July 1986 EPA-530/SW-86-018

Hazardous Waste Ground-Water Task Force

Evaluation of Casmalia Resources Disposal Facility Casmalia, California

EPA UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
215 Fremont Street
San Francisco, Ca. 94105

July 9, 1986

UPDATE OF THE HAZARDOUS WASTE GROUND WATER TASK FORCE EVALUATION OF CASMALIA RESOURCES, CASMALIA, CALIFORNIA

The United States Environmental Protection Agency's Hazardous Waste Ground Water Task Force (Task Force) in conjunction with the State of California Department of Health Services, State Water Resources Control Board, and Regional Water Quality Control Board conducted an evaluation of the ground water monitoring program at the Casmalia Resources disposal facility located near Casmalia, California. Onsite field inspections were conducted between October 21-30, 1985 and November 18-21, 1985. The evaluation of the Casmalia Resources facility focused on (1) determining if the facility was in compliance with applicable regulatory ground water requirements and policies under the Resource Conservation and Recovery Act (RCRA), (2) determining if hazardous waste constituents were present in the ground water, and (3) providing information to assist EPA in determining if the facility meets EPA requirements for waste management facilities receiving wastes from response actions conducted under the Federal Superfund program.

Casmalia Resources is one of 58 facilities that are to be evaluated by the Task Force. The Task Force effort came about in response to recent concerns by Congress and the public as to whether operations of hazardous waste treatment, storage and disposal facilities are complying with the state and Federal ground water monitoring regulations.

The results of the chemical analysis of ground water samples collected from existing monitoring wells at the facility indicated low levels of organic constituents in several off-site and on-site wells. Additional work will be necessary before it can be determined whether the source of these contaminants is from well construction materials and methods, sampling and analysis errors, or ground water contamination.

The additional work needed must be performed by Casmalia Resources in accordance with State and Federal requirements for a ground water quality assessment program. If the assessment indicates off-site ground water contamination to be present, the facility will be required to take corrective measures.

In accordance with ground water monitoring permit requirements, a facility's monitoring system must be capable of immediately detecting a release of hazardous waste constituents from a regulated unit. Under the current EPA permitting standards for ground water

monitoring, Casmalia Resources must upgrade and improve their ground water monitoring program in order to fully comply with applicable requirements. The facility is currently conducting an extensive hydrogeologic investigation of the site as part of its RCRA Part B permit application process. The existing ground water monitoring system will be upgraded based on the results of this investigation. This work is being conducted in response to a Part B application Notice of Deficiency (NOD) issued by EPA and the State of California in March 1986. EPA and the State of California are currently reviewing the work completed to date and proposed work, as part of the NOD response and hazardous waste management permitting process. Installation of the upgraded ground water monitoring system is expected to be completed by July 1987. The results of the Task Force investigation support the need to complete these activities as planned.

Task Force sampling personnel worked with the facility and their contractor after the investigation towards revising the facility's field sampling and analysis procedures. Implementation of the revised sampling procedures has been in effect since February 1986. EPA observed the May 1986 RCRA ground water sampling episode at the facility and found their practices to be greatly improved. They appeared to be in full compliance with current EPA sampling standards. The facility is required to submit a revised Sampling and Analysis Plan by August 1986 in accordance with the March 1986 NOD.

Based on the Task Force investigation at this facility the following activities are necessary:

1. The facility should begin a ground water assessment program to determine the presence and source of:

    a. Tetrahydrofuran in wells C6B, C1B, C2M, WS4, A2M, C4M, A2B, and CpH.
    b. Elevated levels of TOX in wells A1B, C4M, and A2B, including a complete pesticides scan.
    c. Dichloroethane and Phthalate in wells B3B and C5.
    d. pH values in wells C1B, C6B, and CpH.
    e. Metals levels in wells CpH, A1B, B3B, and C6B.

2. Redevelop or replace existing monitoring wells, as necessary, after completion of a site characterization.

3. Conduct statistical evaluation of heavy metals to determine background levels and statistical differences.

4. Provide an updated Sampling and Analysis Plan that identifies the procedures currently being used by the facility.

5. Determine the degree of hydraulic continuity between the facility and nearby ground water basins.

6. Determine the effect of the surface impoundments on local hydrology.

7. Determine the effectiveness of the barrier dams to impede ground water flow.

8. Develop a statistical evaluation method to ascertain when statistically significant differences occur between background and downgradient ground water quality.

Technical aspects of items 2 thru 8 are being addressed through the NOD process. California Department of Health Services (DOHS) and Casmalia Resources are currently negotiating a settlement of a DOHS Directors Order issued in December 1984. The State is attempting to incorporate the above recommendations into a Consent Agreement. EPA and DOHS coordinated enforcement action will continue to insure full implementation of all of the above items. In addition, EPA and the State will continue to work with the facility to bring the ground water monitoring system into compliance with 40 CFR Part 264 for permitting purposes.

This concludes the Hazardous Waste Ground Water Task Force evaluation of the Casmalia Resources facility.

Mark G. Filippini
U.S. Environmental Protection Agency

EPA-530/SW-86-018

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
HAZARDOUS WASTE GROUND WATER TASK FORCE

GROUND WATER MONITORING EVALUATION
CASMALIA RESOURCES DISPOSAL FACILITY
CASMALIA, CALIFORNIA

July 1986

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CONTENTS

page

I. EXECUTIVE SUMMARY 1

A. INTRODUCTION 1

1 Task Force Objectives 1
2 Participants 2
3 Facility Background/Location 3

B. SUMMARY OF FINDINGS AND CONCLUSIONS 5

1 Ground Water Monitoring Program During Interim Status 6
2 Proposed Ground Water Monitoring Program 10
3 Task Force Sampling Data 11
4 Conclusions 12

II. TECHNICAL REPORT 14

A. BACKGROUND 14

1 Site History 14
2 Enforcement Actions 16
3 Adjacent Land Use 17

B. INVESTIGATIVE METHODS 18

1 Facility Inspection/Record Review 18
2 Laboratory Audits and Inspections 19
3 Sampling Audits 20
4 Sampling Program 21

C. WASTE MANAGEMENT UNITS & OPERATIONS 22

1 Waste Management Units 22
2 Facility Operations 23

D. SITE GEOLOGY/HYDROGEOLOGY 26

1 Geomorphology 26
2 Geology 28
3 Hydrogeology 28
4 Climate 32

(continued)

II. (Continued) page

E. GROUND WATER MONITORING SYSTEM 33

1 Monitoring Requirements State/Interim Status 33
2 Current Monitoring Well Network 33
3 Well Construction 35
4 Site Characterization 42
5 Sampling & Analysis Plan and Field Procedures 43
6 Facility Water Quality Analysis & Data Quality Assessment 45
7 Interim Status Ground Water Monitoring Data 46

F. GROUND WATER MONITORING PROGRAM PROPOSED FOR RCRA PERMIT 48

1 Initial Submittals 48
2 Deficiency Notices 48
3 Revised Proposals 52
4 Current Status 54

G. TASK FORCE DATA COLLECTION/RESULTS 55

1 Sample Collection Methods 55
2 Limitations of Data 62
3 Results of Task Force Data 63

REFERENCES 68

APPENDICIES

APPENDIX A Analytical Parameters for Ground Water and Leachate Samples

APPENDIX B Table of Water Level Measurements from November 1985 Task Force Sampling

APPENDIX C Contractual and Actual Laboratory Limits of Quantification for Organic Compounds

I. EXECUTIVE SUMMARY

I. A. INTRODUCTION

1. Task Force Objectives

This report summarizes the results of investigations conducted during October and November 1985 at the Casmalia Resources disposal facility located near Casmalia, California.

The Administrator of the Environmental Protection Agency (EPA) established a Hazardous Waste Ground Water Task Force (Task Force) to evaluate the level of compliance with ground water monitoring requirements at commercial off-site treatment storage and disposal (TSD) facilities and address the causes of non-compliance. The Task Force comprises personnel from EPA Headquarters core team, Regional offices and the states. This investigation was conducted on behalf of the Task Force by Region 9 and represented the first Region-lead investigation nationwide.

The principal objectives of the inspection at Casmalia Resources were to determine the level of compliance with the requirements of 40 C.F.R. Part 265, Subpart F - Ground Water Monitoring, determine if the ground water monitoring program described in the Resource Conservation and Recovery Act (RCRA) Part B Permit application for the Casmalia facility was in compliance with Part 270.14(c), and determine if hazardous waste constituents have migrated into ground water around the facility.

The Casmalia facility has received wastes from Superfund sites where response actions are being conducted under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA P.L. 96-510). Under current policy, specific land disposal units used for Superfund wastes must be in compliance with the Part 265 ground water monitoring requirements.* The results of this investigation will determine the ability of this site to meet the policy's requirements.

The specific objectives of the investigation were to determine if:

1. The facility has in place a ground water monitoring system capable of meeting RCRA 40 CFR Parts 265 and 264 ground water monitoring requirements.

2. The wells in place at the facility have detected any contamination.

3. Designated RCRA monitoring wells are properly located and constructed.

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* May 6, 1985 memorandum from Jack McGraw on "Procedures for Planning and Implementing Off-Site Response".

4. Casmalia has developed and is following an adequate plan and procedures for ground water sampling and analysis.

5. The facility's ground water laboratory is producing accurate and precise results.

6. The ground water quality assessment program outline is adequate.

7. Record keeping and reporting procedures for ground water monitoring are adequate.

Since these objectives required both in-field and in-office investigations and reviews, and the expertise of sampling, laboratory (analysis), and geologic personnel, the investigation was conducted in several discrete components. In-depth record reviews and interviews of facility personnel were conducted by the project leader, Mark Filippini, EPA Region 9 and Donald Shosky, on detail to the Task Force from EPA Region 8. Sampling of 16 facility wells, direction of the Versar Inc. contract sampling team, and the audit of facility sampling procedures was conducted by Peter Rubenstein of the Field Operations Branch, EPA Region 9. Laboratory audits of both on and off-site facility and contract labs were conducted by Kevin Wong, also of EPA Region 9. Analyses of ground water samples for 194 organic and inorganic parameters were conducted through the EPA Contract Laboratory Program (CLP). Organic parameters were run by California Analytical Laboratories of Sacramento, California. Inorganic parameters were run by Rocky Mountain Analytical of Denver, Colorado.

A complete Project Plan which incorporates a Sampling Plan for sampling of the facility wells, a Laboratory Audit Plan for the audit of both on and off-site laboratory and a Sampling Audit Plan for the audit of facility sampling procedures is incorporated into this report by reference and not included in whole.

2. Participants

Participants in the Task Force investigation included Regional, Task Force, Headquarters, and State personnel. Aside from Filippini, Shosky, Rubenstein, and Wong mentioned above as project and task leaders, 11 other State, Regional, and contract personnel were involved. Mark Kamiya, the EPA permit writer for the site, was present for initial facility personnel interviews and data gathering and record reviews. Messers Jim Foster, Michael Grasso, and Don Paquette represented the contract sampling team for Versar, Inc., of Springfield, Virginia.

All four California State regulatory agency offices were represented at the initial organizational and kickoff meetings and at various times throughout the field investigations. Department of Health Services (DOHS), Los Angeles, and Regional Water Quality Control Board (RWQCB), San Luis Obispo, had representatives present throughout the entire investigation. Steve Lavinger, Maxine Richey, and Nick Sauer represented the DOHS-LA office. Eric Gobler and Vern Jones were present from RWQCB, San Luis Obispo. Elizabeth Babcock and Mike Sorensen from State Water Resources Control Board and DOHS, Sacramento, respectively, were also present. All parties were part of the report review team and their input is incorporated into this report.

3. Background

Casmalia Resources operates a 250-acre commercial Class I waste management facility which includes five RCRA landfills and one TSCA landfill, 43 RCRA surface impoundments, and one treatment unit (i.e. wet air oxidation). The landfills contain solvents and pesticides, acids, metal sludges, and alkaline and cyanide wastes. The wastes are segregated into different landfills depending upon compatibility characteristics. In the past, containerized liquid wastes were also put into the landfills. The land application unit handles oil field sludges, sewage sludges, drilling muds, and storm waters mixed with hazardous wastes. Several land application units are operated to dewater oil field sludges and sewage sludges, and to evaporate storm waters. The surface impoundments contain oil field wastes, metal finishing wastes, agricultural wastes, acid/alkaline wastes, and storm water runoff. As of 1985, Casmalia handled approximately 536,200,000 pounds of liquids and 48,700 cubic yards of solids yearly.

The facility began operation in 1972 under RWQCB Waste Discharge Requirements as a Class I site for oil field waste disposal, owned and operated by Hunter Resources of Santa Barbara, California. The facility received a State DOHS permit in 1979, and attained interim status in 1980 to handle all hazardous wastes listed in 40 C.F.R. Part 261 and PCB's under a Toxics Substance Control Act (TSCA) permit.

Casmalia Resources is located in the south-central coast area of California approximately 50 miles north of Santa Barbara, California, halfway between San Francisco and Los Angeles (Figure 1). The facility lies 4 miles from the Pacific Coast and 10 miles south of Santa Maria, California (population 47,000). The town of Casmalia (population 250) lies about 2 miles to the south of the site. The site is about 2 miles south of State Highway 1 on Black Road. The Class I site occupies approximately 250 acres of a 4,300-acre undeveloped land holding.

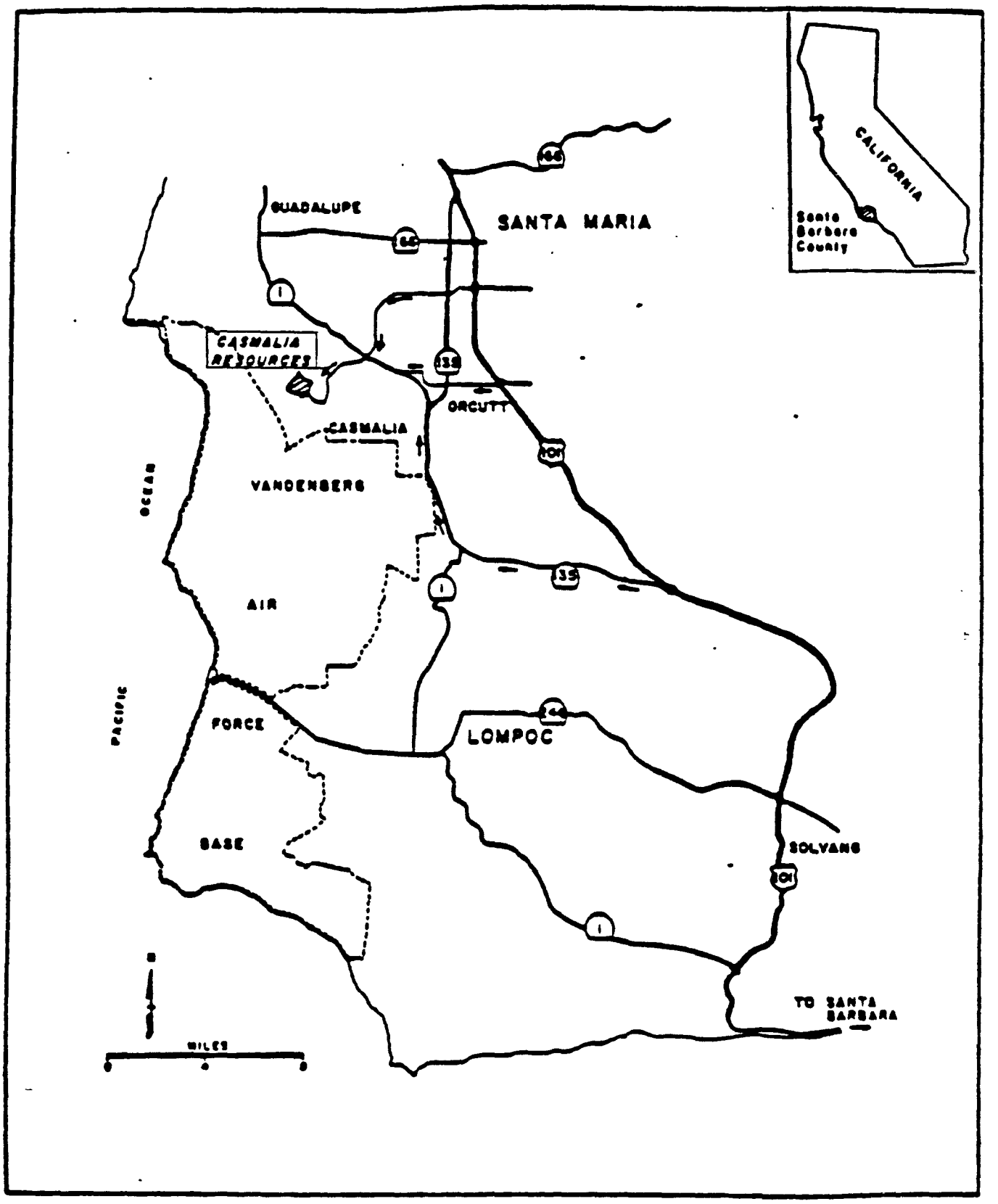

Figure 1. FACILITY LOCATION MAP

Background data for interim status were collected by the facility in July/August, September, October, and November 1984 as part of the September 1984 Consent Agreement. Statistical analysis of ground water data was run on the May 1985 and November 1985 data. The May 1985 data indicated statistically significant increases in Specific Conductance (SpC) in wells A2B and B3M, total organic halides (TOX) in well B3M, and pH in well CIB. The November 1985 data indicated two wells showing significant increases in pH, wells C1B and C6B. C1B is the only well showing a recurrence of a statistically significant increase of an indicator parameter from May 1985 to November 1985.

The organic analysis conducted by the facility during detection monitoring indicated the presence of several compounds. Tetrahydrofuran (THF) was reported at levels ranging from 10 to 200 ppb in five wells in the July 1984 sampling. THF levels were attributed by the facility to the PVC glue used for well casing construction. However, these high levels may not be completely attributed to glues especially if purging was conducted properly. Trihalomethane (THM) compounds such as chloroform and bromoform have been reported for all sampling periods. Other organic compounds reported for the six sampling episodes were a phthalate compound, methylene chloride, and caprolactam, detected in the May 1985 analyses.

Although all the above compounds are accepted in the facility waste streams, the facility attributes their presence to the following well construction and sampling methods: The presence of THM is attributed to the use of sodium hypochlorite which was added to several wells to breakdown the organic drilling mud used during well construction. The phthalate and methylene chloride levels are attributed to field and laboratory contamination. Caprolactam is reportedly a leachable compound found in some grades of nylon and is attributed to the nylon line used during sampling.

2. Ground Water Monitoring Program Proposed for RCRA Permit

A revised Part B permit application was submitted in January 1985 for the proposed ground water monitoring program for Part 264. This revised monitoring plan, although improved over the original submittal, was still inadequate. The proposed ground water monitoring system for 264 final permit includes the 11 wells currently in place for interim status plus the addition of an existing well not included in interim status. The facility also proposed to abandon and replace two of the Interim Status wells which have had high levels of THF and pH.

As stated previously, the Agency and the State have determined the inadequacy of the proposed system and issued a Notice of Deficiency in March 1986. The Agency and State are pursuing upgrading the monitoring system through this process. Upgrading will require a complete hydrogeologic investigation and installation of monitoring wells based on the results of the investigation.

3. Task Force Sampling Data

As part of the Task Force investigation samples were collected from 16 facility wells and one ground water spring near the facility. Samples were analyzed for 194 organic and inorganic parameters through the Agency Contract Laboratory Program. Due to laboratory analytical problems several organic parameters were analyzed with abnormally high detection limits thus rendering the possibility that contaminants went undetected if concentrations were below the detection limit.

Of the organic data that were validated, three organic compounds were identified in several facility wells. In one well, B3B, 1,2-dichloroethane (DCA) was detected at a level of 5 ppb. In well C5, a ground water gallery well upgradient of the C barrier dam, bis-(2-ethylhexyl)phthalate was detected at a level of 16 ppb.

The most common organic found in the samples was tetrahydrofuran (THF), detected in eight facility wells; C4M, CpH, C1B, WS4, A2M, A2B, C6B, and C4M. The range in levels was from 2.5 to 780 ppb. The concentrations of THF could not be confirmed by our data reviewers through the data validation process, as documentation for standards and spectra were not provided. Therefore, the data must be used with caution.

Samples from three wells; C5, A1B, and C4M indicated the presence of Total Organic Halides (TOX) at concentrations greater than 1000 ppb. Well A1B, the background well, had the highest level of 2140 ppb as did a duplicate sample of well C5. The original C5 reading was 1420 ppb. Well C4M had a level of 1260 ppb. All other sampling points reported levels between 12 and 323 ppb. None of the high TOX values correlated to any sampling point where speciated organics were recorded. Therefore, the type of organic halide(s) causing these levels is unknown.

Values for pH ranged from 6.3 (B3M) to 10.4 (C1B) and specific conductance ranged from 2600 um/cm (D1M) to 14000 um/cm (B spring). These values are highly variable throughout the site due to the existance of evaporite deposits such as gypsum, present naturally throughout the region.

Several inorganic constituents of interest appear in the analyses at some sampling points. Arsenic was detected in well A1B (21 ppb) and in the B canyon ground water spring

- The facility's ground water quality assessment program outline is adequate.

- Reporting procedures for ground water monitoring data are adequate although recordkeeping procedures in the field are not.

There exists enough uncertainty concerning the source of contaminants at several wells to warrant consideration of further analyses for selected analytical parameters or to place the facility into partial or full assessment. This would confirm contaminant sources and determine whether leaks from the facility have gone undetected.

A more thorough hydrogeologic characterization of the site should be conducted and a monitoring system, which meets current EPA construction standards, should be installed based on the characterization. Although recent changes have been made to the sampling and analysis procedures used by the facility, inspections should be made to assure these procedures are being properly implemented.

II. TECHNICAL REPORT

II. A. BACKGROUND

1. Site History

Casmalia Resources currently operates a commercial off-site hazardous waste disposal facility consisting of 43 RCRA surface impoundments, 5 RCRA Landfills, 1 TSCA landfill for PCB's, and a Zimpro Wet Air Oxidation treatment unit (Figure 3). All units at the facility are hazardous waste units. The facility began operation in 1972 under Regional Water Quality Control Board Waste Discharge Requirements (Order Number 72-28) as a 61-acre oilfield hazardous waste disposal site. At that time the facility consisted of 15 surface impoundments and 1 landfill.

The Waste Discharge Requirements were amended in 1976 to allow for a 118-acre expansion of the facility to the east and north, bringing the site to 179 acres. In November 1978, EPA issued the facility a Toxics Substance Control Act (TSCA) permit for the disposal of PCB's. The PCB landfill was later expanded under new orders issued in March 1979 and January 1980. In addition, California Department of Health Services issued a Hazardous Waste Facility Permit to the site on April 20, 1979 (Permit No. 42-001-78) in response to then-new California State DOHS requirements.

Just prior to receiving RCRA interim status on November 19, 1980, the facility received an additional revision to their Waste Discharge Requirements (Order No. 80-43) expanding by 75 acres to the west. This revision was issued on November 14, 1980, added 5 surface impoundments and 1 landfill, and brought the facility to its current size of 254 acres. California DOHS issued an addendum to the Hazardous Waste Facility Permit in September 1982 for a Zimpro Wet Air Oxidation Thermo Treatment unit bringing the facility to its current operating status. In November 1985 DOHS issued a directive to Casmalia to cease accepting liquid organic hazardous wastes and implement an air monitoring/odor mitigation program. In January 1986 DOHS also amended the permit to include an in-tank acid neutralization system.

The facility was issued a Conditional Use Permit (CUP) (76-CP-6) by the Santa Barbara County Planning Commission on June 23, 1976. The CUP was issued for 168 acres of the facility prior to the 1980 expansion. In 1985, the County of Santa Barbara claimed Casmalia Resources violated their Conditional Use Permit by expanding beyond the 1976 boundaries. An agreement between the County and the facility, signed in April 1986, redefined the total acreage of the site, limited daily truck traffic, restricted liquids received on-site, restricted the use of the TSCA PCB landfill, and revised the administrative record.

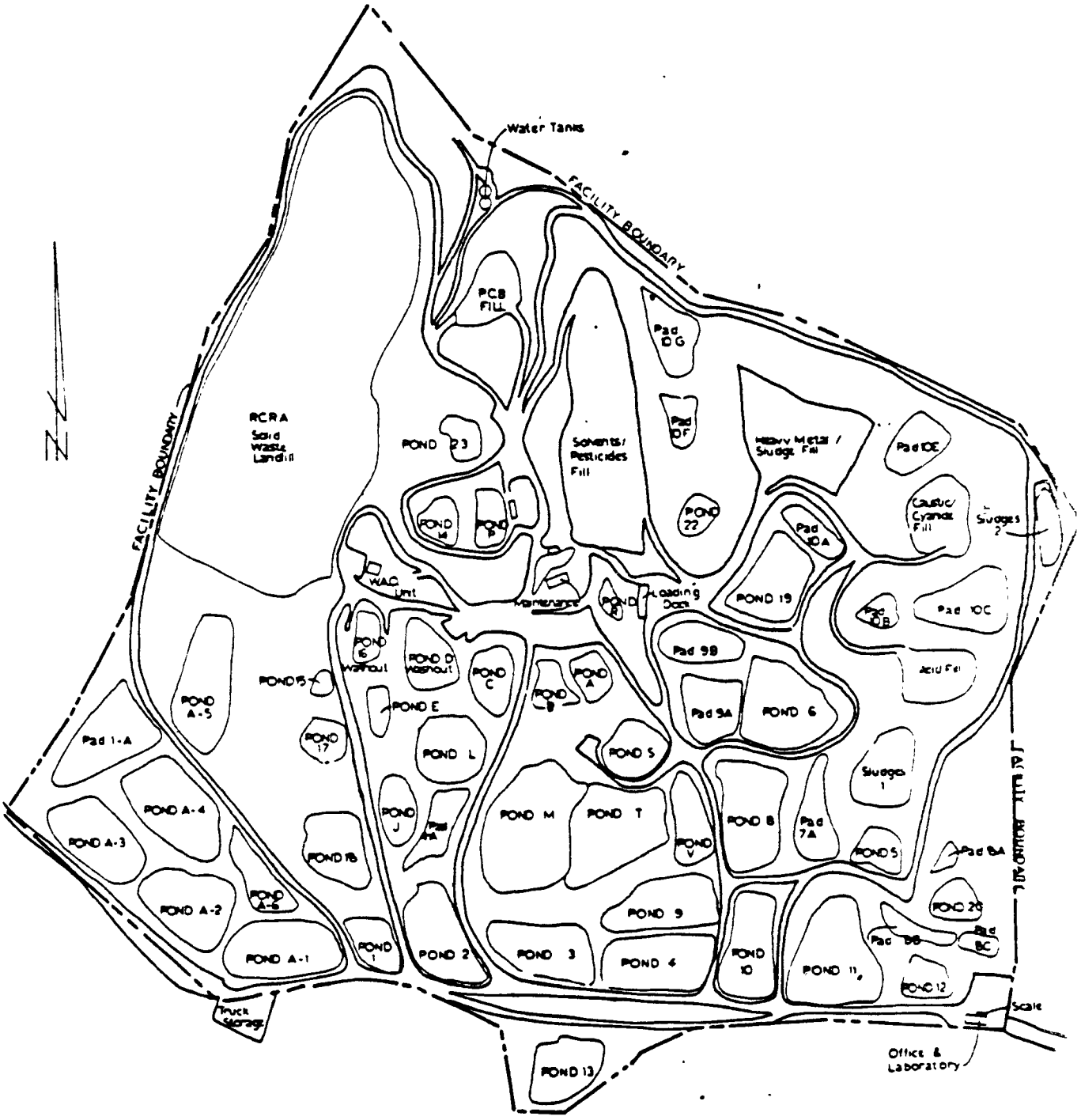

Figure 3. CASMALIA RESOURCES HAZARDOUS WASTE MANAGEMENT FACILITY

0 400 feet

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The facility also operates under a County Dump Permit and an Oil Recovery Permit issued by Santa Barbara County. None of the county permits involve any ground water monitoring requirements.

The RCRA Part B Permit Application was called in by EPA in January 1983 and the first application was received in July 1983. After review of the application, the Agency issued the first Notice of Deficiency (NOD) in May 1984 under a Warning Letter. That same month (May 1984) the Agency issued a 3008(a) complaint against Casmalia Resources for ground water monitoring violations noted during a December 1983 ground water inspection. That order was settled under a Consent Agreement finalized in September 1984 with a $35,000 fine. A second Part B application, incorporating changes resulting from the NOD and the Consent Agreement, was received in November 1984. The ground water (Subpart F) portion of the application was, however, received in January 1985 to allow the incorporation of the data from the ground water sampling conducted in November 1984.

A second NOD for the revised application which included State comments was issued in March 1986 under a Warning Letter. The agencies are currently working with the facility on the technical details and schedule for implementation of the tasks identified in the NOD.

2. Enforcement Actions

State enforcement action against Casmalia came in December 1984 and November 1985. In December 1984, DOHS issued a complaint in response to a May 1984 General Operating Requirements Inspection. A Consent Agreement was drafted in June 1985 with a $47,000 proposed penalty. In lieu of the penalty, an agreement was reached with the facility to fund a $626,000 air study and monitoring plan and comply with the other terms of the complaint. In November 1985, DOHS directed the facility to cease receipt of liquid hazardous hazardous wastes excluding inorganic acids and bases. This became effective December 21, 1985. The Regional Water Quality Control Board has implemented several administrative enforcement actions, under Title 23, Chapter 3, Subchapter 15 of the California Administrative Code authority, since 1972.

The only EPA enforcement action involved the May 1984 Complaint which resulted in a September 1984 Consent Agreement carrying a $35,000 fine.

3. Adjacent Land Use

The facility was developed in a range of hills about 5 miles wide, known as the Casmalia hills, which separates two 15-mile wide regional river valleys: the Santa Maria Valley to the north and the San Antonio Creek Valley (in which Vandenburg Air Force Base lies) to the south. Both valleys, and the Casmalia Hills, trend almost due east-west.

The facility represents 250 acres of a 4,300 acre land-holding. The land use immediately adjacent to the facility, and the entire Casmalia Hills area, is almost exclusively cattle grazing. There are several oil-well fields to the east of the facility and several ranch homesites about a mile east and north of the site.

II. B. INVESTIGATIVE METHODS

Data gathering and methods used for this investigation involved four major areas; record reviews and facility personnel interviews, ground water sampling and analysis, audit of sampling procedures, and audit of on-site and off-site facility and contractor laboratories. For each task, a specific program plan was developed by the individual task leader. As mentioned previously, the record reviews and facility personnel interviews were conducted by the overall project leader, Mark Filippini, EPA Region 9. Both ground water sampling and sampling audit projects were led by Peter Rubenstein of Region 9 Field Inspections Section. Laboratory audits both on and off-site and ground water data validation were conducted by Kevin Wong, chemist, also of Region 9. The Project Plan which consists of the Sampling Plan, Sampling Audit Plan, and On-site and Off-site Laboratory Audit Plans are incorporated by reference. For a thorough review of the procedures used in this investigation and for a comprehensive understanding of the results of this report, the Project Plan should be consulted.

1. Facility Inspection/Record Review

The facility inspection involved two major areas, collection and review of all pertinent data and documents relating to the facility design and operation, and interviews of facility personnel. Inspections of facility units and operations were also conducted.

In June 1985, Planning Research Corporation (PRC) Chicago, Illinois under contract to U.S. EPA Headquarters and the Task Force, compiled an information/document package for the Casmalia Disposal Facility. The PRC file consists of 12 volumes containing a cataloguing of copies of all documents and correspondence regarding the facility from all EPA and State files. The PRC file was used as a comprehensive review and reference document to aid in this investigative process. Documents and records were also reviewed and collected at the facility to verify information currently in Government files and to supplement them with new information. A total of 69 documents were reviewed, copied and collected at the facility. Documents requested of the facility were those known to be missing from Government files, new information or documents not yet received by the Agency, and documents of interest brought to our attention through interviews with facility personnel. All documents are on file with EPA Region 9.

Interviews of facility personnel and their contractors were conducted throughout the investigation. A total of eight facility representatives were interviewed through six interview/meeting sessions totaling approximately 10 hours. The kickoff meeting held the first morning of the field investigation at the facility offices lasted three hours and involved four facility representatives as well as Task Force, Regional, and State representatives. Discussions from the meetings and interviews were documented in field log books issued to each Task Force participant. Sixteen notebooks were issued to Task Force, Versar, Regional and State participants to document and log all activities observed and conducted during the investigation. All notebooks were collected at the end of the investigation, used in the report writing, and are kept on file at Region 9.

Photodocumentation of facility units and operations, Task Force operations, and facility sampling procedures were also conducted. Sixteen rolls of film were taken and all photographs and slides are on file at Region 9. Selected photos were incorporated into the Sampling Audit report, Laboratory Audit report, and the Sampling and Documentation report.

2. Laboratory Audits and Inspections

Audits were conducted at both the on-site facility laboratory and the facility's contract off-site laboratory, Brown and Caldwell of Pasadena, California. The on-site laboratory conducts mostly fingerprinting of waste loads received at the facility to assure consistency with the manifest and waste description provided by the generator. The off-site contract laboratory conducts analyses of the ground water samples collected by either facility personnel or their sampling consultant Woodward-Clyde. Kevin Wong was the Laboratory Audit program leader for this investigation. His Laboratory Audit Plan is Attachment B of the Project Plan and should be consulted for details of the investigation.

The purpose of the audits was to assess such factors as the laboratories' analytical capabilities, the technical capability of laboratory personnel, and the existence and implementation of a proper quality assurance/quality control plan. The Audits involved acquisition of documents regarding laboratory equipment, personnel, and operations, interviews of laboratory personnel and management, determination of personnel qualifications, verification of instruments, and evaluation of quality control/quality assurance procedures. The reader is referred to the Laboratory Audit Plan developed by Kevin Wong, dated October 16, 1985, for details. Results of the audits are discussed in Sections II. C. 2 and II. E. 6 of this report.

The on-site laboratory audit was conducted on October 21 and 22, 1985. The off-site laboratory audit was conducted on October 23, 24, and 25, 1985 at the Brown and Caldwell laboratories in Pasadena, California. As mentioned, the purpose of the on-site laboratory audit was to determine the facility's capability to perform screening ("fingerprinting") analysis of wastes received by the facility for potential disposal. The purpose of the off-site commercial laboratory audit was to determine the laboratory's ability to perform appropriate chemical analyses on ground water samples. The results of these investigations are discussed in subsequent portions of this report.

3. Sampling Audit

In order to assess the facility's ground water sampling procedures, an audit was conducted during the facility's November sampling. The sampling was conducted by Woodward-Clyde Consultants between November 18 and November 21, 1985. Sixteen samples including one duplicate and one blank were collected by the facility contractor during the sampling. The investigative procedures included observations of sampling procedures, interviewing sampling personnel, collection of documents, review of the sampling plan, and photodocumentation of procedures.

A Sampling Audit Plan was developed by Peter Rubenstein and is included as Attachment C of the Project Plan. The purpose of conducting this portion of the investigation separately from the sample collection, as opposed to conducting it in conjunction with the Task Force sampling as it has historically been done, was to give a more representative perspective of the procedures used by the facility sampling personnel. To attempt to critique facility sampling procedures during Task Force sampling would place an excessive workload on the facility sampling team as well as Task Force personnel who have to coordinate both the sampling audit and the sample collection for the Task Force. A review of the well purging procedures used by Casmalia was, however, conducted during the Task Force sampling in October 21-30, 1985.

The Sampling Audit team was led by Peter Rubenstein and included Mark Filippini and Kevin Wong. State involvement was limited in this phase of the investigation. To facilitate a consistent review at each well, a checklist was developed to record all pertinent information. An additional checklist was developed for general field methods, quality assurance and quality control (QA/QC), and Chain-of-Custody. Copies of the checklists are included in the Sampling Audit Plan (Attachment C) of the Project Plan.

4. Sampling Program

One of the major objectives of the Task Force investigation at Casmalia was to determine if any of the monitoring wells at the facility have detected any contamination. Between October 21 and 30, 1985 EPA, with our contractor, Versar Inc, sampled 15 of the facility perimeter monitoring wells, one water supply well, and one ground water spring. Including replicates, performance evaluations, and blank samples, a total of 35 sets of samples were collected. The facility declined an offer for split samples. However, the State DOHS and RWQCB requested splits from selected sampling points. DOHS collected samples to analyze at their own laboratory in order to get a faster turnaround on the analyses. The RWQCB collected samples in order to verify their own laboratory's data. DOHS and RWQCB took 14 replicate samples from 10 wells during the investigation. Their results will not be discussed in this report due to the limited QA/QC that was conducted on the samples.

The sampling team leader in charge of all field sampling operations was Peter Rubenstein. Peter was in charge of the three-man Versar sampling team and was assisted by Donald Shosky on detail to the Task Force from EPA Region 8, Denver. Various state personnel observed the sampling operations and were on hand during collection of their split samples.

Samples were shipped the same day or the day following sample collection to the EPA contract laboratories for analysis. Organic samples were shipped to California Analytical Laboratory in Sacramento and inorganic samples were shipped to Rocky Mountain Analytical Laboratory in Arvada, Colorado.

The sampling activities were based upon the October 1985 Sample Plan, developed by Rubenstein. Sampling procedures are described in detail in the Sampling Plan, Attachment A of the Project Plan. Description of sampling protocol, proposed sampling schedule, container and preservative details, shipping, and QA/QC procedures are described in the Sample Plan. The reader is referred to the Sampling Plan and the Sampling and Documentation Report, March 1986, for details of the actual procedures used during the investigation. These reports are on file at the Region 9 office.

II. C. WASTE MANAGEMENT UNITS AND OPERATIONS

1. Waste Management Units

The facility consists of 43 RCRA surface impoundments, 5 RCRA landfills, 1 TSCA landfill, and a Wet Air Oxidation treatment unit (see Figure 2). All units at the facility receive hazardous waste. Until recently large spray fields were also employed to encourage evaporation of liquid hazardous wastes mixed with runoff. They were removed from operation as part of an agreement with the State. Shallow evaporation ponds are being employed instead to accommodate evaporation. As of 1985, Casmalia handled approximately 536,200,000 pounds of liquids and 48,700 cubic yards of solids yearly. There is a capacity of 200,000,000 gallons of surface impoundment and 2,000,000 acre-feet of landfill.

All units at the facility are currently active. There are no closed units at the facility. The several spray areas were used prior to April 1985 but were decommissioned as part of the State directive. The spray areas were mostly hillsides above landfills and impoundments and were frequently moved around the facility through the use of irrigation-type piping. The spray areas were not considered RCRA units by the facility.

None of the units at the facility are lined. All impoundments are constructed of local soil materials. The facility plans to phase out most active surface impoundments by the RCRA November 1988 deadline for double lining. Several lined units may remain for impounding runoff from the facility. It plans on building larger scale treatment systems to maintain liquid capacity. Negotiations are ongoing with Santa Barbara County for treatment permits. After County approval, RCRA/State permits will be sought.

Casmalia has also proposed a double liner for the RCRA Solid Wastes Landfill on the western edge of the facility. Approval by the County of this expansion and construction (which could be done under RCRA interim status) would give the facility 2,100,000 cubic yards of lined solid waste disposal capacity. That capacity currently exists under interim status but has not been granted by County permit.

Whereas none of the units have any liners or leachate collection systems, the lower ends of the two canyons on which the facility is constructed, have barrier dike systems. These dikes were constructed at the request of the State to intercept any ground water or leachate that might migrate off the facility through these potential ground water flow paths.

The dikes are constructed of recompacted soil borrowed from on-site and keyed to the bedrock contact. The effective-

ness of the dikes has not been demonstrated through pump tests, tracer tests, or construction details.

The smaller of the two barriers, the "B" dam is between 130 and 150 feet long (east-west), and 50 feet wide (north-south). The trench was excavated four feet into "unweathered" bedrock, and a 10-foot thick compacted clay layer was placed in the trench. On the downgradient side (south), a one- to two-foot thick gravel layer was placed in the trench, with a six-inch diameter pipe underdrain and vertical pipe to collect and remove liquids which leak through the barrier. The pipe is the gallery well B5.

The second barrier, "C" dam, is 1200-feet long and reportedly constructed in the same fashion as the "B" dam except the gravel blanket and piping were placed upgradient of the dam to capture ground waters upgradient of the barrier. Gallery wells C-5, C5E, and C5W are part of that system.

The B gallery well, B-5, collects on the order of 100 cubic feet per day (800 gallons). The C gallery well, C-5 collects about 200 cubic feet of liquid a day (1,500 gallons). Recovered water is reintroduced back into the surface impoundments. Both gallery wells were sampled as part of the Task Force sampling program.

2. Facility Operations

The following description of facility operations is based on interviews of facility personnel, review of facility documents, and review of the RCRA Part B permit application. Implementation of these practices was not actually observed. Inspection reports should be consulted to confirm the actual implementation of the procedures.

Normal operating hours for receipt of hazardous waste loads are between 7:30 a.m. and 4:30 p.m., 5 days a week. Waste loads received after these hours are usually restricted to oilfield refinery wastes and non-hazardous wastes which are accepted on a 24-hour basis. However, there have been exceptions to this practice, as exhibited by the facility's acceptance of routine waste loads delivered by Casmalia Resources' own transporters. If hazardous waste loads are received after hours, the stated standard policy is for the weighmaster to contact the on-call chemist prior to acceptance. The time and date of receipt of all accepted waste loads are recorded and noted on all accompanying documentation.

The standard waste acceptance procedures reportedly being implemented at the time of the audit required that all generators be provided with a waste acceptance policy form

and that a Waste Characterization Form (WCF) be completed by generators prior to any acceptance of waste. Upon review and, in some cases, analysis of pre-disposal samples, a waste disposition form is forwarded to the generator. Final disposition in determining where to dispose of a particular waste load on-site is the responsibility of the chemist or laboratory technician. If a waste load is refused, a Waste Refusal Report is completed, logged and filed. The laboratory typically analyzes approximately 50 samples a day, and reportedly averages about 2 to 3 refusals per week.

Samples are typically collected by the drivers of the trucks delivering the samples, and are immediately provided directly to the weighmaster. After processing the appropriate paperwork, the weighmaster handcarries these samples, with documentation, to the laboratory. Standard fingerprint testing includes pH, flash point, heavy metals, sulfides, cyanides, halogens, and/or oxidizers. Fingerprinting procedures identified in the Waste Analyses Plan, which has been modified since the November 1984 Part B submittal, are those followed by the facility.

The laboratory also performs the Paint Filter Test on all bulk solids ("pasty or wet solids") received at the facility. If liquids are determined to be present in the waste, the facility will provide two options to the generator. The first option is to provide the generator an opportunity to solicit outside assistance in "solidifying" the load in question. The second option is for Casmalia Resources to offer to solidify the waste load by using vermiculite, cement or some other absorbant. If the second option is used, the waste loads are allowed to set directly in the trucks prior to disposal. No chemical or physical tests are conducted on the "solidified" waste to assess the structural integrity or chemical stability of the waste load.

Once a determination has been made as to final disposal of a waste to a particular pond or landfill, the transporters are informed of the disposal area's location. Only five of the 43 impoundments are receiving ponds for bulk liquids. Organic wastes are placed in either ponds A, B, or C. Non-RCRA wastes are placed in Pond A and RCRA wastes are placed in Ponds B or C. RCRA acid wastes are received in Pond E and alkaline wastes are placed in Pond J. Heavy metals are placed in either the Acid or Alkaline ponds which are later mixed for precipitation of the metals. Liquids from the receiving ponds are then pumped into other units, through the use of irrigation piping and portable pumps, depending on the nature of waste and level of ponds. Very little control on the wastes streams is exercised after discharge into receiving ponds. Non-RCRA wastes are routinely mixed with RCRA wastes. The actual implementation of these practices was not verified by the Task Force.

The wet air oxidation unit at the facility is used for the oxidation of sulfide scrubbing wastes, cyanide plating wastes, and various organic wastes. The two former represent the majority of the wastes streams treated. The unit is operated by the manufacturer, Zimpro Inc. of Wisconsin. A sample of each waste stream is sent to the manufacturer in Wisconsin for evaluation before treatment.

Solid wastes are segregated for disposal into one of six landfills: Acids, Caustic Cyanides, Heavy Metals, Solvent-Pesticides, RCRA Solid Wastes, and a TSCA PCB landfill. The on-site chemist decides on the disposition of the load per procedures described above. The load is then sent to the loading dock where it is checked for standing liquids. A spot check of 10% of the containerized loads is conducted by sounding the drum and use of a PVC sampler. As stated, the implementation of this practice for drum testing was not observed by the Task Force.

II. D. SITE GEOLOGY/HYDROGEOLOGY

1. Geomorphology

The Casmalia facility is located in a range of hills with a vertical relief on the order of 700 feet. The relief at the site ranges from 350 feet elevation to the south to 650 feet elevation to the north over the 4,000 foot length of the facility. The facility is constructed on the southern slope of a ridge and encompasses three small subdrainages of a watershed which drains to the south (see Figure 2). The drainage has been altered by the facility such that no run-off leaves the facility boundaries. Runoff is circulated into the surface impoundment system. The canyons are now used for landfills and surface impoundments.

The main drainage course in the area, to which the streams on the facility previously discharged, is Casmalia Creek which runs due south along the western boundary of the site. The nearest stream to the east is Shuman Creek located about one mile from the eastern boundary of the site. Casmalia Creek is joined by Shuman Creek and then drains west to the Pacific Ocean.

The Casmalia Hills are located between two large ground water basins (Figure 4). The Santa Maria Valley ground water basin to the north and the San Antonio Creek basin to the south (part of the Santa Ynez Valley) in which Vandenberg Air Force Base is located. The Santa Maria Valley, San Antonio Creek basin, and Santa Ynez Valley aquifers are the main water supply in the region. Several livestock wells and the facility non-potable water supply wells are located in the small Casmalia Creek alluvial aquifer near the site. This water is not potable because of high TDS levels, due to gypsum and other evaporite deposits that exist in the area.

The above ground water basins are comprised of unconsolidated alluvial deposits underlain by consolidated marine deposits of the Sisquoc and Monterey Formations. The unconsolidated alluvial deposits constitute the basin aquifers. Ground water flow in these basins is seaward, east to west. According to available data and a study conducted by the Santa Barbara County Water Agency, the ground water basin boundaries generally coincide with the surface water divides.

The surface water, and apparently ground water units surrounding the facility drain towards the south and San Antonio Creek basin. There is no evidence of a bedrock aquifer in the Casmalia Hills. Direct hydrologic connections through bedrock between the facility and either of the basins is not indicated.

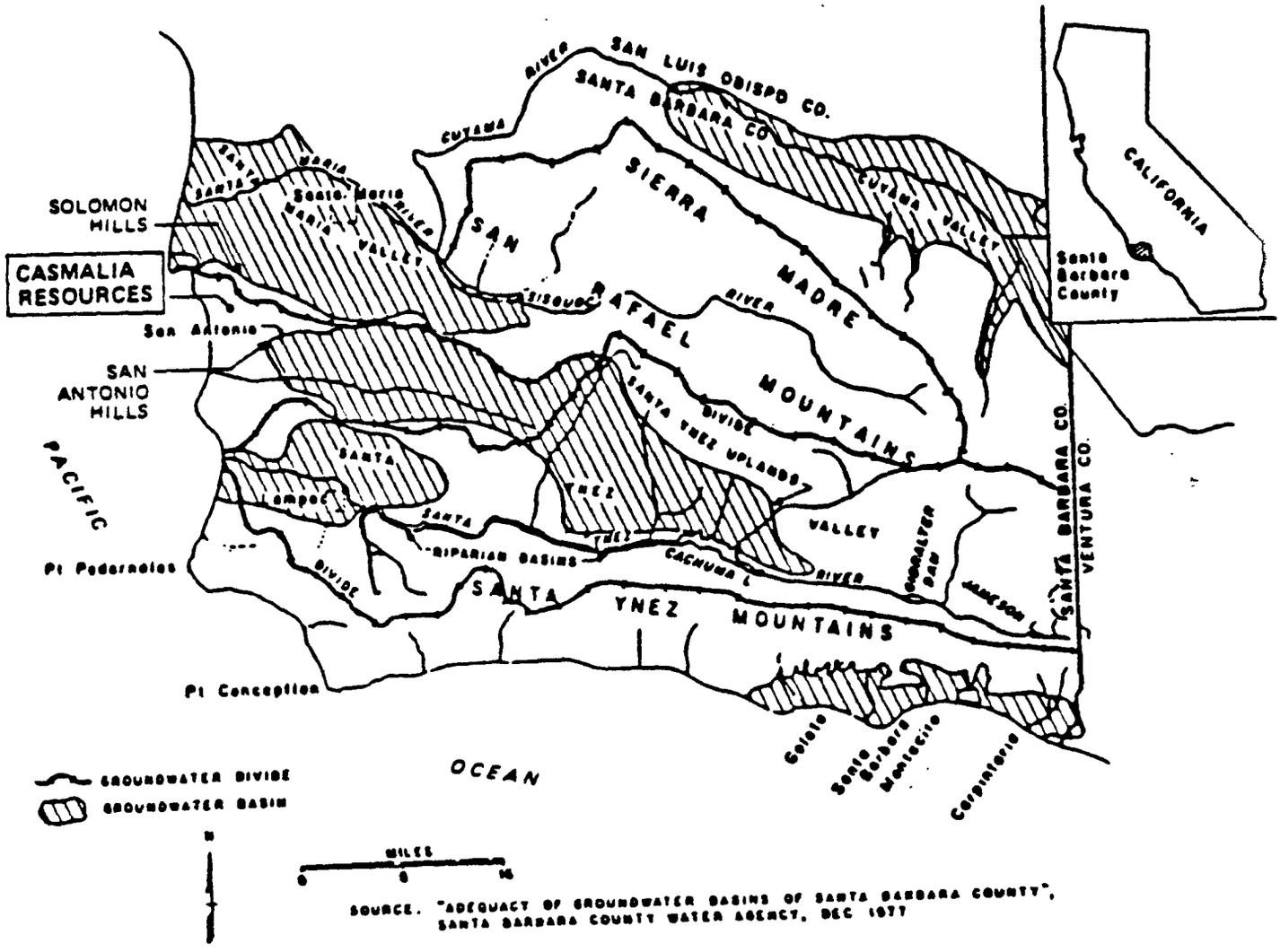

Figure 4. Ground Water Basins of Santa Barbara County.

2. Geology

The bedrock lithology of the site consists entirely of the lower portion of the Sisquoc Formation which is a late Miocene, early Pliocene marine deposit of claystones, silty claystones, shales, and diatomaceous and partly opaline shales. According to geologic studies conducted by Alden Loomis, the Sisquoc Formation extends downward for 400 to 700 feet below the surface where it contacts the Monterey Formation (Figure 5). The bedrock is thinly bedded under most of the site with no known sand beds through the formation.

No known large folds or faults affect the unit beneath the site. There is surface and near surface fracturing of the bedrock. The bedrock weathers into silty clay that contains shale fragments. Soils are fine grained with low permeability. Bedding dips gently to the east and north from about 1 to 15 degrees.

The soils and weathered bedrock on the site range in thickness from about 3 feet in the upper reaches of the site to over 35 feet in the lower portions of the site.

3. Hydrogeology

The facility has designated two separate water-bearing strata; fractured or weathered bedrock (Sisquoc Formation), and alluvial/unconsolidated deposits. To estimate hydraulic conductivities of each of the zones field testing was performed at selected wells and piezometers by the facility in 1984.

Rising head permeability tests were conducted by the facility on wells A1B, A2M, A2B, B3B, C2M, C2B, CpH, D1M, and D1B. Constant discharge permeability tests were also conducted on piezometers T-3A, T-3B, T-3C, SB-5, SB-6, SB-7, SB-8, SB-10 and WB-7. The estimated permeability values are presented in Tables 1 and 2.

Hydraulic conductivity values, estimated by the facility from field data measured in wells completed in relatively unweathered bedrock were low and ranged from 10^{-6} to 10^{-7}cm/sec. Weathered bedrock or mantle zones, such as alluvial soils, yielded hydraulic conductivity values of 10^{-5} to 10^{-7}cm/sec. There are several exceptions to the ranges as noted in Tables 1 and 2. Local fracturing of the bedrock has probably caused increases in the permeability to 10^{-5}cm/sec.

Potentiometric maps developed by the facility indicate the ground water flow direction to be due south through either the C-canyon or the B-canyon to the barrier dams. With the given potentiomentric surface, the facility calculated estimated ground water flow velocities from well A1B to well C5

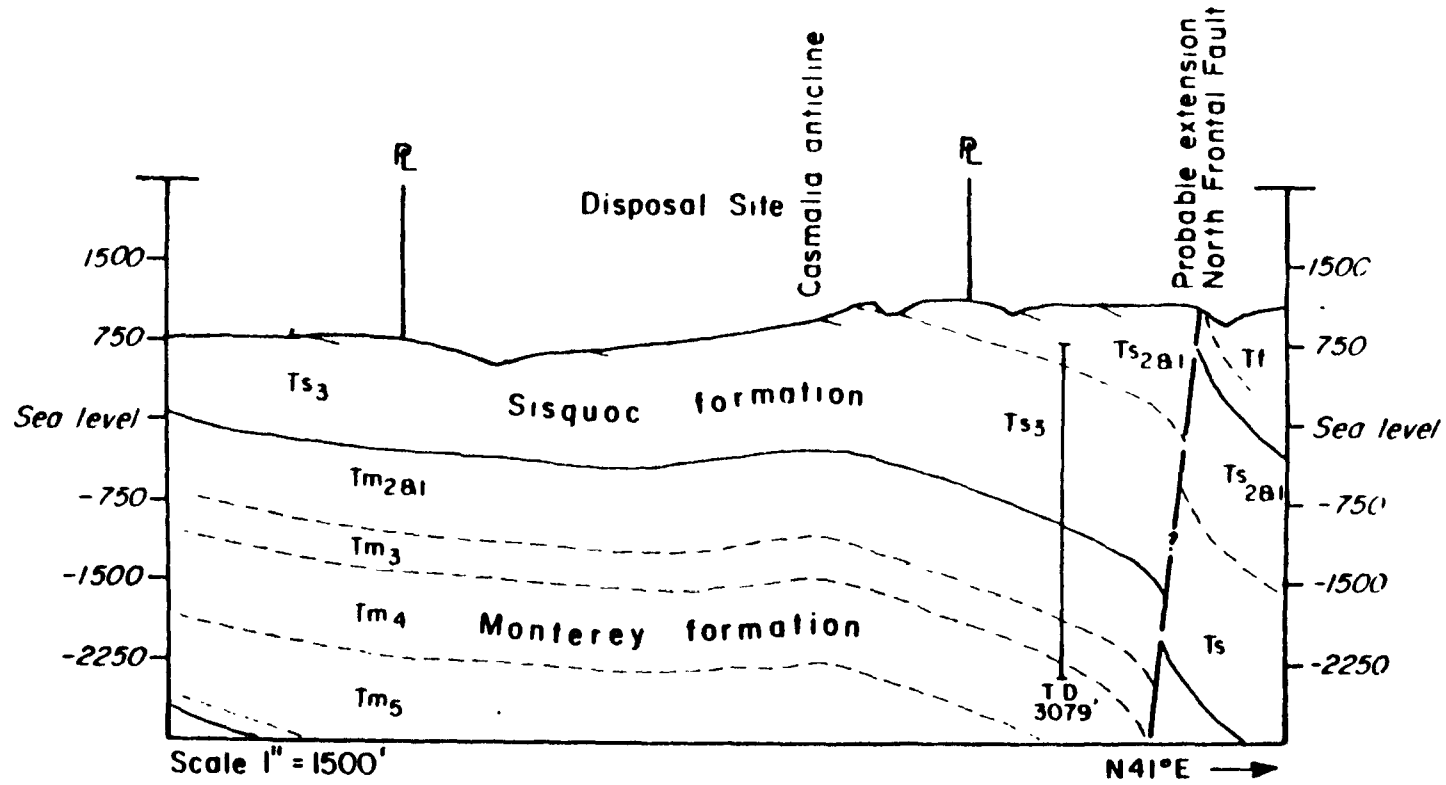

Figure 5. GEOLOGIC CROSS SECTION A-A'
HUNTER DISPOSAL SITE

Courtesy Union Oil Company

A Loomis
January, 1972

TABLE 1.

RISING HEAD PERMEABILITY TEST RESULTS
(Saturated Zone)
(From Casmalia January 1985 Part B Permit Application)

Well Number	Screened Interval (feet)	Lithology	Hydraulic Conductivity* (cm/sec)
A1B	174 - 198	mudstone	-3×10^{-7}
A2M	10 - 15.5	clay & shale	2×10^{-5}
A2B	37 - 61	mudstone	6×10^{-6}
B3B	40 - 64	mudstone	2×10^{-7}
C2M	10 - 55.5	fill & shale	2×10^{-6}
C2B	82.5 - 92.5	mudstone	3×10^{-5}
CpH	110 - 120	mudstone	1×10^{-7}
D1M	10 - 44.5	fill & shale	1×10^{-6}
D1B	78 - 102	mudstone	1×10^{-6}

*Method of analysis as specified by M. Juul Hvorslev, Time Lag and Soil Permeability in Groundwater Observation, Bulletin No. 36, Corps of Engineers, U.S. Army (1951).

TABLE 2.

CONSTANT DISCHARGE PERMEABILITY TEST RESULTS
(From Casmalia January 1985 Part B Permit Application)

Piezometer Number	Screened Interval (feet)	Lithology	Permeability* (cm/sec)
T-3A	29.5 - 39.5	clay and shale	1×10^{-7}
T-3B	45 - 59.5	clay and shale	1×10^{-7}
T-3C	95 - 139	mudstone	$<1 \times 10^{-7}$
SB-5	31 - 39.5	clay and shale	4×10^{-6}
SB-6	39 - 46	mudstone	7×10^{-7}
SB-7	29.5 - 40	mudstone	8×10^{-5}
SB-8	37 - 49	mudstone	2×10^{-7}
SB-10	11 - 22	mudstone	$<1 \times 10^{-7}$
WB-7	15 - 26	mudstone	$<1 \times 10^{-7}$

*Method of analysis as specified by H. Bouwer, Groundwater Hydrogeology, McGraw-Hill Company, (1978), and by Juul Hvorslev, Time Lag and Soil Permeability in Groundwater Observation, Bulletin No. 36, Corps of Engineers, U.S. Army (1951).

(the steepest topographic gradient). Velocities in the bedrock zone were estimated to be 7 X 10^{-7} cm/sec (or 1 foot/year). Velocities in the mantle zone were calculated to be 4 X 10^{-6} cm/sec (or 4 feet/year). Using values for the higher permeability alluvium or fractured bedrock, this author calculated velocities on the order of 6 X 10^{-5} cm/sec (or 60 feet/year). These high permeabilities were confirmed by observation of water level recovery rates in wells during Task Force purging and sampling operations. This indicates the possibility of higher permeability areas of the alluvial and fractured bedrock zones than indicated by the facility.

Boring logs reviewed by Yelsey (1984) indicated the presence of discrete seepage zones. He felt the heterogeneity of the unconsolidated deposits (clays, gravelly clays, silty sands) probably resulted in lateral ground water movement in materials of slightly higher permeability. The unconsolidated deposits appear to act as semi-permeable aquitards, helping to explain the presence of multiple seepage zones in some boring logs.

4. Climate

The area is characterized by short, mild winters and dry, warm summers. Most precipitation falls during the winter months of November through April. The average annual precipitation ranges from 10 to 15 inches. Annual precipitation can vary from as low as 5 inches to as much as 30 inches.

II. E. GROUND WATER MONITORING SYSTEM

1. Monitoring Requirements State/Interim Status

A monitoring program has been in effect at Casmalia Resources since 1972 when State Waste Discharge Requirements were granted. The ground water monitoring program evolved over the years as the site expanded and modifications were made to the facility. To bring the facility into compliance with Interim Status requirements under RCRA, the Water Quality Control Board modified the monitoring program in 1981. Modifications to the monitoring program, after the initial 1972 well system was installed, came in 1974, 1982, and 1983 per additional State changes.

However, as a result of a December 1983 ground water monitoring inspection conducted by EPA, a Consent Agreement was entered into in September 1984 for further modifications to the program. Four additional wells were installed per this agreement. A total of 11 wells currently comprise the RCRA interim status monitoring system. Previous wells were phased out of the RCRA system due to their inappropriate construction. The RWQCB requires monitoring of 19 facility wells. The location of each facility well including non-RCRA wells, gallery wells, and water supply wells is provided in Figure 6.

2. Current Monitoring Well Network

The current RCRA monitoring system consists of one upgradient well (A1B) and 10 downgradient wells (A2M, A2B, B3M, B3B, C1B, C2M, C4M, C6B, D1M, and D1B)(see Figure 6). The first letter of the well nomenclature refers to the area on the facility where wells are placed (B-canyon, C-canyon etc). Further classification of wells is into one of two categories, bedrock monitoring wells and soil-mantle monitoring wells. The bedrock wells are reported to be screened in consolidated deposits, and the soil-mantle monitoring wells are reported to be screened in the overlying unconsolidated materials and fractured bedrock. The letters B and M after a well number designate a bedrock (B) or soil-mantle (M) monitoring well. The numeric designation in the well nomenclature is an ordinal number.

Two additional wells were constructed at the base of the PCB landfill (EPA-1 and EPA-2). These wells were constructed to comply with the TSCA permit for PCB disposal. Records indicate these wells have never had any water in them. They are monitored per a TSCA permit and are not monitored (or constructed) to meet RCRA requirements.

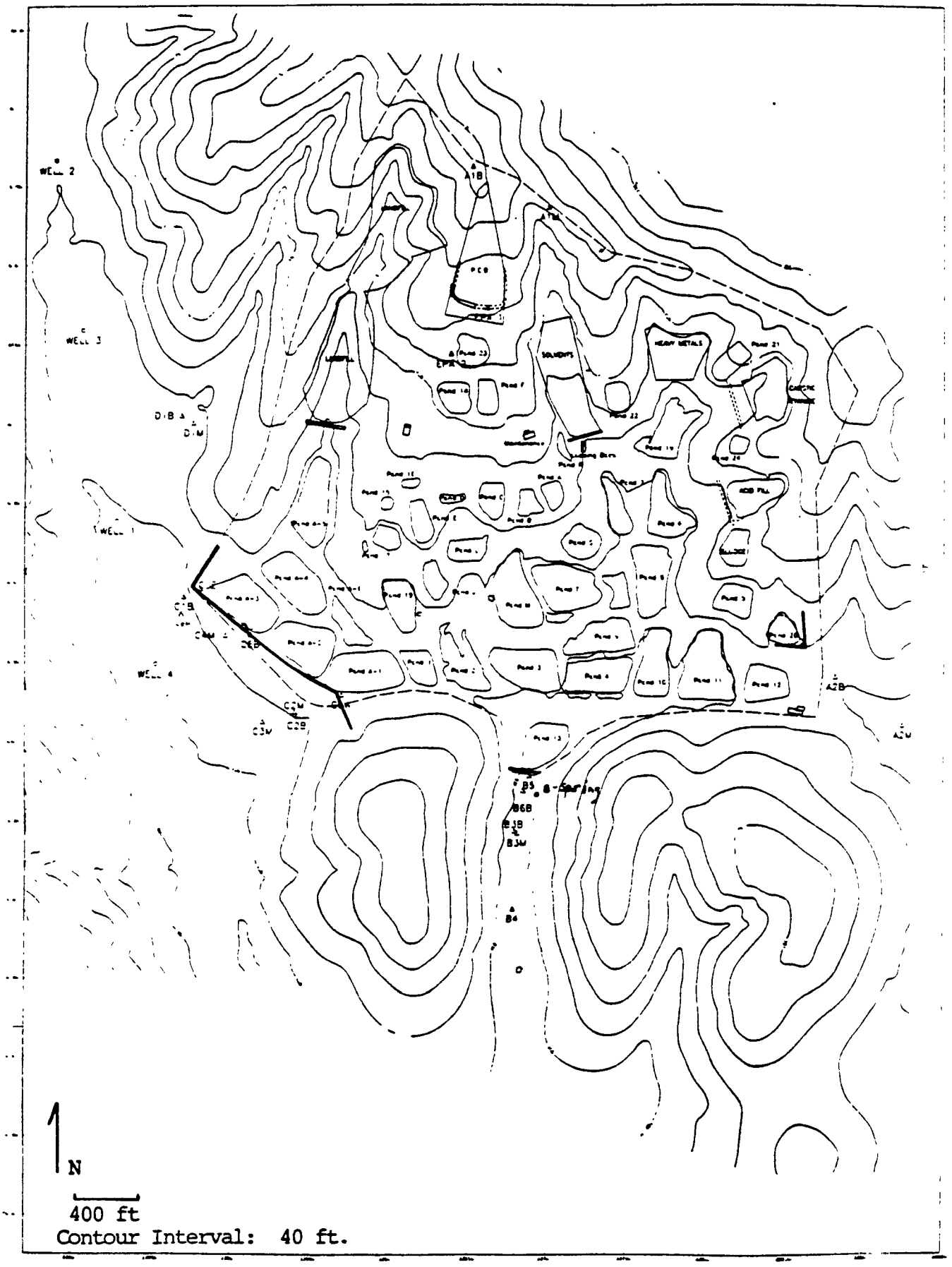

Figure 6. Topographic Map with Waste Units and Facility Well Locations, Casmalia Resources. (Source; Woodward-Clyde Consultants, 1985)

The downgradient wells are located from 300 to 1150 feet from the edge of the waste management units and may not meet the RCRA requirement for placement at the limit of the waste management boundary to immediately detect potential releases of hazardous waste constituents.

3. Well Construction

A summary of the well construction details for the 11 RCRA wells is provided in Table 3. The explanation of well construction which follows was provided by the facility and was not confirmed by State or EPA observations.

The five soil-mantle wells (A2M, B3M, C2M, C4M, and D1M) were installed in 1982. Well drilling was accomplished using a bucket auger rig to obtain an 18-inch diameter bore hole. The well casings are PVC-glue cemented 6-inch I.D. PVC which are perforated (0.08 inch saw-cut) from approximately 10 feet below the ground surface to the bottom of the well. An unperforated 2.5-foot section of casing and a cap was placed at the bottom of each well to act as a collection sump for well debris and silt. A filter pack of 1/4 to 1/8-inch gravel was placed around the entire length of the perforated section. The annular spaces above and below the screened interval were sealed with concrete grout. The space above the pack were grouted to the surface. No bentonite seals were used between the filter packs and the grouting. See Figure 7 for a schematic of a typical soil-mantle well construction.

The purpose of this type of construction was to collect water samples from the entire length of the unconsolidated zone. This, however, resulted in excessively long screen lengths (some in excess of 70 feet) causing, at times, several saturated zones to be transected.

The six B-wells (A1B, A2B, B3B, C1B, C6B, and D1B), were installed into less weathered bedrock. Wells C1B and C6B were installed in 1982 using a rotary-wash method which makes logging down-hole moisture conditions at the site impossible. C1B and C6B were drilled with an 18-inch diameter borehole, a 6-inch inside diameter well casing, and a 10- to 20-foot long machine-slotted well screen. These two wells, constructed similarly to the M-wells, have PVC glue-cemented well casings rather than threaded couples and have no bentonite seals between the filter pack and the cement seal. See Figure 8 for a schematic of a typical older bedrock well construction.

Well A1B, A2B, B3B, and D1B were installed in 1984 in response to a Consent Agreement reached in September 1984 between EPA and the facility. The four wells constructed in 1984 were installed under the direction of Woodward-Clyde Consultants. These bedrock wells were drilled until bedrock

TABLE 3

SUMMARY OF WELL CONSTRUCTION DETAILS
(from Casmalia January 1985 Part B Permit Application)

Well Number	Date Constructed	Drilling Method	Depth of Boring (feet)	Borehole Diameter (inches)	Depth of Well Casing (feet)	Screened Interval (feet)	Casing Diameter I.D. (inches)	Lithology of Screened Interval	Surveyed Elevation (feet)	
									Pad	Top of Well Casing
A1B	7/84	Rotary-Wash	357	12.25	198	174 - 198	6	gray mudstone	806.6	808.01
A2M	8/82	Bucket Auger	18	18	18	10 - 15.5	6	clay & tan shale	415.5	419.14
A2B	7/84	Rotary-Wash	61	12.25	61	37 - 61	6	gray mudstone	452.0	452.84
B3M	6/82	Bucket Auger	25	18	25	10 - 22.5	4	clay & tan shale	383.0	385.97
B3B	8/84	Rotary-Wash	70	12.25	64	40 - 64	6	gray mudstone	383.3	384.56
C1B	1982	Rotary-Wash	87	18	87	74.5 - 87	6	gray mudstone	435.5	439.06
C2M	1982	Bucket Auger	58	18	58	10 - 55.5	6	fill & tan shale	445.3	448.56
C4M	8/82	Bucket Auger	89	18	89	10 - 86.5	6	fill & tan shale	452.9	456.16
C6B	1982	Rotary-Wash	106	18	106	94 - 103.5	6	gray mudstone	450.9	453.91
D1M	1982	Bucket Auger	47	18	47	10 - 44.5	6	fill & tan shale	474.9	478.45
D1B	7/84	Rotary-Wash	130	12.25	102	78 - 102	6	gray mudstone	477.9	478.86

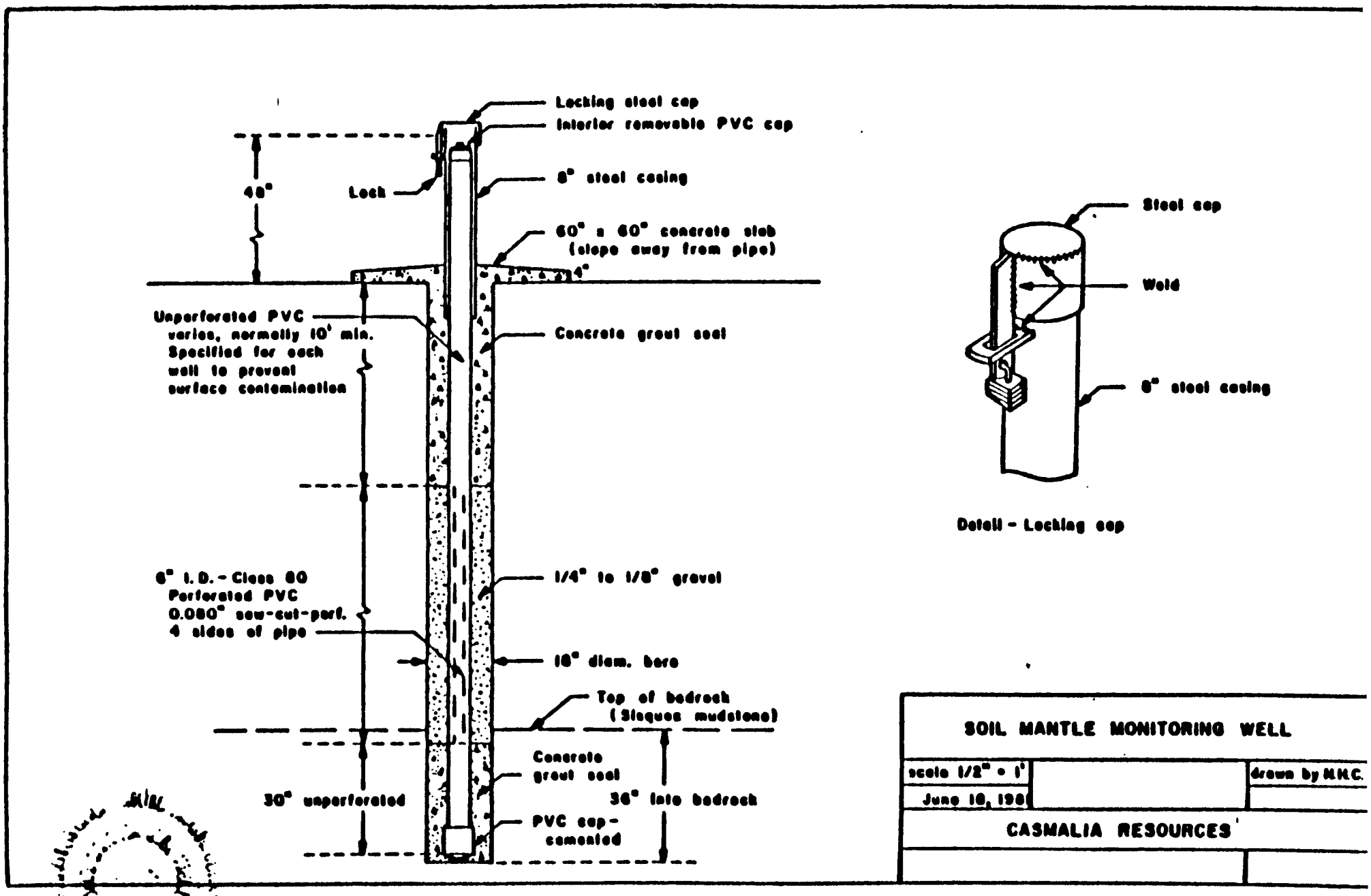

Figure 7. Typical Soil-Mantle Well Construction, 1981, Casmalia Resources.

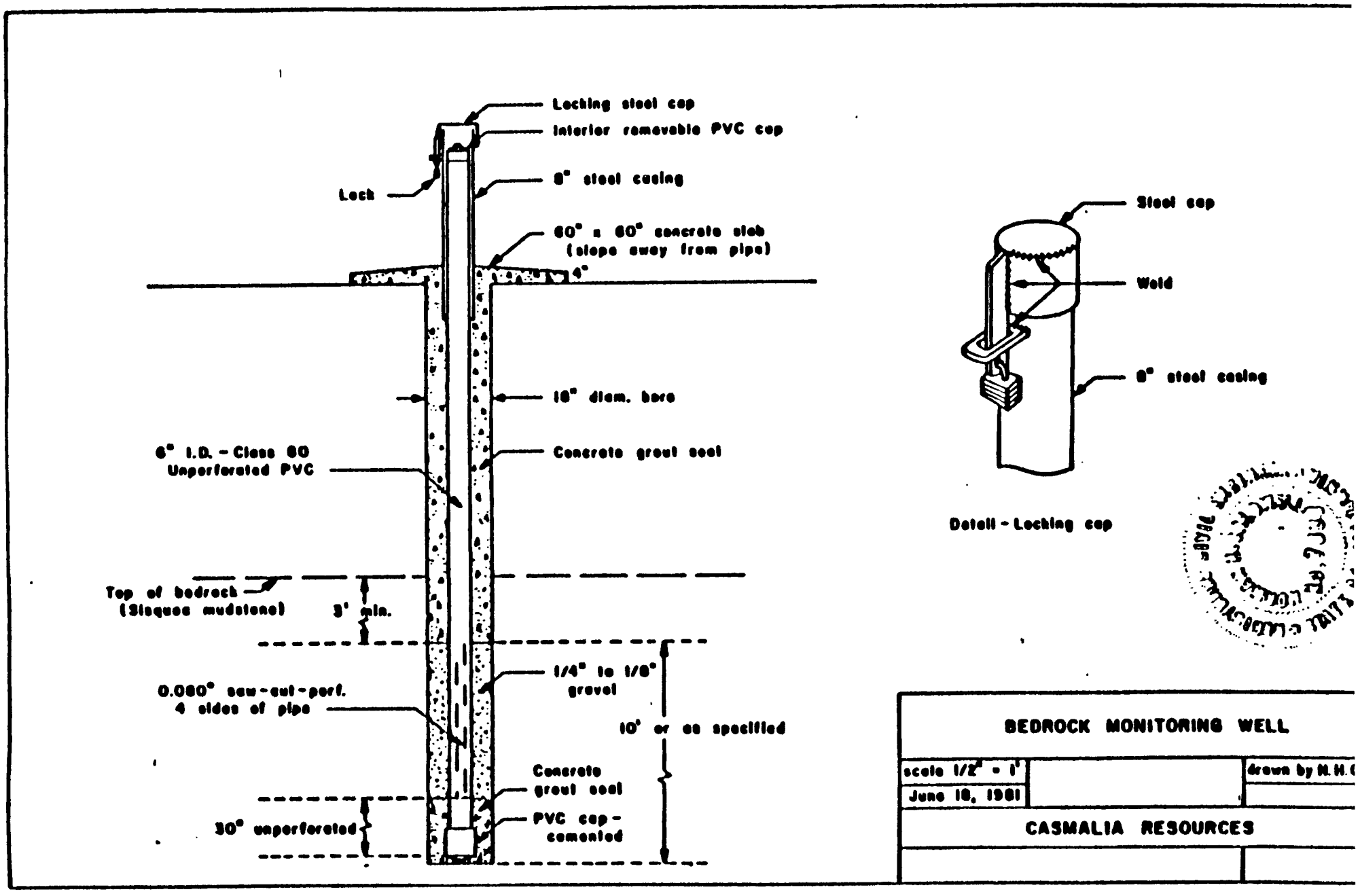

Figure 8. Typical Bedrock Well Construction, 1981, Casmalia Resources.

was reached, then an additional 5 feet into bedrock, 20 feet of well screen was then used with four feet or unscreened casing at the bottom to serve as a sump.

The wells were drilled using an air rotary method to obtain a 12.25-inch diameter bore hole. After the water table was reached with air-rotary, the boring was then continued using a rotary-wash method. An organic drilling mud ("Clear Mud") was then used to develop the hole. The well casing is 6-inch PVC with 20-foot of slotted PVC screening and four feet of unslotted casing at the bottom to serve as a sump. Threaded joints were used rather than glue with these four wells. A filter pack was placed along the entire length of the screened interval plus three to five feet above the top of the well screen. Dry sodium hypochlorite was added to the sand to break down the drilling mud. Three to four feet of bentonite seal was then placed above the filter pack and the remainder of the annular space was filled to the surface with cement/bentonite grout. Figure 9 gives a schematic of a typical construction of the four newer wells.

The screen slot size determination was made by the Woodward-Clyde project geologists. No rationale is given for their selection; it was not done based on grain size analyses. Filter pack size selection was then based on the screen slot size, not formation grain size.

PVC materials used for construction of the wells in 1984 were steam cleaned prior to their installation, details on decontamination procedures for wells installed prior to 1984 are not available.

To accomodate purging prior to sampling, all but two RCRA wells have dedicated jet pumps installed which operate with a portable air compressor (see Figure 10). The purging and operation of the air compressor is conducted by a Casmalia site employee. The Task Force found that these jet pumps do not work efficiently under conditions of low head or where the purge water has to be lifted any height. Wells appear to go dry even when water remains in the casing.

All of the wells also have a bailer access tube for access of the bailer used for sample collection. Water can only enter the tube through the bottom which prevents free circulation of water within the well casing. The access tubes have a constriction at their base to prevent the bailer from falling through the bottom. An indirect result of the construction of the bailer access tube is that immiscible compounds in the ground water (floating and sinking fractions) cannot enter the sampling tube. The tubes must be perforated throughout the entire length of the water column to allow free circulation of water.

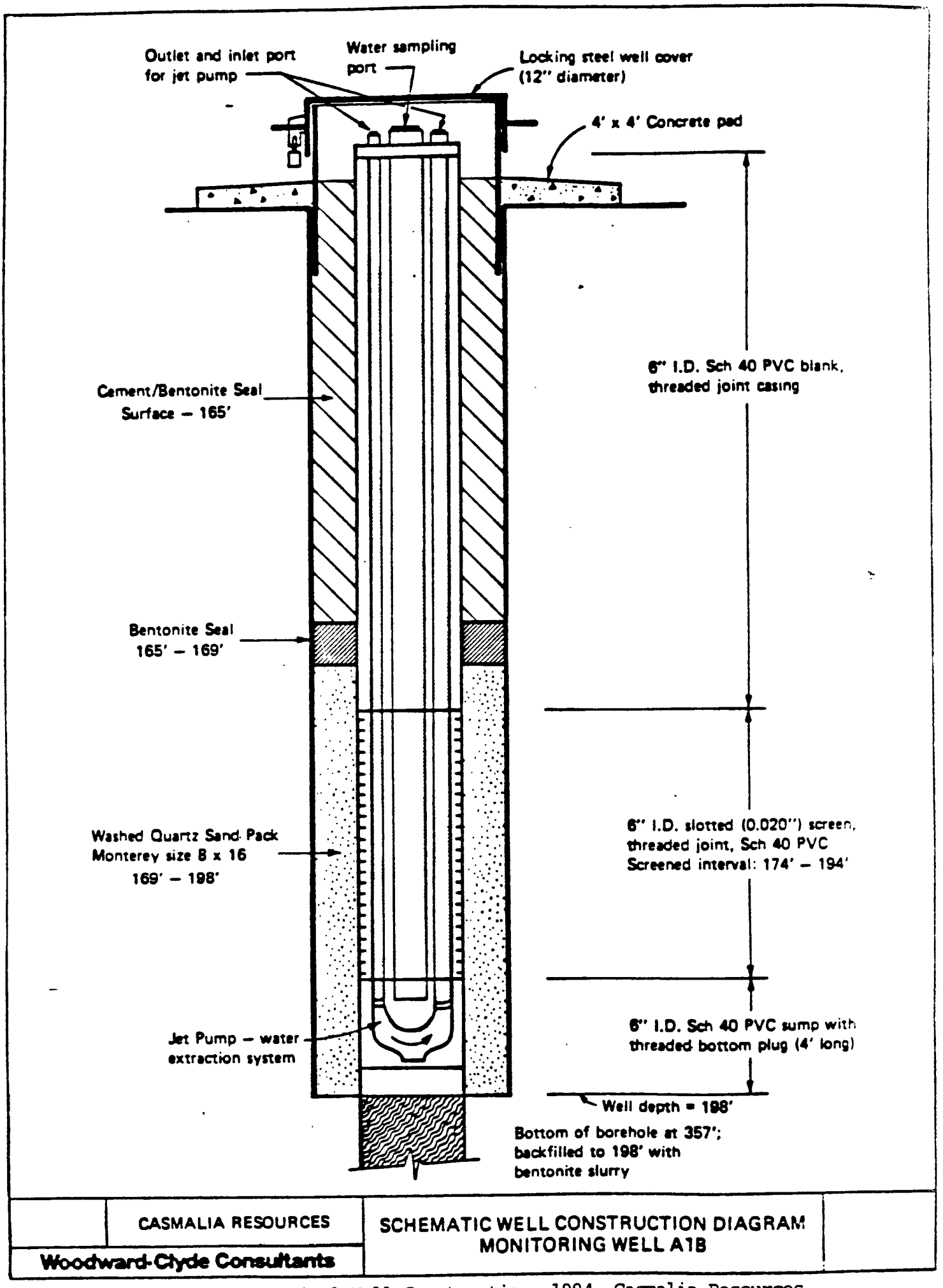

Figure 9. Typical Well Construction, 1984, Casmalia Resources.

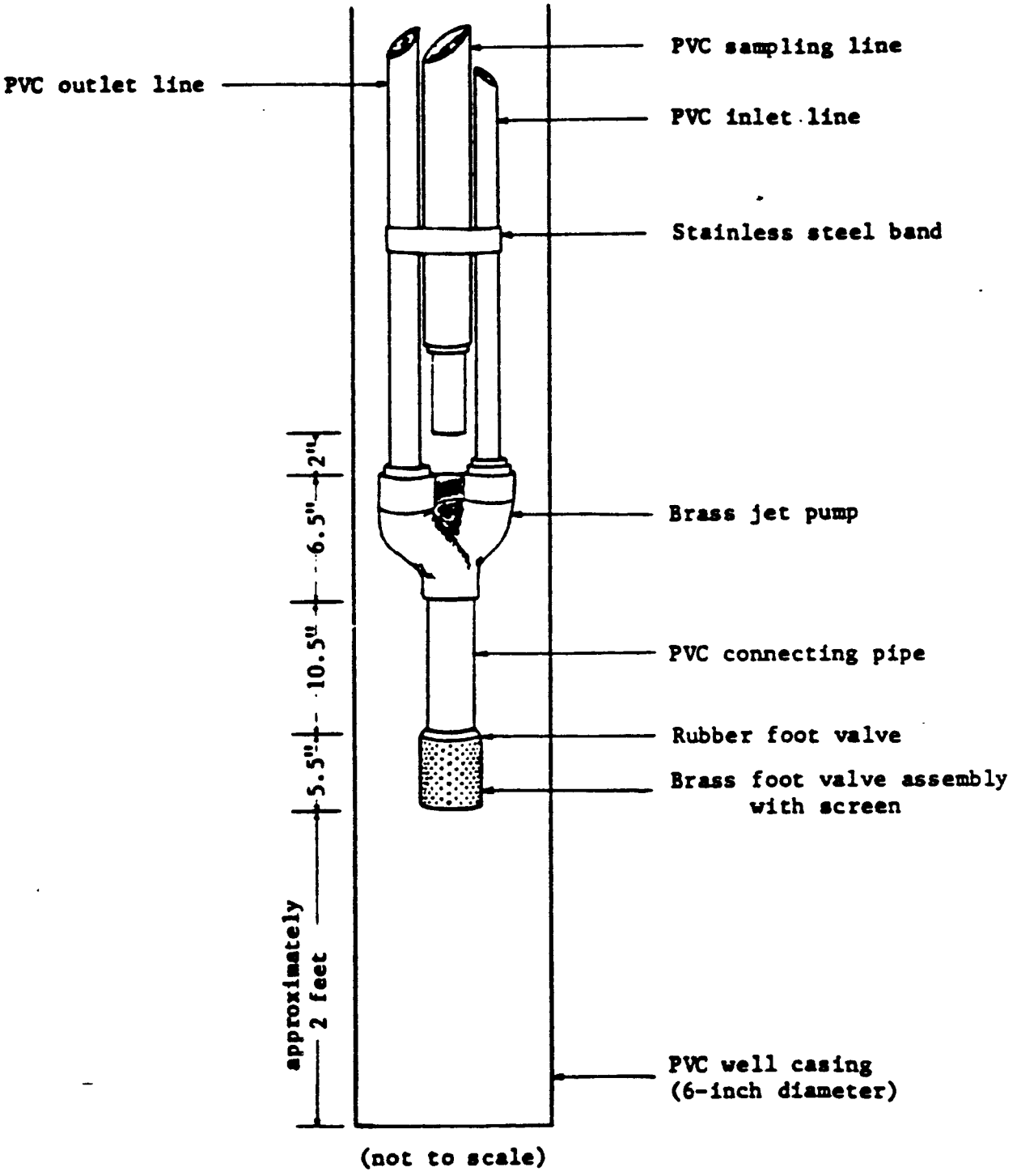

Figure 10. Schematic Drawing of Jet Pump Assembly (from Woodward-Clyde Consultants, 1985)

4. Site Characterization

An insufficient amount of site characterization has been conducted at the Casmalia facility. Site characterization started in 1972, however, it is not adequate for the complexity of the site. A broad concept of the hydrogeology exists for the site, but it is not detailed enough to assure adequate well placement. Well placement has not been based on flow paths identified through hydrogeologic characterization. Well locations have been based on topographic considerations (canyons, downgradient of barrier dam etc.), not demonstrated hydrogeologic considerations. Wells were logged from cuttings and not from soil or rock samples. This has yielded well log descriptions with too little detail. No continuous soil corings have been taken and the intermittent samples that have been taken were not analyzed for grain size or any other physical properties.

Vertical and horizontal hydraulic conductivity distribution has not been defined for the unconsolidated alluvial deposits, the Sisquoc, or the Monterey Formations.

Nine off-site piezometers have been installed to attempt to determine horizontal flowpaths, however, no characterization of vertical gradients of flow has been attempted. The wells and piezometers that have been installed have such large and variable screen intervals that accurate water level measurements are impossible. In addition, past water level measurements have not allowed for proper recovery of wells prior to measurement.

Based on given rationale for well construction, screen locations have also not been based on locations of saturated zones. Saturated zones should be identified through proper well logging and continuous corings of well borings. The background well (A1B) has not been demonstrated to be reflective of proper background quality water. High and variable TOX levels have plagued this well as well as several others at the site.

The facility originally contended that no ground water existed beneath the site. This assumption was based on an improper definition of aquifer as being a water supply rather than a potential pathway. The wells were installed to meet State monitoring requirements prior to attainment of interim status. However, the facility acted based on the assumption that no ground water existed beneath the site up until the 1984 Consent Agreement.

The facility has subsequently identified two water-bearing zones at the site; the weathered/fractured bedrock zone (where the B series wells are installed) and the alluvial/unconsolidated aquifers (where the M series wells are installed). The characteristics and extent of these two zones have not been

fully demonstrated by the facility. Potential pathways off-site through the bedrock saturated zones have not been identified and the interaction between the bedrock saturated zones and the alluvial saturated zones has not been characterized.

5. Sampling and Analysis Plan and Field Procedures

The Sampling and Analysis Plan presented in the Part B application was reviewed as part of the Sampling Audit conducted during November 1985. Review of the plans was conducted by Peter Rubenstein, the sampling team leader. The plan was critiqued, observations of its implementation were made in the field, and facility representatives were interviewed for details of field practices and rationales. Detailed review of the Sampling and Analysis Plan is provided in the Ground Water Sampling Audit report prepared by Peter Rubenstein, March, 1986. As with the other supporting documents and reports, it is incorporated into this report by reference and is part of the Task Force file.

The plan was not written to guide field work, but rather as a documentation report for work already completed. The plan needs to be a stand-alone document with enough detail such that any qualified sampler can apply the document at the facility and assure consistency.

The sampling plan differed from actual field procedures used and observed during the November, 1985 sampling. Both the plan and actual field procedures used have several problems which must be corrected before the data collected by the facility can be considered unbiased and representative of the uppermost aquifer. Improper sampling procedures can either add constituents not actually present in the ground water (false positives) or potentially mask parameters actually present in the ground water (false negatives).

The biggest problem observed with sample collection was the improper well purging procedures used. The amount of water purged from the wells was not based on the casing volume. The wells were purged using a jet pump assembly run with an air compressor. Purging was conducted by facility site personnel several days prior to the start of sampling by Woodward-Clyde. No sampling team member was available to direct the purging and assure consistency with the sampling plan. The purge volumes evacuated from the wells were not measured or documented. The amount of purging was based on the length of time the operator had purged or until the well appeared to have run dry because no water discharged from the pump. On several occasions the well appeared to have "run dry" when there were tens of feet of water remaining in the well. Purging volumes must be based on the well casing volume and the number of casing volumes purged should remain constant between each sampling event. Purging must also be

done at a rate such that cascading in the well does not occur. Some sampling did not occur until eight days after purging. The incomplete purging and the excessive length of time between purging and sampling can cause chemical interference and allow the loss of volatile and semi-volatile organic compounds. Volatile samples must be collected as soon as possible after a complete purging to assure a minimal loss of volatile constituents.

Water level measurements were not taken at the proper time. Water level measurements in wells were taken after purging, not before when static water levels were reached. This adds an additional potential error to potentiometric surface measurements.

Sampling was conducted by the facility contractor, Woodward-Clyde Consultants from Walnut Creek, California. A sampling team of four was present for the sampling event. Just prior to sampling, water levels were taken by the sampling team. Samples were collected using a 2-inch diameter, 3- or 4-foot long sectional Teflon bailer with a ball check valve on the bottom. The bailer was lowered through the 2.25-inch sampling access tube on teflon coated line. Sampling containers were provided by the facility's contract analytical lab, Brown and Caldwell in Pasadena, California. Containers arrived on-site with preservative already in them. Whereas this expedited the sampling process, it allowed spillage of preservatives during filling and leakage during transport, and possibly changed preservative concentration.

Pre-labeled, pre-preserved sampling containers together with a Sampling Plan with too little detail caused several container mixups during the observed sampling. TOC samples were not acidified, while TOX samples were acidified and allowed to have head space. These are not standard sample collection methods.

QA samples were not collected as "splits" of the original, but rather as "duplicates". This is not an inappropriate procedure but should be designated properly. Only one blank sample was taken per sampling event and it was not filled in a clean area. The water used for the blanks was store-bought distilled water not demonstrated to meet "organic free" standards.

Chain of Custody procedures were not being properly maintained. Records were not established until the end of each day, rather than being maintained throughout sampling activities. Chain of Custody was not maintained on samples throughout the day. Samples were observed being left unattended in an unlocked storage area several times during the day. Samples were also shipped without Chain of Custody seals so custody was not maintained through arrival at the laboratory.

The varied sampling practices followed by the facility sampling personnel cannot assure unbiased sampling. Cross-contamination and loss of sample integrity were potential problems as a result of the procedures followed. The sampling plan does not provide enough detail to assure errors are not made during sampling. It also does not provide enough guidance such that a different sampling team could collect samples in an appropriate, consistent manner.

Data from the volatile organic samples collected with a time lag of greater than one day between purge and sample must be considered suspect. The bailer access tube construction can also cause masking of parameters. This, in conjunction with incomplete well purging, can cause bias of certain indicator parameters and should be considered when reviewing facility ground water quality data.

The facility has been apprised through interviews and the Notice of Deficency (NOD), issued in March 1986, of all of the concerns identified in Rubenstein's Sampling Audit Report. Correction of these deficiencies is being pursued by the State and Federal agencies.

6. Facility Water Quality Analysis and Data Quality Assessment

To assess the facility's contract laboratory's ability to analyze the ground water samples, an audit of Brown and Caldwell's analytical laboratory in Pasadena, California was conducted. Brown and Caldwell is an off-site commercial laboratory which has been contracted by Casmalia Resources to perform ground water analyses. The audit was conducted by Kevin Wong, Chemist, EPA Region 9.

The major objectives of the audit were twofold: 1) To assess Brown and Caldwell's capabilities to conduct ground water analyses and their general ability to produce data of acceptable quality; and 2) To investigate and assess the quality of actual ground water data generated specifically for Casmalia Resources. In conjunction with this Task Force audit, the California Department of Health Services also participated in a concurrent laboratory evaluation in support of the State's hazardous waste laboratory certification program.

The laboratory procedures were found to be generally acceptable. However, several QA/QC problems were noted. The lack of sufficient documentation and establishment of standard operating procedures for sample receiving, glassware cleaning, and instrument servicing appear to be the major problems found with the laboratory.

As mentioned earlier in this report, a problem was encountered in the field during our audit of Woodward-Clyde sampling when inappropriate sample containers were received from Brown and Caldwell. For the sampling, sample containers are labeled and the necessary preservatives added prior to shipping the containers to the sampling team. During the November sampling audit, the TOC sample container, and thus the sample, was not acidified. The TOX sample container was acidified but not checked for headspace.

Such mixups can be avoided by following a more thorough Sampling and Analysis Plan, but a strict sample handling protocol by the laboratory is also necessary.

7. Interim Status Ground Water Monitoring Data

As discussed previously, only limited Part 265 Interim Status ground water monitoring parameters were being analyzed at Casmalia Resources prior to the September 1984 Consent Agreement. No statistical analysis had been run on any of the data prior to that time. Statistical analysis of the data was not run until May 1985. Accelerated ground water monitoring analysis for the Part 265 parameters was conducted in July/August, September, October, and November 1984 for the purpose of establishing background water quality. After the next semi-annual sampling (May 1985) statistical analysis was conducted on the data using the Cochran's approximation to the Behrens-Fisher t-Test (Students t-Test).

The results of the May 1985 analyses with the statistical calculations were received in July 1985. The results indicated statistically significant increases or decreases in pH, specific conductance (SpC), and/or total organic halogens (TOX) for all but three of the monitoring wells (A2M, B3B, and C6B). Due to the drastic seasonal and spatial variations in these parameters seen over the year, it was suggested by the facility that the Students t-Test, required by RCRA Part 265, was not appropriate for this hydrogeologic system.

An alternative statistical method was proposed by the facility to accommodate the geochemical and seasonal influences on the ground water. The average replicate Students t-Test using a natural-log-transformation on the data to account for highly skewed, non-normally distributed data was suggested by the facility and accepted by the Agency. The reanalysis also incorporated the May 1985 upgradient data into the background to account for more seasonal variations in the parameters. Reanalysis of the May 1985 data using the log-transformation reduced the number of statistically significant increases to three wells (A2B, SpC; B3M, SpC; Duplicate B3M, TOX; and C1B, pH). Subsequent analysis of data taken in November 1985 indicated two wells showing significant increases

in pH, C1B and C6B. C1B is the only well showing a recurrence from November 1985 to May 1985 of a statistically significant increase of a parameter. The facility notified the State and EPA of the statistical results in a Februaty 28, 1986 letter and contended the increase resulted from improper well construction. There were no plans submitted to address the apparent triggering of assessment. However, the facility indicated that correction of well construction problems and a reanalysis of the indicator problems would be conducted through the NOD process when new wells are to be constructed and installed after a thorough hydrogeologic investigation.

Also, in order to account for high TOX levels in their samples, the facility has conducted a scan for priority pollutants for each sampling period since July 1984. The analytical method used was GC/MS, EPA method 624 and 625 or 501.2. The organic analysis indicated the presence of several compounds. Tetrahydrofuran (THF) was reported at levels ranging from 10 to 200 ppb in five wells in the July 1984 sampling. THF levels are attributed by the facility to the PVC glue used for well casing construction. However, these high levels may not be completely attributed to glues especially if proper purging was conducted. Trihalomethane (THM) compounds such as chloroform and bromoform have been reported for all sampling periods. Other organic compounds reported for the six sampling episodes were an unidentified phthalate compound, methylene chloride, and caprolactam detected in the May 1985 analyses.

The facility attributes the presence of THM to the use of sodium hypochlorite which was added to several wells to breakdown the organic drilling mud used during well construction. The phthalate and methylene chloride levels are attributed by the facililty to the field and laboratory contamination. The facility has linked caprolactam to the nylon line used during sampling. Caprolactam is reportedly a leachable compound found in some grades of nylon.

It should be noted that waste streams accepted at the facility contain all of the above-mentioned compounds.

During the December 1983 EPA ground water inspection, several RCRA monitoring wells were reported to have exceeded federal drinking water standards for chromium (RCRA Inspection Report, Yelsey, March 1984). The chromium standard was exceeded at three wells, A2M, C6B, and D1M, in a 1982 sampling episode. This reporting of contaminant levels exceeding drinking water standards has received much publicity in the past as being an indication of a release from the facility. However, a determination of a release must be based on a comparison of background to downgradient values. It has subsequently been suggested by the facility that analysis of turbid ground water samples was incorporating metals from suspended clay minerals and drilling muds, therefore elevating the levels.

II. F. GROUND WATER MONITORING PROGRAM PROPOSED FOR RCRA PERMIT

1. Initial Submittals

Casmalia's Part B application was first called in January 1983 and subsequently received in July 1983. The ground water monitoring system proposed in July 1983 consisted of 12 monitoring wells, 2 TSCA wells, and 4 gallery wells, (See Figure 11). At that time, the facility contended that "... no ground water existed in the area ..." but it was "... still essential to provide continuous environmental monitoring to detect the presence of any potential leachate leaving the facility." This contention concerning ground water, again, probably rose for the water-supply definition of ground water and not the definition for the purpose of RCRA. However, the facility did monitor, under the direction of the Regional Water Quality Control Board, for most of the 265.92 parameters in the wells on a complex schedule of monthly, quarterly, biannually, and annually, depending on the parameter and the well (see Table 4).

2. Deficiency Notices

The first NOD was issued in May 1984 by EPA. The ground water portion of the NOD contained rather generic comments requesting additional information on the system and clarification of the original submittals. No additional wells were requested but detailed information regarding well design and construction and more description of the site hydrogeologic properties was requested.

The deficiencies of the monitoring system and the lack of appropriate 265.92 monitoring was noted in a December 1983 ground water monitoring inspection conducted by EPA. The inspection report was issued in March 1984 and resulted in a Compliance Order. A Consent Agreement was reached in September 1984. As a result, the facility installed four additional wells and conducted sampling of the full suite of 265.92 ground water monitoring parameters on an accelerated scale. The four wells were installed as part of the Consent Agreement (A1B, A2B, B3B, and D1B) are described in section II. E. of this report. The suite of 265.92 parameters were run on all 11 RCRA wells in July/August, September, October, and November, 1984 to establish background water quality.

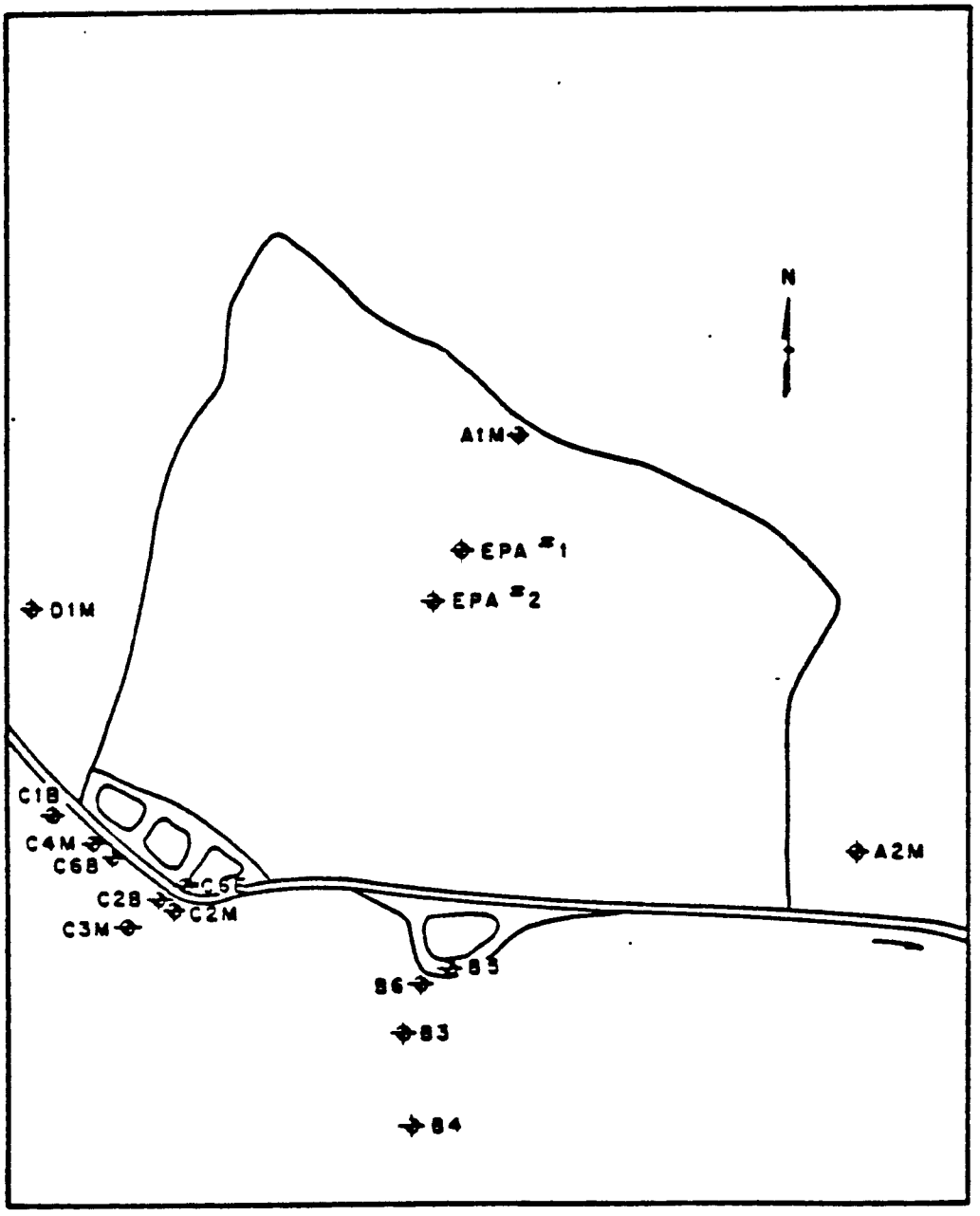

Figure 11. Ground Water Monitoring System Proposed in Casmalia Resources' July 1983 Part B Permit Application.

Table 4. Casmalia Resources Ground Water Monitoring Parameters and Frequency of Sampling used During Interim Status Monitoring, November 1981 to June 1984. (from June 1983 Part B Permit Application)

Parameter	Units	Frequency/Well No.
		Daily
Water Surface Elevation	feet	B-5, C-5
		Monthly
Water Surface Elevation	feet	All but B-5 & C-5
Volume Pumped	cubic feet	B-5, C-5
*pH	--	All wells
*Specific Conductance	umhos/cm	All wells
*Total Organic Halogens (TOX)	mg/l	B-5, C-5, EPA-1, EPA-2
*Total Organic Carbon (TOC)	mg/l	B-5, C-5, EPA-1, EPA-2
PCBs	mg/l	B-5, C-5, EPA-1, EPA-2
		Quarterly (Jan., Apr., July & Oct.)
Arsenic	mg/l	B-5, B-6, C-5, C-6
Cadmium	mg/l	B-5, B-6, C-5, C-6
Lead	mg/l	B-5, B-6, C-5, C-6
Total Filtrable Residue (TDS)	mg/l	B-5, B-6, C-5, C-6
Chemical Oxygen Demand (COD)	mg/l	All but B-4, C5E & C5W
*Total Organic Halogens (TOX)	mg/l	A-1, A-2 & D-1
*Total Organic Carbon (TOC)	mg/l	A-1, A-2 & D-1

TABLE 4, CONT'd....

Parameter	Units	Frequency/Well No.
		Bi-Annually (April & Oct.)
Copper	mg/l	B-5, B-6, C-5, C-6
Cyanide	mg/l	B-5, B-6, C-5, C-6
Total Chromium	mg/l	B-5, B-6, C-5, C-6
Mercury	mg/l	B-5, B-6, C-5, C-6
Nickel	mg/l	B-5, B-6, C-5, C-6
Phenols	mg/l	B-5, B-6, C-5, C-6
Silver	mg/l	B-5, B-6, C-5, C-6
Zinc	mg/l	B-5, B-6, C-5, C-6
Boron	mg/l	B-5, B-6, C-5, C-6
Chloride	mg/l	B-5, B-6, C-5, C-6
PCBs	mg/l	A-1, A-2, B-6 & D-1; C-6 if detected in B-5 or C-5
TOX	mg/l	B-3, B-6, C-1, C-2B, C-6
TOC	mg/l	B-3, B-6, C-6
		Annually (April)
TOX	mg/l	C-2M, C-3, C-4
		Once Each Even-Numbered Year (April)
TOC	mg/l	C-1, C-3, C-4

3. Revised Proposals

The revised Part B application was submitted in November 1984 for all portions of the application except Subpart F (Ground Water Monitoring). The ground water portion of the application was submitted to the Agency in January 1985 to allow for the analytical results from the November 1984 sampling to return from the lab. This application represented a more detailed presentation of the monitoring system, presented the 265 data produced during the accelerated monitoring program, and contained a Sampling and Analysis Plan. However, the first round of Detection Monitoring was not conducted until six months after background monitoring was completed (May 1985). Results from that sampling were submitted to the Agency in July 1985. RCRA Detection Monitoring continues on a semi-annual basis and Regional Board monitoring is conducted quarterly.

The proposed ground water monitoring system for 264 final permit included the 11 wells currently in place for interim status (see Section II E) plus the addition of existing well C2B (constructed in 1982). The addition of C2B to the monitoring system for 264 permitting purposes was proposed by the facility in order to provide a deep bedrock well at the southeast end of the C barrier dam. The facility also proposed to abandon and replace wells C1B and C6B for permitting. These two wells (constructed in 1982) have yielded samples containing high levels of Tetrahydrofuran (THF) (200 ppb) reportedly resulting from the PVC glue used for well casing construction. The proposed reconstruction of wells C1B and C6B was to be of similar design to the wells constructed in 1984 (A1B, A2B, B3B, and D1B). Detail of their construction is given in Section II E.

The ground water monitoring parameters proposed by Casmalia Resources for the permit included the four 265.92 indicator parameters (pH, SpC, TOC, TOX) plus a host of metals and inorganics, the complete proposed list is in Table 5. No organic constituents were proposed.

Potentiometric surface determinations were made from monitoring wells, springs and ground water seeps, water supply wells, and nine exploratory borings/wells. Water level measurements were taken from the wells during the summer and fall of 1984. The potentiometric surface map provided in the Part B application was generated from these measurements. No details are provided on the construction and installation of the nine boring/wells or the rationale for their location. Potentiometric surface water measurements from the wells are considered by the facility to be reflecting levels from the same hydrologic unit. However, the bedrock and the unconsolidated monitoring wells are completed in different geologic units, and may be effected differently by local gradients. Also, some wells have excessively long screen intervals that

Table 5

Proposed 264 Ground Water Monitoring Parameters
Casmalia Resources, January 1985

- pH
- specific conductance
- total organic carbon (TOC)
- total halogenated organics (TOX)
- sodium
- magnesium
- chloride
- cyanide
- fluoride
- arsenic
- barium
- cadmium
- chromium
- copper
- lead
- mercury
- nickel
- silver
- zinc

may transect several saturated zones. If the water level measurements were taken immediately after the purging, as during the sampling event, the measurements may be inaccurate.

4. Current Status

In March 1986 the second Notice of Deficiency (NOD) was issued to the facility to address the 1984/85 application. The NOD included comments and requests which resulted from the observations made during the Task Force investigation. State comments were also included in the NOD. The ground water portion of the NOD basically stated that a complete hydrogeologic investigation must be conducted at the facility before an appropriate ground water monitoring system can be selected for permitting. The monitoring system design must then be based on the site characterization.

It was also stated that the construction of the proposed monitoring wells, the proposed monitoring parameters, and the sampling procedures were inappropriate for 264 permitting purposes.

Due to the complex nature of the required submittals, the NOD required the facility to develop a proposed schedule for implementation of the requirements identified in the NOD. The facility submitted its proposed schedule on March 28, 1986. It is currently being reviewed and finalized by the State and EPA. The details of the proposed implementation schedule will not be discussed in this report due to the schedule's draft status. Meetings are being held with the facility, the State, and Federal agencies to finalize the schedule and discuss the technical details of the projects.

II. G. TASK FORCE DATA COLLECTION/RESULTS

1. Sample Collection Methods

In order to determine if any of the monitoring wells at Casmalia had detected any contamination, selected wells at and around the facility were sampled. Between October 21 and 30, 1985 our sampling contractor, Versar Inc., under the direction of Peter Rubenstein, sampled 15 facility monitoring wells, one water supply well, and a ground water spring. The list of sampling points sampled during the investigation, including dates of purging and sampling, is provided in Table 6.

The sampling points were selected, in a priority order, during a preliminary meeting of State and Task Force personnel. Selection was made based on well location, construction, screen interval, and previous water quality data in order to get the most indictive sampling points. Not all wells sampled were RCRA monitoring wells. Gallery wells were sampled to give an indication as to whether the dams were being effective in retaining ground water contaminants. This was done by comparing water quality above and below the dams. The water supply well was sampled to determine if contamination had reached the Casmalia Creek alluvial aquifer. The list of sampling points, in priority order is provided in Table 7. Not all sampling points were sampled due to field and time constraints.

The list of chemical parameters selected for analyses at Casmalia was based on the modified Hazardous Substances List (HSL) of organic and inorganic constituents specified under the Agency's Contract Laboratory Program (CLP) contract. The HSL essentially includes priority pollutants, a number of RCRA indicator parameters, radionuclides and additional inorganic compounds. For this sampling event, it was deemed appropriate to monitor for other chemical compounds suspected to be contaminants in the ground water at the site. As a result, the list for the Casmalia investigation was expanded to include seven (7) additional volatile organics, six (6) additional semivolatile organics, three (3) additional pesticides, and three (3) additional miscellaneous inorganic compounds. The purpose of this revised monitoring list was to provide a broader spectrum of analyses to detect and identify the most prevalent type of chemical contaminants which could be expected in the site's ground water matrix if there were a release from the facility. A complete list of the specific chemical constituents analyzed is provided in Appendix A.

Table 6: Purge/Sample Sequence for Sampling by EPA at Casmalia Resources (10/22-10/29)

	PURGE INFORMATION					SAMPLE INFORMATION	
Well #	Date (Hrs)	DTW[a]	Volume (gal)[b] episode	total	3CV[c] (1CV)	Date	Purge/Sample Time Lag
A1B[d]	10/23 (3.9)	164.96'	22	22	(48.5)	10/24	18.2 hrs
A2B[d]	10/28 (2.4)	13.26'	227	227	210	10/28	0.4 hrs
A2M[d]	10/25 (2.7)	7.18'	30-dry	30	48	10/25	2.8 hrs
B3B[d]	10/22 (0.6)	55.09'	7				22.2 hrs
	10/23 (0.1)	57.71'	1	8	(13.4)	10/23	4.8 hrs
B3M[d]	10/23 (1.8)	5.91'	58	58	41.2	10/23	1.0 hr
B5						10/23	
B6B	10/28 (4.4)	3.12'	206	206	206	10/28	0.7 hr
C1B[d]	10/24 (2.7)	68.06'	23-dry	23	(30)	10/25	17.4 hrs
C2M[d]	10/28 (2.1)	33.71'	41				
	10/29 (6.5)	35.81'	73	114	107	10/29	1.6 hrs
C4M[d]	10/23 (1.0)	50.97'	56				
	10/24 (4.2)	52.73'	112	168	168	10/24	2.6 hrs
C5						10/24	
C6B[d]	10/29 (3.7)	81.15'	35-dry	35	(40)	10/29	1.8 hrs
CpH	10/24 (4.4)	22.88'	18.0	18.0	(12.5)	10/24	3 hrs
D1B[d]	10/22 (1.4)	20.53'	117	117	244	10/23	16.25 hrs
D1M[d]	10/22 (2.9)	17.79'	137	137	129	10/22	0.3 hr
WS4	10/25 (0.7)	7.65'	370				
	(0.2)		125	495	371	10/25	0.1 hr
SEEP	10/25					10/25	1.0 hr

a Measured by EPA on 10/21 prior to purge.
b Measured by EPA w/ a 55-gal drum.
c Casing Volume (CV) calculations based on pre-purge DTW measurements
d Designated by Casmalia Resources as a RCRA Monitoring Well

Table 7: Sample Location Priorities

Sampling Point	Casing Dia (in)	Dedicated Pumping Equipment	Comments on Purging	Analytical Parameters
1) Gallery Wells				
C5	8	submersible	Sample from tap in outflow.	All Org, Inorg, & Rad. RWQCB dups.
B5	8	submersible	Sample from tap in outflow.	All Org, Inorg, & Rad
C5W	6	none	Use portable submersible pump to purge.	All Org & Inorg.
2) Monitoring Wells				
B3M*	4	none	Use portable submersible pump to purge.	All Org & Inorg.
B6B	6	none	Use portable submersible pump to purge.	All Org & Inorg.
B3B*	6	jet	3 weeks to recover**	All Org & Inorg.
C1B*	6	jet	6 weeks to recover** C.R. purges 1 casing	All Org & Inorg.
C2M*	6	jet	12 hours to recover** C.R. purges 3 casing	All Org & Inorg.
C4M*	6	jet	24 hours to recover** C.R. purges 3 casing	All Org & Inorg.
C6B*	6	jet	6 weeks to recover**	All Org & Inorg. RWQCB dups.
CpH	2	none	48 hours to recover**	All Org & Inorg.
A1B*	6	jet	1 week to recover** C.R. purges 1 casing	All Org & Inorg.
A2M*	6	jet	1 hour to purge 3 casing volumes.	All Org, Inorg, & Rad.
A2B*	6	jet	1 hour to purge 3 casing volumes.	All Org & Inorg. RWQCB dups.
D1M*	6	jet	1 hour to purge 3 casing volumes.	All Org & Inorg.
D1B*	6	jet	1 hour to purge 3 casing volumes.	All Org, Inorg, & Rad.
3) Seeps				
≤ 6				All Org & Inorg.
4) Off-site Water Supply Wells				
≤ 3				All Org & Inorg
4) Other Monitoring Wells (Least likely to be sampled)				
C2B	6	none	Use portable submersible pump to purge.	All Org & Inorg.
C3M	4	none	Use portable submersible pump to purge.	All Org & Inorg.
C5E	6	none		All Org & Inorg.
B4M	4	none	Use portable submersible pump to purge.	All Org & Inorg.
A1M	6	jet	6 to 8 weeks to recover.	All Org & Inorg.

* RCRA Monitoring Well
** 1 Casing Volume

The organic samples were analyzed by California Analytical Laboratories in Sacramento, California. The inorganic samples were analyzed by Rocky Mountain Analytical Laboratory in Arvada, Colorado. Both labs are part of the EPA Contract Laboratory Program.

As arranged by prior agreement, five (5) ground water samples collected for radionuclides and seven (7) for organo-sulfide analyses were submitted to the California Department of Health Services - Hazardous Materials Laboratory in Berkeley. However, at the time of this report, no analytical data for these constituents had yet been received by Region 9.

All the wells were measured prior to purging for depth to the water table. A table of potentiometric surface elevations for the 11 RCRA monitoring wells measured during the Task Force sampling is presented in Appendix B. The wells were purged using the dedicated jet pump present in most wells (see Figure 10). The jet pump is operated using a portable air compressor. Operation of the compressor and hookup to the jet pump was conducted by a Casmalia site employee, Abel Valli. Purge water was discharged into 55-gallon drums for measurement and later disposal into the facility's surface impoundments. Wells which could not be purged with the jet pump (either because pumps were not in place or because the pumps were not functioning properly) were purged by hand with 2-inch teflon bailers. The Task Force team attempted to purge three casing volumes of water from each well, if possible. Casing volumes were calculated using the casing size and the length of the water column. Volumes were measured in the 55-gallon drums provided by the facility. Slow recovery wells were purged of at least one casing volume, if possible. Actual purge volumes are presented in Table 6.

Wells were sampled as soon after purging as possible. A lag time of less than three hours was attempted at all wells. However, with wells that were slow to purge and recover, it was sometimes necessary to wait overnight in order to assure enough water in the well column for sampling of a complete host of parameters.

Sample parameters were collected in priority order, starting with volatile organics, in case an insufficient volume of water remained in some of the slow-recovery wells. The list of sample aliquots and their containers is given in priority order of collection in Table 8. Teflon bailers with double check valves that are bottom filling and emptying were used. Bailers were decontaminated in the lab and shipped, sealed, to the site. The bailers were lowered using Teflon coated wire to minimize introduction of any outside chemical interference.

Table 8: Sample Aliquots and Containers

Parameters	# / Type of Sample Container	Preservation	Comments
Volatile Organics	4 / 40 ml glass vials teflon septa	Cool, 4°	No Head Space
Total Organic Carbon (TOC) Purgeable Organic Carbon (POC)	2 / 40 ml glass vials teflon septa 1 / 40 ml glass vial teflon septa	H_2SO_4 to pH<2 Cool, 4°	
Acid Extractables Base/Neutral Extractables Pesticides/PCBs	4 / 1 liter amber glass bottles	Cool, 4°	
Metals (Total & Dissolved)	2 / 1 liter Polyethylene bottles	HNO_3 to pH<2 Cool, 4°	Dissolved sample to be filtered in field
Cyanide	1 / 1 liter Polyethylene bottle	NaOH to pH>12 Cool, 4°	
Total Organic Halogens (TOX) Purgeable Organic Halogens (POX)	1 / 1 liter amber glass bottle	Cool, 4°	No Head Space
Organo Sulfides*	1 / 1 liter amber glass bottle	Cool, 4°	
Chlorides Sulfates Fluorides Alkalinity	1 / 1 liter Polyethylene bottle	Cool, 4°	
Nitrates and Ammonia	1 / 1 liter Polyethylene bottle	H_2SO_4 to pH<2 Cool, 4°	Nitrates must be analyzed w/in 48 hours
Phenolics	1 / 1 liter amber glass	H_2SO_4 to pH<2 Cool, 4°	
Gross Alpha* Gross Beta* Uranium* Radium* Radium 226*	1 / 1 gallon Cubetainer	HNO_3 to pH<2	

* To be Analyzed by California DOHS Laboratories in Berkeley.

The facility did not request or take any split samples. EPA's activity at the wells was observed and technical assistance was provided by Mr. Abel Valli, an employee of Casmalia Resources. Mr. Valli provided operation of purging equipment, answered operational questions, and provided the sampling team with any equipment or access needed from the facility.

Samples were preserved and prepared for shipment immediately upon collection. They were then shipped the same day or the day following collection by next-day delivery Federal Express to the respective labs. Complete details of sample collection, preservation, and shipment are given in the Sampling Plan and Sampling and Documentation Report. The reader is referred to the documents for further elaboration of procedures used in the field.

As mentioned, a ground water spring and a water supply well were also sampled during the investigation. A goal of the investigation was to sample as many ground water springs emanating from and around the facility as possible. There has been much concern expressed by local community members regarding springs and seeps they see around the site. Since these springs also discharge directly to surface waters, it was our desire to sample as many as possible. Reconnaissance was conducted of the entire perimeter area and all stream channels around the facility, only one spring was found to be discharging enough water to sample. This spring was located in the B-canyon on the southern border of the facility just above the site boundary fence (see Figure 6). The spring did not appear to be emanating from any units on-site.

A facility water supply well was also selected for sampling. The selected well, WS4, is located south and west of the C-barrier dam in the alluvial aquifer of Casmalia Creek. This well was selected due to its high rate of discharge, the fact that it is the furthest downgradient of any well in Casmalia Canyon, and downgradient of the C-barrier dam. The water supply wells at the facility (WS 1 to 4) supply only general utility water to the facility; rinse water, process water, and water for sinks and toilets. The water produced from the Casmalia Creek aquifer exceeds Santa Barbara County TDS standards for human consumption. Due to gypsum and other salt deposits in the area, the ground water is unpotable.

A day-by-day breakdown of samples collected, blanks, and duplicates is give in Table 9.

Table 9. Samples collected each day at Casmalia Resources, sorted by agency and parameter and identifying the sample # and the number of sample containers per parameter.

Date	Well	Agency	Sample #	Ext Org	VOAs (P&T)	VOAs (DI)	Metals (Tot)	Metals (Diss)	CN	Phenols	NO3/ NH4	Anions	TOX	TOC	POX	POC	Org Sul	RAD
10/22	D1M	EPA	00256/MQ0256	4	2	2	1	1	1	1	1	1	1	1	1	1		
	FB@D1M	EPA	00257/MQ0257	4	1	2	1	1	1	1	1	1	1	1	1	1		
	PE	EPA	00306/MQ0306	4	2	1	1	1	1	1	1	1	1	1	1	1		
	TBw/PE	EPA	00272	2	2	2												
10/23	D1B	EPA	00258/MQ0258	4	2	2	1	1	1	1	1	1	1	1	1	1		
		DHS		1	2		1										1	4
	B5	EPA	00259/MQ0259	4	2	2	1	1	1	1	1	1	1	1	1	1		
		EPA dup	00260/MQ0260	4	2	2	1	1	1	1	1	1	1	1	1	1		
		EPA trp	00261/MQ0261	4	2	2	1	1	1	1	1	1	0	1	1	1		
		DHS		1	2		1										1	4
		DHS dup															1	4
		RWQCB		1	2		1											
	B3B	EPA	00262/MQ0262	3	2	2	1	1	1	1	1	1	1	1	1	1		
		DHS		1	2		1										1	
	B3M	EPA	00264/MQ0264	4	2	2	1	1	1	1	1	1	1	1	1	1		
	FB@B3B	EPA	00263/MQ0263	4	2	2	1	1	1	1	1	1	1	1	1	1		
10/24	C5	EPA	00265/MQ0265	4	2	2	1	1	1	1	1	1	1	1	1	1		
		EPA dup	00266/MQ0266	4	2	2	1	1	1	1	1	1	1	1	1	1		
		DHS		1	2		1										1	4
		RWQCB		1	2		1											
	A1B	EPA	00267/MQ0267	4	2	2	1	1	1	1	1	1	1	1	1	1		
		DHS		1	2		1											
	C4M	EPA	00279/MQ0279	4	2	2	1	1	1	1	1	1	1	1	1	1		
		DHS		1	2		1											
	CpM	EPA	00280/MQ0280	4	2	2	1	1	1	1	1	1	1	1	1	1		
	FB@A1B	EPA	00268/MQ0268	4	2	2	1	1	1	1	1	1	1	1	1	1		
10/25	C1B	EPA	00281/MQ0281	4	2	2	1	1	1	1	1	1	1	1	1	1		
	WS4	EPA	00282/MQ0282	4	2	2	1	1	1	1	1	1	1	1	1	1		
		EPA dup	00283/MQ0283	4	2	2	1	1	1	1	1	1	1	1	1	1		
	A2M	EPA	00286/MQ0286	4	2	2	1	1	1	1	1	1	1	1	1	1		
		DHS		1	2		1										1	4
	"B" Seep	EPA	00285/MQ0285	4	2	2	1	1	1	1	1	1	1	1	1	1		
	FB@WS4	EPA	00284/MQ0284	4	2	2	1	1	1	1	1	1	1	1	1	1		
10/28	A2B	EPA	00287/MQ0287	4	2	2	1	1	1	1	1	1	1	1	1	1		
		EPA dup	00288/MQ0288	4	2	2	1	1	1	1	1	1	1	1	1	1		
		RWQCB		1	2		1						1					
	B6B	EPA	00291/MQ0291	4	2	2	1	1	1	1	1	1	0	1	1	1		
		DHS		1	2		1											
	FB@B6B	EPA	00290/MQ0290	4	2	2	1	1	1	1	1	1	0	1	1	1		
	EquipR	EPA	00289/MQ0289	2	2	2	1								1	1		
	TB	EPA	00305/MQ0305	4	2	2	1	1	1	1	1	1	0	1	1	1		
10/29	C5	EPA	00273/MQ0273		2		1											
	C6B	EPA	00293/MQ0293	4	2	2	1	1	1	1	1	1	0	1	1	1		
		RWQCB			2		1											
	C2M	EPA	00294/MQ0294	4	2	2	1	1	1	1	1	1	0	1	1	1		
		EPA dup	00295/MQ0295	4	2	2	1	1	1	1	1	1	0	1	1	1		
		DHS		1	2		1										1	
	FB@C6B	EPA	00292/MQ0292	4	2	2	1	1	1	1	1	1	0	1	1	1		
	Cooler8	EPA	00296/MQ0296		2	2									1	1		

2. Limitations of Data

In order to validate the Task Force data, a thorough quality assurance/quality control review of the data was conducted. Upon completion of analyses, the complete data packages were simultaneously forwarded by the laboratories to EPA's Sample Management Office (SMO), EPA-EMSL-Las Vegas, and to the Ground Water Task Force's QA contractor (Life Systems, Inc.) for completeness review, validation, and evaluation. Final evaluation reports were then prepared and transmitted to Region 9 and to the Agency's Ground Water Task Force. Subsequently, the Task Force prepared a summary which highlighted the findings from these reports, and forwarded this product to the Region for final disposition. Each of these reports are included in the Summary of the Ground Water Sample Analysis Data report prepared by Kevin Wong, Region 9 chemist in charge of RCRA data review. The reader is referred to this report for complete details of data results and validation.

Review of procedures used in the laboratories resulted in several findings regarding the validity of the data provided the Task Force. Several analytical problems resulted in detection limits too high for the level of accuracy needed for a complete ground water evaluation. The laboratory deviated from specified methods for analysis of semi-volatile organics thus causing detection limits to be raised by 2 to 8 times acceptable levels. While the detection limits were high, no values were detected above these limits. A table of the contracted and actual detection limits achieved for each sample is given in Appendix C.

Lack of adherence to laboratory extraction/concentration procedures and poor chromatography had rendered the pesticide and PCB data unusable with the recommendation that no conclusions be drawn as to whether pesticides are present in any sample. Inappropriate procedures have also rendered the herbicide data inconclusive with a possibility of false negatives.

Results from samples taken for analysis of radionuclides and seven organosulfides have not been received in time by the Task Force from the California Department of Health Services - Hazardous Materials Laboratory in Berkeley where they were sent per a State request. Consequently these results cannot be discussed in this report.

Several analytical problems were discovered for a few inorganic parameters analyzed, but they were not considered significant. Otherwise, all volatile organics, metals, and the other parameters analyzed are acceptable.

Tentatively identified compounds or estimated data that did not meet our minimum quality control requirements is not reported or discussed in this document per Agency policy. However, they can be the basis for further investigation either by the Agency or the facility.

Several factors from EPA sample collection procedures in the field could also have effected the data for certain wells. Large time lag between purging and sample collection, purging of less than two casing volumes, and construction of the bailer access tubes as discussed previously could have negatively biased the Task Force sampling results. Parameter levels could actually be higher than reported due to these field conditions. The Sampling and Documentation report should be consulted for details.

3. Results of Task Force Data

Tabulated results of the Task Force data are provided in Tables 10 and 11. Discussions of significant results and parameters follow.

The Task Force data on 17 sampling points confirmed the identification of a total of 3 different organic constituents in Casmalia wells. In one well, B3B, 1,2-dichloroethane (DCA) was detected at a level of 5 ppb. DCA was not found in any field or travel blanks so its source is not considered to be lab or field contamination.

The most ubiquitous organic found in the samples was tetrahydrofuran (THF), detected in eight facility wells; C4M, CpH, C1B, WS4, A2M, A2B, C6B, and C4M. The Task Force results confirmed the results submitted by the facility for THF levels detected during interim status sampling. The range in levels was from 2.5 to 780 ppb. The only significant differences in the Task Force data and the facility data were the high level of THF in well C6B and the detection of THF in wells A2B and CpH. The level of THF in well C6B determined from the Task Force data was 780 ppb in October 1985 as compared to 200 ppb reported by the facility in November 1985. A2B and CpH are wells reportedly constructed with threaded PVC casing, not glue, the suspected source of the contamination in other wells. The facility had also not previously reported THF in wells C4M and WS4. The concentrations of THF could not be confirmed by our data reviewers through the data validation process, as documentation for standards and spectra were not provided. Therefore, the data must be used with caution.

The only other quantifiable organic contaminant found in a facility well was bis-(2-ethylhexyl)phthalate. This was detected in well C-5 at a level of 16 ppb. Well C-5 is a gallery collection well located upgradient of the C-barrier dam to collect accumulated ground water.

Table 10. Summary of Organic Parameters Analyzed from October 1985 Ground Water Task Force Sampling at Casmalia Resources. (units = ug/l unless otherwise noted)

	TOX	POX	mg/l TOC	mg/l POC	Methylene Chloride	Acetone	2-Butanone	1,2-Dichloro-Ethane	Tetrahydro-Furan	Bis(2-Ethylhexyl) Phthalate
*D1M	NR		5.9		5.7	13				
D1Mfb			0.59				12			
*D1B	36		5.7	0.11		13	16			
D1Bre						11	15			
B5	257		22	0.17		14	14			
B5dup	225	16	20	0.23			13			
B5trp	323	35	NR	0.24			14			
*B3B	41	54	7.8			11		5		
B3Bfb			0.56			15	12			
*B3M	76		12	0.17		11	12			
C5	1420	9	18				16			
C5re										16
C5dup	2140	31	17				14			
C5					7.3	13	17			
bg*A1B	2140		11				16			
A1Bfb			0.53				12			
TB:PE					7.3	22	14			
*C4M	1260		6.4				14		25	
CpH	21		12						2.5	
*C1B	76		4.0			12	15		490	
WS4	24		6.9				11		35	
WS4dup	18		6.4			14	15		13	
WS4fb			0.56				14			
Bspring	12	23	29	0.11			16			
*A2M	34	7	4.6				12		27	
*A2B	44	6	5.9				14		9.0	
A2Bdup	408		5.4				14			
EB							12			
B6Bfb			0.4				12			
B6B	133		5.4				13			
C6Bfb	5		0.41			14	30			
*C6B	96		8.6	0.53		11	13		780	
*C2M	60		4.9	0.14			13		65	
C2Mdup	67		5.5				13		27	
CB							12			
TB			0.49		5.9	12	14			
PE						32/28	16/15			

fb: field blank, dup: duplicate, trp: triplicate, re: replicate, TB: travel blank, EB: equipment blank
CB: cooler blank, PE: performance evaluation sample, *: RCRA monitoring well, bg: background well, NR: not analyzed
Blank Space = Non-Detection

Table 11. Summary of Inorganic Parameters Analyzed from October 1985 Ground Water Task Force Sampling at Casmalia Resources. (units = mg/l unless otherwise noted) (T/D = Total/Dissolved)

	Aluminum T/D	Arsenic T/D	Cadmium T	Calcium	Chromium T	Copper T	Iron T	Lead T	Magnesium T	Manganese T	Nickel T	Potassium T
*D1M				139		.041	0.366	0.022	71.9	0.162		
D1Mfb												
*D1B	0.64/			106		.065	1.82	0.02	76.9	0.434		20.0
D1Bre	NR →											
B5				981			18.6		642	5.28		
B5dup				991			18.8		652	5.33		
B5trp				944			17.9		620	5.07		
*B3B	0.683/			199		0.373	1.23	0.102	110	0.216		30.2
B3Bfb								0.005				
*B3M				657					482	0.052		11.3
C5				673					551	3.52	0.309	27.9
C5re	NR →											
C5dup			0.029	763					622	4.00	0.363	31.2
C5	/NR		0.028	773		3.62			605	4.03	0.348	29.5
bg*A1B		0.021/		177		0.231	2.88	0.614	210	0.376		78.2
A1Bfb	/0.215											
TB:PE	NR →											
*C4M				262		.098	0.63	0.025	137	0.632		7.85
CpH	0.771/		0.453	124			1.43	0.126	69.7	0.364		28.2
*C1B				161		0.51	0.282					41.3
WS4				101			13.1		57.8	1.27		12.6
WS4dup				100			13.1		57.7	1.27		12.6
WS4tb												
Bspring	36.6/	.044/.028		784	.086		92.2		702	6.27		
*A2M				569			0.246		408			27.8
*A2B			0.017	469			2.20		654	0.498		45.8
A2Bdup			0.18	493			2.33		672	0.526		47.0
EB	/NR →											
B6Bfb			0.006									
B6B	0.636/			129			2.17	0.015	94.7	0.262		16.6
C6Bfb												
*C6B				235		.041						16.1
*C2M		0.031/	0.014	416				0.012	299	0.767	0.054	17.2
C2Mdup			0.008	391		.033	0.15	0.051	274	0.675	0.059	15.3
CB	NR →											
TB				6.79								

fb: field blank, dup: duplicate, trp: triplicate, re: replicate, TB: travel blank, EB: equipment blank
CB: cooler blank, PE: performance evaluation sample, *: RCRA monitoring well, bg: background well, NR: not analyzed
Blank Space = Non-Detection

Table 11. Continued

	Selenium D	Sodium T	Vanadium T	Zinc D	Nitrate	Total Alkalinity	Chloride	Fluoride	Sulfate	Total Phenolics	Ammonia	pH	SpC um/cm
*D1M		427			5.1	227	576	0.40	700			6-7	2600
D1Mfb				.023									
*D1B		637		.076	2.6	335	522	0.34	1080		10.	6-7	2700
D1Bre	NR →												
B5		2150			1.3	274	4860	0.31	2620	0.02	1.3	6-7	12800
B5dup		2180			1.4	363	4850	0.31	2610		1.3		
B5trp		2080			1.0	343	4870	0.31	2610		1.3		
*B3B		1010		.173	1.4	475	1240	0.21	780		0.8	6.8	5300
B3Bfb				.054							0.1		
*B3M		1590		.053	7.0	220	2950	0.26	6900			6.5	11100
C5		1660			8.5	314	3670	0.74	2880		0.4	6.3	13600
C5re	NR →												
C5dup		1880			9.5	309	3650	0.70	2900		0.4		
C5		1850											
bg*A1B		1280		.230	16.0	821	888	0.22	2610		45	7.1	7000
A1Bfb				.064									
TB:PE	NR →												
*C4M		671		.027	1.4	203	1140	0.52	730		0.3	6.5	4500
CpH	0.10	1050		.081	0.7	886	1120	0.34	395		22	7.6	5100
*C1B		832		.075	0.8	150	1360	0.19	506		18	10.4	4700
WS4		311			1.1	345	268	0.82	312	0.04	6.4	6.4	1800
WS4dup		310		.028	1.2	495	283	0.80	315	0.014	6.6		
WS4fb				.031					6				
Bspring		2550		.240	1.1	369	4800	1.00	2960		0.8	6.5	14400
*A2M		1180			22.0	162	1260	0.52	3370			7.5	8000
*A2B		1550			2.0	479	1450	0.52	3900		29	6.8	10600
A2Bdup		1600			1.8	489	1480	0.52	4000		31		
EB													
B6Bfb				.047									
B6B		766		.025	0.4	512	926	0.21	590		14	7.1	3400
C6Bfb							4.5						
*C6B		775	0.061		0.9	77	900	0.15	700		11	9.3	2900
*C2M		999			1.3	422	1160	0.72	2050		0.2	6.5	4800
C2Mdup		917		.080	1.3	414	1190	0.70	1090		0.1		
CB	NR →												
TB		7.42			1.0	30	4.2						

tb: field blank, dup: duplicate, trp: triplicate, re: replicate, TB: travel blank, EB: equipment blank
CB: cooler blank, PE: performance evaluation sample, *: RCRA monitoring well, bg: background well, NR: not analyzed
Blank Space = Non-Detection

Three additional organics were identified in the samples, 2-butanone, methylene chloride, and acetone. However, all were determined to be present in all or most of the field and laboratory blanks. Therefore these constituents are considered to be artifacts due to laboratory contamination and not present in the ground water.

Samples from three wells C5, A1B, and C4M indicated the presence of Total Organic Halides (TOX) at concentrations greater than 1000 ppb. Well A1B, the designated background well had the highest level of 2140 ppb as did a duplicate sample of well C5. The original C5 reading was 1420 ppb. Well C4M had a level of 1260 ppb. All other sampling points reported levels between 12 and 323 ppb. None of the high TOX values correlated to any sampling point where speciated organics were recorded.

Purgeable organic halides (POX) concentrations were detected at six sampling points B5, B3B, C5, B-spring, A2M, and A2B, ranging from 6 to 54 ppb. However, these results have not been verified by the detection of specific volatile organic compounds analyzed.

Values for pH ranged from 6.3 (B3M) to 10.4 (C1B) and specific conductivity values ranged from 2600 um/cm (D1M) to 14400 um/cm (B spring).

Several inorganic constituents of interest appeared in the analyses at some sampling points. Arsenic was detected in the background well A1B (21 ppb) and in the B-canyon ground water spring (B-spring)(44 ppb total and 28 ppb dissolved). None of the arsenic values exceeded federal drinking water standards. Cadmium was detected in wells C5, CpH, A2B and C2M in concentrations ranging from 14 ppb (C2M) to 453 ppb (CpH). All other values for cadmium and arsenic were below detection limits. The only chromium value reported above detection limits was 86 ppb found in the B canyon ground water spring. Maximum contamination levels for federal drinking water standards for cadmium is 10 ppb and for chromium is 50 ppb. Lead was detected in wells B3B, A1B, CpH, and C2M in concentrations ranging from 614 ppb (A1B) to 51 ppb (C2M). The maximum contamination level for lead is 50 ppb.

Total phenols were reported above detection limits in two ground water samples. Gallery well B5 had a level of 20 ppb and water supply well WS4 had a level of 40 ppb.

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Summary of the Ground Water Sample and Analysis Data, Casmalia Resources, Kevin Wong, USEPA Region 9, April 1986.

Notice of Deficency issued to Casmalia Resources March 7, 1986 by USEPA Region 9.

APPENDIX A

Analytical Parameters for Ground Water and Leachate Samples

Appendix A

Analytical Parameters for Groundwater and Leachate Samples

Volatiles

Chloromethane
Bromomethane
Vinyl chloride
Chloroethane
Methylene chloride
Acetone
Carbon disulfide
1,1-Dichloroethene
1,1-Dichloroethane
trans-1,2-Dichloroethene
Chloroform
1,2-Dichloroethane
2-Butanone
1,1,1-Trichloroethane
Carbon tetrachloride
Vinyl acetate
Bromodichloromethane
1,1,2,2-Tetrachloroethane
1,2-Dichloropropane
trans-1,3-Dichloropropene
Trichloroethene
Dibromochloromethane
1,1,2-Trichloroethane
Benzene
cis-1,3-Dichloropropene
2-Chloroethyl vinyl ether
Bromoform
2-Hexanone
4-Methyl-2-pentanone
Tetrachloroethene
Toluene
Chlorobenzene
Ethyl benzene
Styrene
Total xylenes
Acrolein
Acrylonitrile
1,2-Dibromo-3-chloropropane
1,2-Dichloroethene
1,4-Dioxane
Pyridine
1,2,4,5-Tetrachlorobenzene
1,2,3,4-Tetrachlorobenzene
Ethylene dibromide (EDB)

Semi-Volatiles

N-Nitrosodimethylamine
Phenol
Aniline
bis(2-Chloroethyl) ether
2-Chlorophenol
1,3-Dichlorobenzene
1,4-Dichlorobenzene
Benzyl alcohol
1,2-Dichlorobenzene
2-Methylphenol
bis(2-Chloroisopropyl) ether
4-Methylphenol
N-Nitrosodipropylamine
Hexachloroethane
Nitrobenzene
Isophorone
2-Nitrophenol
2,4-Dimethylphenol
Benzoic acid
bis(2-Chloroethoxy) methane
2,4-Dichlorophenol
1,2,4-Trichlorobenzene
Naphthalene
4-Chloroaniline
Hexachlorobutadiene
4-Chloro-3-methylphenol
(para-chloro-meta-cresol)
2-Methylnaphthalene
Hexachlorocyclopentadiene
2,4,6-Trichlorophenol
2,4,5-Trichlorophenol
2-Chloronaphthalene
2-Nitroaniline
Dimethyl phthalate
Acenaphthylene
3-Nitroaniline
Acenaphthene
2,4-Dinitrophenol
4-Nitrophenol
Dibenzofuran
2,4-Dinitrotoluene
2,6-Dinitrotoluene
Diethyl phthalate
4-Chlorophenyl phenyl ether
Fluorene
4-Nitroaniline
4,6-Dinitro-2-methylphenol
N-Nitrosodiphenylamine
4-Bromophenyl phenyl ether
Hexachlorobenzene
Pentachlorophenol
Phenanthrene
Anthracene
Di-n-butyl phthalate
Fluoranthene
Benzidine
Pyrene
Butyl benzyl phthalate
3,3'-Dichlorobenzidine
Benzo(a)anthracene
bis(2-ethylhexyl)phthalate
Chrysene
Di-n-octyl phthalate
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Benzo(a)pyrene
Indeno(1,2,3-cd)pyrene
Dibenz(a,h)anthracene
Benzo(g,h,i)perylene
Benz[a]anthracene
Benzyl chloride
2,4-Dichlorophenoxyacetic acid
2,4,5-Trichlorophenoxyacetic acid
Diphenylamine
1,2,4,5-Tetrachlorobenzene
1,2,3,4-Tetrachlorobenzene
Pentachloronitrobenzene (PCNB)
Tetrahydrofurans
Pentachlorobenzene
1,4-Dioxane

Pesticides

alpha-BHC
beta-BHC
delta-BHC
gamma-BHC (Lindane)
Heptachlor
Aldrin
Heptachlor epoxide
Endosulfan I
Dieldrin
4,4'-DDE
Endrin
Endosulfan II
4,4'-DDD
Endrin aldehyde
Endosulfan sulfate
4,4'-DDT
Endrin ketone
Methoxychlor
Chlordane
Toxaphene
AROCLOR-1016
AROCLOR-1221
AROCLOR-1232
AROCLOR-1242
AROCLOR-1248
AROCLOR-1254
AROCLOR-1260

Metals (Dissolved and Total)

Aluminum
Antimony
Arsenic
Barium
Beryllium
Boron
Cadmium
Calcium
Chromium
Cobalt
Copper
Iron
Lead
Magnesium
Manganese
Mercury
Molybdenum
Nickel
Potassium
Selenium
Silver
Sodium
Thallium
Tin
Vanadium
Zinc
Silica

Misc. (via the CLP)

Purgeable organic carbons (POC)
Total organic carbon (TOC)
Purgeable organic halogens (POX)
Total organic halogens (TOX)
Alkalinity
Ammonia
Chlorides
Fluorides
Sulfates
Nitrates
Phenolics
Cyanide

Misc. (via CA DOHS lab)

Organosulfides
Gross alpha
Gross beta
Uranium
Radium, total
Radium 226

APPENDIX B

Table of Water Level Measurements from
November 1985 Task Force Sampling

Appendix B

Table of Water Level Measurements from November 1985 Task Force Sampling

Well Number	Surveyed Elevations (feet) Top of Well Casing	November 1985 Task Force Measurements (feet)	
		Depth to Water	Elevation of Water (MSL)
A1B	808.01	164.96	643.05
A2M	419.14	7.18	411.96
A2B	452.84	13.26	439.58
B3M	385.97	5.91	380.06
B3B	384.56	55.09	329.47
C1B	439.06	68.06	371.00
C2M	448.56	33.71	414.85
C4M	456.16	50.97	405.19
C6B	453.91	81.15	372.76
D1M	478.45	17.79	460.66
D1B	478.86	20.53	458.33

APPENDIX C

Contractual and Actual Laboratory Limits of Quantification for Organic Compounds

APPENDIX C

CONTRACTUAL AND ACTUAL LABORATORY LIMITS OF QUANTITATION FOR ORGANIC COMPOUNDS

VOLATILES

	Contract Limit of Quantitation (ug/l)		Contract Limit of Quantitation (ug/l)
Chloromethane	10	1,1,2-Trichloroethane	5
Bromomethane	10	Benzene	5
Vinyl chloride	10	cis-1,3-Dichloropropene	5
Chloroethane	10	2-Chloroethyl vinyl ether	10
Methylene chloride	5	Bromoform	5
Acetone	100	2-Hexanone	10
Carbon disulfide	5	4-Methyl-2-pentanone	10
1,1-Dichloroethene	5	Tetrachloroethene	5
1,1-Dichloroethane	5	Toluene	5
trans-1,2-Dichloroethene	5	Chlorobenzene	5
Chloroform	5	Ethyl benzene	5
1,2-Dichloroethane	5	Styrene	5
2-Butanone	20	Total xylenes	5
1,1,1-Trichloroethane	5	Acrolein	500
Carbon tetrachloride	5	Acrylonitrile	500
Vinyl acetate	10	1,2-Dibromo-3-chloropropane	100
Bromodichloromethane	5	1,2-Dichloroethene	NA*
1,1,2,2-Tetrachloroethane	5	1,4-Dioxane	500
1,2-Dichloropropane	5	Pyridine	100
trans-1,3-Dichloropropene	5	Ethylene dibromide (EDB)	NA*
Trichloroethene	5		
Dibromochloromethane	5		

Multiplication Factors for Determining Actual Limits of Quantitation:

x1: all samples

* Not analyzed

Semi-Volatiles

	Contract Limit of Quantitation (ug/l)		Contract Limit of Quantitation (ug/l)
N-Nitrosodimethylamine	NA*	2,4-Dinitrotoluene	10
Phenol	10	2,6-Dinitrotoluene	10
Aniline	20	Diethyl phthalate	10
bis(2-Chloroethyl) ether	10	4-Chlorophenyl phenyl ether	10
2-Chlorophenol	10	Fluorene	10
1,3-Dichlorobenzene	10	4-Nitroaniline	50
1,4-Dichlorobenzene	10	4,6-Dinitro-2-methylphenol	50
Benzyl alcohol	10	N-Nitrosodiphenylamine	10
1,2-Dichlorobenzene	10	4-Bromophenyl phenyl ether	10
2-Methylphenol	10	Hexachlorobenzene	10
bis(2-Chloroisopropyl) ether	10	Pentachlorophenol	50
4-Methylphenol	10	Phenanthrene	10
N-Nitrosodipropylamine	10	Anthracene	10
Hexachloroethane	10	Di-n-butyl phthalate	10
Nitrobenzene	10	Fluoranthene	10
Isophorone	10	Benzidine	100
2-Nitrophenol	10	Pyrene	10
2,4-Dimethylphenol	10	Butyl benzyl phthalate	10
Benzoic acid	50	3,3'-Dichlorobenzidine	20
bis(2-Chloroethoxy) methane	10	Benzo(a)anthracene	10
2,4-Dichlorophenol	10	bis(2-ethylhexyl)phthalate	10
1,2,4-Trichlorobenzene	10	Chrysene	10
Naphthalene	10	Di-n-octyl phthalate	10
4-Chloroaniline	10	Benzo(b)fluoranthene	10
Hexachlorobutadiene	10	Benzo(k)fluoranthene	10
4-Chloro-3-methylphenol (para-chloro-meta-cresol)	10	Benzo(a)pyrene	10
		Indeno(1,2,3-cd)pyrene	10
2-Methylnaphthalene	10	Dibenz(a,h)anthracene	10
Hexachlorocyclopentadiene	10	Benzo(g,h,i)perylene	10
2,4,6-Trichlorophenol	10	Benzyl chloride	10
2,4,5-Trichlorophenol	50	2,4-Dichlorophenoxyacetic acid	0.25
2-Chloronaphthalene	10	2,4,5-Trichlorophenoxy-proprionic acid	0.05
2-Nitroaniline	50		
Dimethyl phthalate	10	2,4,5-Trichlorophenoxyacetic acid	0.05
Acenaphthylene	10	Diphenylamine	NA*
3-Nitroaniline	50	1,2,4,5-Tetrachlorobenzene	10
Acenaphthene	10	1,2,3,4-Tetrachlorobenzene	10
2,4-Dinitrophenol	50	Pentachloronitrobenzene (PCNB)	10
4-Nitrophenol	50	Pentachlorobenzene	10
Dibenzofuran	10	Tetrahydrofurans	10

Multiplication Factors for Determining Actual Limits of Quantitation:

x2: Samples Q0258 Q0260RE Q0265 Q0267 Q0282 Q0284 Q0292 Q0305
Q0259 Q0261 Q0265RE Q0268 Q0282RE Q0286 Q0293 Q0306
Q0259RE Q0263 Q0266 Q0279 Q0283 Q0288 Q0294
Q0260 Q0264 Q0266RE Q0281 Q0283RE Q0290 Q0295

x4: Samples Q0257 Q0261 Q0261RE Q0262 Q0272 Q0280 Q0285 Q0287 Q0289
x8: Sample Q0256

* Not Analyzed

Pesticides

	Contract Limit of Quantitation (ug/l)
alpha-BHC	0.05
beta-BHC	0.05
delta-BHC	0.05
gamma-BHC (Lindane)	0.05
Heptachlor	0.05
Aldrin	0.05
Heptachlor epoxide	0.05
Endosulfan I	0.05
Dieldrin	0.10
4,4'-DDE	0.10
Endrin	0.10
Endosulfan II	0.10
4,4'-DDD	0.10
Endrin aldehyde	0.10
Endosulfan sulfate	0.10
4,4'-DDT	0.10
Endrin ketone	0.10
Methoxychlor	0.50
Chlordane	0.50
Toxaphene	1.00
AROCLOR-1016	0.50
AROCLOR-1221	0.50
AROCLOR-1232	0.50
AROCLOR-1242	0.50
AROCLOR-1248	0.50
AROCLOR-1254	1.00
AROCLOR-1260	1.00

Multiplication Factors for Determining Actual Limits of Quantitation:

x2.5: Samples	Q0258	Q0265	Q0282	Q0290	Q0305
	Q0259	Q0266	Q0283	Q0291	Q0306
	Q0260	Q0267	Q0284	Q0292	
	Q0261	Q0268	Q0285	Q0293	
	Q0263	Q0279	Q0286	Q0294	
	Q0264	Q0280	Q0287	Q0295	

x5: Samples Q0257
Q0262
Q0272
Q0281
Q0288
Q0289

x10: Sample Q0288RI