargement. The quality and resolution was excellent at both scales and allowed for the site features to be clearly identified as listed below:

Landfills

- Waste placement continues in landfills previously noted in other photos
- Grading and dozing activities in the RCRA Canyon area
- Vegetation noted in PCB landfill

Storage/Evaporation Ponds

- 41 waste ponds active
- Aeration units are used in Ponds 3, 4, 6, 10 and 19

Evaporation Pads

- 9 evaporation pads active
- Both sludge ponds active, grading in Sludge Pond 1
- Pad 4A active, with liquid draining to Pond 2

Oil Field Waste Spreading Areas

- Waste on Spreading Area 6 ponding also noted in Spreading Area 6
- Grading activities on all spreading areas
- WCCB pond visible

Treatment Units

- CNS structure visible
- No other changes to the Liquids Treatment Area from the previous photo
- H<sub>2</sub>O<sub>2</sub> system visible (two short white tanks located near the rim above Pond 3)

## Zone 2

- No significant activity noted in this portion of the site

**11/11/1988 – Source: PW, Flight #32356, Frame #1, Enlargement  
Approximate Scale 1”=300’, Diapositive Scale 1’=625’**

The resolution and quality of this enlarged, color photo was excellent and allowed for the site features to be clearly identified as listed below. ERI examined the diapositive for this year.

Landfills

- Drums in the Pesticides/Solvents Landfill
- Possible waste placement in Acids Landfill with dark-toned material or staining graded on top of it
- Fill placement in Pesticides/Solvents, Metals, Caustic/Cyanide, and Acids Landfills
- Grading in the PCB Landfill
- Dark-toned material or staining and drums noted in the Heavy Metals Landfill

Storage/Evaporation Ponds

- All ponds excavated with the exception of the WCCB at the base of RCRA Canyon
- Active excavation noted in most ponds, areas of ponding and staining noted in several ponds, large trenches noted in Ponds 2 and 11

Evaporation Pads

- All evaporation pads being excavated / graded
- Both sludge ponds being graded
- Clay liner test pads in Pad 1A area

Oil Field Waste Spreading Areas

- Grading activities on all spreading areas

Treatment Units

- 6-pack structure
- 4 tanks north of Liquids Treatment Building
- 1 tank northeast of Liquids Treatment Building
- No other changes to the Liquids Treatment and CNS area
- Oil Recovery Tanks are gone; small square structure stands in their place
- H<sub>2</sub>O<sub>2</sub> system at Pond 3 now gone

Other

- Initial Administration trailers replaced by a smaller truckers’ lounge and computer center building, new (current) Administration Building
- Two tanks between WAO and CNS relocated to expand 4-pack to 6-pack
- Discolored soil along road between the Liquids Treatment building and the CNS
- Discolored soil along road from Liquids Treatment building down to former Pond 2
- New concrete containment feature south of liquids treatment area, with graded dark-toned material or stained soil noted adjacent to it
- Stored drums noted at Drum Loading Dock
- Drums in open trailer trucks south of Pond 11 and southwest of the Administration Building Area

- Vertical tank for staging PCT liquids located east of former Pond 13

#### Zone 2

- Two trench excavations are noted south of the site
- Several new partially constructed roads are visible south of the site
- Graded area and new roads are noted east and north of the site
- Two excavated areas north of site along access road contains a dark colored object

11/22/88 – Source: Intrasearch, Flight #3537, Frame #172, 173 (diapositive), Scale 1"=2000'

#### Landfills

- Fill placement with possible drums noted in Pesticides/Solvents Landfill
- Fill placement with possible drums noted in Heavy Metals and Acids Landfill
- Grading is noted in the RCRA landfill

#### Evaporation Pads

- All pads excavated

#### Oil Field Waste Spreading Areas

- All areas are graded

#### Treatment Units

- CNS structure visible
- 6-pack structure visible
- Two horizontal tanks and vehicles (one with staining adjacent to it) are noted east of the CNS in former Ponds 14 and P
- Flow staining noted south of CNS, continues south towards the Liquids Treatment Building
- 4 tanks north of Liquids Treatment Building
- 1 tank northeast of Liquids Treatment Building
- 1 tank noted east of former Pond 13

#### Zone 2

- Trenches noted south of the site remain as excavations

**07/06/1989 – Source: PW, Flight #SB7, Frame #329(print) 328, 329 (Diapositive), Enlargement Scale 1"=2517', Scale Diapositive Scale: 1"=2,000'**

The quality and resolution of these color photographs is good and allowed the features at the site to be recognized with a good degree of certainty and are listed below. ERI analyzed the diapositive for this year. The resolution of the diapositives is excellent. The following site features were visible:

#### Landfills

- Fill placement in the Pesticides/Solvents Landfill
- Darker soils graded / filled in the Metals Landfill
- Fill placement in the Caustic/Cyanide Landfill

- Fill placement in the Acids Landfill
- Grading activities in the PCB Landfill
- Grading noted at the RCRA Landfill

#### Storage/Evaporation Ponds

- One waste pond (Pond A-5) with some liquids during pond closure activities
- All others ponds excavated
- Possible stormwater along a drainage that runs through former Ponds 6, 8 and 10
- Discolored soil along the northern perimeter road from Sludges 2 to the P/S Landfill

#### Evaporation Pads

- 6 evaporation pads excavated / graded
- Both sludge ponds graded
- Light-toned material is spread around a pit in the Pad 9A and 9B area

#### Oil Field Waste Spreading Areas

- All spreading areas graded or undisturbed from the previous year

#### Treatment Units

- No change to the Liquids Treatment, CNS and 6-Pack areas

#### Other

- Two horizontal tanks are noted east of former Pond 13

#### Zone 2

- Excavations noted directly south of former Pond 13

#### **5/25/90 – Source: UCSB MIB, Flight #90-084, Frame #55, Scale 1”=2,708’**

Although the scale of this black and white photo is small and the resolution is fair, some of the features at the site could still be identified and are listed below:

#### Landfills

- Grading / filling dark soil in the Pesticides/Solvents Landfill
- Other landfills graded
- Discolored soil extends from the former Pond 9 location to the Pesticides/Solvents Landfill

#### Storage/Evaporation Ponds

- Former Ponds A-2 and A-3 joined (A-Series Pond) and active
- Probable liquid is visible in Pond A-5
- Grading in current RCF Pond location

#### Evaporation Pads

- All evaporation pads and sludge ponds graded

#### Oil Field Waste Spreading Areas

- No activities apparent

Treatment Units

- No other changes to the Liquids Treatment and CNS area
- Probable staining noted north of CNS building

## Zone 2

- No significant activity noted in this portion of the site

**1991 – Source: UCSB MIB, Flight #91-022, Frame #1546 (diapositive), Scale 1”=5,417’**

The scale of this black and white photo is too small and the resolution is poor. Site features could not be identified; therefore most site features could not be identified

## Treatment Units

- Six-pack structure noted
- CNS structure visible

**11/30/1992 – Source: PW, Flight #C4896-19, Frame #04 (print), 3-5 (diapositive) Scale 1”=4,500’**

Although the scale of this color photo is small and the resolution is fair. ERI analyzed the diapositives for this year. The resolution of the diapositives is also good. Most of the features at the site could be identified, to some extent, and are listed below:

Landfills

- Vegetation on all site landfills
- Possible filling / grading in limited portion of the Metals Landfill
- Concrete ditch in Heavy Metals Landfill
- Light-toned mounded material noted on PCB Landfill

Storage/Evaporation Ponds

- Former Ponds 4, 9, 10 and 11 are joined as one (current RCF Pond) and active; former Ponds A-1 and A-4 joined into the active A-Series Pond; Pond A-5 active

Evaporation Pads

- All evaporation pads vegetated or otherwise inactive
- Both sludge ponds vegetated

Oil Field Waste Spreading Areas

- Vegetation on all spreading areas

Treatment Units

- No change to the Liquids Treatment, CNS and 6-pack structure etc. from previous photo

Other

- Lineation in the vicinity of PCT-C
- Probable horizontal tank east of Pond 13

## Zone 2

- Area south of Pond 13 graded

### **09/15/1994 – Source: UCSB MIB, Flight #NAPP-2<sup>nd</sup> cycle, Frame #6928-93 (print) 93, 94 (diapositive), Scale 1"=3,333'**

The scale of this black and white photo is small and the resolution is poor. Only large site features could be identified. ERI examined the diapositives for this year. The resolution of the diapositives is good.

#### Landfills

- All landfills vegetated
- Ground scars noted in RCRA Canyon

#### Storage/Evaporation Ponds

- Former Ponds 3 and 12 joined into the active RCF Pond
- A-Series, Pond A-5, Pond 18 and Pond 13 active
- Probable impoundment noted in Pond D area

#### Evaporation Pads

- Grading for possible drainage improvement on vegetated evaporation pads
- Sludge ponds vegetated

#### Treatment Units

- No change in the Liquids Treatment area from the previous photo
- Tanks north and northeast of Liquids Treatment building removed

## Zone 2

- No significant activity is noted in this area

### **07/05/1997 – Source: PW, Flight #SB10, Frame #401 (print), 401, 402 (diapositives), Enlargement Scale 1"=300', Diapositive Scale 1"=2,000'**

The resolution and quality of this enlarged, color photo and the diapositives were excellent and allowed for the site features to be clearly identified as listed below:

#### Landfills

- Landfills vegetated
- Concrete ditch at southwest corner of Pesticides/Solvents Landfill
- Concrete ditch on Metals Landfill
- Access road leads to an area of light-toned material noted in PCB Landfill

#### Storage/Evaporation Ponds

- No change to the ponds from the previous photo

Evaporation Pads

- Evaporation pads vegetated

Oil Field Waste Spreading Areas

- All spreading areas are vegetated

Treatment Units

- 2 Frac tanks for PACT system immediately north of Liquids Treatment Building
- Carbon units northeast of Liquids Treatment Building
- 4 Frac tanks between the Liquids Treatment Building and CNS
- CNS structure and drums visible

Other

- Concrete ditch in central drainage area; new ditch links drainage from Metals and Pesticides Landfills to RCF Pond

**01/05/1998 – Source: GS, Flight #3335-1, Enlargement Approximate Scale 1"=300'**

The resolution and quality of this enlarged, color photo was excellent and allowed for the site features to be clearly identified as listed below:

Landfills

- Landfills are vegetated

Storage/Evaporation Ponds

- No change to the ponds from the previous photo

Evaporation Pads

- Pads and sludge ponds vegetated

Oil Field Waste Spreading Areas

- Spreading areas vegetated

Treatment Units

- 6 new carbon treatment cylinders
- No other change to the Liquid Treatment area and CNS from the previous photo

Other

- Road in central drainage area removed and concrete ditch from the Pesticides/Solvents Landfill to the central drainage area ditch joined
- Pavement in truck loading facility south of the 6-pack tanks

**12/17/1999 – Source: GS, Flight #4116-S, Scale 1"=1,000'**

The resolution and quality of this color photo was excellent and allowed for the site features to be clearly identified, most as listed below:

Landfills

- Pesticides/Solvents Landfill capped; erosion mat and silt fence downgradient from landfill benches
- Other landfills vegetated

Storage/Evaporation Ponds

- Enhanced evaporation / irrigation system north of RCF pond
- No other changes to the ponds from the previous photo

Evaporation Pads

- No change to the evaporation pads and sludge ponds from the previous photo

Treatment Units

- 1 new vapor phase GAC unit located between the Liquids Treatment Building and the 6-Pack
- 2 Frac tanks between the Liquids Treatment Building and the CNS (2 are missing from previous photo)

Other

- Temporary access road to the Pesticides/Solvents Landfill and buttress area
- Erosion mat on Pesticides/Solvents landfill buttress
- Erosion Mat on borrow area northwest of the Pesticides/Solvents Landfill

**02/12/2002 – Source: GS, Flight #4850-S, Scale 1”=1,000’**

The resolution and quality of this color photo was excellent and allowed for the site features to be clearly identified as listed below:

Landfills

- Pesticides/Solvents Landfill top deck is regraded
- Heavy Metals Landfill is capped and has silt fence placed
- Grading on crest of Caustics/Cyanides Landfill and much of landfill is grubbed
- Acids Landfill vegetated
- New road loops through the PCB Landfill

Storage/Evaporation Ponds

- Former Pond A-6 joined into the active A-Series Pond; no other changes to the ponds from the previous photo

Evaporation Pads

- Evaporation Pad 10A, 10F and 10G are capped
- Sludge 2 used for geosynthetics storage
- No other changes to the evaporation pads and sludge ponds from the previous photo

Treatment Units

- Line of ATS vessels plus one ATS-regenerate tank located between the Liquids Treatment Building and the 6-Pack
- 1 new frac tank

- Line of 6 GAC vessels
- No other changes to the Liquids Treatment and CNS area

Other

- Northern borrow area expanded

**TABLE J-1  
HISTORICAL AERIAL PHOTOGRAPH REVIEW**

<b>DATE</b>	<b>SOURCE / FLIGHT NUMBER</b>	<b>FRAME</b>	<b>SCALE</b>	<b>FILM COLOR (1)</b>	<b>SOURCE TYPE (2)</b>	<b>COVERAGE TYPE (3)</b>	<b>RESOLUTION</b>	<b>MATERIAL (4)</b>
3-28-56	UCSB MIB / HA-AN	6-103	1"=800'	B/W	POS	FM	GOOD	PRINT
6-18-70	UCSB MIB / HB-RF	135-138, 141-144	1"=1000'	B/W	POS	FS	GOOD	DIAP
5-20-74	UCSB MIB / AF-74-9	278-282, 798-802, 203-206	1"=1200'	B/W	POS	FS	FAIR	DIAP
6-18-75	PW / 5048	4	1"=2000'	CC	POS	FM	GOOD	DIAP
7-29-77	PW / SM2	9	1"=2000'	CC	POS	FM	FAIR	DIAP
3-14-78	PW / 7301	1, 2	1"=1000'	CC	POS	FS	GOOD	DIAP
7-18-79	PW / 9118	1	1"=130'	CC	POS	FM	EXCELLENT	PRINT
7-18-79	PW / 9118	1	1"=500'	CC	POS	FM	EXCELLENT	DIAP
9-15-80	PW / 10708	1	1"=800'	CC	POS	FM	EXCELLENT	DIAP
6-18-81	PW / USDA 615070	61, 62	1"=3333'	B/W	POS	FS	FAIR	DIAP
8-25-81	PW / SM3	107-109	1"=2000'	CC	POS	FS	GOOD	DIAP
12-16-81	EPA / 82009	1-7	1"=600'	CC	POS	FS	EXCELLENT	DIAP
6-2-82	PW / 13449	1-15	1"=850'	CC	POS	FS	EXCELLENT	DIAP
10-6-83	PW / 16566	1	1"=600'	CC	POS	FM	EXCELLENT	DIAP
7-6-84	PW / 18505	1	1"=300'	CC	POS	FM	EXCELLENT	PRINT
7-6-84	PW / 18505	1	1"=1000'	CC	POS	FM	EXCELLENT	DIAP
1985/1986	Unknown source	Unknown source	1"=120'	CC	POS	FM	EXCELLENT	PRINT
4-6-87	PW / 26570	9	1"=175'	CC	POS	FM	GOOD	PRINT
4-6-87	PW / 26570	9	1"=2000'	CC	POS	FM	GOOD	DIAP
11-11-88	PW / 32356	1	1"=267'	CC	POS	FM	EXCELLENT	PRINT

**TABLE J-1  
HISTORICAL AERIAL PHOTOGRAPH REVIEW**

<b>DATE</b>	<b>SOURCE / FLIGHT NUMBER</b>	<b>FRAME</b>	<b>SCALE</b>	<b>FILM COLOR (1)</b>	<b>SOURCE TYPE (2)</b>	<b>COVERAGE TYPE (3)</b>	<b>RESOLUTION</b>	<b>MATERIAL (4)</b>
11-11-88	PW / 32356	1	1"=625'	CC	POS	FM	EXCELLENT	DIAP
11-22-88	INTRA	3537:172, 173	1"=2000'	CC	POS	FS	EXCELLENT	DIAP
7-6-89	PW / SB7		1"=217'	CC	POS	FM	GOOD	PRINT
7-6-89	PW / SB7	328, 329	1"=2000'	CC	POS	FS	EXCELLENT	DIAP
5-25-90	UCSB MIB / 90-084	55	1"=2708'	B/W	POS	FM	FAIR	DIAP
1991	UCSB MIB / 91-022	1546	1"=5417'	B/W	POS	FM	POOR	DIAP
11-30-92	PW / C4896-19	3-5	1"=4500'	CC	POS	FS	GOOD	DIAP
9-15-94	UCSB MIB / NAPP-2 <sup>nd</sup> cyc.	6928:93, 94	1"=3333'	B/W	POS	FS	GOOD	DIAP
7-5-97	PW / SB10	401	1"=300'	CC	POS	FM	GOOD	PRINT
7-5-97	PW / SB10	401, 402	1"=2000'	CC	POS	FS	GOOD	DIAP
1-5-98	GS / 3335-1	2	1"=300'	CC	POS	FM	EXCELLENT	PRINT
11-18-98	GS / 3648	1	1"=225'	CC	POS	FM	EXCELLENT	PRINT
12-17-99	GS / 4116	S	1"=1000'	CC	POS	FM	EXCELLENT	PRINT
2-12-02	GS / 4850	S	1"=1000'	CC	POS	FM	EXCELLENT	PRINT

**SOURCES:**

EPA – Environmental Protection Agency, Las Vegas, NV  
 GS – Golden State Aerial Surveys, San Luis Obispo, CA  
 PW – Pacific Western Aerial Surveys, Santa Barbara, CA  
 UCSB MIB – University of California, Santa Barbara Map and Image Library, Santa Barbara, CA  
 INTRA – Intrasearch, Denver, CO

**Notes:**

- 1 Film color:  
     B/W – Black-and White  
     CC – conventional Color
- 2 Source Type:  
     POS – Positive
- 3 Coverage Type:  
     F – Full Coverage  
     M – Monoscopic Coverage  
     P – Partial Coverage  
     S – Stereo Coverage
- 4 Material:  
     DIAP - Diapositive

CAD File: G:\5084\00\50840008.dwg  
Drawn By: D. Ludlam  
Date: 08/22/03  
Project No. 5084.00



0 800  
FEET

Source: Map and Imagery Library, UCSB.  
Date: March-28-1956, Flight: HA-AN, Frame: 6-103

*Aerial Photo 28 March 1956  
Casmalia, California*

ERM 01/03

CAD File: G:\5084\00\50840008.dwg  
Drawn By: D. Ludlam  
Date: 02/03/03  
Project No. 5084.00



Source: Map and Imagery Library, UCSB.  
Date: June-18-1970, Frame: HB-RF-136

*Aerial Photo 18 June 1970  
Casmalia, California*

ERM 01/03



CAD File: G:\5084\00\50840008.dwg  
Drawn By: D. Ludlam  
Date: 02/03/03  
Project No: 5084.00

280

0 800  
FEET

Source: Map and Imagery Library, UCSB.  
Date: May-20-1974, Flight: AF74-9, Frame: 280

*Aerial Photo 20 May 1974  
Casmalia, California*

ERM 01/03

CAD File: G:\5084\00\50840008.dwg  
Drawn By: D. Ludlam  
Date: 02/03/03  
Project No. 5084.00



0 800  
FEET

Source: Pacific Western Aerial Surveys  
Date: June-18-1975, Frame: PW 5084-4

*Aerial Photo 18 June 1975  
Casmalia, California*

ERM 01/03

CAD File: G:\5084\00\5084-0008.dwg  
Drawn By: D. Ludlam  
Date: 02/03/03  
Project No. 5084.00



0 800  
FEET

Source: Pacific Western Aerial Surveys  
Date: July-29-1977, Frame: PW SM2-9

*Aerial Photo 29 July 1977  
Casmalia, California*

ERM 01/03

Project No.  
5084.00

Date:  
02/03/03

Drawn By:  
D. Ludlam

CAD File:  
C:\5084\00\50840008.dwg



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FEET

*Aerial Photo 14 March 1978  
Casmalia, California*

Source: Pacific Western Aerial Surveys  
Date: March-14-1978, Frame: PW 7301-1

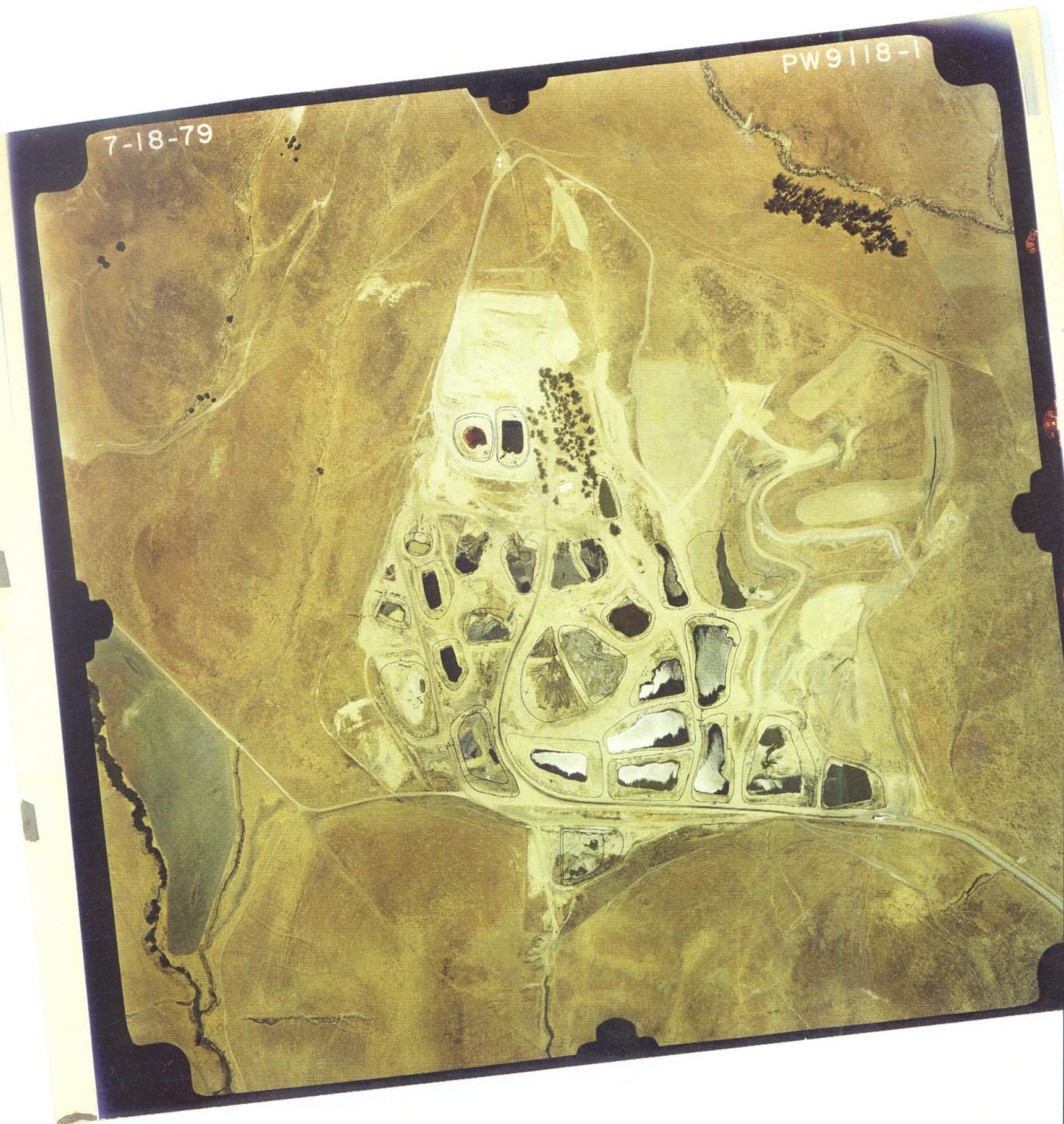
ERM 01/03

Project No.  
5084.00

Date:  
02/03/03

Drawn By:  
D. Ludlam

CAD File:  
G:\5084\00\50840008.dwg



0 800  
FEET

*Aerial Photo 18 July 1979  
Casmalia, California*

Source: Pacific Western Aerial Surveys  
Date: July-18-1979, Frame: PW9118-1

ERM 01/03

CAD File: C:\5084\00\50840008.dwg  
Drawn By: D. Ludlam  
Date: 02/03/03  
Project No. 5084.00

9-15-80

PW10708



0 800  
FEET

*Aerial Photo 15 September 1980  
Casmalia, California*

Source: Pacific Western Aerial Surveys  
Date: September-15-1980, Frame: PW10708-1

ERM 01/03



0 800  
FEET

Source: Pacific Western Aerial Surveys/United States  
Department of Agriculture  
Date: June-18-1988, Frame: 615070-61

*Aerial Photo 18 June 1981  
Casmalia, California*

CAD File: C:\5084\00\50840008.dwg  
Drawn By: D. Ludlam  
Date: 02/03/03  
Project No. 5084.00



0 800  
FEET

Source: Pacific Western Aerial Surveys  
Date: August-25-1981, Frame: PW SM3-108

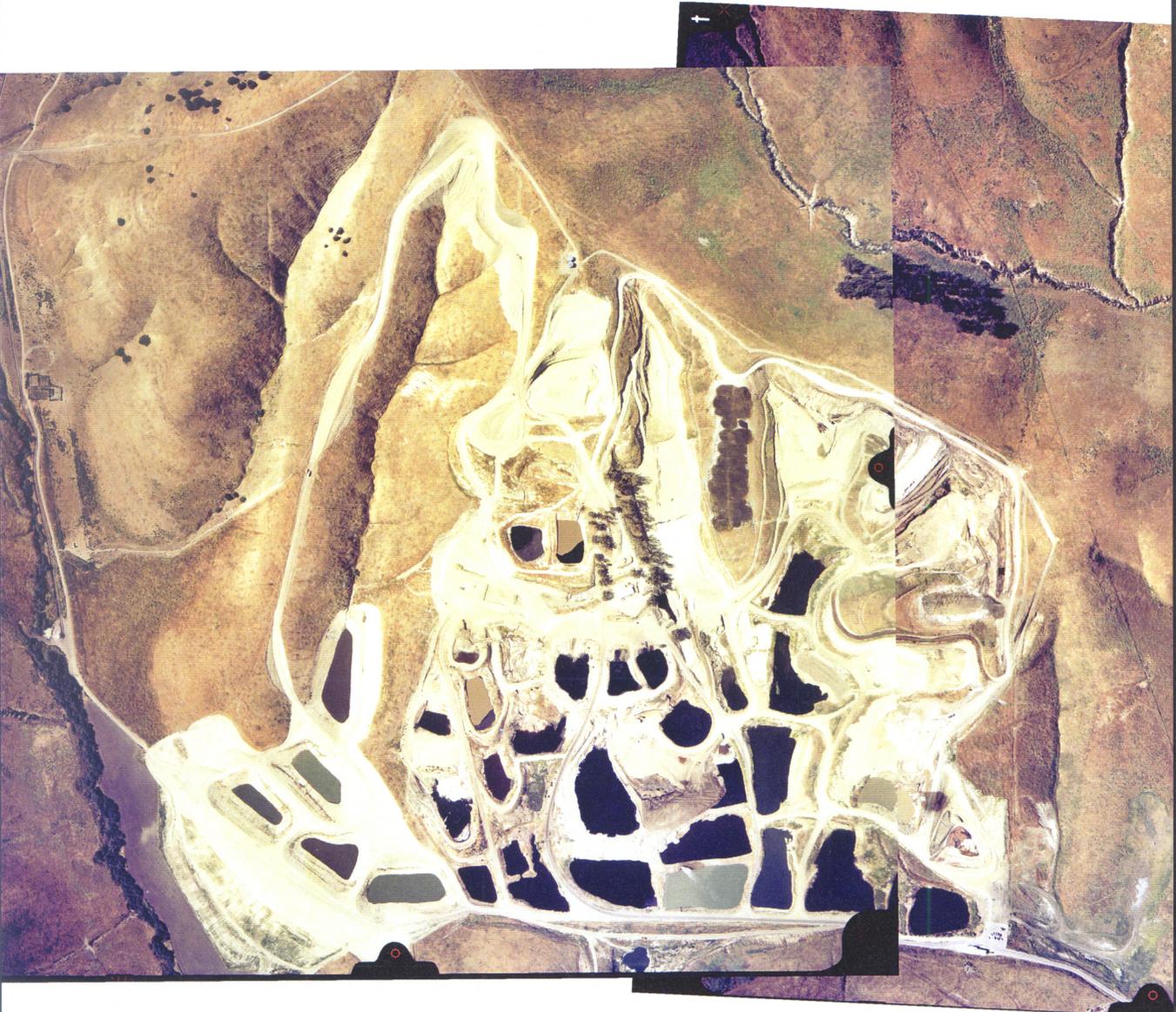
*Aerial Photo 25 August 1981  
Casmalia, California*

ERM 01/03



*Aerial Photo 16 December 1981  
Casmalia, California*

Source: Environmental Protection Agency  
Date: December-16-1981, Frame: 82009-1



0 800  
FEET

Source: Pacific Western Aerial Surveys  
Date: June-2-1982, Frame: PW13449-3,4,5

*Aerial Photo 02 June 1982  
Casmalia, California*

ERM 01/03

Project No:  
5084.00

Date:  
02/03/03

Drawn By:  
D. Ludlam

CAD File:  
G:\5084\00\50840008.dwg



*Aerial Photo 06 October 1983  
Casmalia, California*

Source: Pacific Western Aerial Surveys  
Date: October-6-1983, Frame: PW16566-1

ERM 01/03



0 800  
FEET

*Aerial Photo 06 July 1984  
Casmalia, California*

Source: Pacific Western Aerial Surveys  
Date: July-6-1984, Frame: 18505-1



0 800  
FEET

Date: 1985/1986

*Aerial Photo 1985/1986  
Casmalia, California*

ERM 01/03

Project No.  
5084.00

Date:  
02/03/03

Drawn By:  
D. Ludlam

CAD File:  
C:\5084\00\50840008.dwg

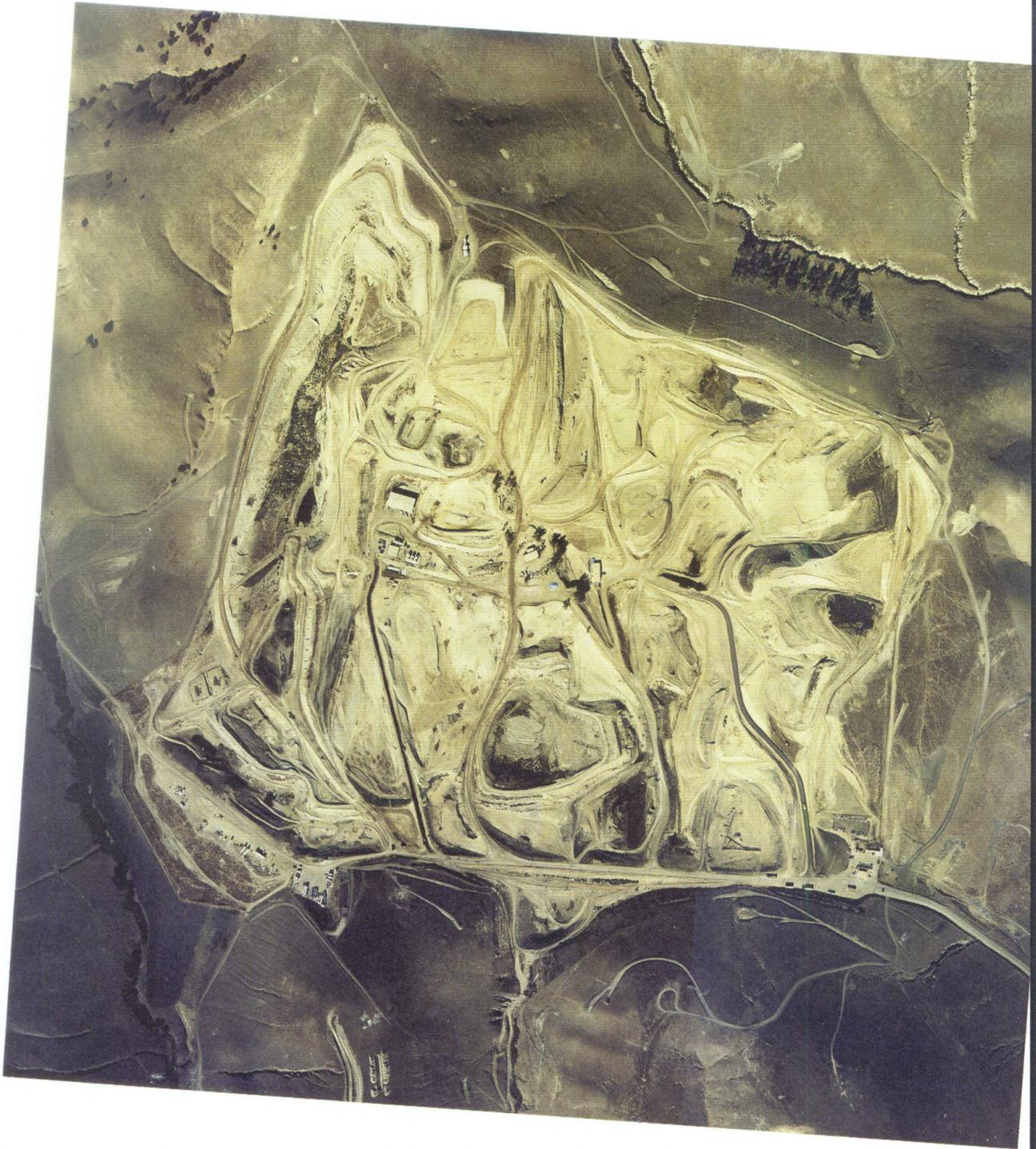


0 800  
FEET

*Aerial Photo 06 April 1987  
Casmalia, California*

Source: Pacific Western Aerial Surveys  
Date: April-6-1987, Frame: PW 26570-9

ERM 01/03



0 800  
FEET

*Aerial Photo 11 November 1988  
Casmalia, California*

Source: Pacific Western Aerial Surveys  
Date: November-11-1988, Frame: 32356-1

ERM 01/03



*Aerial Photo 22 November 1988  
Casmalia, California*

Source: IntraSearch  
Date: November-22-1988, Frame: 3537-172

CAD File: G:\5084\00\50840008.dwg

Drawn By: D. Ludlam

Date: 02/03/03

Project No. 5084.00



0 800  
FEET

Source: Pacific Western Aerial Surveys  
Date: July-6-1989, Frame: PW SB 7-329

*Aerial Photo 06 July 1989  
Casmalia, California*

ERM 01/03

CAD File: G:\5084\00\50840008.dwg  
Drawn By: D. Ludlam  
Date: 02/03/03  
Project No. 5084.00



0 800  
FEET

*Aerial Photo 25 May 1990  
Casmalia, California*

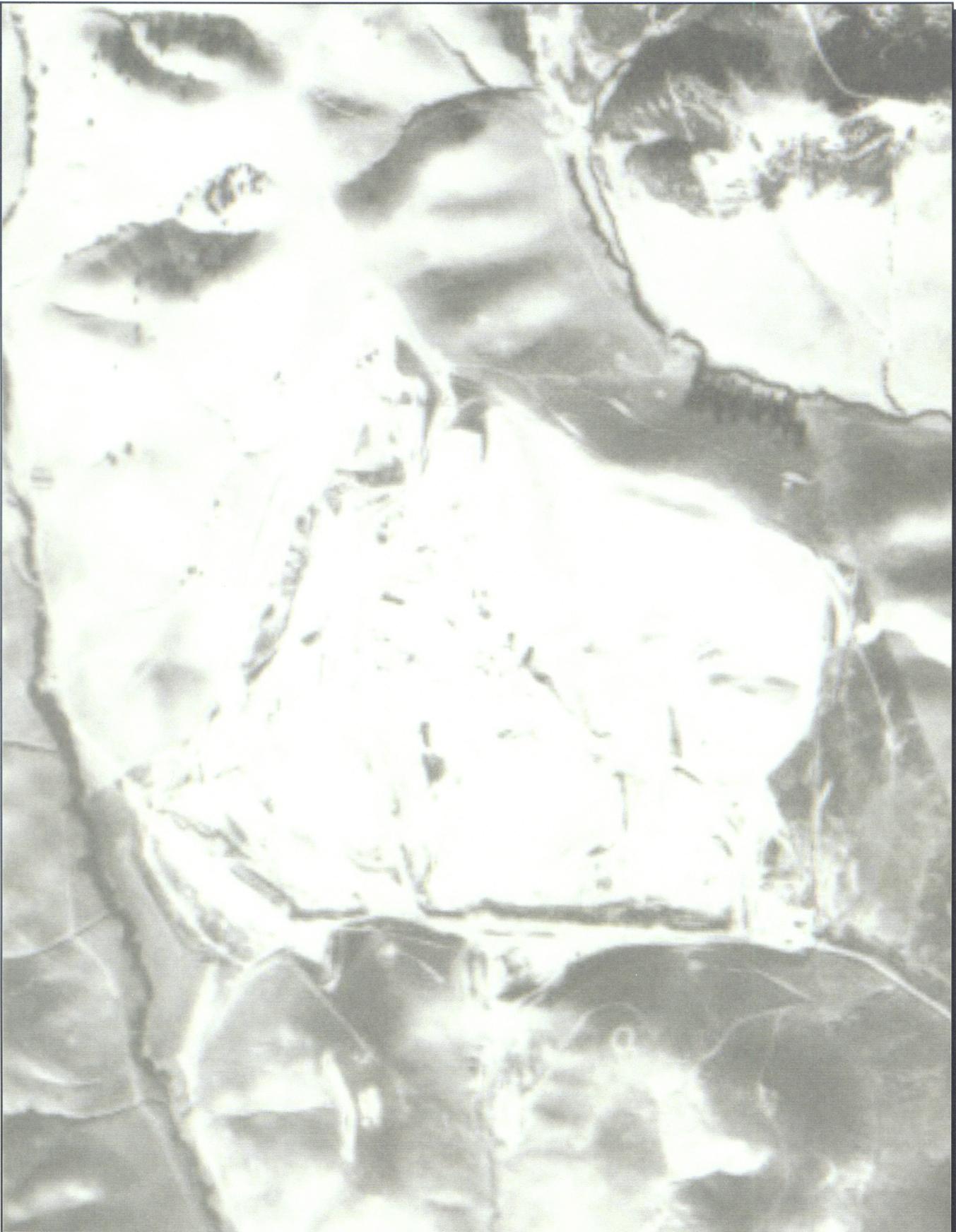
Source: Map and Imagery Library, UCSB.  
Date: May-25-1990, Flight: 90 084, Frame: 55

Project No.  
5084.00

Date:  
08/22/03

Drawn By:  
D. Ludlam

CAD File:  
G:\5084\00\50840008.dwg



0 800  
FEET

Source: Map and Imagery Library, UCSB.  
Date: 1991, Flight: 91-022, Frame: 1546

*Aerial Photo 1991  
Casmalia, California*

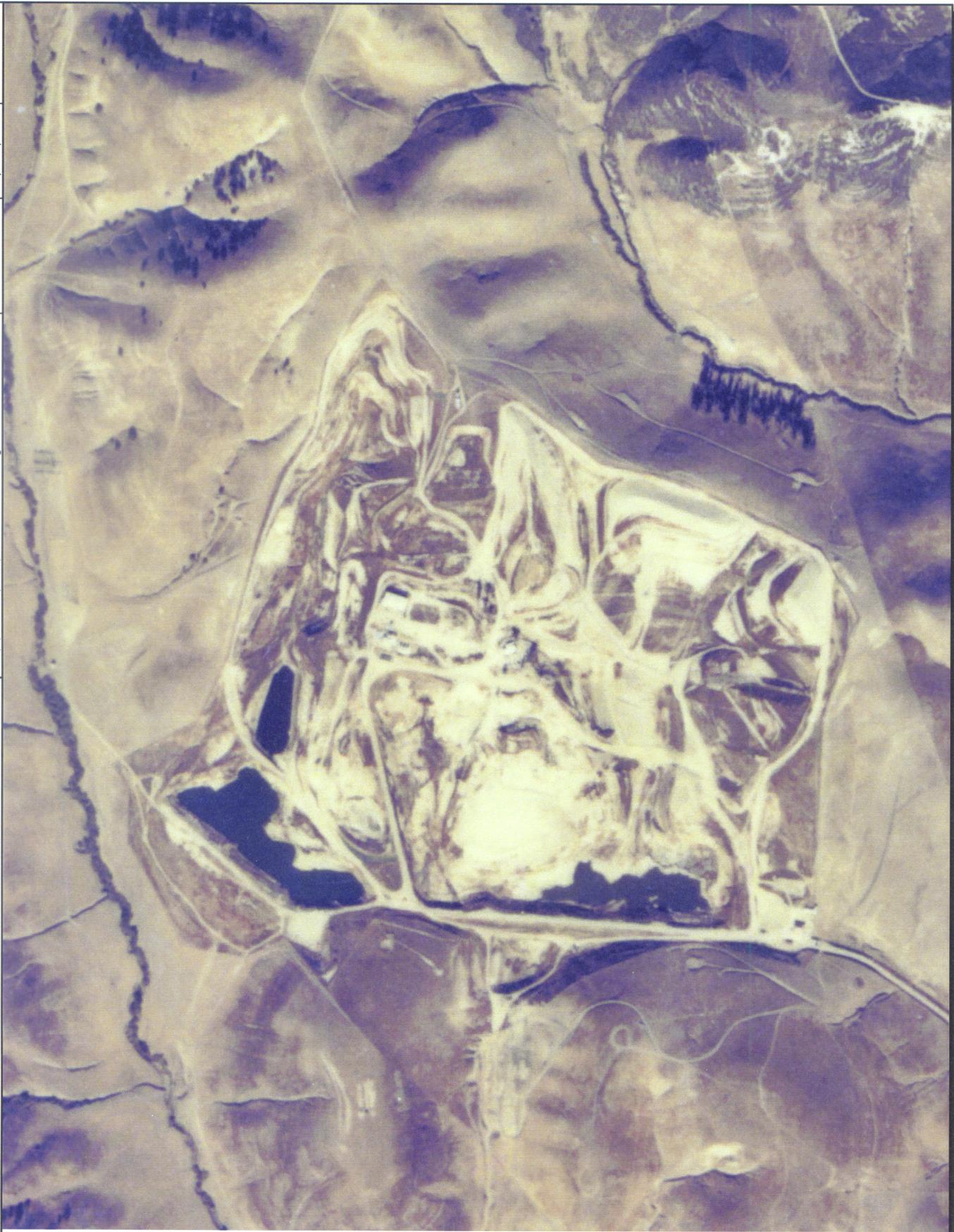
ERM 01/03

Project No.  
5084.00

Date:  
02/03/03

Drawn By:  
D. Ludlam

CAD File:  
G:\5084\00\50840008.dwg



0 800  
FEET

*Aerial Photo 30 November 1992  
Casmalia, California*

Source: Pacific Western Aerial Surveys  
Date: November-30-1992, Flight: C4896-19, Frame: 4

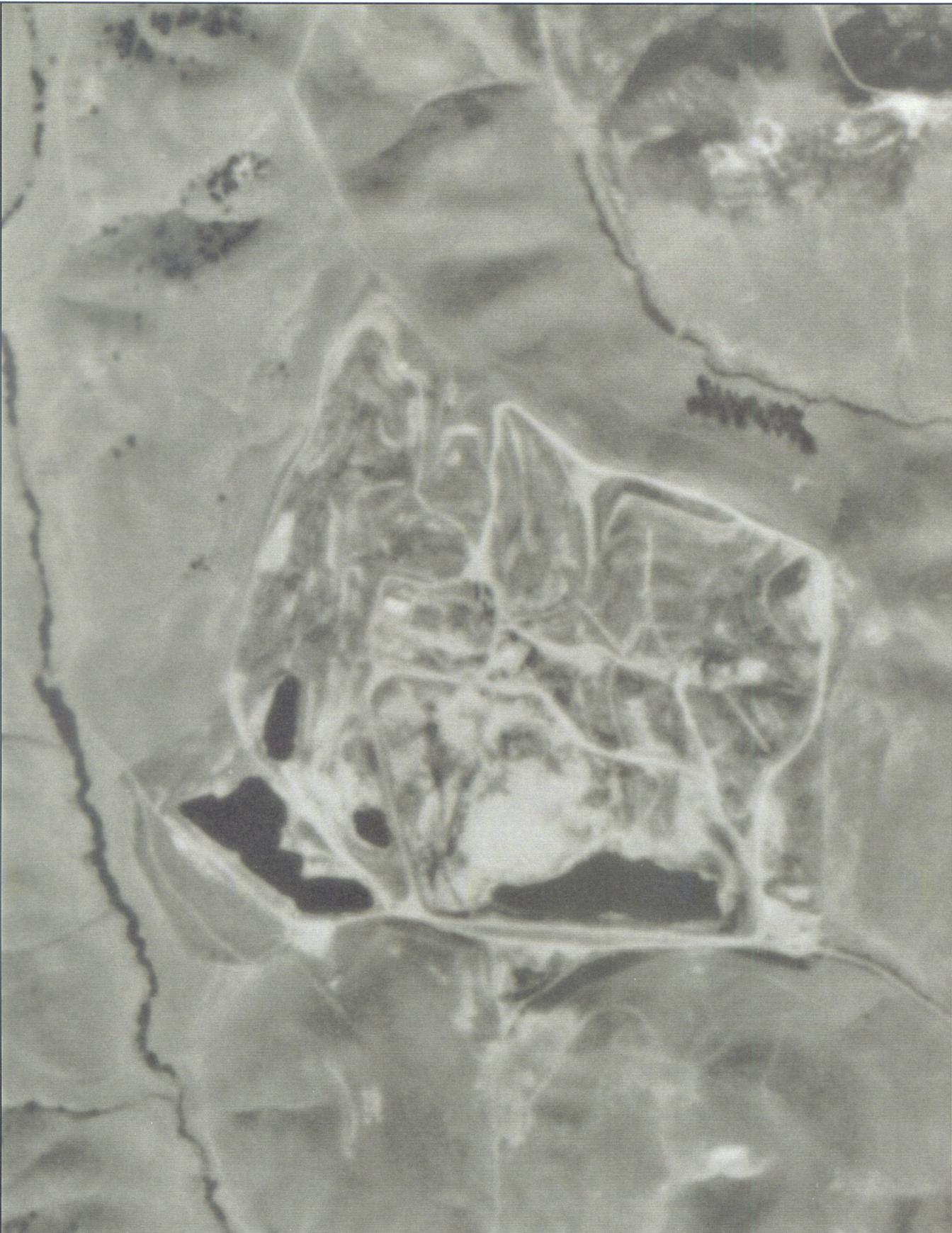
ERM 01/03

Project No.  
5084.00

Date:  
08/22/03

Drawn By:  
D. Ludlam

CAD File:  
G:\5084\00\50840008.dwg



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FEET

Source: Map and Imagery Library, UCSB.  
Date: September-15-1994, Flight: NAPP, 2nd Cycle,  
Frame: 6928-93

*Aerial Photo 15 September 1994  
Casmalia, California*

ERM 01/03

Project No.  
5084.00

Date:  
08/22/03

Drawn By:  
D. Ludlam

CAD File:  
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CASMALIA RESOURCES SITE- July 1997



0 800  
FEET

*Aerial Photo 05 July 1997  
Casmalia, California*

Source: Pacific Western Aerial Surveys  
Date: July-5-1997, Frame: PW/SB10-401

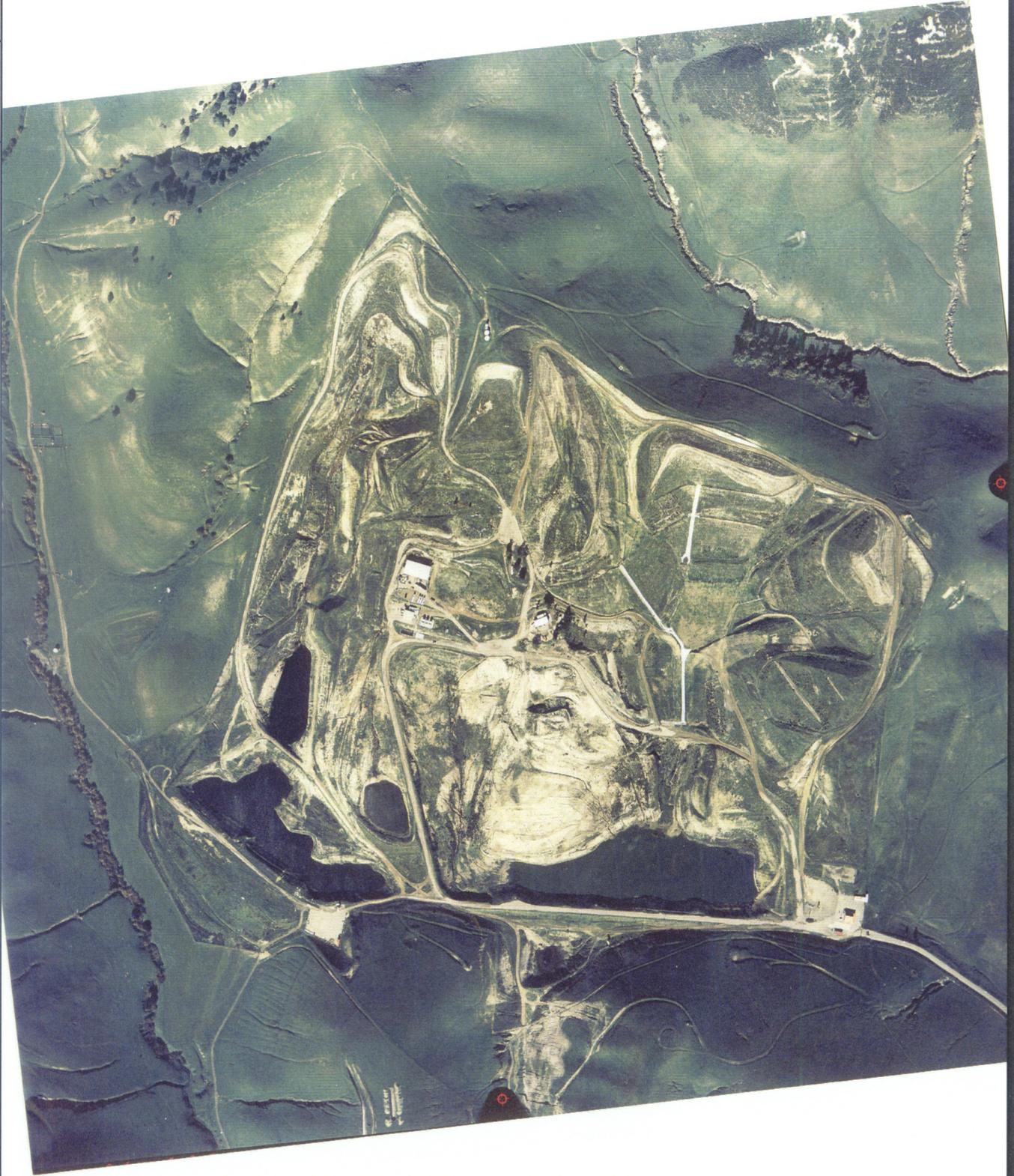
ERM 01/03

Project No.  
5084.00

Date:  
02/03/03

Drawn By:  
D. Ludlam

CAD File:  
G:\5084\00\50840008.dwg



0 800  
FEET

Source: Golden State Aerial Surveys  
Date: January-5-1998, Flight: GS3335-1, Frame: 2

*Aerial Photo 05 January 1998  
Casmalia, California*

ERM 01/03

Project No.  
5084.00

Date:  
08/22/03

Drawn By:  
D. Ludlam

CAD File:  
G:\5084\00\50840008.dwg



0 800  
FEET

*Aerial Photo 17 December 1999  
Casmalia, California*

Source: Golden State Aerial Surveys  
Date: December-17-1999, Frame: GS4116-S

ERM 01/03

Project No.  
5084.00

Date:  
01/24/03

Drawn By:  
D. Ludlam

CAD File:  
G:\5084\00\50840008.dwg



0 800  
FEET

Source: Golden State Aerial Surveys  
Date: February-12-2002, Frame: GS4850-S

*Aerial Photo 12 February 2002  
Casmalia, California*

ERM 01/03

**Attachment J-1**

**Resumes for Photo Review Analysts**



8 January 2004

Mr. Corey Bertelsen  
Casmalia Resources Steering Committee  
868 Greystone Place  
San Luis Obispo, CA 93401



Subject: Staff Resumes  
Casmalia Resources Superfund Site

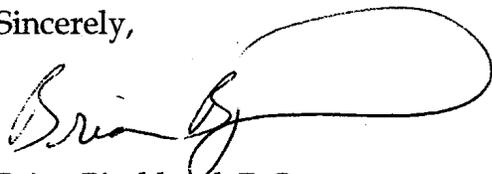
Dear Mr. Bertelsen:

Enclosed are resumes of selected Environmental Resources Management staff that supported the CSC on the review of aerial photographs of the Casmalia site. A summary of staff responsibilities on this project are described briefly below.

- Anne Perez – Reviewed aerial photographs, summarized observations and noted land use changes over time. Provided quality control reviews of basemap figures and aerial photo overlays.
- Don Ludlam – Provided AutoCad support for production of Appendix J figures and digital overlays.
- Brian Bjorklund, R.G., C.HG. – Reviewed photo interpretation summaries and provided overall quality control for several workplan figures associated with the aerial photography reviews.

ERM looks forward to providing continued environmental services to Casmalia Steering Committee. Please call me at (925) 946-0455 with any questions.

Sincerely,



Brian Bjorklund, R.G.  
Project Manager

BSB/bsb/5084  
enclosures: noted



# Anne E. Perez

Ms. Perez has 5 years of experience in the environmental consulting industry. Her experience encompasses ground water sampling and monitoring programs, and complex soil and ground water investigations. She has maintained drilling logs, participated in ground water monitoring well installation, conducted field observations, reviewed reports and environmental impact reports; and updated fault/liquefaction maps. Her experience includes conducting extensive historical aerial photo analysis and interpretation of faulted regions, glaciated terrains, Phase I sites, and Superfund sites.

Ms. Perez' responsibilities have included soil and ground water sampling; reporting analytical results to the appropriate governing agencies; evaluating site investigation data to address site remediation; natural attenuation sampling and evaluation; historical aerial photo analysis and interpretation; quality assurance and quality control; and regulatory compliance.

## **Fields of Competence**

- Soil and ground water investigations
- Soil and ground water sampling and analysis
- Monitoring well installation
- Aerial photo analysis and interpretation
- Drilling and coring logs
- Quality assurance and quality control
- Report preparation

## **Education**

- M.S., Geology, University of California at Riverside, 2003
- B.S., Geology, University of California at Riverside, 2000
- 40-Hour OSHA Hazardous Waste and Emergency Response certification, 2002
- Railroad Safety Training, 2002
- Refinery Safety Training, 2003

## **Professional Affiliations**

### **Honors and Awards**

UCR Earth Science Department Fellowship

### **Publications**

Owen, Lewis, Finkle, Robert, Minnich, Richard and Perez, Anne. "Extreme Southern Margin of Late Quaternary Glaciation in North America: Timing and Controls." Published in the Journal *Geology*.

## **Key Projects**

Prepared quarterly ground water monitoring report for Caltrans site investigation in Oakland, CA.

Assisted in ground water monitoring and reporting at San Francisco International Airport, Boarding Area E, using both peristaltic pump and hand bailer sampling technologies.

Assisted in ground water monitoring, reporting, and surveying at major airline's maintenance and operations center at San Francisco International Airport using the peristaltic pump, whale pump, and hand bailer sampling technologies.

Conducted an extensive aerial photo review (25 photo years) and prepared the historical written review for the Casmalia Superfund site; performed QA/QC for the data presented in figures, tables, and text.

Performed various tasks associated with a complex state Superfund site in Nevada. Duties included constructing geologic cross sections, checked all figures and data, assisted in report preparation and writing, collected soil and other geologic data, maintained extensive boring log appendices, and constructed ground water contour maps.

# Donald Ludlam

Mr. Ludlam has 12 years of CAD and Geographic Information Systems (GIS) experience. For the last 4 years he has focused on the environmental field managing the development of graphics and AutoCAD products for engineering drawings and environmental reports, as well as the budget, schedule, computer software, and quality assurance/quality control. Mr. Ludlam is well versed in piping and mechanical system design. He is skilled in preparing engineering drawings, technical specifications, operating procedures, and cost estimates.

Mr. Ludlam has supervised up to 15 drafters with the responsibility of completing a multi year CAD project on time and under budget. He integrated drafting procedures to lower overall cost while increasing productivity and quality assurance.

## Fields of Competence

- AutoCAD Release 14 and 2000
- AutoCAD Map 2000
- AutoCAD Land Development
- Intergraph Microstation
- Arcview
- Eagle Point Software
- Autolisp and C+ languages
- Database Design/Management
- Global Positioning Systems (GPS)
- Aerial Photogrametry
- Soil and Groundwater Sampling
- Solinst Well Installation

## Education

- OSHA 40-Hour Hazardous Waste Site Training, 2000
- OSHA 8-Hour Refresher, 2002
- Caltrain Advanced Track Safety Trained, 2002
- ESRI Arcview Development, 1993
- A.S., Computer Aided Design and Computer Science, IIT Technical Institute, 1991
- A.A., Business, IIT Technical Institute, 1990

## **Key Projects**

Developed construction drawings for Camp San Luis Obispo erosion and sediment control project. Including site plan, grading plan, sections, sediment control plan and details.

Developed graphics for UAL Flight 93 investigation project in Somerset County, PA. Including site plan, monitoring well location, soil sample and collection, and background data maps.

Developed graphics for ground water monitoring and soil investigation reports for United Airlines operations at San Francisco International Airport, CA. using AutoCAD. Included water level and water quality figures showing sampling location and posting of contaminant concentrations, conceptual site models, and overall site maps with aerial photograph bases.

Assisted with aspects of field operations at San Francisco International Airport, CA. Cleared boring locations, supervised drilling crew, installed multi-level wells, collected samples using three multi-port systems located historic fuel pits from aerial photos using GPS.

Oversaw hazardous soil excavation and off-site disposal of lead-impacted soil for BART extension project on behalf of Union Pacific Railroad in South San Francisco, CA.

Developed graphics for quarterly ground water monitoring and soil investigation reports for a Union Pacific Yard in Tucson, Arizona using AutoCAD. Included water level and water quality figures showing sampling location and posting of contaminant concentrations, conceptual site models, and overall site maps with aerial photograph bases.

Developed a GIS system and graphical interface for three Union Pacific Sites. Including basemap creation, GPS survey data input, database link for soil and water data and assessors parcel data to graphics. Software used: AutoCAD Map, Arcview, and Access.

Managed the development of City Wide GIS cadastral and infrastructure maps for use with AutoCAD and ArcInfo GIS engines.

Performed a site investigation, a remediation alternative assessment, a closure plan preparation, and bench-scale remediation testing for a waste oil recycling facility.

# Brian S. Bjorklund, R.G., C.H.G

Mr. Brian Bjorklund has 12 years of professional experience as a geologist and hydrogeologist involved in assessment and remediation of sites with soil and ground water contamination. His expertise includes management and technical oversight of Remedial Investigation/Feasibility Study (RI/FS) and remedial action plan projects; planning, conducting, and managing soil and ground water investigations at industrial and military facilities; designing and implementing soil and ground water remediation systems; providing potentially responsible party cost allocation evaluations and environmental litigation support; and providing regulatory interaction and negotiation advocacy on behalf of semiconductor, utility, petroleum distributor and railroad clients.

## **Registration**

- Registered Geologist, California (#6617)
- Certified Hydrogeologist, California (#531)

## **Fields of Competence**

- RI/FS programs
- Geologic and hydrogeologic site investigations
- Computer applications for hydrogeologic investigations
- Design and installation of ground water treatment systems
- Soil and ground water sampling techniques
- Ground water monitoring programs
- Construction oversight
- Aquifer testing
- Litigation support
- Regulatory compliance/agency negotiations
- Project management

## **Education**

- B.S., Geological Sciences, University of California, Santa Barbara, 1990
- 40-Hour OSHA Hazardous Waste Operations and Emergency Response, 1990
- Annual 8-Hour Hazardous Waste Operations Refresher Training

## **Professional Affiliations**

- National Ground Water Association

## Key Projects

Managed completion of remedial investigation for chlorinated solvent-impacted soil and ground water at former fiber drum manufacturing plant in Pittsburg, California, with identified release area immediately adjacent to deep agricultural water supply well. Performed extensive passive soil vapor survey to characterize known and suspected source areas, and completed multilevel ground water sampling using cone penetrometer equipment. Prepared removal action workplan for affected soils and on-site ground water investigation workplan to address deep ground water impacts. Also performed chemical oxidation pilot study and developed user-friendly, client-oriented GIS database for environmental chemistry and geologic data collected at site.

Managed site investigations at 22-acre Union Pacific Railroad property in Santa Barbara, California. Collected soil and ground water samples at suspected source areas based on historical records and aerial photographs. Site impacted by TPH, PAHs, and MTBE. Negotiated No Further Action closures for all parcels prior to sale of property.

Provided technical oversight for series of four long-term pumping tests at Equilon's Bakersfield, California, refinery. Conducted tests to aid design of planned ground water extraction system to capture MTBE plume threatening off-site receptors. Analyzed test data for hydraulic parameters and input test results into ground water model developed by Equilon's Westhollow Technology Center.

Managed hydrocarbon release project on Native American tribal lands in Tuba City, Arizona, where large MTBE ground water plume originated from gasoline station on Navajo Nation and extended downgradient onto Hopi land. Because of conflicts among tribal entities, USEPA acted as lead regulatory agency. Negotiated reduction in ground water monitoring requirements. Currently preparing Corrective Action Plan.

Prepared remedial investigation report for ground water TCE plume at Fresno Yosemite International Airport. Provided technical support for source investigations and downgradient plume delineation.

Developed ground water monitoring network to observe chemical and hydrologic influences of startup of municipal water supply within mixed chlorinated solvent plume in Fresno, California. Used data to calibrate ground water model of Fresno Yosemite International Airport area.

Planned and implemented effectiveness monitoring program for startup of ground water pump-and-treat remediation system at state Superfund site in Palo Alto, California. Performed aquifer testing and pumping influence studies in solvent-contaminated, multi-layer shallow aquifer. Prepared construction implementation and treatment system effectiveness report for approval by Department of Toxic Substances Control. Managed long-term operation, monitoring, and maintenance of extraction system.

Performed site characterization study at former PG&E manufactured gas plant bulk fuel facility in Eureka, California. Completed exploration trenches and GeoProbe borings to delineate impacts of Bunker-C fuel oil, SVOCs, and metals. Prepared removal action workplan to mitigate on-site contaminant releases.

Supervised removal of Bunker-C oil pipeline from within city street in Eureka, California. Removed 700 tons of Bunker-C oil-impacted soil and disposed of waste off site. Received Regional Water Quality Control Board approval of remedial action, which allowed city to complete roadway extension project.

Developed remedial action plan to address off-site ground water operable unit at FMC's site in Fresno, California. Prepared technical analysis of chromium, TCE, and pesticide plumes and determined allocation of responsibility for off-site remediation.

Managed investigative and remedial activities at several former automotive parts distribution facilities in Northern and Central California. Conducted site assessments, and provided oversight during remediation at fuel UST and hydraulic hoist. Prepared workplans, site characterization reports, and remediation reports. Assisted client with local and state regulatory agency negotiations.

Coordinated and prepared parcel evaluation summaries for Alameda (California) Naval Air Station during base realignment and closure process. Performed sampling data review and interpretation, conducted quality assurance reviews, and wrote technical report. Provided recommendations for further sampling prior to property transfers or leases.

Conducted remedial investigation at major Bay Area port facility. Collected surface soil and harbor sediment samples, installed monitoring wells, and conducted hydraulic testing. Completed tidal influence study to assess gradient fluctuations and to verify hydrogeologic boundaries.

Managed remediation construction of JP-5 product recovery system at Lemoore (California) Naval Air Station. Supervised system construction and performed startup, operation inspections, and maintenance.

Provided litigation support for microchip manufacturer in Sunnyvale, California. Prepared hydrogeologic analyses for co-mingled, multi-aquifer solvent plume. Reviewed and critiqued aquifer characterization data, remediation effectiveness, and capture zone analyses.



ENVIRONMENTAL RESEARCH, INC.

Environmental Imagery Analysis

January 2, 2004

Corey Bertelsen  
Project Coordinator  
Casmalia Resources Site Steering Committee  
868 Greystone Place  
San Luis Obispo, CA 93401

Re: Casmalia Disposal Site, Casmalia, California

Dear Mr. Bertelsen:

Per your request, the information provided herein identifies the Environmental Research, Inc. staff that completed work on the above referenced project and as listed in the reports below. I have attached resumes for each of the analysts listed.

Kenneth Giles and Glen Hickerson: Mr. Giles and Mr. Hickerson performed the aerial photograph analysis and quality control as outlined in the report dated April 2001 and titled *Aerial Photographic Analysis, Casmalia Disposal Site, Casmalia, CA.*

Kenneth Giles: Mr. Giles performed research and acquisition of aerial photography as outlined in the report dated March 2003 and titled *Aerial Photographic Acquisitions, Casmalia Disposal Site, Casmalia, CA.*

Glen Hickerson, Donley Kisner and Anthony Pruitt: Mr. Hickerson, Mr. Kisner and Mr. Pruitt performed aerial photographic analysis, photographic registration and quality control in the report dated May 2003 and titled *Aerial Photographic Analysis of the Burial Trench Area, P/S Landfill Barrier, and Pre-Site Drainage, Casmalia Disposal Site, Casmalia, CA.*

Kenneth Giles and Mary Sitton: Mr. Giles and Ms. Sitton performed the aerial photograph analysis and quality control as outlined in the report dated August 2003 and titled *Supplemental Aerial Photographic Analysis, Casmalia Disposal Site, Casmalia, CA.*

If you have any questions regarding this information, please give me a call 540-636-4460 or reach me via email at [mseri@shentel.net](mailto:mseri@shentel.net).

Regards,

Mary D. Sitton

President

Imagery Analyst, CMS

**MARY D. SITTON**  
**Curriculum Vitae**

**Environmental Research, Inc. 5267 John Marshall Hwy, Suite C Linden, VA 22642**  
**Phone: 540-636-4460 Fax: 540-636-2628 email: mseri@shentel.net**

**PROFESSIONAL EXPERIENCE**

*Environmental Research, Inc., Linden, VA July 1993 - present*

**President.** Providing remote sensing analyses for environmental investigations and natural resource mapping. Specialize in historical aerial analysis to support remedial investigations of hazardous waste sites and environmental assessments of military installations. Document historical industrial operations and disposal practices to support environmental litigation for a variety of government and private agencies. Oversee all aspects of the firm including marketing and proposal preparation, project and quality control, maintaining certifications and insurance, personnel, accounting and legal aspects.

*Self-Employed May 1990-July 1993*

**Independent Environmental Consultant.** Acquired and analyzed aerial photography to document site activity for the U.S. Department of Justice and law firms. Prepared attorney work products to support litigation and prepared for expert witness testimony as needed.

*The Bionetics Corporation, Warrenton, VA January 1983 - April 1993*

Held technical and managerial positions on two consecutive level-of-effort contracts with the EPA Environmental Photographic Interpretation Center (EPIC). Contract provided operational remote sensing, geographic information system (GIS) and photogrammetry support to EPA's research and regulatory programs for RCRA, CERCLA, SARA, Clean Water Act, Safe Drinking Act, and EMAP.

**Team Leader, Hazardous Waste Analysis 1987 - 1993.** The Team Leader position combined managerial and technical scientific duties to oversee all aspects of scientific work performed by the team; including staff training and research and development. Other duties included editing hazardous waste site analyses and other environmental assessment projects with respect to technical content; project control; prepared cost estimates and work plans; maintained liaison between the contract, EPA, and Department of Justice personnel. Also prepared standard operating procedures and prepared documents to be included in contract proposals. Authored over 60 EPA reports and edited numerous others from 1983 to 1993.

**Program Manager, Army Installation Assessment Program 1984-1993.** Managed a program established through an interagency agreement between EPA and the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA, currently referred to as the Army Environmental Center). Aerial photography was used to identify and assess areas of past use, storage treatment and disposal of hazardous and/or explosive materials on Army installations. Scheduled, tracked and reported on work flow and resource utilization. Trained and directed analysis staff. Led field visits to develop signatures of military activities and for field reconnaissance.

**Imagery Analyst 1983-1987.** Performed imagery and collateral data research to produce detailed site analyses and reports. Analyzed remotely sensed data including conventional color, color infrared, thermal infrared, and black and white vertical and panoramic aerial photography to detect and inventory potential pollution sources, to monitor the migration of pollutants (e.g., plumes, spills, releases). Projects included detailed land use/land cover mapping, point and non-point source inventories, and detailed analysis of landfills and other industrial waste handling and disposal practices.

Developed a cost effective method of locating abandoned oil and gas wells using historical aerial photography as part of a cooperative R&D program with EPA/Environmental Monitoring Systems Laboratory, USGS, National Well Water Association and the Environmental Groundwater Institute at the University of Oklahoma. Work is cited in the ASPRS Manual of Photographic Interpretation, Second Edition, 1997.

## EDUCATION

Radford University Radford, Virginia - Bachelor of Science Degrees  
Geology and Business Management - 1982, 1980

## PROFESSIONAL AFFILIATIONS/CERTIFICATIONS

American Society for Photogrammetry and Remote Sensing (ASPRS)

ASPRS Certified Mapping Scientist - #RS120

American Society for Testing and Materials

American Academy of Forensic Scientists

### **AWARDS AND LETTERS OF COMMENDATION**

Received letter of commendation from Foster Wheeler Environmental for aerial analysis and GIS work performed on Nomans Land Island, MA in support of the US Navy – Naval Facilities Engineering Command, October 2002.

Received letter of appreciation from Department of Army, U.S. Topographic Engineering Center, for providing guidance to a team of Army scientists regarding remote sensing techniques used in environmental monitoring, January 1995.

Received Commendation and Award of Contractor Performance from the U.S. EPA Environmental Photographic Interpretation Center for work completed under the Hazard Ranking System project, October 1989.

Received letter of appreciation from the Department of Army for outstanding overhead imagery support provided during 1986.

### **PROFESSIONAL PAPERS, SEMINARS, REPORTS**

Sitton, M.D., Hickerson, G.H, McKenzie, M.L., 2001. "Aerial Photography Provides an Unbiased View in Environmental Site Investigations". Abstract in Proceedings of the American Academy of Forensic Sciences 53<sup>rd</sup> Annual Meeting, February 19-24, 2001 Seattle, WA.

Sitton, M.D. February 1999. "Who? Did What? When? Historical Aerial Photographic Analysis Supports Cost Recovery Litigation and Remediation". Abstract in Proceedings of the American Academy of Forensic Sciences 51<sup>st</sup> Annual Meeting, February 15-20, 1999 Orlando, FL.

Sitton, M.D. and Hickerson, G.H. February 1998. "Remote Sensing: An Essential Tool for Environmental Site Investigations". Abstract and presentation at 50<sup>th</sup> Annual Meeting of the American Academy of Forensic Scientists, February 10, 1998, San Francisco, CA

Sitton, M.D. September 1997. "Historical Aerial Photographic Assessment Assists BRAC Cleanup Team at Fort Pickett". *Environmental Bulletin, A Quarterly Environmental Newsletter*, Norfolk District, U.S. Army Corps of Engineers, Vol. 2, Issue 3, September 1997, p. 1

Presented seminar "Remote Sensing: An Essential Tool for Environmental Site Investigations" at the Florida Environmental Chemistry Conference, December 2-6, 1997

Baer, W.L. and M. D. Sitton, 1984. "Incorporation of Hydrogeologic Data into United States Environmental Protection Agency/Environmental Photographic Interpretation Center Investigations". Proceedings of the National Water Well Association, Ground Water Technology Division, Eastern Regional Ground Water Conference, Newton, Massachusetts.

**MARY D. SITTON Page 4**

Baer, W. L. and M. D. Sitton. 1984. "Graphically Integrating Aerial Photography and Hydrogeologic Data in Evaluating Groundwater Pollution Sources: Southington, Connecticut", Hazardous Wastes and Environmental Emergencies, Houston, Texas.

Stout, K. K. and M. D. Sitton. 1984. "Locating Abandoned Oil and Gas Wells with Historical Aerial Photos". Proceedings of the First National Conference on Abandoned Wells; Problems and Solutions, Norman, Oklahoma, May 1984.

Attended and presented paper entitled "Uses of Aerial Photographic Analysis When Developing a Wellhead Protection Program" at EPA's Wellhead Protection Delineation Program conference, December 1988, New Orleans, Louisiana.

Completed EPA's Wellhead Protection Area Delineation Course, August 1988, Fairfax, Virginia.

Completed Revised Hazard Ranking System Training Course, November 1988, Mitre Corporation, Vienna, Virginia.

Completed the Geographic Information Systems and Remote Sensing Course, March 1986, National Space Technology Laboratories, Mississippi.

Completed "The Hydrologic Significance of Fracture Trace and Lineament Related Structures" course at the Pennsylvania State University by Richard Parizek and D. P. Gold, March 1986. Completed Terrain Analysis Course by Robert Frost, May 1984, Warrenton, Virginia

**EXPERT WITNESS/PRIOR TESTIMONY**

*Provided expert testimony for the following:*

Burlington Northern Railroad Co. v. Allianz Ins. Co., et al., November 30, 1994

Loren S. Riggins, Jr. et al. v. Domanic & Rosa Connena, Superior Court of New Jersey, Law Division - Gloucester County, October 2, 1995

CSX Transportation, Inc. v. Admiral Insurance Company, U.S. District Court for the Middle District of Florida, Jacksonville District, November 8, 1995

Commercial Union Insurance Co. et al. v. Cannelton Industries, September 16, 1996

Wausau v. McGraw-Edison Co., Circuit Court, Dupage Co., IL, October 22, 1997

Allstate Insurance Co., et al. v. Sta-Rite Industries, et al. State of Wisconsin: Circuit Court: Milwaukee County, April 28 and 29, 1998

American Cyanamid Co. v. Aetna Casualty & Surety Co. Superior Court of New Jersey, Law Division, Passaic County, November 2, 1998

TRW Inc. v. Underwriters at Lloyd's of London, et al. Court of Common Pleas, Trial Division, Philadelphia County, PA, January 28, 1999

Hoechst Celanese Corp. v. Aetna Casualty & Surety Co. Baltimore City Circuit Court, January 14, 2000

McCandless Fuels, Inc. v. Progressive Fuel Oil Co., Inc., Superior Court of New Jersey, Chancery Division, Gloucester County, February 19, 2001

DuPont v. United States, United States District Court, District of New Jersey, May 1-2, 2001

Santa Maria Enterprises, Inc., B.H. and Ebba Richards Family Trust and Richards Holding Company vs. Texaco Exploration and Production, Inc.; Cirrus Environmental, Inc.; Buena Resources, Inc.; RMR, Inc.; Unocal, and Does 2-1000, Superior Court of California for the County of Santa Barbara, Deposition: October 17, 2001. Trial: February 6, 2002.

United States of America v. Pharmacia Corporation, et al.; Pharmacia Corporation and Solutia Inc. v. United States of America, et al., Civil Action No. 99-63-DRH (Southern District of Illinois), Deposition: November 11-12, 2002. Trial: November 4 and 6, 2003.

American Home Products Corporation v. Adriatic Insurance Company, et al., Docket No. HUD-L-5002-92, Superior Court of New Jersey, Hudson County, May 6, 2003.

**GLEN M. HICKERSON**  
**Environmental Research Incorporated**  
**5267 John Marshall Highway, Suite C**  
**Linden, Virginia 22642**  
**540-636-4460**  
**Curriculum Vitae**

## **PROFESSIONAL EXPERIENCE**

**July 1993 - Present:**                      **Environmental Research, Inc.**  
**Linden, VA**  
**Vice-President**

Mr. Hickerson is Vice President of ERI managing the Environmental Site Assessments Section and administering Quality Control procedures. Responsibilities include project planning, management, and implementation of remote sensing analyses for environmental investigations and natural and cultural resources mapping. He has performed numerous historical aerial photographic analyses documenting environmental conditions and operations of industrial facilities for the U. S. Army Environmental Center, the Department of Justice, the U.S. Corps of Engineers, the U.S. Environmental Protection Agency, various state agencies, and engineering and law firms. Mr. Hickerson has experience in the use of the Cowardin, et al., Classification System for Identifying Wetlands and Deepwater Habitats.

**April 1993 - September 1993:**        **U. S. Department of Justice, Washington, D.C.**  
**Natural Resources Division**  
**Environmental Enforcement Section**  
**Independent Environmental Consultant**

As an independent consultant to DOJ, Mr. Hickerson performed aerial photographic research, acquisition and analysis documenting environmental conditions and operations of industrial facilities. These projects supported cost recovery litigation.

**January 1991 - March 1993:**        **Bionetics Corporation, Warrenton, VA**  
**September 1983 - March 1987:**    **Imagery Analyst/Geologist**

As an on-site contractor to the U. S. Environmental Protection Agency at EPA's Environmental Photographic Interpretation Center (EPIC), Mr. Hickerson performed research, acquisition, and analysis of aerial photography and available site related data to document environmental conditions and operations of industrial facilities to support EPA's research and regulatory programs for RCRA, CERCLA, SARA, the Clean Water Act, and the Safe drinking Water Act.

## **PROFESSIONAL EXPERIENCE (Continued)**

During his time at EPIC, Mr. Hickerson performed numerous detailed site analyses, land use/land cover mapping projects, various research projects, and project management. Mr. Hickerson performed quality control and editing for technical content on aerial photographic site analyses and mapping projects. While at EPIC, Mr. Hickerson was involved in refining the technique for utilizing aerial photography to identify lineament and fractures to determine groundwater flow influences. Mr. Hickerson completed analyses utilizing aerial photography and imagery to identify crops, submerged aquatic vegetation, and to detect springs and ground water seeps. Mr. Hickerson managed EPIC's "Blow Box" monitoring program to identify illegal brine discharges from natural gas wells in Pennsylvania. He performed land use/land cover analyses using Anderson, et al, classification system, including point and non-point pollution source inventories. He operated a Trimble Pathfinder Global Positioning Satellite (GPS) system to obtain feature locations and the geographical referencing coordinates, and operated and maintained the EPA Enviropod aerial photographic camera system. Authored over thirty-five EPA Aerial Photographic Analysis reports and edited numerous others from 1983 to 1987 and 1991 to 1993.

## **EXPERT WITNESS TESTIMONY**

Provided expert witness testimony for the following cases:

American Cyanamid Company and Cyro Industries, v. Aetna Casualty and Surety, Superior Court of New Jersey Law Division: Passaic County Docket Number I-8275-91, Deposition Testimony October 3, 1998.

TRW v. Underwriters at Lloyds of London, et al., Philadelphia County Court of Common Pleas, Trial Division Case Number 1088, Deposition Testimony January 21, 1999.

Niagara Mohawk Power Corporation v. Consolidated Rail Corporation, U.S. District Court, Northern District of New York, Case Number 98 CIV. 1039 (DNH/GJD), Deposition Testimony July 12, 2001.

United Technologies Corp. et al. v. American Home Assurance Company, U.S. District Court for the District of Connecticut, Case Number 92-CV-00267 (JBA) Deposition Testimony September 26, 27, and November 7, 2001.

Olin Corporation v. Insurance Company of North America, et al., U.S. District Court, Southern District of New York, Case Number 84 CIV. 1968(TPG), Deposition Testimony March 22, 2002, Trial Testimony April 16, 2002.

## **EXPERT WITNESS TESTIMONY (continued)**

General Electric as successor-in-interest to Radio Corporation of America v. Certain Underwriters at Lloyds, London, et al., Superior Court of New Jersey Law Division, Mercer County, Case Number L-88-6432, Deposition Testimony July 12, 2002

## **EDUCATION**

Radford University, Radford, VA  
Bachelor of Science in Geology, 1982  
Coursework: Geology, Business Finance and Management

## **PROFESSIONAL AFFILIATIONS**

American Society for Photogrammetry

## **PROFESSIONAL REPORTS, PAPERS, AND SEMINARS**

Mary D. Sitton, BS, CMS\*, Glen M. Hickerson, BS and Morris McKenzie, BA, February 2001. "Aerial Photography Provides an Unbiased View in Environmental Site Investigations" (abstract and presentation) in Proceedings of the American Academy of Forensic Scientists Meeting, Seattle, Washington.

Sitton, M.D., G.M. Hickerson. February 1998. "Remote Sensing: An Essential Tool for Environmental Site Investigations" (abstract and presentation) in Proceedings of the American Academy of Forensic Scientists Meeting, San Francisco, CA.

Authored over 35 Aerial Photographic Site Analyses for the U.S. Environmental Protection Agency's Environmental Photographic Interpretation Center (EPA/EPIC), Warrenton, VA.

Authored over 15 Aerial Photographic Site Analyses for the U.S. Environmental Protection Agency's Characterization Research Division, Monitoring Sciences Branch, Las Vegas, NV.

Authored over 15 Aerial Photographic Site Analyses for the Pennsylvania Department of Environmental Protection, Bureau of Land Recycling & Waste Management, Harrisburg, PA.

Authored 2 Aerial Photographic Site Analyses for the U.S. Corps of Engineers, CA and FL.

## **PROFESSIONAL REPORTS, PAPERS, AND SEMINARS (continued)**

Authored 2 Aerial Photographic Site Analyses for the U.S. Army Environmental Center, Aberdeen, MD.

Authored over 25 Aerial Photographic Site Analyses for a variety of clients to support litigation.

Provided technical quality control review for approximately 150 additional Aerial Photographic Site Analyses.

Introduction to AutoCAD 12, Lord Fairfax Community College, 1997.

Introduction to ArcView II, Community College of Southern Nevada, 1996.

The "Hydrologic Significance of Fracture Trace and Lineament Related Structures" course conducted at the Pennsylvania State University by Richard Parizek and D. P. Gold, March, 1986.

Terrain Analysis Course conducted by Robert Frost, May, 1984, Warrenton, VA.



**PROFESSIONAL EXPERIENCE (Continued)**

**August, 1989 - April, 1993:                    Bionetics Corporation, Warrenton, VA  
Imagery Analyst**

Mr. Kisner provided a broad range of aerial photography based analyses, including the identification of Upland/Wetland boundaries, detailed wetland identification using the Cowardin, et al, Classification System for Wetlands and Deepwater Habitats, and other land cover and land use analyses using the Anderson Classification System and the Brown and Lowe classification system for Biotics Communities of the Southwestern United States.

For EPA's EMAP Program, Mr. Kisner developed Land Use and Land Cover classification systems, followed up by managing projects performed to evaluate these systems. He acted as liaison between EPA and EMAP's Agroecosystem Resource Group. Mr. Kisner participated in the organization of the EPA/USGS's co-sponsored forum on Land Use and Land Cover Classification, and was a participant in several peer reviews and workshops with EMAP Resource Groups.

**May, 1984 - July, 1989:                    Martel Laboratories, St. Petersburg, FL  
Photo Interpreter/Status and Trends Manager**

Mr. Kisner was responsible for performing wetland interpretation from aerial photography for the U. S. Fish and Wildlife Service's National Wetland Inventory. He conducted intensive field work throughout the U. S. for the purpose of correlating aerial photographic signatures with on-site investigation of wetland hydrology and botanical ecology. Mr. Kisner prepared technical reports, maintained budgeting schedules, trained new personnel, and maintained professional client/contractor relationships.

As a result of gained expertise, Mr. Kisner performed quality control of wetland interpretations at the regional offices of the National Wetlands Inventory located in Atlanta, Georgia and Denver, Colorado. In addition, Mr. Kisner managed the Fish and Wildlife Services Status and Trends Project, which consisted of a team of five photo interpreters and four cartographic and computer technicians.

## **TRAINING**

Federal Manual for Identifying and Delineating Jurisdiction Wetlands  
Wetland Training Institute, Poolesville, MD

Expert in use of the Cowardin, et al, classification system for Identifying Wetlands and Deepwater Habitats and the Anderson et al Classification System for Land Use and Land Cover.

USGS Topographic Map Update Training  
Rolla, Missouri and Fairfax, Virginia

Training related to USGS specifications for updating maps with specific emphasis on the Raster Graphic Revision Process (RGR) used for performing Basic Graphic Revisions

## **EDUCATION**

University of South Florida, Tampa, FL  
Bachelor Degree in Geography, 1984

Fairmont State College, Fairmont, WV  
June, 1974 - December, 1978

Undergraduate coursework concentrated on physical geography, cartography, and aerial photography interpretation. Graduate coursework included soils and wetland plant identification.

## **PROFESSIONAL AFFILIATIONS**

Society of Wetlands Scientists

Arizona Riparian Council

American Society for Photogrammetry and Remote Sensing

**KENNETH W. GILES**  
**IMAGERY ANALYST / ACQUISITION MANAGER**

Kenneth Giles has seven years experience in the stereoscopic interpretation of aerial photography for environmental assessments and natural resource identification and mapping. He has completed numerous historical aerial photographic analyses documenting environmental conditions and operations of industrial facilities for government and private agencies. Mr. Giles is also in charge of research, documentation, and acquisition of historical aerial photography for Environmental Research, Inc.

**PROFESSIONAL EXPERIENCE**

**September 1996 - Present:                    Environmental Research, Inc. Linden, VA**  
**Image Analyst/Acquisitions Manager**

Primary responsibilities include:

- analyzing aerial photographs to document hazardous waste site activity and change
- the research and acquisition of current and historical aerial photography
- assisting with the graphic production of final reports; requiring knowledge of Adobe Illustrator software and graphic file conversion
- Geo-referencing historical aerial photography and digitizing analysis findings to create GIS project files.

Other experience includes:

- field checking wetland delineations originally determined from analysis of aerial photography using the Cowardin et al., Classification System for Identifying Wetlands and Deepwater Habitats
- conducting inventories using aerial photography to map point and non-point pollution sources
- use of the Anderson et al., Classification System for delineating land use ( Level I & II )
- use of the Stereo Zoom Transfer Scope (ZTS) to transfer features of varying scales from one map or photo to another

**EDUCATION**

Virginia Polytechnic Institute and State University, Blacksburg, VA  
Bachelor of Science, Environmental Resource Management  
School of Forestry and Wildlife, September 1996

**PROFESSIONAL AFFILIATIONS**

American Society of Photogrammetry and Remote Sensing (ASPRS)

Society of Wetland Scientists



**COMPUTER EXPERIENCE**

**Geographic Information Systems**

- ArcView 3.0-3.2
- ArcGIS 8.2
- ERDAS Imagine 8.5
- ERDAS Imagine OrthoBase
- MicroStation SE
- Autocad Release 12
- Trimble GPS Asset Surveyor

**Graphic & Image Processing Software**

- Adobe Illustrator
- Adobe Photoshop
- Corel Draw 7
- Corel Photopaint
- Microsoft Access 2000
- Microsoft Excel 2000
- Powerpoint
- Word Perfect 7
- Word

**Operating Systems**

- Windows 3.1
- Windows 95
- Windows 98
- Windows NT Workstation
- Windows NT Server
- Windows 2000
- Windows XP
- DOS

**SPECIFIC COMPUTER EDUCATION**

- DOS Operating Systems
- Windows Operating Systems
- Microcomputer Troubleshooting
- Microsoft Access 2000
- Microsoft Excel 2000
- Introduction to ArcView 3.0
- ArcGIS 8.1
- Desktop Mapping with ERDAS Orthobase
- Trimble GPS Mapping with Asset Surveyor
- Computer Aided Drafting
- Administration of Local Area Networks

**EDUCATION**

Dixie Hollins, St. Petersburg, FL, 1975

Graphic Arts (offset and letterpress operations, composition, and bindery)

**Attachment J-2**

**ERI Letter Regarding Photoregistration**





January 2, 2004

Corey Bertelsen  
Project Coordinator  
Casmalia Resources Site Steering Committee  
868 Greystone Place  
San Luis Obispo, CA 93401

RE: Casmalia Disposal Site, Casmalia, California

Dear Mr. Bertelsen:

Per your request, the information provided herein discusses the photographic registration that was performed on historical aerial photographs for discrete portions of the Casmalia site, and identifies limitations of the aerial photographic registration of the Casmalia site as a whole.

In addition, a discussion is provided of the zoom transfer process utilized to extract selected features (terraces, ponds, impoundments located in RCRA Canyon, and staining and the portable fuel tanks in the Maintenance Shed Area).

**Registration of Historical Aerial Photographs for Discrete Portions of the Casmalia site.**

Photographic registration is the process of aligning a digital photographic image to another digital photographic image and/or digital map image. Environmental Research, Inc. (ERI) used specialized software to align the discrete portions of the Casmalia site, specifically, the Burial Trench Area and the Pesticide/Solvent (P/S) Landfill Barrier. Common features were selected as ground control points for registering these discrete portions of the Casmalia site to one another for eight dates of digital aerial photographs spanning the time frame from 1974 to 1981, and two digital base maps (Figures 4-1 and 4-2).

Accuracies associated with this process varied due to inherent aerial photographic characteristics such as photographic parallax, scale, and resolution, as well as changes in

surface features from one image to the other image. Accuracies specific to this analysis were digitally measured directly between the registered digital aerial photographs and the digital base map images and found to be in the 6-12 foot range with one exception being the 1978 photograph, which the accuracy was measured to be in the 12-20 foot range. Specific common features that were used in the process of the photographic registration in the Burial Trench Area and the P/S Landfill Barrier from July 18, 1979 to December 16, 1981 were vertical tank(s) in the northern portion of the site, drainage features, the Maintenance Shed located between the Burial Trench Area and the P/S Landfill Barrier, and wellheads (visible from July 18, 1979 to December 16, 1981). Accuracy of the photographic registration was measured at the various ground control points that were common between digital aerial photograph images and digital map base images.

The accuracies stated are in relation to the features visible from the aerial photographs to the features visible on the base map and do not reflect the accuracy of the base maps used.

#### **Limitations of Photographic Registration of the Casmalia site as a Whole.**

Attempts were made early in the photographic registration process to register the entire Casmalia site. Due to lack of a sufficient number of common ground control points with appropriate spacing at the Casmalia site it was not possible to obtain registered data suitable for accurate placement of features from one image to another. The unacceptable level of accuracy was determined through visual comparison of the digital images utilizing specific software features designed for such task. This comparison revealed displacement across the image ranging from tens to hundreds of feet between features depending on where the displacement was measured. Major factors contributing to inaccuracy of registration for the entire site was the lack of sufficient ground control, the degree of relief of the topography, and the significant and rapid change in the surface of the Casmalia site due to onsite operations.

### Zoom Transfer Process Utilized to Extract Selected Features

CB Consulting, Inc. requested that ERI provide “approximate locations of selected features” that had been identified at the Casmalia site during the stereoscopic analysis of the aerial photograph film positives. To accomplish this task, ERI utilized a stereo zoom transfer scope (ZTS) to overlay aerial photograph prints to hard copy Figure 4-1 maps that were generated and supplied by others.

Selected features were transferred from Spreading Area Five and Six located in the RCRA Canyon (five terraces containing impoundments or areas of liquid and staining) were transferred from 10/6/83 and 7/6/84 aerial photographs to the Figure 4-1 map base. From the 7/6/84 aerial photographs additional select features were transferred from Spreading Area Six (WCCB Pond and impoundment) to the Figure 4-1 map base.

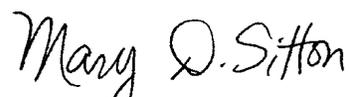
Selected features (staining and the portable fuel tanks) were also transferred from the Maintenance Shed Area from aerial photographs onto the Figure 4-1 and Figure 4-4 map bases.

The accuracy assessment of the ZTS method is accomplished by conducting a visual quality control of the alignment and transfer process by a senior analyst to ensure proper adjustment of the scope and transfer of features from the aerial photographs to the base maps.

The ZTS is a cost-effective method to extract hard copy spatial information. The spatial alignment of images using the ZTS is not based on the selection of ground control points but rather is based on magnified, optical alignment of the scenes (field of view within the scope) of two hard copy images through image elongation, compression, and rotation adjustments.

If you have any questions regarding this information, please give me a call or reach me via email at [mseri@shentel.net](mailto:mseri@shentel.net).

Regards,

  
Mary D. Sitton  
*President*  
*Imagery Analyst, CMS*

