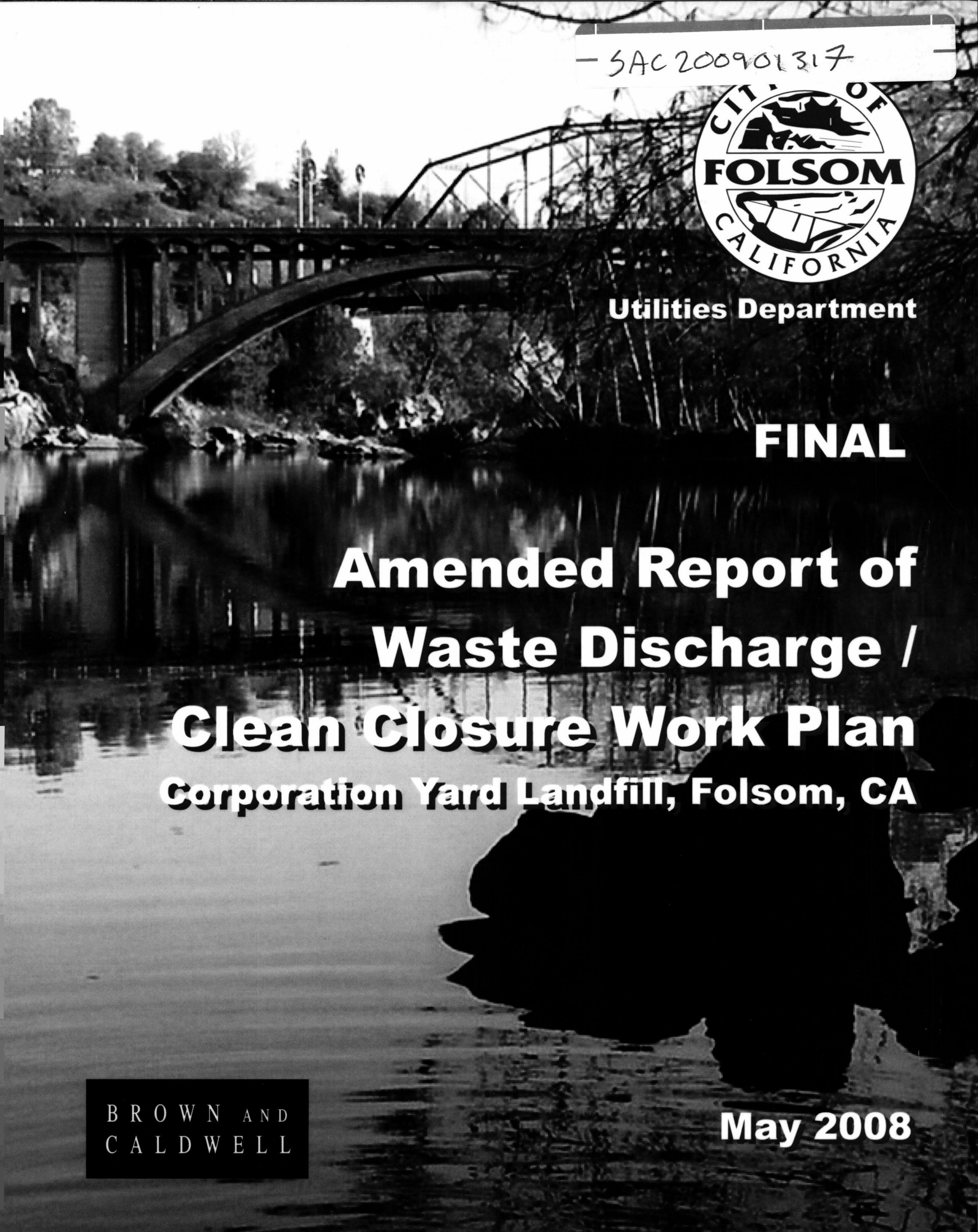

City of Folsom California

Utilities Department

FINAL

Amended Report of Waste Discharge / Clean Closure Work Plan

Corporation Yard Landfill, Folsom, CA

BROWN AND CALDWELL

May 2008

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May 8, 2008

BROWN AND CALDWELL

Ms. Patrice Webb
Environmental Management Department
County of Sacramento
8475 Jackson Road, Suite 240
Sacramento, CA 95826

1017-08-134473

Subject: Final Amended Report of Waste Discharge / Clean Closure Work Plan Corporation Yard Landfill, Folsom, California

Dear Ms. Webb:

The attached *Final Amended Report of Waste Discharge (AROWD)/Clean Closure Work Plan* has been prepared for the clean closure project at the Corporation Yard Landfill located at 1300 Leidesdorff Street in Folsom, California. The objective of the project is to obtain clean closure certification from regulatory agencies and prepare the site for unrestricted reuse. Regulatory agency comments on the draft final document dated February 13, 2008 were incorporated in the final document. The response to comment table is attached.

This document provides a combined AROWD and Clean Closure Work Plan. The first portion of this document provides the AROWD. According to the State Water Resources Control Board (SWRCB) in Title 27 of the California Code of Regulations (27 CCR) §21585, §21710, §21750, and §21760, the contents of the AROWD must include:

- Topography (Section 2.1);
- Climatology (Section 2.2);
- Geology (Section 2.3 and Appendix C);
- Hydrogeology (Section 2.4 and Appendix C); and
- Land and Water Use (Section 2.5).

The SWRCB Joint Technical Document (JTD) index is provided in Appendix B that indicates where specific AROWD information can be found in this document. This document proposes that Waste Discharge Requirements (WDRs) Order No. 95-246 prepared in 1995 by the California Regional Water Quality Control Board, Central Valley Region (RWQCB) and Revised Monitoring and Reporting Program (MRP) Order No. 95-246 prepared in 2001 by the RWQCB be revised to allow clean closure activities to proceed. A *Form 200 Application/ROWD General Information Form for WDRs or NPDES Permit* required by the RWQCB is attached.

The following specific activities are proposed.

- Conduct the semi-annual monitoring event in June 2008 per the existing MRP. Activities will consist of monitoring methane in landfill gas wells, measuring groundwater elevation, sampling and analysis of groundwater wells FCY-2 through FCY-9, and reporting/data evaluation.
- Following the June 2008 event and prior to beginning construction, abandon landfill gas monitoring wells GAS-1 through GAS-6 which will no longer be needed. In addition, abandon groundwater monitoring well FCY-9 which is in the excavation footprint. If required by the RWQCB for post-closure monitoring, FCY-9 will be replaced following the completion of clean closure activities.
- Protect groundwater monitoring wells FCY-2 through FCY-8 during construction.
- Remove the landfill cap and excavate waste per the excavation plan.
- Implement a Construction Storm Water Pollution Prevention Plan (SWPPP).
- Following final grading, conduct post-closure monitoring similar to the existing MRP.
- Upon evaluation of the post-closure monitoring results, the RWQCB would then rescind the WDRs.

The second portion of this document provides the Clean Closure Work Plan. According to the California Integrated Waste Management Board (CIWMB) in the LEA Clean Closure Advisory provided in Appendix B, the contents of the Clean Closure Work Plan must include:

- Site characterization (Section 2.0 and Appendix A);
- Excavation and material management (Section 3.0);
- Confirmation of waste and degraded material removal (Section 4.0); and
- Post-closure maintenance and land use (Section 5.0).

Cleanup goals were proposed by letter dated April 7, 2008 (attached) for regulatory agency approval. The cleanup goals were developed in part from statistical analysis of the background soil sampling results from the pre-design field investigation conducted in February 2008. Based on comments by the RWQCB, the cleanup goals for soluble nitrate and sulfate were revised in a letter dated May 8, 2008 (attached). This letter also proposes groundwater Concentration Limits (CLs) required by the RWQCB for the revised WDRs.

As indicated in the proposed project schedule provided in Appendix G, the City of Folsom would like to begin construction activities in August 2008. The construction period is anticipated to last 3 months and every effort will be made to complete excavation and final grading during the dry season. To meet this construction schedule, the City would appreciate written approval from regulatory agencies within 30 days of receipt of this letter for the following items:

- Approval of the *Final AROWD/Clean Closure Work Plan*;
- Approval of soil/solid media cleanup goals; and
- Approval to proceed with clean closure construction.

Please call me at (916) 853-5385 if you have any questions regarding the project.

Sincerely,

BROWN AND CALDWELL

Guy J. Graening

Guy J. Graening, P.E.
Project Manager

GJG:ds

cc: Mr. Frank Davies, Jr., CIWMB
Mr. John Moody, Central Valley RWQCB
Mr. Joseph Hurley, SMAQMD
Ms. Maria Gillette, DTSC
Ms. Laura Caballero and Ms. Kathryn Schroeder, U.S. Bureau of Reclamation
Mr. Jim Micheaels CA Department of Parks and Recreation
Mr. Walt Sadler, City of Folsom

Attachments

1) Final AROWD/Clean Closure Work Plan
2) Response to Comments Table
3) RWQCB Form 200
4) Letter dated April 7, 2008 re: soil/solid cleanup goals
5) Letter dated May 8, 2008 re: revised cleanup goals and CLs

Response to Comments
Draft Final Amended Report of Waste Discharge / Clean Closure Plan
Corporation Yard Landfill, Folsom, CA

Comment	Response
County of Sacramento (LEA) comments by letter dated March 25, 2008.	
3.4.4 Abandonment of Landfill Gas/Groundwater Monitoring Wells - The plan states that landfill gas wells and at least one groundwater monitoring well will be removed during the clean closure of the landfill. The plan states that the monitoring wells will be abandoned in accordance with methods approved by the County of Sacramento. The LEA comments that well destruction permits will be required for the removal of these wells and has attached a copy of the current Sacramento County Well Ordinance as well as a copy of Sacramento County's Well Permit Application.	The City of Folsom received the ordinance and appplication and, as stated in Section 3.4.4 Abandonment of Landfill Gas/Groundwater Monitoring Wells, will obtain well destruction permits from the County of Sacramento as requested.
3.5.4 Landfill Gas Monitoring - The plan states that landfill gas monitoring will be conducted in accordance with the Air Monitoring Plan provided in Appendix E of the Clean Closure Plan. The LEA comments that the City of Folsom shall notify the LEA if at any time landfill gas concentrations are noted at the Lower Explosive Level of 5% by volume.	The following text was added to Section 3.5.4 of the main report and Section 4.1 of Appendix E Air Monitoring Plan: "The City of Folsom shall notify the LEA if at any time landfill gas concentrations are noted at the Lower Explosive Level of 5% by volume."
3.1 Health and Safety - The plan states that a Health and Safety Plan will be developed during the construction. State Law requires that a health and safety plan designed to protect the public health and safety be developed and provided to the LEA and CIWMB. Provide the LEA and the CIWMB with copies of this plan prior to commencing construction.	An electronic copy of the *Health and Safety Plan, Corporation Yard Landfill Clean Closure Activities* prepared by Brown and Caldwell in February 2008 was provided to the LEA, CIWMB, and RWQCB via e-mail on April 3, 2008.
3.2 Community Relations - The plan describes how public nuisances such as fugitive dust and noise will be controlled and measured but does not state how complaints from the public are to be handled. Please provide the LEA with a protocol as to how complaints from the public will be addressed.	The following text was added to Appendix D Community Relations Plan: "Any complaints during construction will be received by Jennifer Tencati, MMC Communications, at (916) 567-6309 or jennifer@mmcpr.com. The complaint will be forwarded to the City of Folsom to formulate a response. The comment and response will be provided to the individual filing the complaint and the LEA within two business days of receiving the complaint. If appropriate, construction practices will be modified to resolve the complaint."
3.6.1 Waste Segregation - The plan states that potentially impacted soil will be segregated and disposed of at an offsite landfill. The plan further states that this soil may be used as alternative daily cover. The LEA comments that if at any time soil sampling indicates that this material contains hazardous materials then this soil must be taken to a disposal site permitted to accept such materials.	A new Section 3.6.3 Waste Characterization Plan and Figure 3-2. Waste Characterization Process were added to the report that describes how soil will be stockpiled, segregated, sampled, analyzed, and manifested for proper disposal. Documentation of proper disposal will be provided in the results report at the end of the clean closure project.
Regionaly Water Quality Control Board, Central Valley Region comments by e-mail/phone - various dates	

Response to Comments
Draft Final Amended Report of Waste Discharge / Clean Closure Plan
Corporation Yard Landfill, Folsom, CA

Comment	Response
I noticed for example the trench results show household waste even though the landfill is said to have accepted primarily street sweeping wastes and C&D. Let's revisit such assumptions so we can describe things accurately. Where did the HHW come from? I've tentatively added household waste to the findings.	The Main Landfill Area (i.e., covered by the permitted cap) contains mostly soil with some C&D waste, green waste, and street litter (a general term that includes minor amounts of household waste that may have been swept up). In the Uncontrolled Fill Area south of the Main Landfill Area, we consistently find household waste but do not know exactly how it got there (hence the term, "uncontrolled"). We have anecdotal information that the public would dump there, but the access required 4-wheel drive. This waste is part of the project and will be removed.
It would be helpful if the RWD lists/summarizes all major components of the corporation yard and labels them on the site map. That way the LF can be put in the context of the site. Keep it simple.	Please refer to the Initial Study, Figure 9-2 Current Hazardous Materials Usage for a labeled figure of the Corporation Yard functions. Note that municipal solid waste is not processed at the Corporation Yard.
The landfill stopped taking wastes in 1988. Where's the transfer station and where has the waste gone since then?	The City has used and continues to use Kiefer for municipal solid waste. There was never a transfer station at the Corporation Yard for municipal solid waste. There used to be a transfer station at the Prison Authority where inmates would sort out recyclables, but this has since been closed. Circa 1986, the Corporation Yard stopped accepting waste associated with road maintenance/construction, tree clippings, and street cleaning - all non-municipal type, household waste.
I'm going to call DWR and get the rainfall statistics from the nearest weather station.	Please refer to Section 2.2.1 Precipitation and Evapotranspiration for statistics from the Fair Oaks CIMIS station and the Folsom Dam USBR station.
[Mr. Moody requested clearer versions of the topographic and floodplain maps that make it easier to interpret contours and flood zones.]	Clearer versions of Figure 2-1. Topographic Map and Figure 2-2. Floodplain Map are included in the final report.
[Mr. Moody requested a Department of Water Resources well survey.]	Upon written request and authorization by Mr. Moody, DWR provided the results of a survey of wells within 1 mile of the site. Brown and Caldwell conducted two reconaissance trips in February 2008 to verify the presence of specific wells. The results of the survey were incorporated into Section 2.5.3 Groundwater Use and a new Figure 2-8 DWR Well Search Results Map was added to the report.

Response to Comments
Draft Final Amended Report of Waste Discharge / Clean Closure Plan
Corporation Yard Landfill, Folsom, CA

Comment	Response
[Mr. Moody requested detailed cross sections of the landfill.]	New Figure Longitudinal Cross Section 2-9 and Figure 2-10 Latitudinal Cross Sections of the Landfill were added to the report.
Regionaly Water Quality Control Board, Central Valley Region comments by letter dated April 18, 2008.	
1. The soil cleanup goals proposed for the project, which include an assumption that residual wastes could be allowed to degrade groundwater quality up to the maximum contaminant level (MCL), rais anti-degradation concerns. Under the State's anti-degradation policy (*State Water Resources Control Board Resolution No. 68-16, Statement of Policy With Respect to Maintaining High Quality of Waters in California*, copy enclosed), background water quality cannot be degraded unless it is demonstrated that such degradation meets the criteria of the policy (e.g., best available cleanup technology, infeasibility of further cleanup, benefit to people of state, will not unreasonably affect beneficial uses). No such demonstration is included in the report. Soil cleanup goals for the project should also be based on the designated level methodology, which, in addition to other factors, incorporates the water quality goal (i.e., concentration limit or water quality limit, whichever is lower).	Revised soil cleanup goals that are based on the designated level methodology which incorporates groundwater concentrations limits are provided in a separate letter (see response to Comment #3).
2. The discussion of the site conceptual model and perched groundwater flow (Sections 2.4.2 and 2.4.6) should incorporate, and be consistent with the topographic map of the Mehrten formation (faxed in after submission of the report). The report states that shallow groundwater flows to the north and south from a ridge on the Mehrten near FCY-6, while from the map it appears that shallow groundwater flows radially away from a mounded area of the Mehrten on the eastern side of the site.	A new Figure C-5. Top of Mehrten Isocontour Map was added to Appendix C. Conceptual Site Model. The text in Section 2.4.2 and in Appendix C was modified to describe shallow groundwater flowing radially away from the mounded area of the Mehrten formation on the eastern site of the site.
3. The report did not include groundwater concentration limits (CLs). The CLs provided in the report for calculation of soil cleanup goals do not apply to groundwater, since they are based on soluble analysis of background soil rather than direct groundwater monitoring. Absent a demonstration of concentration limits greater than background (CLGB) per Title 27 Section 20400(c), groundwater CLs need to be provided based on the results of background groundwater monitoring per 20415(e)(10)(A). With regard to CLGBs, it is unlikely that the discharger could successfully demonstrate the infeasibility of cleaning up to background levels prior to implementing, and monitoring the effectiveness of, the proposed corrective action.	Groundwater concentration limits for groundwater constituents of concern monitored in alternative background monitoring point FCY-9 are provided in a separate letter (see response to Comment #4).

Response to Comments
Draft Final Amended Report of Waste Discharge / Clean Closure Plan
Corporation Yard Landfill, Folsom, CA

Comment	Response
4. An alternative background monitoring point (i.e., one not hydraulically upgradient of the landfill) may be needed per Section 20415(b)(2), if it is not feasible to install an upgradient background well, as indicated by the site conceptual model. Well FCY-9 in the southern part of the site, which appears to be the least impacted well, may be a candidate for an alternative background well.	Attempts to install an upgradient background well east of the landfill have been unsuccessful since perched groundwater terminates at the interface with the Laguna Formation, which is unsaturated and forms a hill east of the landfill. Monitoring results of FCY-9 indicate former site operations (as sewage treatment plant lagoons and subsequently as a landfill) do not appear to affect groundwater in the southern portion of the site. Therefore, concentration limits were based on groundwater results from alternative background monitoring point FCY-9 (see response to Comments #1 and #3).
5. The report does not provide sufficient justification for abandonment of well FCY-9, which, as noted above, may be needed as a background monitoring well. It is not clear, for example, why excavation activities cannot be conducted so as to preserve this well despite its location within the footprint of the uncontrolled fill area. The report also needs to demonstrate that this well is not needed for postclosure monitoring.	Excavation in the uncontrolled fill area may extend to 8 ft below grade and monitoring well FCY-9 is near the center of the excavation area. Once confirmation sampling is completed, this area will most likely be used for staging clean fill soil. The text in Section 3.4.4 will be modified to read, "If required by the RWQCB for post-closure monitoring, FCY-9 will be replaced following completion of clean closure activities."
6. The report needs to clarify whether there has been a release from the landfill, and to what extent such release has impacted groundwater at the site. Section 2.4.5 of the report provides a statistical summary of historical monitoring results for the site, but does not provide the requisite comparison with CLs under Title 27. See Section 20415(3)(7). The provided comparison with drinking water standards also does not resolve the issue. Given that monitoring data for the site indicates an historical release from the landfill, and clean closure is being proposed as a corrective action measure, this issue is central to the plan. The discussion also needs to include water quality trends; spatial variability; the extent to which the landfill (as opposed to other sources) may be the source of the impacts; likely mechanism(s) for landfill impacts (e.g., leachate, landfill gas, inadequate groundwater separation); and the effectiveness of proposed and previously implemented corrective action measures.	Additional text was added to Section 2.4.5 Water Quality that indicates groundwater has been impacted from former Site operations, briefly discusses water quality trends/spatial variability, and lists possible sources/mechanisms for impacts.
7. The list of landfill constituents of concern (COCs) in Section 2.7 of the report needs to include dissolved iron, which has been detected at elevated concentrations in several of the wells at the site. Concentration limits (CLs) also need to be developed for this constituent (see Comment 4).	Dissolved iron was added to the list of groundwater constituents of concern in Section 2.7 and concentration limits were developed for this constituent.

Response to Comments
Draft Final Amended Report of Waste Discharge / Clean Closure Plan
Corporation Yard Landfill, Folsom, CA

Comment	Response
8. The report does not include financial assurance information (i.e., cost estimates, amounts and mechanisms) as follows: a) Closure - costs of landfill cover and drainage repairs in event clean closure construction is interrupted for significant period of time (i.e., greater than six months) or is not completed; b) Postclosure maintenance - existing and anticipated in event clean closure construction is interrupted or is not completed; c) Postclosure monitoring - existing and after removal of landfill; and d) Corrective action - anticipated funding for any additional measures needed to achieve compliance with the Water Quality Protection Standard after removal of landfill (i.e., known or reasonably foreseeable release).	Funding for the existing and/or proposed corrective action/clean closure activities is from the City's Solid Waste Fund. This is an enterprise fund that is funded by City's solid waste rates. Currently Brown and Caldwell's activities are secured by funds that have been encumbered in the Solid Waste Fund. This year's budget has a line item for $1,000,000 for the clean closure activity and tipping fees at the receiving landfill (e.g., Kiefer) will be handled in a separate account. Brown & Caldwell is currently working on an Engineer's Estimate of Probable Construction Costs for the closure activity which will be available in mid-June. A preliminary estimate of the total project value is $1,500,000. In the event clean closure construction is interrupted or is not completed, costs to repair and cover the disturbed portion of the landfill are estimated at $75,000. The current annual cost of postclosure maintenance and monitoring is estimated at $30,000.
9. The report needs to include (or reference if separately submitted) the project construction documents, including maps, plans and drawings for various stages of the project. The excavation plan should describe both lateral and vertical excavation methods, and the grading plan should show final contours after backfilling. See Section 21760.	Construction deliverables were added to Section 3.7 Construction Deliverables and Quality Assurance. Additional details on excavaton were added to Section 3.5 Excavation and a new Figure 3-1. Hypothetical Construction Layout was added.
10. The report should include an updated project schedule, including contingencies if construction extends into the next construction season.	An updated schedule project schedule is included in Appendix G Project Schedule.
CA Integrated Waste Management Board comments by letter dated Month Day, 2008.	
[Mr. Davies requested a Health and Safety Plan.]	Please see the response to LEA comment #3 regarding electronic submittal of the Health and Safety Plan.
[Mr. Davies requested a Waste Characterization Plan.]	Please see the response to LEA comment #5 regarding the addition of the Waste Characterization Plan to the report.
Miscellaneous Changes to Document	
A meteorological station was installed at the Site in early March 2008 that records wind direction/speed, temperature/relative humidity, and barometric pressure at 15-minute intervals on a continuous basis. Section 2.2.4 Wind Rose and Appendix E. Air Monitoring Plan was updated with site met data from March 7, 2008 to April 28, 2008.	

Response to Comments
Draft Final Amended Report of Waste Discharge / Clean Closure Plan
Corporation Yard Landfill, Folsom, CA

Comment	Response
During the Neighborhood Meetinng on April 29, 2008, the public commented on the Air Monitoring Plan. Appendix E. was revised by substituting a continuous PM10 monitor (the pDR 1200) for the PQ100 sampler so that PM10 measurements can be recorded every 15 minutes at 5 stations during construction activity. The pDR 1200 uses a 37 mm Teflon filter instead of 47 mm and uses a 1 L/min flow rate instead of 16.7 L/min. Target detection limits were adjusted accordingly. The action levels for barium and cadmium were set at the detection limit. In addition, asbestos analysis was added. The Sampling and Analysis Plan was modified as well.	
Appendix F. Confirmation Sampling Plan was modified to limit the iterations of sampling, delineation, and re-excavation to a maximum of 2.	

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

State of California
Regional Water Quality Control Board

APPLICATION/REPORT OF WASTE DISCHARGE GENERAL INFORMATION FORM FOR WASTE DISCHARGE REQUIREMENTS OR NPDES PERMIT

I. FACILITY INFORMATION

A. Facility:

Name: City of Folsom Corporation Yard Landfill			
Address: 1300 Leidesdorff Street			
City: Folsom	County: Sac	State: CA	Zip Code: 95630
Contact Person: Walt Sadler, Asst. Utilities Dir.		Telephone Number: 916-351-3372	

B. Facility Owner:

Name: City of Folsom, Dept. of Utilities			Owner Type (Check One) 1. ☐ Individual 2. ☐ Corporation 3. ☒ Governmental Agency 4. ☐ Partnership 5. ☐ Other:
Address: 50 Natoma Street			
City: Folsom	State: CA	Zip Code: 95630	
Contact Person: Walt Sadler, Asst. Utilities Dir		Telephone Number: 351-3372	Federal Tax ID: 94-6000334

C. Facility Operator (The agency or business, not the person):

Name: (same as owner)			Operator Type (Check One) 1. ☐ Individual 2. ☐ Corporation 3. ☐ Governmental Agency 4. ☐ Partnership 5. ☐ Other:
Address:			
City:	State:	Zip Code:	
Contact Person:		Telephone Number:	

D. Owner of the Land:

Name: (same as owner)			Owner Type (Check One) 1. ☐ Individual 2. ☐ Corporation 3. ☐ Governmental Agency 4. ☐ Partnership 5. ☐ Other:
Address:			
City:	State:	Zip Code:	
Contact Person:		Telephone Number:	

E. Address Where Legal Notice May Be Served:

Address: (same as owner)		
City:	State:	Zip Code:
Contact Person:		Telephone Number:

F. Billing Address:

Address: (same as owner)		
City:	State:	Zip Code:
Contact Person:		Telephone Number:

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

State of California
Regional Water Quality Control Board

APPLICATION/REPORT OF WASTE DISCHARGE GENERAL INFORMATION FORM FOR WASTE DISCHARGE REQUIREMENTS OR NPDES PERMIT

II. TYPE OF DISCHARGE

Check Type of Discharge(s) Described in this Application (A or B):

[x] **A. WASTE DISCHARGE TO LAND** [ ] **B. WASTE DISCHARGE TO SURFACE WATER**

Check all that apply:

[ ] Domestic/Municipal Wastewater Treatment and Disposal
[ ] Cooling Water
[ ] Mining
[ ] Waste Pile
[ ] Wastewater Reclamation
[ ] Other, please describe: ______

[ ] Animal Waste Solids
[ ] Land Treatment Unit
[ ] Dredge Material Disposal
[ ] Surface Impoundment
[ ] Industrial Process Wastewater

[ ] Animal or Aquacultural Wastewater
[ ] Biosolids/Residual
[ ] Hazardous Waste (see instructions)
[x] Landfill (see instructions)
[ ] Storm Water

III. LOCATION OF THE FACILITY

Describe the physical location of the facility.

1. Assessor's Parcel Number(s)	2. Latitude	3. Longitude
Facility: (see below)	Facility: 38° 40' 27"	Facility: 121° 11' 07"
Discharge Point:	Discharge Point:	Discharge Point:

12 parcels toatal
070-0032 (various) 070-0033 (various) 070-0045 (various)
070-0034 (Various)
070-0041 (various)

IV. REASON FOR FILING

[ ] New Discharge or Facility
[ ] Change in Design or Operation
[ ] Change in Quantity/Type of Discharge
[ ] Changes in Ownership/Operator (see instructions)
[x] Waste Discharge Requirements Update or NPDES Permit Reissuance
[x] Other: Clean Closure of landfill

V. CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA)

Name of Lead Agency: City of Folsom, CA

Has a public agency determined that the proposed project is exempt from CEQA? [ ] Yes [x] No

If Yes, state the basis for the exemption and the name of the agency supplying the exemption on the line below.

Basis for Exemption/Agency: ______

Has a "Notice of Determination" been filed under CEQA? [x] Yes [ ] No

If Yes, enclose a copy of the CEQA document, Environmental Impact Report, or Negative Declaration. If no, identify the expected type of CEQA document and expected date of completion.

Expected CEQA Documents:

[ ] **EIR** [x] **Negative Declaration**

Expected CEQA Completion Date: March 12, 2008

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

State of California
Regional Water Quality Control Board

APPLICATION/REPORT OF WASTE DISCHARGE GENERAL INFORMATION FORM FOR WASTE DISCHARGE REQUIREMENTS OR NPDES PERMIT

VI. OTHER REQUIRED INFORMATION

Please provide a COMPLETE characterization of your discharge. A complete characterization includes, but is not limited to, design and actual flows, a list of constituents and the discharge concentration of each constituent, a list of other appropriate waste discharge characteristics, a description and schematic drawing of all treatment processes, a description of any Best Management Practices (BMPs) used, and a description of disposal methods.

Also include a site map showing the location of the facility and, if you are submitting this application for an NPDES permit, identify the surface water to which you propose to discharge. Please try to limit your maps to a scale of 1:24,000 (7.5' USGS Quadrangle) or a street map, if more appropriate.

VII. OTHER

Attach additional sheets to explain any responses which need clarification. List attachments with titles and dates below:

You will be notified by a representative of the RWQCB within 30 days of receipt of your application. The notice will state if your application is complete or if there is additional information you must submit to complete your Application/Report of Waste Discharge, pursuant to Division 7, Section 13260 of the California Water Code.

VIII. CERTIFICATION

"I certify under penalty of law that this document, including all attachments and supplemental information, were prepared under my direction and supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment."

Print Name: Walter E. Sadler   Title: Asst. Director Utilities

Signature: Walter E Sadler   Date: 6 May 08

FOR OFFICE USE ONLY

Date Form 200 Received:	Letter to Discharger:	Fee Amount Received:	Check #:

10540 White Rock Road, Suite 180
Rancho Cordova, California 95670

Tel: (916) 444-0123
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www.brownandcaldwell.com

April 7, 2008

Ms. Patrice Webb
Environmental Management Department
County of Sacramento
8475 Jackson Road, Suite 240
Sacramento, CA 95826 1017-08-134473

BROWN AND CALDWELL

Subject: Soil/Solid Media Cleanup Goals for Confirmation Sampling
Corporation Yard Landfill Clean Closure, Folsom, California

Dear Ms. Webb:

This letter proposes soil/solid media cleanup goals for confirmation sampling associated with the clean closure of the Corporation Yard Landfill (Site) located at 1300 Leidesdorff Street in Folsom, California. The objective of the project is to obtain clean closure certification from regulatory agencies and prepare the site for unrestricted reuse.

The *Draft Final Amended Report of Waste Discharge (AROWD)/Clean Closure Work Plan* prepared on February 13, 2008 included the information listed below.

- Section 2.7.2 proposed target parameters in soil/solid media: CAM 17 total metals and soluble nitrate and sulfate.

- Section 2.8 proposed that cleanup goals for target parameters in soil/solid media would be proposed in a separate document (i.e., this letter) after completion of the pre-design field investigation conducted in February 2008. The approved cleanup goals will then be incorporated into the final AROWD/Clean Closure Work Plan.

- Appendix F proposed a confirmation sampling plan with an iterative procedure consisting of:
  1. Soil sample collection at nodes on a 25-foot by 25-foot grid;
  2. Analysis of soil for target parameters;
  3. Comparison of analytical results to soil/solid media cleanup goals;
  4. Step-out sampling and delineation of hot spots; and
  5. Excavation and re-sampling as necessary.

The *Results Report for Pre-Design Data Collection Activities* prepared on March 26, 2008 included the collection of background samples and calculation of soil background concentration limits (BCL). The BCL was set equal to the 95% Chebyshev upper prediction limit (UPL) for all parameters with the exception of antimony, which was not detected in any of the background samples. The BCL for antimony was set at the method detection limit of 2 milligrams per kilogram (mg/kg). The BCLs for CAM 17 total metals are provided in the following table. The table also includes two types of health-based regulatory levels for metals in soil at a hypothetical site with future residential land use:

1) California Human Health Screening Levels (CHHSLs); and
2) U.S. EPA Region 9 Preliminary Remediation Goals (PRGs).

CAM 17 Total Metals	Background Conc. Limit (mg/kg)	CA Human Health Screening Level (mg/kg)	EPA Region 9 PRG (mg/kg)	Soil/Solid Media Cleanup Goal (mg/kg)
Antimony	2	30	31	30
Arsenic	10	0.07	0.39	10
Barium	234	5,200	5,400	5,200
Beryllium	0.8	150	150	150
Cadmium	0.97	1.7	37	1.7
Chromium	143	100,000 (Cr III)	100,000 (Cr III)	210
		17 (Cr VI)	30 (Cr VI)	
		---	210 (1:6 ratio Cr VI:Cr III)	
Cobalt	24	660	900	660
Copper	87	3,000	3,100	3,000
Lead	103	150	150	150
Mercury	0.28	18	23	18
Molybdenum	1.8	380	390	380
Nickel	78	1,600	1,600	1,600
Selenium	0.52	380	390	380
Silver	0.43	380	390	380
Thallium	0.66	5	5	5
Vanadium	103	530	78	530
Zinc	92	23,000	23,000	23,000

The soil/solid media cleanup goals are proposed to be the greater of the BCL or the CHHSLs for each of the CAM 17 metals except chromium. For chromium, the cleanup goal was set at the PRG based on a hypothetical soil ratio of one part hexavalent chromium to six parts trivalent chromium. This is a conservative cleanup goal since there is no indication of hexavalent chromium in soil/solid media at the Site.

In order to address potential impacts from soil nitrate (NO3) and sulfate (SO4) on groundwater beneath the landfill, a soil/solid media cleanup goal was calculated that is protective of the Maximum Contaminant Level (MCL) in groundwater for both constituents. We assumed the following physical properties for a 25-foot by 25-foot cell at the Site and chemical properties that apply to sulfate and nitrate.

- 0% of the NO3 or SO4 is adsorbed to the soil
- 0% of the NO3 or SO4 is biologically transformed by denitrification or sulfate reduction
- Vadose zone thickness = 10 ft
- V_{soil} (volume of soil cell) = 25 ft * 25 ft * 10 ft = 6,250 ft^3 or 177 m^3
- n (porosity) = 0.3 ft/ft
- Soil NO3 and SO4 is distributed uniformly with depth
- Bulk density = 1.8 g/cm^3
- Moisture content = 0.2 cm^3/cm^3
- Rainwater infiltration rate = 12 in/yr
- Initial groundwater quality in the perched water beneath the landfill based on average analytical results from the December 2007 monitoring event (excludes monitoring wells FCY-3 and FCY-7): NO3 at 9 mg/L and SO4 at 118 mg/L
- There is attenuation capacity in groundwater up to the MCL: NO3 at 45 mg/L and SO4 at 250 mg/L
- Groundwater samples will be collected from a monitoring well with a 10-ft screened interval underneath the 25 ft by 25 ft cell
- Q (groundwater flux) = K*i*a
- K (hydraulic conductivity) = 0.01 cm/sec or 10,350 ft/yr

- i (groundwater gradient) = 0.005 ft/ft
- a (cross sectional area) = 25 ft * 10 ft =250 ft^2

Based on these assumptions, the volume of groundwater, allowable mass of NO3, SO4, infiltration and allowable concentration in soil can be calculated as shown in the following steps.

Step 1 – Calculate Volume of Annual Groundwater Flux

- Annual groundwater flux = groundwater flux + initial groundwater volume
  = K*i*a + V_{soil} * porosity
  = (10,350 ft/yr)(0.005)(250 ft^2) + (6,250 ft^3)(0.3)
  = 14,810 ft^3 or 419,400 L

Step 2 – Calculate Allowable mass of NO3 and SO4 in Groundwater

- Allowable annual mass NO3 in groundwater
  = (MCL – average groundwater concentration) * annual groundwater flux
  = (45 – 9 mg/L)(419,400 L) = 1.53×10^7 mg

- Allowable annual mass SO4 in groundwater
  = (250 – 118 mg/L)(419,400 L) = 5.52×10^7 mg

Step 3 – Determine Percentage of Total Soil Moisture that Infiltrates Into Groundwater Each Year

- Total soil moisture in vadose zone = V_{soil} * moisture content
  = (6,250 ft^3)(0.2) = 1,250 ft^3 or 35,400 L

- Annual infiltration (12 in/yr) = cell area * infiltration depth
  = (25 ft * 25 ft)(1 ft) = 625 ft^3 or 17,700 L

- Annual moisture flux to groundwater
  = annual infiltration / total soil moisture = 17,700 L / 35,400 L = 0.5

Step 4 – Calculate Allowable Concentration from Allowable Mass Divided by the Percentage of Total Moisture that Infiltrates Into Groundwater

- Total mass soil in vadose zone = V_{soil} * bulk density
  = (177 m^3)(1.8 g/cm^3) = 318,600 kg

- Allowable NO3 concentration in soil = (allowable mass in groundwater / moisture flux to groundwater) / total mass soil in vadose zone
  = (1.53×10^7 mg /0.5) / 318,600 kg = 96 mg/kg

- Allowable SO4 concentration in soil = (5.52×10^7/0.5)/318,600 = 347 mg/kg

The BCLs and proposed soil/solid media cleanup goals for soluble nitrate and sulfate are provided in the following table.

Soluble Parameters	Background Conc. Limit (mg/kg)	Soil/Solid Media Cleanup Goal (mg/kg)
Nitrate as NO3	28	100
Sulfate as SO4	48	350

Please indicate your acceptance of these proposed soil/solid media cleanup goals for the project. Please call me at (916) 853-5385 if you have any comments of questions regarding the cleanup goals.

Sincerely,

BROWN AND CALDWELL

Guy J. Graening

Guy J. Graening, P.E.
Project Manager

GJG:ds

cc: Mr. Frank Davies, Jr., CIWMB
Mr. John Moody, Central Valley RWQCB
Mr. Walt Sadler, City of Folsom

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May 8, 2008

BROWN AND CALDWELL

Ms. Patrice Webb
Environmental Management Department
County of Sacramento
8475 Jackson Road, Suite 240
Sacramento, CA 95826 1017-08-134473

Subject: Revised Soil/Solid Media Cleanup Goals for Confirmation Sampling and Groundwater Concentration Limits for Corrective Action, Corporation Yard Landfill Clean Closure, Folsom, California

Dear Ms. Webb:

This letter revises soil/solid media cleanup goals (specifically soluble nitrate and sulfate) for confirmation sampling associated with the proposed clean closure of the Corporation Yard Landfill (Site) located at 1300 Leidesdorff Street in Folsom, California. The objective of the project is to obtain clean closure certification from regulatory agencies and prepare the site for unrestricted reuse. The cleanup goals were originally proposed by Brown and Caldwell in a letter dated April 7, 2008. The revisions to cleanup goals, specifically soluble nitrate and sulfate, are based on written comments from the Regional Water Quality Control Board (RWQCB) dated April 18, 2008. This letter also proposes concentration limits (CLs) for groundwater corrective action at the Site as requested in the April 18, 2008 RWQCB letter.

Groundwater at the Site is perched within the dredge tailings above the low permeability silts and clays of the underlying Mehrten Formation. Based on the isocontour map of the top of the Mehrten Formation (refer to Figure C-5 in Appendix C. Conceptual Site Model in the *Final Amended Report of Waste Discharge/Clean Closure Work Plan* dated May 8, 2008) a high spot for the top of this formation occurs to the east of the landfill resulting in perched groundwater flowing radially from this area to the west, northwest and southwest. Due to the limited easterly extent of the groundwater, attempts to install a background/upgradient well to the east or northeast of the landfill have been unsuccessful. Although monitoring well FCY-9 is downgradient of the landfill, monitoring results indicate former Site operations (i.e., as sewage treatment plant ponds and subsequently as a landfill) have not affected groundwater in the southern portion of the Site. Therefore, CLs were based on groundwater results from FCY-9 which is designated as an alternative background monitoring point.

The development of CLs is presented in detail in the attachment and summarized in this section. The CLs were set equal to the 95% Chebyshev upper prediction limit (UPL) for six of the nine analytes in the monitoring program (i.e., arsenic, chloride, iron, nitrate, sulfate, and TDS). The reporting limit was used as the CL for the remaining three analytes (i.e., chromium, lead and mercury) because they have no detected measurements. The proposed CLs are summarized in the following table.

Proposed CLs Based on FCY-9								
Arsenic (µg/L)	Chloride (mg/L)	Chromium (µg/L)	Iron (µg/L)	Lead (µg/L)	Mercury (µg/L)	Nitrate as NO_3 (mg/L)	Sulfate as SO_4 (mg/L)	TDS (mg/L)
4.6	151	10	93	5	0.2	60	57	354

The UPLs are a preferred method for calculating CLs and are recommended by the U.S. Environmental Protection Agency (U.S. EPA) for use at Resource Conservation and Recovery Act (RCRA) sites. ProUCL software was selected to perform the statistical analysis because it includes methods for analyzing background data, including the Chebyshev method for UPLs. In addition, ProUCL includes methods for analyzing censored data such as the Kaplan-Meier (KM) method. ProUCL was developed for the U.S. EPA and is widely used by environmental professionals. The authors of ProUCL favor UPLs over other methods of determining CLs.

The RWQCB commented that soil/solid media cleanup goals for soluble nitrate and sulfate should be based on the designated level methodology (DLM). The DLM is a simple equation that uses water quality goals (i.e., CL or water quality limit, whichever is lower) to solve for a soluble concentration of soil/solid media. The DLM document (Marshack, 1986; pg. 39) provides the following equation.

$$\underset{(mg/kg\ of\ waste)}{\textit{Total Designated Level for a Constituent of a Solid Waste}} = \underset{(mg/L)}{\textit{Water Quality Goal}} \times \textit{Environmental Attenuation Factor} \times \textit{Leachability Factor}$$

The water quality goal for nitrate is set at the water quality limit of 45 mg/L (which is based on the primary maximum contaminant level [MCL]) since it is lower than the CL of 60 mg/L. The water quality goal for sulfate is set at the CL of 57 mg/L since it is lower than the water quality limit of 250 mg/L (which is based on the secondary MCL). The environmental attenuation factor is estimated at 10 and the leachability factor is estimated at 1.0 (e.g., total nitrate = soluble nitrate). The total designated level for nitrate is calculated to be 450 mg/kg (i.e., 45 mg/L x 10 x 1) and the total designated level for sulfate is calculated to be 570 mg/kg (i.e., 57 mg/L x 10 x 1). Based on the DLM, the revised soil/solid media cleanup goals for soluble nitrate and sulfate are provided in the following table.

Soluble Parameters	Groundwater CL (mg/L)	Water Quality Limit (mg/L)	Water Quality Goal (mg/L)	Soil/Solid Media Cleanup Goal (mg/kg)
Nitrate as NO_3	60	45	45	450
Sulfate as SO_4	57	250	57	570

Please indicate your acceptance of these proposed groundwater CLs and revised soil/solid media cleanup goals for the project. Please call me at (916) 853-5385 if you have any comments of questions regarding the cleanup goals.

Sincerely,

BROWN AND CALDWELL

Guy J. Graening

Guy J. Graening, P.E.
Project Manager

GJG:ds

Attachment

cc: Mr. Frank Davies, Jr., CIWMB
Mr. John Moody, Central Valley RWQCB
Ms. Maria Gillette, DTSC
Mr. Walt Sadler, City of Folsom

Table 1. Analyte Concentrations in FCY-9
Corporation Yard Landfill, Folsom, California

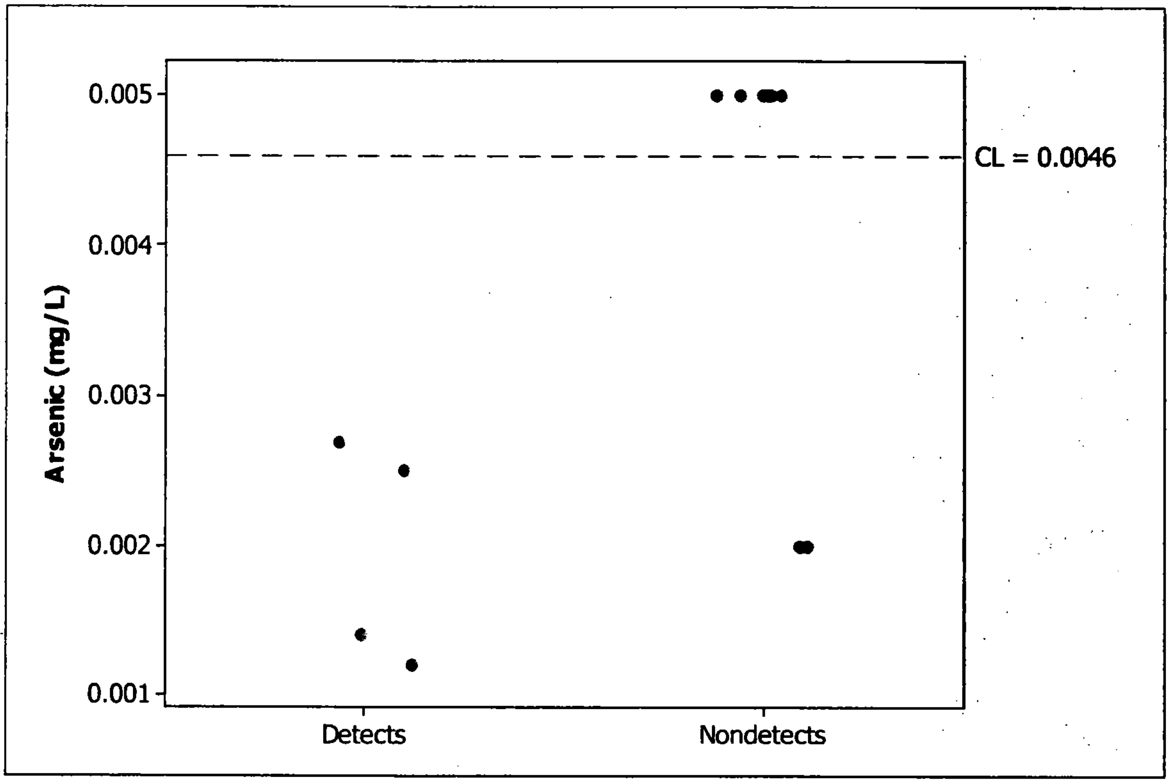
Sample Date	Arsenic (mg/L)	Chloride (mg/L)	Chromium (mg/L)	Iron (mg/L)	Lead (mg/L)	Mercury (mg/L)	Nitrate as NO_3 (mg/L)	Sulfate as SO_4 (mg/L)	TDS (mg/L)
6/19/02	<0.005	10	<0.01	<0.02	<0.005	<0.0002	26.0	37	190
12/19/02	<0.005	9.7	<0.01	<0.02	<0.005	<0.0002	21.0	34	180
6/9/03	<0.005	7.2	<0.01	0.0430	<0.005	<0.0002	26.1	34	280
12/11/03	<0.005	22	<0.01	0.0720	<0.005	<0.0002	10.8	24	190
6/15/04	<0.005	10	<0.01	<0.02	<0.005	<0.0002	26.0	28	200
12/7/04	0.0014	6.9	<0.01	<0.02	<0.005	<0.0002	41.0	26	190
6/5/05	<0.005	6.5	<0.01	<0.10	<0.005	<0.0002	20.0	29	230
12/5/05	0.0027	6.9	<0.02	<0.30	<0.001	<0.0002	15.0	16	180
6/6/06	0.0012	110	<0.005	0.0450	<0.001	<0.0002	24.0	29	210
12/1/06	<0.002	5.6	<0.01	<0.10	<0.005	<0.0002	11.0	24	150
6/1/07	<0.002	6.7	<0.01	<0.10	<0.005	<0.0002	17.0	21	170
12/7/07	0.0025	6.0	<0.01	<0.10	<0.005	<0.0002	13.7	16	150

Table 2. Summary Statistics and Groundwater Concentration Limits
Corporation Yard Landfill, Folsom, California

	Arsenic (mg/L)	Chloride (mg/L)	Chromium (mg/L)	Iron (mg/L)	Lead (mg/L)	Mercury (mg/L)	Nitrate as NO_3 (mg/L)	Sulfate as SO_4 (mg/L)	TDS (mg/L)
Number of observations	12	12	12	12	12	12	12	12	12
Number of detects	4	12	0	3	0	0	12	12	12
Percent detects	33	100	0	25	0	0	100	100	100
Minimum detect	0.0012	5.6	n/a	0.043	n/a	n/a	10.8	16	150
Maximum detect	0.0027	110	n/a	0.072	n/a	n/a	41.0	37	280
Minimum nondetect	0.002	n/a	0.005	0.02	0.001	0.00008	n/a	n/a	n/a
Maximum nondetect	0.005	n/a	0.02	0.30	0.005	0.0002	n/a	n/a	n/a
Estimation method for mean & std. dev.	KM	arithmetic	n/a	KM	n/a	n/a	arithmetic	arithmetic	arithmetic
Mean	0.0017	17	n/a	0.047	n/a	n/a	21.0	27	193
Standard deviation	0.00062	30	n/a	0.010	n/a	n/a	8.50	6.7	36
Method for determining Concentration Limit	95% Chebyshev UPL	95% Chebyshev UPL	reporting limit	95% Chebyshev UPL	reporting limit	reporting limit	95% Chebyshev UPL	95% Chebyshev UPL	95% Chebyshev UPL
Concentration limit (CL)	0.0046	151	0.01	0.093	0.005	0.0002	60	57	354

Figure 1. Individual Value Plots with Concentration Limits for Groundwater

Corporation Yard Landfill, Folsom, CA



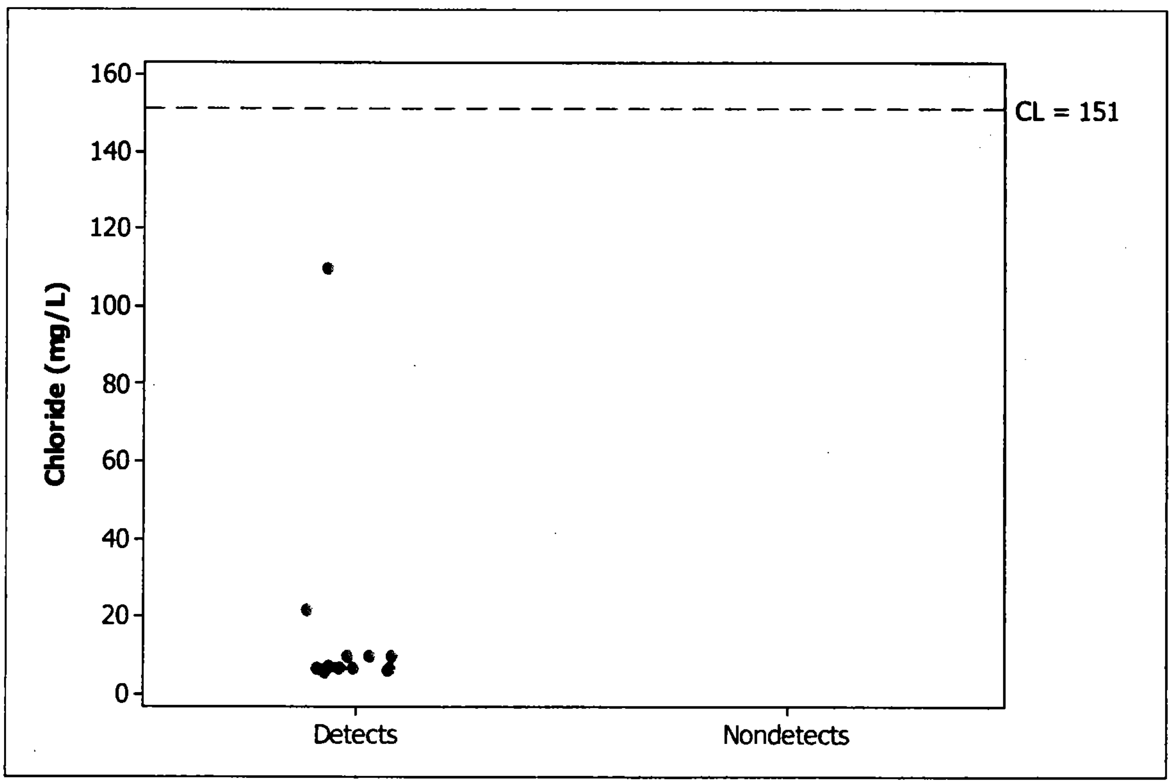
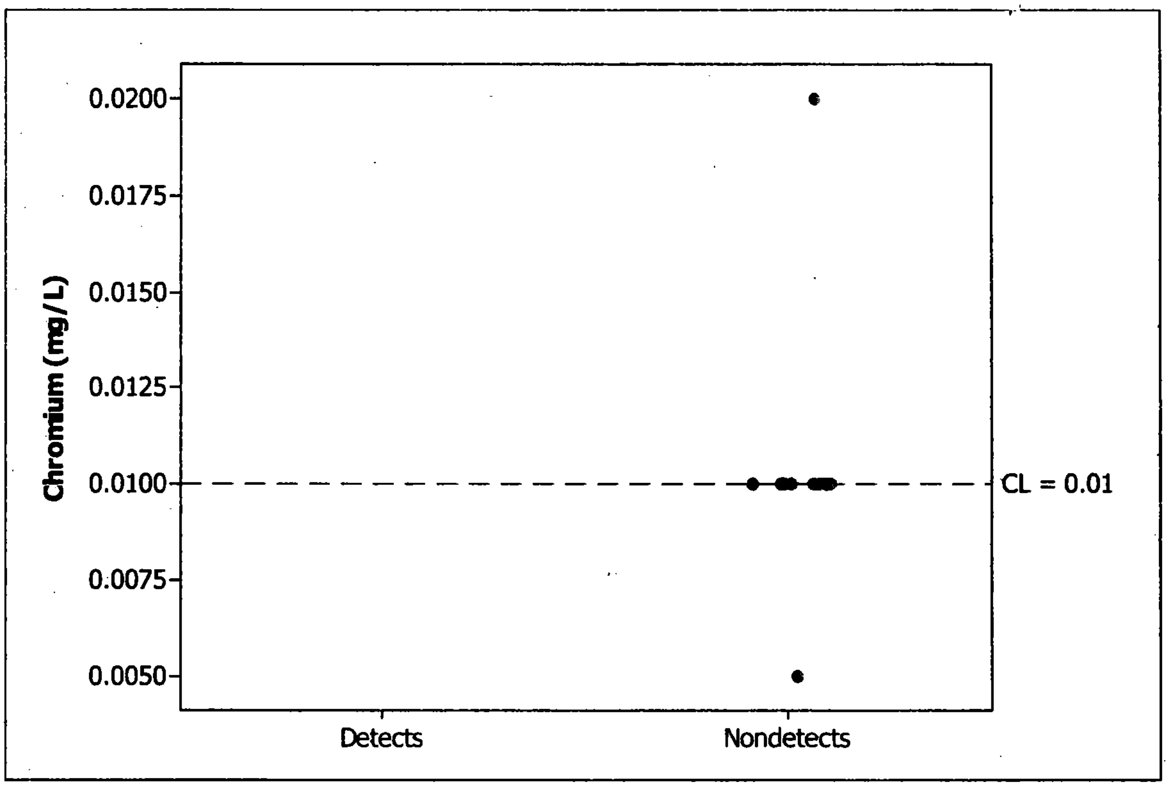


Figure 1. Individual Value Plots with Concentration Limits for Groundwater

Corporation Yard Landfill, Folsom, CA



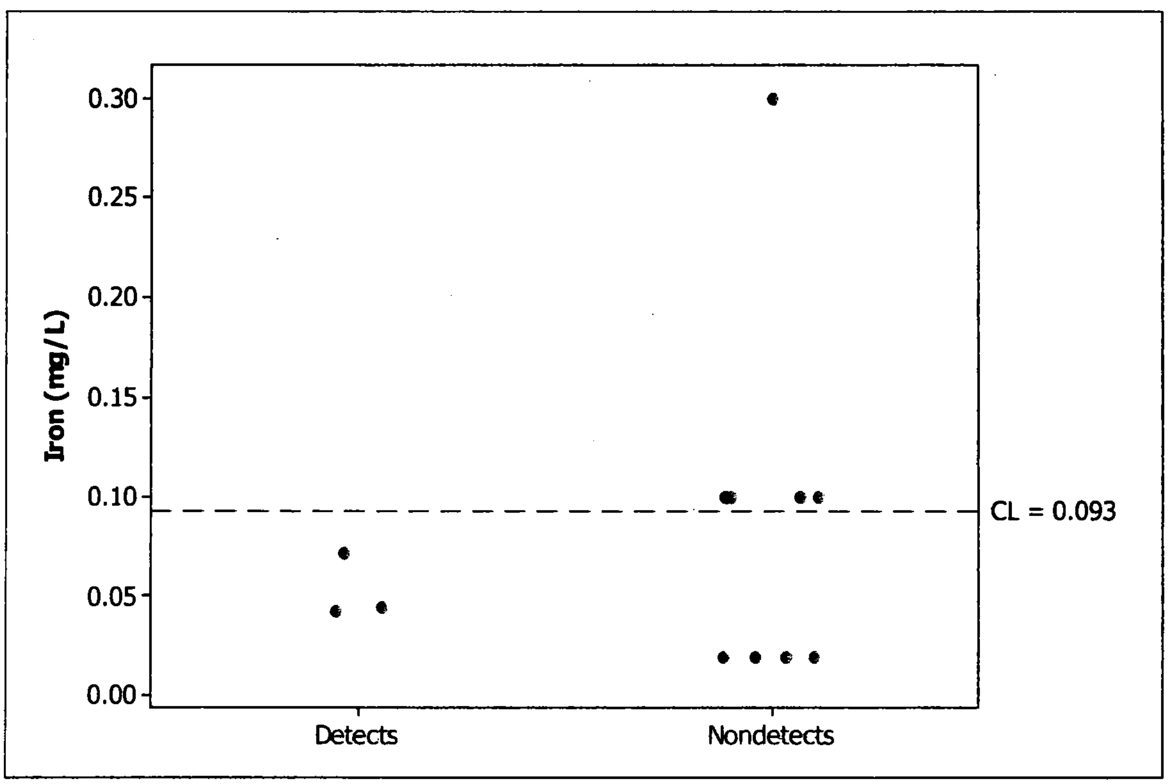
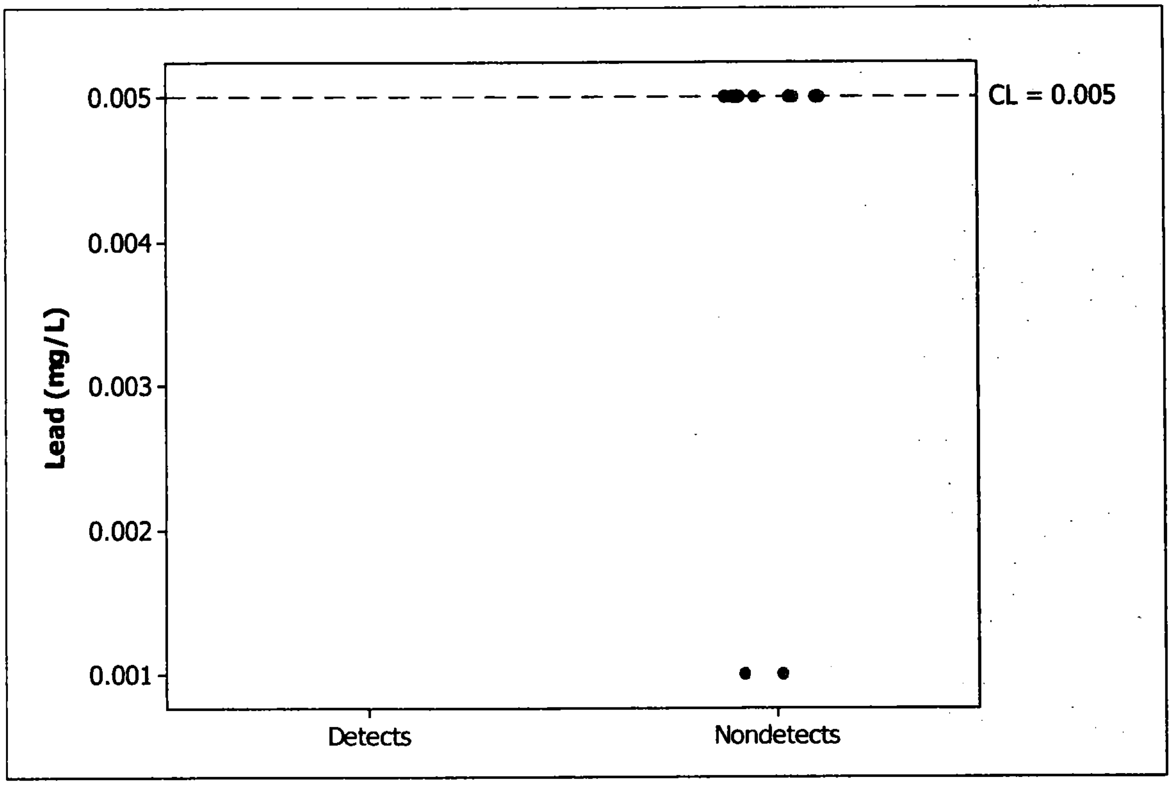


Figure 1. Individual Value Plots with Concentration Limits for Groundwater

Corporation Yard Landfill, Folsom, CA



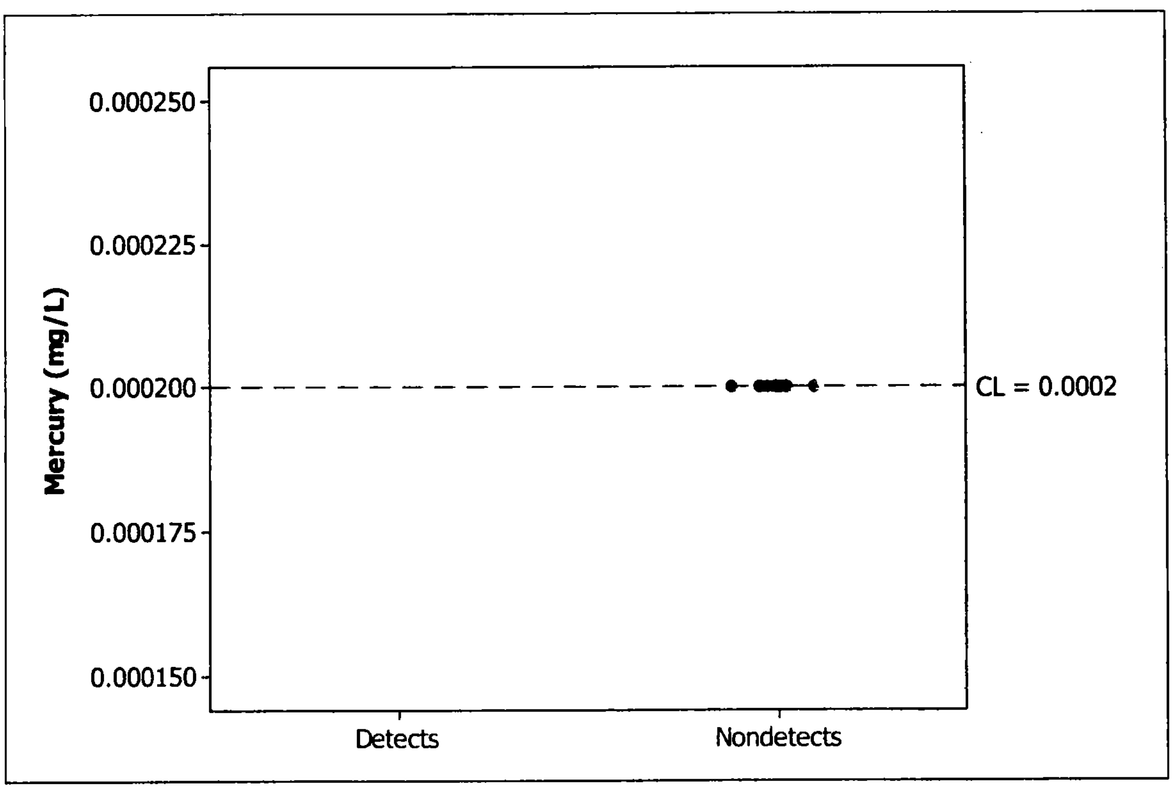
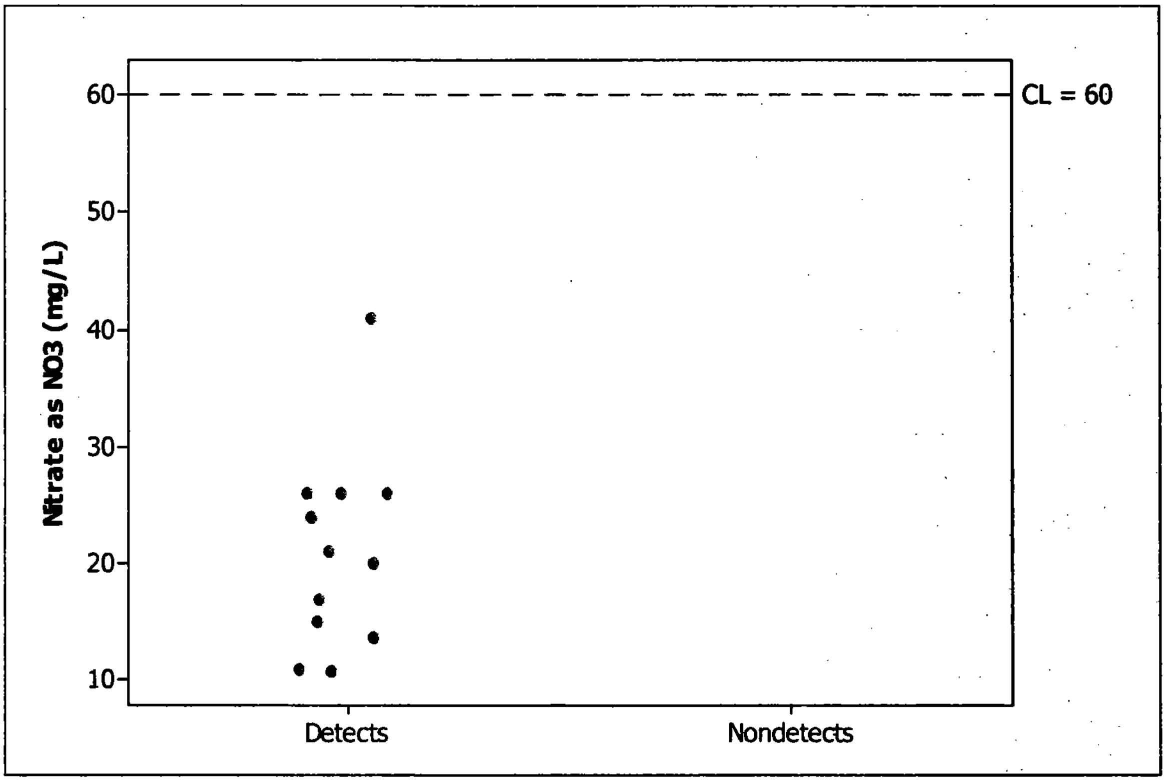


Figure 1. Individual Value Plots with Concentration Limits for Groundwater

Corporation Yard Landfill, Folsom, CA



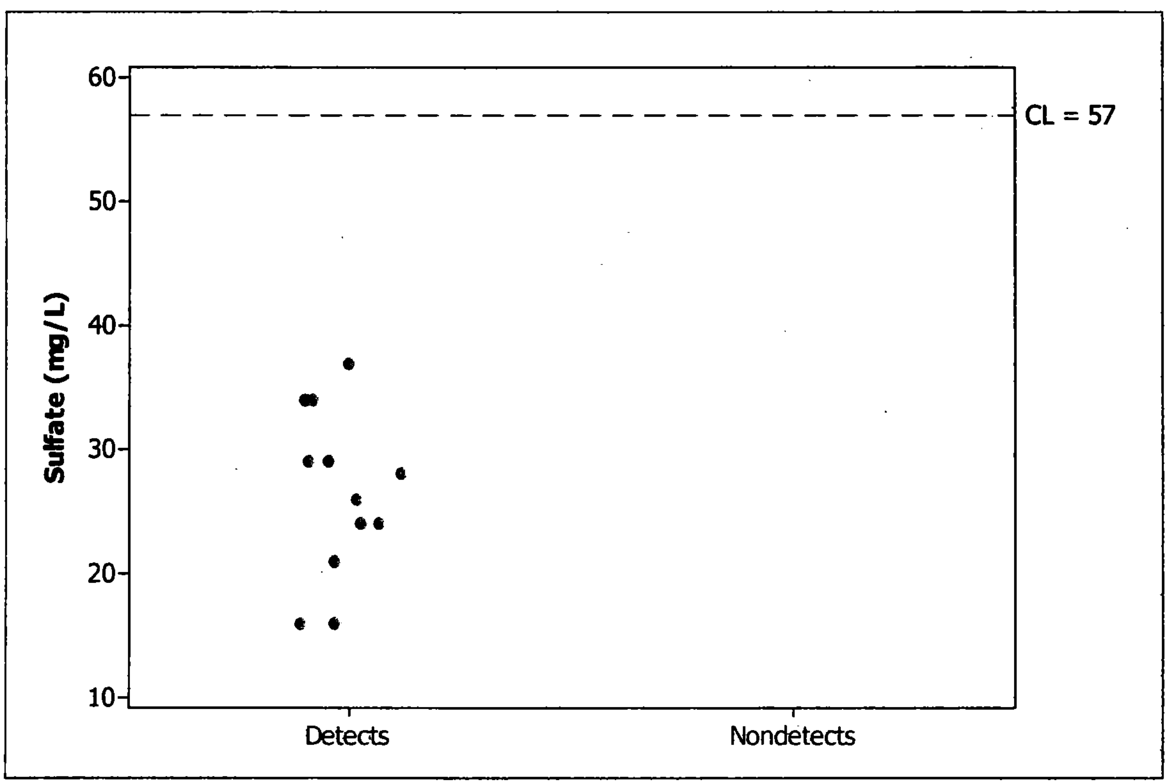
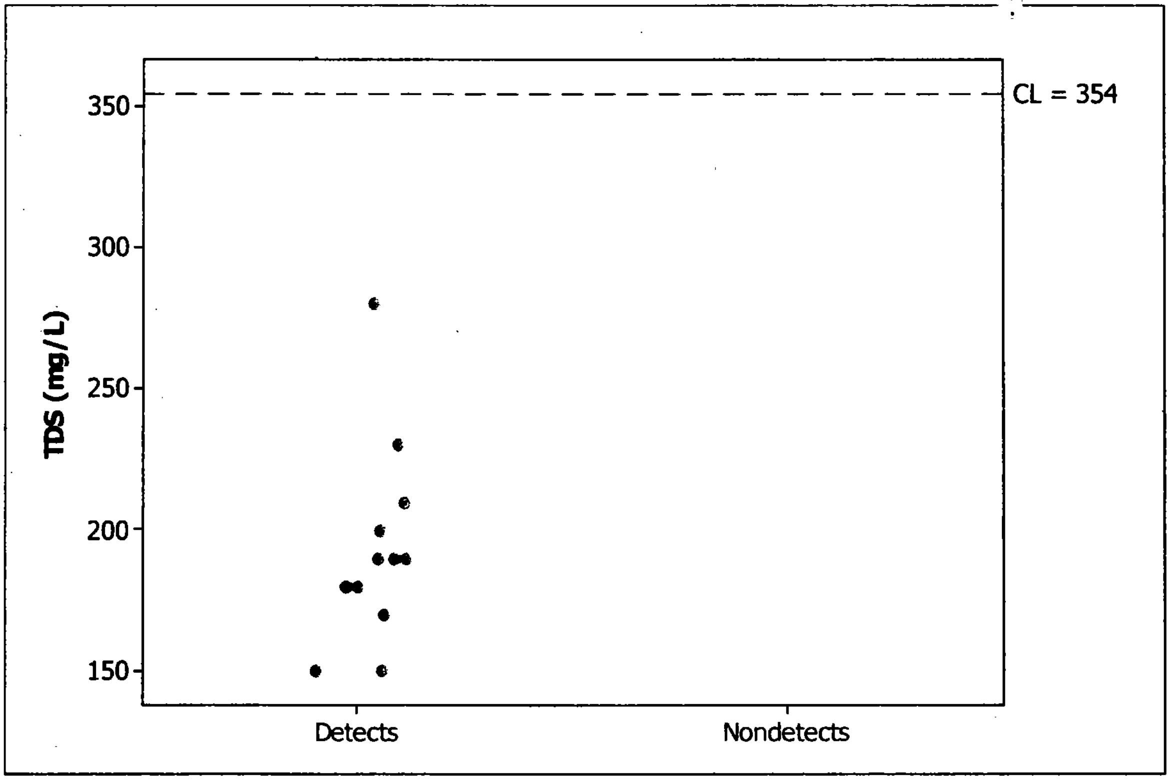


Figure 1. Individual Value Plots with Concentration Limits for Groundwater

Corporation Yard Landfill, Folsom, CA



Attachment 1. Development of Groundwater Concentration Limits
Corporation Yard Landfill, Folsom, CA

This attachment describes the statistical methodology used to develop concentration limits (CLs) for groundwater. The objective of the statistical analysis was to calculate values that would correspond to background conditions at the Site.

The following steps were used for this analysis:

1. Use data for nine analytes at monitoring well FCY-9 which was selected to represent background conditions at the Site (Table 1);
2. Characterize the data using summary statistics (Table 2);
3. Calculate CLs for each of the nine analytes (Table 2); and
4. Graphically evaluate the reasonableness of the CLs relative to the data (Figure 1).

CLs were set equal to the 95% Chebyshev upper prediction limit (UPL) for six of the nine analytes (i.e., arsenic, chloride, iron, nitrate, sulfate, and TDS). The reporting limit was used as the CL for the remaining three analytes (i.e., chromium, lead and mercury) because they have no detected measurements.

UPLs are a preferred method for calculating CLs. The Texas Risk Reduction Program is currently developing guidance for using UPLs (to be released as *TRRP-15, Determining Representative Concentrations*). UPLs are recommended by EPA (1989 and 1992) for use at RCRA sites. The authors of ProUCL favor UPLs over other methods of determining CLs (EPA, 2007b, page 116).

ProUCL (EPA, 2007a) was selected to perform the statistical analysis because it includes methods for analyzing background data, including the Chebyshev method for UPLs. In addition, ProUCL includes methods for analyzing censored data such as the Kaplan-Meier (KM) method. ProUCL was developed for the EPA and is widely used by environmental professionals.

1.0 DATA COMPILATION AND CHARACTERIZATION

Data that were used to develop CLs are presented in Table 1. Simple summary statistics for the groundwater concentration data are presented in Table 2. The summary statistics were used to select appropriate methods for determining CLs.

CLs were calculated for all nine analytes that are monitored at the site on a semi-annual basis including: arsenic, chloride, chromium, iron, lead, mercury, nitrate, sulfate, and TDS. Monitoring well FCY-9 was selected to represent background conditions for the site. FCY-9 has been monitored semi-annually for six years beginning in 2002.

There are a total of 12 measurements for each of the nine analytes at FCY-9. Chloride, nitrate, sulfate and TDS datasets have 100 percent detects. Arsenic and iron have four and three detects, respectively. Nondetects are present at two reporting limits in the arsenic dataset and three reporting limits in the iron dataset. (A dataset consists of all data for a given analyte and location, such as iron at FCY-9). Chromium, lead and mercury have no detected measurements, and one to three reporting limits for the nondetects.

2.0 DEVELOPMENT OF BACKGROUND CONCENTRATION LIMITS

For the six analytes with detected values, CLs were set equal to the 95% Chebyshev UPL. CLs for the remaining three analytes were set equal to current reporting limits. In all cases, the current reporting limit was also the one which occurred most frequently in the dataset.

Estimates of the mean and standard deviation, which are required for the Chebyshev UPL, were determined in two ways: 1) if the data do not contain nondetects, the mean and standard deviation were calculated using standard equations in Microsoft Excel; and 2) if the data do contain nondetect measurements, the Kaplan-Meier method was used to estimate the mean and standard deviation. Details of the Kaplan-Meier and the Chebyshev UPL methods are described below.

2.1 Kaplan-Meier Estimation Method

The KM estimation method has been used extensively in the field of survival analysis where right censored data (i.e., "greater-thans") are encountered. The KM method has recently been adapted to environmental datasets, which often contain left censored data (i.e, "less-thans"). The KM method is particularly useful for environmental data because it can handle datasets with multiple detection limits. Helsel (2005) and EPA (2007b) recommend the use of the KM estimation method for environmental data. Calculations were performed using ProUCL (EPA, 2007a). Further details on the method are available in Kaplan and Meier (1958), Helsel (2005) and EPA (2007b).

2.2 Upper Prediction Limits by the Chebyshev Method

UPLs are one of several ways to develop CLs. Examples of other methods are upper tolerance limits, upper percentiles, and the maximum concentration. An upper prediction limit gives a specified probability (e.g., 95%) that a single measurement from the site will produce a value higher than the UPL if the two distributions are the same. For a 95% UPL, there would be a five percent chance that the UPL could be exceeded by single site value even if there is no contamination (Gibbons 1994, page 11).

The Chebyshev method for calculating upper prediction limits was conducted for this analysis using the ProUCL software (EPA, 2007b). This method was selected because it produces realistic estimates of the UPL for a wide variety of datasets. Also, because this is a nonparametric method, it can be used on all datasets regardless of their distribution. The equation for calculating the Chebyshev UPL is given below (EPA 2007b, eq. 5-2):

$$UPL = \bar{x} + [\sqrt{((1/\alpha)-1)*(1+1/n)}]s_x$$

Where $\bar{x}$ is the mean and s_x is the standard deviation. As stated previously, the mean and standard deviation were calculated using standard equations in Excel for datasets with no nondetects. Otherwise, the KM method was used.

3.0 GRAPHICAL REPRESENTATION

Individual value plots (IVPs) were constructed for the nine analytes for which UPLs were calculated. The IVPs are presented in Figure 1. Each concentration value was plotted individually, and a random horizontal offset was applied to decrease the overlap between data of the same magnitude. Detects and nondetects are shown separately with nondetects plotted at the reporting limit. CLs are depicted as a dashed line on the IVPs. These graphs were examined to evaluate the reasonableness of the CLs relative to the background concentration data. All of the CLs appear to represent reasonable estimates of background conditions. Minitab (2004) was used to construct the IVPs.

4.0 REFERENCES

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Helsel, D.R. 2005. Nondetects and Data Analysis. John Wiley and Sons, New York, NY, 250 pages.

Kaplan, E.L. and Meier, O. 1958. *Nonparametric Estimation from Incomplete Observations.* Journal of the American Statistical Association, Vol. 53. 457-481.

Minitab, Inc. 2004. MINITAB for Windows. Minitab, Inc., 3081 Enterprise Drive, State College, PA 16801-3008, phone: (814) 238-3280, WEB: http://www.minitab.com. Release 14.

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U.S. EPA. 2007a. ProUCL, Version 4.00.02. Statistical software developed by Anita Singh and Robert Maichle, Lockheed Martin Environmental Services, and Ashok Singh, University of Nevada, Las Vegas.

U.S. EPA. 2007b. ProUCL Version 4.0 Technical Guide. Authored by Anita Singh, Lockheed Martin Environmental Services, and Ashok Singh, University of Nevada, Las Vegas. Document number EPA/600/R-07/041, April 2007.

Final

Amended Report of Waste Discharge / Clean Closure Work Plan

Corporation Yard Landfill, Folsom, CA

May 8, 2008

Prepared for:

City of Folsom
Department of Utilities
50 Natoma Street
Folsom, CA 95630

Prepared by:

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Contents

BROWN AND CALDWELL

TABLE OF CONTENTS

SECTION **PAGE**

FIGURES

APPENDICES

1

BROWN AND CALDWELL

1.0 INTRODUCTION

The City of Folsom (City) is planning to clean close the Corporation Yard Landfill (Site) located at 1300 Leidesdorff Street, Folsom, California. Clean closure of a solid waste disposal site refers to the complete removal of all waste and waste residuals, including any contaminated soils. A clean closure is generally defined as being successful when waste materials and residuals are removed to a point where remaining contaminant concentrations are at or below background levels or clean up goals established by the relevant regulatory agencies.

The objective of the project is to obtain clean closure certification from regulatory agencies and prepare the Site for future unrestricted land use. This document presents summary information required to revise the existing landfill permit in the form of an Amended Report of Waste Discharge (AROWD). This document also presents detailed information regarding how clean closure will be accomplished in the form of a Clean Closure Work Plan.

1.1 Site Location and Features

The City Corporation Yard is an 18-acre property located adjacent to Lake Natoma at the western terminus of Leidesdorff Street in the Folsom Historic District as shown in Figure 1-1. The Site is a closed landfill that occupies approximately 4 acres of the lower half of the Corporation Yard property as shown in Figure 1-2. The northern portion of the landfill features a parking lot for City employees. The Folsom Lake State Recreation Area and East Lake Natoma Multi-purpose Trail borders the Site to the west and north. The Folsom Veterans Hall and Lake Natoma Shores residential development borders the Site to the east and south. Eight groundwater monitoring wells (FCY-2 through FCY-9) and six landfill gas monitoring wells (GAS-1 through GAS-6) are currently used to monitor the Site.

1.2 Site History

Site history is presented in detail in Appendix A and summarized in this section. Historical aerial photographs are provided in Figure 1-3. During the late 1800s to early 1900s, the general area of the Site was dredged for gold. The dredge tailings at the Site and surrounding area are shown in the 1952 aerial. In the 1950s, the City constructed a domestic sewage treatment plant and operated it through the 1970s (refer to the 1952, 1961, and 1971 aerials). A photograph (circa 1973) of the former aeration and settling ponds associated with the sewage treatment plant is provided in Figure 1-4. In 1974, the City began using the former ponds associated with the sewage treatment plant as a landfill (refer to the 1981 aerial). The City discharged primarily non-municipal solid-waste including construction and demolition debris, green waste, and street litter. In 1978, the landfill was permitted as a Class III sanitary landfill and continued to operate until 1986. Plan and section drawings of the inactive landfill in 1986 are provided in Figure 1-5. Illegal dumping of municipal waste by unknown parties south of the landfill may have occurred – this area is designated as the "uncontrolled fill area" shown in Figure 1-2. In 1996 after ten years of inactivity, a cap was installed on the landfill as part of the regulatory closure plan (refer to the 1993 and 2002 aerials). From 1996 to present, the City has maintained the landfill cap and conducted post-closure monitoring of landfill gas and groundwater.

1.3 Regulatory Agencies and Permitting Requirements

Agencies with regulatory oversight and approval for clean closure activities consist of:

- County of Sacramento acting as the Local Enforcement Agency (LEA);
- California Regional Water Quality Control Board, Central Valley Region (RWQCB);
- California Integrated Waste Management Board (CIWMB);
- California Department of Toxic Substances Control (DTSC); and
- Sacramento Metropolitan Air Quality Management District (SMAQMD).

Agencies that own and manage land to the west and north of the Site (i.e., the Folsom Lake State Recreation Area) will be informed throughout the project and consist of:

- U.S. Bureau of Reclamation; and
- California Department of Parks and Recreation.

1.3.1 CEQA Requirements

In January 2008, the lead agency (i.e., the City) determined the clean closure activity qualified as a project under the California Environmental Quality Act (CEQA) and prepared an *Initial Study* (Natural Investigations Co., 2008). The Initial Study concluded that the project will not have a significant effect on the environment after the incorporation of mitigation measures. In February 2008, the City adopted a Mitigated Negative Declaration which included mitigation monitoring and reporting.

1.3.2 Waste Discharge Requirements

The RWQCB is the only agency that has issued a current permit for the landfill. In October 1995, the RWQCB prepared *Waste Discharge Requirements (WDRs) Order No. 95-246* (RWQCB, 1995) which authorized the installation of the landfill cap and specified a monitoring and reporting program (MRP). In September 2001, the RWQCB prepared the *Revised Monitoring and Reporting Program Order No. 95-246* (RWQCB, 2001) which addressed deficiencies in the original MRP. In November 2001, an *Amended Report of Waste Discharge* (Brown and Caldwell, 2001a) was prepared to provide required information on the MRP. The current MRP requires the following activities:

- Maintenance of the landfill cap and inspection on a semi-annual basis;
- Monitoring groundwater elevation on a quarterly basis;
- Monitoring landfill gas on a semi-annual basis;
- Monitoring groundwater quality on a semi-annual and 5-year basis; and
- Evaluating and reporting monitoring results on a semi-annual basis.

Using information in this document (i.e., the second AROWD), the RWQCB plans to revise the WDRs again to allow clean closure activities to proceed.

1.3.3 Clean Closure Requirements

None of the agencies require a permit for clean closure activities; however, requirements for how to conduct clean closure activities are specified by the State Water Resources Control Board (SWRCB) and CIWMB in Title 27 of the California Code of Regulations (27 CCR) §21090(f) and §21810 and the *LEA Clean Closure Advisory* (CIWMB, 1994).

1.4 Project Approach

The clean closure project involves the following general tasks:

- Completing the CEQA process including evaluating environmental effects resulting from the project, avoiding or mitigating effects where possible, and notifying regulatory agencies and the community;
- Preparing an AROWD/Clean Closure Work Plan for regulatory review and approval;
- Obtaining revised WDRs and regulatory agency approval prior to commencing clean closure activities;
- Preparing bid documents (e.g., design drawings and specifications) and contracting;
- Conducting clean closure activities (e.g., waste excavation/disposal, confirmation sampling, final grading, re-vegetation);
- Preparing a Clean Closure Results Report documenting the completion of clean closure activities;
- Obtaining regulatory agency certification of clean closure; and
- Conducting limited groundwater monitoring prior to rescinding WDRs.

1.5 Document Format and Organization

This document provides a combined AROWD/Clean Closure Work Plan (Work Plan). The first portion of this document provides the AROWD. According to the SWRCB in 27 CCR §21585, §21710, §21750, and §21760, the contents of the AROWD must include:

- Topography (Section 2.1);
- Climatology (Section 2.2);
- Geology (Section 2.3);
- Hydrogeology (Section 2.4); and
- Land and Water Use (Section 2.5).

The SWRCB Joint Technical Document (JTD) index is provided in Appendix B that indicates where specific AROWD information can be found in this document.

The second portion of this document provides the Clean Closure Work Plan. According to the CIWMB in the LEA Clean Closure Advisory provided in Appendix B, the contents of the Clean Closure Work Plan must include:

- Site characterization (Section 2.0);
- Excavation and material management (Section 3.0);
- Confirmation of waste and degraded material removal (Section 4.0); and
- Post-closure maintenance and land use (Section 5.0).

2

BROWN AND CALDWELL

2.0 SITE CHARACTERIZATION

This section provides the Site topography, climatology, geology, hydrogeology, and land/water use that are required content for an AROWD. This section also provides investigation results and landfill characteristics (e.g., landfill cap construction and nature/extent of waste) that are required content for a Clean Closure Work Plan.

2.1 Topography

This section provides information on topography of the Site and surrounding region and the Site location relative to the floodplain.

2.1.1 Topographic Map

The topographic map for the Site and its surrounding region within a 1-mile radius is provided in Figure 2-1. The surrounding region is within the watershed of the American River and the regional drainage pattern is towards Lake Natoma. The Site is located on a terrace of the American River, adjacent to Lake Natoma. The elevation of the landfill cap ranges from approximately 153 to 156 feet above mean sea level (MSL). The topography rises to the east of the landfill to approximately 173 to 175 feet MSL and falls to the west to approximately 135 to 137 feet MSL. The primary Site drainage pattern is discussed in Section 2.2.3.

2.1.2 Floodplain

The floodplain map for the Site and its surrounding region within a 1-mile radius is provided in Figure 2-2. The Site is located in Zone C (areas of minimal flooding) and is not within the 100-year or 500-year flood zone according to the Federal Emergency Management Agency (FEMA).

2.2 Climatology

This section provides Site climatology information including precipitation, evapotranspiration, surface water drainage, and wind direction.

2.2.1 Precipitation and Evapotranspiration

An isohyetal contour map for the Site and surrounding region within a 10-mile radius is provided in Figure 2-3. The isohyetal map indicates the average annual precipitation for the Site is approximately 23 to 24 inches. The average precipitation and evapotranspiration near the Site is provided in the table below. The sources of the data and periods of record are noted in the table. The minimum monthly precipitation of 0.09 inches typically occurs in July and the maximum precipitation of 4.43 inches typically occurs in January. Average annual evapotranspiration near the Site is 57.06 inches. The minimum monthly evapotranspiration of 1.59 inches typically occurs in December and January and the maximum evapotranspiration of 8.67 inches typically occurs in July.

Average Precipitation and Evapotranspiration Near Site		
Month	**Precip.(1) (in)**	**Evap.(2) (in)**
January	4.43	1.59
February	3.82	2.20
March	3.92	3.66
April	1.91	5.08
May	0.63	6.83
June	0.24	7.80
July	0.09	8.67
August	0.11	7.81
September	0.46	5.67
October	1.47	4.03
November	3.36	2.13
December	3.48	1.59
Total	**23.92**	**57.06**

(1) National Weather Service (NWS) Cooperative Observer Program (COOP) Folsom Dam Station 043113 operated by the U.S. Bureau of Reclamation; period of record 10/26/55 to 4/30/93

(2) California Irrigation Management Information System (CIMIS) & California Department of Water Resources (DWR) Fair Oaks Station 131; period of record 4/97 to present

2.2.2 Design Storm

The landfill was originally designed to accommodate surface water drainage per regulations in 1996. The design storm (100-year/24-hour) precipitation for the region surrounding the Site is 3.91 inches (CIMIS & DWR Fair Oaks Station 131; period of record 4/97 to present).

2.2.3 Runoff Volume/Pattern

The surface water drainage for the landfill is provided in Figure 2-4. Surface water that does not infiltrate the vegetative soil layer of the landfill cap drains from the crest of the cap toward the margins. The surface water is then collected in earthen drainage ditches and directed along the perimeter to grouted riprap discharge structures. After waste in the landfill has been removed, the Site will be final-graded as necessary to ensure that drainage is adequate to prevent ponding or erosion. Calculation of the runoff volume for the landfill is not relevant for clean closure since the landfill will be removed.

2.2.4 Wind Rose

Wind direction in the region near the Site blows predominantly from the south/southeast based on Western Regional Climate Center (WRCC) hourly data from 1992 to 2002 from the Mather Station. The average annual wind speed in the region is 7.8 miles per hour based on National Climatic Data Center (NCDC) data from 1950 to 2001 at Sacramento, California.

In early March 2008, a meteorological station was installed in the southern portion of the Site along Young Wo Circle. The station records wind direction/speed, temperature/relative humidity, and barometric pressure at 15-minute intervals on a continuous basis. The station also features a digital camera, data logger with flash memory, and solar powered battery. A Site wind rose is provided in Appendix E for wind measurements from March 7 to April 28, 2008. The preliminary wind data indicate that wind at the Site blows primarily from the north and the south. This wind pattern is common for areas near a water body (e.g., "up-canyon" and "down-canyon" winds on a river). Wind speeds at the Site are typically light to moderate.

2.3 Geology

Geology of the Site is provided in detail in Appendix C and summarized in this section. The Site is located where fluvial deposits of the ancestral and modern American River flood plain abut the foothills of the Sierra Nevada. A geologic map of the Site is provided in Figure 2-5 and geologic cross sections are provided in Figure 2-6 and Figure 2-7. Two surface units have been identified at the Site: the undisturbed Laguna Formation and dredged material (from historical gold mining operations) of the Laguna Formation (i.e., dredge tailings). Surface exposures of the Laguna Formation occur east and north of the landfill. The landfill was constructed within and is directly underlain by dredge tailings which overly the Mehrten Formation. More extensive dredge tailings can be observed to the west and south of the Site towards the American River. Off-site, the characteristic serrated shape of the dredge tailings can be observed. On-site, this material has been leveled for the landfill and Corporation Yard

2.3.1 Materials

The geologic formations at the Site consist primarily of the Laguna Formation (and dredged material of the Laguna Formation) and the Mehrten Formation as described below.

- <u>Laguna Formation</u>: This formation consists of poorly bedded layers of silt, clay, sand, and gravel deposited by meandering rivers and streams such as the American River. Historical gold mining operations in the area included extensive dredging of the Laguna Formation to reported depths of 40 to 90 feet below ground surface (bgs). At the Site, dredge tailings have been noted to a depth of approximately 30 feet bgs. Sediments are generally non-volcanic and predominantly arkosic (feldspar-rich) in contrast to the underlying formations. The underlying Mehrten Formation is distinguished from the Laguna Formation by the first occurrence of sediments composed predominantly of andesitic material. Unaltered dredge tailings consist predominantly of cobbles with interbedded fine-grained layers.

- <u>Mehrten Formation</u>: This formation consists of clays, conglomerates, and mudflows predominantly of andesitic detritus. The conglomerates are poorly sorted, well-rounded porphyritic andesitic cobbles with a matrix composed of ashy clay, silt, and sand. The mudflow, or lahar, consists of moderate to cobble size clasts cemented in an ash matrix. Both the Mehrten and Laguna Formations represent deposits of the paleo-

American River and, depending on the amount of andesitic material within the Mehrten, can be difficult to distinguish from each other in the subsurface.

2.3.2 Geologic Structure

There are no reported faults within a 1-mile radius of the Site as indicated on the Fault Activity Map (California Geologic Data Map Series Map No. 6) prepared by the California Department of Mines and Geology (CDMG) in 1994.

2.3.3 Engineering and Chemical Properties

During the 2000 Site investigation, information was collected on geotechnical properties of Site materials (Kleinfelder, 2000) as described below. Chemical properties of dredge tailings underlying the landfill were investigated during the February 2008 pre-design data collection field activities (Brown and Caldwell; 2008a, 2008d).

- Soil Parameters: One soil sample was collected at 3 feet below grade from test pit TP-13 outside the main landfill area and tested for geotechnical properties. The soil material description was brown sandy gravel with clay. The plasticity index was 16 while the liquid limit was 33. Based on plasticity charts for the classification of fine-grained soils, this soil had low plasticity.

- Faulting and Seismicity: Historically, seismicity in the Site vicinity has been relatively infrequent and consists of low to moderate size earthquake events. Based on the U.S. Geologic Survey probabilistic map for the region surrounding the Site, the estimated peak horizontal bedrock acceleration at the Site is approximately 0.2 to 0.3 g. As this value does not represent an unusually high ground motion, it is not likely that subsurface dredge tailings would liquefy.

2.4 Hydrogeology

Hydrogeology of the Site is provided in detail in Appendix C and summarized in this section. The regional aquifer in the vicinity of the Site consists of a series of discontinuous layers of permeable and low permeable sediments. Permeable units consist of sand and gravel that correspond to the channel deposits of the Mehrten and Laguna Formations. Low permeability units consist of interbedded clays and silts of the Mehrten and Laguna Formations and form local aquitards and confining units. Perched water has been observed in the area within the dredge tailings and groundwater flow within these zones is dependent upon the slope of the underlying low permeability unit.

2.4.1 Hydraulic Conductivity

The dredge tailings below the landfill generally consist of 60 to 95 percent well-rounded gravel and cobbles with clasts up to 14-inches in diameter. The gravel near the upper portions of the tailings is generally matrix supported with interstices packed with fine-grained material. The hydraulic conductivity of this type of material (i.e., well-sorted sands and gravels) as reported by Fetter (1994) typically ranges from approximately $1x10^{-1}$ to $1x10^{-3}$ centimeters per second.

2.4.2 Flow Direction(s)

In the region surrounding the Site, groundwater generally flows toward the American River. The groundwater monitoring system for the landfill includes six upper zone wells (FCY-2, FCY-4, FCY-5, FCY-6, FCY-8, and FCY-9) and two lower zone wells (FCY-3 and FCY-7). An initial shallow well, FCY-1, was abandoned in 2002 because it was typically dry. Site groundwater within the dredge tailings appears to be perched above the low permeability silts and clays of the underlying Mehrten Formation. As such, the groundwater flow in this unit follows the topography of the top of the Mehrten Formation. As illustrated on Figure C-5 in Appendix C, both the slope of this material and groundwater surface appears to trend away from a mound in the Mehrten Formation near GAS-3 at the eastern edge of the landfill. Therefore, Site groundwater flows radially from the mounded area to the west, southwest and northwest. Due to the limited easterly extent of the shallow zone, attempts to install a shallow upgradient well to the east or northeast of the landfill have been unsuccessful. All of the shallow wells to the west, southwest, and northwest are downgradient. Although no specific data is available, it is expected that the groundwater encountered within the Mehrten Formation at FCY-3 and FCY-7 is not hydraulically connected to the perched groundwater within the dredge tailings.

During the annual groundwater monitoring event in December 2007 (Brown and Caldwell, 2008b), the elevation of groundwater (excluding FCY-3 and FCY-7 completed in the Mehrten Formation) perched within the dredge tailings ranged from approximately 128.00 to 129.34 feet MSL. The hydraulic gradient of the groundwater ranged from 0.004 to 0.006 foot per foot.

2.4.3 Capillary Rise

As described above, the landfill is constructed on dredge tailings, consisting primarily of gravels, cobbles, and boulders, with relatively minor amounts of sand, silt, and clay. The vadose zone occurs between the ground surface and the groundwater surface. Vadose water is held between soil particles by capillarity, which is an inverse function of the average grain size of the material in the vadose zone. Therefore, capillary rise is not as effective in coarse sediments, but can cause water to migrate upward 5 feet or more in fine, well-sorted sediments. Because the majority of sediments lying below the landfill are very coarse-grained and not well sorted, the potential for capillary rise from the vadose zone is low. A waiver from vadose zone sampling beneath the landfill was requested by the City and was granted by the RWQCB on January 17, 1989.

2.4.4 Springs

No springs were identified within a 1-mile radius of the Site (EDR, 2007).

2.4.5 Water Quality

The groundwater monitoring program for the Site was developed to monitor water quality parameters that may be affected as a result of the material present in the landfill. Groundwater monitoring at the Site has been conducted periodically since 1985. On a semi-annual basis, Site groundwater is monitored for the following parameters:

- Field parameters (temperature, turbidity, pH, and specific conductance);
- General minerals (chloride, nitrate, sulfate, total dissolved solids [TDS]);
- Metals (arsenic, chromium, iron, lead, mercury); and
- Volatile organic compounds (VOCs; list of 48 analytes).

A summary of analytical results detected at least once during the semi-annual groundwater program is provided in the following table.

Summary of Groundwater Quality

Class	Analyte(1)	Units	Count	Detects	Min.	Mean	Max.	Std. Dev.
General Minerals	Chloride	mg/L	175	169	1.0	11.1	110	11.3
	Nitrate as NO_3	mg/L	168	134	0.1	10.0	43	10.0
	Sulfate as SO_4	mg/L	162	161	2.0	135	690	111
Metals	Arsenic	µg/L	108	53	1.0	4.9	31	5.8
	Chromium	µg/L	108	3	7.3	5.6	24	2.8
	Iron	µg/L	168	119	12	2,628	42,000	6,254
	Lead	µg/L	108	9	2.1	2.5	5.0	1.8
	Mercury	µg/L	108	6	0.025	0.10	0.33	0.03
VOCs	1,2,4-Trichlorobenzene	µg/L	64	1	1.8	---	1.8	---
	Chloroform	µg/L	64	1	0.51	---	0.51	---
	Ethylbenzene	µg/L	67	1	1.0	---	1.0	---
	MTBE	µg/L	66	16	0.54	1.2	20	3.2
	Toluene	µg/L	67	2	6.4	0.4	6.4	1.9
	Total Xylenes	µg/L	66	3	1.8	0.6	7.1	0.9

(1) Statistics shown only for analytes detected at least once during semi-annual monitoring program.

Site groundwater was most recently monitored in December 2007 for the semi-annual monitoring program and six water quality parameters were detected above their primary or secondary maximum contaminant level (MCL) in at least one monitoring well as described below. Historical groundwater monitoring at the Site shows spatial variability in various inorganic constituents indicative of impacts from former Site operations. Trend analysis presented in the 2007 annual report (Brown and Caldwell, 2008b) does not show any clear rising or falling trends since landfill capping in 1996, except for slightly increasing general minerals in off-site well FCY-4 and slightly decreasing general minerals in wells FCY-5 and FCY-6. Concentrations in the most impacted well, FCY-8, have remained constant since the well was installed in 1992. A summary of the data from the December 2007 monitoring event is presented below.

- Arsenic: detected in only one well above the primary MCL of 10 micrograms per liter (µg/L; FCY-8 at 21 µg/L).

- Iron: detected in three wells above the primary MCL of 300 µg/L (FCY-2 at 1,900 µg/L; FCY-4 at 410 µg/L; and FCY-8 at 18,000 µg/L).

- Nitrate: detected in two wells above the primary MCL of 10 milligrams per liter (mg/L; FCY-6 at 14.6 mg/L; and FCY-9 at 13.7 mg/L).

- Sulfate: detected in only one well above the secondary MCL of 250 mg/L (FCY-2 at 260 mg/L).

- Specific Conductance: detected in two wells above the secondary MCL of 900 microSiemens per centimeter (µS/cm; FCY-3 at 910 µS/cm; and FCY-8 at 930 µS/cm).

- Total Dissolved Solids: detected in three wells above the secondary MCL of 500 mg/L (FCY-2 at 520 mg/L; FCY-3 at 610 mg/L; and FCY-8 at 610 mg/L).

On a 5-year basis, Site groundwater is monitored for the following parameters:

- Field parameters (temperature, turbidity, pH, and specific conductance);
- General minerals (bicarbonate, bromide, carbonate, chloride, fluoride, magnesium, nitrate – nitrogen, phosphate, potassium, sodium, sulfate, TDS);
- Metals (aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium, chromium VI, cobalt, copper, cyanide, iron, lead, manganese, mercury, molybdenum, nickel, selenium, silver, sulfide, thallium, tin, vanadium, zinc);
- VOCs (list of 66 analytes); and
- Semi-volatile organic compounds (SVOCs; list of 116 analytes).

Site groundwater was most recently monitored in December 2006 for the 5-year review monitoring program. General minerals and inorganic parameters were either within historical ranges or not detected. No VOCs or SVOCs were detected. The SVOC list includes polychlorinated byphenyls (PCBs), organochlorine pesticides, organophosphorous pesticides, and chlorophenoxy herbicides.

Groundwater impacts at the Site may be attributable to one or more of the following factors:

- Leachate infiltration due to the unlined landfill and reported disturbance of the pond liner;

- Reducing effects of the former sewage treatment plant pond sediments on groundwater chemistry (e.g., dissolution of natural iron and arsenic);
- Landfill gas effects (i.e., elevated bicarbonate); and
- Natural spatial variability.

Increasing concentrations to the north of the Site (i.e., from FCY-9 to FCY-8) may be attributable to one or more of the following factors:

- Thicker waste column and less groundwater separation in the former aeration pond;
- More leachate infiltration or landfill gas in the northern portion of the landfill; and
- Natural spatial variability.

2.4.6 Background

As discussed in Section 2.4.2, first groundwater beneath the landfill occurs within perched water developed within dredge tailings. Both FCY-3 and FCY-7 were installed in areas that have not been dredged and are completed within the Mehrten Formation. Assessment of depth to groundwater and the groundwater gradient strongly suggests that the groundwater at FCY-3 and FCY-7 is not hydraulically connected with the perched water system beneath the landfill. As such, these wells do not monitor background conditions for the landfill. However, it is important to note, that even if groundwater in the two systems are hydraulically connected, water elevations at FCY-3 and FCY-7 are significantly higher than beneath the landfill and therefore, potential impacts from the landfill would not migrate in this direction.

In June 2002, groundwater monitoring well FCY-8 was installed to provide an upgradient monitoring point; however, contact with the Mehrten Formation at FCY-8 was slightly lower than the contact at FCY-6. As such, groundwater in the northern portion of the Site trends away from the mound near FCY-6 and moves toward FCY-8. Based on this, there is no area near the landfill that would be in a location considered to be upgradient of the landfill.

Monitoring results of FCY-9 indicate former Site operations (i.e., as sewage treatment plant ponds and subsequently as a landfill) do not appear to affect groundwater in the southern portion of the Site. Therefore, concentration limits (CLs) presented in a separate document were based on groundwater results from alternative background monitoring point FCY-9.

2.5 Land and Water Use

Land and water use at the Site and within a 1-mile radius are provided below.

2.5.1 Water Use

There were no water wells, oil wells, or geothermal wells identified within one mile of the Site (EDR, 2007).

2.5.2 Land Use

Current land use within a 1-mile radius of the Site is provided in Figure 1-1. Land use includes recreational (e.g., Folsom Lake State Recreation Area), residential (e.g., Lake Natoma Shores development), commercial (e.g., Folsom Historic District), and industrial (e.g., Kikkoman soy sauce production facility). Currently, there is no agricultural or grazing activity within a 1-mile radius of the Site.

2.5.3 Groundwater Use

Based on a 2008 Department of Water Resources (DWR) survey, there are no water supply wells within a one-mile radius of the Site (Figure 2-8). The DWR survey did find a 1956 well log for an "industrial well" located 150 feet east of Main Avenue and 150 feet south of Greenback Lane in Orangevale. This well would be located approximately 1 mile west of the Site and 1/2 mile west of Lake Natoma (Figure 2-8). On the well log, the driller stated, "The well was dry from 68 feet to 107 feet." Reconnaissance conducted by Brown and Caldwell on February 27, 2008 of the area indicated that the area is developed and there is no trace of the well at the location stated on the well log.

There were also two wells of unknown use installed in 1948 on the south side of Bidwell Street near Reading Street, approximately 3/4 mile southeast of the Site. Reconnaissance conducted by Brown and Caldwell on February 27, 2008 indicated that the area is developed with an industrial complex, a storage facility, and small businesses. Mr. Scalzi, a long-time resident and owner of a 5-acre parcel where these wells would be located, was contacted and interviewed by Brown and Caldwell on February 29, 2008. He had no knowledge of any wells on his property or surrounding properties. He said he thought it was very likely that these wells were abandoned a long time ago.

All of the other wells provided by DWR within 1 mile of the Site are monitoring wells, remediation wells, and one cathodic protection well as shown on Figure 2-8. Properties with monitoring wells and remediation wells are represented on the figure as a single point even though all of those sites have multiple wells. There are no wells reported within 1,000 feet of the landfill, except the existing monitoring wells at the Corporation Yard Landfill. Residences and businesses in the landfill vicinity are connected to treated water supplied by the City of Folsom. The City gets its water from the Folsom Reservoir.

The City supplies treated water to the Corporation Yard, Veterans Hall, and Lake Natoma Shores development. There are no known restrictions on groundwater use at the Site and the adjacent properties.

2.6 Landfill Characteristics

Characteristics of the landfill cap, waste, and landfill gas are provided below and are based on investigation results and monitoring.

2.6.1 Summary of Investigation Results

Detailed investigation results are provided in Appendix A. From December 1985 through February 2008, the City of Folsom conducted the following investigation and monitoring activities:

- Drilled 12 exploratory borings;
- Installed 17 temporary landfill gas test probes;
- Installed nine groundwater wells for periodic monitoring;
- Installed six landfill gas wells for periodic monitoring;
- Excavated 43 exploratory test pits; and
- Collected over 180 groundwater samples, 150 landfill gas samples, and 20 soil samples for analysis.

2.6.2 Landfill Cap

In July 1996, the landfill cap was constructed that consists of three layers totaling approximately 4 feet:

- 12-inch vegetative soil layer;
- 12-inch clay layer; and
- 24-inch foundation layer.

The northern portion of the landfill cap features a 180-foot by 240-foot parking lot for City employee parking. The landfill cap in this area consists of four layers totaling approximately 4 feet:

- 2.5-inch asphalt concrete Type B;
- 10-inch aggregate base rock Class 2;
- 12-inch clay layer; and
- 24-inch foundation layer.

Details of the landfill cap and pavement are provided in Figure 2-4.

2.6.3 Nature and Extent of Waste

Based on the investigation results, the nature and extent of waste has been adequately characterized. Cross sections of the landfill are provided in Figures 2-9 and 2-10. The landfill can be divided into two basic areas: the main landfill area and the uncontrolled fill area.

- <u>Main Landfill Area</u>: the nature of the fill in this area generally consists mostly of soil with some concrete, asphalt, green waste, metal, and trash. The fill covers what appears to be a clay liner covering a plastic liner associated with the former sewage treatment plant ponds. The clay pond liner appears to have been disturbed and mixed with debris fill in some locations. The historical photograph in Figure 1-4 indicates a roadway through the center of the former ponds; however, a distinct separation between the former ponds was not identified during the investigations.

The extent of fill is shown in Figure 1-2 and is estimated at 140,000 square feet (ft^2; 3.2 acres). The maximum depth of fill is approximately 12 to 16 feet below grade (i.e., the top of the cap). The cap is approximately 4 feet thick; therefore, the fill layer is approximately 8 to 12 feet thick. Assuming the fill layer has a uniform thickness of 8 feet throughout the fill area, the approximate *in situ* fill volume is 42,000 cubic yards (yds^3). The approximate *in situ* volume of the cap materials is 21,000 yds^3.

- Uncontrolled Fill Area: the nature of fill in this area generally consists mostly of soil with some household waste such as newspaper, carpet, plastic bags, clothing, and tires. The fill in this area is less dense and more variable than the fill in the main landfill area.

  The extent of fill is shown in Figure 1-2 and is estimated at 50,000 ft^2 (1.1 acres). The maximum depth of fill is approximately 4 to 8 feet below grade. Assuming the fill depth is uniform at an average of 6 feet throughout the fill area, the approximate *in situ* fill volume is 11,000 yds^3.

Based on the estimates above, the total *in situ* volume of material associated with the cap and waste in both the main landfill area and the uncontrolled fill area is approximately 74,000 yds^3. Assuming 30% expansion upon excavation, the total ex situ volume of all excavated materials is approximately 96,000 yds^3. The bid documents will include design drawings of the existing conditions of the landfill. Land Development AutoCAD software by AutoDesk will be used during the contracting phase of the project to refine the material volumes and provide an Engineer's Estimate of Probable Cost.

2.6.4 Landfill Gas Monitoring

The landfill gas monitoring program consists of measuring methane concentration in six gas wells (GAS-1 through GAS-6) on a periodic basis. Methane measurements from July 1995 through December 2007 are summarized in the following table. Methane is typically either detected at low concentrations (i.e., less than 1%) or not detected at all.

Summary of Methane Measurements in Gas Wells

Gas Well ID	General Location	Count	Detects	Min. (%)	Mean (%)	Max. (%)	Std. Dev. (%)
GAS-1	South of landfill	26	2	0.00	0.08	2.00	0.39
GAS-2	Main landfill area	27	17	0.00	1.36	6.10	1.85
GAS-3	Main landfill area	26	5	0.00	0.01	0.20	0.04
GAS-4	North of landfill	25	13	0.00	0.63	4.45	1.19
GAS-5	Main landfill area	27	5	0.00	0.01	0.05	0.02
GAS-6	West of landfill	26	1	0.00	0.0004	0.01	0.002

2.7 Target Parameters

Target parameters to evaluate during clean closure activities are presented in this section based on the Site characterization information.

2.7.1 Groundwater

Former use of the Site for sewage treatment plant ponds and subsequently for the Corporation Yard landfill appears to have impacted Site groundwater and several water quality parameters are currently above primary or secondary MCLs in one or more Site wells: arsenic, iron, nitrate, sulfate, specific conductance, and TDS. Groundwater concentration limits (CLs) for these parameters are proposed in a separate document.

The 2008 semi-annual groundwater monitoring event scheduled for June 2008 will be conducted per the current MRP prior to commencing construction. Following construction, limited semi-annual groundwater monitoring will be conducted to compare results to CLs. Statistical trend analysis will be performed on pre- and post-closure data. Upon evaluation of these post-closure monitoring results, the RWQCB will rescind the WDRs.

2.7.2 Soil/Solid Media

The landfill waste and former landfill sewage treatment plant pond liner will be removed during construction and there are no indications that underlying dredge tailings have been impacted by Site use. The target parameters in soil/solid media to evaluate during clean closure activities, therefore, are primarily based on elevated groundwater parameters:

- Metals;
- Soluble nitrate as NO_3; and
- Soluble sulfate as SO_4.

These target parameters will be incorporated into the confirmation sampling and analysis described in Section 4.1.

2.7.3 Ambient Air

The waste in the Corporation Yard landfill contains some decomposable green waste (e.g., tree stumps/branches, lumber) and methane is typically detected at low concentrations or not detected at all in semi-annual monitoring of the gas wells. Waste containing VOCs is not anticipated to be present in the landfill based on previous investigations. In addition, the waste is not expected to generate hydrogen sulfide. However, monitoring for landfill gases such as methane, total VOCs, and hydrogen sulfide at landfills is a standard health and safety precaution for on-site workers. General construction activities such as excavation and grading have the potential to temporarily increase airborne concentrations of dust. Target parameters in soil/solid media (i.e., metals) may be disturbed during construction and temporarily become suspended in air. According to U.S. Geological Survey maps, no naturally occurring asbestos is present within a mile of the Site; however, old landfills have the potential to contain asbestos containing building materials (ACBM). The target parameters in ambient air to evaluate during clean closure activities are:

- Methane;
- Total VOCs;
- Hydrogen Sulfide;
- Dust;
- Metals; and
- Asbestos.

These target parameters will be incorporated into the air monitoring described in Section 3.3.1.

2.8 Cleanup Goals

Since clean closure involves the removal of all solid waste and impacted soil, cleanup goals are limited to soil/solid media. As part of the revised WDRs from the RWQCB, groundwater CLs will be developed and monitoring will continue following the completion of clean closure activities. Cleanup goals for in soil/solid media are proposed in a separate document. The cleanup goals will be developed in part from statistical analysis of the background soil sampling results from the pre-design field investigation conducted in February 2008 (Brown and Caldwell, 2008a).

3

BROWN AND CALDWELL

3.0 EXCAVATION AND WASTE MANAGEMENT

This section presents the plan for excavation and waste management. This section describes responsibilities of: the construction contractor (Contractor), the Contractor's surveyor; the project engineer (Brown and Caldwell); and the construction manager (Brown and Caldwell).

3.1 Health and Safety

The health and safety of the community and Site workers during clean closure construction activities are of primary concern. Health and safety practices to be implemented during construction include preparation of a health and safety plan (HASP) and excavation plan, traffic control, and air monitoring.

Each contractor and subcontractor on Site will be responsible for the health and safety of their own employees during construction. A HASP will be developed by each contractor and subcontractor that identifies anticipated Site hazards and required personal protective equipment (PPE) associated with each construction activity. In February 2008, a HASP was prepared that governs the activities of Brown and Caldwell personnel at the Site during clean closure (Brown and Caldwell, 2008c). The HASP will be available at the Site during construction.

In addition to the HASP, the Contractor will be required to submit a detailed excavation plan before excavation showing the design of shoring, bracing, sloping or other provisions to be made for worker protection from the hazard of caving ground during the excavation of any trench or excavations five feet or more in depth. If the excavation plan varies from shoring system standards, the excavation plan will be required to bear the signature of a civil engineer registered in the State of California.

Construction activities will involve using public rights-of-way and therefore, appropriate measures will be implemented to minimize potential traffic concerns. Equipment decontamination, dust suppression, and other precautions will be implemented to minimize potential exposure to waste or impacted soil.
Air monitoring and dust suppression for all exposed materials during Site construction will be performed. This includes monitoring for and controlling dust on haul roads, areas where waste will be consolidated, areas where waste will be excavated, and staging areas. Measures to minimize fugitive dust from exposed or un-vegetated cover soils will also be implemented. Air monitoring will be conducted throughout construction to ensure that dust emissions meet the minimum health and safety requirements to Site workers and the community.

3.2 Community Relations

The community surrounding the Site includes members of the Folsom Veterans Hall, occupants of the surrounding residences (e.g., the Lake Natoma Shores development), City employees at the Corporation Yard, and recreational users of the East Lake Natoma Multi-purpose Trail (and the greater Folsom Lake State Recreation Area). Outreach to the community during the project will include neighborhood meetings, public notices, a project website, and signs. The Community Relations Plan is provided in Appendix D.

3.3 CEQA Mitigation Measures

The mitigation measures incorporated into the project as a result of the CEQA Initial Study findings are summarized below.

3.3.1 Air Monitoring

The Contractor will maintain proper emissions systems on construction vehicles and comply with emissions standards for vehicles. The Contractor will implement fugitive dust control measures specified by the City. An Air Monitoring Specialist, independent of the Contractor, will implement a monitoring program for methane, total VOCs, hydrogen sulfide, dust, metals, asbestos, and meteorological parameters during construction. The Air Monitoring Plan is provided in Appendix E and includes a combination of monitoring near excavations with real-time, hand-held meters and monitoring at the perimeter with fixed equipment.

3.3.2 Biological Resources Monitoring

The Contractor will implement the avoidance and protection measures specified by U.S. Fish and Wildlife Service to protect the elderberry shrub on the southern portion of the Corporation Yard property. A qualified biologist will perform pre-construction surveys for the presence of special-status bird species or any nesting bird species within 500 feet of proposed construction areas if construction activities will occur during the nesting season. If active nests are identified in these areas, the California Department of Fish and Game will be consulted to develop measures to avoid take of active nests prior to commencing construction. If construction requires removal of Protected Trees or ground disturbance within Protected Zones of Protected Trees, a City Tree Permit will be obtained before any construction activity occurs. Compensatory mitigation for loss of tree resources will be implemented according to the City Tree Ordinance.

3.3.3 Cultural Resources Monitoring

A qualified archaeologist will be present to monitor all ground-breaking activities on the portions of the Site not previously disturbed or developed. If any archaeological, cultural, historical resources, artifacts or other features are discovered during the course of construction anywhere on the Site, work will be suspended in that location until a qualified professional archaeologist assesses the significance of the discovery and provides consultation with City staff, the Heritage Preservation League, and the Folsom Historical Society. Appropriate mitigation, as recommended by the archaeologist, will be implemented. If agreement cannot be reached, the Historic District Commission will determine the appropriate implementation measure.

3.3.4 Hazardous Materials Management

Hazardous materials may consist of: 1) products used by the Contractor to perform the Site remediation; and 2) wastes uncovered during landfill excavation.

Site remediation activities will require the temporary storage of some hazardous materials on-site. They may consist of materials that are commonly used at construction sites, including:

- Vehicle fluids such as oil, grease, fuel, and coolant;
- Compressed gases;
- Asphaltic emulsions;
- Cement and sub-base materials;
- Paints, solvents, glues, and thinners;
- Landscaping chemicals such as fertilizers and herbicides; and
- Treated lumber.

The Contractor will be required to store and use hazardous materials in a manner that is protective of the public, on-site workers and the environment. The Contractor will present its proposed storing, handling and spill contingency methods in its HASP and its Construction Storm Water Pollution Prevention Plan (SWPPP). These plans will require that on-site staff is appropriately trained in identifying, monitoring for, and responding to releases of hazardous materials.

Although no hazardous materials are known to have been placed in the landfill, the Contractor will monitor for materials that may potentially pose an imminent health or safety hazard. Monitoring will include inspecting uncovered waste for discoloration, free liquids, and containers (e.g., chemical sacks, tanks, cylinders and drums). Using a photoionization detector (PID), the construction manager will screen ambient air during waste excavation for VOCs. If a material is encountered that is deemed as an imminent threat to human health or the environment (e.g., an unlabeled, bulging drum), then the Contractor will cease excavation and contact the City's Hazardous Materials Division.

Wastes that are removed from the landfill will be segregated, stockpiled and characterized for off-site disposal. Some wastes may be characterized as hazardous waste per 22 CCR §66261. Methods for the segregation and characterization of waste and the management and transportation of hazardous waste are described in Section 3.6.

3.3.5 Storm Water Pollution Prevention

The Site construction will be subject to the requirements of the SWRCB National Pollutant Discharge Elimination System (NPDES) WDRs for discharges of storm water associated with industrial activities and/or general construction. The Contractor will be responsible for compliance with these permit requirements, which include filing a Notice of Intent (NOI) to discharge storm water associated with construction activities and preparing a Construction SWPPP.

Prior to construction, the Contractor will be responsible for installing erosion and sedimentation control devices to minimize the potential for discharges of waste and impacted storm water during construction. These controls will be described in detail in the Construction SWPPP and include:

- Installation of silt fencing and sedimentation barriers;
- Slope minimization;
- Stabilization of temporary waste stockpiles;
- Use of plastic tarps, mulching, or hydro-seeding on areas that are not being actively graded or completed and will be exposed for extended periods (i.e., longer than 45 days);
- Construction and stabilization of storm water ditches and down chutes; and
- Planting of permanent native vegetative cover when construction is complete.

Additional prevention measures include performing heavy equipment fueling and storing hazardous materials in designated areas and parking vehicles and locating waste stockpiles away from storm water drainage points.

Temporary storm water pollution prevention controls must remain in place until restoration is complete and final vegetation is fully established. If remediation activities span more than one construction season, erosion and sedimentation controls in the wet season between periods of construction will need to accommodate greater volumes of storm water. Requirements to winterize the Site between construction seasons are further discussed in Section 6.2.

3.3.6 Noise Control

The Contractor will comply with the City Noise Control Ordinance, General Plan Noise Element, and Standard Construction Specifications. Hours of construction operation will be limited to 7:00 a.m. to 6:00 p.m. on weekdays and 8:00 a.m. to 5:00 p.m. on Saturdays. Construction equipment will be muffled and shrouded to minimize noise levels.

3.3.7 Traffic Control and Temporary Parking

The Contractor will submit a Traffic Control Plan for City review and approval prior to commencing construction. Minimum requirements for traffic control will be identified in the design specifications and include: haul routes, anticipated times and frequency of hauling, equipment decontamination, truck tarping procedures, and roadway cleaning practices. To avoid disturbing residents of the Lake Natoma Shores development, the Contractor must access the Corporation Yard via the Leidesdorff Street entrance and avoid the Forrest Street/Veterans Way entrance. Since the clean closure project involves the demolition of the parking lot on the northern portion of the landfill, the City will arrange for alternate employee parking near the Site at the newly constructed parking structure on

Leidesdorff Street in the Folsom Historic District. After completion of clean closure activities, the parking lot will be replaced at the northern portion of the Site.

3.4 Site Preparation

Prior to commencing excavation, the Contractor will prepare the Site by:

- Protecting existing structures;
- Providing Site security;
- Establishing temporary construction facilities and staging areas;
- Removing selected monitoring wells; and
- Demarcating excavation limits.

3.4.1 Protection of Existing Structures

The Contractor will be responsible for coordinating with utility owners, Folsom Department of Public Works, and natural resource agencies prior to construction such that these activities are planned for in the construction schedule and do not delay the completion of the overall project. These activities include demarcation and protection of existing Site structures prior to construction.

- Utilities: The Contractor will be responsible for protecting all utilities and will not assume that utilities are absent if not shown on the design drawings. The Contractor will arrange for the location and marking of underground utility lines which include, but may not be limited to: water, sanitary sewer, storm sewer, electrical, natural gas, telephone, and cable. The Contractor will request and review available as-built drawings from the Folsom Department of Public Works and applicable utility agencies and companies. The Contractor will also be responsible for notifying Underground Service Alert (USA) prior to any digging. A USA notification ticket will remain active for the duration of excavation. Once the utilities are marked, the Contractor will take the necessary precautions to prevent disrupting and damaging the utility lines during construction. Utilities that are shown to be within 5 feet of the proposed excavation areas must be visually located by potholing using manual excavation tools. The Contractor's surveyor will survey the underground utilities identified by the Contractor. The Contractor will attempt to work around utilities and prevent utility outages and service disruptions.

  Known utilities include the storm sewer near the entrance to the employee parking lot on the landfill cover and lines that run along adjacent City streets. No underground lines are known to cross through the waste in the main landfill area or the uncontrolled fill area. For any utilities identified in the waste, the Contractor will consult with the project engineer regarding procedures to preserve or excavate and restore the utility backfill.

Prior to construction, the Contractor will submit a Utility Shut-off and Contingency Plan. This plan must outline procedures and response actions for shutting down utilities and controlling releases accidentally caused by construction activities and identify the necessary emergency notifications.

- Groundwater Monitoring Wells: Seven groundwater monitoring wells (FCY-2 through FCY-8) will remain during construction and will be used to monitor groundwater quality after construction. As explained in Section 3.4.4, FCY-9 is in the excavation footprint and will be abandoned prior to construction. The Contractor will be responsible for protecting the remaining wells during construction and for repairing any damage to the wells caused during construction. The completion of these wells may need to be lowered to conform to the final grading plan. The Contractor's surveyor will record new top-of-casing elevations as part of the record drawings.

- Un-Impacted Areas: The Contractor's surveyor will demarcate the horizontal extent of excavation based on the design drawings. If necessary, the Contractor will install barriers to prevent uncontrolled entry of equipment into areas outside the excavation limit (i.e., un-impacted areas). The Contractor will also provide sufficient dust control and equipment decontamination to prevent contaminating un-impacted areas. If the construction manager observes a condition that may result in contamination of an un-impacted area, the condition will be documented and the area may be sampled as described in Section 4.1.

  It may be necessary for the Contractor to stage equipment or traverse an un-impacted area to access areas proposed for excavation or to transport waste. Roads, staging areas, and remediation activities that occur in un-impacted areas must be pre-approved by the project engineer. Confirmation sampling and analysis will be performed in these areas to ensure that these portions meet clean up goals after Site remediation.

3.4.2 Site Security

The Contractor will be responsible for Site security during construction and will restrict access to the Site to authorized personnel. Fencing currently surrounds the Corporation Yard property; however, the Contractor may remove portions of the existing fencing during construction. The Contractor will erect temporary construction fencing as necessary to secure the construction area and prevent unauthorized access. Temporary fencing will be secured across ingress and egress points when construction is not actively being performed. Signs will be posted at 50-foot intervals to prohibit trespassers.

3.4.3 Temporary Construction Facilities and Staging Areas

Temporary construction facilities and staging areas will most likely consist of a Contractor equipment and material lay down area, a construction trailer that contains a temporary project office, utilities that support the office and construction (e.g., water tanks, generators, worker sanitation facilities), stockpiles of excavated waste destined for off-site recycling and disposal, and stockpiles of clean soil destined for backfill after remediation. These facilities will probably be located in two areas shown on Figure 3-1: 1) the small paved parking area between the landfill parking lot and the Corporation Yard buildings on the northern part of the Site; and 2) the uncontrolled fill area. The northern parking area is the best location for the Contractor's office trailer and other support utilities, soil and waste stockpiles and truck loading because it is closest to the point of ingress and egress for the Site. This area is small, however, and facilities for these activities may overflow onto the landfill parking lot during the early stages of remediation. As remediation progresses from south to north, the uncontrolled fill area will undergo confirmation sampling. Once the area is cleared based on sample results, the Contractor may relocate some of the construction facilities and staging to this area to make the landfill ready for excavation.

Temporary haul roads will be established on Site during remediation to enhance construction efficiency. They will be located to allow movement of waste from the excavation areas to the staging stockpiles and the movement of clean fill from the stockpiles to the areas proposed for backfill. The road alignments will change as the excavation and staging areas change. To the extent feasible, the Contractor will limit waste movement to parts of the Site that have not yet been remediated. Road surfaces will consist of the existing parking lot pavement, gravel, and moistened soil so that dust from construction traffic is properly controlled. The haul road that provides construction access to the project area will remain fixed throughout the remediation.

The Contractor will propose the final location and layout of temporary construction facilities and staging areas to the project engineer prior to mobilization. The Contractor will establish haul roads or crossings as necessary according to the design drawings and specifications. Confirmation sampling and analysis will be completed in these areas at the completion of construction to assure adequate Site cleanup.

3.4.4 Abandonment of Landfill Gas/Groundwater Monitoring Wells

The landfill gas wells (GAS-1 through GAS-6) will no longer be needed since the landfill will be removed. Groundwater monitoring well FCY-9 is in the excavation footprint and will be abandoned prior to construction. If required by the RWQCB for post-closure monitoring, FCY-9 will be replaced following completion of clean closure activities. The City will obtain well abandonment permits from the County of Sacramento. The wells will be abandoned by methods approved by the County of Sacramento.

3.4.5 Demarcation of Excavation Area

The Contractor's surveyor will be responsible for performing the necessary construction surveying tasks outlined in the design drawings and specifications. These activities include, but may not be limited to, locating control points, and demarcating the limits of waste and excavation areas and property boundaries.

3.5 Excavation

This section describes the anticipated approach for excavation at the Site including the sequence, removal rate, and timeframe. The Contractor may modify the approach as necessary given that the contents of the landfill are not completely known.

3.5.1 Excavation Sequence

The general anticipated sequence of excavation is to remove waste from the southern portion of the Site to the northern portion as outlined below.

1) Uncontrolled fill area: excavation and off-site disposal of waste. Significant recycling of materials in this area is not anticipated due to the low density and variability of waste.
2) Main landfill area: excavation and on-site segregation of waste. Large pieces of concrete, asphalt, vegetation, and metal will likely be recycled off-site. Refuse and soil fill mixed with refuse will likely be disposed off-site. The landfill cap soil will likely be used for final grading.
3) Landfill parking lot: removal of 1-foot thick parking lot. The asphalt concrete pavement will likely be recycled off-site and the aggregate base will likely be stockpiled on-site. Removal and on-site stockpiling of the 4-foot thick cap and foundation soil.

Additional details on the excavation sequence will be determined by the Contractor.

3.5.2 Excavation equipment, removal rate and timeframe

The Contractor will use a variety of equipment to perform the excavation and other remedial activities. The following table presents a list of equipment that may be used. Actual equipment will depend on what is available during remediation.

The excavation removal rate for each excavation area depends upon the quantity and type of excavation equipment selected by the Contractor. The estimated excavation timeframe for each excavation area is provided in the following table. The total excavation timeframe is estimated at 5 to 9 weeks. Accounting for mobilization/de-mobilization, confirmation sampling, and other construction activities, the construction phase of the project is anticipated to last approximately 3 months.

Example Equipment for Construction		
Equipment	**Example Model**	**Potential Application**
Excavator	CAT 330D L	Excavating soil and waste and direct-loading into trucks
Off-Highway Truck (Dump Truck)	CAT 730 Articulated	Moving waste and soil within the Site
Backhoe	CAT 450E	Excavating and loading waste and soil and moving of equipment and materials within the Site
Skid Steer	CAT 256C	Excavating and loading waste and soil and moving of equipment and materials within the Site
Bulldozer	CAT D6	Maintaining stockpiles and finish grading
Grader	CAT 140M	Finish grading
Roller	CAT CS -323C	Compacting sub-base of new parking lot after remediation
Paver	CAT AP-800D	Paving new asphalt parking lot

Estimated Excavation Timeframe		
Excavation Area	**Volume**	**Timeframe**
Uncontrolled Fill Area	11,000 yd^3	1-3 weeks
Main Landfill Area Waste	42,000 yd^3	3-6 weeks
Landfill Cap/Parking Lot	21,000 yd^3	< 1 week

3.5.3 Groundwater, surface water, and leachate management

Groundwater is not anticipated to be encountered during excavation. The elevation of the bottom of the landfill is approximately 137 feet MSL (based on a landfill cap elevation of 153 feet MSL and 16-foot maximum depth of fill). In December 2007, groundwater elevation (excluding FCY-3 and FCY-7 completed in the Mehrten Formation) ranged from 128.00 to 129.34 feet MSL; therefore, groundwater is approximately 8 to 9 feet below the bottom of the landfill. However, some water may be trapped in the landfill above the settling pond liner after periods of heavy rain, especially in the southern portion of the landfill (i.e., near test pit TPB-4). The Contractor will pump water that is observed in Site excavations to the extent practical and will contain the pumped water on-site for proper characterization and disposal. Surface water/leachate management practices are described in Section 3.3.5.

3.5.4 Landfill Gas Monitoring

Real-time monitoring for dust and landfill gases (methane, VOCs, and hydrogen sulfide) will be conducted during construction as described in the Air Monitoring Plan provided in Appendix E. The City shall notify the LEA if at any time landfill gas concentrations are noted at the Lower Explosive Level (LEL) for methane of 5% by volume.

3.6 Segregation and Disposal

As waste is excavated, the Contractor will stage it in a pre-determined area for segregation, stockpiling, and characterization to assess its final destination. As described below, excavated material may be backfilled on-site as clean soil or base rock or loaded for transport to an off-site recycling or disposal facility.

3.6.1 Waste Segregation

The Contractor will inspect the waste as it is excavated and delivered to the staging area and segregate it based on observations of its content. The waste will be segregated into the categories described below.

Materials that potentially present an imminent threat to human health or the environment: Based on historical Site documents, it is unlikely that such materials will be encountered. Nevertheless, the Contractor will inspect waste as it is uncovered for sealed containers (e.g., chemical sacks, tanks, cylinders, and drums). If necessary, the Contractor will consult with the City's Hazardous Materials Division regarding segregation, storage, and disposal methods.

Household hazardous waste: No known household hazardous waste (i.e., universal waste or principal threat waste) is known to be in the landfill. However, the Contractor will inspect excavated refuse and soil for household hazardous items including: thermometers and thermostats; batteries; lamps and fluorescent bulbs; electronic components and devices (e.g., televisions and household appliances); asbestos-cement pipe; and containers of herbicides, pesticides, cleaners, paints, solvents and petroleum products. These items will be segregated and transferred to the Folsom Household Hazardous Waste Program.

Recyclable materials: The Contractor will remove materials from the waste that can be salvaged for reuse or recycling if it is determined to be economical. These materials include the parking lot asphalt pavement and aggregate base, concrete and asphalt debris, scrap metal, tires and vegetation debris. The parking lot materials may be reused on-site for the construction of the new parking lot, and the other materials will likely be transported to the off-site facilities presented in Section 3.6.5. Known quantities that can be recycled or reused are listed below.

- Asphaltic concrete: Approximately 300 yds^3 (*in situ* volume) of asphaltic concrete surface will be excavated from the portion of the existing parking lot on the landfill cover. This material, along with an unknown quantity of asphaltic concrete waste that can be cost-effectively separated from waste excavated from the landfill, will be transported to an off-site recycling facility.

- Base rock: A 10-inch thick layer of aggregate road base underlies the existing parking lot pavement. The Contractor will attempt to segregate this base rock, a quantity of approximately 1,300 yds^3 (*in situ* volume), and stockpile it on-site for future use in the replacement parking lot.

Refuse: Previous investigation information indicates that buried Site refuse consists of discarded construction debris, and garbage similar to residential household disposal (e.g., carpet, plastic, and newspaper). Materials that can be classified as household hazardous waste will be segregated from the refuse and transferred to the Folsom Household Hazardous Waste Program. The Contractor will segregate refuse from soil only if it is deemed economical.

Mixed refuse and soil: Mixed refuse and soil that cannot be economically separated will be stockpiled. As it is excavated, the Contractor will inspect for household hazardous waste. Waste that appears chemically saturated or yields high VOC readings is not expected to be encountered. However, if such a waste is observed, it will be segregated and stockpiled separately from other mixed refuse and soil.

Soil: Soil will be segregated as it is excavated to maximize the volume that can be backfilled on-site during Site restoration. Returning clean soil as backfill to excavated areas will conserve fuel and off-site landfill space, reduce truck traffic and provide cost savings to the City. Excavated soil will most likely consist of the landfill cover, soil that was disposed in the landfill, and soil that is excavated from near or below buried waste to meet Site cleanup goals. The Contractor will segregate these soils as described below.

- Soil from the landfill cover will be set aside by the Contractor as potentially clean soil for Site restoration. The landfill cover consists of approximately 21,000 yds^3 (*in situ* volume) of soil in a 12-inch vegetative layer, 12-inch clay layer, and a 24-inch foundation layer. Because the lower 6 inches of the foundation layer is potentially in contact with waste, only the vegetative and clay layers and the upper 18 inches of the foundation layer (a total of approximately 18,000 yds^3 [*in situ* volume]) will be set aside as clean soil. The lower 6 inches, approximately 3,000 yds^3 (*in situ* volume), will be segregated as soil from within the landfill or mixed refuse and soil, depending on its refuse content.

- Soil from within the landfill that contains no visible refuse or contains refuse that can be economically separated will be carefully excavated and stockpiled for characterization to determine if it is to be backfilled on-site or disposed at an off-site landfill as described in Section 3.6.3.

- Soil excavated from adjacent to or beneath the landfill and uncontrolled fill area to achieve site cleanup goals will be segregated for off-site disposal. This soil will not be backfilled on-site.

It is not expected that any soils will be chemically saturated or yield high VOC readings. However, soil that exhibits these characteristics will be segregated and characterized for potential off-site disposal.

Waste segregated as described above will be estimated and documented so that the City can claim landfill diversion credit for reused materials and recycled wastes per the Integrated Waste Management Act.

3.6.2 Waste Stockpiling

Wastes will be temporarily stored on-site in stockpiles after they are excavated and until they are removed for reuse, recycling, or disposal. Stockpiles will be managed to control odors and prevent dust emissions and storm water impacts. They will be located away from drainage courses and storm water drop inlets. The Construction SWPPP will provide a detailed plan for the location and maintenance of the stockpiles.

Stockpiles will be regularly inspected to verify that stockpile maintenance best management practices (BMPs) are in place and working effectively. The Contractor will cover stockpiles with plastic sheeting and sandbags if they yield high VOC readings or strong odors. Stockpiles will be encircled with berms and wattles to prevent run-on contact. Water and other dust suppressants will be applied to the stockpiles to prevent wind erosion. The Contractor will be responsible for ensuring that the stockpiles are stabilized from wind erosion at night and during non-construction days.

3.6.3 Waste Characterization Plan

As described in Section 3.6.1, waste will be screened visually and with a PID and segregated as it is excavated. Waste will be characterized for reuse, recycling or disposal into several categories, including household hazardous waste; recyclable materials, refuse, mixed refuse and soil; and soil. The waste characterization process is presented in Figure 3-2 and described below.

- **Household Hazardous Waste:** The Contractor will document types and volumes that are recovered and transferred to the Folsom Household Hazardous Waste Program. No sampling will be performed to characterize this waste.
- **Recyclable materials:** The Contractor will document volumes and destinations for materials that are salvaged for reuse or recycling. These materials will not be sampled for characterization.
- **Refuse:** Stockpiled refuse that does not contain significant soil and that has been visually screened for household hazardous waste will not be

sampled for characterization. The Contractor will request a local Class III facility to accept it as non-hazardous waste.

- **Mixed refuse and soil:** Mixed refuse and soil will be characterized for off-site landfill disposal. The waste characterization described below is in general accordance with characterization requirements of local Class III landfills.

  The Contractor will place the waste in on-site stockpiles with maximum volumes of approximately 750 cubic yards. After a stockpile reaches its final volume, the Contractor will collect one four-point composite sample. The stockpile will be divided into four quadrants, and each quadrant sample, or aliquot, will be collected from the approximate center of the quadrant and so the sample depth is at least one foot beneath the stockpile surface. Samples will be collected into stainless steel or brass tubes that are sealed with Teflon sheeting and plastic caps or laboratory-supplied glass jars. Samples that will be analyzed for VOCs will be collected with samplers that comply with U.S. Environmental Protection Agency (EPA) Method 5035. Samples will be labeled, refrigerated and transported under chain-of-custody to a laboratory certified by the California Department of Public Health Environmental Laboratory Accreditation Program.

  The samples will be analyzed in accordance with the following table. The laboratory will combine the four-point composite samples to achieve the analysis to waste volume ratios indicated and as pre-approved by the potential receiving landfill.

Proposed Laboratory Analyses for Mixed Refuse and Soil

Analyte	Laboratory Method	Waste Volume Represented by Each Laboratory Analysis (cubic yards)
Asbestos	NIOSH 7400	750
Herbicides, chlorophenoxy	EPA 8151A	3,000
Pesticides, organophosphorous	EPA 8141A	3,000
Metals (CAM 17)	EPA 6010B/6020/7471B	750
pH	EPA 150.1	750
PCBs	EPA 8082	1,500
SVOCs	EPA 8270C	1,500
Specific conductance	EPA 120.1	750
Total petroleum hydrocarbons in gasoline, diesel and motor oil ranges	EPA 8015M	750
VOCs	EPA 8260B	750

As shown in Figure 3-2, additional solubility testing, including the California Waste Extraction Test (WET) using de-ionized water or citric acid and/or the Toxicity Characteristic Leaching Procedure (TCLP), may be performed on the samples pending the laboratory results and the proposed disposal facility. After the characterization is complete, mixed refuse and soil will be transported to an off-site landfill. Depending on the waste classification as determined by the analytical results, the waste will be disposed at a Resource Conservation Recovery Act (RCRA) Subtitle C landfill, a Class I landfill, a Class II landfill or a Class III landfill.

- **Soil:** Soil will be stockpiled in piles with maximum volumes of approximately 750 cubic yards each and will be inspected for refuse. If refuse is visible in soil and it is not economical to remove the refuse or if the soil appears to be geotechnically unsuitable as Site backfill, then the soil will be characterized as "mixed refuse and soil" as described above. Soil from the cover, soil from within the landfill, and soil from beneath or adjacent to the landfill and uncontrolled fill area will be stockpiled separately.

  The characterization process for soil is generally consistent with the *Clean Imported Fill Material Information Advisory*, published by the DTSC in October 2001. It also generally complies with the characterization requirements of Class III landfills so that minimal additional sampling would be needed if a stockpile sample fails to meet Site cleanup goals.

  The Contractor will collect stockpile samples as described for mixed refuse and soil. Samples from the soil stockpiles will be analyzed in accordance with the following table. The laboratory will combine the four-point composite samples to achieve the analysis to waste volume ratios indicated.

Proposed Laboratory Analyses for Soil

Analyte	Laboratory Method	Waste Volume Represented by Each Laboratory Analysis (cubic yards)
Asbestos	NIOSH 7400	750
Herbicides, chlorophenoxy	EPA 8151A	3,000
Pesticides, organophosphorous	EPA 8141A	3,000
Metals (CAM 17)	EPA 6010A/7471B	750
Soluble Nitrate as NO_3*	EPA 300	750
pH	EPA 150.1	750
PCBs	EPA 8082	1,500
SVOCs	EPA 8270C	1,500
Specific conductance	EPA 120.1	750
Soluble Sulfate as SO_4*	EPA 300	750
Total petroleum hydrocarbons in gasoline, diesel and motor oil ranges	EPA 8015M	750
VOCs	EPA 8260B	750

* = Laboratory will prepare sample in accordance with the California Waste Extraction Test using a de-ionized water extract prior to analysis.

If the results for cover soil or soil from within the landfill indicate that analyte concentrations satisfy Site cleanup goals, then the soil will be backfilled on-site. If analyte concentrations do not meet Site cleanup goals, then the soil will be disposed at an off-site landfill. Additional laboratory testing may be performed as required by the landfill. Soil that is excavated to achieve Site cleanup goals adjacent to or beneath the landfill and uncontrolled fill area will not be backfilled on-site and will be disposed off-site.

3.6.4 Waste Transportation

Once a waste is characterized and acceptance for the waste has been secured by an off-site facility, the Contractor will load it into trucks. For hazardous waste, a hazardous waste manifest will be completed, and a hazardous waste-licensed hauler will be hired for each load. Prior to departure, trucks will be tarped, and tires will be dry-brushed as necessary to remove visible soil. Waste and soil in the truck bed will be sufficiently moist to prevent dust production during transport. Trucks will travel to and from the Site during times that are pre-approved by the City and will follow pre-determined routes to the recycling and disposal facilities.

3.6.5 Waste Disposal or Final Disposition

Off-site recycling and disposal facilities will be pre-approved by the City. The Contractor will notify the facility of scheduled waste shipments. The anticipated final disposition of waste is provided in the following table.

Anticipated Final Disposition of Waste

Waste Type	Facility	Distance from Site
Asphaltic concrete, concrete & dredge tailings	Teichert Aggregates, Inc. 3417 Grant Line Road, Rancho Cordova (916) 768-8847	9 mi
Metal Scrap	Schnitzer Steel, Inc. 12000 Folsom Boulevard, Rancho Cordova (916) 985-4810	5 mi
Refuse, Vegetation, Non-haz. Waste, Tires, Batteries, Appliances & Vehicles	Kiefer Landfill/Sacramento County Waste Mgt. 12701 Kiefer Boulevard, Rancho Murrieta (916) 875-5555	13 mi
Designated Waste	Forward Landfill/Allied Waste, Inc. 9999 South Austin Road, Manteca (209) 982-4298	72 mi
Hazardous Waste	Kettleman Hills Landfill/Waste Management, Inc. 35251 Old Skyline Road, Kettleman City (559) 386-9711	240 mi

3.7 Construction Deliverables and Quality Assurance

Deliverables for the project consist of City deliverables and Contractor deliverables as summarized below. A copy of each deliverable will be provided to the regulatory agencies upon request.

3.7.1 City Deliverables

Deliverables to be prepared by the City/project engineer include bid documents (i.e., design drawings and specifications), cost estimate, and the Clean Closure Results Report.

- Design Drawings: the following sheets are anticipated in the drawing set.
  - Cover Sheet (engineer signature/stamp, project vicinity & location)
  - Index of Drawings, Abbreviations and Legend
  - Existing Conditions (existing topographic contours, survey monuments, property and project boundaries, utilities, pavement, wells and protected habitat)
  - Site Preparation and Demolition Plan (Contractor staging area, features to be demolished)
  - Excavation Plan (plan view of anticipated limits of excavation)
  - Cross Sections (3 sheets illustrating cross sectional views of excavation limits)
  - Final Grading Plan (final topographic contours and features)
  - Parking Lot Layout (plan view of replacement parking lot)
  - Details (2 sheets illustrating fence construction, well protection, drainage features, and paving details)

- Design Specifications: the following topics are anticipated in the specification set.
  - General Requirements (health and safety, submittals, construction progress schedule, work sequence, dust control, air emissions and noise control, stormwater pollution prevention, security, traffic control, excavation plan, etc.)
  - Site Work (protection of existing features, demolition, excavation, segregation, stockpile management, stockpile characterization and determination of disposal/reuse, transportation and disposal, confirmation sampling, revegetation, erosion control, etc.)

- Cost Estimate: the project engineer will provide an Estimate of Probable Construction Costs that is based on volumes of waste estimated from previous investigations.

- Clean Closure Results Report: see Section 4.2.

3.7.2 Contractor Deliverables

Deliverables to be prepared by the Contractor include the following items.

- Health and Safety Plan (includes Utility Shut-off and Contingency Plan)
- SWPPP
- Construction Schedule
- Construction Sequencing Plan
- Environmental Management Plan (dust control, protection of trees, etc.)

- Traffic Control Plan
- Excavation Plan
- Winterization Plan
- Final Record Drawing survey package (monitoring wells, fence, parking lot, final grade, etc.)
- Laboratory reports (includes chains-of-custody)
- Manifests and landfill acceptance forms
- Material submittals (hydroseed mix, geotextile, gravel, soil binders, dust suppressing chemicals, fencing, concrete, etc)
- Work Area Security Protocol
- Warranties and bonds

3.7.3 Quality Assurance

CQA procedures will be implemented during the project to monitor and document that the clean closure activities meet or exceed the design specifications, permit requirements, and applicable regulations. A construction manager will ensure that the Contractor adheres to the design drawings and specifications. It is anticipated that the construction manager will be present full time on Site during construction. An Air Monitoring Specialist, independent of the Contractor, will monitor field activities related to possible dust generation, collect ambient air samples, and document that the construction is performed per the Air Quality Monitoring Plan provided in Appendix E.

4

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4.0 CONFIRMATION OF WASTE REMOVAL

Confirmation of waste removal will be accomplished by conducting confirmation sampling and analysis and preparing a Clean Closure Results Report.

4.1 Confirmation Sampling and Analysis

Confirmation sampling will be conducted in accordance with the Confirmation Sampling and Analysis Plan (Appendix F) throughout all areas of waste excavation and areas that may become impacted during construction (e.g., haul roads, staging areas). If the confirmation sampling indicates that residual concentrations exceed acceptable levels in any portion of the Site, then re-excavation will be required in that portion of the Site.

4.2 Clean Closure Results Report

After clean closure activities have been completed, a pre-final construction inspection with representatives from the City and regulatory agencies will be performed. If no outstanding work items are identified, the pre-final construction inspection will serve as the final construction inspection.

After the final construction inspection, a Clean Closure Results Report will be prepared that certifies clean closure activities were completed in accordance with this Work Plan and design drawings/specifications. The report will include the information described below.

- Explanation of any variances to this Work Plan and design drawings/ specifications
- Field notes and observations
- Confirmation sampling analytical results and interpretation
- Transportation manifests and landfill receipts
- As-built drawings showing the final grade
- Air monitoring analytical results and interpretation

The report will be certified by a Professional Civil Engineer licensed in the State of California.

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5

5.0 POST-CLOSURE ACTIVITIES

Post-closure activities consist of Site restoration and groundwater monitoring.

5.1 Site Restoration

After the confirmation sampling is complete and the agencies have confirmed that no additional excavation is required, the Contractor will proceed with re-grading and re-vegetating excavated areas.

Excavated areas will be final-graded as necessary to ensure that drainage is adequate to prevent ponding or erosion. After final grading is complete, temporary fencing will be erected along the perimeter of the Site. The fences will restrict access to the Site during the first wet season while vegetation is established. The Contractor will implement erosion protection measures to minimize erosion until the vegetation is sufficiently rooted which may continue through the first wet season. These controls will be detailed in the Construction SWPPP.

5.2 Groundwater Monitoring

Groundwater monitoring of the remaining wells (FCY-2 through FCY-8) will be conducted following completion of final grading to ensure groundwater quality remains unaffected. Groundwater monitoring well FCY-9 will be replaced if required by the RWQCB. The target parameters will be the same as those on the existing parameter list for semi-annual monitoring. Upon evaluation of the post-closure monitoring results, the RWQCB will rescind the WDRs.

6

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6.0 SCHEDULE

The milestones for clean closure are:

- Completion of the CEQA process;
- Regulatory approval of this Work Plan;
- Preparation of bid documents (e.g., design drawings and specifications);
- Completion of contracting and selection of a Contractor;
- Completion of construction and confirmation sampling and analysis;
- Site restoration (e.g., final grading and re-vegetation);
- Certification of clean closure;
- Completion of groundwater monitoring and rescission of the WDRs.

6.1 Project Schedule

The general anticipated schedule for the clean closure project is provided in Appendix G.

6.2 Winterization Contingency

It is possible, although unlikely, that Site construction may span more than one dry season, and therefore, waste could potentially be freshly exposed during the rainy season. If necessary, the Contractor will prepare a Winterization Plan for review and approval by the project engineer prior to the beginning of each rainy season. The Winterization Plan will be required until all waste is removed and excavation areas are fully restored with vegetation. This plan will detail storm water erosion and sedimentation controls, wind erosion controls, the placement of interim cover to prevent human exposure to waste and storm water contamination, and Site security measures. The plan will also address periodic inspection and maintenance of the winterization controls.

BROWN AND CALDWELL

7

7.0 REFERENCES

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BROWN AND
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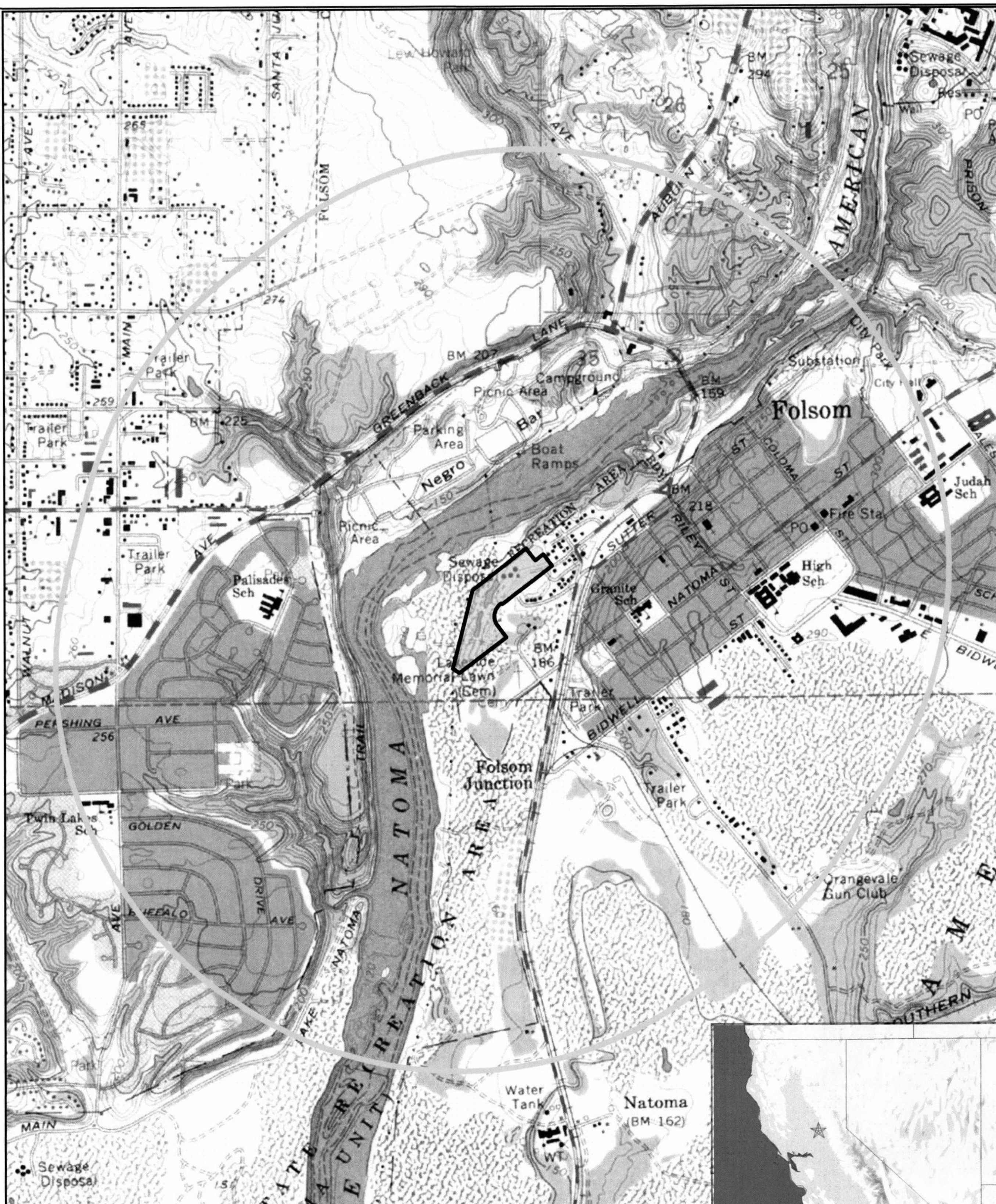
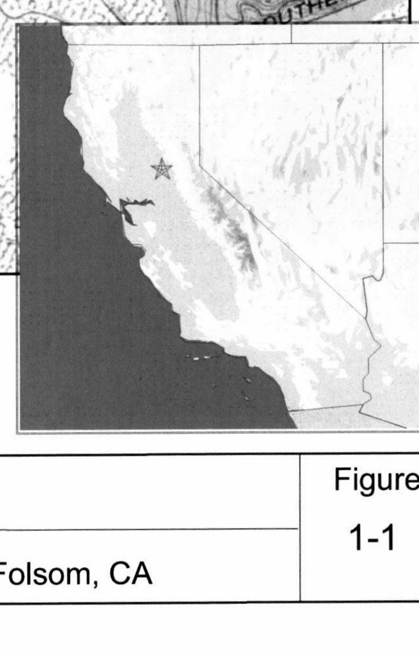
Figures





1-mile radius

N

0 0.25 0.5 Miles

Source Map: USGS 7.5-minute Quadrangle "Folsom" dated 1980

BROWN AND CALDWELL	PROJECT 134473	TITLE Site Location	Figure 1-1
	DATE 2-1-08	SITE Corporation Yard Landfill, Folsom, CA	

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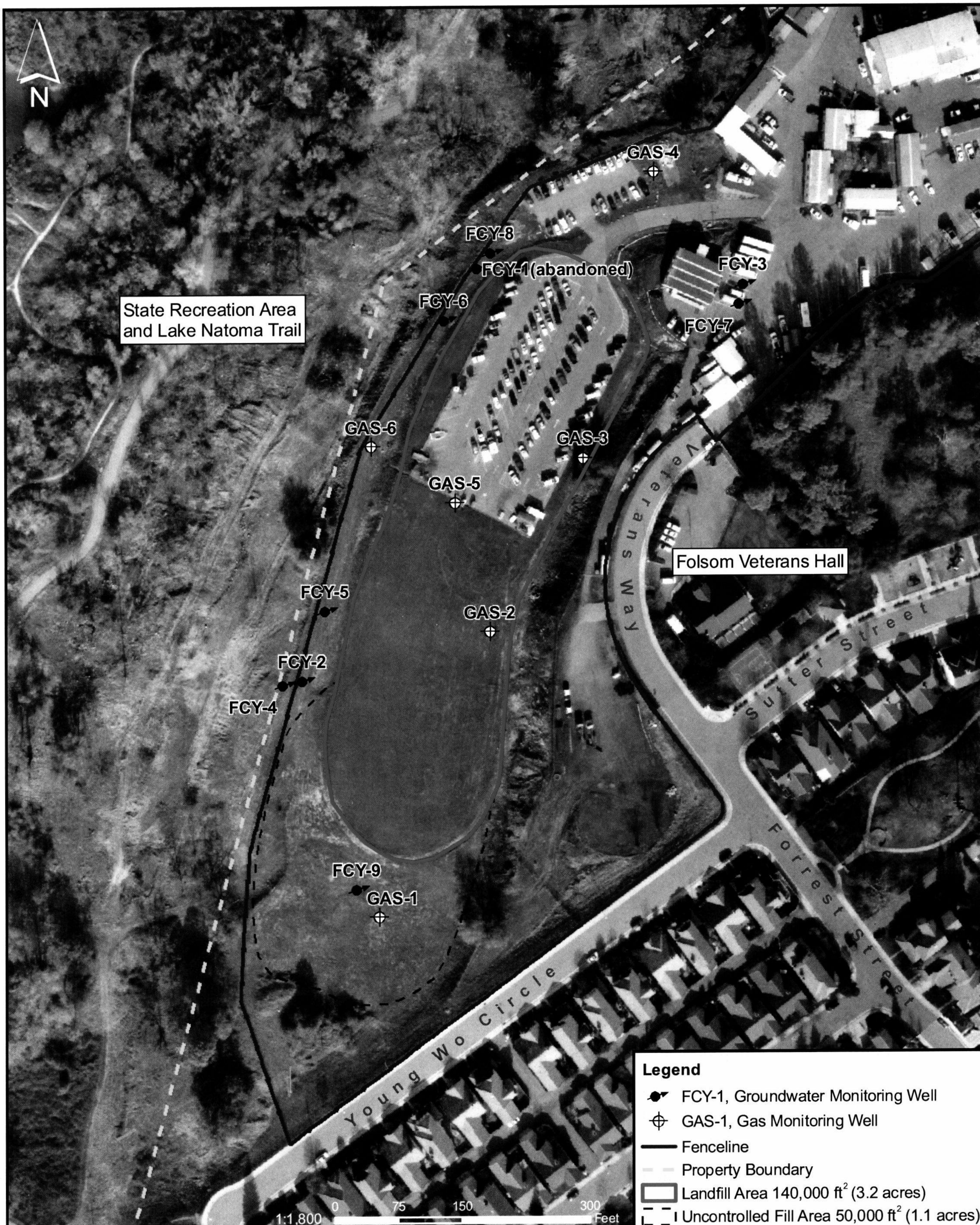

BROWN AND CALDWELL	PROJECT 134473	TITLE Site Features	Figure 1-2
	DATE 2-1-08	SITE Corporation Yard Landfill Clean Closure, Folsom, CA	

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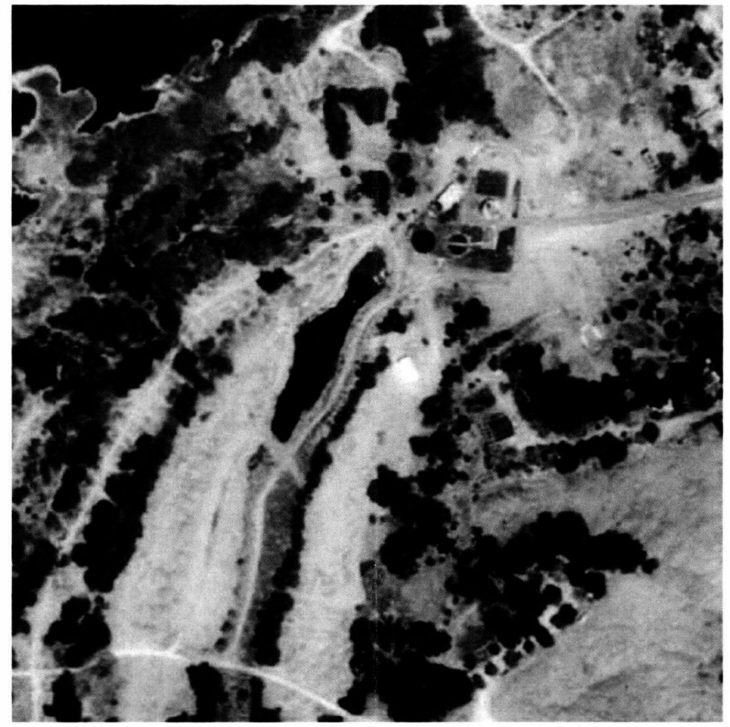
1952 (Pacific Air)

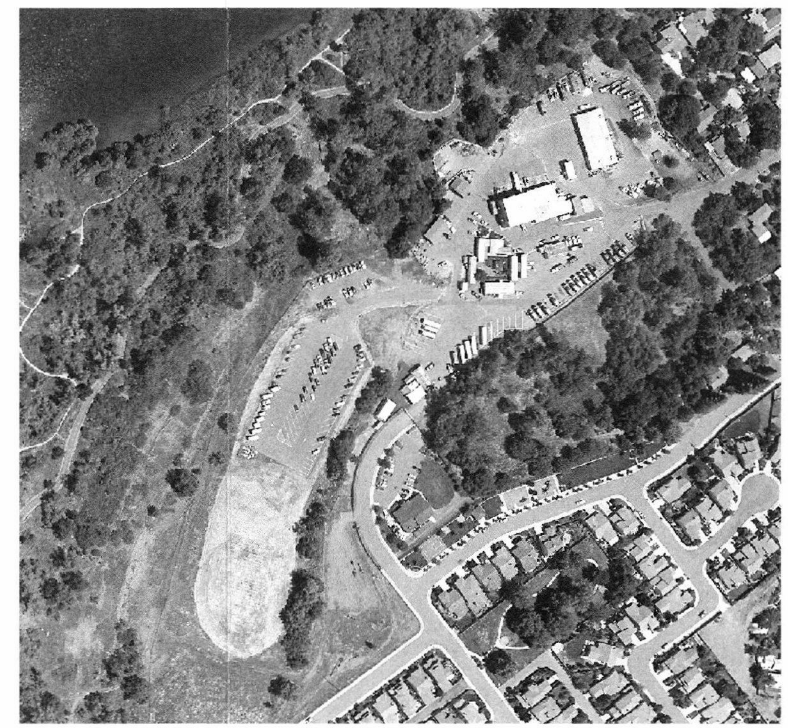


1961 (Cartwright)

1971 (Cartwright)

1981 (Cartwright)

1993 (USGS)



2002 (MapMart)

TITLE	Historical Aerial Photographs
SITE	Corporation Yard Landfill, Folsom, CA

BROWN AND CALDWELL	PROJECT 134473	Figure 1-3
	DATE 2-12-08	

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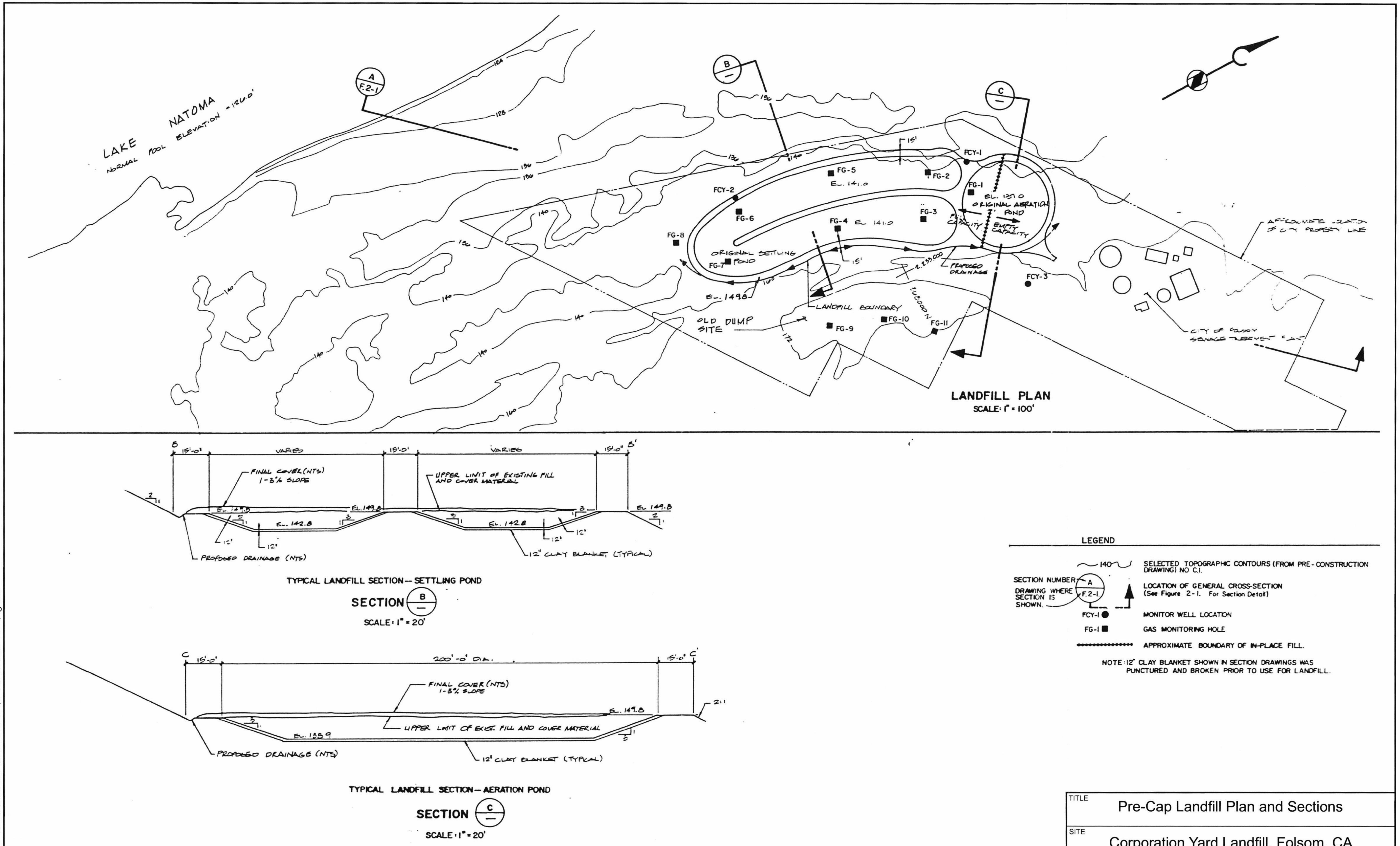
Source: Unknown, circa 1973

BROWN AND CALDWELL	PROJECT 134473	TITLE Former Sewage Treatment Plant Aeration and Settling Ponds	Figure 1-4
	DATE 2-1-08	SITE Corporation Yard Landfill, Folsom, CA	



Source: Brown and Caldwell, Corporation Yard Site Investigation Report, 1986

TITLE	Pre-Cap Landfill Plan and Sections	
SITE	Corporation Yard Landfill, Folsom, CA	
BROWN AND CALDWELL	PROJECT 134473 / DATE 2-1-08	Figure 1-5

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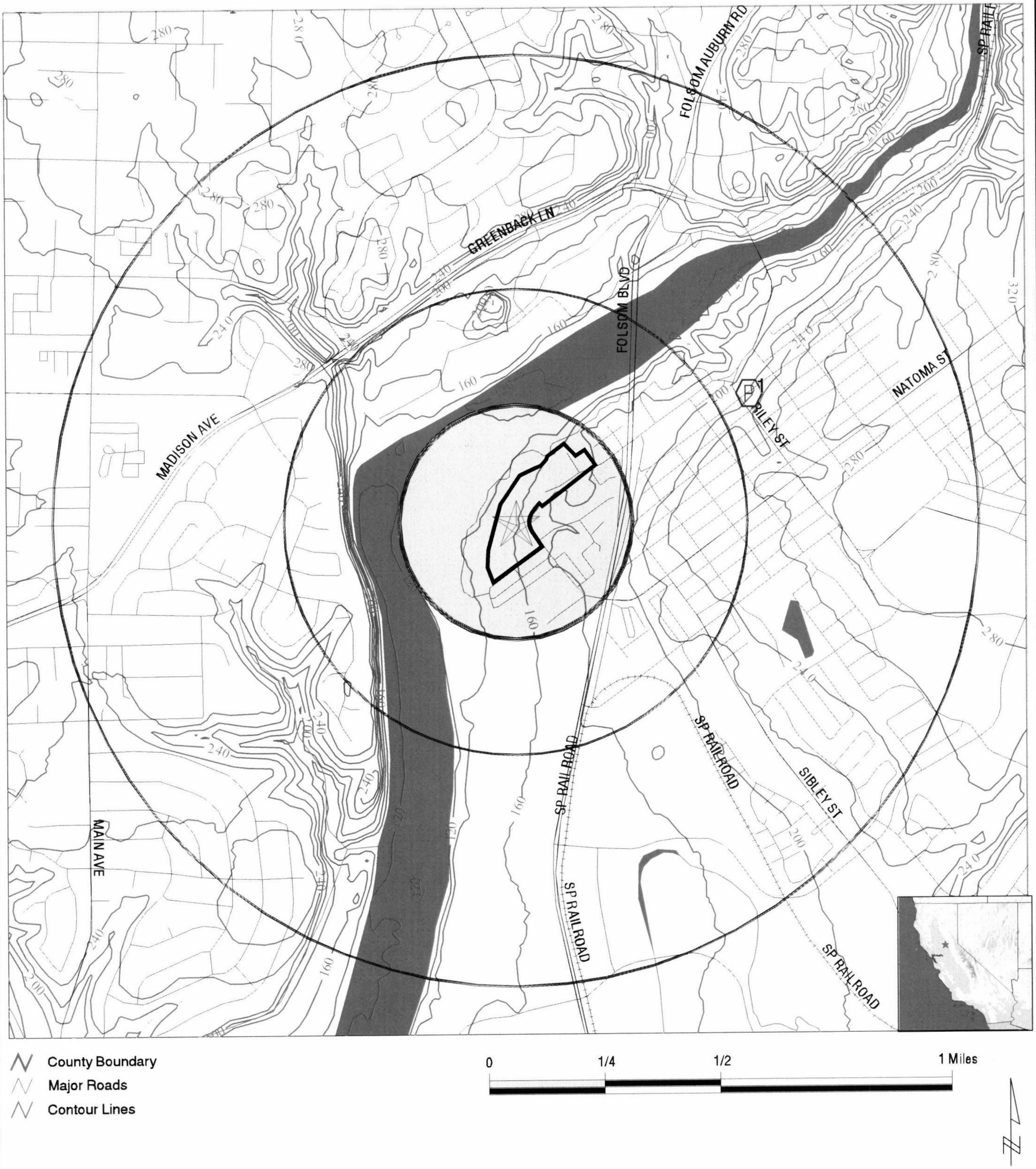

Source: EDR, Inc. 2007

BROWN AND CALDWELL	PROJECT 134473	TITLE Topographic Map	Figure 2-1
	DATE 2-20-08	SITE Corporation Yard Landfill, Folsom, CA	

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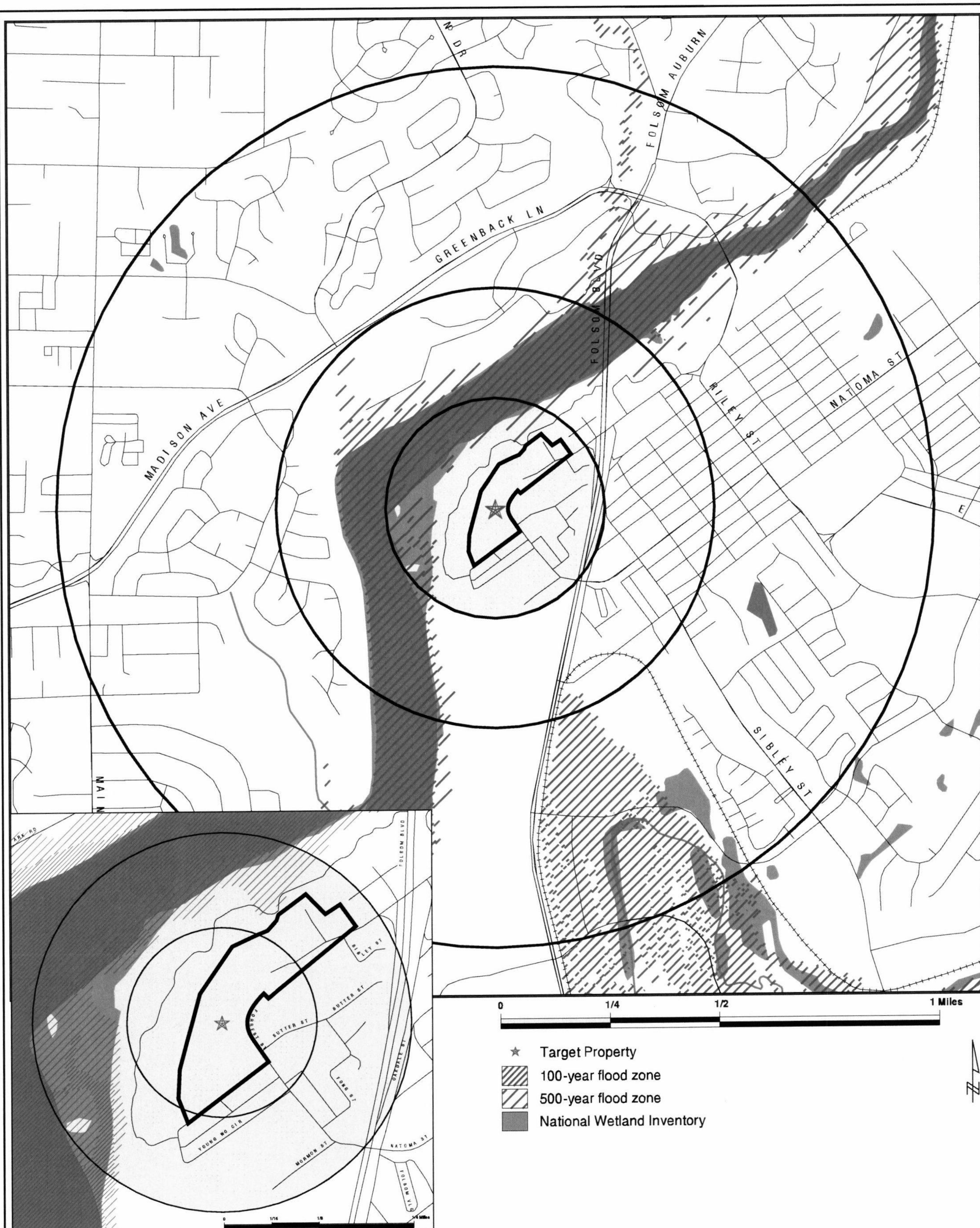

Source: EDR, Inc. 2007

BROWN AND CALDWELL

PROJECT 134473	TITLE Floodplain Map	Figure 2-2
DATE 2-19-08	SITE Corporation Yard Landfill, Folsom, CA	

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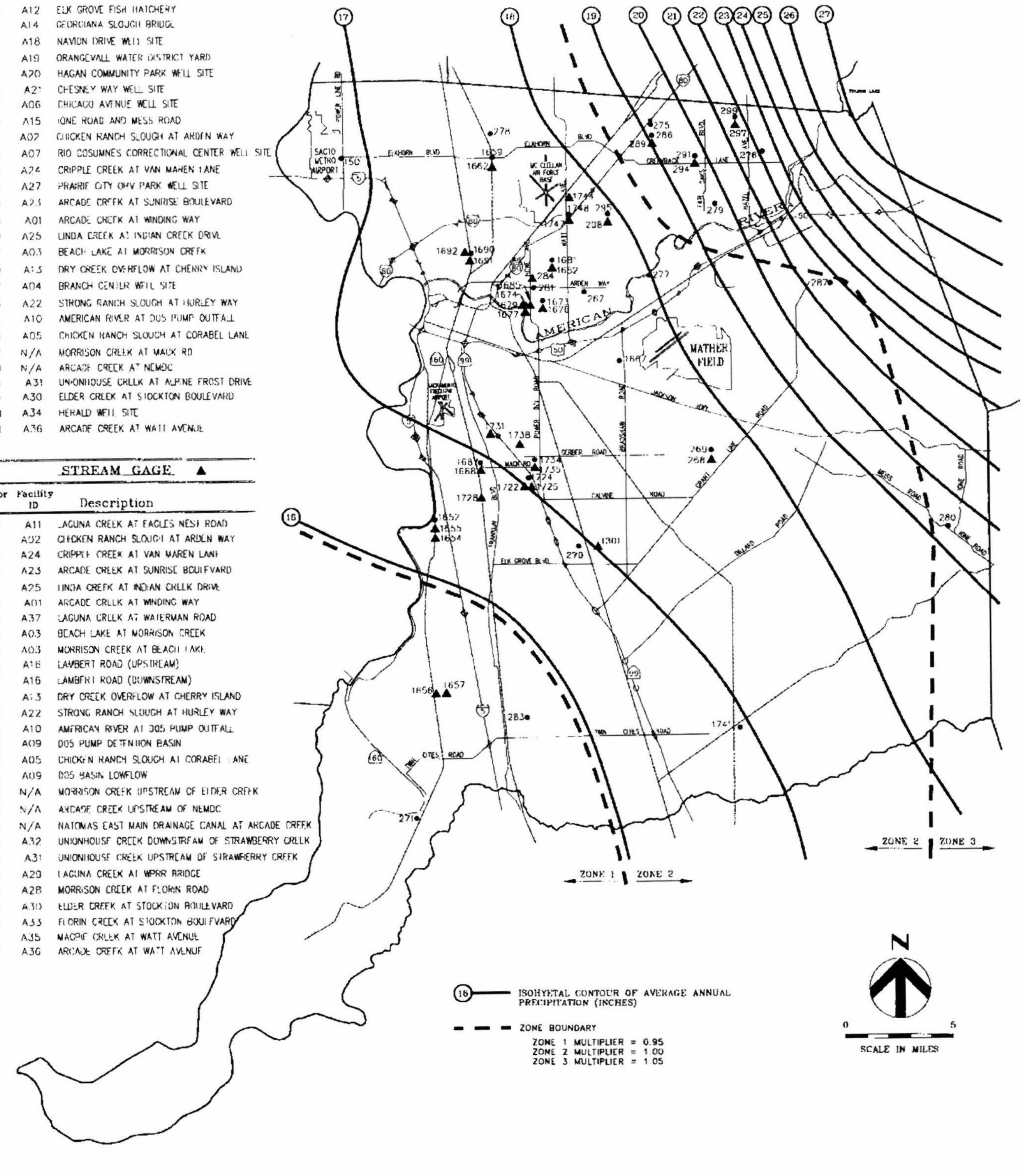
KEY

PRECIPITATION GAGE •

Sensor ID	Facility ID	Description
150	A17	METRO AIRPORT WIND SOCK
267	A08	CRESTA PARK WELL SITE
269	A11	LAGUNA CREEK AT EAGLES NEST ROAD
270	A12	ELK GROVE FISH HATCHERY
271	A14	GEORGIANA SLOUGH BRIDGE
275	A18	NAVION DRIVE WELL SITE
276	A19	ORANGEVALE WATER DISTRICT YARD
277	A20	HAGAN COMMUNITY PARK WELL SITE
278	A21	CHESNEY WAY WELL SITE
279	A06	CHICAGO AVENUE WELL SITE
280	A15	IONE ROAD AND MESS ROAD
281	A02	CHICKEN RANCH SLOUGH AT ARDEN WAY
283	A07	RIO COSUMNES CORRECTIONAL CENTER WELL SITE
286	A24	CRIPPLE CREEK AT VAN MAREN LANE
287	A27	PRAIRIE CITY OHV PARK WELL SITE
291	A23	ARCADE CREEK AT SUNRISE BOULEVARD
295	A01	ARCADE CREEK AT WINDING WAY
299	A25	LINDA CREEK AT INDIAN CREEK DRIVE
1652	A03	BEACH LAKE AT MORRISON CREEK
1659	A13	DRY CREEK OVERFLOW AT CHERRY ISLAND
1667	A04	BRANCH CENTER WELL SITE
1673	A22	STRONG RANCH SLOUGH AT HURLEY WAY
1674	A10	AMERICAN RIVER AT D05 PUMP OUTFALL
1681	A05	CHICKEN RANCH SLOUGH AT CORABEL LANE
1687	N/A	MORRISON CREEK AT MACK RD
1690	N/A	ARCADE CREEK AT NEMDC
1724	A31	UNIONHOUSE CREEK AT ALPINE FROST DRIVE
1734	A30	ELDER CREEK AT STOCKTON BOULEVARD
1741	A34	HERALD WELL SITE
1748	A36	ARCADE CREEK AT WATT AVENUE

STREAM GAGE ▲

Sensor ID	Facility ID	Description
268	A11	LAGUNA CREEK AT EAGLES NEST ROAD
284	A02	CHICKEN RANCH SLOUGH AT ARDEN WAY
289	A24	CRIPPLE CREEK AT VAN MAREN LANE
294	A23	ARCADE CREEK AT SUNRISE BOULEVARD
297	A25	LINDA CREEK AT INDIAN CREEK DRIVE
298	A01	ARCADE CREEK AT WINDING WAY
1301	A37	LAGUNA CREEK AT WATERMAN ROAD
1654	A03	BEACH LAKE AT MORRISON CREEK
1655	A03	MORRISON CREEK AT BEACH LAKE
1656	A16	LAMBERT ROAD (UPSTREAM)
1657	A16	LAMBERT ROAD (DOWNSTREAM)
1662	A13	DRY CREEK OVERFLOW AT CHERRY ISLAND
1676	A22	STRONG RANCH SLOUGH AT HURLEY WAY
1677	A10	AMERICAN RIVER AT D05 PUMP OUTFALL
1679	A09	D05 PUMP DETENTION BASIN
1682	A05	CHICKEN RANCH SLOUGH AT CORABEL LANE
1685	A09	D05 BASIN LOWFLOW
1688	N/A	MORRISON CREEK UPSTREAM OF ELDER CREEK
1691	N/A	ARCADE CREEK UPSTREAM OF NEMDC
1692	N/A	NATOMAS EAST MAIN DRAINAGE CANAL AT ARCADE CREEK
1722	A32	UNIONHOUSE CREEK DOWNSTREAM OF STRAWBERRY CREEK
1725	A31	UNIONHOUSE CREEK UPSTREAM OF STRAWBERRY CREEK
1728	A29	LAGUNA CREEK AT WPRR BRIDGE
1731	A28	MORRISON CREEK AT FLORIN ROAD
1735	A30	ELDER CREEK AT STOCKTON BOULEVARD
1738	A33	FLORIN CREEK AT STOCKTON BOULEVARD
1744	A35	MAGPIE CREEK AT WATT AVENUE
1747	A36	ARCADE CREEK AT WATT AVENUE



Source: City and County of Sacramento Drainage Manual, December 1996.

BROWN AND CALDWELL	PROJECT 134473	TITLE Isohyetal Map	Figure 2-3
	DATE 1-30-08	SITE Corporation Yard Landfill, Folsom, CA	

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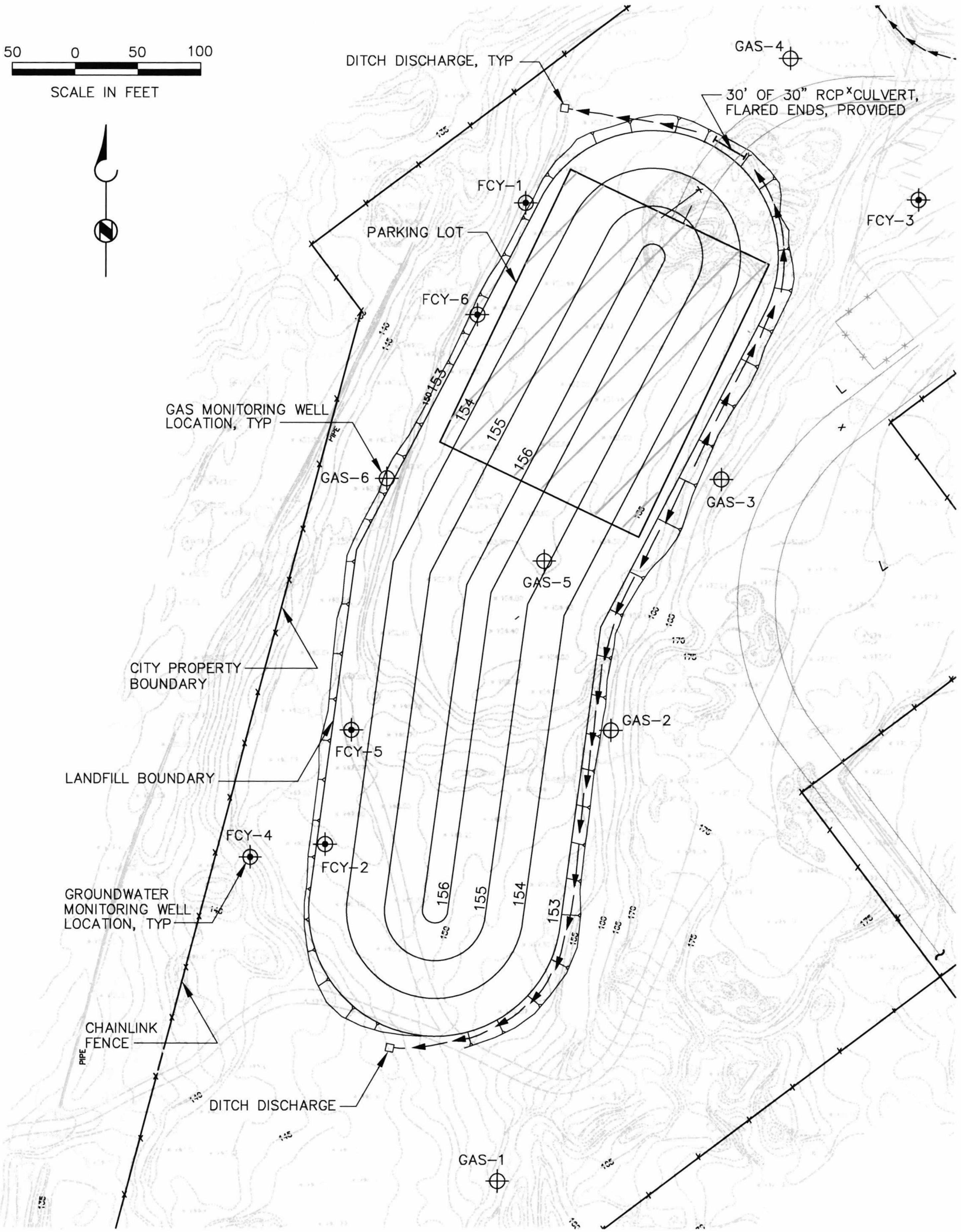
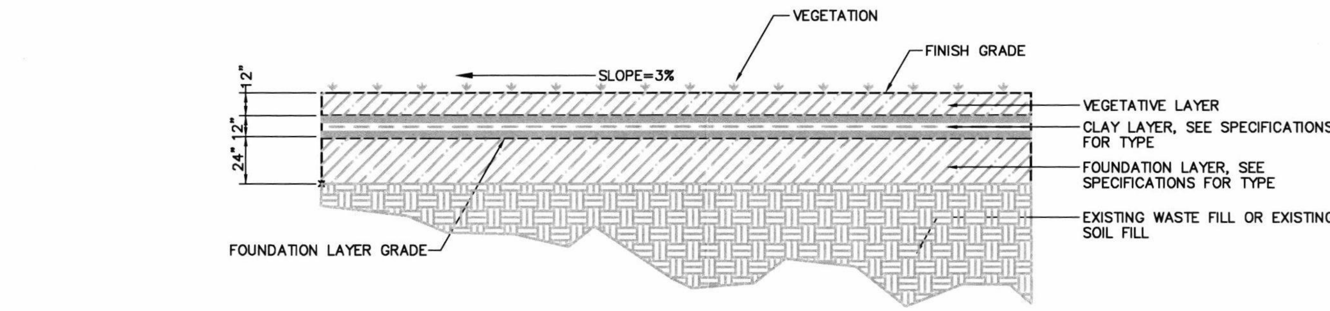


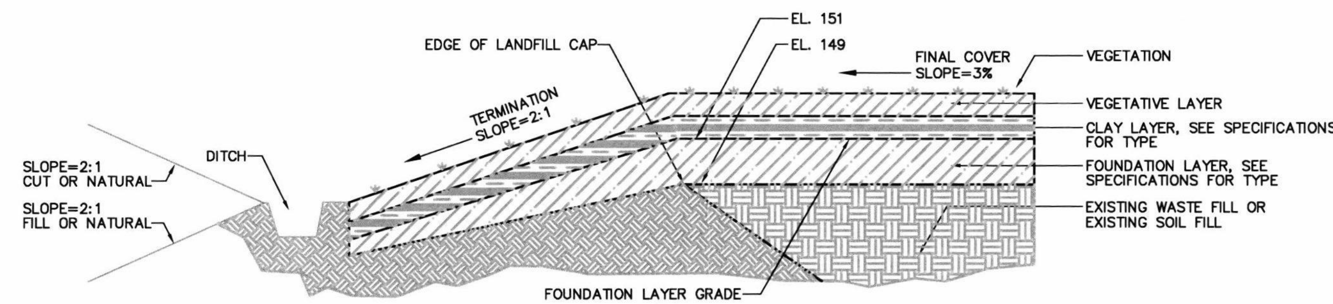
Source:Brown and Caldwell, Landfill Closure Design Drawings, 1994



FINAL COVER

DETAIL A

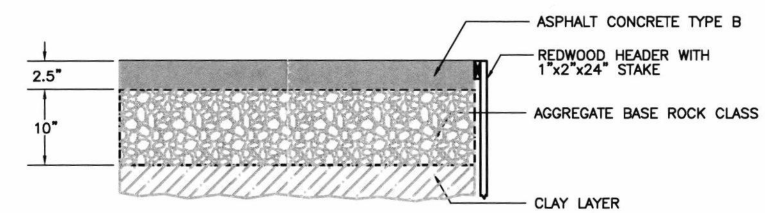
SCALE: NO SCALE



FINAL COVER TERMINATION

DETAIL B

SCALE: NO SCALE

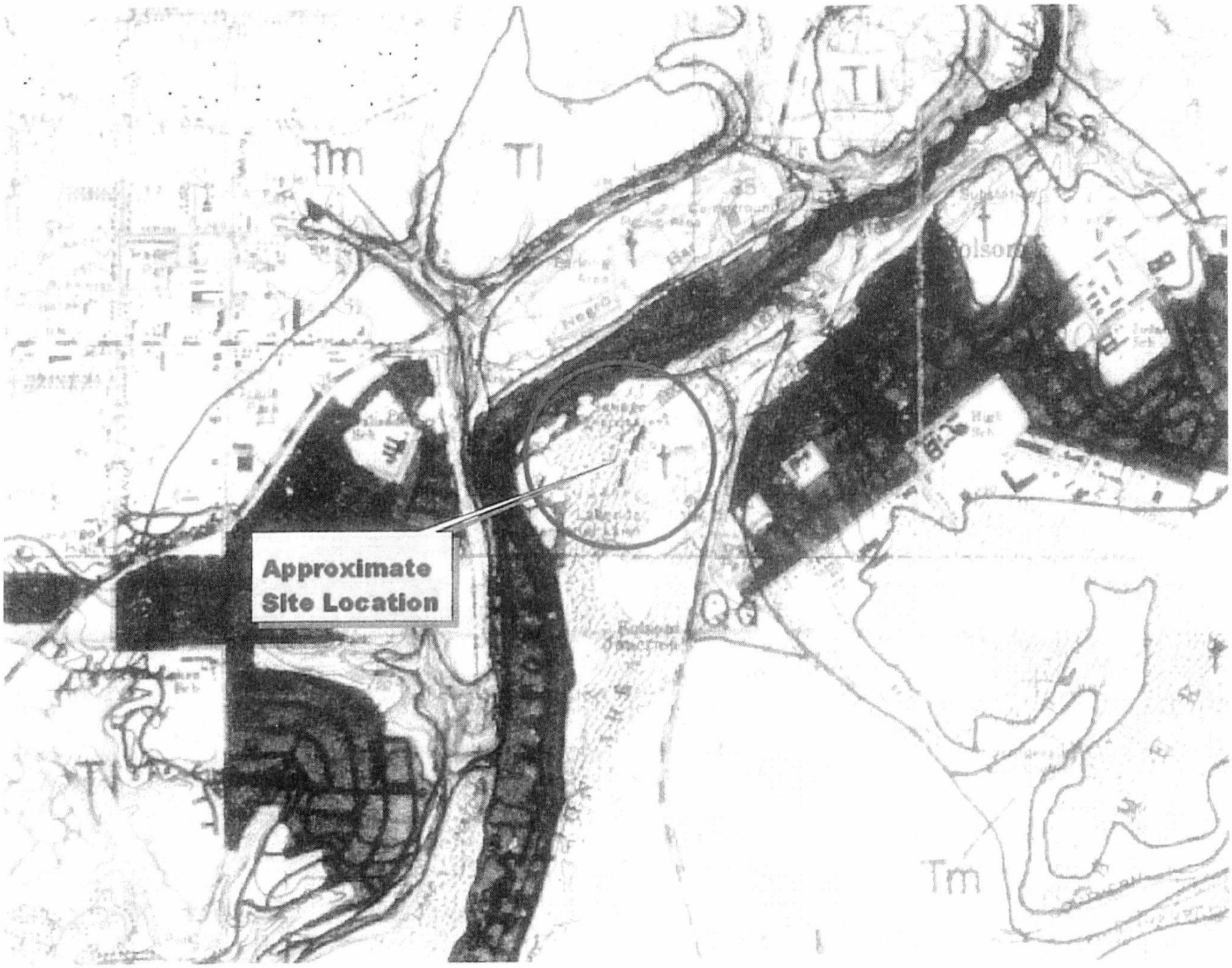


PAVEMENT SECTION

DETAIL C

SCALE: NO SCALE

Landfill Cap Plan and Details		
Corporation Yard Landfill, Folsom, CA		
BROWN AND CALDWELL	PROJECT 134473 DATE 2-1-08	FIGURE 2-4



Legend

t	Dredge tailings
Qa	Quaternary alluvium
Tl	Tertiary Laguna Formation (alluvium sand, silt & conglomerate)
Tm	Tertiary Mehrten Formation (stream channel, alluvium, & mudflow deposits derived mainly from rhyolitic volcanic rocks. Also includes white welded tuff & ash flows)

N

2000 0 2000 Feet

Source: Loyd, 1984, Generalized Geology of the 15-Minute Quadrangle, California (CDMG OFR 84-50 Plate 1)

BROWN AND CALDWELL	PROJECT 134473	TITLE Geologic Map	Figure 2-5
	DATE 2-1-08	SITE Corporation Yard Landfill, Folsom, CA	

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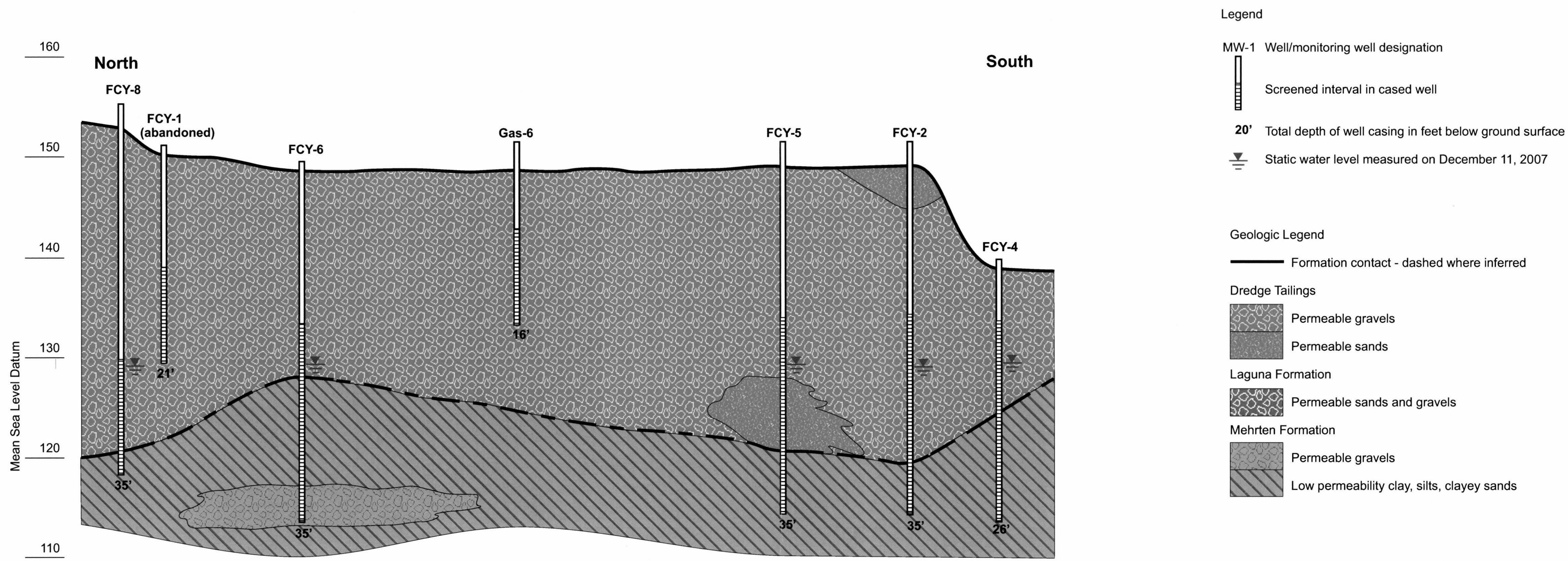

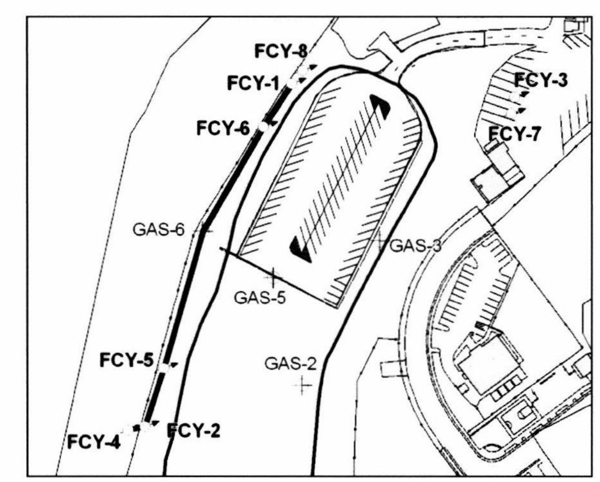

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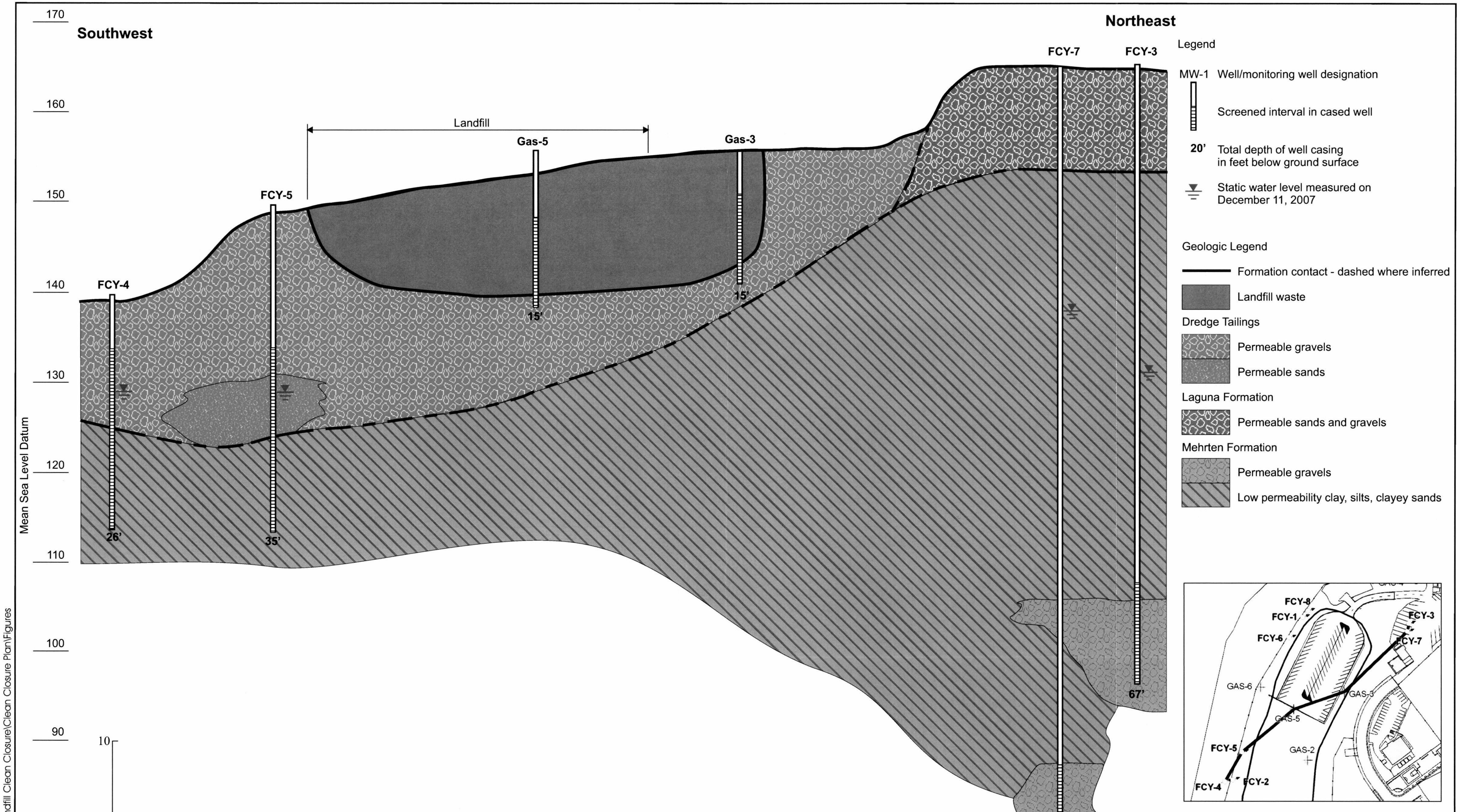
TITLE North-South Geologic Cross Section		
SITE Corporation Yard Landfill, Folsom, CA		
BROWN AND CALDWELL	PROJECT 134473 DATE 1-30-08	Figure 2-6



TITLE Southwest-Northeast Geologic Cross Section

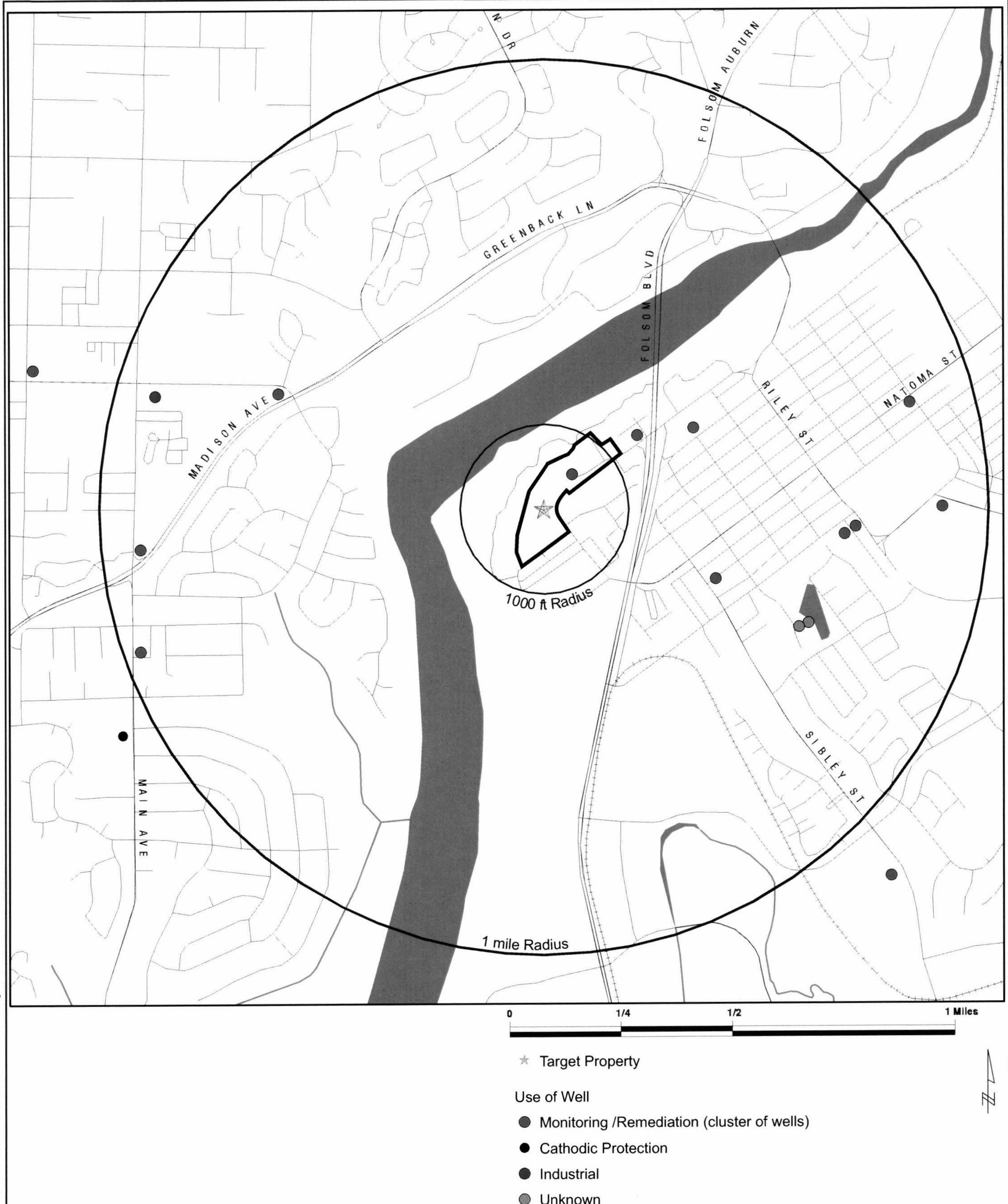
SITE Corporation Yard Landfill, Folsom, CA

BROWN AND CALDWELL

PROJECT 134473

DATE 1-30-08

Figure 2-7



Source: California Department of Water Resources, 2008

BROWN AND CALDWELL	PROJECT 134473	TITLE DWR Well Search Results Map	Figure 2-8
	DATE 4-29-08	SITE Corporation Yard Landfill, Folsom, CA	

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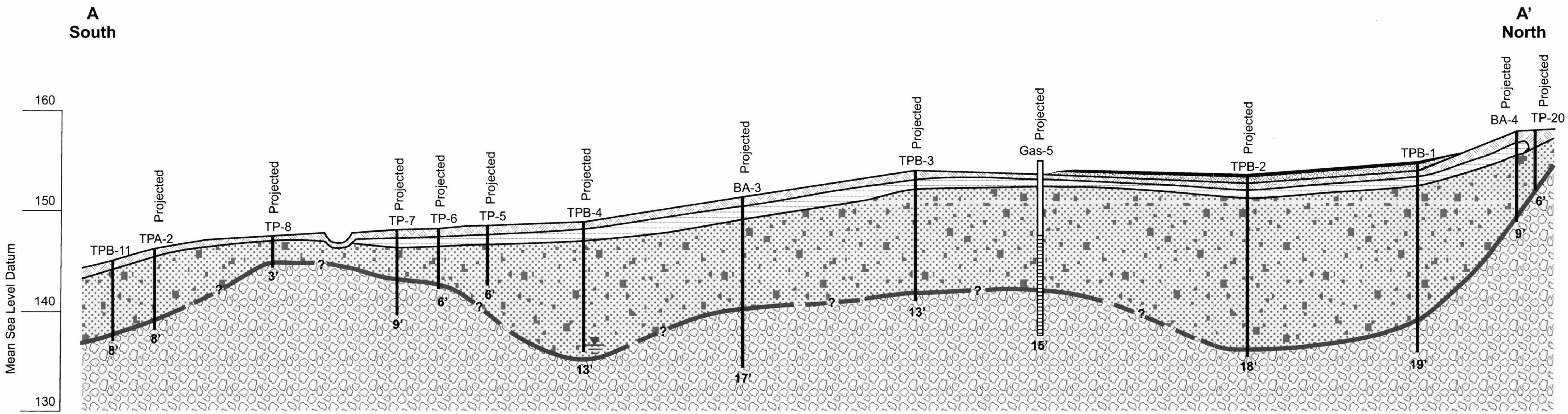

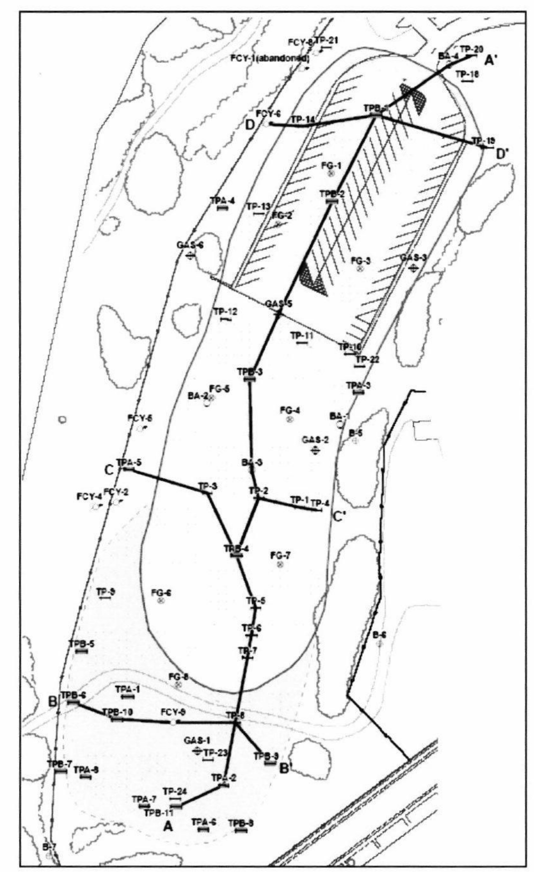

10

0 60

Scale in Feet

Legend

FCY-6 Monitoring well designation (Various, 1985-2002)

Screened interval in cased well

20' Total depth of well casing in feet below ground surface

TP - Test Pit (Kleinfelder, October 2000)
TPB - Test Pit (Brown and Caldwell, February, 2008)
BA - Boring (Kleinfelder, November 2000)
GAS - Gas monitoring well (Brown and Caldwell, January 1994)

Suspected perched water

Geologic Legend

Asphalt

Aggregate

Vegetative Soil Layer

Clay Layer

Fill Soil and Debris

Former Sewage Treatment Plant Pond Liner,
"?" - queried contact

Dredge Tailings - Permeable gravels

TITLE	Longitudinal Cross Section of Landfill
SITE	Corporation Yard Landfill, Folsom, CA
BROWN AND CALDWELL	PROJECT 134473 / DATE 4-29-08 / Figure 2-9

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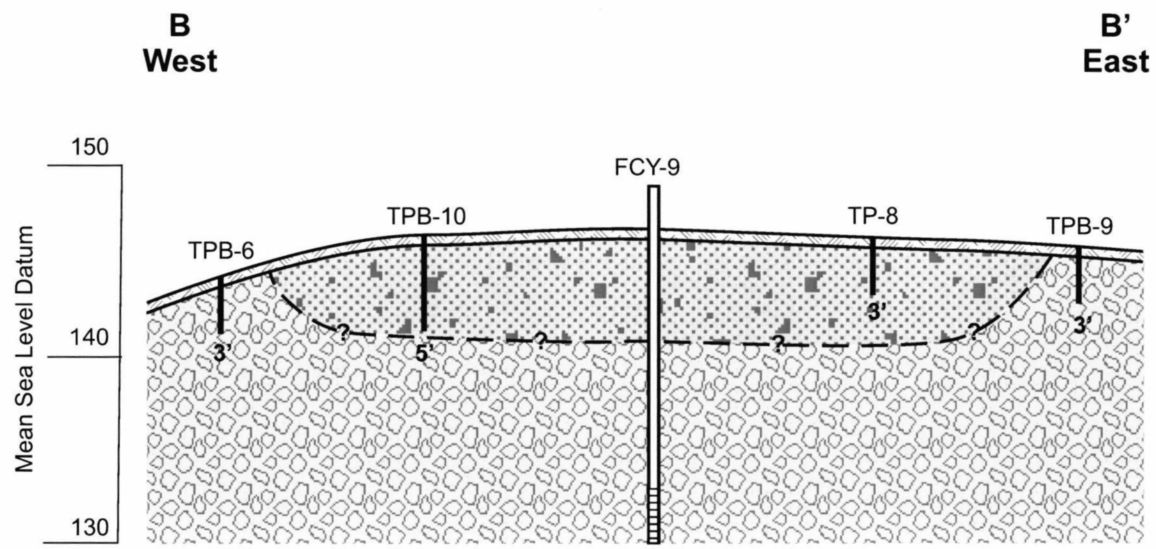
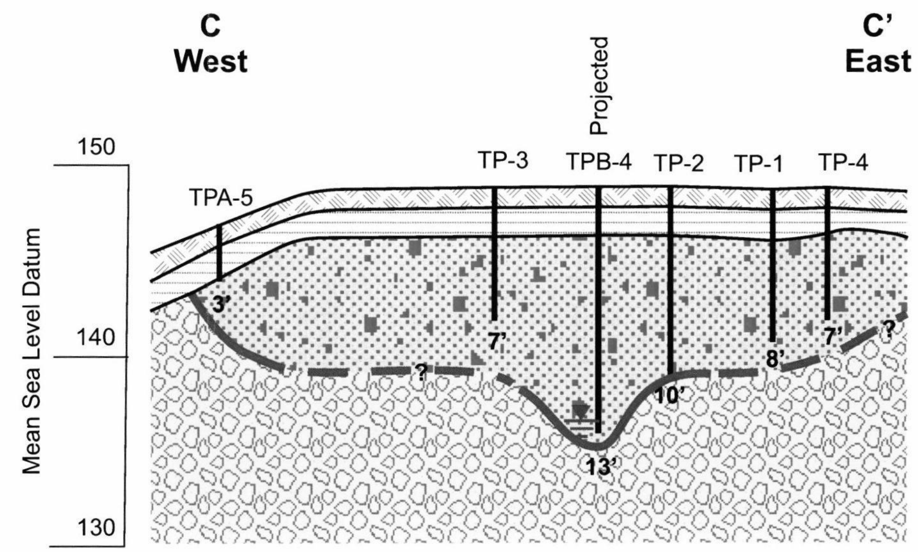




Legend

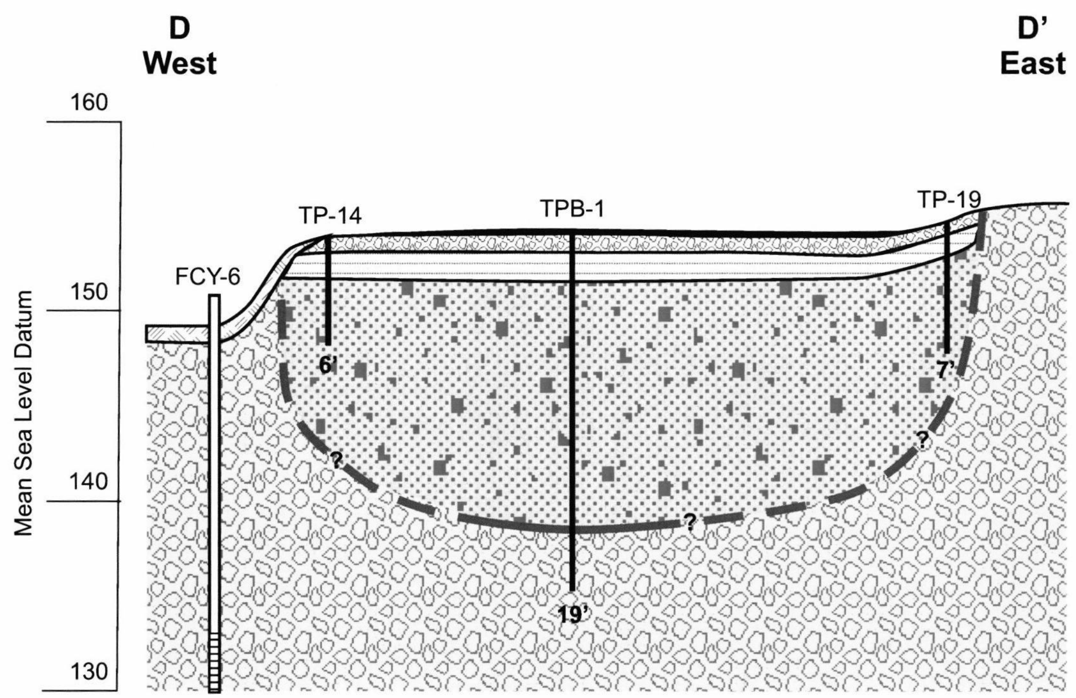
FCY-6 Monitoring well designation (Various, 1985-2002)

Screened interval in cased well

20' Total depth of well casing in feet below ground surface

TP - Test Pit (Kleinfelder, October 2000)
TPB - Test Pit (Brown and Caldwell, February, 2008)
BA - Boring (Kleinfelder, November 2000)
GAS - Gas monitoring well
(Brown and Caldwell, January 1994)

Suspected perched water



Geologic Legend

Asphalt

Aggregate

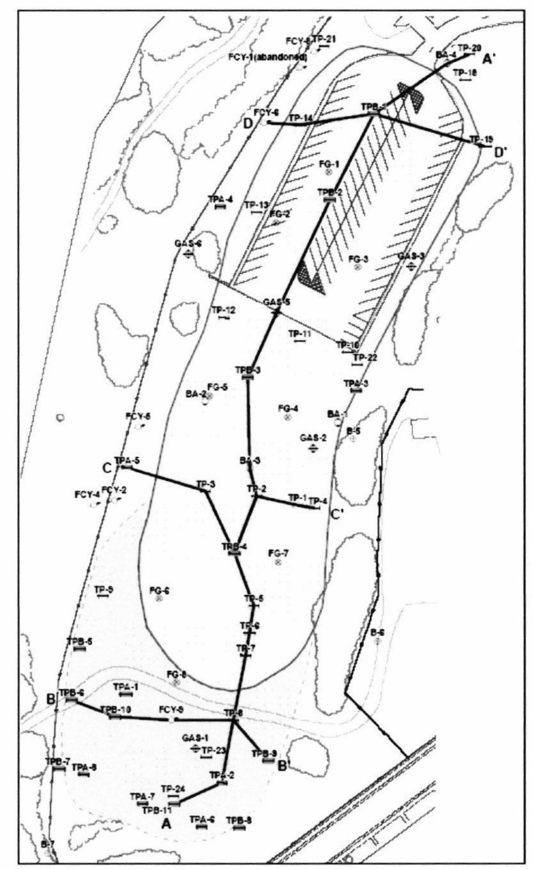
Vegetative Soil Layer

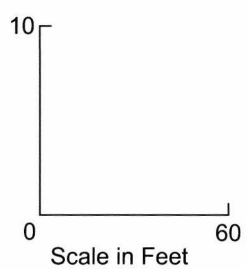
Clay Layer

Fill Soil and Debris

Former Sewage Treatment Plant Pond Liner,
"**?**" - queried contact

Dredge Tailings - Permeable gravels





TITLE	Lateral Cross Sections of Landfill
SITE	Corporation Yard Landfill, Folsom, CA
BROWN AND CALDWELL	PROJECT 134473 / DATE 4-29-08 / Figure 2-10

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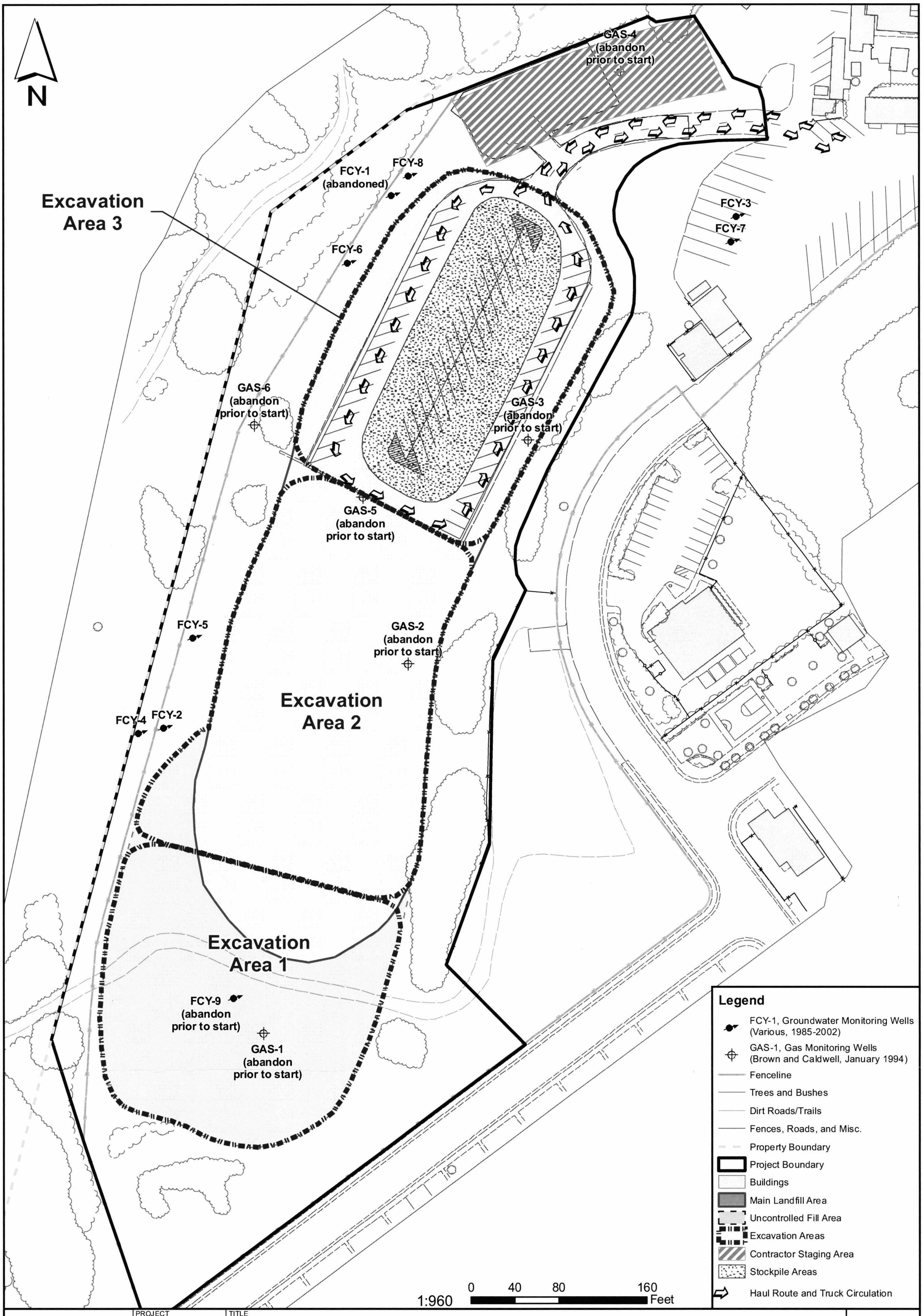
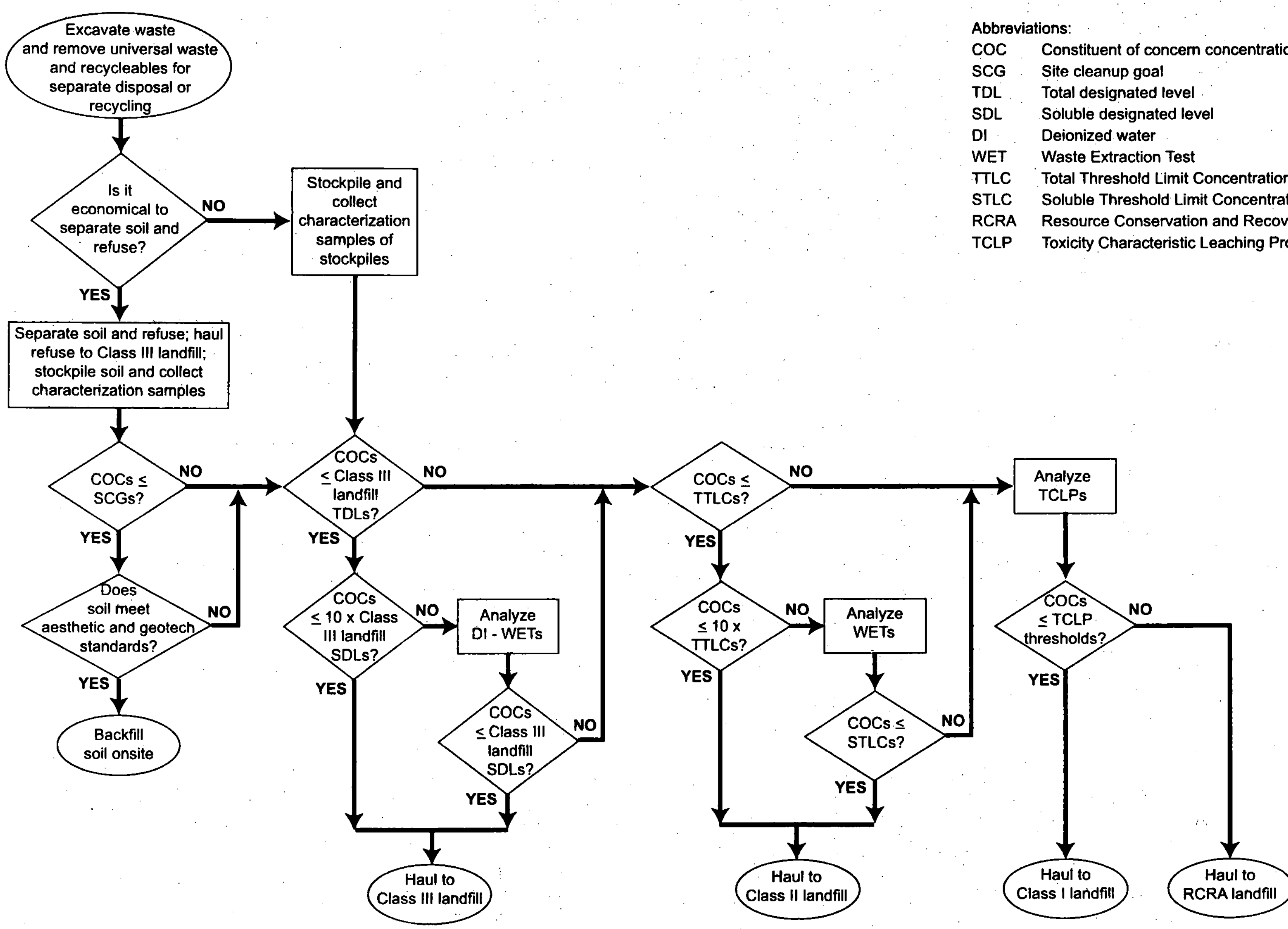


BROWN AND CALDWELL	PROJECT 134473	TITLE Hypothetical Construction Layout	Figure 3-1
	DATE 2-18-08	SITE Corporation Yard Landfill, Folsom, CA	

FILE: \\Bcsac-nas01\GIS\Folsom\Folsom Landfill\Figure 3-1 Hypothetical Construction Layout.mxd



Abbreviations:

COC	Constituent of concern concentration
SCG	Site cleanup goal
TDL	Total designated level
SDL	Soluble designated level
DI	Deionized water
WET	Waste Extraction Test
TTLC	Total Threshold Limit Concentration
STLC	Soluble Threshold Limit Concentration
RCRA	Resource Conservation and Recovery Act
TCLP	Toxicity Characteristic Leaching Procedure

BROWN AND CALDWELL

PROJECT 134473

DATE 5-7-08

TITLE Waste Characterization Process

SITE Corporation Yard Landfill, Folsom, CA

Figure 3-2

BROWN AND
CALDWELL

A

APPENDIX A.

SITE HISTORY AND INVESTIGATION RESULTS

This appendix presents the history and investigations results at the Folsom Corporation Yard Landfill (Site) located at 1300 Leidesdorff Street in Folsom, California. From December 1985 through February 2008, the City of Folsom conducted the following investigation and monitoring activities:

- Drilled 12 exploratory borings;
- Installed 11 temporary landfill gas test probes;
- Installed nine groundwater wells for periodic monitoring;
- Installed six landfill gas wells for periodic monitoring;
- Excavated 43 exploratory test pits; and
- Collected over 180 groundwater samples, 150 landfill gas samples, and 20 soil samples for analysis.

The locations of investigation borings, landfill gas test probes, monitoring wells, and test pits are shown on Figure A-1 and logs are provided in Attachment A-1. References cited in this appendix are provided in Section 7.0 of the main report.

Late 1800s to Early 1900s Gold Dredging
During the late 1800s to early 1900s, the general area of the Site was dredged for gold.

1950s to 1970s Sewage Treatment Plant Operations
In the 1950s, the City constructed a sewage treatment plant at the Site. The plant treated City sewage through the early 1970s. The plant included an aeration pond and settling ponds. The aeration pond measured approximately 200 feet in diameter and 16 feet deep. The settling ponds measured approximately 600 feet long by 200 feet wide and 7 feet deep. The ponds were reportedly lined with a plastic liner covered with a 12-inch thick layer of clay.

1974 to 1986 Landfill Operations
In 1974, the landfill operation began within the berms of the former sewage treatment plant ponds and continued through the spring of 1986. During the course of converting the ponds to a landfill, the clay liner was perforated to avoid flooding the landfill in the wet season.

When the landfill was in operation, all vehicles unloading at the Site were owned and operated by the City with City-employed crews. The landfill was open to receive wastes from 7:00 a.m. to 3:30 p.m., Monday through Friday, except on days when inclement weather prohibited access. A paved road led to the Corporation Yard from the City, while a dirt road led to the landfill from the Corporation Yard. The road became impassible during heavy rains. Part of the

Corporation Yard was surrounded by a chain-link fence with two gates leading to the landfill which were locked every night at 3:30 p.m. The only normal vehicular access to the landfill was through the Corporation Yard. The landfill itself was not fenced and was accessible by foot and off-road vehicles.

No formal records were kept on the type or quantity of fill. According to interviews with City employees, waste deposited in the landfill consisted of: construction and demolition debris including earth, asphalt, rock, concrete, wood, and metal items; garden and yard prunings and clippings including tree limbs, stumps, and leaves; and street litter including rocks, glass, and plastic items. Portions of the defunct sewage treatment plant (e.g., the concrete clarifier tank) may have been demolished and placed in the landfill. Employees reported that no hazardous or toxic wastes were placed in the landfill. Public neither dumping nor salvaging activities were allowed. Municipal garbage from the Folsom area was disposed at the County of Sacramento landfill. City employees estimated that the average daily quantity placed in the landfill was 5 to 10 yds^3. This amount varied due to the seasonal occurrence of the material placed in the landfill (e.g., construction debris, tree trimmings).

Pushup and compaction occurred two to three times per week. Material used for cover included construction debris, asphalt, and excess construction soil. The cover was compacted in an 18- to 24-inch thick layer. Equipment used for pushup, cover, and compaction consisted of a front-end loader with a 3-yard bucket and a D-7 Cat.

In February 1978, the landfill was permitted by the California Integrated Waste Management Board (CIWMB) Permit No. 34-AC-001 and the California Regional Water Quality Control Board (RWQCB) Waste Discharge Requirements Order No. 78-20. The landfill was monitored by the County of Sacramento Environmental Management Department as the local enforcement agency (LEA).

1985-1986 Preliminary Geotechnical Investigation

During December 1985 to January 1986, Brown and Caldwell/Kleinfelder performed a preliminary geotechnical investigation of the landfill (Brown and Caldwell, 1986; Kleinfelder, 1986). The purpose of the investigation was to evaluate general soil conditions and provide preliminary recommendations for Site redevelopment. Seven borings (B-1 through B-7) were drilled to depths from 5 to 15 feet below ground surface (bgs). Three borings were drilled to depths from 21 to 70 feet and were converted to monitoring wells (FCY-1 through FCY-3). Groundwater was encountered at a depth of about 20 feet bgs although some water was perched within the landfill at about 5 feet bgs. The depth of waste in the landfill was estimated at 7 to 11 feet bgs. In addition to the exploratory borings, 11 landfill gas test probes (FG-1 through FG-11) were drilled and temporarily left open to obtain methane samples. As shown in the following table, methane was detected from 0 to 35% in test probes FG-1 through FG-7 located inside the landfill. Methane was not detected in test probes FG-8 through FG-11 located outside the landfill.

Methane Detections in Test Probes, January 9, 1986											
Test Probe	**FG-1**	**FG-2**	**FG-3**	**FG-4**	**FG-5**	**FG-6**	**FG-7**	**FG-8**	**FG-9**	**FG-10**	**FG-11**
Depth (ft)	10 ft	10 ft	10 ft	8 ft	9 ft	10 ft	10 ft	10 ft	10 ft	10 ft	10 ft
Methane	0.4%	0 %	9 %	0 %	1 %	15 %	35 %	0 %	0 %	0 %	0 %

1985 to 1990 Groundwater Monitoring

Groundwater elevation was monitored periodically from December 1985 through January 1987 and in December 1988 (Brown and Caldwell, 1990). Groundwater samples collected during 1985 through 1987 were analyzed for general minerals by appropriate U.S. EPA approved wet chemistry methods.

In June 1990, a *Solid Waste Water Quality Assessment Test (SWAT) Report* for the landfill was prepared (Brown and Caldwell, 1990). Waste discharge requirements were monitored under RWQCB Order No. 78-20. The City requested quarterly groundwater sampling of FCY-2 and FCY-3 and a waiver from vadose zone sampling from beneath the landfill. These items were granted by the RWQCB on January 17, 1989.

The groundwater samples collected quarterly from 1989 to 1990 were analyzed for volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) by U.S. EPA Methods 624 and 625. No VOCs or SVOCs were detected during this period (Brown and Caldwell, 1992). In addition, the groundwater samples were analyzed for general minerals by appropriate U.S. EPA-approved wet chemistry methods, and for chemical oxygen demand (COD) by U.S. EPA Method 410.1. Low level metal concentrations (below Department of Health Services maximum contaminant levels [MCLs] for drinking water) were detected. Furthermore, unidentified fatty acids were detected in groundwater samples and were most likely decomposition products (Brown and Caldwell, 1990). Groundwater elevation was monitored monthly for one year beginning in July 1989.

During the fourth quarter 1990 sampling event, a surface water sample was collected from Lake Natoma (down-gradient of the landfill) and analyzed for metals using atomic absorption spectroscopy methods. The results of the surface water sampling showed that nickel at 0.04 mg/L was the only metal present, and at a level well below the RWQCB's Designated Level in a Liquid for the Protection of Groundwater Quality (1.34 mg/L for nickel) established in September 1987 (Brown and Caldwell, 1992).

1991 Final Closure Plan

In August 1991, a *Final Closure Plan* was prepared for the landfill (Brown and Caldwell, 1991) and approved by the RWQCB on March 13, 1992. The Closure Plan outlined the City's intent to use the landfill site as a single-level parking lot and included a post-closure maintenance and monitoring plan. A landfill gas collection and control system, an air monitoring schedule, and a quarterly groundwater monitoring schedule were outlined in the closure plan. It was stated that the groundwater monitoring would be conducted on a quarterly basis for the two years following the landfill closure, with annual monitoring continuing for the next five years providing that no significant change in chemical parameters occurred.

1992 Monitoring and Reporting Program
In November 1992, a Water Quality Monitoring and Response Program was developed for the Landfill and approved by the RWQCB in June 1993 in response to the requirements of revised Article 5 of Chapter 15 of Division 3 of the California Code of Regulations. Under the program, the installation of three additional groundwater monitoring wells (FCY-4 through FCY-6) and a semi-annual monitoring schedule for general minerals, chemical oxygen demand (COD) and nickel were proposed. In May 2001, groundwater monitoring well FCY-1 was abandoned because it was completed above the typical groundwater elevation and was dry during multiple sampling attempts. Waivers for surface water and vadose zone sampling were requested. A waiver from vadose zone sampling from beneath the Landfill was granted by the RWQCB on June 8, 1993.

1993 Amendment to Final Closure Plan
In August 1993, the Final Closure Plan was amended to specify a smaller, single-level parking lot and re-vegetated open space for the landfill (Brown and Caldwell, 1993). In addition, the amendment specified semi-annual surface water sampling using the same monitoring parameters for the groundwater. Six gas monitoring wells were proposed to be installed for a perimeter monitoring network.

In December 1993, a Final Amendment to Final Closure Plan and to Letter of Modification was completed and approved by the County on January 21, 1994 and the California Integrated Waste Management Board (CIWMB) on February 1, 1994. The locations of the previously proposed six gas monitoring wells were amended and a semi-annual gas monitoring schedule was added. A waiver from leachate control and monitoring was requested.

1994 Investigation
In January 1994, Brown and Caldwell performed further investigation. During this investigation three additional monitoring wells (FCY-4 through FCY-6) were installed around the perimeter of the landfill and six landfill gas monitoring wells (GAS-1 through GAS-6) were installed through and near the landfill. The semi-annual groundwater sampling of five groundwater monitoring wells (FCY-2 through FCY-6) began mid-1994 (Brown and Caldwell, 1994).

1996 Landfill Cap Construction
In July 1996, the landfill cap was constructed that consists of three layers totaling approximately 4 feet:

- 12-inch vegetative soil layer;
- 12-inch clay layer; and
- 24-inch foundation layer.

The northern portion of the landfill cap features a 180-foot by 240-foot parking lot for City employee parking. The landfill cap in this area consists of four layers totaling approximately 4 feet:

- 2.5-inch asphalt concrete Type B;
- 10-inch aggregate base rock Class 2;
- 12-inch clay layer; and
- 24-inch foundation layer.

2000 Geotechnical Investigation
In October 2000, Brown and Caldwell/Kleinfelder conducted a geotechnical and environmental evaluation of the landfill as part of a study to evaluate remedial alternatives for the Site (Brown and Caldwell, 2001c; Kleinfelder, 2000). Under this investigation, four large-diameter (3-foot) borings (BA-1 through BA-4) were drilled and 24 test pits (TP-1 through TP-24) were excavated to assess the nature and extent of the fill, determine geotechnical parameters, and provide engineering cost estimates.

It appeared that fill extended past the former wastewater treatment plant lagoons to the north and south. In general, mostly soil fill with construction debris was found throughout. The debris in the main landfill area consisted of green waste and construction debris, the debris in the clarifier area consisted of mostly concrete and asphalt, and the debris in the uncontrolled fill area contained concrete, asphalt, newspapers, carpet and tires. The maximum depth of fill was determined to be 12 feet bgs.

Soil samples were collected from the test pits for chemical analysis of:

- Metals (CAM 17 list);
- Total petroleum hydrocarbons in the diesel range (TPH-d) and motor oil range (TPH-mo);
- Volatile organic compounds (VOCs);
- Semi-volatile organic compounds (VOCs);
- Chlorinated herbicides; and
- Organochlorine pesticides.

Samples were not obtained from the borings as they were used for observation purposes only. Analytical results indicated non-detectable or background levels of all measured constituents with the exception of TPH-d and TPH-mo. The samples were collected in fill that contained debris, some of which contained significant amounts of asphalt. All of the samples exhibited TPH-mo concentrations ranging from 180 to 2,200 milligrams per kilogram (mg/kg). According to the laboratory, the chromatograms for these samples indicate that they are not typical of motor oil and may be indicative of asphalt.

One soil sample was collected at 3 feet below grade from test pit TP-13 outside the main landfill area and tested for geotechnical properties. The soil material description was brown sandy gravel with clay. The plasticity index was 16 while the liquid limit was 33. Based on plasticity charts for the classification of fine-grained soils, this soil had low plasticity.

Two closure options were evaluated: off-site disposal and segregation/reuse with selected off-site disposal. The total volume of fill was estimated from 50,000 to 70,000 yds^3. The approximate volume fill for each area was estimated:

- Clarifier demolition debris – 5,000 to 7,000 yds^3;
- Capped landfill – 38,000 to 53,000 yds^3; and
- Uncontrolled fill – 7,000 to 10,000 yds^3.

2001 Revised MRP
A new groundwater monitoring well, FCY-7, was constructed on May 8 and 9, 2001. FCY-7 was installed at the direction of the RWQCB, to provide an upgradient background well. In September 2001, the RWQCB prepared the Revised MRP No. 95-246. In June 2002, FCY-8 and FCY-9 installed. Original location for FCY-9 was abandoned.

2006 Investigation
In April 2006, Brown and Caldwell excavated eight test pits (TPA-1 through TPA-8) to further define the extent of fill primarily in the uncontrolled fill area (Brown and Caldwell, 2006). The test pits confirmed that the uncontrolled fill area contains inert household type waste to a depth of 8 feet bgs. Items observed in the test pits included tires, asphalt, concrete, metal, plastic, glass, rubber, and some burn ash. No odors or staining were noted during the field activities.

2008 Pre-Design Investigation
In February 2008, Brown and Caldwell conducted a pre-design investigation (Brown and Caldwell, 2008a). The objectives of the investigation were to:

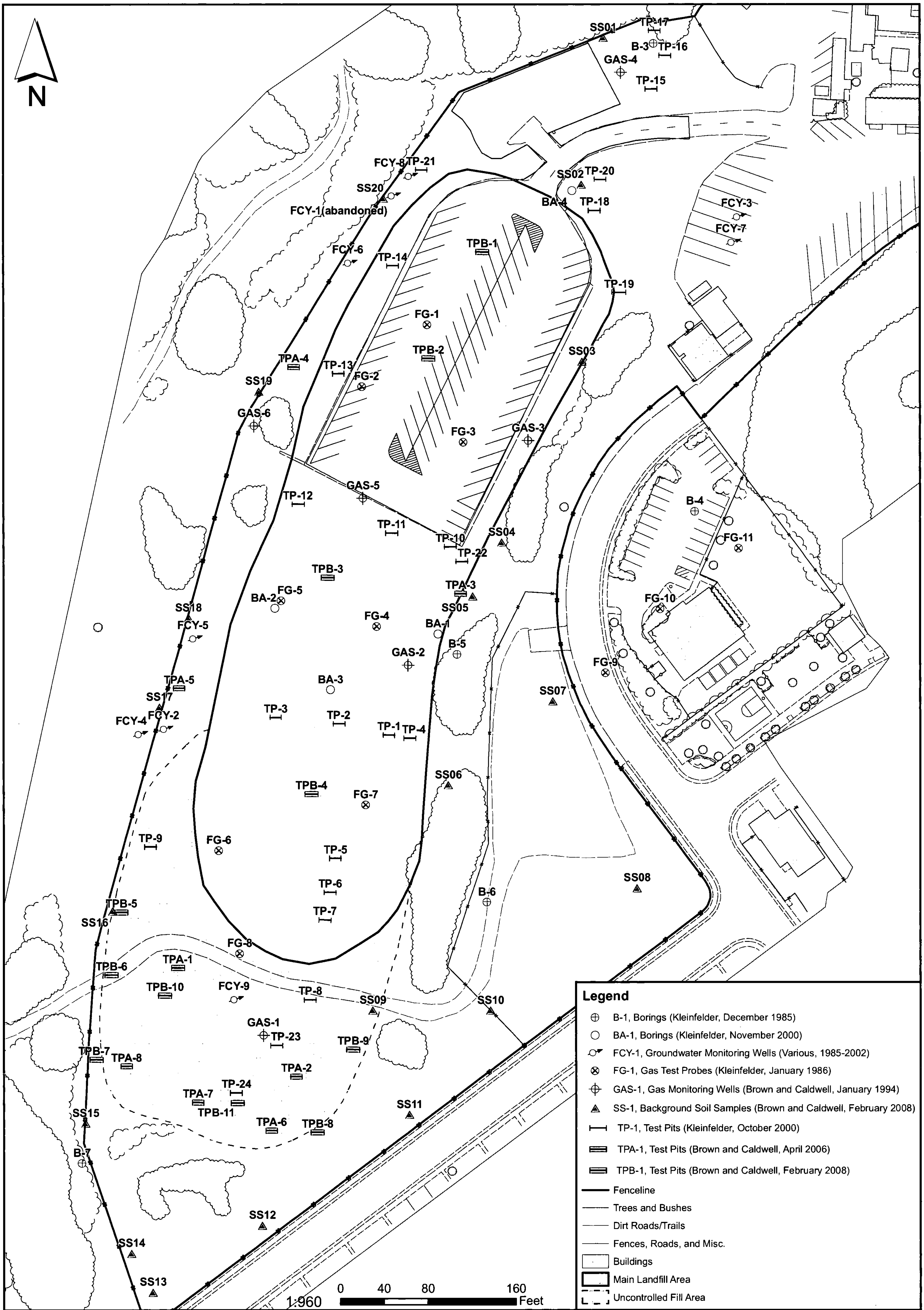
- Provide additional soil and solid waste data that would assist in estimating volumes of material that requiring removal during clean closure; and

- Assess levels of naturally occurring metals within soils outside areas affected by the landfill operations for use in developing cleanup goals for clean closure.

Eleven test pits (TPB-1 through TPB-11) were excavated for delineating fill and 20 soil samples (SS-1 through SS-20) were collected for chemical analysis of metals (CAM 17 list), nitrate, sulfate, pH, and specific conductance.

The contents of test pits TPB-1 through TPB-4 in the main landfill area were found to be predominately soil with some tree limbs, smaller chunks of asphalt and concrete, and a limited amount of trash (metal, PVC pipe, rubber hose, clothing, small pieces of carpet, etc). The plastic liner from the former sewage treatment ponds was observed in TPB-1, but not observed in any of the other test pits in the main landfill area. Test pits TPB-5 through TPB-11 were completed in the uncontrolled fill area. Household trash was observed at 1 to 7 feet below the surface and the fill interval was consistent at approximately 18" thick. Household trash observed consisted of various plastic items, glass, clothing, garden hose, carpet, etc.

Dredge tailings were sampled in background locations SS-1 through SS-20. Samples were collected between 12 to 24 inches below the surface. Trash was observed in the vicinity of SS10 that did not seem consistent with the landfill waste (i.e., a car muffler, wire, and beverage cans). There were some small pieces of asphalt noted in SS2 and SS20 that could be attributed to paving activities in the vicinity. Care was taken to collect the background samples from soil that was not in contact with any trash or asphalt.



BROWN AND CALDWELL

PROJECT	TITLE	Figure
134473	Investigation Locations	A-1
DATE	SITE	
2-1-08	Corporation Yard Landfill, Folsom, CA	

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ATTACHMENT A-1.

LOGS OF BORINGS, LANDFILL GAS TEST PROBES, MONITORING WELLS, AND TEST PITS

Groundwater Monitoring Well Construction Details

Corporation Yard Landfill, Folsom, CA

Well ID	Date Installed	Well Diam. (in)	Slot Size (in)	Top of Casing Elev. (ft msl)	Ground Surface Elev. (ft msl)	Boring Depth (ft bgs)	Blank Casing Interval (ft bgs)	Screen Interval (ft bgs)	Grout Interval (ft bgs)	Bentonite Interval (ft bgs)	Sand Interval (ft bgs)
FCY-1(1)	12/9/85	4	0.02	150.44	150.20	21	0 - 11	11 - 20.5	---	0 - 2	2 - 21
FCY-2	12/11/85	4	0.02	151.51	149.00	35	0 - 15	15 - 35	0 - 9	9 - 12	12 - 35
FCY-3	12/10/85	4	0.02	165.72	163.50	70	0 - 57	57 - 67	0 - 23	23 - 25	25 - 67
FCY-4	1/21/94	4	0.02	139.72	138.90	34.8	0 - 8.5	8.5 - 25.5	0 - 2.5	2.5 - 4.5	4.5 - 34.8
FCY-5	1/27/94	4	0.02	151.30	149.00	35.7	0 - 15	15 - 35	0 - 11	11 - 13.5	13.5 - 35.7
FCY-6	1/20/94	4	0.02	149.20	148.50	36.8	0 - 15	15 - 35	0 - 11.3	11.3 - 13.5	13.5 - 36.8
FCY-7	5/9/01	4	0.02	166.38	166.69	93	0 - 77.5	77.5 - 87.5	0 - 72	72 - 74	74 - 88
FCY-8	6/12/02	4	0.02	155.17	152.90	34.7	0 - 22	22 - 32	0 - 17	17 - 19.5	19.5 - 34.7
FCY-9(2)	6/11/02	4	0.02	148.45	146.30	28	0 - 13	13 - 28	0 - 7	7 - 9.5	9.5 - 28

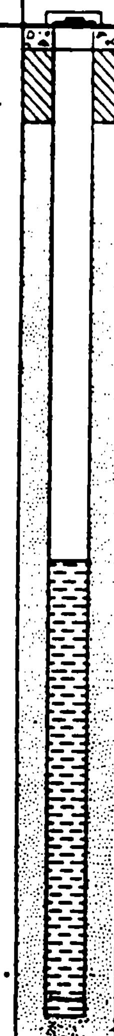
Notes

(1) Abandoned 6/13/02

(2) Originally designated as FCY-10

ft bgs = feet below ground surface

ft msl = feet above mean sea level (last surveyed on 12/19/2002)

Depth	OVA	BLOW/FT.	SAMPLE NO.	USCS	DESCRIPTION	WELL CONST
0				CL	Sandy CLAY: red-brown, moist, stiff, little silt	
2					GRAVEL and COBBLES: gray brown, sub-rounded to rounded, very dense, minor sandy clay matrix	
4						
6						
8						
10						
12						
14						
16					--- grades with sandy clay matrix	
18						
20				▽	--- groundwater encountered at 19 ft.	
22						

Test boring terminated at 21 ft. refusal
Groundwater encountered at 19 ft.
Test boring completed 12/9/86

J.H. KLEINFELDER & ASSOCIATES
GEOTECHNICAL CONSULTANTS • MATERIALS TESTING
LAND AND WATER RESOURCES

PROJECT NO. A-2737-1

LOG OF BORING NO. FCY-1

CITY OF FOLSOM CORPORATION YARD

PLATE 3

Depth (ft)	OVA	BLOW/FT.	SAMPLE NO.	USCS	DESCRIPTION	WELL CONST.
0–4				SC/CL	SAND and CLAY: gray-brown and red-brown, moist, stiff and med. dense, some gravel and cobbles	
4–10					GRAVEL and COBBLES: gray and brown, subrounded to rounded, very dense, minor sandy clay matrix	
10					--- increase in sandy clay matrix below 10 feet.	
20		25		▽		
30–32				ML	SILT: brown, moist, stiff some sand and some clay	

Depth scale: 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32

(Note: continued on next plate)

J.H. KLEINFELDER & ASSOCIATES
GEOTECHNICAL CONSULTANTS • MATERIALS TESTING
LAND AND WATER RESOURCES

PROJECT NO. A-2737-1

LOG OF BORING NO. FCY-2
CITY OF FOLSOM CORPORATION YARD

PLATE 4

Depth	OVA	BLOW/ FT.	SAMPLE NO.	USCS	DESCRIPTION	WELL CONST
32						
34				ML		
36					Test boring terminated at 35 ft. Groundwater encountered at 20ft. Test boring completed on 12-11-86	

J.H. KLEINFELDER & ASSOCIATES
GEOTECHNICAL CONSULTANTS • MATERIALS TESTING
LAND AND WATER RESOURCES

PROJECT NO. A-2737-1

LOG OF BORING NO. FCY-2

CITY OF FOLSOM CORPORATION YARD

PLATE 5

Depth	OVA	BLOW/FT.	SAMPLE NO.	USCS	DESCRIPTION	WELL CONST.
0				ML/GP	Clayey SILT and GRAVEL: brown and gray, moist, dense, some fine sand	
2					GRAVEL AND COBBLES: gray and brown, sub-angular to subrounded sand matrix	
4						
6					--- Increase in sand matrix from 6 to 8 ft	
8						
10						
12				CL	Silty CLAY: light brown, moist, very stiff, trace fine sand	
14				CL	CLAY: gray, moist, stiff some silt, trace fine sand	
16						
18						
20						
22						
24						
26						
28						
30						
32						

(NOTE: Continued on next plate)

Depth	OVA	BLOW/FT.	SAMPLE NO.	USCS	DESCRIPTION	WELL CONST
32					(Continued from previous page)	
34				CL		
36						
38						
40						
42						
44						
46				ML	SILT: gray, moist, very stiff, some clay	
48						
50						
52						
54						
56						
58						
60				SM	Silty SAND: gray, fine to med. grained, very moist very dense, some clay	
62				ML	Clayey SILT: gray, very moist, very stiff	
64						

J.H. KLEINFELDER & ASSOCIATES
GEOTECHNICAL CONSULTANTS • MATERIALS TESTING
LAND AND WATER RESOURCES

PROJECT NO. A-2737-1

LOG OF BORING NO. FCY-3

CITY OF FOLSOM CORPORATION YARD

PLATE 7

OVA	BLOW/ FT.	SAMPLE NO.	USCS	DESCRIPTION	WELL CONST.
64			SC	Clayey SAND: gray, fine to med., saturated dense	
66					
68					
	50/1"	*		Silty SANDSTONE: gray, very dense	
70					
				Test boring terminated at 70 ft. Groundwater level not stabilized Test boring completed 12/10/85	
72					

J.H. KLEINFELDER & ASSOCIATES
GEOTECHNICAL CONSULTANTS • MATERIALS TESTING
LAND AND WATER RESOURCES

PROJECT NO. A-2737-1

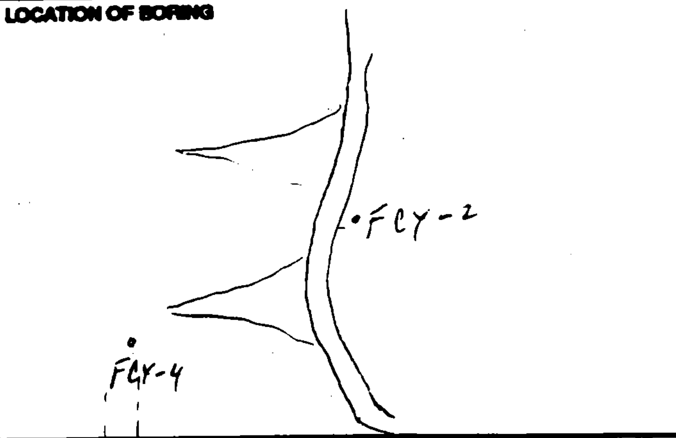
LOG OF BORING NO. FCY-3

CITY OF FOLSOM CORPORATION YARD

PLATE 8

Caldwell Consultants

BOREHOLE/WELL LOG

LOCATION OF BORING	CLIENT		BORING NO.
	Folsom Corp. Yard Landfill		FCY-4
	LOCATION: Folsom	JOB NO. 6720	SHEET 1 OF 2

WATER LEVEL	AT TIME OF DRILLING	SECOND	THIRD	FOURTH
TIME	19.00'	10.49'		
DATE	1/21/94 wrong	1/21/94		

DRILLING	START	FINISH
TIME	9:05	3:00pm
DATE	1/20/94	1/20/94

WELL CONSTR.	START	FINISH
TIME	2:00	12:[illegible]
DATE	1/20/94	1/21/94

DRILLING CONTRACTOR Weeks Drilling.

RIG TYPE Schramm-Rotadrill

DRILLING METHOD, FLUID USED Air rotary, casing hammer

SOIL SAMPLING METHOD

SURFACE ELEV.

MONITORING INSTRUMENT Gastechor #1214S

SURFACE CONDITIONS Rocky.

DRILLER Bob

CHECKED BY

DATE 1/20/94

LOGGED BY W. McConihe

DATE

WELL CONSTRUCTION: CASING	WELL CONSTRUCTION: ANNULUS	SAMPLER TYPE	BLOWS/6" INTERVAL	INTERVAL SAMPLED	RECOVERY	ANALYTICAL SAMPLE	DEPTH IN FEET	INSTRUMENT READING (ppm)	GRAVEL	SAND	FINES	MUNSELL COLOR NO.	USCS GROUP SYMBOL	DESCRIPTION: Group Name, Moisture, Color, Consistency, Density, Other
4" Solid PVC sch. 40	Bentonite cement grout						0						GP/GC	Many volcanic (fine grained) + granitic gravels, cobbles and boulders. Switch to steel casing
							1							
							2							Boring logged from cuttings
	Bentonite Pellet						3							
							4							
4" PVC sch. 40 w/ 0.020" slot	#3 sand						5							
							6							
							7							
							8							
							9							
							10			5	95	2.5Y 5/4	CL	Sitly clay, very damp, olive brown, firm to stiff moderately plastic, micaceous some red-brown streaks, logged from cuttings, contacts from driller
							1						GP	Hard boulder @ 12'
							2							
							3							
							4							
							5			20	80	2.5Y 4.5/4	CL	Clay, damp olive brown, firm, moderately plastic, micaceous, some silt, logged from cuttings many sand grains
							6							
							7					10YR 4/1		gray brown @ 17'
							8			30	70		ML	~~Clay~~ Silt, damp to dry, dark gray, stiff, micaceous ~~gray brown~~ crumbles, very fine sand
							9					N4/0		
							20					10YR 4/2		

Caldwell Consultants

BOREHOLE/WELL LOG

LOCATION OF BORING	CLIENT Folsom Corp. Yard Landfill	BORING NO. FCY-4
	LOCATION / JOB NO. 6720	SHEET 2 OF 2

WATER LEVEL	AT TIME OF DRILLING	SECOND	THIRD	FOURTH
TIME				
DATE				

DRILLING: START TIME / DATE; FINISH TIME / DATE

WELL CONSTR.: START TIME / DATE; FINISH TIME / DATE

DRILLING CONTRACTOR

RIG TYPE

DRILLING METHOD, FLUID USED

SOIL SAMPLING METHOD

SURFACE ELEV.

MONITORING INSTRUMENT

SURFACE CONDITIONS

DRILLER

DATE

CHECKED BY

DATE

LOGGED BY

WELL CONSTRUCTION: CASING	ANNULUS	SOIL SAMPLING: SAMPLER TYPE	BLOWS/6" INTERVAL	INTERVAL SAMPLED	RECOVERY ANALYTICAL SAMPLE	DEPTH IN FEET	INSTRUMENT READING (ppm)	ESTIMATED PERCENT: GRAVEL	SAND	FINES	MUNSELL COLOR NO.	USCS GROUP SYMBOL	DESCRIPTION: Group Name, Moisture, Color, Consistency, Density, Other
4" PVC sch. 40 w/0.020" slots						20						ML	Silt (cont'd) Clay is moist,
						1							
						2							
						3							
						4							
						5							Pull up casing when static water level is at (10.48')
						6							
						7							
						8							
						9							
						30							
	#3 sand					1							
						2							
						3							
						4							Total Depth @34.80 feet
						5							
						6							
						7							
						8							
						9							
						0							

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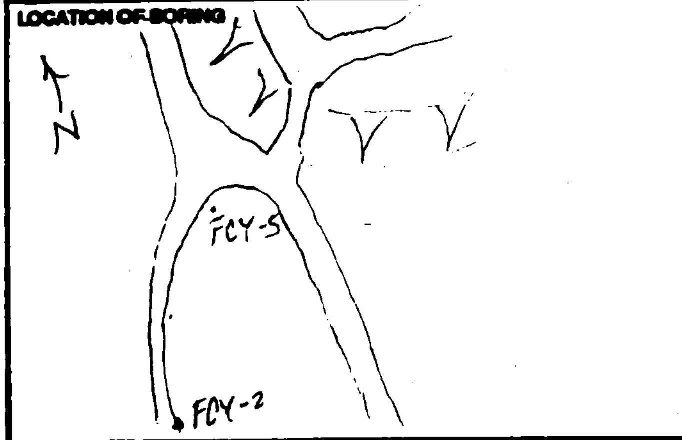
BOREHOLE/WELL LOG

LOCATION OF BORING



CLIENT	Folsom Corp Yard Landfill
LOCATION	Folsom
JOB NO.	6720
BORING NO.	FCY-5
SHEET	1 OF 2

WATER LEVEL	AT TIME OF DRILLING	SECOND	THIRD	FOURTH
TIME				
DATE	1/26/94 20.0			

DRILLING	START	FINISH
TIME	11:45	5:00PM
DATE	1/26/94	1/26/94

WELL CONSTR.	START	FINISH
TIME	7:45AM	5:00PM
DATE	1/27/94	1/27/94

DRILLING CONTRACTOR Weeks Drilling

RIG TYPE Schramm Rotadril

DRILLING METHOD, FLUID USED Air Rotary Casing Hammer

SOIL SAMPLING METHOD

SURFACE ELEV.

MONITORING INSTRUMENT Gastech

SURFACE CONDITIONS clay, gravel, cobble

DRILLER Bob

DATE

CHECKED BY

DATE 1/26/94

LOGGED BY William McConike

WELL CONSTRUCTION (CASING / ANNULUS): Solid 4" PVC sch.40 casing; Bentonite/cement grout; Bentonite Pellets; 4" PVC Sch.40 w/0.020" slot; #3 Sand

DEPTH IN FEET	INSTRUMENT READING (ppm)	GRAVEL	SAND	FINES	MUNSELL COLOR NO.	USCS GROUP SYMBOL	DESCRIPTION: Group Name, Moisture, Color, Consistency, Density, Other
0					5yr	CL	Clay, damp, red brown, moderate to high plasticity, firm
	0	4	1	95	4/6		stiff, occasional coarse SA-SR gravels to 1/4" grey streak
1						GP ↓ to Boulder	Cobbles and gravels SR-R to 6" from surface.
2		100					Observe slough after pulling out drill pipe SR-R boulders to 15 inches
3							
4							Mostly volcanic - basalt fine grained some quartz and garnet phenocrysts (Very hard drilling) medium gray color mostly some have a greenish hue
5	0						
6							Boring logged from cutting
7							
8							
9							
10	0						Drilling very hard
1							
2							
3							
4							
5							
6	0						
7							
8		10	85	5	10yr 3/4	SW	Sand, moist to wet, yellow brown, dense, fine to coarse grained, gravel fragments to 1/2". Upper contact from driller, easy drilling
9							
20	0					∇	

Caldwell Consultants

BOREHOLE/WELL LOG

LOCATION OF BORING

CLIENT	BORING NO.
Folsom Corp. Yard Landfill	FCY-5
LOCATION / JOB NO. 6720-	SHEET 2 OF 2

WATER LEVEL	AT TIME OF DRILLING	SECOND	THIRD	FOURTH
TIME				
DATE				

DRILLING: START TIME / DATE; FINISH TIME / DATE

DRILLING CONTRACTOR

RIG TYPE

DRILLING METHOD, FLUID USED

WELL CONSTR.: START TIME / DATE; FINISH TIME / DATE

SOIL SAMPLING METHOD

SURFACE ELEV.

MONITORING INSTRUMENT

SURFACE CONDITIONS

DRILLER ___ DATE ___ CHECKED BY ___ DATE ___ LOGGED BY ___

Well construction: 4" PVC sched 40 w/ 0.020" slots; #3 sand

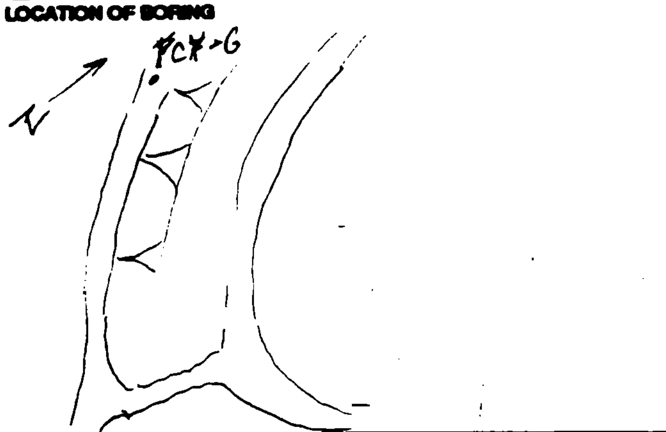
Depth in feet	Gravel	Sand	Fines	Munsell Color No.	USCS Group Symbol	Description: Group Name, Moisture, Color, Consistency, Density, Other
20						Sand as above (cont'd)
24	15	45	40	2.5y 3/2	SC	Clayey sand, moist, dark gray brown, dense, fine to coarse grained, SA gravels to 1/4"; light shade of color with depth.
26		80	20	10yr 4.5/6	SC	Clayey sand, moist to wet, yellow-brown, slightly dense, fine grained, crumbles, occasional medium to coarse sand
28		30	70	7.5yr 4/0	ML	~~Cl~~ Silt, dry to damp, dark gray, hard, crumbles to powder, very fine sand.
						Logged from cuttings.
36						Total Depth @ 35 ft. 8 inches
						35'8
40						

Brown and Caldwell Consultants

BOREHOLE/WELL LOG

CLIENT: Folsom City					BORING NO.: FCY 6
LOCATION: Folsom Landfill		JOB NO.: 6702-00			SHEET 1 OF 2
WATER LEVEL	AT TIME OF DRILLING	SECOND	THIRD	FOURTH	DRILLING START: TIME 14:10, DATE 1/18/94 — FINISH: TIME 12:?, DATE 1/19/94
TIME	7:30 AM				
DATE	20.20				
DRILLING CONTRACTOR: Weeks Drilling					WELL CONSTR. START: TIME 12:40, DATE 1/19/94 — FINISH: TIME 9:55, DATE 1/20/94
RIG TYPE: Schramm - Rotadrill DG-85H					
DRILLING METHOD, FLUID USED: Air rotary, casing driven 5¼" radius					
SOIL SAMPLING METHOD: None taken					SURFACE ELEV.
MONITORING INSTRUMENT: Gastech					
SURFACE CONDITIONS: Dirt cobble					

LOCATION OF BORING



DRILLER: Bob, Les, Pete

DATE: 1/18/94

CHECKED BY:

LOGGED BY: Will McConihe

WELL CONSTRUCTION: Solid 4" PVC sched. 40 casing; bentonite/cement grout; Bentonite; 4" PVC Sch. 40 w/ 0.020 slots; #3 sand

DEPTH IN FEET	MUNSELL COLOR NO.	USCS GROUP SYMBOL	DESCRIPTION: Group Name, Moisture, Color, Consistency, Density, Other
0		GP	Gravel; brown, damp, very dense, rounded to subrounded gravels to cobbles mostly ½ to 1" fragments from tricone bit, many fine sand+gravel fragments, mostly volcanic (Bas...
2			Cobble + gravels are granitic and
3	10yr 6/4		Logged from Cutting
5–7			Cuttings and dust are blowing out through the formation and down it into openings. Dust is blowing out through the cobbles on hillside 20 feet from rig
10			Chatter @ 10' big cobble
12			Cobble + Gravels slough in behind drill bit
18			Big cobble @ 18 feet
19	10yr 5/3	CL	Brown clay, damp, stiff, moderate plasticity
		GP	Gravels and cobble as above
20			

INSTRUMENT READING (ppm)	GRAVEL	SAND	FINES	SAMPLER TYPE	BLOWS/6" INTERVAL	INTERVAL SAMPLED	RECOVERY	ANALYTICAL SAMPLE	CASING	ANNULUS

Brown and Caldwell Consultants

BOREHOLE/WELL LOG

LOCATION OF BORING

CLIENT					BORING NO. FCY-6
LOCATION		JOB NO.			SHEET 2 OF 2
WATER LEVEL	AT TIME OF DRILLING	SECOND	THIRD	FOURTH	DRILLING
TIME					START TIME / FINISH TIME
DATE					DATE / DATE
DRILLING CONTRACTOR					WELL CONSTR.
RIG TYPE					START / FINISH
DRILLING METHOD, FLUID USED					TIME / TIME
					DATE / DATE

SOIL SAMPLING METHOD | SURFACE ELEV.

MONITORING INSTRUMENT

SURFACE CONDITIONS

DRILLER ____ DATE ____ CHECKED BY ____ DATE ____ LOGGED BY ____

Well construction: 4" PVC sch. 40 w/ 0.020" slots; #3 sand

CASING	ANNULUS	SAMPLER TYPE	BLOWS/6" INTERVAL	INTERVAL SAMPLED	RECOVERY	ANALYTICAL SAMPLE	DEPTH IN FEET	INSTRUMENT READING (ppm)	GRAVEL	SAND	FINES	MUNSELL COLOR NO.	USCS GROUP SYMBOL	DESCRIPTION: Group Name, Moisture, Color, Consistency, Density, Other
							20			30	70	N 4/0	ML	Silt ~~Clay~~, ~~gr~~ dry to damp, dark gray, dense ~~soft~~, crumbles, micaceous, very fine sand.
							1							
							2							
							3							
							4							
							5							
							6							
							7							
							8							
							9							
							30							
							1						GP/GC	Boulders at 31 to 35 feet, sloughs in on bit
							2							
							3							
							4							
							5						CL	Clay, soft @35 ft from driller
							6							Total Depth @ 36 ft 8 inches
							7							
							8							
							9							
							40							

BROWN AND CALDWELL

BOREHOLE/WELL LOG

LOCATION OF BORING	N W E S SCALE:
CLIENT	Folsom City
LOCATION	1300 Leidorff Street
PROJECT NAME	Folsom City Corporation Yard
JOB NUMBER	19373
DRILLING CONTRACTOR	Cascade Drilling
RIG TYPE (CIRCLE ONE) HSA DP MUD ARCH NONE	OTHER AIR Rotary
DRILLING METHOD, FLUID USED	
SOIL SAMPLING METHOD (CIRCLE ONE) SPLIT SPOON CC ACETATE NONE	OTHER
MONITORING INSTRUMENT (CIRCLE ONE) PID FID LEL RAD NONE	OTHER
SURFACE CONDITIONS (CIRCLE ONE) ASPHALT CONCRETE DIRT DRY WET	OTHER

BORING NUMBER	FCY-7
SHEET 1	OF 5
DRILLING	
START	FINISH
TIME 10:50	TIME 2:20
DATE 5-8-01	DATE 5-8-01
WELL CONSTRUCTION	
START	FINISH
TIME	TIME
DATE	DATE

FINE GRAINED AND ORGANIC SOIL DESCRIPTION: GROUP NAME, MUNSELL COLOR, COLOR, SIZE DISTRIBUTION, PLASTICITY, DRY STRENGTH, DILATANCY, TOUGHNESS, MOISTURE, ODOR, STRUCTURE, CONSISTENCY, RELATIVE PERMEABILITY, LOCAL GEOLOGIC NAME, CONTACT DESCRIPTION

COARSE GRAINED SOIL DESCRIPTION: GROUP NAME, MUNSELL COLOR, COLOR, GRADATION (g/s/f), SIZE DISTRIBUTION, PLASTICITY, SHAPE, ANGULARITY, MOISTURE, ODOR, STRUCTURE, CEMENTATION, RELATIVE PERMEABILITY, LOCAL GEOLOGIC NAME, MINERALOGY, CONTACT DESCRIPTION

WELL CONSTRUCTION: ANNULUS	CASING	SOIL SAMPLING: SAMPLER USED	BLOWS/6" INTERVAL	INTERVAL SAMPLED	RECOVERY	ANALYTICAL SAMPLE (A,B,C)	WATER LEVEL (INTIAL/STATIC)	DEPTH (FEET)	INSTRUMENT READING (ppm)	USCS GROUP SYMBOL	SAMPLE TYPE: INTERVAL: DESCRIPTION
								0			0-1" ~~Asphalt~~ Asphalt
											1"-18" Road base
										GW	18"-6' GW - Cobbles and gravel, lt brown
								5			6-12' 5"-2" diameter, wet
								10		GW	
											12-14' SP - Sandy layer, lt brown, med grained
											14-18' grades to grey, coarse grained
								15		SP	sand - coarse grained clay, wet
											18' - resistant layer, poss. a boulder
								20			18'-25' - SC - clayey silt gray

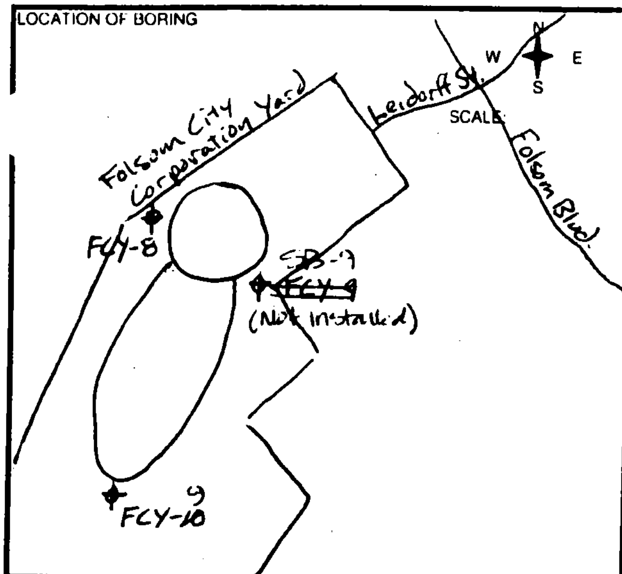
ALYTICAL SAMPLE ID (SEE ABOVE FOR LOCATION)

A ______ D ______
B ______ E ______
C ______ F ______

BROWN AND CALDWELL

BOREHOLE/WELL LC

LOCATION OF BORING



CLIENT: City of Folsom

LOCATION: Folsom, CA

PROJECT NAME: Folsom Corporation Yard Landfill

JOB NUMBER: 21391

DRILLING CONTRACTOR: Cascade

RIG TYPE (CIRCLE ONE): HSA DP MUD ARCH NONE OTHER Air Rotary

DRILLING METHOD, FLUID USED

SOIL SAMPLING METHOD (CIRCLE ONE): SPLIT SPOON CC ACETATE NONE OTHER

MONITORING INSTRUMENT (CIRCLE ONE): PID FID LEL RAD NONE OTHER

SURFACE CONDITIONS (CIRCLE ONE): ASPHALT CONCRETE DIRT DRY WET OTHER

BORING NUMBER: FCY-8

SHEET 1 OF 2

DRILLING	
START	FINISH
TIME 10:00	TIME 18:25
DATE 6-12-02	DATE 6-12-0[illegible]

WELL CONSTRUCTION	
START	FINISH
TIME 7:15	TIME 12:01
DATE 6-13-02	DATE ~~6-13-02~~ 6-25-[illegible]

WELL CONSTRUCTION: ANNULUS, CASING | SOIL SAMPLING: SAMPLER USED, BLOWS/6" INTERVAL, INTERVAL SAMPLED, RECOVERY, ANALYTICAL SAMPLE (A,B,C) | WATER LEVEL (INTIAL/STATIC) | DEPTH (FEET) | INSTRUMENT READING (ppm) | USCS GROUP SYMBOL

FINE GRAINED AND ORGANIC SOIL DESCRIPTION: GROUP NAME, MUNSELL COLOR, COLOR, SIZE DISTRIBUTION, PLASTICIT DRY STRENGTH, DILATANCY, TOUGHNESS, MOISTURE, ODOR, STRUCTURE, CONSISTENCY, RELATIVE PERMEABILITY, LOCAL GEOLOGIC NAME, CONTACT DESCRIPTION

COARSE GRAINED SOIL DESCRIPTION: GROUP NAME, MUNSELL COLOR, COLOR, GRADATION (g/s/f), SIZE DISTRIBUTION, PLASTICITY, SHAPE, ANGULARITY, MOISTURE, ODOR, STRUCTURE, CEMENTATION, RELATIVE PERMEABILIT LOCAL GEOLOGIC NAME, MINERALOGY, CONTACT DESCRIPTION

ANNULUS: Neat Cement (to ~18 ft); Bentonite (below)

CASING: 4" Dia. 40 PVC Blank Casing

DEPTH (FEET)	INSTRUMENT READING (ppm)	USCS GROUP SYMBOL	SAMPLE TYPE: INTERVAL: DESCRIPTION
0			0-3 Silt - medium brown, (0, 20, 80) fine grained sand some cobbles ~ 4" diameter
			3-6 Gravel - rounded, ~ .5"-1.5", reddish brown matrix, clay matrix.
5			6-10 Silt with gravel - dark black, high organic material, and landfill debris
		ML	
			10-15 Silt with gravel - (40, 30, 30) medium brown moist, gravel is rounded ~.5-1.5"
10	0% 20.9ppm %		
			15-20 Gravel with silt - andesite pieces, greenish blue angular, fresh fractures, lt brown silt matrix
			20-21 Sand with gravel - lt brown ~~coarse~~ grained sand to gravel pieces ranging from .25" to 1" in diameter
15			
			2~~1~~3-23 Gravel - lt brown with silt, andesite pieces ~~(60, 40, 0)~~ (60, 20, 20).
		Gravel	23-25 Gravel - lt brown, andesite pieces (90, 5, 5)
20	0% 20.9ppm %		

ANALYTICAL SAMPLE ID (SEE ABOVE FOR LOCATION)

A ______ D ______

B ______ E ______

C F

BROWN AND CALDWELL

BOREHOLE/WELL LOG

LOCATION OF BORING	See Page One
CLIENT	See Page One
LOCATION	
PROJECT NAME	
JOB NUMBER	
DRILLING CONTRACTOR	
RIG TYPE (CIRCLE ONE) HSA DP MUD ARCH NONE OTHER	
DRILLING METHOD, FLUID USED	
SOIL SAMPLING METHOD (CIRCLE ONE) SPLIT SPOON CC ACETATE NONE OTHER	
MONITORING INSTRUMENT (CIRCLE ONE) PID FID LEL RAD NONE OTHER	
SURFACE CONDITIONS (CIRCLE ONE) ASPHALT CONCRETE DIRT DRY WET OTHER	
BORING NUMBER	FCY-8
SHEET	2 OF 2
DRILLING START TIME / DATE; FINISH TIME / DATE	
WELL CONSTRUCTION START TIME / DATE; FINISH TIME / DATE	

FINE GRAINED AND ORGANIC SOIL DESCRIPTION: GROUP NAME, MUNSELL COLOR, COLOR, SIZE DISTRIBUTION, PLASTICITY, DRY STRENGTH, DILATANCY, TOUGHNESS, MOISTURE, ODOR, STRUCTURE, CONSISTENCY, RELATIVE PERMEABILITY, LOCAL GEOLOGIC NAME, CONTACT DESCRIPTION

COARSE GRAINED SOIL DESCRIPTION: GROUP NAME, MUNSELL COLOR, COLOR, GRADATION (g/s/f), SIZE DISTRIBUTION, PLASTICITY, SHAPE, ANGULARITY, MOISTURE, ODOR, STRUCTURE, CEMENTATION, RELATIVE PERMEABILITY, LOCAL GEOLOGIC NAME, MINERALOGY, CONTACT DESCRIPTION

WELL CONSTRUCTION: ANNULUS	CASING	SAMPLER USED	BLOWS/6" INTERVAL	INTERVAL SAMPLED	RECOVERY	ANALYTICAL SAMPLE (A,B,C)	WATER LEVEL (INITIAL/STATIC)	DEPTH (FEET)	INSTRUMENT READING (ppm)	USCS GROUP SYMBOL	SAMPLE TYPE: INTERVAL: DESCRIPTION
#3 SAND	4" Dia 40PVC Blank Casing							20		SW	25-27 · Gravel - gray blue matrix, andesite pieces and ~~pi~~ orthoclase, and quartz. (90% gravel) gravel is angular, ranging in size from ~1/2" to 1"
	4" Dia. 40 PVC 0.020 slotted screen						▼	25		Gravel	27-30 Clay - gray blue, high plasticity, (2,10,88) Sand is fine grained.
										~~Gravel~~	30-31.5 Gravel - andesite, plagioclase, orthoclase, quartz angular, (60,10,30) gray blue clay, high plasticity
								30		CL	31.5-32 Gravel - andesite, orthoclase, quartz, angular range in size 1/2" to 1.5" (10,55) gray blue matrix
										Gravel	32-34.5 Clay - gray blue (5,5,90) high plasticity
								35		CL	
											Total Depth 34.7ft
								40			

ANALYTICAL SAMPLE ID (SEE ABOVE FOR LOCATION)

A ________ D ________

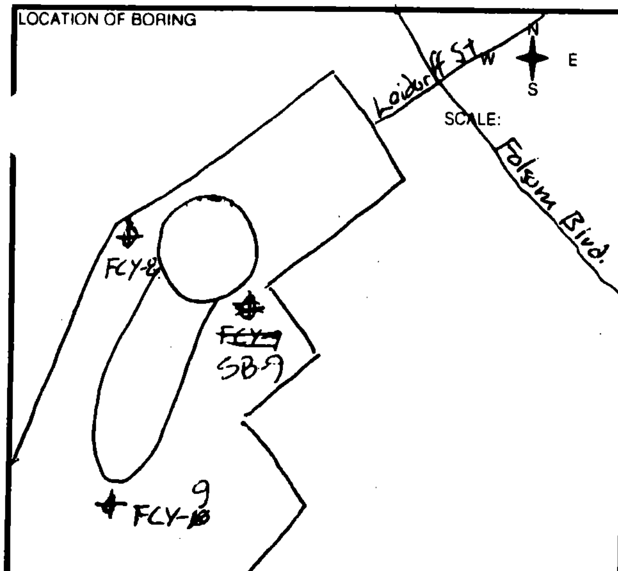
B ________ E ________

C F

BROWN AND CALDWELL

BOREHOLE/WELL LO

LOCATION OF BORING



CLIENT	City of Folsom
LOCATION	Folsom, CA
PROJECT NAME	City of Folsom Corporation Yard Landfill
JOB NUMBER	21391
DRILLING CONTRACTOR	Cascade
RIG TYPE (CIRCLE ONE) HSA DP MUD ARCH NONE	OTHER Air rotary
DRILLING METHOD, FLUID USED	
SOIL SAMPLING METHOD (CIRCLE ONE) SPLIT SPOON CC ACETATE NONE	OTHER
MONITORING INSTRUMENT (CIRCLE ONE) PID FID LEL RAD NONE	OTHER
SURFACE CONDITIONS (CIRCLE ONE) ASPHALT CONCRETE DIRT DRY WET	OTHER

BORING NUMBER: FCY-9 ~~FCY-10~~

SHEET 1 OF 2

DRILLING	
START	FINISH
TIME 10:20	TIME 14:27
DATE 6-11-02	DATE 6-11-02

WELL CONSTRUCTION	
START	FINISH
TIME 14:30	TIME 8:18
DATE 6-11-02	DATE 6-12-02

WELL CONSTRUCTION: ANNULUS	WELL CONSTRUCTION: CASING	SOIL SAMPLING: SAMPLER USED	BLOWS/6" INTERVAL	INTERVAL SAMPLED	RECOVERY	ANALYTICAL SAMPLE (A,B,C)	WATER LEVEL (INTIAL/STATIC)	DEPTH (FEET)	INSTRUMENT READING (ppm)	USCS GROUP SYMBOL
								0		
NEAT CEMENT	4" Dia. 40 PVC Blank Casing							5		Gravel
Bentonite								10		
#3 Sand	4" Dia 40 PVC 0.020 Slotted Screen							15		Gravel
								20		

FINE GRAINED AND ORGANIC SOIL DESCRIPTION: GROUP NAME, MUNSELL COLOR, COLOR, SIZE DISTRIBUTION, PLASTICITY DRY STRENGTH, DILATANCY, TOUGHNESS, MOISTURE, ODOR, STRUCTURE, CONSISTENCY, RELATIVE PERMEABILITY, LOCAL GEOLOGIC NAME, CONTACT DESCRIPTION

COARSE GRAINED SOIL DESCRIPTION: GROUP NAME, MUNSELL COLOR, COLOR, GRADATION (g/s/f), SIZE DISTRIBUTION, PLASTICITY, SHAPE, ANGULARITY, MOISTURE, ODOR, STRUCTURE, CEMENTATION, RELATIVE PERMEABILITY LOCAL GEOLOGIC NAME, MINERALOGY, CONTACT DESCRIPTION

SAMPLE TYPE: INTERVAL: DESCRIPTION

0-6 Gravel - angular pieces of greenish blue andesite range in size from .25"-1", 90% andesite, 10% quartz and orthoclase rounded, range in size from 1/8"-1/4", small layer of fines, ML-silt, lt brown, fine grained

6-12' Gravel - same as above

12'-13' cobbles and Boulders, no recovery

14-15' Gravel - rounded pieces of quartz and orthoclase, range in size from 1/8" to 1/4", some coarse grained sand,

15'-20' Gravel - same as above

23'-25' Sand - fine to coarse grained, lt brown (0,85,15) 15% silt.

ANALYTICAL SAMPLE ID (SEE ABOVE FOR LOCATION)

A ______ D ______
B ______ E ______
C ______ F ______

BROWN AND CALDWELL

BOREHOLE/WELL LO

LOCATION OF BORING	See Page One
CLIENT	See Page One
LOCATION	
PROJECT NAME	
JOB NUMBER	
DRILLING CONTRACTOR	
RIG TYPE (CIRCLE ONE) HSA DP MUD ARCH NONE OTHER	
DRILLING METHOD, FLUID USED	
SOIL SAMPLING METHOD (CIRCLE ONE) SPLIT SPOON CC ACETATE NONE OTHER	
MONITORING INSTRUMENT (CIRCLE ONE) PID FID LEL RAD NONE OTHER	
SURFACE CONDITIONS (CIRCLE ONE) ASPHALT CONCRETE DIRT DRY WET OTHER	
BORING NUMBER	FCY-9 ~~FCY-10~~
SHEET	2 OF 2
DRILLING START TIME / FINISH TIME / DATE / DATE	See Page One
WELL CONSTRUCTION START TIME / FINISH TIME / DATE / DATE	See Page One

W N E S SCALE:

FINE GRAINED AND ORGANIC SOIL DESCRIPTION: GROUP NAME, MUNSELL COLOR, COLOR, SIZE DISTRIBUTION, PLASTICITY, DRY STRENGTH, DILATANCY, TOUGHNESS, MOISTURE, ODOR, STRUCTURE, CONSISTENCY, RELATIVE PERMEABILITY, LOCAL GEOLOGIC NAME, CONTACT DESCRIPTION

COARSE GRAINED SOIL DESCRIPTION: GROUP NAME, MUNSELL COLOR, COLOR, GRADATION (g/s/f), SIZE DISTRIBUTION, PLASTICITY, SHAPE, ANGULARITY, MOISTURE, ODOR, STRUCTURE, CEMENTATION, RELATIVE PERMEABILITY, LOCAL GEOLOGIC NAME, MINERALOGY, CONTACT DESCRIPTION

WELL CONSTRUCTION: ANNULUS	WELL CONSTRUCTION: CASING	SOIL SAMPLING: SAMPLER USED	SOIL SAMPLING: BLOWS/6" INTERVAL	SOIL SAMPLING: INTERVAL SAMPLED	SOIL SAMPLING: RECOVERY	SOIL SAMPLING: ANALYTICAL SAMPLE (A,B,C)	WATER LEVEL (INTIAL/STATIC)	DEPTH (FEET)	INSTRUMENT READING (ppm)	USCS GROUP SYMBOL	SAMPLE TYPE: INTERVAL: DESCRIPTION
#3 SAND	4" Dia 40 PVC 0.020 Slotted Screen							20		Gravel	20' Gravel
											23'-25' Sand, fine to course grained, lt brown (0,85,15) 15% Silt
											27'-28' Sand, fine grained, (0,60,40) lt brown
								25		SW	
											Total Depth 28'
								30			
								35			
								40			

ANALYTICAL SAMPLE ID (SEE ABOVE FOR LOCATION)

A ______ D ______
B ______ E ______
C F

Landfill Gas Monitoring Well Construction Details

Corporation Yard Landfill, Folsom, CA

Well ID	Date Installed	Diam. (in)	Slot Size (in)	Boring Depth (ft bgs)	Blank Casing Interval (ft bgs)	Screen Interval (ft bgs)	Grout Interval (ft bgs)	Bentonite Interval (ft bgs)	Sand Interval (ft bgs)
Gas-1	1/26/94	2	0.02	16	0 - 5	5 - 15	0 - 2	2 - 4	4 - 15
Gas-2	1/27/94	2	0.02	15.5	0 - 5	5 - 15	0 - 2	2 - 4	4 - 15.5
Gas-3	1/27/94	2	0.02	16	0 - 5	5 - 15	0 - 2	2 - 4	4 - 16
Gas-4	1/27/94	2	0.02	14.8	0 - 5	5 - 14.8	0 - 1.7	1.7 - 3.7	3.7 - 14.8
Gas-5	1/27/94	2	0.02	16	0 - 4.7	4.7 - 14.7	0 - 1.5	1.5 - 3.5	3.5 - 14.7
Gas-6	1/27/94	2	0.02	16	0 - 5	5 - 15	0 - 1.7	1.7 - 3.7	3.7 - 15.7

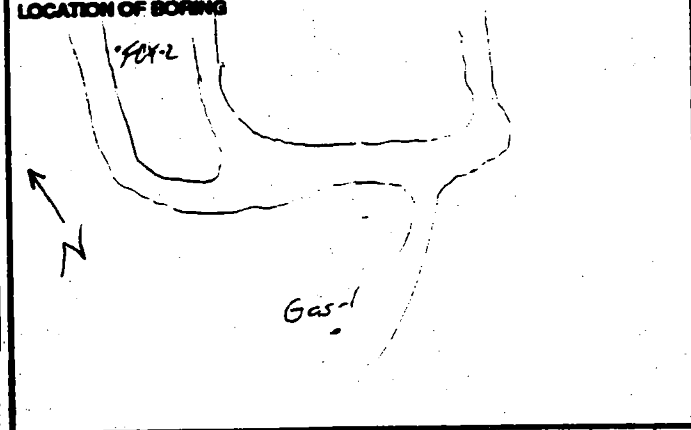
Notes

ft bgs = feet below ground surface

Caldwell Consultants

BOREHOLE/WELL LOG

LOCATION OF BORING



CLIENT	Folsom Corp. Yard Landfill
LOCATION	Folsom
JOB NO.	6720
BORING NO.	Gas-1
SHEET	1 OF 1

WATER LEVEL	AT TIME OF DRILLING	SECOND	THIRD	FOURTH
TIME				
DATE				

	START	FINISH
DRILLING TIME	9:20	10:45
DRILLING DATE	1/26/94	1/26/94
WELL CONSTR. TIME	10:50	14:20
WELL CONSTR. DATE	1/26/94	1/27/94

DRILLING CONTRACTOR Weeks Drillin.

RIG TYPE Schramm Rotodril

DRILLING METHOD, FLUID USED Air Rotary Casing Hammer

SOIL SAMPLING METHOD None

SURFACE ELEV.

MONITORING INSTRUMENT Gastech.

SURFACE CONDITIONS Gravel, Cobble

DRILLER Bob

DATE

CHECKED BY

DATE 1/26/94

LOGGED BY W. McConike

WELL CONSTRUCTION: CASING	ANNULUS	SAMPLER TYPE	BLOWS/6" INTERVAL	INTERVAL SAMPLED	RECOVERY	ANALYTICAL SAMPLE	DEPTH IN FEET	INSTRUMENT READING (ppm)	GRAVEL	SAND	FINES	MUNSELL COLOR NO.	USCS GROUP SYMBOL	DESCRIPTION: Group Name, Moisture, Color, Consistency, Density, Other
2" PVC solid sch. 40	Bentonite / Bentonite Cement Grout						0					5yr 4/6	CL	Clay, red brown, damp, moderate plasticity, stiff to firm. SA gravels to 1", medium to coarse sand; occasional large gravels and cobbles.
							1	0	15	10	75			Logged from cuttings 0-16 ft.
							2							
							3							
							4							
							5		100				GP/C	Gravel and Cobbles, volcanic, very hard drilling.
2" PVC sch. 40 w/ 0.020" slots	#3 sand						6							
							7	0						
							8							
							9							
							0							
							1							
							2	0						
							3							
							4							
							5							Gravel slough at 15'1" to 16 feet
slough							6							Total depth @ 16 feet
							7							
							8							
							9							
							0							

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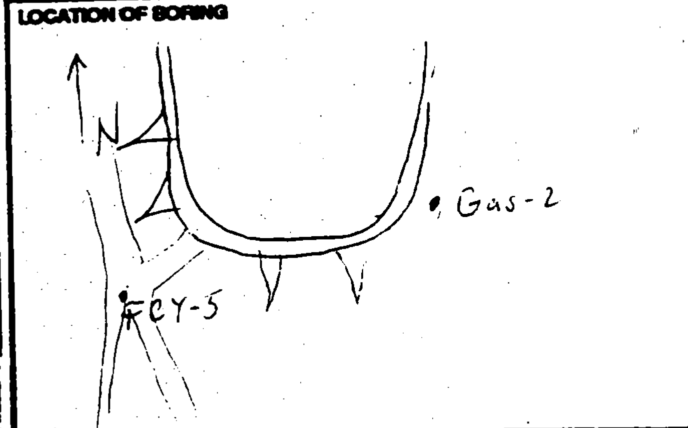
BOREHOLE/WELL LOG

LOCATION OF BORING



CLIENT	Folsom Corp. Yard Landfill
BORING NO.	GAS-2
LOCATION	Folsom
JOB NO.	6720-00
SHEET	1 OF

WATER LEVEL	AT TIME OF DRILLING	SECOND	THIRD	FOURTH
TIME				
DATE				

	DRILLING START	DRILLING FINISH	WELL CONSTR. START	WELL CONSTR. FINISH
TIME	12:15	13:15	13:20	15:30
DATE	1/24/97	1/24/95	1/24/94	1/27/94

DRILLING CONTRACTOR: Weeks Drilling

RIG TYPE: Schramm Rotadrill

DRILLING METHOD, FLUID USED: Air Rotary
Casing-Hammer
- 7" O.D. Casing (6" I.D.

SOIL SAMPLING METHOD: None

SURFACE ELEV.:

MONITORING INSTRUMENT: Gastecher

SURFACE CONDITIONS: Gravel + clay surface

DRILLER: Bio

DATE:

CHECKED BY:

DATE: 1/24/94

LOGGED BY: W. McClimbe

WELL CONSTRUCTION: CASING	WELL CONSTRUCTION: ANNULUS	DEPTH IN FEET	GRAVEL	SAND	FINES	MUNSELL COLOR NO.	USCS GROUP SYMBOL	DESCRIPTION: Group Name, Moisture, Color, Consistency, Density, Other
solid PVC casing	Bentonite Cement Grout	0	2	10	88	10yr 4/4	CL	Sand clay, damp, orange brown, low plasticity, crumbles, occasional coarse sand gravel
		1						Logged from cuttings, 0-15.5 feet
	Bentonite pellets	2–4						
2" PVC sch 40 with 0.020 slots	#3 sand	8	2	15	83	10yr 5/4	CL	Sandy clay, damp, dark yellow brown, moderate plastic, medium to coarse sand, occasional gravels to 1¼ inches
		12					GP/C	Very gravelly and cobbles below 12 feet. Hard drilling, mostly volcanic fragments, fine grained, gray.
		15						Total Depth @ 15.5 feet

Depth scale: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 1, 2, 3, 4, 5, 6, 7, 8, 9, 20

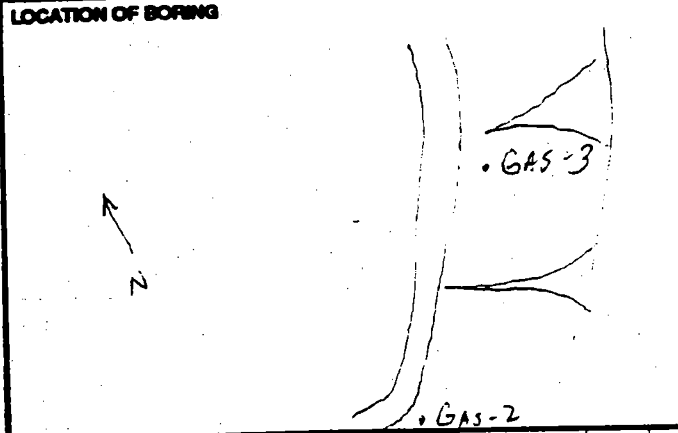
Other columns: SOIL SAMPLING (SAMPLER TYPE, BLOWS/6" INTERVAL, INTERVAL SAMPLED, RECOVERY, ANALYTICAL SAMPLE), INSTRUMENT READING (ppm) — no entries.

Brown and Caldwell Consultants

BOREHOLE/WELL LOG

CLIENT	JOB NO.	BORING NO.
~~Eco~~ Folsom Corp. Yard Landfill		Gas -3
LOCATION: Folsom	6720	SHEET 1 OF 1

LOCATION OF BORING



WATER LEVEL	AT TIME OF DRILLING	SECOND	THIRD	FOURTH
TIME				
DATE				

	DRILLING START	DRILLING FINISH	WELL CONSTR. START	WELL CONSTR. FINISH
TIME	8:11	9:55	8.55	15:00
DATE	1/25/94	1/25/94	1/25/94	1/27/94

DRILLING CONTRACTOR: Weeks Drilling
RIG TYPE: Schramm Rotadrill
DRILLING METHOD, FLUID USED: Air Rotary Casing Hammer
SOIL SAMPLING METHOD:
SURFACE ELEV.:
MONITORING INSTRUMENT: Bastech
SURFACE CONDITIONS: Soil clayey

DRILLER: Bow
DATE:
CHECKED BY:
DATE: 1/25/94
LOGGED BY: W.M^c Conihe

WELL CONSTRUCTION: CASING: 2" PVC solid sch.40 (0–5); ~~2"~~ PVC sch40 w/0.020" slots (5–16). ANNULUS: Bentonite Cement Grout (0–2); Bentonite Pellets (2–4); #3 sand (4–16).

DEPTH IN FEET	INSTRUMENT READING (ppm)	GRAVEL	SAND	FINES	MUNSELL COLOR NO.	USCS GROUP SYMBOL	DESCRIPTION: Group Name, Moisture, Color, Consistency, Density, Other
0	0				5yr 4/4	CL	Clay, damp, red-brown, moderate plasticity some gray modeling, medium to coarse sand occasional gravels, some sandy layer to 5 ft
1		5	5	90			
2							Logged from cuttings 0-14.8"
3							
4							
5	0					GP/GC	Very hard at 5-10 feet, cobbles, from drilling
6							
7			45	55	10yr 5/4	CL	Sandy clay, dry to damp, yellow brown, low plasticity some lighter brown layering, fine sand some medium sand, occasional gravelly fragment. This is matrix soil from 7-10 feet
8							
9							
10	0						Clay from 10-16 feet from driller
1							
2							
3	0						
4							
5							Possible water encountered at bottom of bore hole.
6							Total ~~Depth~~ @ 16 feet
7							
8							
9							
20							

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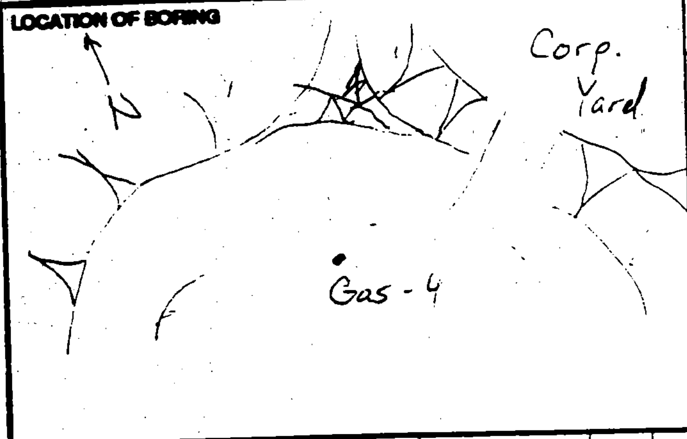
BOREHOLE/WELL LOG

LOCATION OF BORING



CLIENT	Folsom Corp. Yard Landfill
LOCATION	Folsom
JOB NO.	6720-00
BORING NO.	Gas-4
SHEET	1 OF 1

WATER LEVEL	AT TIME OF DRILLING	SECOND	THIRD	FOURTH
TIME				
DATE				

	DRILLING START	DRILLING FINISH	WELL CONSTR. START	WELL CONSTR. FINISH
TIME	15:05	16:17	16:22	14:45
DATE	1/24/94	1/24/94	1/24/94	1/27/94

DRILLING CONTRACTOR Weeks

RIG TYPE Schramm Rotadrill

DRILLING METHOD, FLUID USED Air rotary casing hammer - steel casing 7" O.D & 6" I.D

SOIL SAMPLING METHOD None taken

SURFACE ELEV.

MONITORING INSTRUMENT Gastecher

SURFACE CONDITIONS Gravel

WELL CONSTRUCTION: CASING	ANNULUS	SAMPLER TYPE	BLOWS/6" INTERVAL	INTERVAL SAMPLED	RECOVERY	ANALYTICAL SAMPLE	DEPTH IN FEET	INSTRUMENT READING (ppm)	GRAVEL	SAND	FINES	MUNSELL COLOR NO.	USCS GROUP SYMBOL	DESCRIPTION: Group Name, Moisture, Color, Consistency, Density, Other
Solid 2" PVC sch. 40	Bentonite Cement Grout						0						GP/CL	Gravel interbedded with sandy clay, damp yellow brown, low plasticity
							1		5	10	85	10yr 4/4		Logged from cuttings
	Bentonite Pellets						2							
							3							
							4							
2" PVC Sch 40 w/ 0.020" slots	#3 sand						5		100				GP/C	Gravelly zone @ 5-14 feet. very hard much rig chatter, gravel & cobble, gray, fine grained, mostly volcanic from cuttings
							6							
							7							
							8							
							9							
							10							
							1							
							2							
							3							
							4							Very hard drilling, drill stem is bouncing
							5							Total Depth @ 14 ft 8 inches
							6							
							7							
							8							
							9							
							20							

DRILLED BY Soil.. DATE

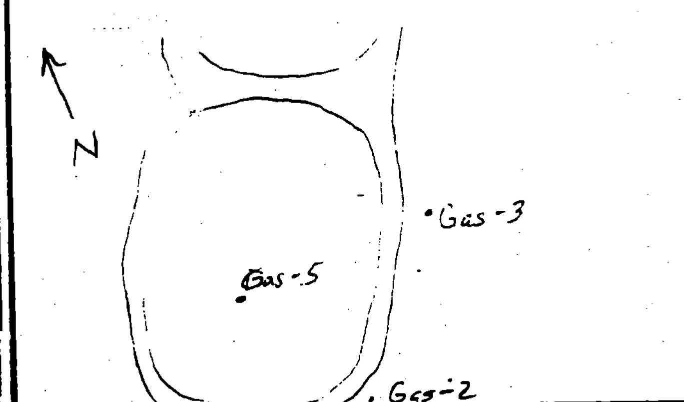
CHECKED BY DATE 1/24/94

LOGGED BY W. McCombe

Brown and Caldwell Consultants

BOREHOLE/WELL LOG

LOCATION OF BORING



CLIENT	Folsom Corp. Yard Landfill
BORING NO.	Gas-5
LOCATION	Folsom
JOB NO.	6220-00
SHEET	1 OF 1

WATER LEVEL	AT TIME OF DRILLING	SECOND	THIRD	FOURTH
TIME				
DATE				

	START	FINISH
DRILLING TIME	9:50	10:55
DRILLING DATE	1/25/94	1/25/94
WELL CONSTR. TIME	11:00	13:00
WELL CONSTR. DATE	1/25/94	1/27/94

DRILLING CONTRACTOR Weeks Drilling

RIG TYPE Schramm Rotadrill

DRILLING METHOD, FLUID USED Air Rotary
Casing Hammer

SOIL SAMPLING METHOD

SURFACE ELEV.

MONITORING INSTRUMENT Gastech

SURFACE CONDITIONS Gravel and clay

DRILLER Joe

DATE 1/25/94

CHECKED BY

DATE

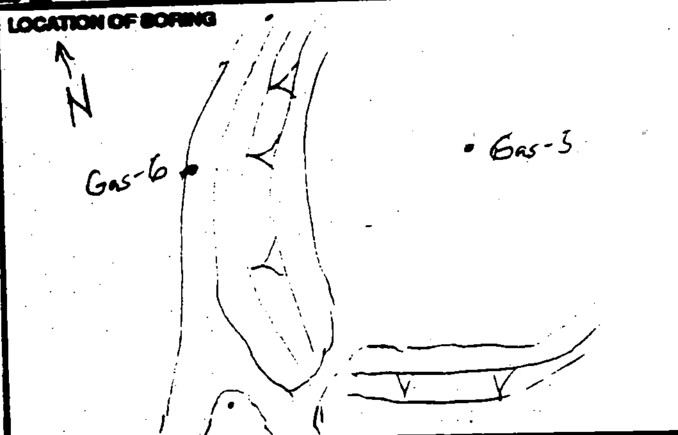
LOGGED BY W. McCombe

WELL CONSTRUCTION: CASING	ANNULUS	SOIL SAMPLING: SAMPLER TYPE	BLOWS/6" INTERVAL	INTERVAL SAMPLED	RECOVERY	ANALYTICAL SAMPLE	DEPTH IN FEET	INSTRUMENT READING (ppm)	ESTIMATED PERCENT: GRAVEL	SAND	FINES	MUNSELL COLOR NO.	USCS GROUP SYMBOL	DESCRIPTION: Group Name, Moisture, Color, Consistency, Density, Other
	Bentonite Cement Grout						0						CL	Clay, damp, red-brown, moderate plasticity
							1		5	15	80	5yr 4/4		fine to coarse sand, rounded gravel to 3/4 inch
2" sch PVC	Bentonite Pellets						2							
							3	0						No methane Readings
							4							
2" PVC sch. 40 w/ 0.020" slots							5							
							6							
							7	0	5	10	85			Strong brown below 7 feet
							8					10yr 4/3		drill up visqueen pieces from 8' depth
							9							No methane readings
							10	0					GP	Very hard drilling at 10 feet
							1		95		5			cobbles and gravels @10-16 feet mainly volcanic cobbles, some clayey matrix
							2							
	#3 Sand						3							
							4							
	Slough						5							
							6							Total Depth@16 feet
							7							
							8							
							9							
							20							

Brown and Caldwell Consultants FCY-6

BOREHOLE/WELL LOG

LOCATION OF BORING



CLIENT	Folsom Corp. Yard Landfill
BORING NO.	GAS-6
LOCATION	Folsom
JOB NO.	6720-00
SHEET	1 OF 1

WATER LEVEL	AT TIME OF DRILLING	SECOND	THIRD	FOURTH
TIME				
DATE				

	DRILLING START	DRILLING FINISH	WELL CONSTR. START	WELL CONSTR. FINISH
TIME	12:25	5:10	8:00	16:00
DATE	1/25/94	1/25/94	1/26/94	1/27/94

DRILLING CONTRACTOR: Weeks Drilling
RIG TYPE: Schramm Rotadrill
DRILLING METHOD, FLUID USED: Air Rotary, Casing Hammer
SOIL SAMPLING METHOD: None
SURFACE ELEV.:
MONITORING INSTRUMENT: Gastech
SURFACE CONDITIONS: Dirt and cobbles

DATE 1/25/94 | CHECKED BY | DRILLED BY | LOGGED BY William White

WELL CONSTRUCTION — CASING: 2" solid PVC casing; 2" PVC sch. 40 w/ 0.020" slots. ANNULUS: Bentonite Cement Grout; Bentonite Pellet; #3 sand; Slough.

DEPTH IN FEET	INSTRUMENT READING (ppm)	GRAVEL	SAND	FINES	MUNSELL COLOR NO.	USCS GROUP SYMBOL	DESCRIPTION: Group Name, Moisture, Color, Consistency, Density, Other
0		15	10	75	7.5yr 4/4	CL	Clay, damp brown, moderate plasticity, firm. ~~Basalt~~ gravels to 1 inch, medium to coarse sand
2							Increasing cobbles below 2 feet, decreasing clay.
3		65	5	30			
5		100				GP/GS	Gravel and cobbles mainly, below 5 feet if any matrix it is being blown out by the air. Fragment are dark gray, volcanic (basalt)
10							Very hard, sloughs in below 10 feet.
16							Total Depth 16 feet

Boring, Test Probe, and Test Pit Details

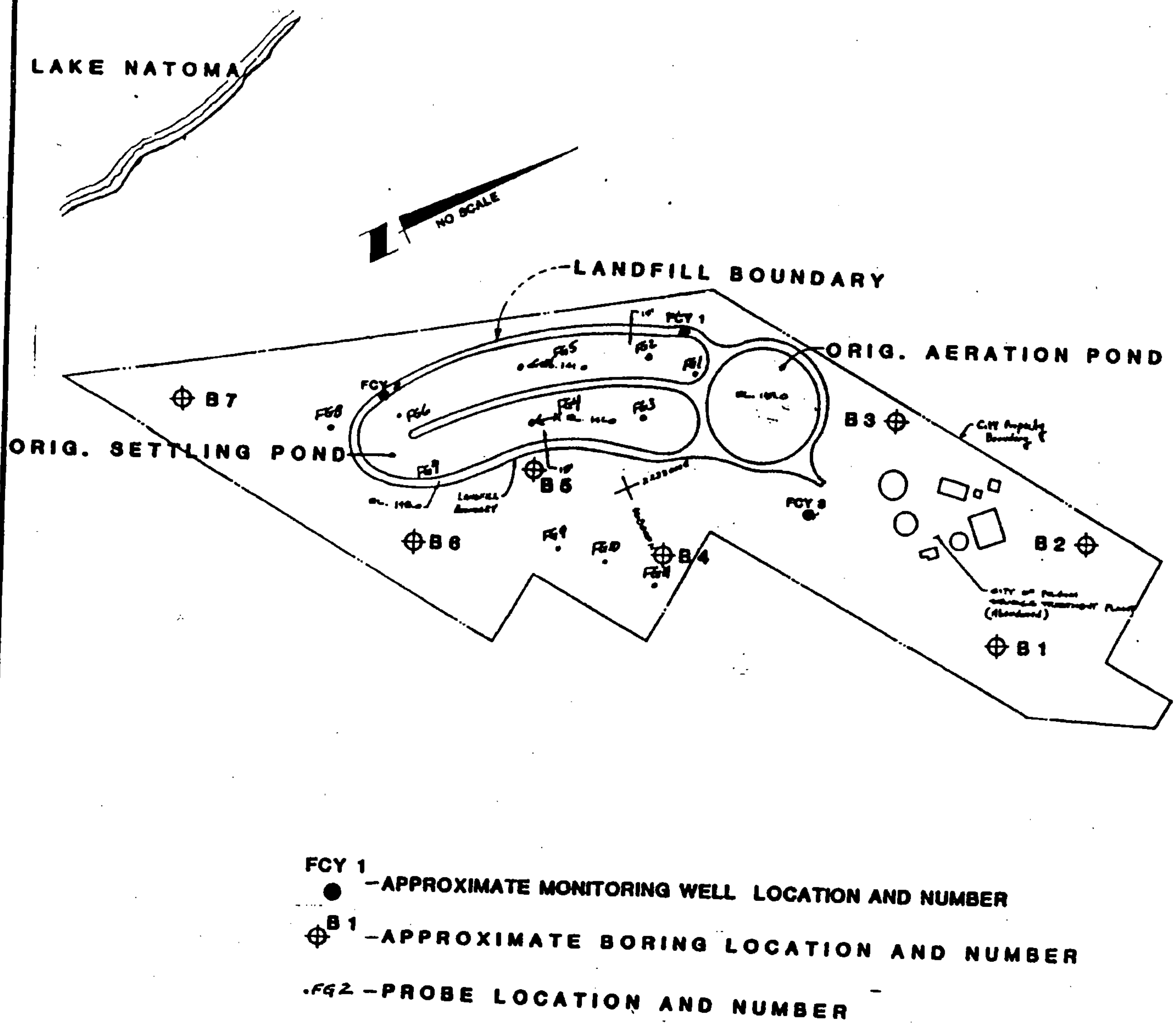
Corporation Yard Land Clean Closure, Folsom, CA

ID	Date Installed	Type	Total Depth (ft bgs)
B-1	12/11/85	Boring	6
B-2	12/11/85	Boring	5
B-3	12/11/85	Boring	11.5
B-4	12/11/85	Boring	15
B-5	12/11/85	Boring	15
B-6	12/11/85	Boring	6
B-7	12/11/85	Boring	8
FG-1	1/86	Gas Test Probe	10
FG-2	1/86	Gas Test Probe	10
FG-3	1/86	Gas Test Probe	10
FG-4	1/86	Gas Test Probe	8
FG-5	1/86	Gas Test Probe	9
FG-6	1/86	Gas Test Probe	10
FG-7	1/86	Gas Test Probe	10
FG-8	1/86	Gas Test Probe	10
FG-9	1/86	Gas Test Probe	10
FG-10	1/86	Gas Test Probe	10
FG-11	1/86	Gas Test Probe	10
BA-1	11/10/00	Boring	20
BA-2	11/10/00	Boring	17
BA-3	11/16/00	Boring	17
BA-4	11/16/00	Boring	9
TP-1	11/20/00	Test Pit	8
TP-2	11/20/00	Test Pit	10
TP-3	11/20/00	Test Pit	7
TP-4	11/20/00	Test Pit	7
TP-5	11/20/00	Test Pit	6
TP-6	11/20/00	Test Pit	6
TP-7	11/20/00	Test Pit	9
TP-8	11/20/00	Test Pit	3
TP-9	11/20/00	Test Pit	8
TP-10	11/20/00	Test Pit	8
TP-11	11/20/00	Test Pit	9
TP-12	11/20/00	Test Pit	10
TP-13	11/20/00	Test Pit	6
TP-14	11/20/00	Test Pit	6
TP-15	11/20/00	Test Pit	5
TP-16	11/20/00	Test Pit	4
TP-17	11/20/00	Test Pit	5
TP-18	11/20/00	Test Pit	8

Boring, Test Probe, and Test Pit Details

Corporation Yard Land Clean Closure, Folsom, CA

ID	Date Installed	Type	Total Depth (ft bgs)
TP-19	11/20/00	Test Pit	7
TP-20	11/20/00	Test Pit	6
TP-21	11/20/00	Test Pit	5
TP-22	11/20/00	Test Pit	7
TP-23	11/20/00	Test Pit	3
TP-24	11/20/00	Test Pit	8
TPA-1	4/18/06	Test Pit	5
TPA-2	4/18/06	Test Pit	8
TPA-3	4/18/06	Test Pit	3
TPA-4	4/18/06	Test Pit	3
TPA-5	4/18/06	Test Pit	3
TPA-6	4/18/06	Test Pit	7
TPA-7	4/18/06	Test Pit	5
TPA-8	4/18/06	Test Pit	7
TPB-1	2/6/08	Test Pit	19
TPB-2	2/7/08	Test Pit	18
TPB-3	2/8/08	Test Pit	13
TPB-4	2/11/08	Test Pit	13
TPB-5	2/8/08	Test Pit	4
TPB-6	2/8/08	Test Pit	3
TPB-7	2/8/08	Test Pit	7
TPB-8	2/8/08	Test Pit	8
TPB-9	2/8/08	Test Pit	3
TPB-10	2/8/08	Test Pit	5
TPB-11	2/8/08	Test Pit	8



J.H. KLEINFELDER & ASSOCIATES GEOTECHNICAL CONSULTANTS • MATERIALS TESTING	FOLSOM CORPORATION YARD Folsom, California	PLATE 1
PROJECT NO. A-2737-1		

Dry Density (lb/ft³)	Moisture Content %	Blow/ Ft.	Sample No.	USCS	DESCRIPTION
				SM/ GP	Silty SAND and GRAVEL: brown and gray, slightly moist, very dense, some clay
					GRAVEL and COBBLES: gray, subangular to subrounded, very dense minor sand matrix
					Test boring terminated at 6 ft., refusal No groundwater encountered Test boring completed 12-11-85

Depth In Feet: 0, 2, 4, 6

J.H. KLEINFELDER & ASSOCIATES
GEOTECHNICAL CONSULTANTS • MATERIALS TESTING

PROJECT NO. A-2737-1

LOG OF BORING NO. B-1

CITY OF FOLSOM CORPORATION YARD

PLATE 9

JHK & A FORM R-22

Depth In Feet	Dry Density lb/ft³	Moisture Content %	Blow/ Ft.	Sample No.	USCS	DESCRIPTION
0–5					SM-GP	SAND and GRAVEL: brown and gray, slightly moist, very dense COBBLES: gray, subrounded to rounded, very dense, trace silty sand matrix
						Test boring terminated at 5 ft., refusal No groundwater encountered Test boring completed 12-11-85

Depth scale: 0, 2, 4, 6

J.H. KLEINFELDER & ASSOCIATES
GEOTECHNICAL CONSULTANTS • MATERIALS TESTING

PROJECT NO. A-2737-1

LOG OF BORING NO. B-2

CITY OF FOLSOM CORPORATION YARD

PLATE 10

JHK & A FORM R-22

Depth In Feet	Dry Density lb/ft³	Moisture Content %	Blow/ Ft.	Sample No.	USCS	DESCRIPTION
0					CL/ GP	Sandy CLAY and GRAVEL: brown and gray, moist very dense, with cobbles
2						
4						
6						--- grades predominately sandy CLAY with thin gravel and cobble lenses below 5.5 ft.
8						
10			27	*		--- groundwater at 10 ft.
12						Test boring terminated at 11.5 ft Groundwater encountered at 10.5 ft Test boring completed 12-11-85

J.H. KLEINFELDER & ASSOCIATES
GEOTECHNICAL CONSULTANTS • MATERIALS TESTING

PROJECT NO. A-2737-1

LOG OF BORING NO. B-3

CITY OF FOLSOM CORPORATION YARD

PLATE 11

JHK & A FORM R-22

Depth In Feet	Dry Density lb/ft³	Moisture Content %	Blow/ Ft.	Sample No.	USCS	DESCRIPTION
0					CL/ GP	Sandy CLAY and GRAVEL: (fill) dark brown to black moist, dense, some silt
2						
4						GRAVEL and COBBLES: gray, subrounded to rounded, very dense, minor sandy clay matrix
6						
8						
10						
12						
14						--- grades with more sandy clay matrix below 13.5 ft.
16						Test boring terminated at 15 ft. No groundwater encountered Test boring completed on 12-11-85

J.H. KLEINFELDER & ASSOCIATES
GEOTECHNICAL CONSULTANTS • MATERIALS TESTING

PROJECT NO. A-2737-1

LOG OF BORING NO. B-4

CITY OF FOLSOM CORPORATION YARD

PLATE 12

JHK & A FORM R-22

Depth in Feet	Dry Density lb/ft³	Moisture Content %	Blow/ Ft.	Sample No.	USCS	DESCRIPTION	
0–2					CL/SP	Sandy CLAY and GRAVEL:	brown and gray, moist dense
2–9.5						GRAVEL and COBBLES:	gray, subrounded to rounded, very dense minor sandy clay matrix
9.5						---	increase in sandy clay matrix from 9.5 to 13.5 ft.

Test boring terminated at 15 ft.
No groundwater encountered
Test boring completed on 12/11/85

J.H. KLEINFELDER & ASSOCIATES
GEOTECHNICAL CONSULTANTS • MATERIALS TESTING

PROJECT NO. A-2737-1

LOG OF BORING NO. B-5

CITY OF FOLSOM CORPORATION YARD

PLATE 13

JHK & A FORM 8-22

Depth In Feet	Dry Density lb/ft³	Moisture Content %	Blow/ Ft.	Sample No.	USCS	DESCRIPTION
0					CL/GP	Sandy CLAY and. GRAVEL: brown and gray, moist dense
2					GP	GRAVEL: gray, subrounded to rounded, very dense occassional cobble minor sandy clay matrix
4						
6						--- grades with more cobbles below 4 ft.
8					CL/GP	Sandy CLAY and GRAVEL: brown and gray, moist, dense, occassional cobble
10						
12						
14						
16						
18						
20						

Test boring terminate at 6 ft.
No groundwater encounterd
Test boring completed 12-11-85

J.H. KLEINFELDER & ASSOCIATES
GEOTECHNICAL CONSULTANTS • MATERIALS TESTING

LOG OF BORING NO. B-6

CITY OF FOLSOM CORPORATION YARD

PLATE 14

PROJECT NO. A-2737-1

JHK & A FORM R-22

Depth In Feet	Dry Density lb/ft³	Moisture Content %	Blow/Ft.	Sample No.	USCS	DESCRIPTION
0–2.5					CL/GP	Sandy CLAY and GRAVEL: (fill) red-brown, gray and slightly moist, dense
2.5–5					ML	Clayey SILT: (fill) light brown, moist, very stiff, some gravel, large roots
5–8						GRAVEL and CLAY: gray, subrounded to rounded, very dense minor sandy clay matrix

Test boring terminated at 8 ft., refusal
No groundwater encountered
Test boring completed 12-11-85

J.H. KLEINFELDER & ASSOCIATES
GEOTECHNICAL CONSULTANTS • MATERIALS TESTING

PROJECT NO. A-2737-1

LOG OF BORING NO. B-7

CITY OF FOLSOM CORPORATION YARD

PLATE 15

JHK & A FORM R-22

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			USCS SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS (More than half of material is larger than the #200 sieve)	GRAVELS (More than half of coarse fraction is larger than the #4 sieve)	CLEAN GRAVELS WITH LITTLE OR NO FINES	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
			GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
		GRAVELS WITH OVER 12% FINES	GM	SILTY GRAVELS, GRAVEL-SILT-SAND MIXTURES
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SANDS (More than half of coarse fraction is smaller than the #4 sieve)	CLEAN SANDS WITH LITTLE OR NO FINES	SW	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
			SP	POORLY-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
		SANDS WITH OVER 12% FINES	SM	SILTY SANDS, SAND-GRAVEL-SILT MIXTURES
			SC	CLAYEY SANDS, SAND-GRAVEL-CLAY MIXTURES
FINE GRAINED SOILS (More than half of material is smaller than the #200 sieve)	SILTS AND CLAYS (Liquid limit less than 50)		ML	INORGANIC SILTS & VERY FINE SANDS, SILTY OR CLAYEY FINE SANDS, CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL	ORGANIC SILTS & ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS (Liquid limit greater than 50)		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILT
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS & ORGANIC SILTS OF MEDIUM-TO-HIGH PLASTICITY
LOAMS				UNDER USDA SOIL CLASSIFICATION SYSTEM, SOIL OF APPROXIMATELY EQUAL SAND/SILT/CLAY

KLEINFELDER

Drafted By: D. Ross
Date: 06/12/2001

Project No.: 23-484361
File Number: 23484361

UNIFIED SOIL CLASSIFICATION SYSTEM

FOLSOM CORPORATION YARD
FOLSOM, CALIFORNIA

PLATE

B-1

KA-USCS 23484361.GPJ 6/12/01

LOG SYMBOLS

BULK / BAG SAMPLE

MODIFIED CALIFORNIA SAMPLER
(2-1/2 inch outside diameter)

CALIFORNIA SAMPLER
(3 inch outside diameter)

STANDARD PENETRATION
SPLIT SPOON SAMPLER
(2 inch outside diameter)

CONTINUOUS CORE

ROCK CORE

WATER LEVEL
(level where first encountered)

WATER LEVEL
(level after completion)

SEEPAGE

-4	PERCENT FINER THAN THE NO. 4 SIEVE (ASTM Test Method C 136)
-200	PERCENT FINER THAN THE NO. 200 SIEVE (ASTM Test Method C 117)
LL	LIQUID LIMIT (ASTM Test Method D 4318)
PI	PLASTICITY INDEX (ASTM Test Method D 4318)
EI	EXPANSION INDEX (UBC STANDARD 29-2)
COL	COLLAPSE POTENTIAL
UC	UNCONFINED COMPRESSION (ASTM Test Method D 2166)
MC	MOISTURE CONTENT (ASTM Test Method D 2216)

GENERAL NOTES

1. Lines separating strata on the logs represent approximate boundaries only. Actual transitions may be gradual.

2. No warranty is provided as to the continuity of soil conditions between individual sample locations.

3. Logs represent general soil conditions observed at the point of exploration on the date indicated.

4. In general, Unified Soil Classification System designations presented on the logs were evaluated by visual methods only. Therefore, actual designations (based on laboratory tests) may vary.

KA-LOG_KEY 23484361.GPJ 6/12/01

KLEINFELDER	LOG KEY FOLSOM CORPORATION YARD FOLSOM, CALIFORNIA	PLATE B-2
Drafted By: D. Ross Date: 06/12/2001	Project No.: 23-484361 File Number: 23484361	

Surface Conditions:	Vegetation	Date Completed:	11/10/2000
		Logged By:	S. Belway
Groundwater:	Groundwater encountered at a depth of about 18 feet below existing site grade.	Total Depth:	20 (feet)

Depth (feet)	FIELD: Sample Type	FIELD: Sample No.	FIELD: Blows/ft	FIELD: PID (ppmv)	Lithography	DESCRIPTION Approximate Elevation feet (msl)
0						**LANDFILL CAP** **Silty SAND** (SM): Red-gray, moist, loose, fine grained, low to medium plasticity **CLAY** (CL): Light gray, moist to dry, stiff, moderately cemented
2						**LANDFILL DEBRIS** **Silty SAND with gravel** (SM): Brown, dry, loose to medium dense, fine grained, low plasticity, subangular to subrounded rock to 6 inches diameter (cobble)
5						with asphalt
						olive-green organic material
						encountered dirty debris liner from 7 to 9-1/2 feet covering plastic sheet
						increasing clay
10						**PRE-LANDFILL MATERIAL (fill, dredge tailings)** **Clayey SAND** (SC): Dark brown, moist, medium dense, weakly to moderately cemented, low plasticity, with organics
						Sandy CLAY (CL): Olive-gray, moist, medium stiff, moderately cemented, slight plasticity
						increasing cobbles and boulders
						brown, with gravel, (no debris)
15						
				▽		
						Clayey SAND (SC): Yellow-brown, moist, weakly to moderately cemented, low plasticity
20						Boring completed at a depth of 20 (feet) below existing site grade .

KA_2001 23484361.GPJ 6/12/01

KLEINFELDER

Drafted By: D. Ross
Date: 06/12/2001

Project No.: 23-484361
File Number: 23484361

LOG OF BORING BA-1
FOLSOM CORPORATION YARD
FOLSOM, CALIFORNIA

PLATE
1 of 1
B-3

Surface Conditions:	Vegetation	Date Completed:	11/10/2000
		Logged By:	S. Belway
Groundwater:	Groundwater encountered at a depth of about 18 feet below existing site grade.	Total Depth:	17 (feet)

Depth (feet)	FIELD: Sample Type	FIELD: Sample No.	FIELD: Blows/ft	FIELD: PID (ppmv)	Lithography	DESCRIPTION Approximate Elevation feet (msl)
						LANDFILL CAP **Sandy SILT** (ML): Red-gray, moist, soft, low plasticity, trace gravel **CLAY** (CL): Light gray, moist, stiff, moderately cemented, high plasticity
						LANDFILL DEBRIS **Silty SAND with gravel** (SM): Brown, dry, loose, weakly cemented, low plasticity, subrounded to subangular gravels, trace cobbles and boulders
5						
						Clayey SAND with cobbles and boulders (SC): Brown, moist, weakly to moderately cemented, low plasticity
10						gray
						significant organic material (wood), increasing clay in matrix with cobbles
						PRE-LANDFILL MATERIAL (fill, dredge tailings) decreasing cobbles
15						
						brown, increasing gravel **GRAVEL** (GM): Olive-brown, wet, loose, low plasticity
						Boring completed at a depth of 17 (feet) below existing site grade .
20						

KLEINFELDER

Drafted By: D. Ross
Date: 06/12/2001
Project No.: 23-484361
File Number: 23484361

LOG OF BORING BA-2
FOLSOM CORPORATION YARD
FOLSOM, CALIFORNIA

PLATE
1 of 1
B-4

KA_2001 23484361.GPJ 6/12/01

Surface Conditions:	Vegetation
Groundwater:	Groundwater encountered at a depth of about 18 feet below existing site grade.
Date Completed:	11/16/2000
Logged By:	S. Belway
Total Depth:	17 (feet)

Depth (feet)	FIELD: Sample Type	FIELD: Sample No.	FIELD: Blows/ft	FIELD: PID (ppmv)	Lithography	DESCRIPTION Approximate Elevation feet (msl)
						LANDFILL CAP **Sandy SILT** (SM): Red-gray, moist, soft, low plasticity
						CLAY (CL): Light gray, moist, stiff, moderately cemented, moderate plasticity
						LANDFILL DEBRIS **Sandy SILT with gavel** (ML): Brown, dry, weakly cemented, with angular cobbles to 12 inches diameter
5						olive-brown
						ASPHALT: 6 inches thick
						SAND (SP): Olive-brown, dry, loose, fine grained, low plasticity dirty debriw line from 7 to 10-1/2 veet covering a plastic sheet
10						
						PRE LANDFILL MATERIAL (fill, derdge tailings **Sandy CLAY with gravel** (CL): Olive-brown, moist, medium stiff, moderately cemented, low to moderate plasticity
15						increasing gravel and cobbles
						GRAVEL with sand and clay (GC): Olive-brown, moist, hard,
						Boring completed at a depth of 17 (feet) below existing site grade .
20						

KLEINFELDER

Drafted By: D. Ross
Date: 06/12/2001
Project No.: 23-484361
File Number: 23484361

LOG OF BORING BA-3
FOLSOM CORPORATION YARD
FOLSOM, CALIFORNIA

PLATE
1 of 1
B-5

KA_2001 23484361.GPJ 6/12/01

Surface Conditions:	Disturbed soil	Date Completed:	11/16/2000
		Logged By:	S. Belway
Groundwater:	Groundwater encountered at a depth of about 18 feet below existing site grade.	Total Depth:	9 (feet)

Depth (feet)	FIELD: Sample Type	FIELD: Sample No.	FIELD: Blows/ft	FIELD: PID (ppmv)	Lithography	DESCRIPTION Approximate Elevation feet (msl)
						LANDFILL CAP **Silty SAND (SM)**: Red-gray, moist, loose, fine grained, low to medium plasticity
						CLAY (CL): Light gray, moist to dry, stiff, moderately cemented
						LANDFILL DEBRIS **Silty SAND with gravel (SM)**: Red-gray, dry, medium dense, low plasticity, subrounded cobbles and boulders to 18 inches
5						olive-brown, increasing coarse grained sand, with trace clay
						trace sandy clay, concrete debris
						Boring completed at a depth of 9 (feet) below existing site grade .
10						
15						
20						

KLEINFELDER

Drafted By: D. Ross
Date: 06/12/2001
Project No.: 23-484361
File Number: 23484361

LOG OF BORING BA-4
FOLSOM CORPORATION YARD
FOLSOM, CALIFORNIA

PLATE
1 of 1
B-6

KA_2001 23484361.GPJ 6/12/01

afc	Artificial fill clay cap
afd	Artificial debris fill
aff	Artificial soil fill
dt	Dredge tailings

KLEINFELDER

Drawn By: D. Shelhart
Project No. 23-484361

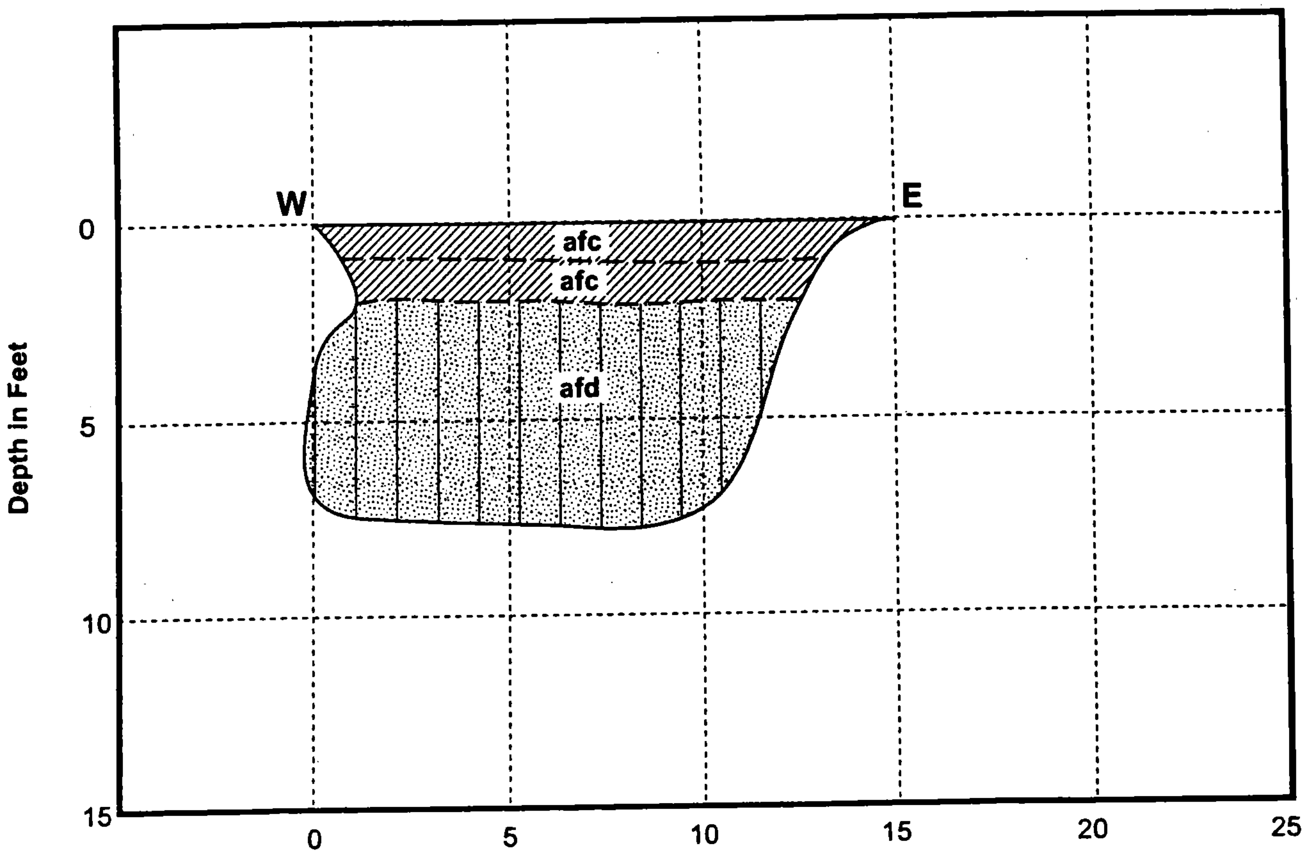
Date: 11-30-2000
Filename: 2388y.fh8

LEGEND

FOLSOM CORPORATION YARD
FOLSOM, CALIFORNIA

PLATE

A



DEPTH	SAMPLE NO.	MATERIAL DESCRIPTION
0-1'		afc; Silt with sand (ML): Red-gray, dry, soft.
1'-2'		afc; clay (CL), light grayish-brown, dry, stiff, strongly cemented, Dessication.
2'-8'	110003 110001	afd; Silty sand with gravel (SM), dry to moist, medium dense, moderately cemented, sub rounded rock up to 1' diameter. Debris consisted of plastic, metal, wood, paper. Hit refusal @ 8'.
		Total Depth=8'

KLEINFELDER

Drawn By: D. Shelhart
Project No. 23-484361

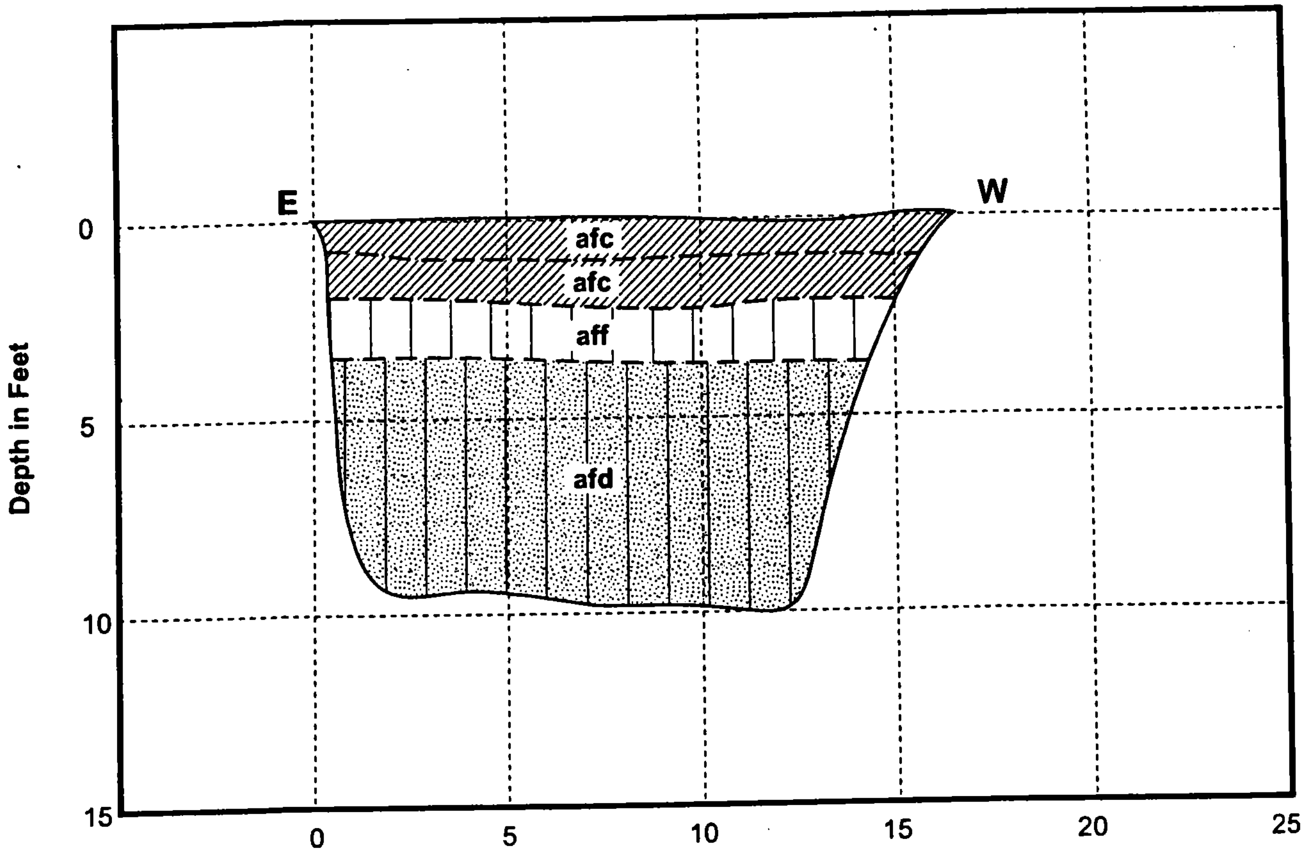
Date: 11-20-2000
Filename: 2388a.fh8

LOG OF TEST PITS TP-1

FOLSOM CORPORATION YARD
FOLSOM, CALIFORNIA

PLATE

A-1



DEPTH	SAMPLE NO.	MATERIAL DESCRIPTION
0-1'		afc; Silt with sand (ML): Red-gray, dry, soft.
1'-2'		afc; clay (CL), light grayish-brown, dry, stiff, strongly cemented, Dessication.
2'-3.5'		aff; Sandy silt with gravel (ML), dry to moist, medium stiff.
3.5'-10'		afd; Silty sand with gravel (SM), dry to moist, medium dense, moderately cemented, sub rounded rock up to 1' diameter. Debris consisted of plastic, metal, wood, paper, with asphalt @ 5', decomposed organics @ 6' to 10'.
		Total Depth=10'

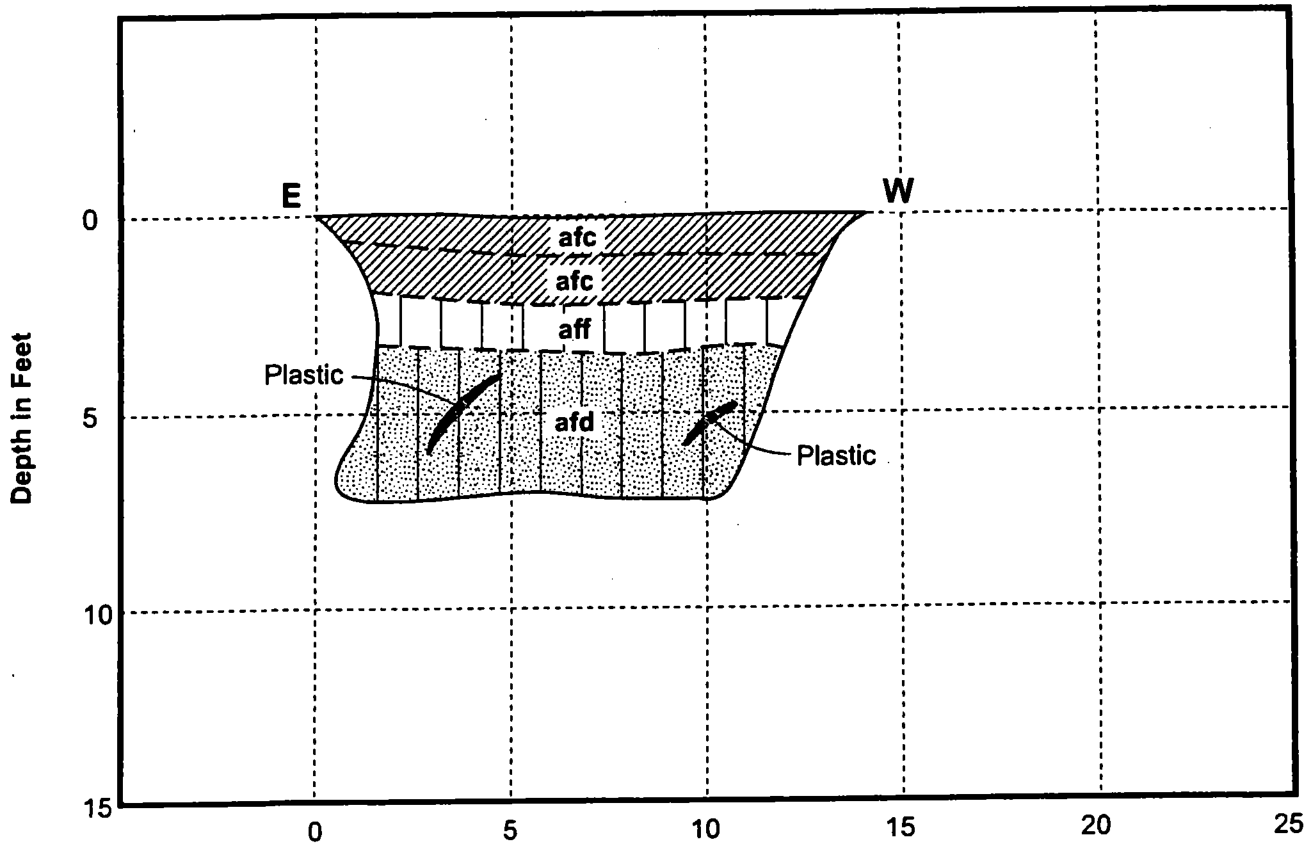
KLEINFELDER

Drawn By: D. Shelhart
Project No. 23-484361

Date: 11-20-2000
Filename: 2388b.fh8

LOG OF TEST PITS TP-2
FOLSOM CORPORATION YARD
FOLSOM, CALIFORNIA

PLATE
A-2



DEPTH	SAMPLE NO.	MATERIAL DESCRIPTION
0-1'		afc; Silt with sand (ML): Red-gray, dry, soft.
1'-2.5'		afc; clay (CL), light grayish-brown, dry, stiff, strongly cemented, Dessication.
2.5'-3.5'		aff; Sandy silt with gravel (ML), dry, medium stiff.
3.5'-7'		afd; Cobble with silt and sand, red-gray, dry to moist, dense, plastic debris, sub-rounded gravel.
		Total Depth=7'

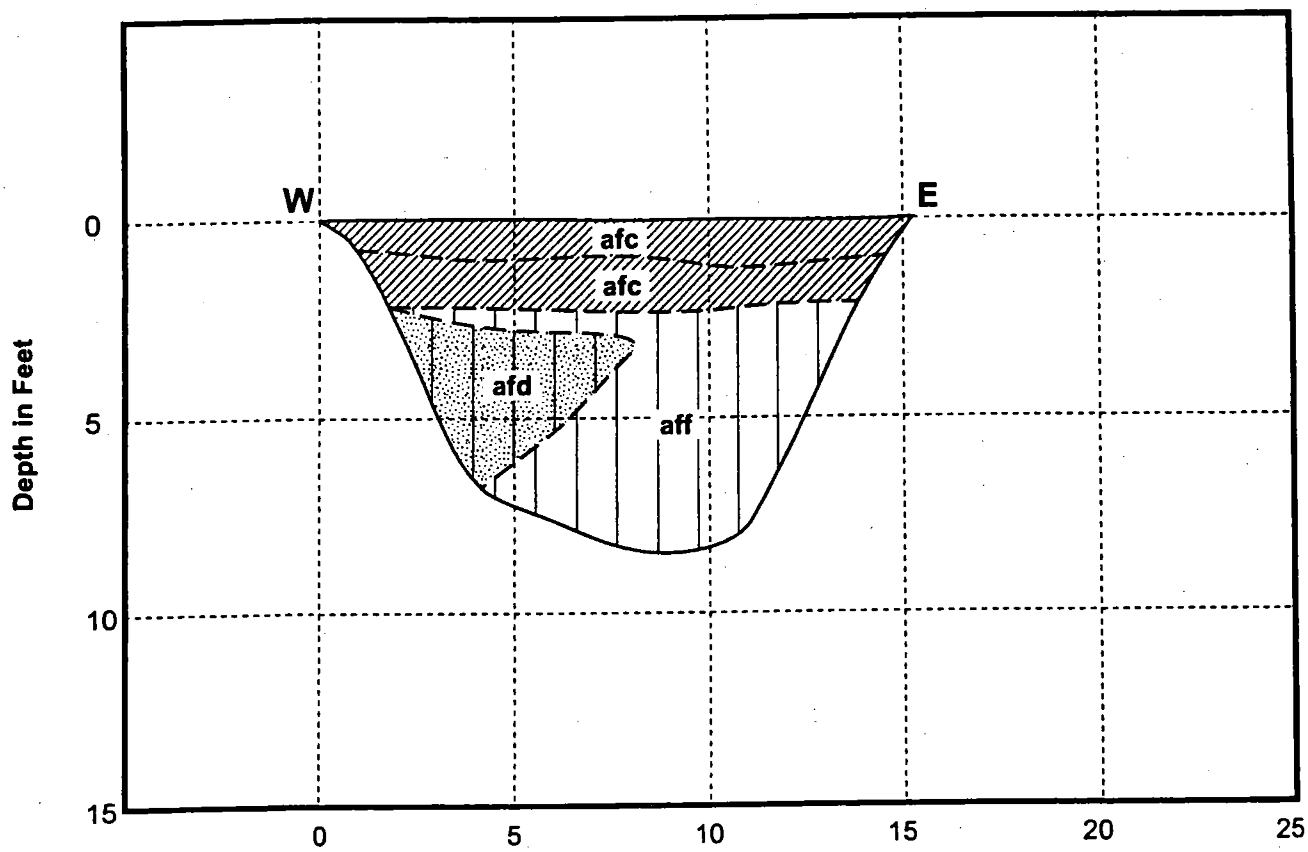
KLEINFELDER

Drawn By: D. Shelhart
Project No. 23-484361

Date: 11-20-2000
Filename: 2388c.fh8

LOG OF TEST PITS TP-3
FOLSOM CORPORATION YARD
FOLSOM, CALIFORNIA

PLATE
A-3



DEPTH	SAMPLE NO.	MATERIAL DESCRIPTION
0-1'		afc; Silt with sand (ML): Red-gray, dry, soft.
1'-2.5'		afc; clay (CL), light grayish-brown, dry to moist, stiff, strongly cemented, Dessication.
2.5'-7'		afd; Silty sand with gravel (SM), moist, loose, weakly to moderately cemented, sub rounded rock up to 1' diameter. Debris consisted of plastic, rubber, wood.
2.5'-7'		aff; Sandy silt with gravel (ML), dry to moist, medium stiff.
		Total Depth=7'

KLEINFELDER

Drawn By: D. Shelhart
Project No. 23-484361

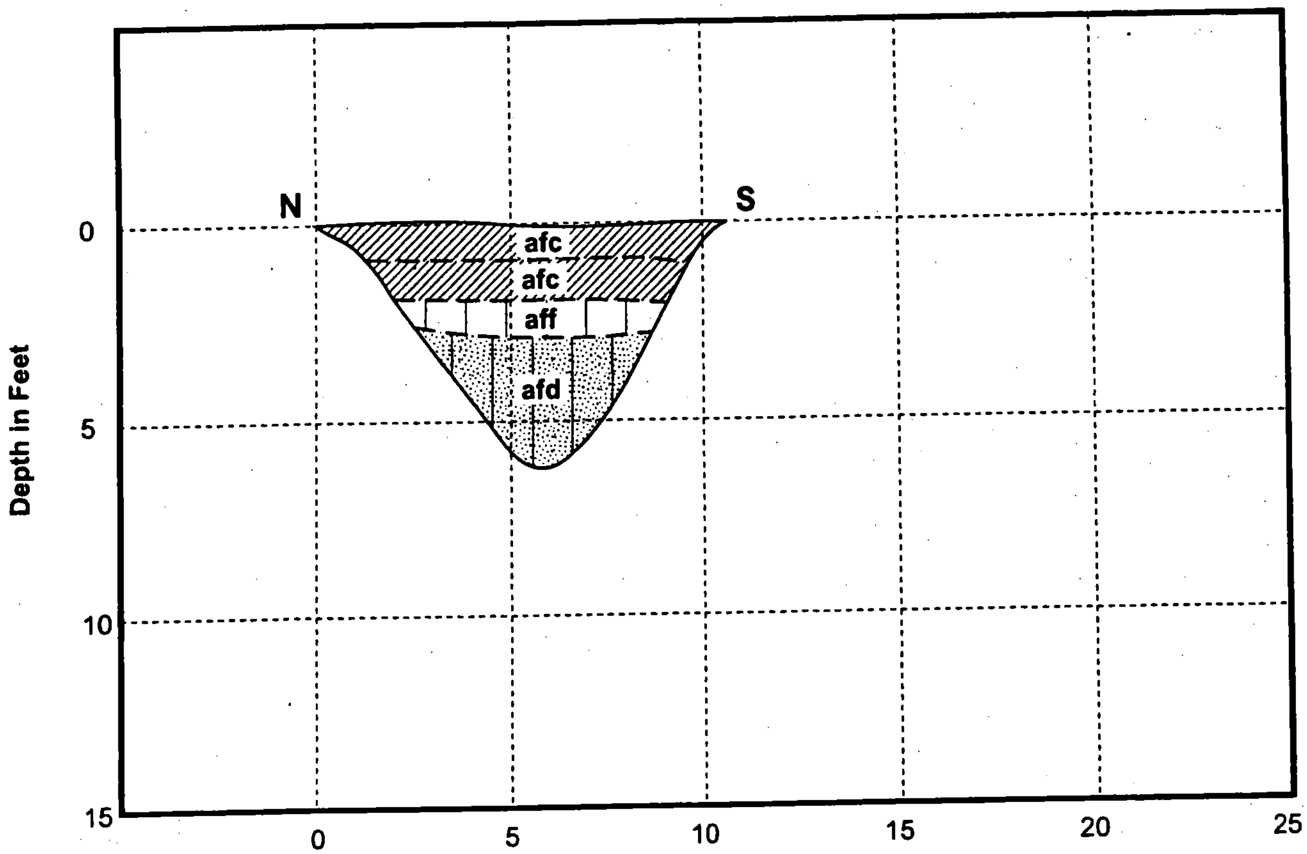
Date: 11-20-2000
Filename: 2388d.fh8

LOG OF TEST PITS TP-4

FOLSOM CORPORATION YARD
FOLSOM, CALIFORNIA

PLATE

A-4



DEPTH	SAMPLE NO.	MATERIAL DESCRIPTION
0-1'		afc; Silt with sand (ML): Red-gray, dry, soft, trace gravel.
1'-2'		afc; clay (CL), light grayish-brown, dry, stiff, strongly cemented, Dessication.
2'-3'		aff; Silty sand with gravel (SM) brown, dry to moist, loose, weak to moderately cemented.
3'-6'		afd; Silty sand with gravel (SM) brown, dry to moist, loose, weak to moderately cemented, sub rounded rock up to 1' diameter. Debris consisted of metal, wood, paper, with decomposed organics from 5' to 6' with slight odor.
		Total Depth=6'

KLEINFELDER

Drawn By: D. Shelhart
Project No. 23-484361

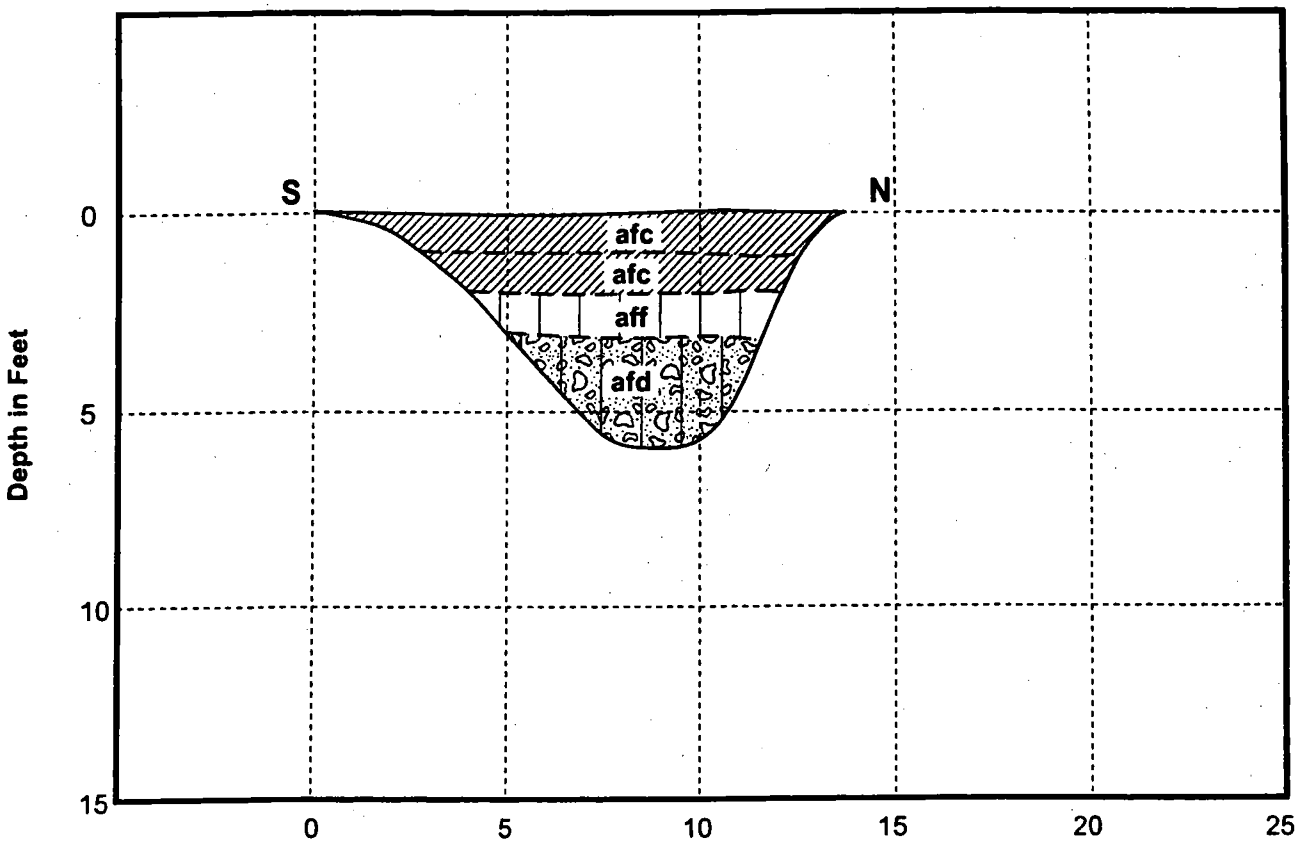
Date: 11-20-2000
Filename: 2388e.fh8

LOG OF TEST PITS TP-5

FOLSOM CORPORATION YARD
FOLSOM, CALIFORNIA

PLATE

A-5



DEPTH	SAMPLE NO.	MATERIAL DESCRIPTION
0-1'		afc; Silt with sand (ML): Red-gray, moist, soft, slight plasticity, trace gravels.
1'-2'		afc; clay (CL), light grayish-brown, dry to moist, stiff, strongly cemented, Dessication.
2'-3.5'		aff; Sandy silt with gravel (ML), dry to moist, medium stiff, with cobble up to 6" diameter.
3.5'-6'	109143	afd; Silty sand with gravel (ML-GM) brown, dry to moist, loose, medium dense, rock up to 6" diameter. Debris consists of plastic, asphalt, wood. Significant wood debris @ 4', minor decomposition.
		Total Depth=6'

KLEINFELDER

Drawn By: D. Shelhart
Project No. 23-484361

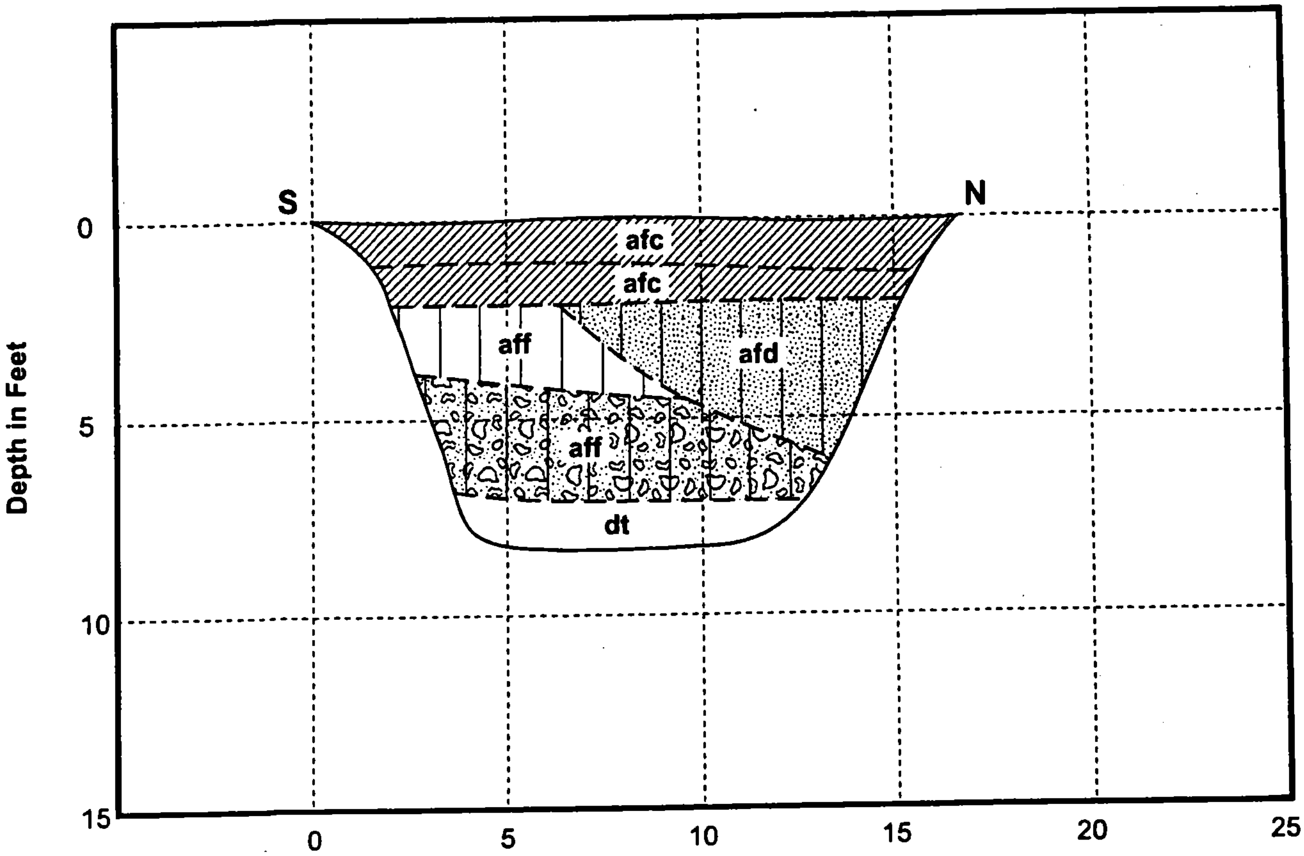
Date: 11-20-2000
Filename: 2388f.fh8

LOG OF TEST PITS TP-6

FOLSOM CORPORATION YARD
FOLSOM, CALIFORNIA

PLATE

A-6



DEPTH	SAMPLE NO.	MATERIAL DESCRIPTION
0-1'		afc; Silt with sand (ML): Red-gray, moist, soft.
1'-2'		afc; clay (CL), light grayish-brown, dry to moist, medium stiff, strongly cemented, Dessication.
2'-4'		aff; Sandy silt with gravel (ML) brown, dry to moist, medium stiff.
2'-5'		afd; Silty sand with gravel (SM), moist, loose, sub rounded rock up to 1' diameter. Debris consisted of plastic, metal, wood, paper with rock up to 12" diameter.
4'-7'		aff; gravel with sand and silt (GM), red-gray, dry to moist, dense.
7'-8'		afc; clay (CL), brown-gray, moist, soft to medium stiff, moderately cemented, with plastic liner.
8'-9'		dt; cobble with sand and silt (GM), red-gray, dry to moist, dense.
		Total Depth=9'

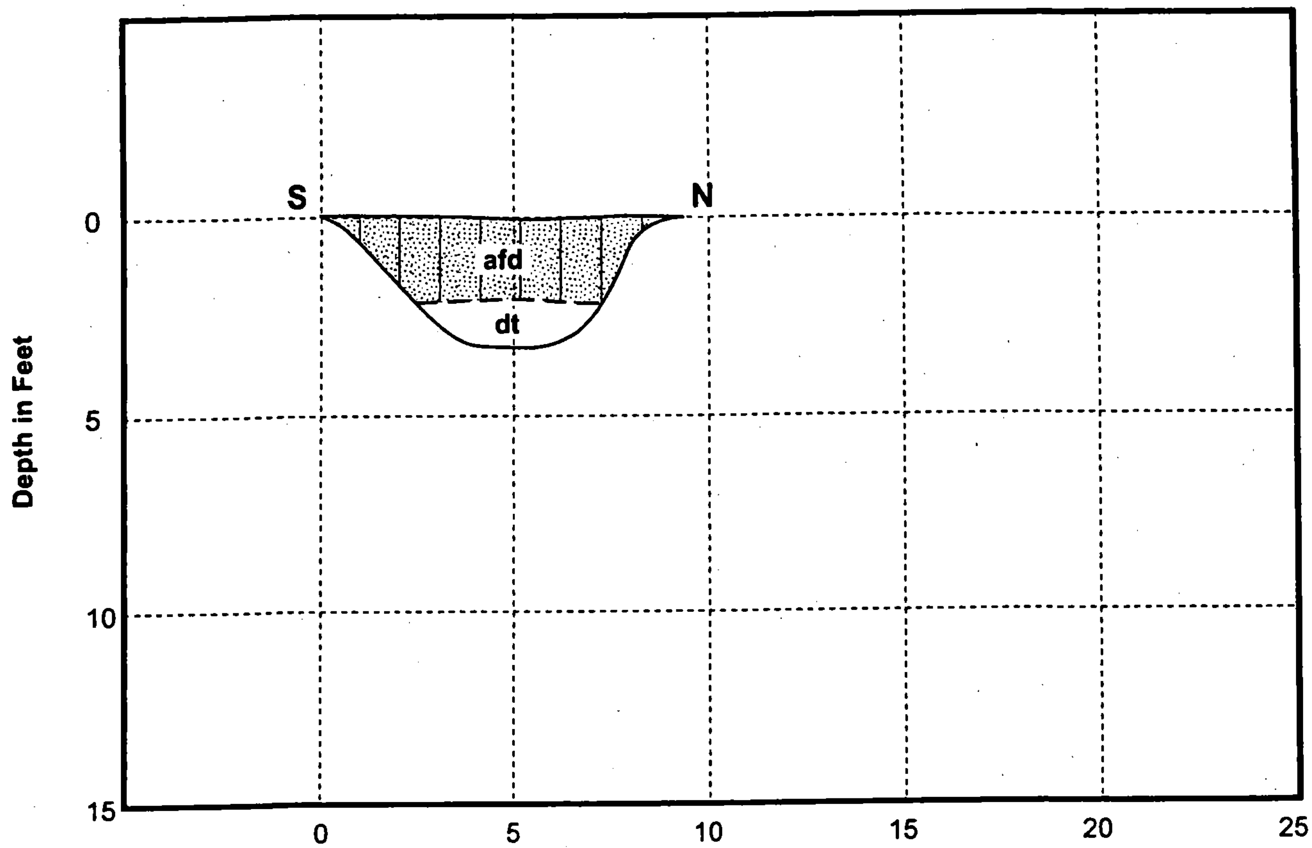
KLEINFELDER

Drawn By: D. Shelhart
Project No. 23-484361

Date: 11-20-2000
Filename: 2388g.fh8

LOG OF TEST PITS TP-7
FOLSOM CORPORATION YARD
FOLSOM, CALIFORNIA

PLATE
A-7



DEPTH	SAMPLE NO.	MATERIAL DESCRIPTION
0-2.5'		afd; Silt with sand (ML): Red-gray, moist, soft, with asphalt debris.
2.5'-3'		dt; cobble with sand and silt (GM), red-gray, dry to moist, dense.
		Total Depth=3'

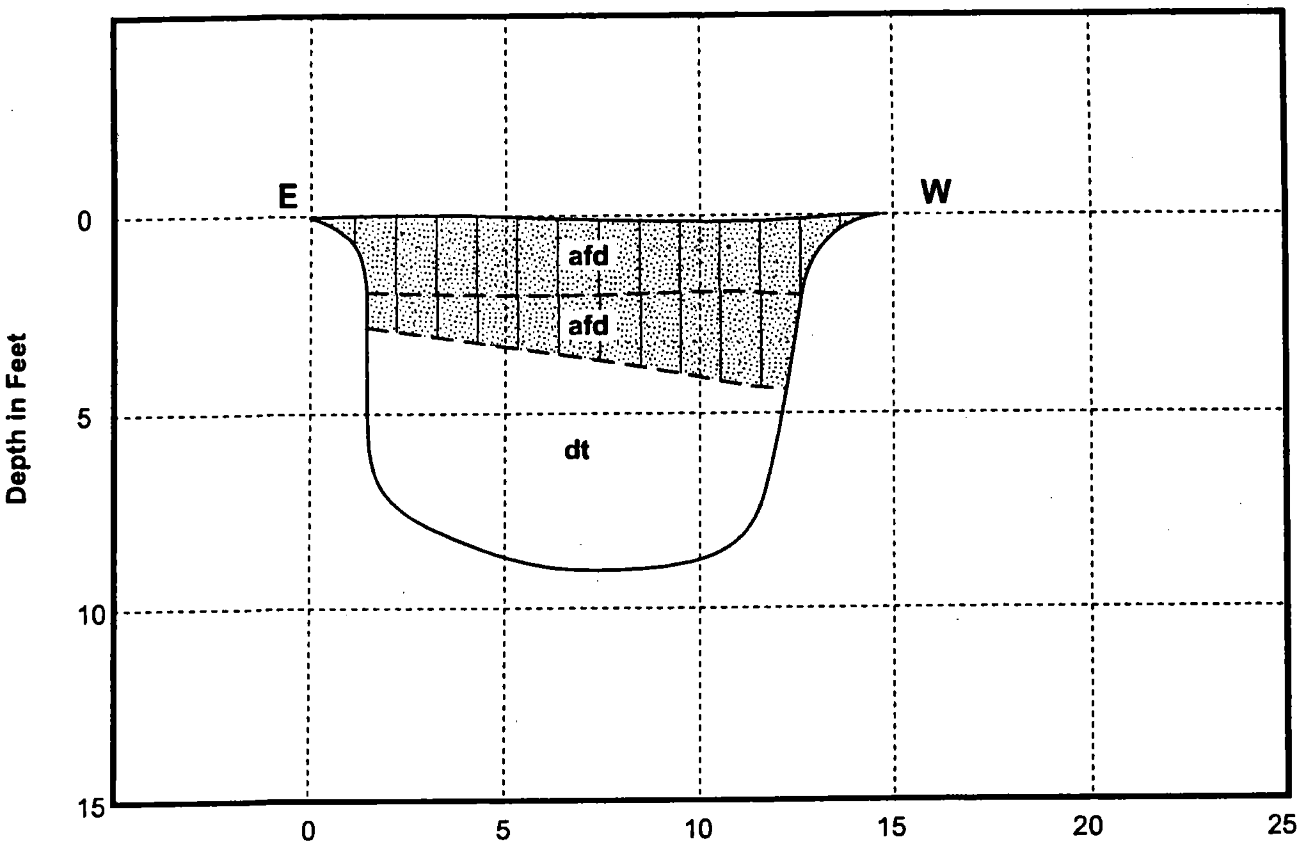
KLEINFELDER

Drawn By: D. Shelhart
Project No. 23-484361

Date: 11-20-2000
Filename: 2388h.fh8

LOG OF TEST PITS TP-8
FOLSOM CORPORATION YARD
FOLSOM, CALIFORNIA

PLATE
A-8



DEPTH	SAMPLE NO.	MATERIAL DESCRIPTION
0-2'	109161	afd; Silty sand with gravel (SM) brown, moist, loose, sub rounded rock up to 1' diameter. Debris consisted of aluminum cans, carpet, plastic, rubber tire.
2'-4'		afd; Cobble with silt and sand, brown, dry to moist, dense, plastic debris, sub-rounded rock up to 18" diameter.
4'-8'		dt; Cobble with sandy silt and sand, brown, dry to moist, dense.
		Total Depth=8'

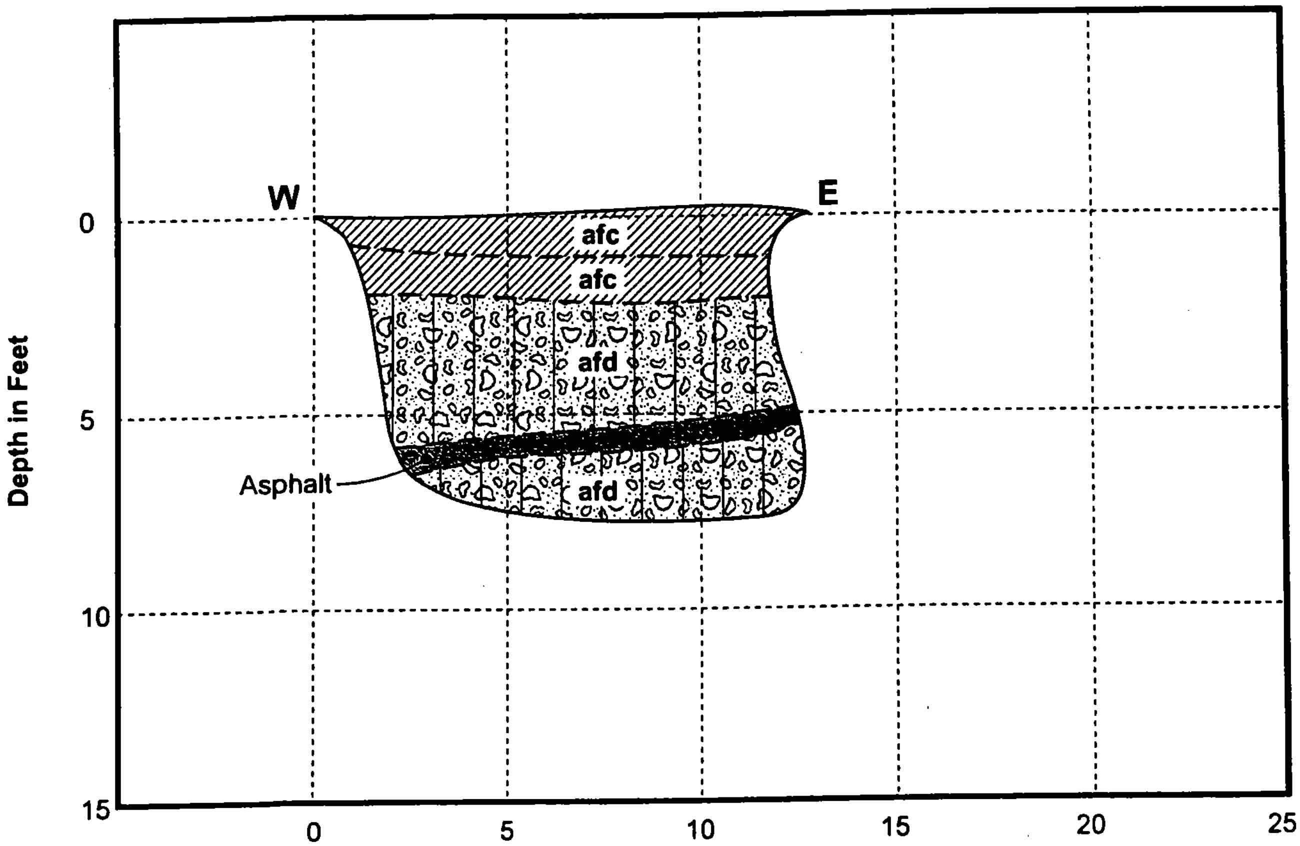
KLEINFELDER

Drawn By: D. Shelhart
Project No. 23-484361

Date: 11-20-2000
Filename: 2388i.fh8

LOG OF TEST PITS TP-9
FOLSOM CORPORATION YARD
FOLSOM, CALIFORNIA

PLATE
A-9



DEPTH	SAMPLE NO.	MATERIAL DESCRIPTION
0-1'		afc; Silt with sand (ML): Red-gray, moist, soft.
1'-2'		afc; clay (CL), light grayish-brown, dry, stiff, moderately cemented, Dessication.
2'-5'		afd; Silt with gravel (ML-GM) olive-brown, dry, soft to medium stiff, rock up to 6" diameter, trace clay. Debris consists of decomposed organics and asphalt.
5'-6'		Asphalt (AC)
6'-8'		afd; Sandy silt with gravel (ML-GM) red-gray, moist, soft to medium stiff, rock up to 6" diameter. Debris consists of asphalt.
		Total Depth=8'

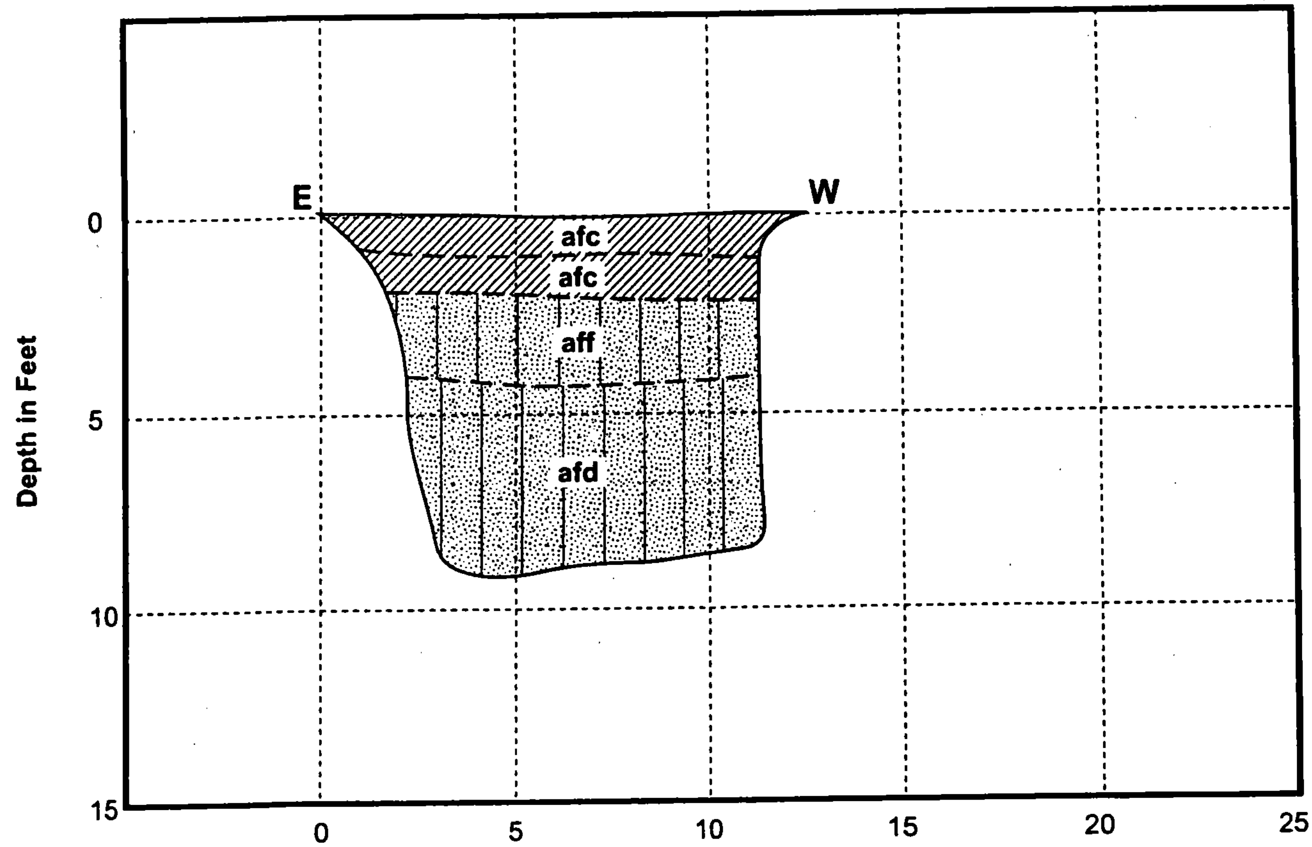
KLEINFELDER

Drawn By: D. Shelhart
Project No. 23-484361

Date: 11-20-2000
Filename: 2388j.fh8

LOG OF TEST PITS TP-10
FOLSOM CORPORATION YARD
FOLSOM, CALIFORNIA

PLATE
A-10



DEPTH	SAMPLE NO.	MATERIAL DESCRIPTION
0-1'		afc; Silt with sand (ML): Red-gray, moist, soft.
1'-2'		afc; clay (CL), light grayish-brown, dry to moist, medium stiff, strongly cemented, Dessication.
2'-4'		aff; Silty sand with gravel (SM), brown to red-brown, loose, rock up to 2' diameter.
4'-9'	109078	afd; Silty sand with gravel (SM), dry to moist, medium dense, moderately cemented, sub rounded rock up to 2' diameter. Debris consisting of asphalt.
		Total Depth=9'

KLEINFELDER

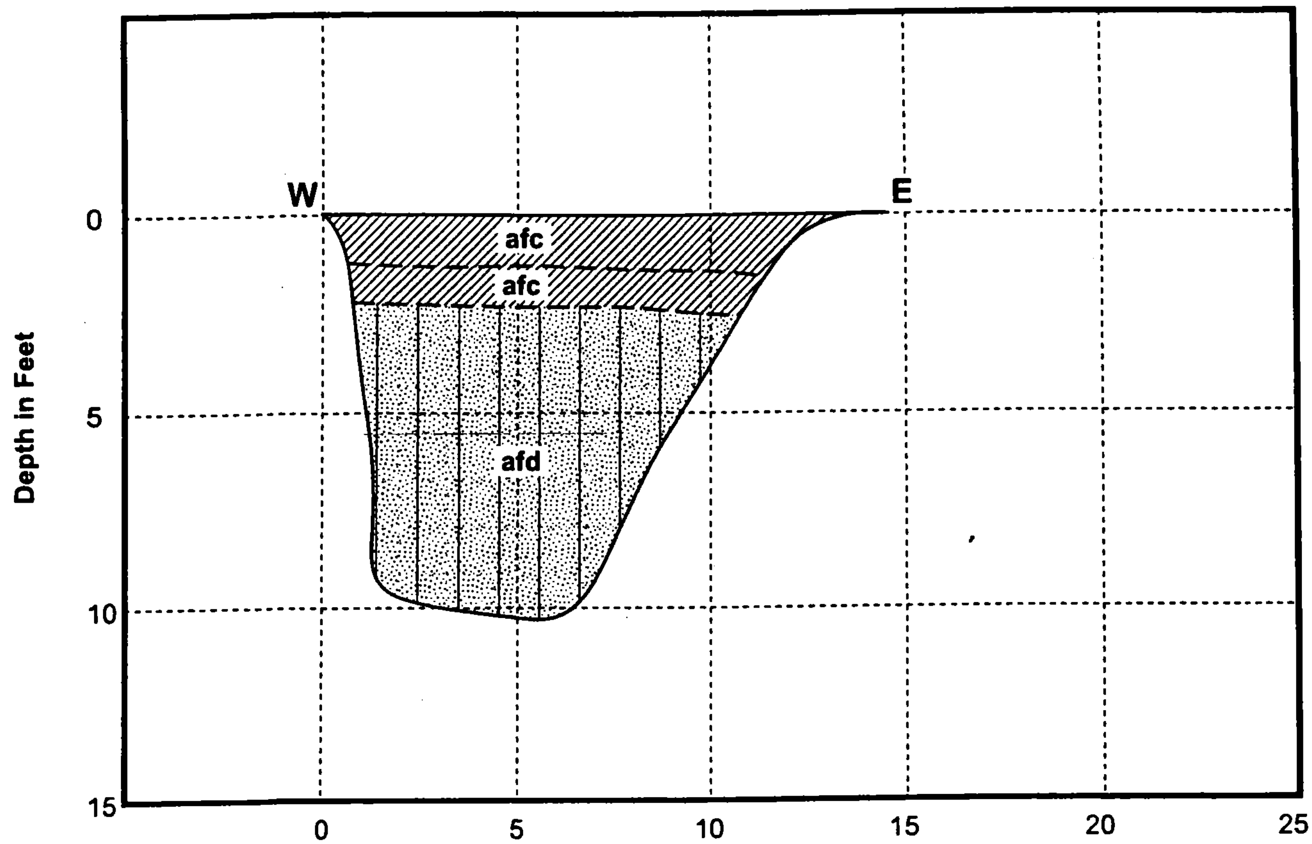
Drawn By: D. Shelhart
Project No. 23-484361

Date: 11-20-2000
Filename: 2388k.fh8

LOG OF TEST PITS TP-11

FOLSOM CORPORATION YARD
FOLSOM, CALIFORNIA

PLATE
A-11



DEPTH	SAMPLE NO.	MATERIAL DESCRIPTION
0-1.5'		afc; Silt with sand (ML): Red-gray, moist, soft.
1.5'-2.5'		afc; clay (CL), light grayish-brown, dry to moist, stiff, strongly cemented, Dessication.
2.5'-10'	109029	afd; Silty sand with gravel (SM), dry to moist, loose to medium dense, sub rounded rock up to 1' diameter, trace clay. Debris consisted of asphalt, with rebar and construction debris. Decomposed organics @ 9'.
		Total Depth=10'

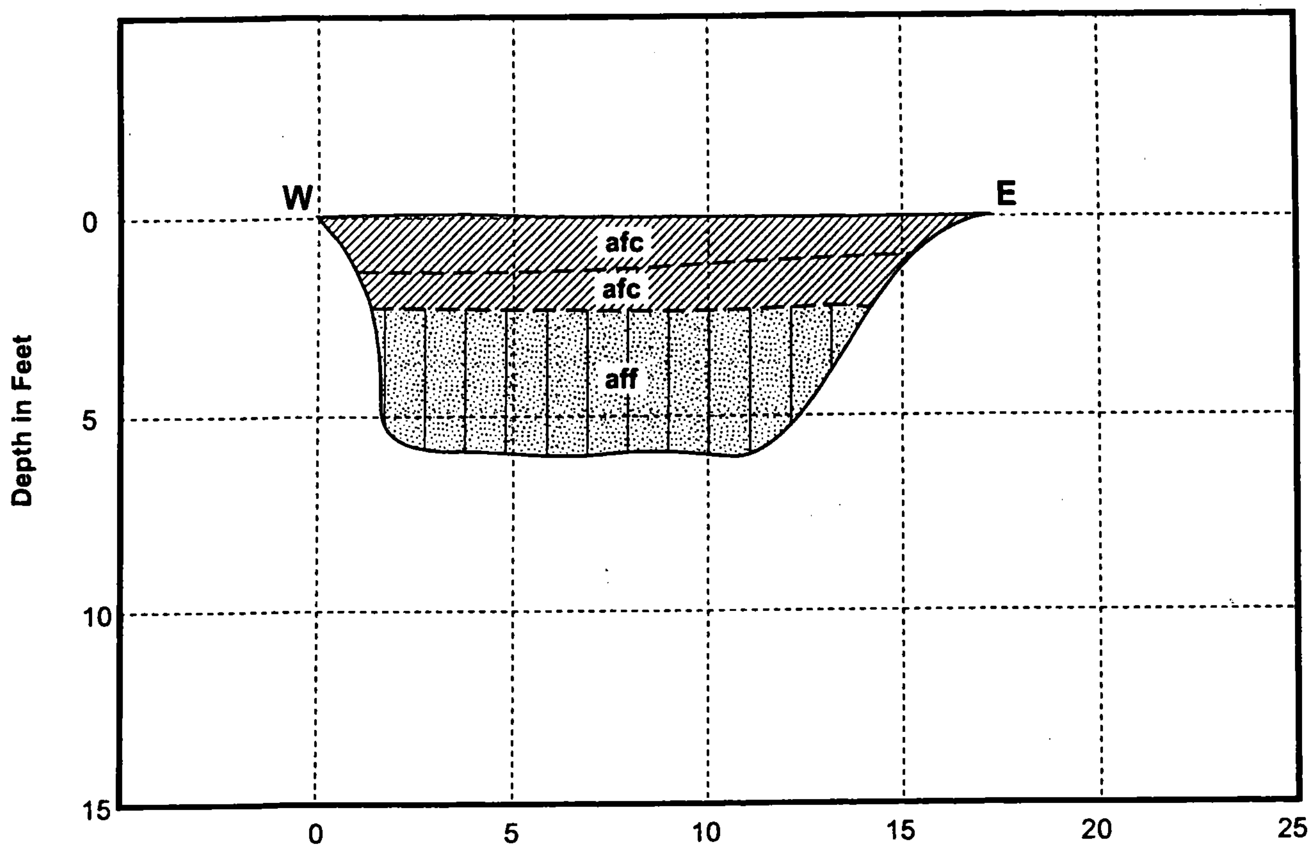
KLEINFELDER

Drawn By: D. Shelhart
Project No. 23-484361

Date: 11-20-2000
Filename: 2388I.fh8

LOG OF TEST PITS TP-12
FOLSOM CORPORATION YARD
FOLSOM, CALIFORNIA

PLATE
A-12



DEPTH	SAMPLE NO.	MATERIAL DESCRIPTION
0-1'		afc; Silt with sand (ML): Red-gray, moist, soft.
1'-2'		afc; clay (CL), light grayish-brown, dry to moist, stiff, strongly cemented, Dessication.
2'-6'	109029	aff; Silty sand with gravel (SM), red-brown, medium dense, weakly to modetately cemented, sub-angular to sub-rounded rock up to 12" diameter.
		Total Depth=6'

KLEINFELDER

Drawn By: D. Shelhart
Project No. 23-484361

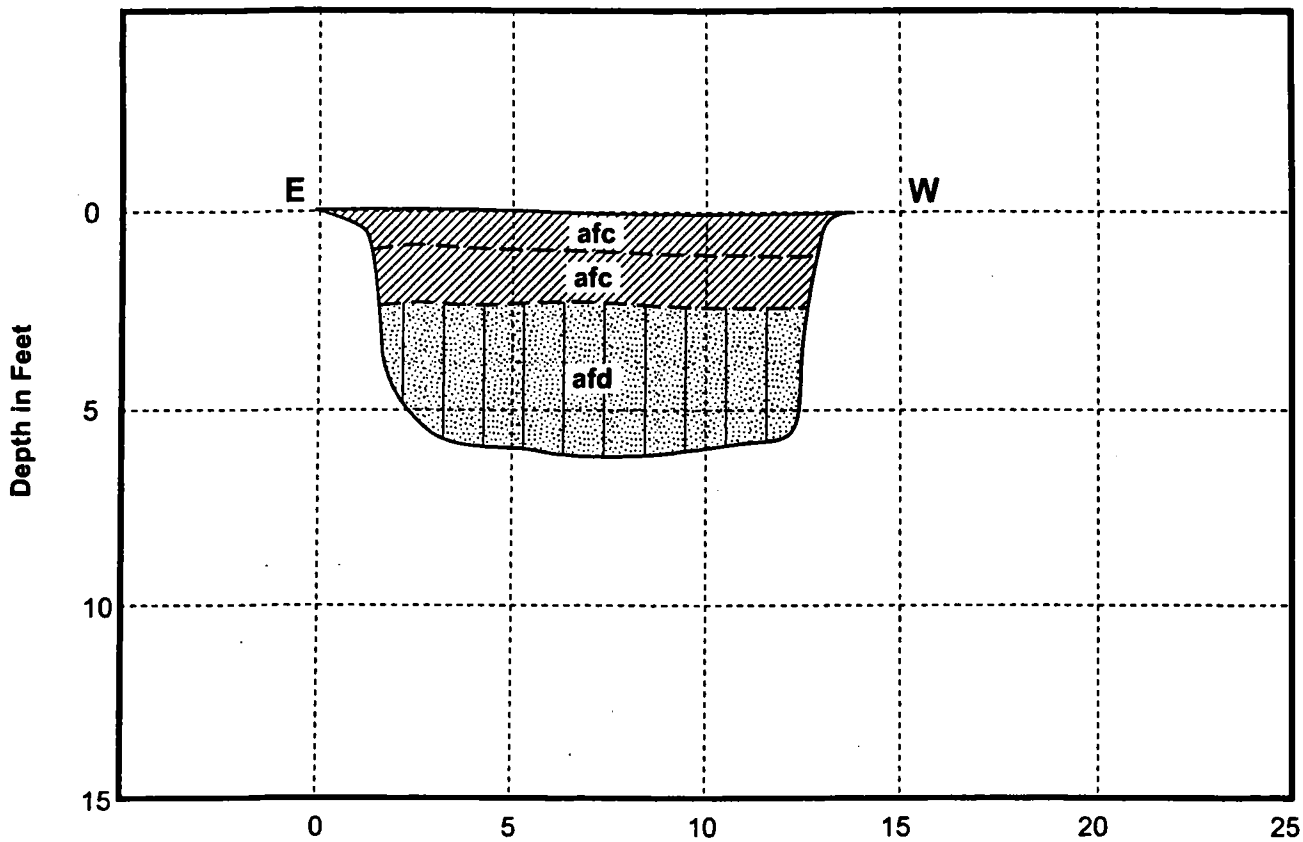
Date: 11-20-2000
Filename: 2388m.fh8

LOG OF TEST PITS TP-13

FOLSOM CORPORATION YARD
FOLSOM, CALIFORNIA

PLATE

A-13



DEPTH	SAMPLE NO.	MATERIAL DESCRIPTION
0-1'		afc; Silt with sand (ML): Red-gray, moist, soft.
1'-2.5'		afc; clay (CL), light grayish-brown, dry to moist, stiff, strongly cemented, Dessication.
2.5'-6'		afd; Silty sand with gravel (SM), dry to moist, loose, sub-angular rock up to 1' diameter. Debris consisted of plastic, metal, wood, paper.
		Total Depth=6'

KLEINFELDER

Drawn By: D. Shelhart
Project No. 23-484361

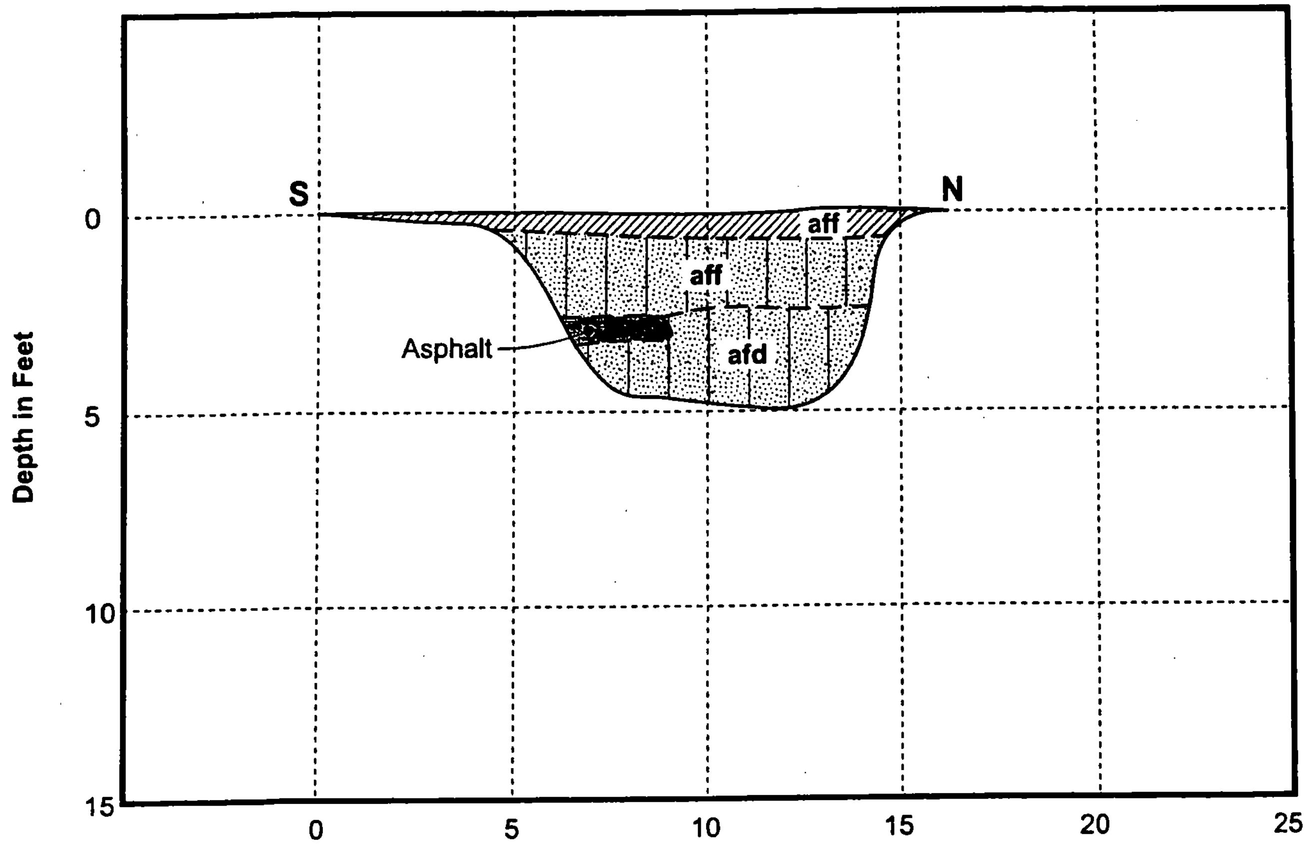
Date: 11-20-2000
Filename: 2388n.fh8

LOG OF TEST PITS TP-14

FOLSOM CORPORATION YARD
FOLSOM, CALIFORNIA

PLATE

A-14



DEPTH	SAMPLE NO.	MATERIAL DESCRIPTION
0-6"		aff; Silty sand (SM): Olive-brown, moist, loose.
6"-3'	109026	aff; Silty sand with gravel (SM), brown, loose.
3'-5'		afd; Silty sand with gravel (SM), brown, dry to moist, loose. Debris consisted of asphalt.
		Total Depth=5'

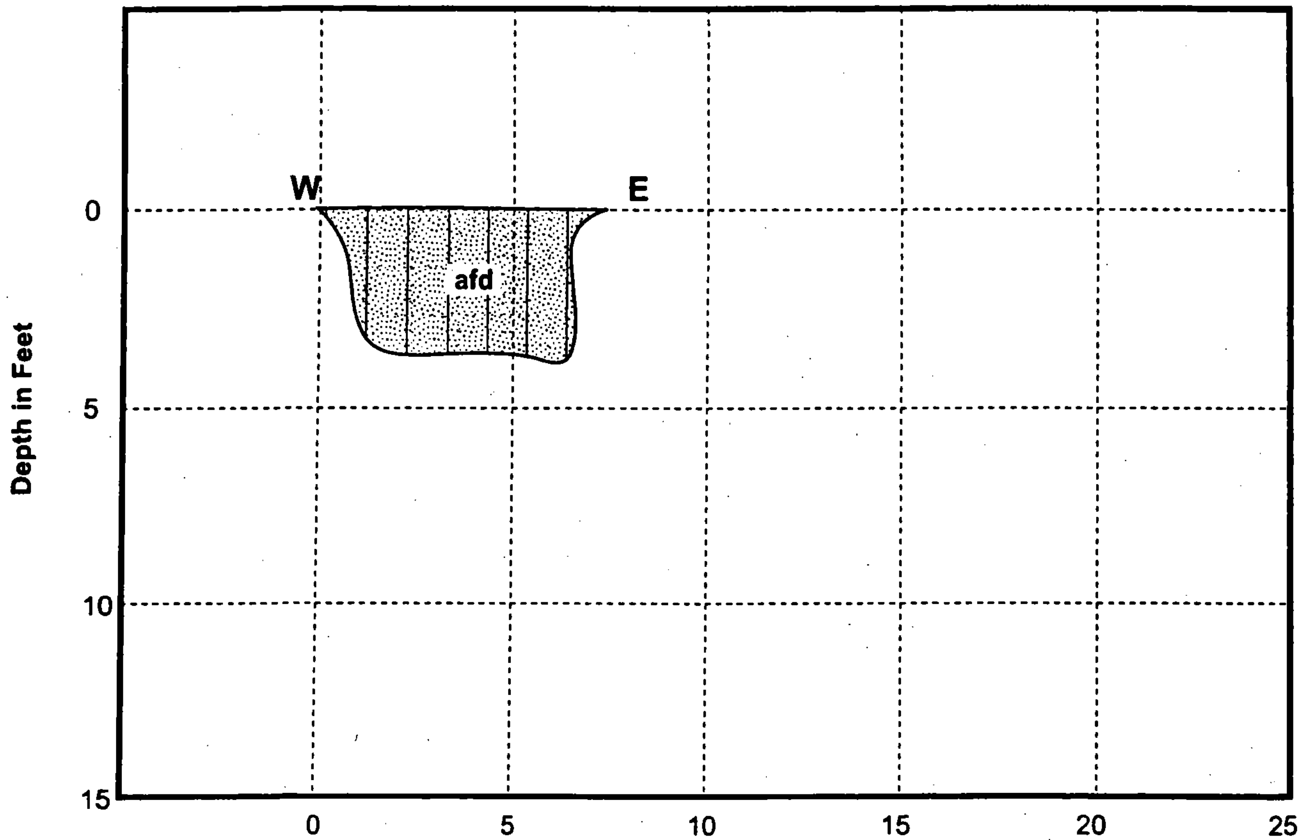
KLEINFELDER

Drawn By: D. Shelhart
Project No. 23-484361

Date: 11-20-2000
Filename: 2388o.fh8

LOG OF TEST PITS TP-15
FOLSOM CORPORATION YARD
FOLSOM, CALIFORNIA

PLATE
A-15



DEPTH	SAMPLE NO.	MATERIAL DESCRIPTION
0-4'		afd; Silty sand with gravel (SM), brown, moist, loose, sub rounded rock up to 6" diameter, trace clay. Debris consisted of minor construction debris throughout.
		Total Depth=4'

KLEINFELDER

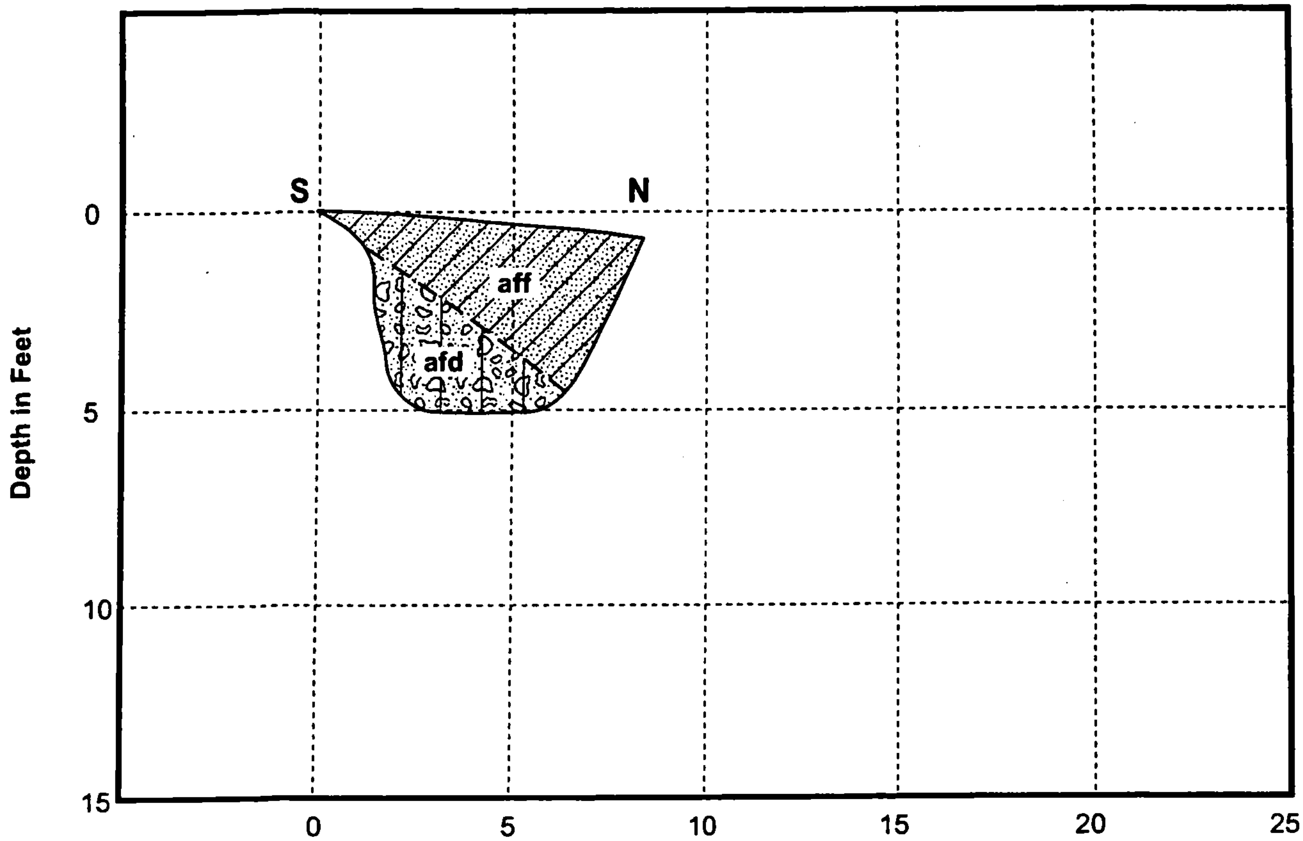
Drawn By: D. Shelhart
Project No. 23-484361

Date: 11-20-2000
Filename: 2388p.fh8

LOG OF TEST PITS TP-16

FOLSOM CORPORATION YARD
FOLSOM, CALIFORNIA

PLATE
A-16



DEPTH	SAMPLE NO.	MATERIAL DESCRIPTION
0-5'		aff; Sand with clay and gravel (SC), red, moist, medium dense, moderately cemented, subrounded rock up to 8" diameter.
1-5'	109027	afd; Silty sand with gravel (ML-GM), red-gray, dry, loose to medium dense, rock up to 6" diameter. Debris consists of asphalt and wood.
		Total Depth=5'

KLEINFELDER

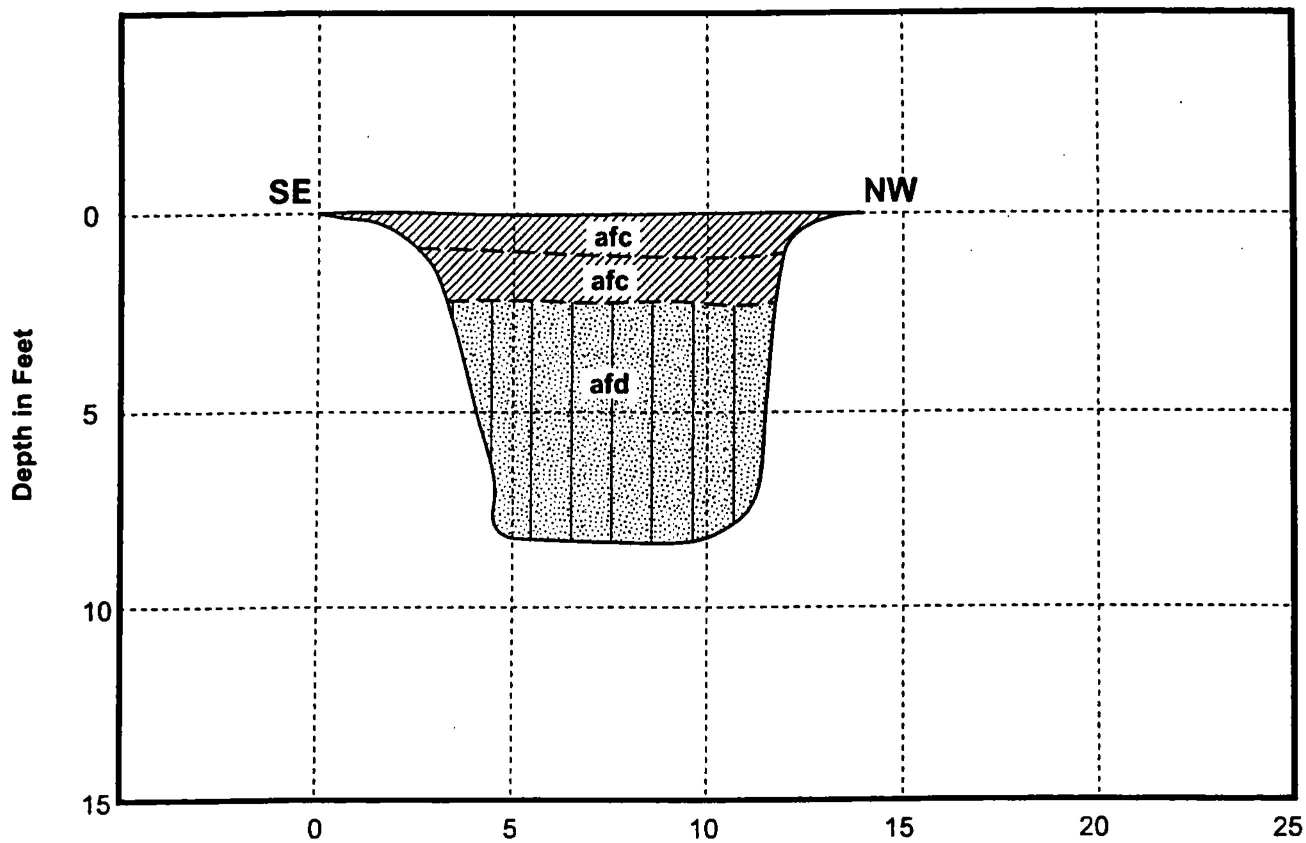
Drawn By: D. Shelhart
Project No. 23-484361

Date: 11-20-2000
Filename: 2388q.fh8

LOG OF TEST PITS TP-17

FOLSOM CORPORATION YARD
FOLSOM, CALIFORNIA

PLATE
A-17



DEPTH	SAMPLE NO.	MATERIAL DESCRIPTION
0-1'		afc; Silt with sand (ML): Red-gray, moist, soft.
1'-2'		afc; clay (CL), light grayish-brown, dry to moist, stiff, moderately to strongly cemented, Dessication.
2'-8'	110003 110001	afd; Silty sand with gravel (SM), Olive-brown, dry to moist, medium dense, sub rounded rock up to 1' diameter. Debris consisted of asphalt and organics at ≈ 3'.
		Total Depth=8'

KLEINFELDER

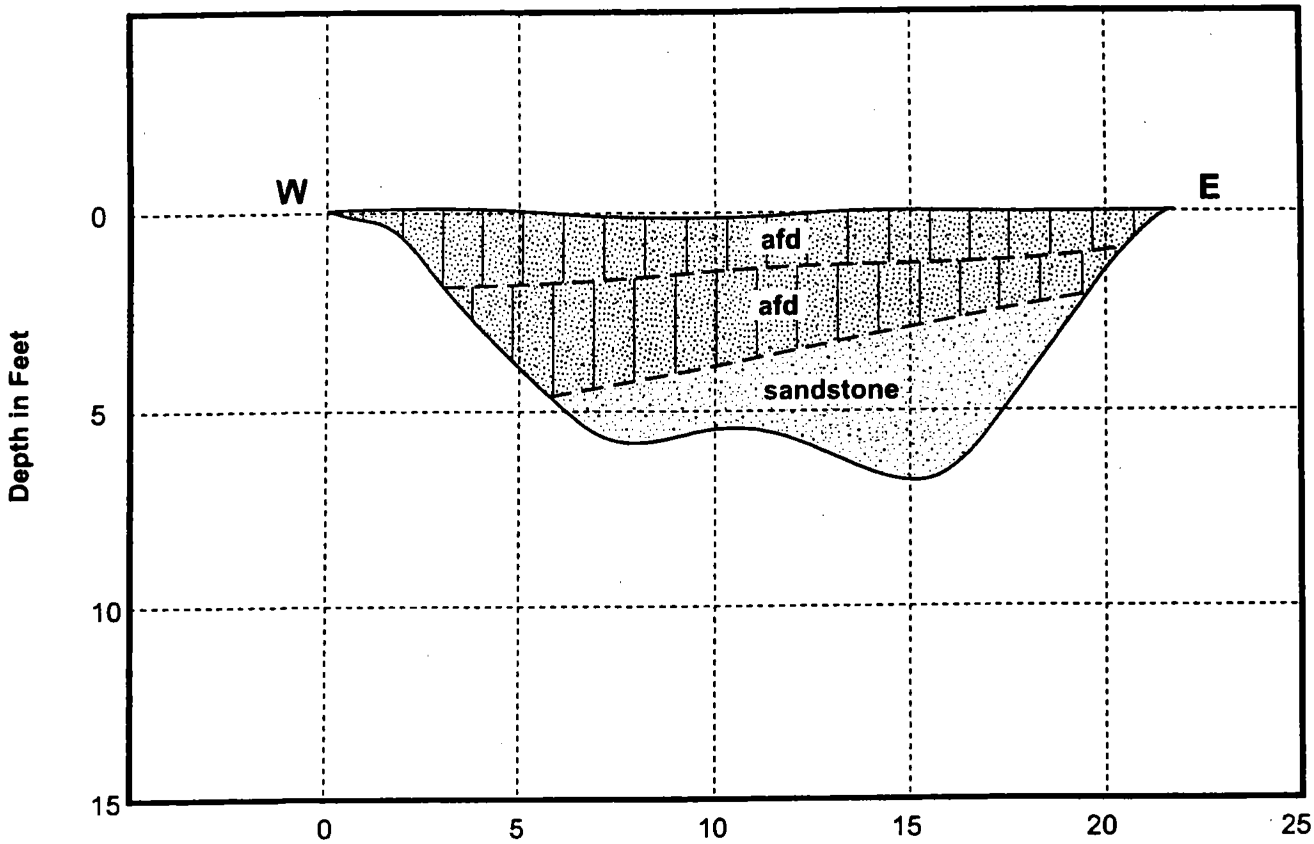
Drawn By: D. Shelhart
Project No. 23-484361

Date: 11-20-2000
Filename: 2388r.fh8

LOG OF TEST PITS TP-18

FOLSOM CORPORATION YARD
FOLSOM, CALIFORNIA

PLATE
A-18



DEPTH	SAMPLE NO.	MATERIAL DESCRIPTION
0-2'		afd; Silt with sand (ML): Red-gray, moist, soft, rock up to 12" diameter, asphalt debris.
2'-4'		afd; Silty sand with gravel (SM), Olive-brown, moist, loose, sub-angular rock up to 1' diameter. Debris consisted of asphalt, straw, and tree roots.
4'-7'		sandstone, gray, dense, strongly cemented.
		Total Depth=7'

KLEINFELDER

Drawn By: D. Shelhart
Project No. 23-484361

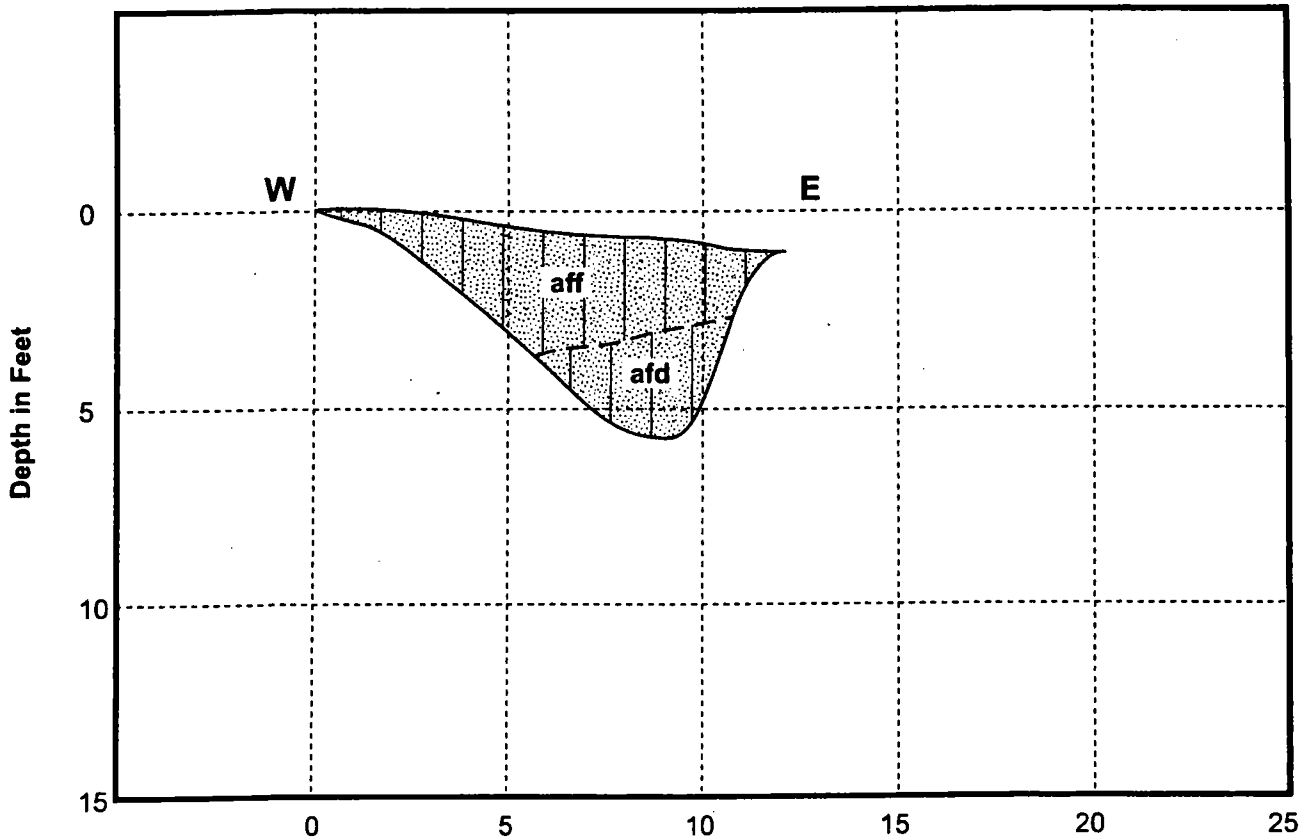
Date: 11-20-2000
Filename: 2388s.fh8

LOG OF TEST PITS TP-19

FOLSOM CORPORATION YARD
FOLSOM, CALIFORNIA

PLATE

A-19



DEPTH	SAMPLE NO.	MATERIAL DESCRIPTION
0-2'		aff; Silty sand with gravel (SM), red-gray, loose, sub-rounded rock up to 1' diameter.
2'-6'	109162	afd; Silty sand with gravel (SM), moist, loose, sub rounded rock up to 1' diameter, trace clay. Debris consisted of asphalt.
		Total Depth=6'

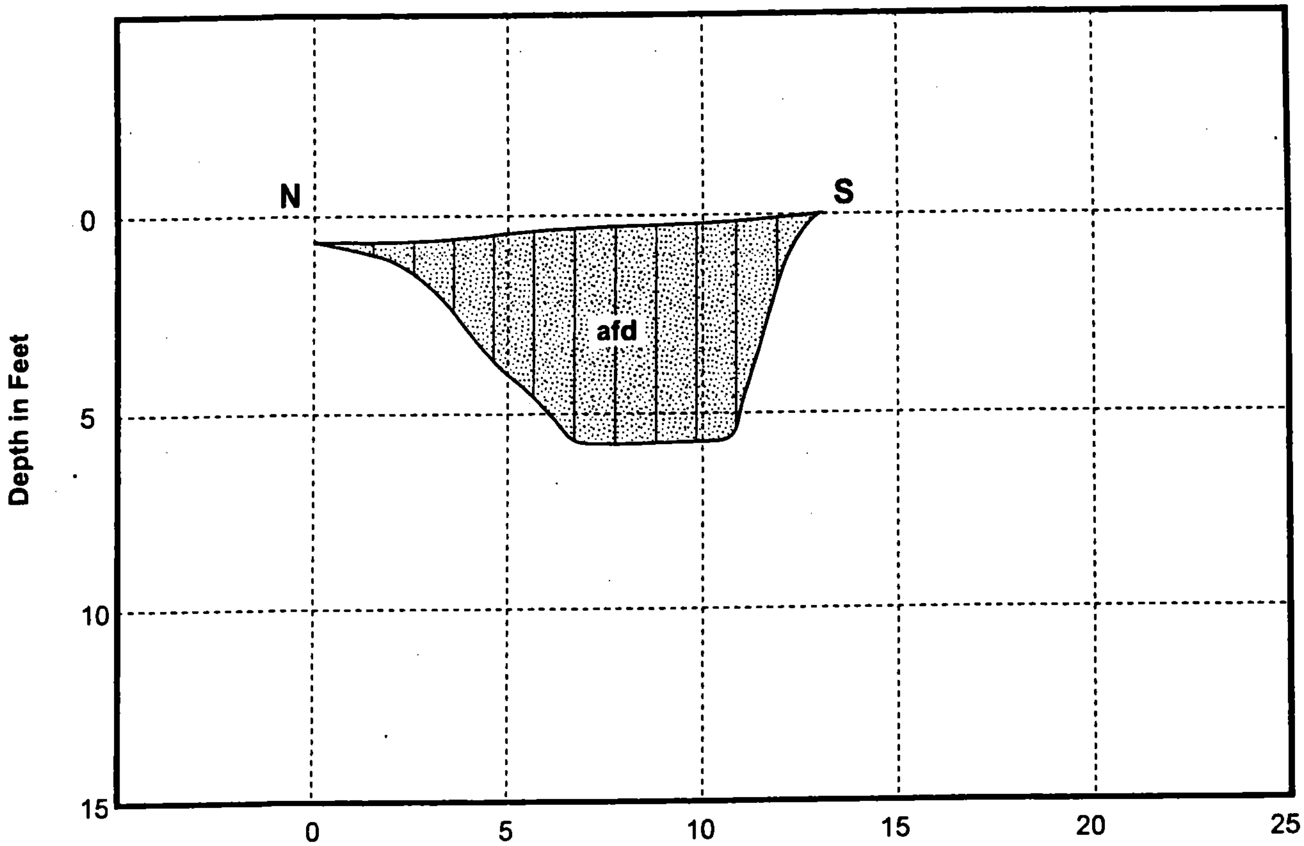
KLEINFELDER

Drawn By: D. Shelhart
Project No. 23-484361

Date: 11-20-2000
Filename: 2388t.fh8

LOG OF TEST PITS TP-20
FOLSOM CORPORATION YARD
FOLSOM, CALIFORNIA

PLATE
A-20



DEPTH	SAMPLE NO.	MATERIAL DESCRIPTION
0-5'		afd; Silty sand with gravel (SM), moist, loose, sub-angular to sub-rounded rock up to 6" diameter. Debris consisted of asphalt and concrete.
		Total Depth=5'

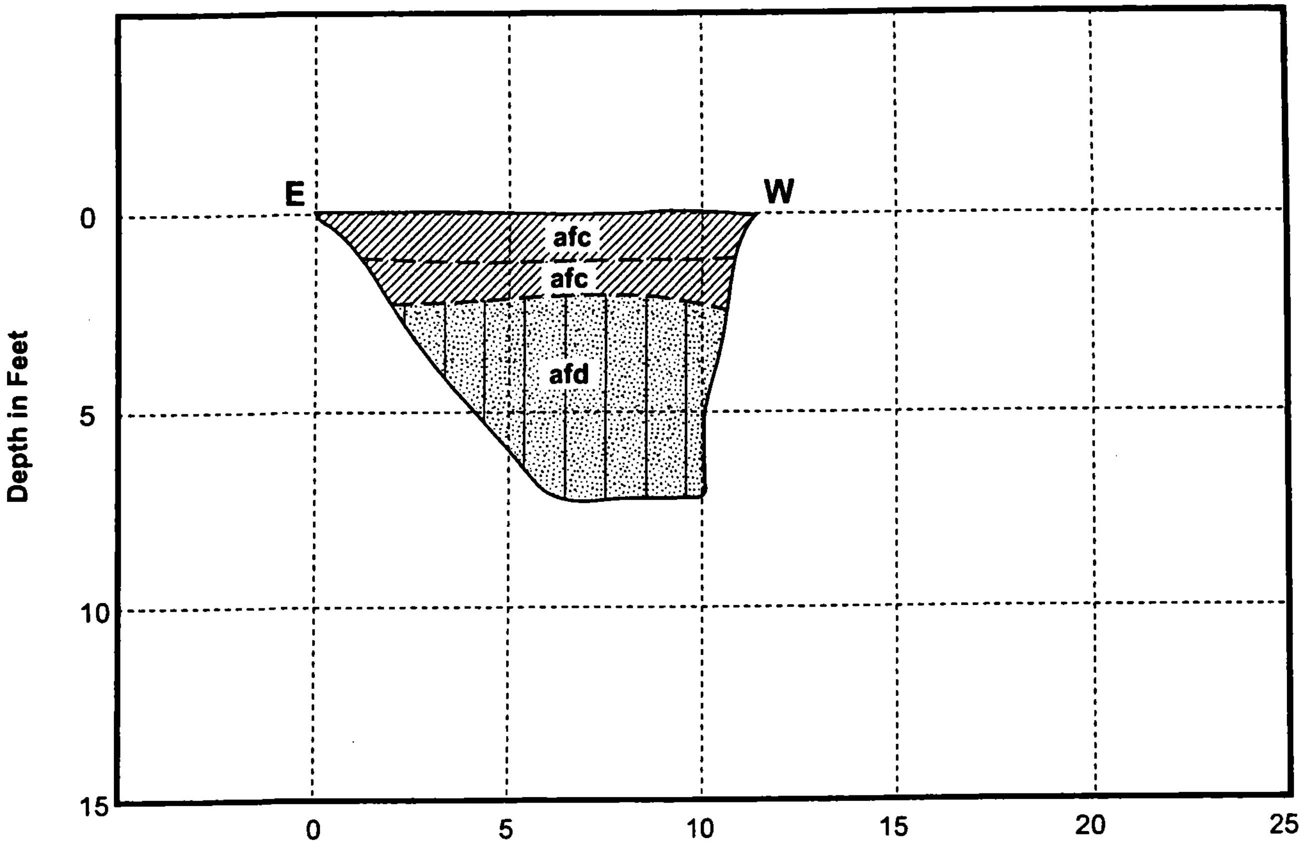
KLEINFELDER

Drawn By: D. Shelhart
Project No. 23-484361

Date: 11-20-2000
Filename: 2388u.fh8

LOG OF TEST PITS TP-21
FOLSOM CORPORATION YARD
FOLSOM, CALIFORNIA

PLATE
A-21



DEPTH	SAMPLE NO.	MATERIAL DESCRIPTION
0-1'		afc; Silt with sand (ML): Red-gray, moist, soft.
1'-2.5'		afc; clay (CL), light grayish-brown, dry to moist, stiff, strongly cemented, Dessication.
2.5'-7'	109190	afd; Silty sand with gravel (SM), dry, loose, sub rounded rock up to 1' diameter. asphalt debris.
		Total Depth=7'

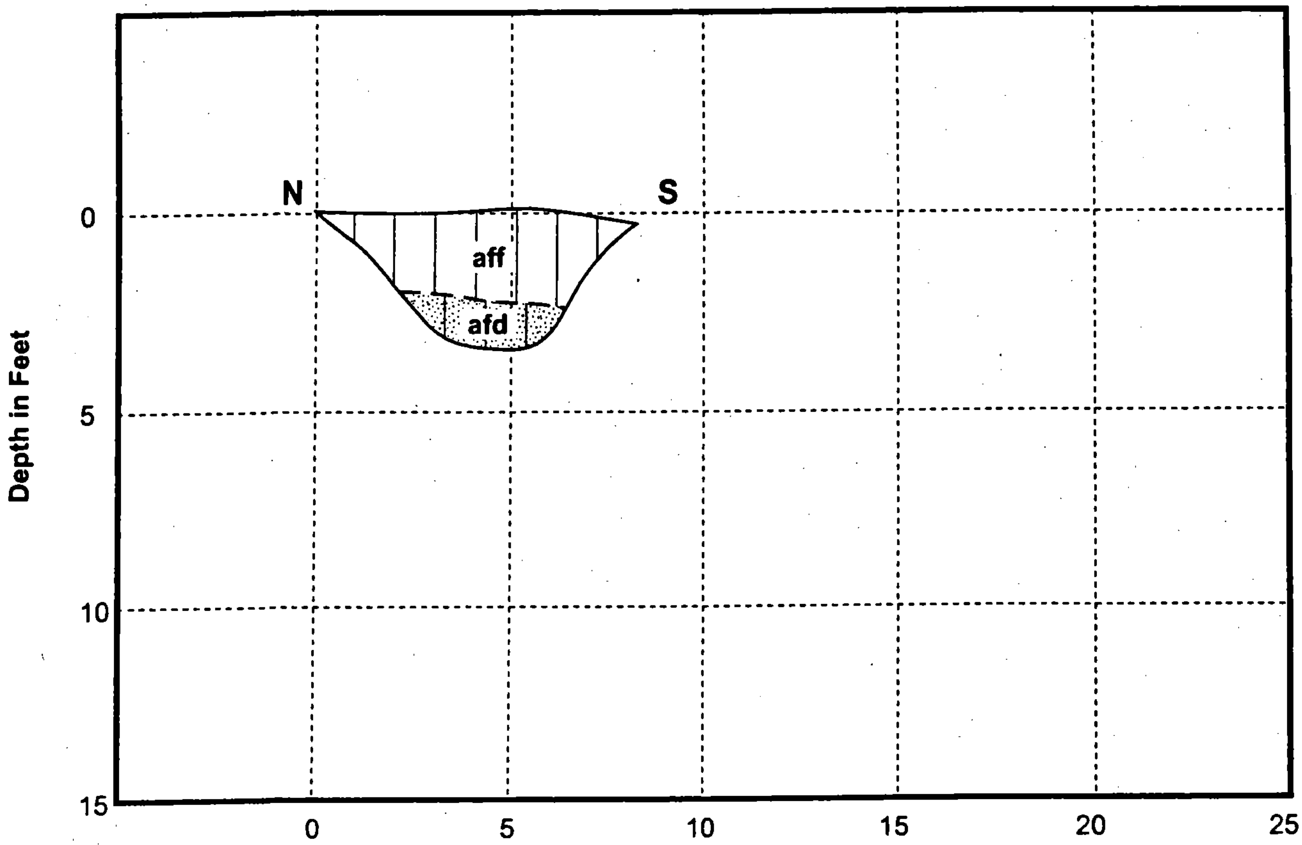
KLEINFELDER

Drawn By: D. Shelhart
Project No. 23-484361

Date: 11-20-2000
Filename: 2388v.fh8

LOG OF TEST PITS TP-22
FOLSOM CORPORATION YARD
FOLSOM, CALIFORNIA

PLATE
A-22



DEPTH	SAMPLE NO.	MATERIAL DESCRIPTION
0-2'		aff; Sandy silt with gravel (ML), Red-brown to brown, dry to moist, soft, with sub-rounded gravel up to 12" diameter.
2'-3'		afd; Silty sand with gravel (SM), moist, moderately cemented, sub rounded rock up to 1' diameter. Significant asphalt debris @ 2'.
		Total Depth=3'

KLEINFELDER

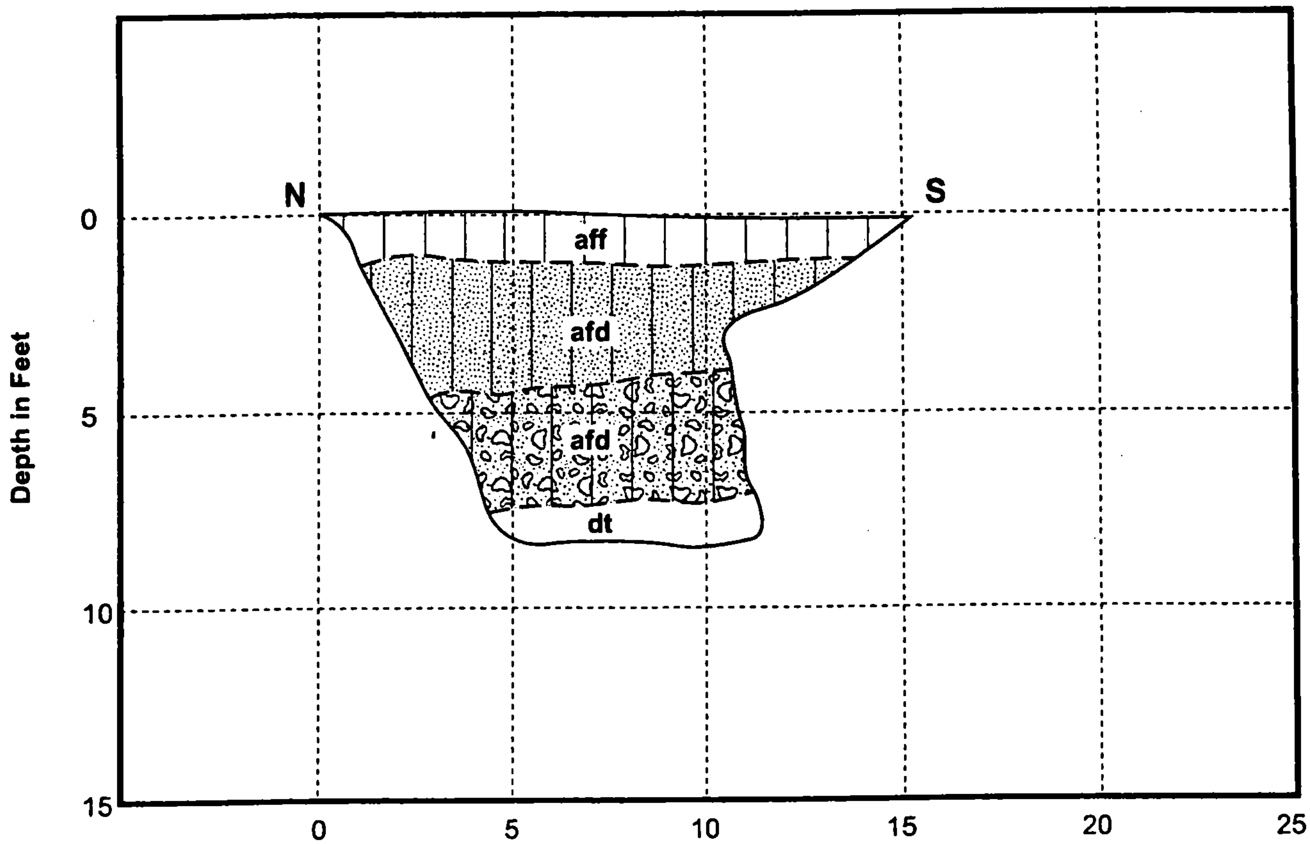
Drawn By: D. Shelhart
Project No. 23-484361

Date: 11-20-2000
Filename: 2388w.fh8

LOG OF TEST PITS TP-23

FOLSOM CORPORATION YARD
FOLSOM, CALIFORNIA

PLATE
A-23



DEPTH	SAMPLE NO.	MATERIAL DESCRIPTION
0-1'	109187	aff; Sandy silt with gravel (ML), Red-gray, moist, soft, with sub-rounded gravel up to 8" diameter.
1'-4'		afd; Silty sand with gravel (ML-GM), Red-gray, moist, soft to medium stiff, asphalt debris.
4'-7'		afd; Silty sand with gravel (SM), dry to moist, medium dense, moderately cemented, sub rounded rock up to 1' diameter, with debris consisting of metal, plastic, concrete, aluminum cans, sheetrock, newspaper.
7'-8'		dt; Cobble with silty sand, red-gray to red-brown, dry, medium stiff, weakly cemented, (cobble).
		Total Depth=8'

KLEINFELDER

Drawn By: D. Shelhart
Project No. 23-484361

Date: 11-20-2000
Filename: 2388x.fh8

LOG OF TEST PITS TP-24
FOLSOM CORPORATION YARD
FOLSOM, CALIFORNIA

PLATE
A-24

Log of Test Pits TPA-1 Through TPA-8

April 18, 2006

Test Pit	Depth (ft)	Material Description
TPA-1	0-4.5	afd; Sandy silt with gravel (ML), Red-gray, dry. Debris consisted of tires, tubing, scrap wood and metal, branches, plastic containers, mulch bags, hose, and hair rollers.
	4.5-5	dt; Cobble with silty sand, dry, cobbles up to 1' diameter.
TPA-2	0-6.5	afd; Sandy silt with gravel (ML), Red-gray, dry, sub-rounded rock up to 6" diameter. Asphalt debris
	6.5-8	afd; Cobble with silt and sand, dry to moist. Debris consisted of carpet/fabric, scrap wood and metal, glass bottles, plastic, leather, and burn ash.
TPA-3	0-1	afc; Silt with sand (ML); Red-gray, moist.
	1-2	afc; clay (CL), light grayish-brown, moist.
	2-3	afd; silt with gravel (ML-GM), cobbles up to 6" diameter. Asphalt debris.
TPA-4	0-1	afc; Silt with sand (ML); Red-gray, moist.
	1-3	afc; clay (CL), light grayish-brown, moist. Plastic liner of landfill observed.
TPA-5	0-1	afc; Silt with sand (ML); Red-gray, moist. Tire exposed at surface 20' east of trench.
	1-3	afc; clay (CL), light grayish-brown, moist. Plastic liner of landfill observed.
TPA-6	0-7	afd; Cobble with silt and sand, dry to moist. Debris consisted of asphalt, concrete, rebar, pipe, plastic bags, electrical wiring, and other metal wire.
TPA-7	0-5	afd; Cobble with silt and sand, dry to moist. Debris consisted of asphalt, plastic bags, a tire, and plastic pipe.
TPA-8	0-2	afd; Sandy silt with gravel (ML), Red-gray, dry to moist.
	2-7	afd; Cobble with silt and sand, dry to moist. Debris consisted of asphalt, plastic sheeting, metal/plastic piping, glass bottles, rope, scrap metal/plastic/wood, electrical wiring, and clothing.

Notes

afc = artificial fill clay cap

afd = artificial debris fill

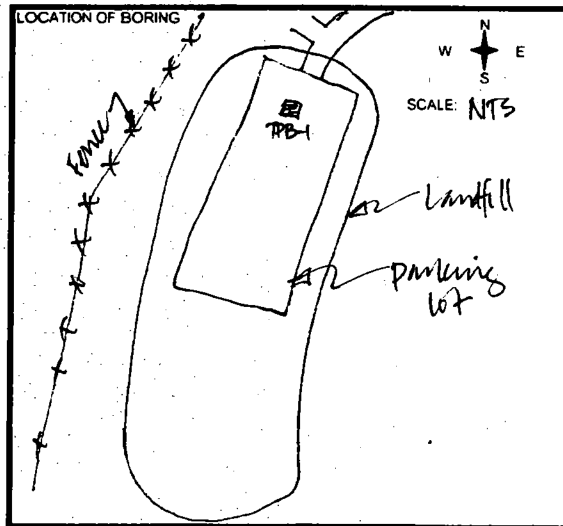
aff = artificial soil fill

dt = dredge tailings

BROWN AND CALDWELL

BOREHOLE/WELL LOG

LOCATION OF BORING



CLIENT	City of Folsom
LOCATION	Corp Yard Landfill
PROJECT NAME	
JOB NUMBER	134473
DRILLING CONTRACTOR	City of Folsom
RIG TYPE (CIRCLE ONE)	HSA DP MUD ARCH NONE OTHER BACKHOE
DRILLING METHOD, FLUID USED	NA
SOIL SAMPLING METHOD (CIRCLE ONE)	SPLIT SPOON CC ACETATE NONE OTHER GRAB
MONITORING INSTRUMENT (CIRCLE ONE)	PID FID LEL RAD NONE OTHER
SURFACE CONDITIONS (CIRCLE ONE)	ASPHALT CONCRETE DIRT DRY WET OTHER

BORING NUMBER	
TPB-1	
SHEET 1	OF 1
DRILLING	
START	FINISH
TIME 730	TIME 1330
DATE 2/6/08	DATE 2/6/08
WELL CONSTRUCTION	
START	FINISH
TIME	TIME
DATE	DATE

FINE GRAINED AND ORGANIC SOIL DESCRIPTION: GROUP NAME, MUNSELL COLOR, COLOR, SIZE DISTRIBUTION, PLASTICITY, DRY STRENGTH, DILATANCY, TOUGHNESS, MOISTURE, ODOR, STRUCTURE, CONSISTENCY, RELATIVE PERMEABILITY, LOCAL GEOLOGIC NAME, CONTACT DESCRIPTION

COARSE GRAINED SOIL DESCRIPTION: GROUP NAME, MUNSELL COLOR, COLOR, GRADATION (g/s/f), SIZE DISTRIBUTION, PLASTICITY, SHAPE, ANGULARITY, MOISTURE, ODOR, STRUCTURE, CEMENTATION, RELATIVE PERMEABILITY, LOCAL GEOLOGIC NAME, MINERALOGY, CONTACT DESCRIPTION

WELL CONSTRUCTION: ANNULUS	CASING	SOIL SAMPLING: SAMPLER USED	BLOWS/6" INTERVAL	INTERVAL SAMPLED	RECOVERY	ANALYTICAL SAMPLE (A,B,C)	WATER LEVEL (INTIAL/STATIC)	DEPTH (FEET)	INSTRUMENT READING (ppm)	USCS GROUP SYMBOL	SAMPLE TYPE: INTERVAL: DESCRIPTION
								0			4" asphalt over 8" AB
										CH	12" clay cap
										SM	Red-brown silty sand w/coarse gravel and cobble up to 12" Ø (coarse gravel and cobble are rounded). Dry.
								5			
											Asphalt chunks noted.
								10			Small amount of green waste, metal, branches, lumber, rubber hose, pvc plastic pipe, sheet plastic, asphalt, concrete * Still predominately soil * 95% soil / 5% waste
						A		15	0	SM	Dark green silty-fine sand (dry) (PID=0ppm; LEL=0%) → Plastic pond liner found ←
						B				SM	Red-brown silty-sand w/coarse gravel & cobble Large chunks of clay (not continuous) red brown, gray mottled. TD=19' bgs (NO TRASH)
								20			

ANALYTICAL SAMPLE ID (SEE ABOVE FOR LOCATION)

A	TPB1A	D	
B	TPB1B	E	
C		F	

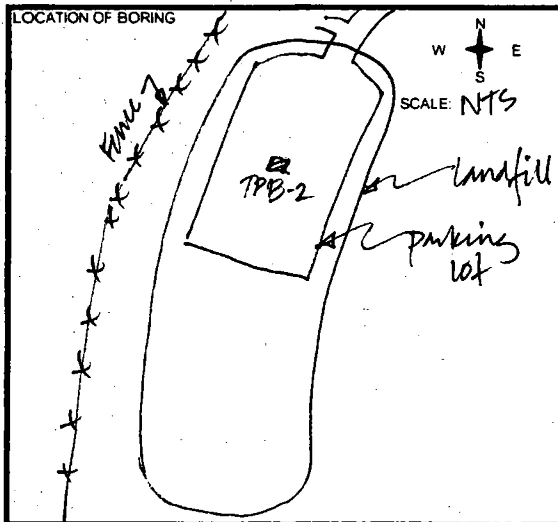
Completed by:

Approved by:

BROWN AND CALDWELL

BOREHOLE/WELL LOG

LOCATION OF BORING



Field	Value
CLIENT	City of Folsom
LOCATION	Corp Yard Landfill
PROJECT NAME	
JOB NUMBER	134473
DRILLING CONTRACTOR	City of Folsom
RIG TYPE (CIRCLE ONE) HSA DP MUD ARCH NONE	OTHER BACKHOE
DRILLING METHOD, FLUID USED	NA
SOIL SAMPLING METHOD (CIRCLE ONE) SPLIT SPOON CC ACETATE NONE	OTHER GRAB
MONITORING INSTRUMENT (CIRCLE ONE) PID FID LEL RAD NONE OTHER	PID, LEL
SURFACE CONDITIONS (CIRCLE ONE) ASPHALT CONCRETE DIRT DRY WET OTHER	ASPHALT

BORING NUMBER	
TPB-2	
SHEET 1	OF 1
DRILLING	
START	FINISH
TIME 730	TIME 1400
DATE 2/7/08	DATE 2/7/08
WELL CONSTRUCTION	
START	FINISH
TIME	TIME
DATE	DATE

FINE GRAINED AND ORGANIC SOIL DESCRIPTION: GROUP NAME, MUNSELL COLOR, COLOR, SIZE DISTRIBUTION, PLASTICITY, DRY STRENGTH, DILATANCY, TOUGHNESS, MOISTURE, ODOR, STRUCTURE, CONSISTENCY, RELATIVE PERMEABILITY, LOCAL GEOLOGIC NAME, CONTACT DESCRIPTION

COARSE GRAINED SOIL DESCRIPTION: GROUP NAME, MUNSELL COLOR, COLOR, GRADATION (g/s/f), SIZE DISTRIBUTION, PLASTICITY, SHAPE, ANGULARITY, MOISTURE, ODOR, STRUCTURE, CEMENTATION, RELATIVE PERMEABILITY, LOCAL GEOLOGIC NAME, MINERALOGY, CONTACT DESCRIPTION

WELL CONSTRUCTION: ANNULUS	WELL CONSTRUCTION: CASING	SOIL SAMPLING: SAMPLER USED	BLOWS/6" INTERVAL	INTERVAL SAMPLED	RECOVERY	ANALYTICAL SAMPLE (A,B,C)	WATER LEVEL (INITIAL/STATIC)	DEPTH (FEET)	INSTRUMENT READING (ppm)	USCS GROUP SYMBOL	SAMPLE TYPE: INTERVAL: DESCRIPTION
								0			4" asphalt over 8" AB
										CH	12" clay cap
										SM/SC	Red-brown clayey-silty sand w/ coarse gravel and cobble (gravel and cobble are rounded) some cobble up to 12" ø
								5			
											some garbage noted: smash hot water heater, clothing, small carpet pieces, a few tree limbs
								10			*STILL PREDOMINATELY SOIL* 98% soil/2% trash
								15			
						A					some clay chunks noted; red-brown & gray mottling. No trash.
								20			TD=18' bgs.

ANALYTICAL SAMPLE ID (SEE ABOVE FOR LOCATION)

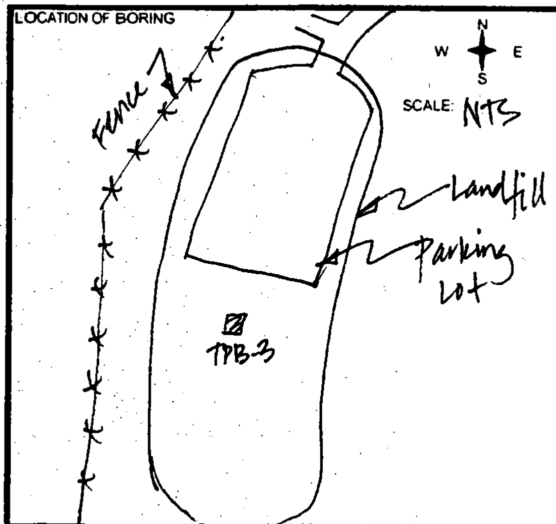
A	TPB2A	D	
B		E	
C		F	

Completed by: [signature] Approved by:

P:\Special\DACW05-97-D-0035A_E\Field Activities\boringlogform.xls

BROWN AND CALDWELL — **BOREHOLE/WELL LOG**

LOCATION OF BORING



Field	Entry
CLIENT	City of Folsom
LOCATION	Corp Yard Landfill
PROJECT NAME	
JOB NUMBER	134473
DRILLING CONTRACTOR	City of Folsom
RIG TYPE (CIRCLE ONE): HSA, DP, MUD, ARCH, NONE	OTHER: BACKHOE
DRILLING METHOD, FLUID USED	NA
SOIL SAMPLING METHOD (CIRCLE ONE): SPLIT SPOON, CC, ACETATE, NONE	OTHER: GRAB
MONITORING INSTRUMENT (CIRCLE ONE): PID, FID, LEL, RAD, NONE	PID, LEL; OTHER:
SURFACE CONDITIONS (CIRCLE ONE): ASPHALT, CONCRETE, DIRT, DRY, WET	DIRT, WET; OTHER: Grass

BORING NUMBER	TPB-3
SHEET	1 OF 1

DRILLING	START	FINISH
TIME	715	930
DATE	2/8/08	2/8/08

WELL CONSTRUCTION	START	FINISH
TIME		
DATE		

FINE GRAINED AND ORGANIC SOIL DESCRIPTION: GROUP NAME, MUNSELL COLOR, COLOR, SIZE DISTRIBUTION, PLASTICITY, DRY STRENGTH, DILATANCY, TOUGHNESS, MOISTURE, ODOR, STRUCTURE, CONSISTENCY, RELATIVE PERMEABILITY, LOCAL GEOLOGIC NAME, CONTACT DESCRIPTION

COARSE GRAINED SOIL DESCRIPTION: GROUP NAME, MUNSELL COLOR, COLOR, GRADATION (g/s/f), SIZE DISTRIBUTION, PLASTICITY, SHAPE, ANGULARITY, MOISTURE, ODOR, STRUCTURE, CEMENTATION, RELATIVE PERMEABILITY, LOCAL GEOLOGIC NAME, MINERALOGY, CONTACT DESCRIPTION

ANNULUS	CASING	SAMPLER USED	BLOWS/6" INTERVAL	INTERVAL SAMPLED	RECOVERY	ANALYTICAL SAMPLE (A,B,C)	WATER LEVEL (INTIAL/STATIC)	DEPTH (FEET)	INSTRUMENT READING (ppm)	USCS GROUP SYMBOL	SAMPLE TYPE: INTERVAL: DESCRIPTION
								0			12" topsoil w/grass (damp from dew)
										CH	12" clay cap
										SM/SC	≈12" clean soil; very dry clayey silty sand w/coarse gravel and some cobble (rounded)
								5			mixture of soil and some garbage: metal, plastic, garden hose, household water filter, asphalt, roll-up shade, clothing.
											* PREDOMINATELY SOIL: 95% soil/5% garbage
								10			
						A				SM	Red-brown silty sand w/cobble up to 8" Ø
											TD=13' bgs.
								15			
								20			

ANALYTICAL SAMPLE ID (SEE ABOVE FOR LOCATION)

A	TPB3A	D	
B		E	
C		F	

Completed by:

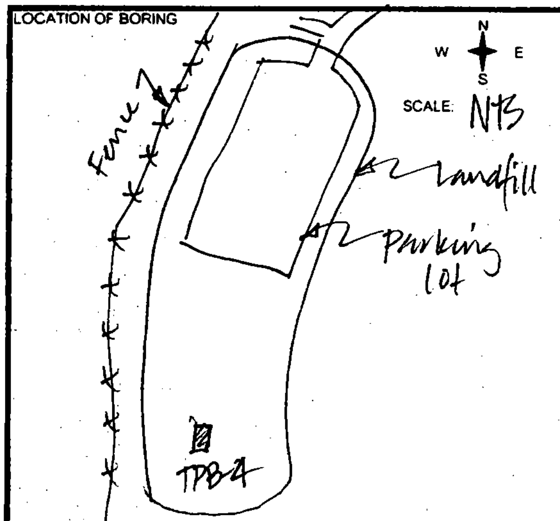
Approved by:

P:\Special\DACW05-97-D-0035A_E\Field Activities\boringlogform.xls

BROWN AND CALDWELL

BOREHOLE/WELL LOG

LOCATION OF BORING



Field	Entry
CLIENT	City of Folsom
LOCATION	Corp Yard Landfill
PROJECT NAME	
JOB NUMBER	134473
DRILLING CONTRACTOR	City of Folsom
RIG TYPE (CIRCLE ONE) HSA DP MUD ARCH NONE	OTHER BACKHOE
DRILLING METHOD, FLUID USED	NA
SOIL SAMPLING METHOD (CIRCLE ONE) SPLIT SPOON CC ACETATE NONE	OTHER GRAB
MONITORING INSTRUMENT (CIRCLE ONE) PID FID LEL RAD NONE	OTHER
SURFACE CONDITIONS (CIRCLE ONE) ASPHALT CONCRETE DIRT DRY WET	OTHER GRASS

BORING NUMBER	
TPB-4	
SHEET 1	OF 1
DRILLING	
START	FINISH
TIME 720	TIME 820
DATE 2/11/08	DATE 2/11/08
WELL CONSTRUCTION	
START	FINISH
TIME	TIME
DATE	DATE

FINE GRAINED AND ORGANIC SOIL DESCRIPTION: GROUP NAME, MUNSELL COLOR, COLOR, SIZE DISTRIBUTION, PLASTICITY, DRY STRENGTH, DILATANCY, TOUGHNESS, MOISTURE, ODOR, STRUCTURE, CONSISTENCY, RELATIVE PERMEABILITY, LOCAL GEOLOGIC NAME, CONTACT DESCRIPTION

COARSE GRAINED SOIL DESCRIPTION: GROUP NAME, MUNSELL COLOR, COLOR, GRADATION (g/s/f), SIZE DISTRIBUTION, PLASTICITY, SHAPE, ANGULARITY, MOISTURE, ODOR, STRUCTURE, CEMENTATION, RELATIVE PERMEABILITY, LOCAL GEOLOGIC NAME, MINERALOGY, CONTACT DESCRIPTION

WELL CONSTRUCTION: ANNULUS	WELL CONSTRUCTION: CASING	SOIL SAMPLING: SAMPLER USED	SOIL SAMPLING: BLOWS/6" INTERVAL	SOIL SAMPLING: INTERVAL SAMPLED	SOIL SAMPLING: RECOVERY	SOIL SAMPLING: ANALYTICAL SAMPLE (A,B,C)	WATER LEVEL (INTIAL/STATIC)	DEPTH (FEET)	INSTRUMENT READING (ppm)	USCS GROUP SYMBOL	SAMPLE TYPE: INTERVAL: DESCRIPTION
								0			12" topsoil w/grass (damp from dew)
										CH	12" clay cap
										SM/SC	Red-brown silty/clayey sand w/coarse gravel and cobble
								5		SM	Grey silty sand w/coarse gravel & cobble mixture of soil and some garbage: plastic, metal, garden hose, metal pipe, small chunks of asphalt, women's sandals, green waste, styrofoam.
								10			
						A	∇				Water coming in consistently @ 11' bgs (sample)
											TD= 12'-13' bgs (below water level, hard to measure).
								15			
								20			

ANALYTICAL SAMPLE ID (SEE ABOVE FOR LOCATION)

A	TPB4A	D	
B		E	
C		F	

Completed by:

Approved by:

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Log of Test Pits from Uncontrolled Fill Area

Test Pit	Depth (ft)	Material Description
TPB-5	0 – 1	aff; (ML) Sandy silt with some gravel and cobble, red-brown, moist, soft, with rounded cobble up to 8" diameter.
	1 - 3	afd; (ML) Sandy silt with some gravel, cobble, and debris, red-brown, dry to moist, soft, with rounded cobble up to 8" diameter. Debris consisted of plastic mulch and potting soil bags.
	3 – 4	dt; (ML-GM) Sandy-silt with gravel, rounded cobble up to 12" diameter (mostly 4" diameter), red-brown, dry to moist, soft to medium stiff
TPB-6	0 – 3	dt; Cobble up to 12" diameter with silty-sand, red-gray to red-brown, dry to moist, loose.
TPB-7	0 - 2	aff; (SM-ML) Silty sand with gravel, red-grey, dry to moist, medium stiff, rounded rock up to 12"' diameter.
	2 - 4	aff; (ML) Sandy silt with some gravel and cobble, red-brown, moist, soft, with rounded cobble up to 8" diameter.
	4 - 6	afd; VERY distinct debris layer consisting of plastic bags, plastic sheeting, metal/plastic pipe, glass bottles, garden hose, and clothing.
	6 - 7	dt; (ML-GM) Sandy-silt with gravel, rounded cobble up to 12" diameter (mostly up to 4" diameter), red-brown, dry to moist, soft to medium stiff
TPB-8	0 - 8	dt; (ML-GM) Sandy-silt with gravel, rounded cobble up to 4" diameter (a few up to 12" diameter), red-brown, dry to moist, soft to medium stiff. Found a few small pieces of foam, but no typical debris.
TPB-9	0 - 3	dt; Cobble up to 12" diameter with silty-sand, red-gray to red-brown, dry to moist, loose.
TPB-10	0 - 2	aff; (ML) Sandy silt with some gravel, Red-gray, dry to moist, rounded rock up to 6" diameter. Small pieces of asphalt debris.
	2 - 4	afd; (ML) Large chunks of asphalt debris with silty sand with some gravel, Red-brown, moist, soft to medium stiff.
	4 - 5	dt; (ML) Sandy-silt with some gravel, rounded cobble up to 8" diameter, red-brown, dry to moist, soft to medium stiff
TPB-11	0 – 6	aff; (ML) Sandy silt with some gravel, Red-gray, dry to moist, rounded rock up to 4" diameter. Small pieces of asphalt debris.
	6 – 7	afd; (ML) Sandy silt with some gravel, cobble, and debris, red-brown, dry to moist, soft, with rounded cobble up to 8" diameter. Debris consisted of plastic mulch and potting soil bags, an unmarked plastic bottle, and clothing.
	7 - 8	dt; (ML) Sandy-silt with gravel, rounded cobble up to 12" diameter (mostly up to 4" diameter), red-brown, dry to moist, soft to medium stiff

Notes
afd = artificial debris fill
aff = artificial soil fill
dt = dredge tailings

B

BROWN AND
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APPENDIX B.

SWRCB JOINT TECHNICAL DOCUMENT (JTD) INDEX

AND LEA CLEAN CLOSURE ADVISORY

SWRCB Joint Technical Document (JTD) Index

SWRCB Requirement	SWRCB Citation	Related CIWMB Citation	JTD Page Range(s) Fulfilling SWRCB Citation
Chapter 1. General Article 1. Purpose, Scope and Applicability of this Subdivision			
э20080. General Requirements. [engineered alternatives to prescriptive standards]	20080(b-c)		If proposed: **N/A**
Chapter 3. Criteria for All Waste Management Units, Facilities, and Disposal Sites ** Subchapter 2. Siting and Design ** Article 2. SWRCB - Waste Classification and Management ** э20200. SWRCB - Applicability and Classification Criteria.			
Concept (& describes possible exemption)	20200(a)		if proposed: **N/A**
Demonstration proposing to allow discharge of a particular waste to a particular landfill of lower classification	20200(a)(1)		if proposed: **N/A**
Dedicated units/cells for certain wastes	20200(b)-(b)(2)(C)		if proposed: **N/A**
Waste characterization	20200(c)		**Sec. 2.6.3, pg 14-15**
Management of liquids	20200(d)-(d)(3)		**Sec. 3.5.3, pg 26**
э20220. Nonhazardous Solid Waste.			
Demonstration by discharger	20220(b)-(b)(2)		**N/A**
Dewatered sludge (describes conditions for discharge)	20220(c)-(c)(3)		If sludge: **N/A**
Ash (allows discharge of non-hazardous ash to Class III landfills w/o determining of ash is designated waste)	20220(d)		If ash: **N/A**
Article 3. Waste Management Unit, Facility, or Disposal Site Classification and Siting **			
э20240. Classification and Siting Criteria.	20240		**N/A**
э20250. Class II: Waste Management Units for Designated Waste.	20250		If Class II: **N/A**
э20260. Class III: Landfills for Nonhazardous Solid Waste.	20260		If Class III: **N/A**
Article 4. SWRCB - Waste Management Unit Construction Standards **			
э20310. General Construction Criteria.	20310		**N/A**
э20320. General Criteria for Containment Structures.	20320		**N/A**
э20323 & э20324. CQA Plan & Requirements	20323 & 20324		**Sec. 3.7.3, pg 34**
э20330. Liners.	20330		**N/A**

SWRCB Requirement	SWRCB Citation	Related CIWMB Citation	JTD Page Range(s) Fulfilling SWRCB Citation
э20340. Leachate Collection and Removal Systems (LCRS).	20340		**Sec. 3.5.3, pg 26**
э20360. Subsurface Barriers.	20360		If proposed: **N/A**
э20365. Precipitation and Drainage Controls.	20365		**N/A**
э20370. Seismic Design.	20370		**N/A**
э20375. Special Requirements for Surface Impoundments.	20375		If LF facility has SI: **N/A**
Subchapter 3. Water Monitoring ** Article 1. SWRCB - Water Quality Monitoring and Response Programs for Solid Waste Management Units ** э20380. SWRCB - Applicability.			
Corrective action financial assurance	20380(b)		**N/A**
Duration of applicability	20380(c)-(c)(2)	21900	**N/A**
Limitations on engineered alternatives	20380(c)-(c)(3)		**N/A**
э20385. Required Programs.	20385		**N/A**
э20390. Water Quality Protection Standard (Water Standard).	20390		**N/A**
э20395. Constituents of Concern (COCs).			
COCs	20395(a)		**Sec. 2.7, pg 16-17**
MSW COCs	20395(b)		**Sec. 2.7, pg 16-17**
э20400. Concentration Limits.			
Proposing COCs	20400(a)-(a)(3)		**Sec. 2.8, pg 16**
Adoption of concentration limits	20400(b)-(b)(3)		**N/A**
Establishing a CLGB (for corrective action only)	20400(c-h)		**N/A**
Decreasing a CLGB (in DMP following a CAP)	20400(i)		**N/A**
э20405. Monitoring Points and the Point of Compliance.	20405(a-b)		**N/A**
э20410. Compliance Period.	20410(a-c)		**N/A**
э20415. General Water Quality Monitoring and System Requirements.			
Section applies to all monitoring programs	20415(a)		**Sec. 1.3.2, pg 2**
G.W. Mon. System (general)	20415(b)-(b)(4)(D)		**Sec. 1.3.2, pg 2**
Sfc. Water Mon. (general)	20415(c)-(c)(2)(D)		If any: **N/A**
U.Z. Mon. (general)	20415(d)-(d)(4)		If any: **N/A**
Mon. systems designed by RG or RCE	20415(e)(1)		**N/A**
	20415(e)(2)-		**N/A**

SWRCB Requirement	SWRCB Citation	Related CIWMB Citation	JTD Page Range(s) Fulfilling SWRCB Citation
Logging of borings	(c)(2)(C)		**App. A**
Shared monitoring system demonstration for contiguous Units	20415(e)(3)		If contig. Units: **N/A**
Monitoring sample QA/QC	20415(e)(4)-(e)(4)(D)		**N/A**
Sampling & analytical methods (perf. std. for)	20415(e)(5)		**N/A**
Monitoring data procurement, analysis, and submittal	20415(e)(6)-(e)(15)		**N/A**
ɘ20420. Detection Monitoring Program.	20420		**Sec. 1.3.2, pg 2**
ɘ20425. SWRCB - Evaluation Monitoring Program.	20425	re &(d)(3): 20919 et seq., 21600(b)(8)(E), 21790(b)(8)(E), 21800(c)	If newly-found release: **N/A**
ɘ20430. Corrective Action Program.	20430		If treating a release: **N/A**
Subchapter 4. Criteria for Landfills and Disposal Sites Article 2. CIWMB - Daily and Intermediate Cover			
ɘ20705. Standards for Daily and Intermediate (Interim) Cover.	20705		**N/A**
Subchapter 5. Closure and Post-Closure Maintenance ** Article 1. General Standards For All Waste Management Units **			
ɘ20950. General Closure and Post-Closure Maintenance Standards Applicable to Waste Management Units (Units) for Solid Waste.	20950	re &(f): 21780(a)(3), 21790(b)(1), 21800(c), 21820, 21840	**N/A**
Article 2. Closure and Post-Closure Maintenance Standards for Disposal Sites and Landfills ɘ21090. Closure and Post-Closure Maintenance Requirements for Solid Waste Landfills.			
Final cover requirements (general)	21090(a)-(a)(2)	21140, 21790(b)(8)(B), 21800(c)	**N/A**
Erosion control layer	21090(a)(3)-(a)(3)(A)3.	21140, 21150, 21790(b)(8)(D), 21800(c)	**N/A**
Maintenance (& plan for)	21090(a)(4)-(a)(4)(D)		**N/A**
Discharges of liquids to covers (leachate & condensate)	21090(a)(5)(A)		**N/A**
Discharges of liquids to covers (other liquids)	21090(a)(5)(B)	20800, 21600(b)(8)(D)	**N/A**
Stability analysis	21090(a)(6)	21145,	**N/A**

SWRCB Requirement	SWRCB Citation	Related CIWMB Citation	JTD Page Range(s) Fulfilling SWRCB Citation
		21790(b)(8)(B)	
Grading requirements (performance standards)	21090(b)-(b)(3)	20650, 21142(a), 21150, 21600(b)(4)(D), 21790(b)(8)(B)	**N/A**
General post-closure duties	21090(c)-(c)(5)	**re (c)(2):** 21150, 21160, 21180, 21790(b)(8)(F) // **re (c)(4):** 21600(b)(8)(F)	**N/A**
Landfill closure deadline & extension	21090(d)	21110, 21790(b)(8), 21800(c)	**N/A**
Final cover survey(s)	21090(e)-(e)(4)	21142(b)	**N/A**
Optional clean closure	21090(f)-(f)(2)	21810	**Sec. 1.0 thru 7.0, pg 1-39**
э21132. Landfill Emergency Response Plan Review.	э21132		**N/A**
э21400. Closure Requirements for Surface Impoundments.	э21400		If LF facility has SI: **N/A**
э21410. SWRCB - Closure Requirements for Waste Piles.	э21410		If LF facility has WP: **N/A**
Chapter 4. Documentation and Reporting For Regulatory Tiers, Permits, WDRs, and Plans Subchapter 3. Development of Waste Discharge Requirements (WDRs) and Solid Waste Facility Permits Article 2. CIWMB - Applicant Requirements.			
э21585. SWRCB - Joint Technical Document (JTD). [format for submittal of э21710, э21750, э21760 information]	21585		**Sec. 1.5, pg 3, App. B**
Article 4. SWRCB - Development of Waste Discharge Requirements (WDRs) **			
э21710. SWRCB - Report Of Waste Discharge (ROWD) and Other Reporting Requirements. [see also э21585]	21710	re &(c)(1-2): 21145(b), 21200, 21630	**Sec. 1.3.2, pg 2**
э21720. SWRCB - Waste Discharge Requirements (WDRs).	21720(d-f)	re &(f): 20510, 20515	**Sec. 1.3.2, pg 2**
э21730. SWRCB - Public Participation. [proposed listing of potentially interested parties]	21730(a)		**Sec. 1.3, pg 2** **Sec. 3.2, pg 18, App. D**
э21740. SWRCB - Waste Characteristics.	21740	re & (a)(1): 21600(b)(2)(A) & (b)(7)(E)	**Sec. 2.6.3, pg 14-15**
э21750. SWRCB - Waste Management Unit (Unit) Characteristics and Attributes to be Described in the ROWD.			
		21600(b)(4)(A)	**Sec. 1.5, pg 3, App. B**

SWRCB Requirement	SWRCB Citation	Related CIWMB Citation	JTD Page Range(s) Fulfilling SWRCB Citation
Analysis of potential for impairment	21750(a)		**N/A**
Support for proposed Unit classification	21750(b)	21600(b)(4)(A)	**N/A**
Listing & incorporation of supporting documents	21750(c)	21600(b)(4)(A)	**Sec. 7.0, pg 38-39**
Topographic map	21750(d)(1)	21600(b)(4)(A)	**Sec. 2.1.1, pg 5, Fig. 2-1**
Floodplain analysis	21750(d)(2)-(d)(2)(C)2.	21600(b)(4)(A)	**Sec. 2.1.2, pg 5, Fig. 2-2**
Climate	21750(e)-(e)(6)	21600(b)(4)(A)	**Sec. 2.2, pg 5-6, Fig. 2-3/-4**
Geology	21750(f)-(f)(7)	21600(b)(4)(A) // re (f)(5): 21145, 21790(b)(8)(B)	**Sec. 2.3, pg 7-8, Fig. 2-5/-6/-7, App. C**
Hydrogeology	21750(g)-(g)(7)(D)	21600(b)(4)(A)	**Sec. 2.4, pg 8-11, Fig. 2-6/-7, App. C**
Land/Water Use	21750(h)-(h)(5)	21600(b)(4)(A) re ¶(h)(4): 21600(b)(3)(E)	**Sec. 2.5, pg 12-13**
Preliminary closure plan	21750(i)		**Sec. 3.0, pg 18-34**
∍21760. SWRCB - Design Report and Operations Plan.			
Design Report X preliminary and as-built plans	21760(a)(1)		**N/A**
Design Report	21760(a)(3)-(a)(4)		**N/A**
Operation Plan	21760(b)-(b)(3)		**N/A**
Subchapter 4. Development of Closure/Post-Closure Maintenance Plans ∍21769. SWRCB - Closure and Post-Closure Maintenance Plan Requirements.			
Prelim. Cl/P-Cl Plan X purpose	21769(b)(1)		**N/A**
Prelim. Cl/P-Cl Plan Contents X cost analysis	21769(b)(2)-(b)(2)(B)5.		**N/A**
Final Cl/P-Cl Plan	21769(c)-(c)(2)(H)3.		**N/A**
Chapter 5. Enforcement Article 4. Enforcement by Regional Water Quality Control Board (RWQCB) **			
∍22190. SWRCB - Mandatory Closure (Cease and Desist Orders).	22190(b)		If early closure mandated: **N/A**
Chapter 6. Financial Assurances at Solid Waste Facilities and at Waste Management Units for Solid Waste Subchapter 2. Financial Assurance Requirements Article 1. Financial Assurance for Closure			
∍22207. SWRCB - Closure Funding Requirements.	22207(a)		**N/A**

SWRCB Requirement	SWRCB Citation	Related CIWMB Citation	JTD Page Range(s) Fulfilling SWRCB Citation
Article 2. Financial Assurance for Postclosure Maintenance			
§22212. SWRCB - Post-Closure Funding Requirements.	22212(a)		**N/A**
Article 4. Financial Assurance Requirements for Corrective Action			
§22222. SWRCB - Corrective Action Funding Requirements.	22222		**N/A**

LEA Advisory #16—January 23, 1994

Clean Closure

To All Local Enforcement Agencies:

What is "Clean Closure"?

Clean closure of a solid waste disposal site refers to the complete removal of all waste and waste residuals, including contaminated soils. A clean closure is generally defined as being successful when waste materials and residuals are removed to a point where remaining contaminant concentrations are at or below background levels or clean up levels established by the relevant regulatory agencies. Clean closure is an alternative to more conventional closure methods (closure with waste in place) described in Title 14, California Code of Regulations (14 CCR), Division 7, Chapter 3, Article 7.8, and 23 CCR, Division 3, Chapter 15, Article 8. Clean closure may also be considered a remedial action or a step in a remedial action in some cases.

The California Integrated Waste Management Board (Board) has not adopted regulations specifically concerning clean closure. However, the Board's Closure and Remediation Branch has developed a set of guidelines for Board and Local Enforcement Agency (LEA) staff to follow when overseeing a clean closure. The following guidelines should **not** be construed as regulations. These guidelines, however, are consistent with existing law and regulations and are intended to ensure that public health and safety and the environment are protected from pollution due to the disposal of solid waste. These guidelines are also intended to provide a basis to allow Board and LEA staff of varying background and expertise to deal with clean closure issues in a consistent manner.

What Sites are Candidates for Clean Closure?

Clean closure may be an appropriate alternative for permitted, illegal, or abandoned solid waste disposal sites. Clean closure may also be an appropriate action for sites which closed prior to the current closure regulations, but which are facing a change in land use which may threaten the integrity of the closed site or pose a threat to public health and safety and the environment. Also, clean closure may be an appropriate part of a remedial action for previously closed sites which have developed environmental problems. Sites that generally lend themselves to clean closure include, but are not limited to:

Small landfills and burn dumps;

Non-hazardous woodwaste disposal sites;

Solid and liquid waste treatment and/or

processing units; and

Sites where the cost of clean closure would be less than or equal to the costs of long term monitoring and postclosure maintenance of the site.

What are the Benefits of Clean Closure?

A properly performed clean closure ensures that waste materials and residuals are removed and disposed of in a safe and environmentally sound manner. In addition, clean closing a disposal site can create several advantages for an owner/operator. If done properly, the clean closure of an entire waste management unit (e.g., a landfill cell or contiguous group of cells) would eliminate the need for the following for that unit: (1) 30 years or more of postclosure maintenance; (2) potential future corrective actions; and (3) Board and LEA inspections of the site. While the clean closure of an illegal disposal site eliminates the necessity for LEA and Board staff inspections, in some areas, particularly rural areas where the use of such sites by local residents has become habitual, continued or even increased inspections may be needed temporarily to prevent reactivation of the illegal disposal site. By clean closing, an owner/operator may also increase the possible postclosure land uses for the site. Furthermore, clean closure plans are typically less involved than conventional closure plans. However, the owner/operator will have to evaluate the potential costs and benefits of clean closure versus those of a conventional closure on a site-by-site basis to determine the viability of this option.

What Does the Clean Closure Process Involve?

The clean closure of a solid waste disposal site is a multiple step process. The steps may include, but are not limited to:

1. Site characterization;
2. Clean closure plan preparation;
3. Review and approval;
4. The actual clean closure; and
5. Verification and approval of the clean closure.

Who Evaluates Clean Closure Proposals?

Adequate advance notification of the appropriate regulatory agencies (Board, Regional Water Quality Control Board [RWQCB], LEA, and in some cases the Air Pollution Control District [APCD] and/or Department of Toxic Substances Control [DTSC] or other agencies as necessary) is necessary to allow review and approval of any proposals as well as observation of the site prior to, during, and after clean closure to verify that the site has been properly clean closed. For clean closures of permitted solid waste disposal sites and those which are subject to 14 CCR, Division 7, Chapter 5, Article 3.4, the review and approval process for clean closure plans is the same as that for conventional closure plans and is described in 14 CCR, Division 7, Chapter 5, Article 3.4. For other sites, the position of coordinating agency for the review and the timeline for the submittal and review of documents by the various agencies should be agreed upon by the agencies at the beginning of each project. The timely submittal of appropriate documentation (e.g., site characterization studies or clean closure plans) allows the approving agencies an opportunity to review and comment on the proposed clean closure prior to the actual clean closure of the site. Failure to involve all of the regulatory agencies early in the clean closure process may lead to lack of final approval of the clean closure of the site and the application of the regulatory requirements described below.

The Board (Closure and Remediation Branch), RWQCB, and LEA must each make a final determination that a solid waste disposal site has been properly clean closed. The determination that a site has been successfully clean closed implies that the potential threats to public health and safety and the environment due to the disposal of solid waste at the site have been mitigated by the clean closure. An owner/operator must provide to these agencies an adequate characterization of the site and satisfactory evidence that all waste and waste residuals were removed and properly disposed of. If these agencies determine a clean closure was not properly completed, 14 CCR, Division 7, Chapter 3, Article 7.8, and 23 CCR, Division 3, Chapter 15, may apply to the site. If the site was operating on or after January 1, 1988, 14 CCR Division 7, Chapter 5, Articles 3.4 and 3.5 will most likely also apply.

What Information Should be Provided in Clean Closure Proposals?

The minimum components of a clean closure plan should include, but not be limited to:

Site characterization;

Excavation and material management;

Confirmation of waste and degraded material removal; and

Postclosure maintenance and land use.

The plan should be prepared by a registered civil engineer, a certified engineering geologist, or other qualified person depending on the complexity of the site. The owner /operator should submit all information regarding clean closure proposals, including clean closure plans, to all of the appropriate regulatory agencies.

Site Characterization

The site characterization phase of the clean closure process is probably the most critical phase as it will determine the suitability of the site for clean closure. A complete site characterization will define the extent and character of the wastes present and the levels and extent of any contamination due to the disposal of waste at the site. A complete site characterization may prevent unplanned for and expensive surprises after the actual clean closure process has been initiated. Depending upon the complexity of the site, it may be necessary or advisable to involve the regulatory agencies prior to or during the site characterization process to ensure that an adequate characterization is performed.

For sites with known or suspected environmental problems, site characterization may occur under an enforcement order by one or more regulatory agencies who may require submittal of a workplan prior to the site characterization.

For complicated sites, it may be beneficial to submit the results of the site characterization study to the regulatory agencies for review prior to development of the clean closure plan rather than as part of the clean closure plan.

For relatively uncomplicated sites, it may be adequate to submit the results of the site characterization with the clean closure plan for review.

The owner/operator should supply the following information regarding the site:

Name and legal description of the site.

Description of the historical development of the site.

Name of legal owner/operator, including title, address, and telephone number.

Map showing the assessor's parcel number, site plot plan, and parcel map including: legal boundaries of the site and adjacent land use, location of existing and proposed footprint of refuse/waste, location of all structures within a 1000-foot radius of the site, including all existing and proposed (if any) environmental monitoring, collection, and control systems.

A description of all refuse/waste materials encountered at the site including how the waste was generated and the method of disposal used. Provide type of waste, volume, and dimensions of each disposal area at the site. Include any chemical characterization of the waste if available or if requested by the regulatory agencies.

If burning of waste occurred at the site, a chemical characterization of the ash.

Sampling results identifying backgound levels of the constituents of concern.

A description of the character and extent of any soil or ground water contamination discovered during the site characterization study.

A description of the geology and soils at the site.

A description of the occurrence of surface water on and adjacent to the site and an estimate of the depth to ground water at the site.

A description of all existing and proposed environmental monitoring, collection, and control systems for the site as required by the regulatory agencies.

Information on the occurrence and character of ground water as required by the RWQCB. This information may include but not be limited to:

A description of the occurrence and character of ground water on and adjacent to the site.

A detailed geologic map of the site with cross sections showing the relationships between the refuse/waste and geologic units and ground water levels.

A conceptual hydrogeologic model for the site.

Excavation and Material Management

Excavation and removal of solid waste may be considered a project under the California Environmental Quality Act (CEQA) or the National Environmental Policy Act (NEPA). An environmental document or appropriate exemption under CEQA or NEPA may have to be secured and submitted as part of the clean closure plan prior to approval. All applicable federal, state, and local permits (e.g., grading permits, Fish & Game approvals, OSHA reviews, etc.) should be obtained prior to any excavation.

The owner/operator should supply the following information regarding the site and the proposed clean closure:

Identification of health and safety issues regarding the proposed site activities and a detailed protocol indicating what measures will be taken to ensure protection of the public health and safety and the environment.

A plan to evaluate and dispose of any hazardous waste encountered during the clean closure operations.

An excavation plan.

A description of the sequence of excavation operations including the proposed removal rate and timeframe for the excavation operation.

A description of the protocol to be followed in monitoring, collecting and controlling leachate, ground and surface water and landfill gas.

A description of the proposed sampling and testing protocols for verification of clean closure.

A description of the transport and fate and/or final disposition of the waste materials and residuals that will be excavated from the site.

A drainage and winterization plan (when applicable).

Any mitigation measures as called for in any necessary CEQA or NEPA document.

Financial assurance for the project as necessary.

Confirmation of Refuse/Waste and Degraded Material Removal

The following activities should be planned for and implemented:

Observation and documentation of removal of refuse/waste.

Documentation verifying the final disposition of all refuse/waste materials.

Adequate sampling must be performed after excavation to verify the removal of all waste materials and residuals, including interpretation of the test results by a qualified professional.

Prepare and submit a map with a letter certifying that the constituents of concern concentration levels in the target media are either at or below the clean up limits established for the project.

Submit a report documenting the activities which have occurred and verifying completion of clean closure to the appropriate regulatory agencies.

Indicate on the site deed and/or title that the project was completed and where it was located.

If the constituents of concern clean up level has not been met and further excavation is deemed not practical, develop and implement a remedial action plan for the site.

If the site cannot be clean closed then closure and postclosure maintenance plans should be developed and submitted for review and approval, prior to implementation.

Postclosure Maintenance and Land Use

One of the advantages of clean closing a solid waste disposal site is that a postclosure maintenance plan should not be needed if the entire site has been successfully clean closed. A description of the proposed postclosure land use should include:

The proposed postclosure land use for the site.

If the clean closure was part of a remedial action, describe any postclosure maintenance activities needed to comply with the implementation of the remedial action plan.

If the clean closure was not successful, a postclosure maintenance plan and a financial assurance mechanism for postclosure maintenance are needed and should be included with the verification report.

These guidelines are intended to provide useful direction for the clean closure of a variety of site types and site conditions. In some instances, certain portions of the information outlined above may not be applicable to a given site or the level of detail necessary may vary due to site conditions. However, it is necessary for all of the regulatory agencies involved to agree on what information is and is not necessary, and the level of detail required, to allow the owner/operator to prepare the necessary documents and to carry out a clean closure that can be approved by all of the agencies.

Additional Information

If you have any questions regarding clean closure, please contact the Closure and Remediation Branch staff person assigned to your jurisdiction for assistance.

Sincerely,

Original signed by:

Deputy Director
Permitting and Enforcement Division

Publication #200-94-010

The intent of the advisories is to provide guidance to Local Enforcement Agencies (LEA) in performing their duties. Guidance, for this purpose, is defined as providing explanation of the Board's regulations and statutes.

Unless included by reference in the LEA's Enforcement Program Plan (EPP), advisories are not enforceable in the same manner as regulations because they have not been adopted through the formal rulemaking process (see Government Code sections 11340.5 and 11342.6). Advisories do not take precedence over statute or regulation.

BROWN AND CALDWELL

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APPENDIX C.

CONCEPTUAL SITE MODEL

This appendix presents the Conceptual Site Model (CSM) for the Folsom Corporation Yard Landfill (Site) located at 1300 Leidesdorff Street in Folsom, California. The regional stratigraphy and hydrogeology are discussed first followed by Site stratigraphy and hydrogeology. References cited in this appendix are provided in Section 7.0 of the main report.

Regional Setting
This section discusses the regional stratigraphy and hydrogeology.

Regional Stratigraphy
The Site is located where fluvial deposits of the ancestral and modern American River flood plain abut the foothills of the Sierra Nevada. The current American River flood plain deposits overlie a thick succession of gravels, sands, and clays that have been interpreted to represent deposits of the ancestral American River system of Pliocene to Pleistocene age. Geomorphically, this area is near the boundary of the "dissected alluvial uplands" and "Sierra Nevada" geomorphic provinces (Olmsted and Davis, 1961). The dissected alluvial uplands are typified by rolling topography, rounded knolls and ridges, separated by minor intermittent streams (U. S. Geological Survey [USGS], 1985). The underlying sediments are being uplifted with the foothills of the Sierra Nevada and are eroding. The Sierra Nevada geomorphic province is underlain by hard, non-water bearing rocks, and is characterized by steep-sided hills and narrow, rocky stream channels.

Based on work conducted at the Aerojet facility (approximately 2.5 miles to the south of the Site), the geology in the vicinity of the Site includes sedimentary formations ranging in age from Cretaceous to Recent periods that thin to the east and are uncomfortably juxtaposed with a Jurassic metamorphic basement complex (Woodward-Clyde, 1997). Figure C-1 illustrates the subsurface geology of the region surrounding the Site. As seen on this figure, at the approximate longitude of the landfill, sedimentary formations underlying the Site include dredged and undisturbed portions of the Laguna Formation, Mehrten Formation, and depending upon depth to bedrock, possibly the Valley Springs Formation. Depth to bedrock in this area is reported to be between 150 feet and 170 feet below ground surface (bgs). Bedrock outcrops within 100 to 200 feet east of the Site suggesting that the sedimentary formations at the Site may be thinner than observed at the Aerojet facility. A brief description of the Laguna, Mehrten, and Valley Springs formations and bedrock are presented below.

- Laguna Formation: Numerous formations have been designated in the area that overlie the Laguna Formation. However, these formations have been identified based on soil profile, depositional environment, or geomorphic features, and thus are for the most part indistinguishable, especially in the subsurface, from the Laguna Formation. As such, and consistent with the North American Commission on Stratigraphic Nomenclature (NACSN, 1983), these younger units have been included with the Laguna Formation for the purposes of this investigation. Therefore, this formation includes deposits varying from latest Holocene to Quaternary in age.

The Laguna Formation consists of poorly bedded layers of silt, clay, sand, and gravel deposited by meandering rivers and streams such as the American River. The sands and gravels were deposited during high velocity flows that occur during times of flooding.

Outside the ribbon-like strips of coarse channel deposits, lower velocity waters deposited silts and clays. The percentage of coarse channel deposits increase towards the mountains from which the streams and rivers emanate. Sediments are generally non-volcanic and predominantly arkosic (feldspar-rich) in contrast to the underlying formations. The underlying Mehrten Formation is distinguished from the Laguna Formation by the first occurrence of sediments composed predominantly of andesitic material.

Historical gold mining operations in the area included extensive dredging of the Laguna Formation to reported depths of 40 to 90 feet bgs. Unaltered dredge tailings consist predominantly of cobbles with interbedded fine-grained layers and on the surface appear as arcuate (curved or bowed) serrated low hills of 10 to 30 feet in relief.

- <u>Mehrten Formation</u>: The Mehrten Formation consists of clays, conglomerates, and mudflows predominantly of andesitic detritus. The conglomerates are poorly sorted, well-rounded porphyritic andesitic cobbles with a matrix composed of ashy clay, silt, and sand. The mudflow, or lahar, consists of moderate to cobble size clasts cemented in an ash matrix. At the Aerojet facility, a general lithologic sequence included: indurated sandstones, siltstone, and brown to purple clays; interbedded silts, sand, and gravel with some clay; green to blue-green interbedded sandstone, sand, cobbles, and clay; green to blue-green silty clay; and blue-gray sand with clay occurring at the bottom of the Mehrten (Woodward-Clyde, 1997). Both the Mehrten and Laguna Formations represent deposits of the paleo-American River and, depending on the amount of andesitic material within the Mehrten, can be difficult to distinguish from each other in the subsurface.

- <u>Valley Springs Formation</u>: The Valley Springs Formation consists primarily of rhyolitic material and is distinguished from the overlying Merthen Formation by the complete absence of andesitic material. The formation contains varying amounts of rhyolite ash, vitreous tuff, quartz sand containing abundant glass shards, pale beds of ashy clay, and fragments of pumice (USGS, 1985). Based on the occurrence of bedrock exposures near the Site, the Valley Springs Formation most likely does not extend to areas underlying the Site.

- Bedrock: The basement complex of the Sierra Nevada has been encountered within numerous boreholes drilled in the area (USGS, 1985; Woodward-Clyde, 1997). The unit consists of hard, non-water-bearing metamorphic and granitic rock (USGS, 1985). Granitic rock can be observed in outcrop within 100 to 200 feet from the Site. Metamorphic rocks beneath the Aerojet facility consist of the Salt Springs Slate and Gopher Ridge Volcanics. Exposures observed east of Prairie City Road are black to dull gray-green slates with interbedded very dense, light gray-green metavolcanics and fine-grained metasediments (Woodward-Clyde, 1997).

Regional Hydrogeology

The regional aquifer in the vicinity of the Site consists of a series of discontinuous layers of permeable and low permeable sediments. Permeable units consist of sand and gravel that correspond to the channel deposits of the Mehrten and Laguna Formations. Low permeability units consist of interbedded clays and silts of the Mehrten and Laguna Formations and form local aquitards and confining units. In areas located within the main portion of the paleo-river channels, Laguna paleo-channel deposits cut through permeable units of the Mehrten Formation so that permeable gravels of the Laguna are juxtaposed against gravels of the Mehrten Formation. Because these gravels exhibit very similar hydraulic properties, in many areas gravel from both units appear to act as a single hydrostratigraphic unit.

As reported in Brown and Caldwell (2001b), Regional groundwater in the vicinity of the Site occurs at approximately 120 feet above mean sea level (30 to 35 feet bgs). During the period from 1954 to 1982, USGS (1985) reports that water levels in the area have declined an average of 2.5 feet per year possibly due to extensive groundwater pumping for irrigation and slow recharge. Seasonal fluctuations average from 5 to 10 feet. In general, groundwater flow in this area is towards the American River. Steep gradients occur when materials of low permeability present partial barriers to groundwater movement.

Perched water has been observed in the area within the Laguna Formation and dredge tailings (Woodward-Clyde, 1997). At the nearby Aerojet facility, where present, depth to water within these discontinuous water bearing units occurs approximately at 15 feet bgs. Groundwater flow within these zones is dependent upon the slope of the underlying low permeability unit.

Site Setting
This section describes the Site stratigraphy and hydrogeology.

Site Stratigraphy
The landfill is located on a terrace of the American River, adjacent to what is now called Lake Natoma. A geologic map of the Site is provided in Figure C-1. As seen on this map, two surface units have been identified at the Site, the undisturbed Laguna Formation (Tl) and dredged material of the Laguna Formation (dt). Surface exposures of the Laguna Formation occur east and north of the landfill. The landfill was constructed within and is directly underlain by dredge tailings. More extensive dredge tailings can be observed to the west and south of the Site towards the American River. Off-site, the characteristic serrated shape of the dredge tailings can be observed. On-site, this material has been leveled and currently a large area has been paved for parking at the adjacent corporation yard.

The subsurface stratigraphy for the Site is described from the geologic well logs produced during previous investigations at the Site (Brown and Caldwell, 1991; 1994, 2001b). The maximum depth obtained in borings from this Site is approximately 93 feet bgs (73 feet above mean sea level) in the borehole drilled for monitoring well FCY-7. Figures C-2 and C-3 represent generalized hydrogeologic cross-sections across the Site and are constructed from the geologic well logs. As seen on these figures, the subsurface material observed at the Site includes the dredge tailings, Laguna Formation, and the Mehrten Formation.

Sub-units within each of these units were distinguished based on relative permeabilities and include:

- Low permeability clays, silts, and clayey sands; and
- Permeable sands and gravels.

Dredge tailings were observed within monitoring well soil borings FCY-1, FCY-2, FCY-4, FCY-5 and FCY-6 and ranged in thickness from 15 feet (FCY-4) to 30 feet (FCY-2). This material consists of 60 to 95 percent well-rounded gravel and cobbles with clasts up to 14-inches in diameter. The soil borings for the Site were drilled using air-rotary methods and as such, undisturbed samples of material have not been observed at the Site. However, based on Brown and Caldwell's experience of dredge tailings in other areas, gravel near the upper portions is generally matrix supported with interstices packed with fine-grained material. Lower portions of the tailings are generally still coated with fine material but interstices are generally air-filled or water filled if perched water is present. Dredging operations also deposited lenses of clay and in some areas basal sand units. Thin clay layers (less than 1-foot thick) were observed in several borings and a basal sand was observed in the soil boring for FCY-5.

The Laguna Formation was fully penetrated by the soil borings for FCY-3 and FCY-7 and was approximately 12 feet in thickness at both locations. Since dredging occurred within the Laguna Formation, this material is similar to the dredge tailings. However, as described above, the dredging operations removed a large portion of the matrix material and concentrated the percentage of gravel and cobbles. The Mehrten Formation was partially penetrated by six of the seven monitoring well soil borings, FCY-2 through FCY-7. Depth of penetration ranges from 5 feet (FCY-2) to 81 feet (FCY-7). Distinguishing characteristics between the Laguna and Mehrten Formation are the light gray changes to silty clays characteristic of the andestic material of the Mehrten Formation. The upper portion of this unit consisted predominantly of low permeability silts, clays, and clayey sands with varying degrees of cementation. Channel deposits consisting of sand and gravel were only observed as small lenses within the soil borings for FCY-3, FCY-6, and FCY-7 as illustrated on Figures 2-6 and 2-7 in the Work Plan.

Site Hydrogeology

Nine groundwater monitoring wells, designated FCY-1 through FCY-9, have been installed at the Site and groundwater elevations have been recorded periodically since 1985. Hollow-stem augers were used for the construction of FCY-1 instead of air rotary drilling methods as used for other wells at the site. Because of this drilling method, refusal was encountered near the first observed groundwater during drilling. Since installation of this well, because of the shallow completion, it is often dry. As such, FCY-1 was abandoned in June 2002.

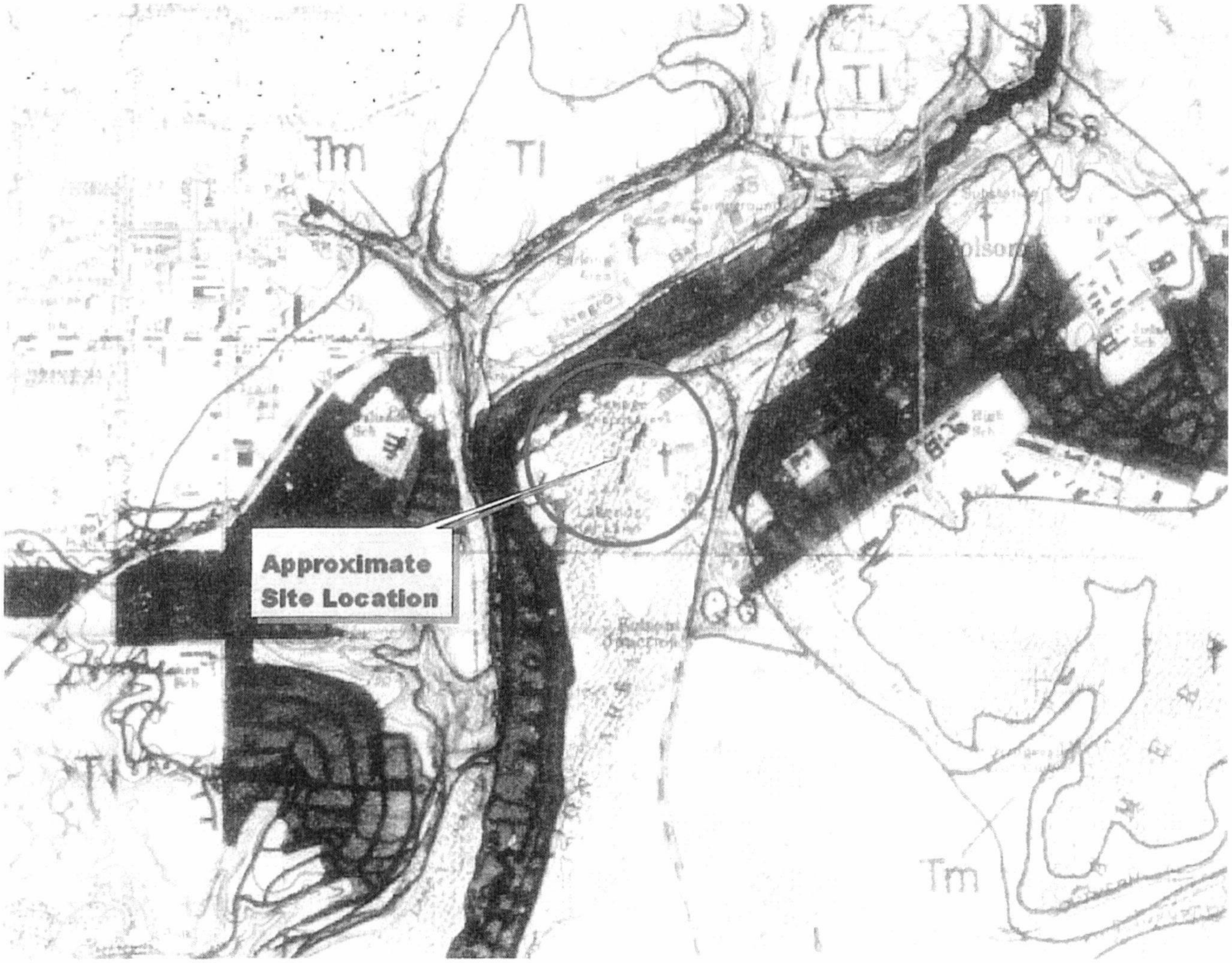
Cumulative groundwater elevation and gradient data for these wells have been presented in the numerous monitoring reports most recently in the *Annual Detection Monitoring Summary Report 2007* (Brown and Caldwell, 2008a). In December 2007, the highest groundwater elevations were observed in monitoring wells FCY-3 and FCY-7 (130.98 to 138.28 feet above mean sea level). Elevations in the other five monitoring wells ranged from 128.00 to 129.34 feet above mean sea level as shown on Figure C-4. As illustrated on Figure C-3, first water at FCY-3 and FCY-7 occurs within the Mehrten Formation (dredge tailings are not present at these locations) whereas first water in the other five wells occurs within the dredge tailings.

Groundwater within the dredge tailings appears to be perched above the low permeability silts and clays of the underlying Mehrten Formation. This perched system terminates along the eastern edge of the landfill where dredging operations ceased. Attempts to install a monitoring well to the east of the landfill were unsuccessful since perched water was not encountered in this area. The perched groundwater is most likely fed by surface infiltration. Groundwater flow within this system is controlled by the slope of the perching layer represented by the low permeable material of the Mehrten Formation. To illustrate the slope of this layer, an isocontour map of the top of the Mehrten Formation was constructed and is presented on Figure C-5. As illustrated on Figures C-2 and C-

3, both the slope of the top of Mehrten and groundwater surface appears to trend away from a slight mound in the Mehrten Formation, illustrated in Figure C-5, near GAS-3 at the eastern edge of the landfill. The presence of this mound suggests that Site groundwater flows radially from the mounded area to the west, southwest and northeast. In December 2007, the hydraulic gradient of the groundwater was relatively flat and ranged from 0.004 to 0.006 foot per foot.

Review of hydrographs for the Site, suggest that the groundwater encountered within the Mehrten Formation at FCY-3 and FCY-7 is not hydraulically connected to the perched groundwater within the dredge tailings. This interpretation is supported by the unlikely steep gradient calculated between FCY-3 and FCY-7 to FCY-6 of 2 percent. Regardless, groundwater in the area of FCY-3 and FCY-7 is higher than the groundwater in the dredge tailings located beneath the landfill and therefore any impacts from the landfill area cannot flow uphill to this area.

Based on observations made during the last sampling round (also see Figures C-2 and C-3), it appears that the upper groundwater in the Mehrten Formation occurs within discontinuous gravel lenses. During this sampling round, the water level in well FCY-7 was monitored for any response while purging well FCY-3, and then well FCY-3 was monitored while purging well FCY-7. In both cases, after purging one well for at least 2 hours, no change in water level was observed in the other well.



Legend

t	Dredge tailings
Qa	Quaternary alluvium
Tl	Tertiary Laguna Formation (alluvium sand, silt & conglomerate)
Tm	Tertiary Mehrten Formation (stream channel, alluvium, & mudflow deposits derived mainly from rhyolitic volcanic rocks. Also includes white welded tuff & ash flows)

N

2000 0 2000 Feet

Source: Loyd, 1984, Generalized Geology of the 15-Minute Quadrangle, California (CDMG OFR 84-50 Plate 1)

BROWN AND CALDWELL	PROJECT 134473	TITLE Geologic Map	Figure C-1
	DATE 2-11-08	SITE Corporation Yard Landfill, Folsom, CA	

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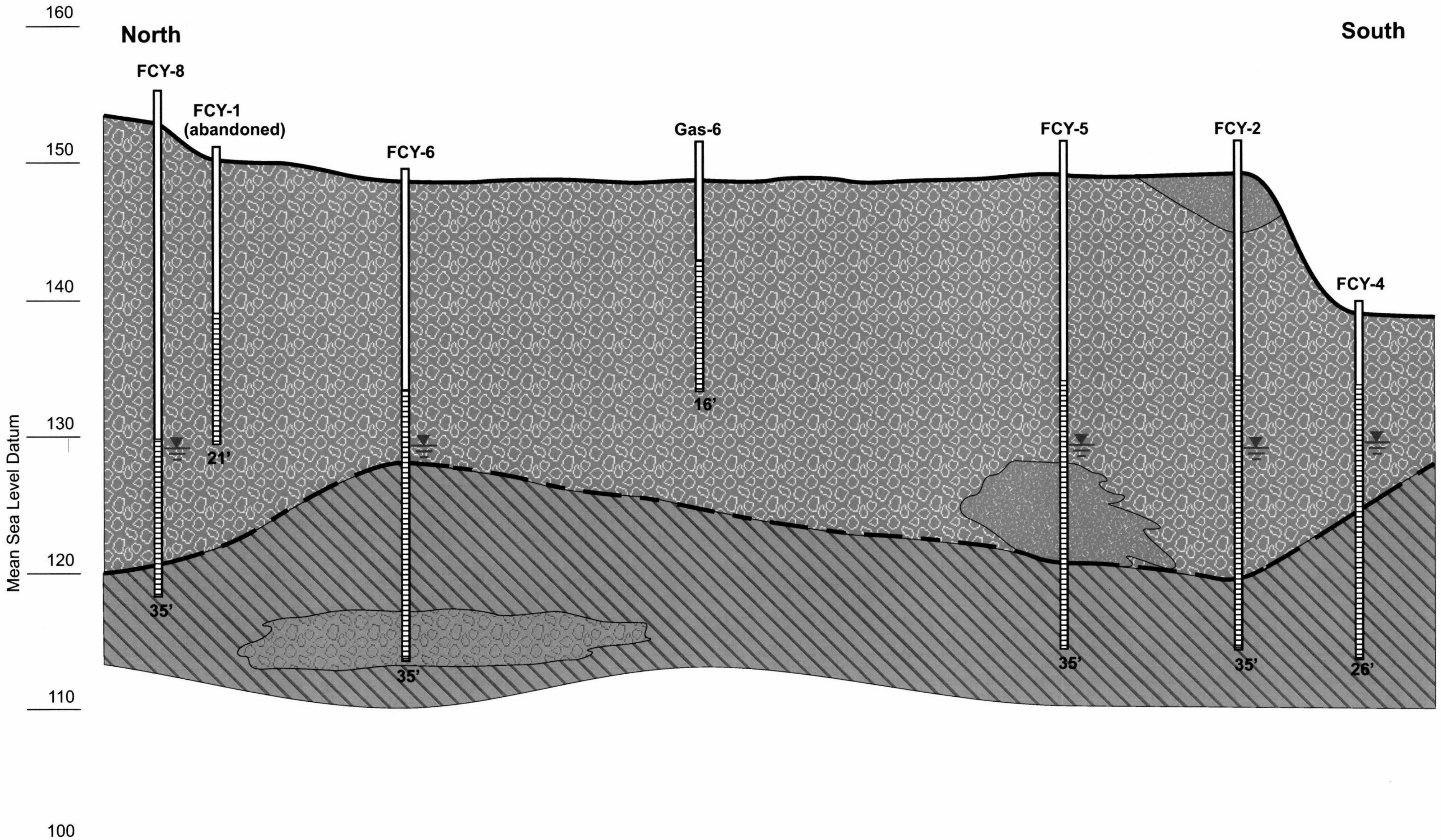


Legend

MW-1 Well/monitoring well designation

Screened interval in cased well

20' Total depth of well casing in feet below ground surface

Static water level measured on December 11, 2007

Geologic Legend

Formation contact - dashed where inferred

Dredge Tailings

Permeable gravels

Permeable sands

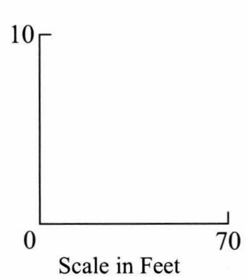
Laguna Formation

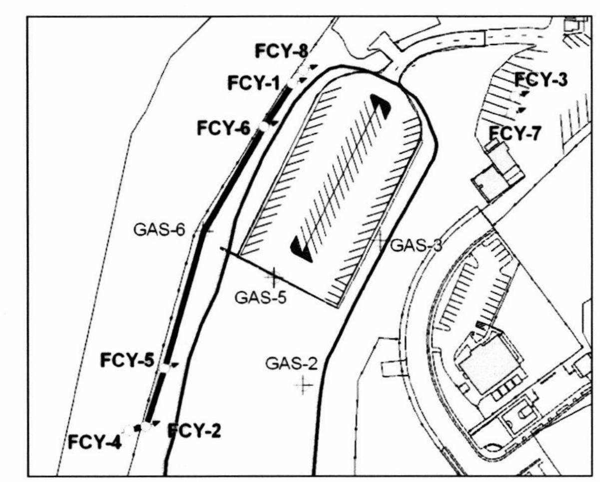
Permeable sands and gravels

Mehrten Formation

Permeable gravels

Low permeability clay, silts, clayey sands





TITLE	North-South Geologic Cross Section
SITE	Corporation Yard Landfill, Folsom, CA
BROWN AND CALDWELL	PROJECT 134473 / DATE 2-11-08 / Figure C-2

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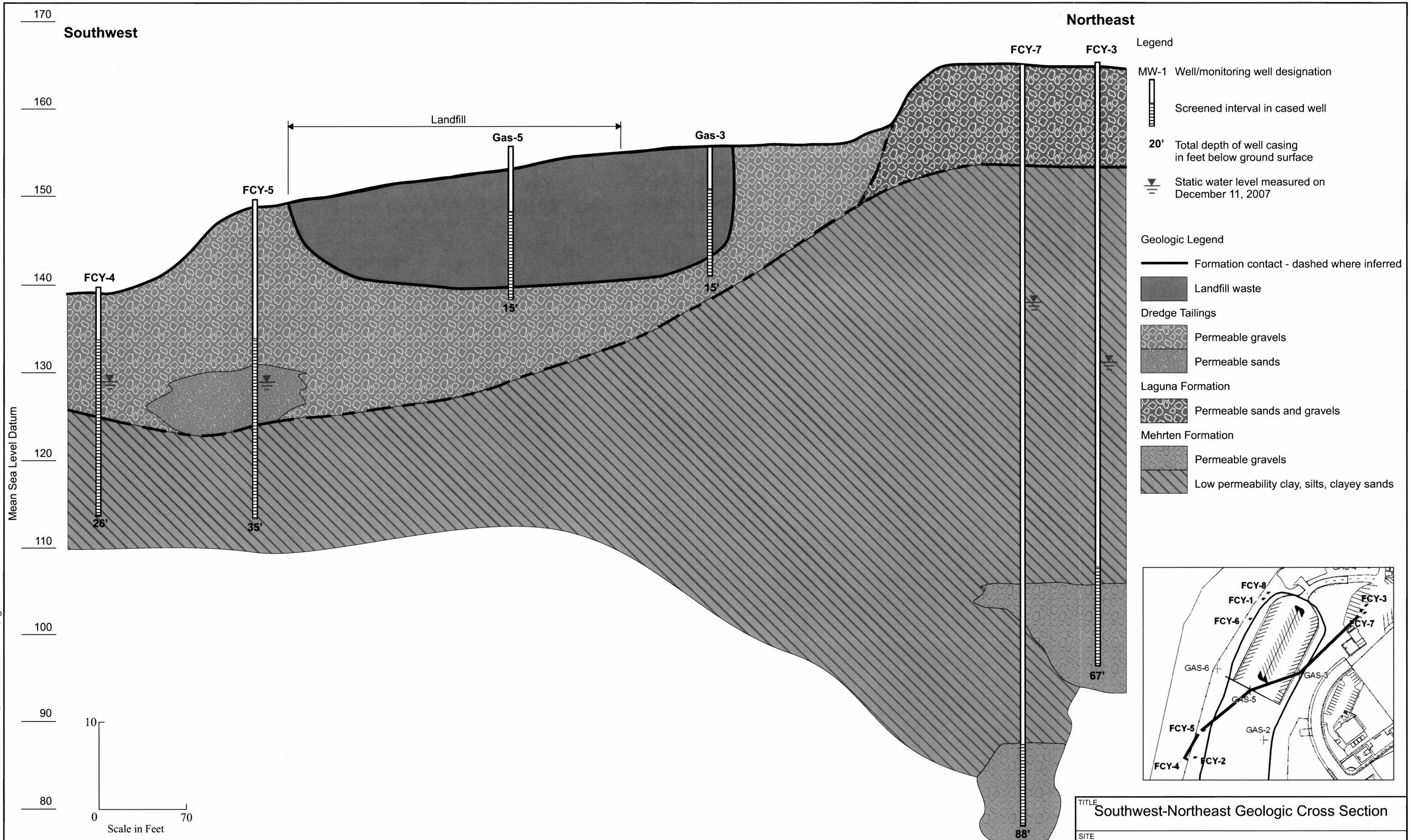

TITLE Southwest-Northeast Geologic Cross Section

SITE Corporation Yard Landfill, Folsom, CA

BROWN AND CALDWELL

PROJECT 134473

DATE 2-11-08

Figure C-3

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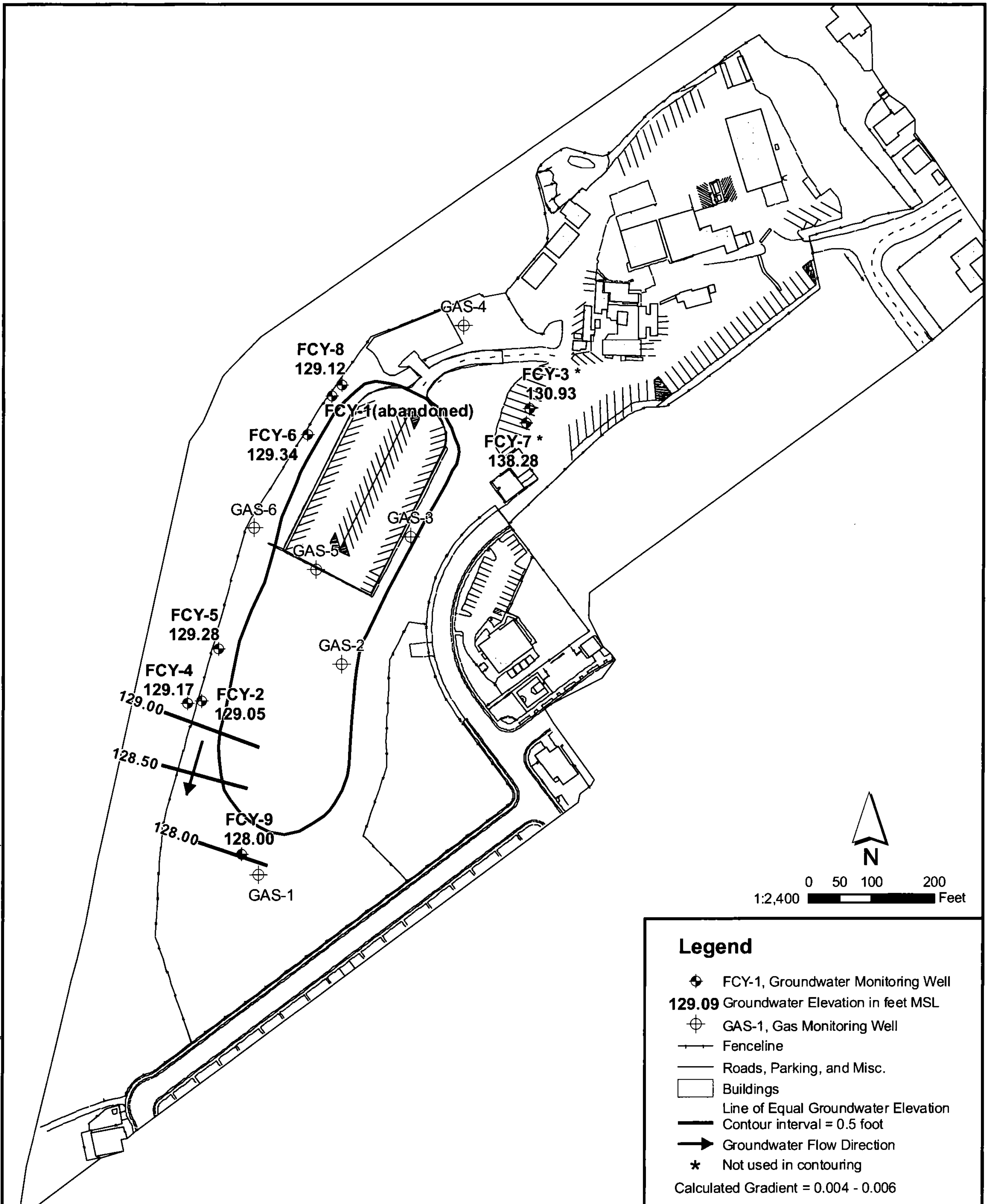
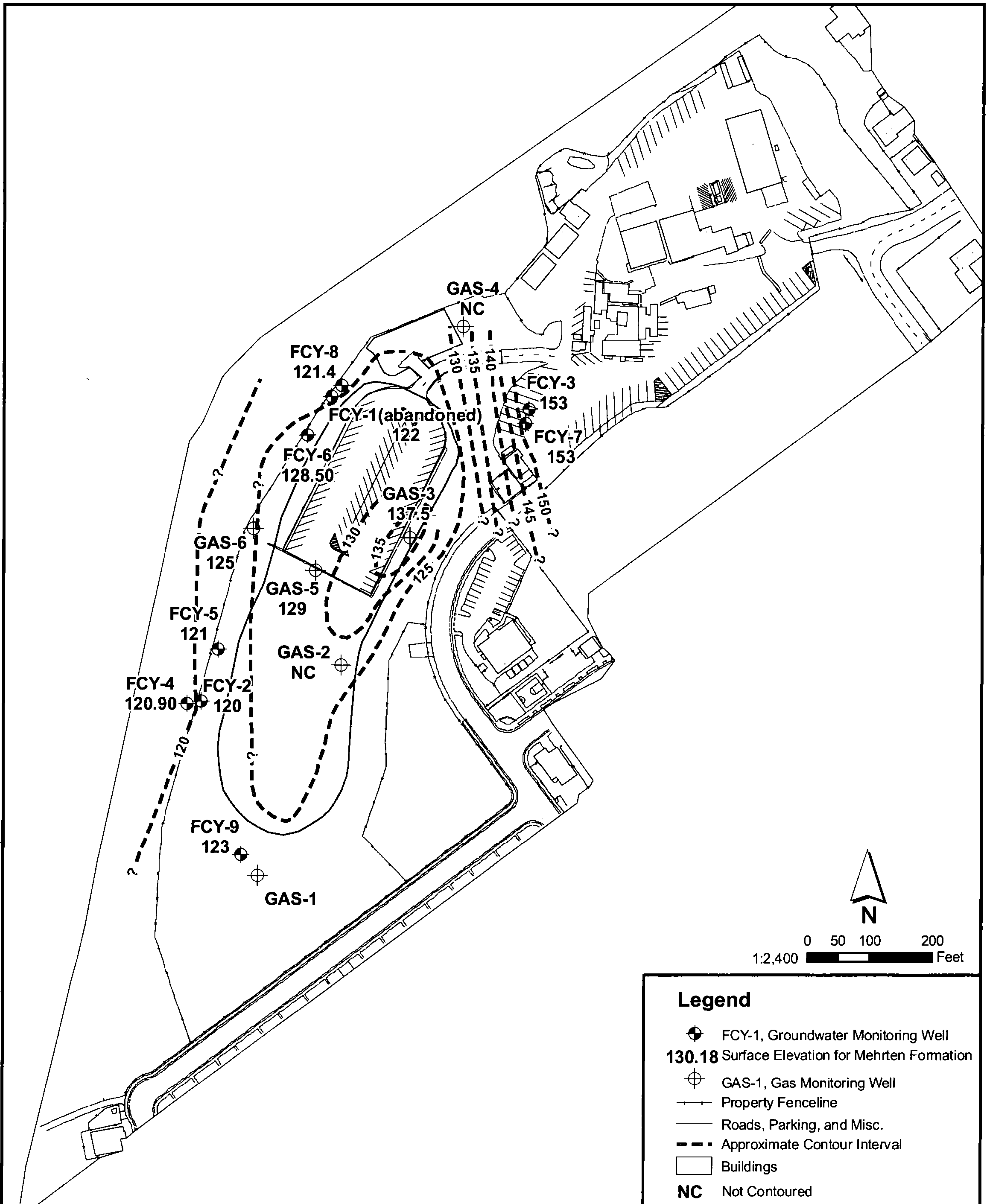


FILE: \\Bcsac-nas01\GIS\Folsom\Folsom Landfill\Figure C-4 Groundwater Elevation Map, December 11, 2007.mxd

BROWN AND CALDWELL	PROJECT 134473	TITLE **Groundwater Elevation Map, December 11, 2007**	Figure C-4
	DATE 2-8-08	SITE Corporation Yard Landfill, Folsom, CA	



BROWN AND CALDWELL	PROJECT 127373-002	TITLE **Top of Mehrten Isocontour Map**	Figure C-5
	DATE 2-26-08	SITE Corporation Yard Landfill, Folsom, CA	

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D

APPENDIX D.

COMMUNITY RELATIONS PLAN

This appendix presents the Community Relations Plan (Plan) for clean closure activities at the Folsom Corporation Yard Landfill (Site) located at 1300 Leidesdorff Street in Folsom, California. Positive community relations and public participation are integral parts of a successful project. The Plan describes the activities that will be conducted throughout the project to inform the community and provide opportunities for public participation. The Plan is considered dynamic in that the types and frequency of community outreach activities can be updated to meet the needs of the public throughout the project. The Plan is limited to the clean closure project and does not include future land use activities. There are a variety of community outreach efforts planned for this project including: a California Environmental Quality Act (CEQA) Initial Study and public comment period, neighborhood meetings, information repository, mailing list, fact sheets, and newspaper ads. Several outreach activities have already been conducted at the time this document was prepared.

CEQA Initial Study / Public Comment Period
A CEQA Initial Study was prepared in January 2008 to identify potential environmental impacts resulting from the project. Mitigation measures were included to reduce the impacts to less than significant levels. Mitigation measures included air monitoring, dust control, biological/cultural monitoring during excavation, complying with the City of Folsom (City) noise ordinance, relocating the City employee parking lot, and traffic planning. The 30-day public comment period for the Initial Study began on January 7, 2008 and ended on February 17, 2008. The City of Folsom's web site provided a direct link to e-mail inquires or comments for individuals that prefer e-mail. The public hearing on the Clean Closure was held on February 26, 2008 and the City Council adopted the Mitigated Negative Declaration. A notice of determination was filed with the County of Sacramento Clerk on March 12, 2008.

Neighborhood Meetings
Neighborhood meetings provide residents and interested persons with the opportunity to obtain information about the project, provide comments, and ask questions. Typical meetings will consist of technical presentations, fact sheets, posters boards, and question/answer period. Comment cards are available for individuals that prefer questions to be read by the facilitator or as a formal means for recording public comment.

The City intends to host multiple neighborhood community meetings during the project. The initial neighborhood meeting was held at the Folsom Veterans Hall on January 17, 2008 during the CEQA public comment period. This facility was chosen because of its proximity to the Site and convenience to the local community. A second meeting was held on April 29, 2008 to discuss the results of the pre-design investigation and to provide additional details on air monitoring and the excavation plan. The next neighborhood meeting will be scheduled prior to construction and the final meeting will be held during construction. Copies of all presentations and related handout material will be posted to the project website.

Information Repository / Project Website
During the public comment period, the Initial Study will be available for review at the project information repository:

- Folsom Public Library, Georgia Murray Building, 411 Stafford Street, Folsom (916) 355-7374.

Information on the project will also be posted on the project website at:

- http://www.folsom.ca.us

Mailing List
The City, with assistance from MMC Communications, has compiled a mailing list for the project. The list includes individuals, groups, public agencies, elected officials, private businesses, and other known parties. The list is maintained by MCC Communications and will be updated as needed. The City prepared and distributed letters to the community to provide information about the initial neighborhood meeting and where to obtain a copy of the Initial Study.

Fact Sheets
The City will prepare multiple fact sheets to inform the public of meetings and comment opportunities and important site activities. An electronic version of fact sheets will be posted to the project website. Fact Sheet #1 informed the community about the project and preparation of the Initial Study and Negative Declaration. Fact Sheet #2 described the investigation of the landfill and the nature and extent of waste.

Newspaper Ads
The City will place ads in the *Folsom Telegraph* and *Folsom Life* to announce the public comment period, public hearing, and neighborhood meetings.

Responding to Complaints
Any complaints during construction will be received by Jennifer Tencati, MMC Communications, at (916) 567-6309 or jennifer@mmcpr.com. The complaint will be forwarded to the City of Folsom to formulate a response. The comment and response will be provided to the individual filing the complaint and the LEA within two business days of receiving the complaint. If appropriate, construction practices will be modified to resolve the complaint.

BROWN AND CALDWELL

E

APPENDIX E.

AIR MONITORING PLAN

Corporation Yard Landfill Clean Closure

Folsom, California

TABLE OF CONTENTS

FIGURES

ATTACHMENTS

1.0 INTRODUCTION

Perimeter air monitoring will be conducted during the construction phase of clean closure activities at the City of Folsom Corporation Yard Landfill located at 1300 Leidesdorff Street in Folsom, California (Site). Construction activities include demolishing the landfill parking lot, handling fill (excavating, segregating, stockpiling, loading, and hauling), and grading. If not managed carefully, these activities may have the potential to temporarily degrade ambient air quality. This monitoring plan presents the monitoring objective, target parameters, monitoring locations and equipment, analytical methods, action levels, quality assurance, data management, and monitoring schedule.

1.1 Objectives

The objectives of the monitoring plan are to:

- Describe equipment and methods to perform air monitoring; and
- Determine when construction practices should be limited or modified based on acceptable perimeter ambient air quality levels.

This monitoring plan is not intended to monitor personal exposure to on-site construction workers. Personal exposure monitoring is the responsibility of the contractor performing the construction activities.

1.2 Target Parameters

The waste in the Corporation Yard landfill contains some decomposable green waste (e.g., tree stumps/branches, lumber) and methane is typically detected at low concentrations or not detected at all in semi-annual monitoring of the gas wells. Waste containing volatile organic compounds (VOCs) is not anticipated to be present in the landfill based on previous investigations. In addition, the waste is not expected to generate hydrogen sulfide. However, monitoring for landfill gases such as methane, VOCs, and hydrogen sulfide at landfills is a standard health and safety precaution for on-site Site workers.

General construction activities such as excavation and grading have the potential to temporarily increase airborne concentrations of dust. Target parameters in soil/solid media (i.e., metals) may be disturbed during construction activities and temporarily become suspended in air. According to U.S. Geological Survey maps, no naturally occurring asbestos is present within a mile of the Site; however, old landfills have the potential to contain asbestos containing building materials (ACBM). Measurement of meteorological parameters is important for interpretation of air monitoring results. Therefore, the target parameters in ambient air to monitor during clean closure activities are methane, VOCs, hydrogen sulfide, dust, metals, asbestos, and meteorological parameters. The target parameters are described in detail below.

- Methane: this gas is colorless, odorless, tasteless, and lighter than air. Although non-toxic, methane is explosive and can present a physical hazard.

- VOCs: a broad class of man-made organic compounds that volatilize easily at standard conditions. VOCs can be inhaled and many have toxic effects. For this plan, total VOCs will be monitored.

- Hydrogen Sulfide: this gas is colorless, odiferous (smells like rotten eggs), flammable, and heavier than air. Hydrogen sulfide is often produced from decaying waste/organic matter and is toxic at relatively low concentrations.

- Dust: the respirable fraction of dust, or particulate matter, has been associated with respiratory health effects. For this plan, particulate matter with a mean aerodynamic diameter less than 10 micrometers (PM_{10}) will be monitored.

- Metals: for this plan, a total of 16 metals will be monitored: antimony, arsenic, barium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, silver, thallium, vanadium, and zinc.

- Asbestos: refers to a group of naturally occurring minerals used in products such as building materials and vehicle brakes. The asbestos fibers are too small to be visible, but can be inhaled and cause serious diseases of the lungs and other organs.

- Meteorological Parameters: for this plan, wind speed, wind direction, ambient temperature/relative humidity, and barometric pressure will be measured.

1.3 Site Wind Pattern

In early March 2008, a meteorological station was installed in the southern portion of the Site along Young Wo Circle. A Site wind rose is provided in Figure E-1 for wind measurements from March 7 to April 28, 2008. The preliminary wind data indicates that wind direction at the Site is bipolar with wind blowing primarily from the north and south. This wind pattern is common for areas near a water body (e.g., "up-canyon" and "down-canyon" winds on a river). During the two month period, wind speeds at the Site were typically light to moderate with about 99% of measurements less than 10 mph. The maximum wind speed of 14.7 mph occurred on March 16, 2008 at 11:00 a.m. When wind speeds were above 10 mph, winds were typically from the north.

2.0 MONITORING LOCATIONS AND EQUIPMENT

The plan involves a combination of monitoring landfill gases (i.e., methane, VOCs, and hydrogen sulfide) near excavations with real-time, hand-held meters and monitoring particulate matter (i.e., PM_{10}, metals, and asbestos) at the perimeter with fixed equipment. Fixed monitoring will be conducted at five stations, AM1 through AM5, located along the perimeter of the Site as shown in Figure E-2. The locations were chosen to monitor air quality at four principal directions and near neighboring properties as summarized in the following table. The locations were also chosen to represent upwind and downwind conditions. Each station will be equipped with a continuous PM_{10} sampler with an air pump/filter for collecting airborne metals. Station AM1 will also be equipped with an air pump/filter for airborne asbestos, a meteorological station, and digital camera, as indicated in the following table. The lack of permanent electrical power at the Site constrained the selection of monitoring equipment.

Monitoring Locations and Equipment		
Station	**Location**	**Equipment**
---	Near excavations	Real-time, hand-held meters for methane/VOCs/hydrogen sulfide
AM1	Southern station; downwind station during moderate winds; near residents of Natoma Shores development	Continuous PM_{10} sampler and air pump/filter for metals, separate air pump/filter for asbestos, meteorological station, digital camera
AM2	Near residents of Natoma Shores development	Continuous PM_{10} sampler and air pump/filter for metals
AM3	Eastern station; cross-wind station during moderate winds; near members of Folsom Veterans Hall	Continuous PM_{10} sampler and air pump/filter for metals
AM4	Northern station; upwind station during moderate winds; near City employees working at the Corporation Yard	Continuous PM_{10} sampler and air pump/filter for metals
AM5	Western station; cross-wind station during moderate winds; near recreational users of Lake Natoma State Recreation Area	Continuous PM_{10} sampler and air pump/filter for metals

2.1 Landfill Gas Meter

Methane, VOCs, and hydrogen sulfide will be monitored near excavations with one or more real-time, hand-held meters. The meter(s) will provide direct and continuous readout as well as electronic data logging. Methane will be measured in a range from 0 to 100% lower explosive level (LEL) with a resolution of 1%. Total VOCs will be monitored with a photo-ionization detector (PID) with a lamp strength of 10.0 electronvolts (eV) and calibrated to isobutylene. The range of VOC measurement will be 0 to 200 parts per million by volume (ppmv) with a resolution of 0.1 ppmv. Hydrogen sulfide will be measured in a range from 0 to 100 ppmv with a resolution of 1 ppmv.

2.2 PM_{10} and Metals Sampler

Each station will be equipped with a Thermo Electron model pDR-1200 aerosol meter (or equivalent) that provides continuous measurement of PM_{10}. The pDR-1200 uses a light-scattering photometer to measure aerosol concentration (ranging from 1 to 400,000 $\mu g/m^3$), and provides direct and continuous readout as well as electronic data logging. The particle size-selective inlet cyclone and external Gillian GilAir 5 sampling pump ensure that PM_{10} is measured with the photometer and subsequently deposited on a 37 millimeter (mm) diameter Teflon filter at a constant flow rate. The pDR-1200 will sample at a flow rate of 1 liter per minute (L/min) to measure average PM_{10} at 15-minute intervals and collect a filter sample over a duration of 8 hours. The filter is removed at the end of the sample duration and sent to the laboratory for analysis of airborne metals. Both the pDR-1200 and GilAir 5 have rechargeable batteries.

2.3 Asbestos Sampler

Station AM1 will be equipped with a Gillian GilAir 5 sampling pump operating at 2 L/min to draw air through a 25 mm diameter mixed cellulose ester (MCE) fiber filter over a duration of 8 hours. The filter is removed at the end of the sample duration and sent to the laboratory for analysis of airborne asbestos.

2.4 Meteorological Station

Meteorological monitoring will be conducted continuously at AM1 during clean closure construction activities. The meteorological station is equipped with instruments for recording wind speed/direction, ambient temperature/relative humidity, and barometric pressure. The data logger will measure parameters during a 15-minute interval and record average values every 15 minutes. Station AM1 will also be equipped with a digital camera to record project progress every 15 minutes during days of construction activity. In addition, the digital photographs can be reviewed to evaluate the effectiveness of dust control measures. The instruments and equipment comprising the station consist of:

- RM Young 05305-L AQ wind monitor;
- Vaisala HMP50-L temperature/RH probe with RM Young 6-plate gill solar radiation shield;
- Setra CS100 barometer;
- CSC digital camera with PELCO EH4718 weatherproof enclosure;
- Campbell Scientific CR1000 data logger;
- 12" by 14" weatherproof enclosure;
- 12 V power supply with 7AH sealed rechargeable battery and 10W solar panel; and
- 10-foot tripod with grounding kit and aluminum cross arm sensor mount.

3.0 ANALYTICAL METHODS

This section provides information on analytical methods and associated information for metals by X-ray fluorescence (XRF) and asbestos by phase contrast microscopy (PCM). Metal samples will be collected on a 37-mm diameter Teflon filter at a target flow rate of 1 L/min. A sampling duration of 8 hours (480 minutes) will be targeted resulting in an approximate sample volume of 0.5 cubic meters (m^3). Asbestos samples will be collected on a 25 mm diameter MCE filter at a target flow rate of 2 L/min. A sampling duration of 8 hours will be targeted resulting in an approximate sample volume of 1 m^3.

Sample flow rates and durations may vary somewhat resulting in actual sample volumes that differ from targeted values. The actual detection limits achieved are dependent upon the actual sample volume collected (e.g., sample volumes less than targeted values result in higher than targeted detection limits). The sample media (i.e., filter) hold time for metals and asbestos analyses is six months.

Summary of Analytical Methods

Parameter	Method	Instrumen-tation	Media	Sample Hold Time
Metals	U.S. EPA IO-3.3	XRF	37 mm diam. Teflon filter	6 months
Asbestos	NIOSH 7400A	Phase Contrast Microscopy	25 mm diam. MCE filter	

3.1 Metals Analysis

A total of 16 metals present on the Teflon filters will be analyzed by XRF according to U.S. EPA Method IO-3.3. The detection limits in microgram (µg) per filter for each metal are provided in the following table. Target detection limits in micrograms per cubic meter ($\mu g/m^3$) for each metal are also provided based on a target sample volume of 0.5 m^3.

3.2 Asbestos Analysis

Asbestos analysis begins with cutting a section of the MCE filter and collapsing it using an acetone aerosol. Asbestos fibers will be quantified by PCM according to National Institute for Occupational Safety and Health (NIOSH) Method 7400A. The asbestos analysis will be performed by a laboratory with current accreditation from the American Industrial Hygiene Association (AIHA).

Target Detection Limits for Metals		
Metal	Mass (μg / filter)	Concentration[1] (μg / m^3)
Antimony	0.088	0.18
Arsenic	0.014	0.03
Barium	0.675	1.4
Cadmium	0.063	0.13
Chromium	0.008	0.02
Cobalt	0.007	0.02
Copper	0.007	0.02
Lead	0.032	0.07
Mercury	0.028	0.06
Molybdenum	0.028	0.06
Nickel	0.007	0.02
Selenium	0.011	0.03
Silver	0.061	0.13
Thallium	0.042	0.09
Vanadium	0.008	0.02
Zinc	0.008	0.02

(1) Based on target sample volume of 0.5 m^3 (1 L/min x 480 min)

4.0 ACTION LEVELS

Action levels in this monitoring plan are not regulatory levels; instead, they are used to provide timely notification when concentrations of target chemicals in air near the Site perimeter are near levels that may require work practices to be modified or limited. Note that the action levels are cumulative for all sources on the Site or off. Action levels for landfill gases (i.e., methane, total VOCs, and hydrogen sulfide), PM_{10}, and metals are described in the following sections.

4.1 Landfill Gases

Methane has a LEL of 5% by volume and an upper explosive limit (UEL) of 15% by volume. The methane action level for the Site is set at 10% LEL. The City of Folsom shall notify the LEA if at any time landfill gas concentrations are noted at 100% LEL. The VOC action level for the Site is set at 3 ppmv. The hydrogen sulfide action level for the Site is set at 5 ppmv. Action levels for landfill gasses are based on instantaneous readings from real-time meters.

4.2 PM_{10}

The current primary National Ambient Air Quality Standard (NAAQS) for PM_{10} is 150 micrograms per cubic meter (μg/m^3) averaged over a 24-hour period. The PM_{10} action level for the Site is set at 150 μg/m^3 averaged over a 15-minute period.

4.3 Metals

The action levels for the 16 targeted metals are set at the California Environmental Protection Agency (Cal EPA) chronic inhalation Reference Exposure Levels (RELs), if available for each metal. RELs are concentrations at or below which adverse health effects are not likely to occur. In the case where Cal EPA has not set a REL for a particular target metal, then the action level is based on U.S. EPA Region IX ambient air Preliminary Remediation Goals (PRGs). U.S. EPA sets a range of $1x10^{-4}$ to $1x10^{-6}$ for managing health risks. For target metals with a cancer risk endpoint, the action level is set at a 1×10^{-4} target risk level. PRGs are health-based concentrations that assume an individual breathes the air every day for 30 years. Therefore, a risk level of 1×10^{-4} is considered safe for short term exposure; the clean closure construction activities are anticipated to last only three months. For lead, neither a REL nor a PRG is available; therefore, the action level is based on the NAAQS. For barium and cadmium, the detection limit is above the PRG; therefore, the action level is set at the laboratory detection limit for each metal. Action levels for metals are based on a sample duration of 8 hours.

Action Levels for Metals

Metal	U. S. EPA PRG (µg / m³) Non-cancer Endpoint	U. S. EPA PRG (µg / m³) Cancer Endpoint $1x10^{-6}$	U. S. EPA PRG (µg / m³) Cancer Endpoint $1x10^{-4}$	Cal/EPA REL (µg / m³)	Detection Limit (µg / m³)	Action Level (µg / m³)
Antimony	1.5	---	---	---	0.18	1.5
Arsenic	---	0.00045	0.045	0.03	0.03	0.03
Barium	0.52	---	---	---	1.4	1.4
Cadmium	---	0.0011	0.11	0.02	0.13	0.13
Chromium(1)	---	0.00016	0.016	0.2(2)	0.02	0.2
Cobalt	---	0.00069	0.069	---	0.02	0.069
Copper	146	---	---	---	0.02	146
Lead	1.5(3)	---	---	---	0.07	1.5
Mercury	0.31(4)	---	---	0.09	0.06	0.09
Molybdenum	18	---	---	---	0.06	18
Nickel	---	0.004(5)	0.4	0.05	0.02	0.05
Selenium	18	---	---	20	0.03	20
Silver	18	---	---	---	0.13	18
Thallium	0.24	---	---	---	0.09	0.24
Vanadium	3.7	---	---	---	0.02	3.7
Zinc	1,100	---	---	---	0.02	1,100

(1) PRG provided assumes a ratio of 1 part Cr IV to 6 parts Cr VIII
(2) REL provided is for hexavalent chromium
(3) Value provided is the U.S. EPA primary NAAQS
(4) PRG provided is for elemental mercury
(5) PRG provided is for nickel subsulfide

4.4 Asbestos

The Occupational Safety and Health Administration (OSHA) permissible exposure level (PEL) is 0.1 fiber per cubic centimeter (f/cc) of air averaged over 8 hours. The asbestos action level for the Site is set at 0.01 f/cc averaged over 8 hours.

5.0 QUALITY ASSURANCE

The quality assurance program incorporates the following items: standard operating procedures (SOPs), equipment calibration and maintenance, field and laboratory quality control, and data verification.

5.1 Standard Operating Procedures

Sampling, calibration, and maintenance will be conducted in accordance with SOPs provided by the equipment manufacturer. The SOP for operation of the PM_{10} and metals sampler is provided in Attachment A. The SOP includes detailed instructions on sampler operation, calibration, and maintenance.

5.2 Equipment Maintenance and Calibration

Equipment maintenance and calibration will be performed in accordance with manufacturer specifications and/or U.S. EPA guidance as described below.

- Landfill Gas Meter: Initial calibration of the landfill gas meter(s) will be performed by the manufacturer/supplier. The calibration of the meter(s) will be verified daily with a zero-check and one or more gas standards (e.g., CO_2 or isobutylene).

- Continuous PM_{10} Sampler: Initial calibration of the pDR-1200 was performed by the manufacturer. The calibration of the pDR-1200 will be verified weekly with a zeroing filter that filters the sampling air stream of detectable aerosols.

- Meteorological Station: meteorological equipment will be calibrated at the start of the program and, if necessary, every 6-months thereafter.

5.3 Field Quality Control

Field quality control will be evaluated through the collection and analysis of one field blank for every 20 primary samples (i.e., 5%). Field blank media will be selected randomly from the same lot as primary sample media. Field blanks will accompany primary samples at all times on Site and during shipment to and from the laboratory. Field blanks will not be taken out of their individual packaging.

5.4 Laboratory Quality Control

Laboratory quality control will be evaluated through various instrument accuracy and precision checks specified in each analytical method as summarized in the following table.

Laboratory Quality Control				
Method	**Quality Control Element**	**Frequency**	**Acceptance Criteria**	**Corrective Action**
IO-3.3	Calibration verification	Weekly	Within NIST uncertainties	Re-calibrate
	Instrument precision	Once per batch up to 15 samples	90 to 110% recovery	Batch re-analysis
	Inter-excitation condition check	100%	Within analysis uncertainty	Determine cause; remedy
	Sample replicate precision	10%	Within analysis uncertainty	Determine cause; remedy

5.5 Data Verification

The laboratory will provide a standard data package for all samples and data verification will be performed for 100% of all samples. Data verification activities include:

- Check completeness of actual results to planned;
- Check field blanks for background levels of target parameters; and
- Verify laboratory quality control elements are within acceptance criteria.

6.0 DATA MANAGEMENT AND REPORTING

Data management components consist of data acquisition, data entry, and the database. Data acquisition will consist of downloading PM_{10} measurements from each continuous sampler, manually recording filter sample information on the laboratory chain-of-custody (COC), downloading meteorological measurements from the data logger, and electronic submission of laboratory analytical results in the form of electronic data deliverables (EDDs). The data will be stored in a relational database and retrieved and queried with a graphical user interface. Information from the COC (e.g., sample start/stop time, flow rate, and volume) will be manually entered into the database. Meteorological data will be uploaded into the database and evaluated weekly. EDDs will be uploaded into the database with automatic data loading programs.

Air monitoring results will be provided to regulatory agencies and the public via the project web site on a weekly basis during construction activities. The results of the entire program will be documented in the Clean Closure Results Report to be prepared upon completion of the excavation and subsequent confirmation sampling. The documentation will include a summary of results in tables and figures, interpretation of results, and copies of field data sheets and analytical laboratory reports.

7.0 MONITORING SCHEDULE

Monitoring will be conducted prior to, during, and after construction activities. The construction schedule is anticipated to span three months with activities occurring eight to ten hours a day for up to six days a week. The monitoring will target eight core hours of a typical construction day from approximately 7:30 a.m. to 3:30 p.m. A Sampling and Analysis Plan (SAP) is provided in Attachment B that provides the locations and schedule for sampling and the analyses to be performed. Note that the SAP is a guide for field personnel and the actual quantities, locations, and schedule may vary somewhat.

Monitoring will be conducted frequently at the beginning of the air monitoring program. Daily samples will be sent overnight to the laboratory and rush turnaround times for analyses will be requested. Statistical relationships (e.g., correlations, ratios) will be studied between PM_{10} and any specific particulates analyzed (e.g., metals and asbestos) so that real-time readings of PM_{10} can provide an indicator when other target parameters may be near their respective action levels. Wind patterns will be analyzed daily to determine upwind and downwind stations and evaluate the contribution of target parameters from construction activities to the downwind concentrations. If the evaluation of results from the start-up period indicates downwind concentrations are well within action levels, the frequency of monitoring may be reduced and the turnaround time of analyses may be increased. Real-time readings of PM_{10} at all stations and meteorological monitoring at AM1 will continue throughout the air monitoring program.

7.1 Pre-Construction Monitoring

Limited fixed monitoring will be conducted prior to the start of construction activities to establish baseline concentrations of target parameters and to determine general wind patterns. Fixed monitoring for PM_{10}, metals, and asbestos will be conducted during one day a month for at least two months prior to the start of construction activities. The sample days will be staggered each month to avoid bias. Meteorological monitoring will be conducted continuously for at least two months prior to the start of construction activities.

7.2 Construction Monitoring

Monitoring during construction activities will be conducted frequently during the start-up period, defined as two weeks. If the analytical results indicate target parameters are well within action levels, the frequency of monitoring will be reduced for the remainder of the construction schedule. If field staff determine that excavation conditions have changed (e.g., a segregating trommel has been started up, the waste composition changes significantly), then the frequency of air monitoring may be increased until the results indicate that target parameters are still within action levels under the new conditions.

- Start-Up Monitoring: Real-time monitoring of landfill gases (i.e., methane, total VOCs, and hydrogen sulfide) will be conducted near excavations while excavation is occurring. Parameters will be monitored every 15-minutes and recorded. Fixed monitoring for PM_{10}, metals, and asbestos will be conducted at all five stations during each day of construction activities for the first two weeks (i.e., 10 days total) of the construction schedule. Average PM_{10} will be measured at each station every 15 minutes and recorded. Metals will be analyzed from filters generated daily at each station (i.e., 5 stations x 10 days = 50 samples). Asbestos will be analyzed from the filter generated daily at AM1 (i.e., 1 station x 10 days = 10 samples).

- On-going Monitoring: Real-time monitoring of landfill gases will be conducted near excavations while excavation is occurring. Pending evaluation of landfill gas results during the start-up period, the frequency of real-time monitoring may be reduced at the discretion of field staff (e.g., from every 15-minutes to hourly). Parameters will be monitored at periodic intervals (at the discretion of field staff) and recorded. Fixed monitoring for PM_{10} will be conducted at all five stations during each day of construction activities. Average PM_{10} will be measured at each station every 15 minutes and recorded.

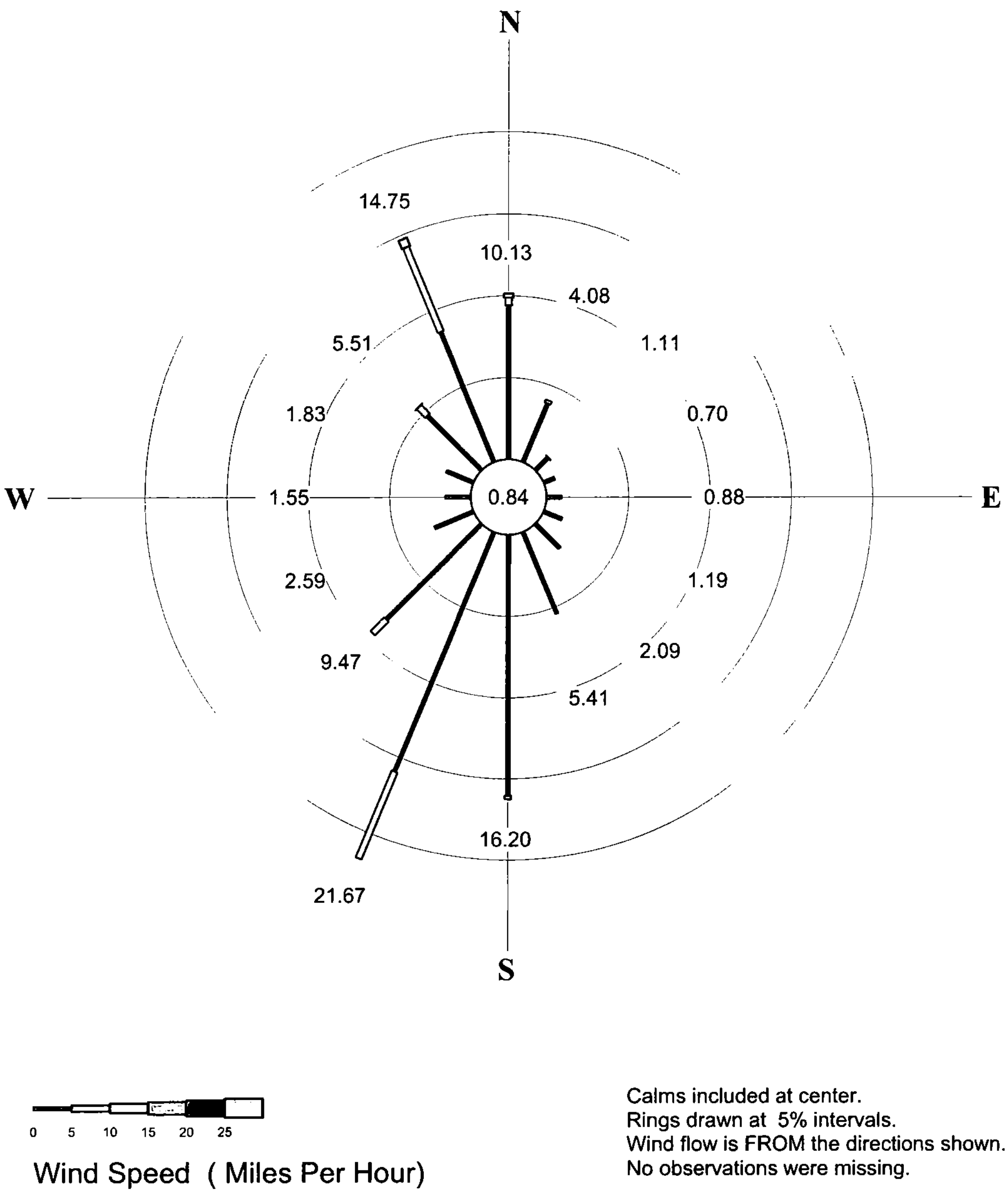
  Pending the evaluation of results during the start-up period, the frequency of fixed monitoring for metals and asbestos may be reduced. Filter samples for metals will be collected at each station during three days of each construction week during the remainder of the construction schedule. The sample days will be staggered each week to avoid bias. Metals will be analyzed on two filters from the daily 5-filter set that correspond to the upwind and downwind stations determined by analyzing the daily wind rose. The laboratory will be instructed to store all filters for the duration of the air monitoring program which should be well within the 6-month hold time. This allows the remaining filters in a 5-filter set to be analyzed later if desired.

  The results of fixed monitoring for metals and asbestos shall be evaluated approximately half-way through the construction period. If the results indicate concentrations of target parameters are well within action levels, the frequency of fixed monitoring may be reduced further (e.g., three times a week to weekly).

Meteorological monitoring will be conducted continuously during construction activities.

7.3 Post-Construction Monitoring

Limited fixed monitoring will be conducted after the completion of construction activities to confirm that baseline concentrations of target parameters are re-established. Fixed monitoring for PM_{10}, metals, and asbestos will be conducted at each stations during one day during the week following the completion of construction activities. Meteorological monitoring will be conducted continuously for one week after the completion of construction activities.



Calms included at center.
Rings drawn at 5% intervals.
Wind flow is FROM the directions shown.
No observations were missing.

PERCENT OCCURRENCE: Wind Speed (Miles Per Hour)
LOWER BOUND OF CATEGORY

DIR	0	5	10	15	20	25
N	9.41	0.46	0.26	0.00	0.00	0.00
NNE	3.90	0.18	0.00	0.00	0.00	0.00
NE	1.07	0.04	0.00	0.00	0.00	0.00
ENE	0.70	0.00	0.00	0.00	0.00	0.00
E	0.88	0.00	0.00	0.00	0.00	0.00
ESE	1.19	0.00	0.00	0.00	0.00	0.00
SE	2.09	0.00	0.00	0.00	0.00	0.00
SSE	5.41	0.00	0.00	0.00	0.00	0.00

TOTAL OBS = 4975 MISSING OBS = 0

PERCENT OCCURRENCE: Wind Speed (Miles Per Hour)
LOWER BOUND OF CATEGORY

DIR	0	5	10	15	20	25
S	16.00	0.20	0.00	0.00	0.00	0.00
SSW	15.90	5.77	0.00	0.00	0.00	0.00
SW	8.28	1.19	0.00	0.00	0.00	0.00
WSW	2.59	0.00	0.00	0.00	0.00	0.00
W	1.55	0.00	0.00	0.00	0.00	0.00
WNW	1.83	0.00	0.00	0.00	0.00	0.00
NW	4.74	0.74	0.02	0.00	0.00	0.00
NNW	8.62	5.57	0.56	0.00	0.00	0.00

CALM OBS = 42 PERCENT CALM = 0.84

P:\34000\134473 - Folsom Landfill Clean Closure\Clean Closure Plan\Figures

BROWN AND CALDWELL

PROJECT	TITLE	Figure
134473	Wind Rose, March 7 to April 28, 2008	E-1
DATE 5-6-08	SITE Corporation Yard Landfill, Folsom, CA	

BROWN AND CALDWELL	PROJECT 134473	TITLE Air Monitoring Locations and Parameters	Figure E-2
	DATE 2-8-08	SITE Corporation Yard Landfill Clean Closure, Folsom, CA	

FILE: \\Bcsac-nas01\GIS\Folsom\Folsom Landfill\Figure E-2 - Air Monitoring Locations and Parameters.mxd

ATTACHMENT E-1.

STANDARD OPERATING PROCEDURE (SOP)
PM_{10} AND METALS SAMPLER

MODEL *p*DR-1000AN/1200

*personal*DATARAM

PARTICULATE MONITOR

INSTRUCTION MANUAL
P/N (100181-00)

THERMO ELECTRON CORPORATION
ENVIRONMENTAL INSTRUMENTS
27 FORGE PARKWAY FRANKLIN MASSACHUSETTS 02038

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(508) 520-0430 International
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Apr2005

Table of Contents

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Seller warrants that the Products will operate substantially in conformance with Seller's published specifications, when subjected to normal, proper and intended usage by properly trained personnel, for 13 months from date of installation or 12 months from date of shipment, whichever is less (the "Warranty Period"). Seller agrees during the Warranty Period, provided it is promptly notified in writing upon the discovery of any defect and further provided that all costs of returning the defective Products to Seller are pre-paid by Buyer, to repair or replace, at Seller's option, defective Products so as to cause the same to operate in substantial conformance with said specifications. Replacement parts may be new or refurbished, at the election of Seller. All replaced parts shall become the property of Seller. Shipment to Buyer of repaired or replacement Products shall be made in accordance with the provisions of Section 5 above. Lamps, fuses, bulbs and other expendable items are expressly excluded from the warranty under this Section 8. Seller's sole liability with respect to equipment, materials, parts or software furnished to Seller by third party suppliers shall be limited to the assignment by Seller to Buyer of any such third party supplier's warranty, to the extent the same is assignable. In no event shall Seller have any obligation to make repairs, replacements or corrections required, in whole or in part, as the result of (i) normal wear and tear, (ii) accident, disaster or event of force majeure, (iii) misuse, fault or negligence of or by Buyer, (iv) use of the Products in a manner for which they were not designed, (v) causes external to the Products such as, but not limited to, power failure or electrical power surges, (vi) improper storage of the Products or (vii) use of the Products in combination with equipment or software not supplied by Seller. If Seller determines that Products for which Buyer has requested warranty services are not covered by the warranty hereunder, Buyer shall pay or reimburse Seller for all costs of investigating and responding to such request at Seller's then prevailing time and materials rates. If Seller provides repair services or replacement parts that are not covered by the warranty provided in this Section 8, Buyer shall pay Seller therefore at Seller's then prevailing time and materials rates.
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THE OBLIGATIONS CREATED BY THIS SECTION TO REPAIR OR REPLACE A DEFECTIVE PRODUCT SHALL BE THE SOLE REMEDY OF BUYER IN THE EVENT OF A DEFECTIVE PRODUCT. EXCEPT AS EXPRESSLY PROVIDED IN THIS SECTION 8, SELLER DISCLAIMS ALL WARRANTIES, WHETHER EXPRESS OR IMPLIED, ORAL OR WRITTEN, WITH RESPECT TO THE PRODUCTS, INCLUDING WITHOUT LIMITATION ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. SELLER DOES NOT WARRANT THAT THE PRODUCTS ARE ERROR-FREE OR WILL ACCOMPLISH ANY PARTICULAR RESULT.

1.0 GENERAL DESCRIPTION

The Thermo Electron Corporation *personal*DataRAM™ (for *Personal* Data-logging Real-time Aerosol Monitor) is a technologically advanced instrument designed to measure the concentration of airborne particulate matter (liquid or solid), providing direct and continuous readout as well as electronic recording of the information.

The *personal*DataRAM is available in two versions: model *p*DR-1000AN and model *p*DR-1200. The model *p*DR-1000AN operates as a passive air sampler whereas the model *p*DR-1200 uses active air sampling. The user can convert from one to the other of these two versions by means of optional conversion kits offered by Thermo Electron (see Sections 4.2 and 15.0 of this manual).

The model *p*DR-1000AN passively samples (i.e., without a pump) the air surrounding the monitor; air freely accesses the sensing chamber of the instrument by means of convection, diffusion, and adventitious air motion. The model *p*DR-1200, on the other hand, requires a separate vacuum pump (not included) such as Thermo Electron's *p*DR-PU, a personal-type pump for its operation.

In addition, the model *p*DR-1200 includes a particle size-selective inlet cyclone which permits size segregated measurements (i.e., PM_{10}, $PM_{2.5}$, respirable, etc.) as well as enabling the user to perform aerodynamic particle sizing by varying the sampling flow rate. The model *p*DR-1200 incorporates, downstream of its photometric sensing stage, a standard 37-mm filter holder on which all sampled particles are collected for subsequent analysis or gravimetric referencing/calibration, if so desired.

The *personal*DataRAM is the result of many years of field experience acquired with thousands of units of its well known predecessor, the Thermo Electron/MIE MINIRAM, and embodies many technological advances made possible by the latest electronic hardware and software. The *personal*DataRAM is also a worthy miniaturized companion to the Thermo Electron DataRAM 4, a recognized paragon of portable aerosol monitors.

The *personal*DataRAM is a high sensitivity nephelometric (i.e. photometric) monitor whose light scattering sensing configuration has been optimized for the measurement of the respirable fraction of airborne dust, smoke, fumes and mists in industrial and other indoor environments.

The *personal*DataRAM is an ultra-compact, rugged and totally self-contained instrument designed for hand-held, belt-worn, as well as unattended operation. It is powered either by its internal replaceable 9V battery, or by an optional attachable rechargeable battery pack, or by an AC supply (included as standard accessory). For the model *p*DR-1200, power to an adjunct pump must be provided separately.

Zeroing is accomplished by means of a hand-inflatable "zero air" pouch included with the model *p*DR-1000AN, and by an inlet filter cartridge provided with the model *p*DR-1200. In addition, the instrument automatically checks agreement with its original factory calibration by checking its optical background during the zeroing sequence.

The *personal*DataRAM covers a wide measurement range: from 0.001 mg/m^3 (1 µg/m^3) to 400 mg/m^3, a 400,000-fold span, corresponding to very clean air up to extremely high particle levels.

In addition to the auto-ranging real-time concentration readout, the *personal*DataRAM offers the user a wide range of information by scrolling its two-line LCD screen, such as run start time and date, time averaged concentration, elapsed run time, maximum and STEL values with times of occurrence, etc.

Operating parameters selected and diagnostic information displays are also available. Furthermore, the *personal*DataRAM features complete, large capacity internal data logging capabilities with retrieval through an externally connected computer. The stored information (up to 13,000 data points) includes average concentration values, maximum and STEL values with time information as well as tag numbers.

Selectable alarm levels with built-in audible signal and switched output, a RS-232 communications port, and a programmable analog concentration output (voltage and current) are all part of this versatile instrument.

A custom software package is provided with the *personal*DataRAM to program operating/logging parameters (e.g. logging period, alarm level, concentration display averaging time, etc.) as well as to download stored or real-time data to a PC or laptop for tabular and/or graphic presentation. If required, the data can also be imported to standard spreadsheet packages (e.g. Microsoft Excel™, IBM Lotus 1-2-3™, etc.).

2.0 SPECIFICATIONS

- Concentration measurement range (auto-ranging)[1]: 0.001 to 400 mg/m^3

- Scattering coefficient range: 1.5 x 10^{-6} to 0.6 m^{-1} (approx.) @ λ=880 nm

- Precision/repeatability over 30 days (2-sigma)[2]:
  ± 2% of reading or ±0.005 mg/m^3, whichever is larger, for 1-sec. averaging time
  ±0.5% of reading or ±0.0015 mg/m^3, whichever is larger, for 10-sec. averaging time
  ±0.2% of reading or ±0.0005 mg/m^3, whichever is larger, for 60-sec. averaging time

- Accuracy[1]: ±5% of reading ±precision

- Resolution: 0.1% of reading or 0.001 mg/m^3, whichever is larger

- Particle size range of maximum response: 0.1 to 10 µm

- Flow rate range (model *p*DR-1200 only): 1 to 10 liters/minute (external pump required)

- Aerodynamic particle sizing range (model *p*DR-1200 only): 1.0 to 10 µm

- Concentration display updating interval: 1 second

- Concentration display averaging time[3]: 1 to 60 seconds

- Alarm level adjustment range[3]: selectable over entire measurement range

- Alarm averaging time[3]: real-time (1 to 60 seconds), or STEL (15 minutes)

- Datalogging averaging periods[3]: 1 second to 4 hours

- Total number of data points that can be logged in memory: 13,391

- Number of data tags (data sets): 99 (maximum)

- Logged data:

  - Each data point: average concentration, time/date, and data point number
  - Run summary: overall average and maximum concentrations, time/date of maximum, total number of logged points, start time/date, total elapsed time (run duration), STEL concentration and time/date of occurrence, averaging (logging) period, calibration factor, and tag number.

- Elapsed time range: 0 to 100 hours (resets to 0 after 100 hours)

- Time keeping and data retention: > 10 years

- Readout display: LCD 16 characters (4 mm height) x 2 lines

- Serial interface: RS-232, 4,800 baud

- Computer requirements: IBM-PC compatible, 486, Pentium, or higher, Windows™ '95 or higher, ≥ 8 MB memory, hard disk drive, CD-ROM Drive, VGA or higher resolution monitor

- Outputs:

  - ❖ Real-time digital signal (1 sec^{-1}): concentration, 16-character code, simplex mode
  - ❖ Real-time analog signal: 0 to 5 V and 4 to 20 mA. Selectable full scale ranges: 0-0.1, 0-0.4, 0-1.0, 0-4.0, 0-10, 0-40, 0-100, and 0-400 mg/m^3.
  - ❖ Minimum load impedance for voltage output: 200 kΩ.
  - ❖ Maximum load impedance for current output: 300 Ω (when powered by AC power supply)
  - ❖ Alarm output: 1 Hz square wave, 5 V peak-to-peak amplitude. Load impedance > 100 kΩ

- Internal battery: 9V alkaline, 20-hour run time (typical)

- Current consumption: 15 to 25 mA (in Run Mode); 10 to 20 mA (in Ready Mode)

- AC source: universal voltage adapter (included) 100-250 V~, 50-60 Hz (CE marked)

- Optional battery pack: model *p*DR-BP, rechargeable NiMH, 72-hour run time (typical)

- Operating environment: -10° to 50° C (14° to 122° F), 10 to 95% RH, non-condensing

- Storage environment: -20° to 70° C (-4° to 158° F)

- Dimensions (max. external):

  - ❖ Model *p*DR-1000AN: 153 mm (6.0 in) H x 92 mm (3.6 in) W x 63 mm (2.5 in) D
  - ❖ Model *p*DR-1200 (including cyclone and filter holder): 160 mm (6.3 in) H x 205 mm (8.1in) W x 60 mm (2.4 in) D

- Weight:

    - Model *p*DR-1000AN: 0.5 kg (18 oz)
    - Model *p*DR-1200: 0.68 kg (24 oz)

- Cyclone (included in model *p*DR-1200 only): Model KTL

- Filter holder (included in model *p*DR-1200 only): Model MAWP037AO (with 0.8 µm pore size filter)

---

[1] Referred to gravimetric calibration with SAE Fine (ISO Fine) test dust (mmd = 2 to 3 µm, σg = 2.5, as aerosolized)
[2] At constant temperature and full battery voltage
[3] User selectable

3.0 USER GUIDELINES

3.1 Handling Instructions

The *personal*DataRAM is a sophisticated optical/electronic instrument and should be handled accordingly. Although the *personal*DataRAM is very rugged, it should not be subjected to excessive shock, vibration, temperature or humidity. As a practical guideline, the *personal*DataRAM should be handled with the same care as a portable CD player.

If the *personal*DataRAM has been exposed to low temperatures (e.g. in the trunk of a car during winter) for more than a few minutes, care should be taken to allow the instrument to return near room temperature before operating it indoors. This is advisable because water vapor may condense on the interior surfaces of the *personal*DataRAM causing temporary malfunction or erroneous readings. Once the instrument warms up to near room temperature, such condensation will have evaporated. If the *personal*DataRAM becomes wet (e.g. due to exposure to water sprays, rain, etc.), allow the unit to dry thoroughly before operating.

Whenever the *personal*DataRAM is shipped care should be taken in placing it in its carrying case and repackaging it with the original cardboard box with the factory provided padding.

3.2 Safety Instructions

- Read and understand all instructions in this manual.
- Do not attempt to disassemble the instrument. If maintenance is required, return unit to the factory for qualified service.
- The *personal*DataRAM should be operated only from the type of power sources described in this manual.
- When replacing the internal 9V battery, follow the instructions provided on the back panel of the unit.
- Shut off *personal*DataRAM and any external devices (e.g. PC or Laptop) before connecting or disconnecting them.
- Shut off *personal*DataRAM before replacing the internal battery, or when plugging in or disconnecting the AC power supply or the optional rechargeable battery pack.

3.3 Handling and Operation

3.3.1 Model *p*DR-1000AN

The model *p*DR-1000AN can be operated in any position or orientation. Exposure to high intensity fluctuating light of the interior of the sensing chamber, through the front and back slotted air openings (see Section 5.5), should be avoided. Such large intensity transients may cause erroneous readings. Direct access of sunlight to the sensing chamber should be prevented.

Typical modes of instrument support/handling include:

- Hand-held. Do not obstruct or cover the sensing chamber opening slots on front and back of unit.
- Belt attached. Use belt clip provided as standard accessory. The unit can be worn on a waist belt, or with optional shoulder belt (model *p*DR-SS) for breathing zone monitoring.
- Tabletop operation. The *p*DR-1000AN can be placed on a table either in an upright position (i.e., resting on its lower protective bumper), or on its back (i.e., resting on the rear edges of its two protective bumpers).
- Tripod mounted. The unit can be attached to any standard tripod using the threaded bushing on the bottom of the monitor (see Figure 3).
- Fixed point operation. The model *p*DR-1000AN can be mounted at a fixed location (e.g., wall or post) using the optional wall-mounting bracket, model *p*DR-WB.

3.3.2 Model *p*DR-1200

The *p*DR-1200 requires an external vacuum pump, such as a small diaphragm pump (e.g., model *p*DR-PU) for its sampling operation. The inlet of the pump must be connected by means of tubing to the hose fitting on the *p*DR-1200 37-mm filter holder attached to sensing chamber (see Figure 2).

The inlet metal tube of the cyclone can be oriented in any desired direction (i.e., upward, forward, downward or backward) by rotating the cyclone body within its holder cup on the right side of the sensing chamber (see Figure 2).

Always ensure unobstructed access to the cyclone inlet when sampling directly the air in the instrument's vicinity. Alternatively, tubing can be connected to the cyclone inlet in order to extract a sample stream from a duct, chamber or other enclosed volume.

Typical modes of instrument support/handling include:

- Hand-held. For example, using a personal type pump, clipped to the belt and using a tubing connection to the *p*DR-1200.
- Belt attached. Use belt clip kit provided as standard accessory. The unit can be worn on a waist belt, or with the optional shoulder belt (model *p*DR-SS) for breathing zone monitoring. A personal pump can then be belt-worn as well.
- Tabletop operation. The *p*DR-1200 can be placed on a table either in an upright position (i.e. resting on its lower protective bumper), or on its back (i.e. resting on its backside).
- Wall mounted for fixed point monitoring. Use optional wall mounting bracket, model *p*DR-WB, either in combination with model *p*DR-PU pump module and model *p*DR-AC power supply (powering both the *p*DR-1200 and the *p*DR-PU), or with a separate pump.

- Tripod mounted. The unit can be attached to any standard tripod using the threaded opening on the bottom base (see accessory attachment fitting on Fig. 4).

3.4 Air Sampling Guidelines

Although the *personal*DataRAM is designed primarily for intramural use, i.e. for indoor air quality, in-plant, or mining environment monitoring, its active sampling version (model *p*DR-1200) also makes it compatible with extramural use (i.e. ambient monitoring). General ambient monitoring applications, however, are performed preferentially using an appropriate inlet configuration, in order to ensure representative particle sampling under conditions of variable wind speed and direction. Consult with Thermo Electron Corporation for such outdoor applications.

For typical area monitoring applications, the *personal*DataRAM should be placed and operated centrally within the area to be monitored, away from localized air currents due to fans, blowers, ventilation intakes/exhausts, etc. This is to ensure representative sampling within the area to be assessed.

3.5 Environmental Constraints and Certifications

The *personal*DataRAM is designed to be reasonably dust and splash resistant, however, it is not weatherproof. To operate the unit outdoors provisions should be made to protect it from environmental extremes outside its specified range, and <u>from any exposure to precipitation</u>.

The *personal*DataRAM has received intrinsic safety approval (No. 2G-4126-0) from the U.S. Mine Safety and Health Administration (MSHA) for use in coal-mining environments containing methane gas. The MSHA approval (type 2G) closely resembles the standard intrinsic safety rating as defined by Class 1, Div. 1, Group D. This approval makes the MIE *personal*DataRAM the only commercially produced direct reading dust monitor so certified by MSHA and, therefore, the only instrument of this type permitted to be used routinely in U.S. coal mines and similar environments.

The *personal*DataRAM is certified for compliance with the electromagnetic radiation limits for a Class A digital device, pursuant to part 15 of the FCC Rules. The unit also complies and is marked with the CE (European Community) approval for both immunity to electromagnetic radiation and absence of excessive emission interference.

4.0 ACCESSORIES

4.1 Standard Accessories

The *personal*DataRAM is provided to the user with the following standard accessories:

- Soft-shell carrying case (Thermo Electron model *p*DR-CC-1)
- Digital communications cable (Thermo Electron model *p*DR-DCC)
- Analog signal/alarm output cable (Thermo Electron model *p*DR-ANC)
- Communications software disk (Thermo Electron model *p*DR-COM)
- Z-Pouch zeroing kit (Thermo Electron model *p*DR-ZP [for use with *p*DR-1000AN only])
- Zeroing filter cartridge and tubing (Thermo Electron model *p*DR-ZF)(for use with *p*DR-1200 only)
- Belt clip kit (Thermo Electron model *p*DR-CA)
- AC power supply (and charger for optional Thermo Electron model *p*DR-BP) (Thermo Electron model *p*DR-AC)
- Metal cyclone (Thermo Electron model *p*DR-GK2.05)(for use with *p*DR-1200 only)
- 37-mm filter holder and hose fitting (Thermo Electron model *p*DR-FH)(for use with *p*DR-1200 only)
- Instruction manual

4.2 Optional Accessories

The following optional accessories are available from Thermo Electron for use with the *personal*DataRAM:

- Rechargeable battery module (Thermo Electron model *p*DR-BP)
- Shoulder strap (Thermo Electron model *p*DR-SS)
- Remote alarm unit (Thermo Electron model *p*DR-RA)
- Wall mounting bracket (Thermo Electron model *p*DR-WB)
- Active sampling kit to convert model *p*DR-1000AN to model *p*DR-1200 (Thermo Electron model *p*DR-ASC)
- Upper bumper kit to convert model *p*DR-1200 to model *p*DR-1000AN (Thermo Electron model *p*DR-UB)
- Attachable pump unit (Thermo Electron model *p*DR-PU)(for use with *p*DR-1200 only)

5.0 INSTRUMENT LAYOUT

The user should become familiar with the location and function of all externally accessible controls, connectors and other features of the *personal*DataRAM. Refer to Figures 1 through 6.

All user related functions are externally accessible. All repair and maintenance should be performed by qualified Thermo Electron personnel. Please contact the factory if any problem should arise. Do not attempt to disassemble the *personal*DataRAM, except as described in Section 12.0 (Maintenance), **otherwise voiding of instrument warranty will result.**

5.1 Front Panel

Refer to Figures 1 (for model *p*DR-1000AN) or 2 (for model *p*DR-1200) for location of controls and display.

The front panel contains the four touch switches (keys) and the LCD screen required for the operation of the *personal*DataRAM.

The four touch switches provide tactile ("popping") feedback when properly actuated.

The ON/OFF key serves only to turn on the unit (while it is in the off state), and to turn it off (when it is operating).

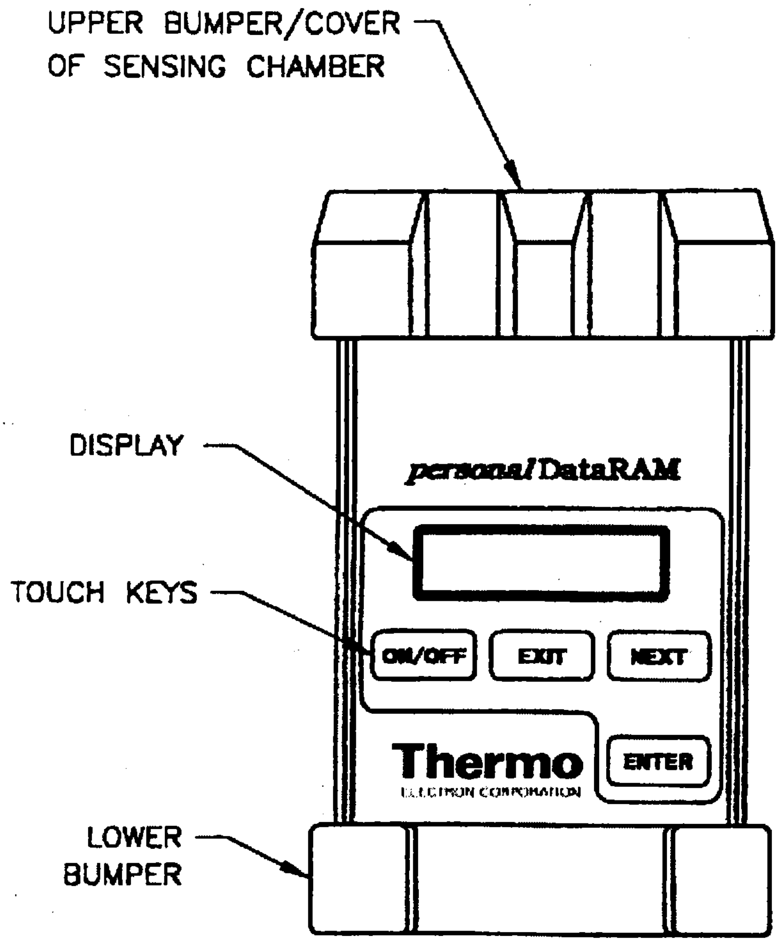


Figure 1 – FRONT PANEL (MODEL pDR-1000AN)

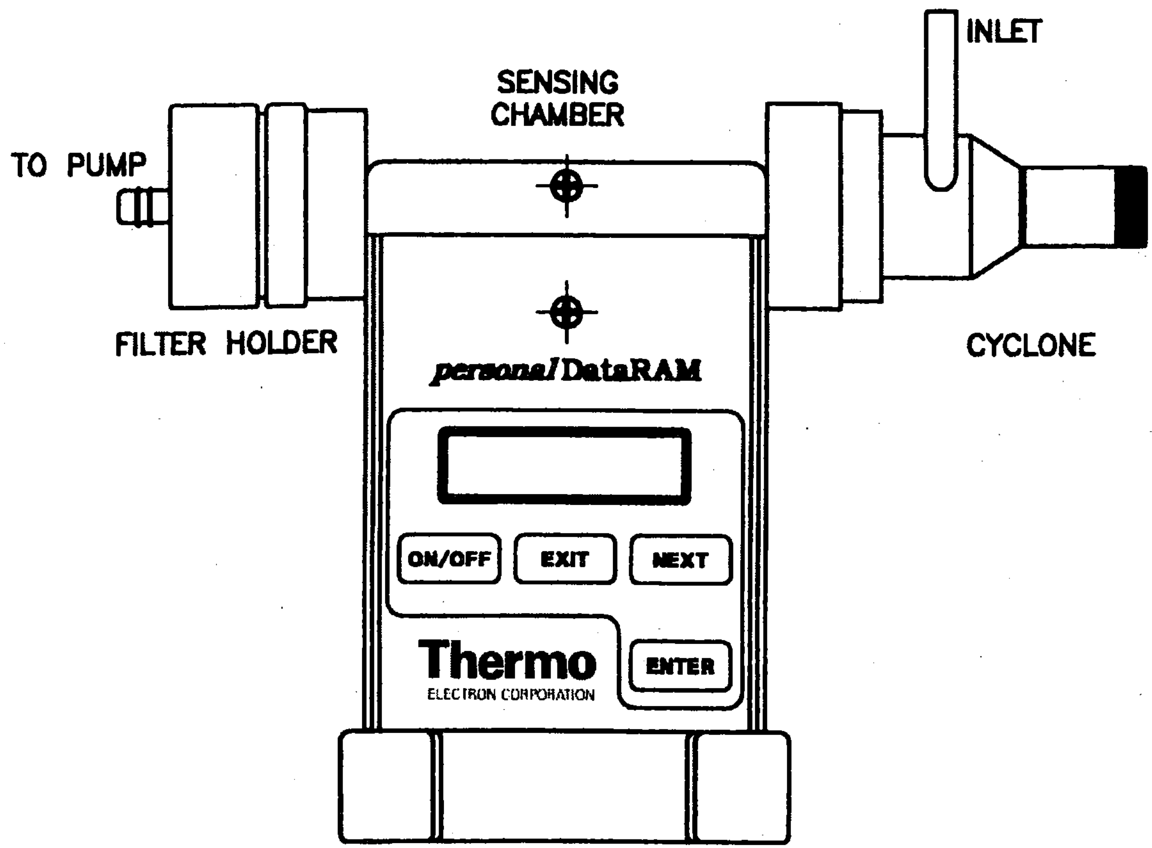


Figure 2. MODEL pDR-1200 WITH CYCLONE & 37MM FILTER HOLDER

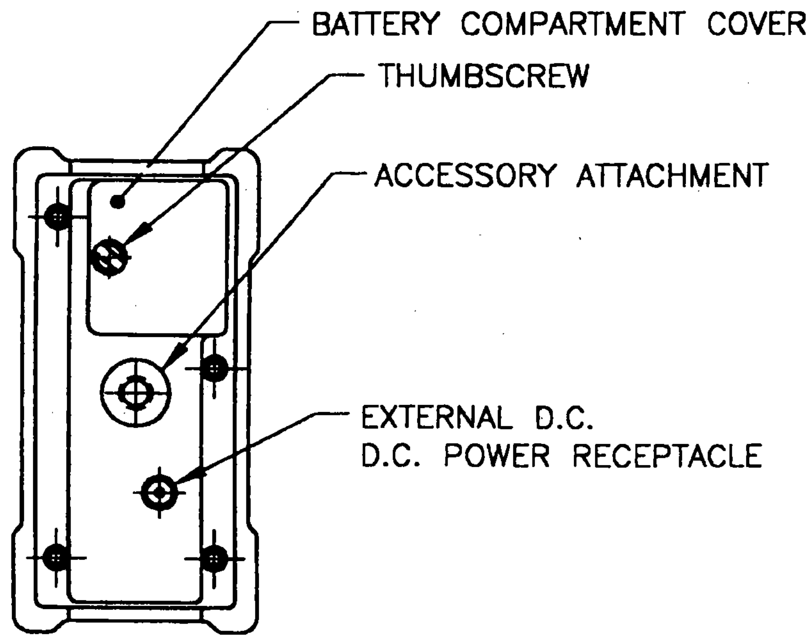


Figure 3 – BOTTOM BASE (MODEL pDR–1000AN)

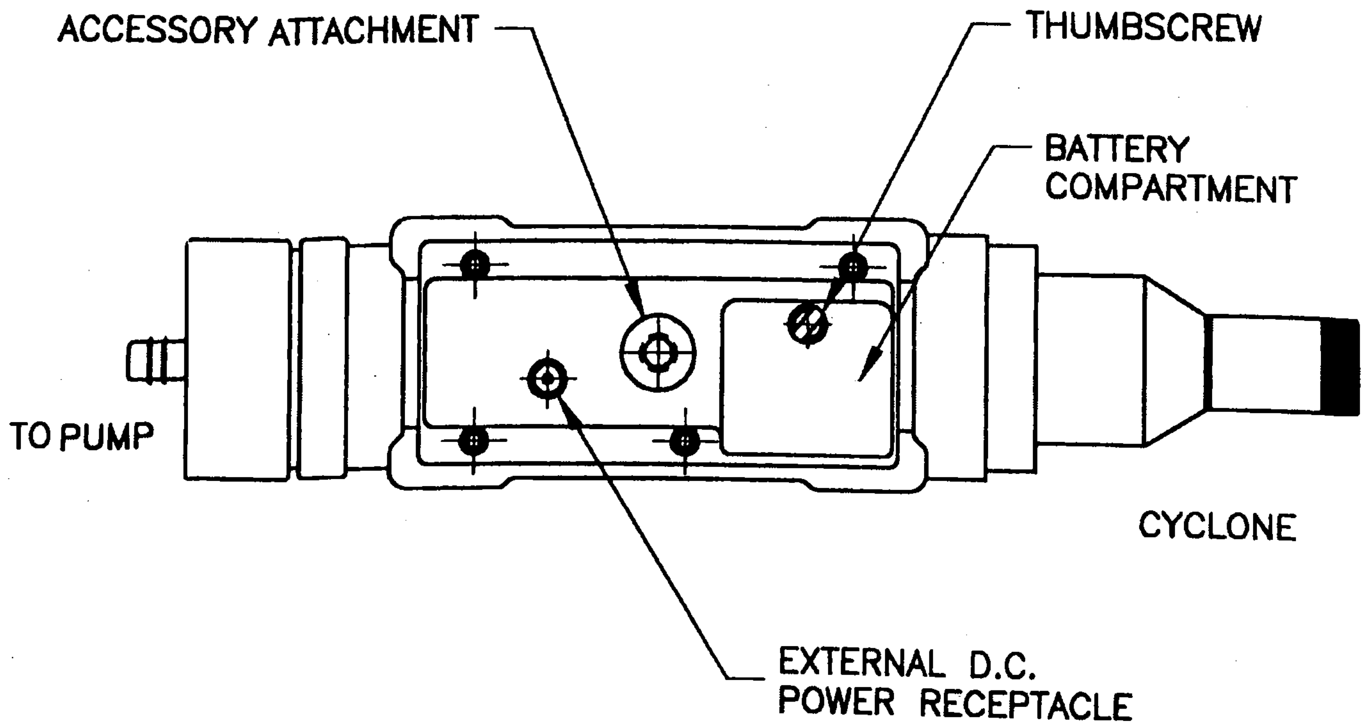


Figure 4 – BOTTOM VIEW (MODEL pDR–1200)

The EXIT and ENTER keys serve to execute specific commands that may be indicated on the screen, and the NEXT key generally serves to scroll the displayed information, e.g. to review the operating parameters that have been programmed, display maximum/STEL values, diagnostic values, etc.

If an incorrect command is keyed (e.g. ENTER when the *personal*DataRAM displays real-time concentration) a beep is heard to alert the user.

The two-line, 16-character per line LCD indicates either measured values of concentration (instantaneous and time averaged on the same screen), elapsed run time, maximum and STEL (short term excursion limit) values, operating and logging parameters, diagnostics, or other messages.

The acoustic alarm transducer is located directly behind the center of the Thermo Electron Corporation logo on the front panel.

5.2 Bottom Base

Refer to Figures 3 (for model *p*DR-1000AN) or 4 (for model *p*DR-1200). The base of the *personal*DataRAM contains the following: a) internal battery compartment cover, b) external DC power input receptacle, and c) threaded bushing for the attachment of optional battery pack, tripod, or other mounting/support hardware.

Only the internal battery compartment cover should be opened by the user, for removal and replacement of the on-board 9V battery. Removal of the base plate could result in voiding of instrument warranty.

5.3 Right Side Panel

Refer to Figures 5 (for model *p*DR-1000AN) or 6 (for model *p*DR-1200) which shows the manner of attachment of the belt clip assembly (belt clip should be attached only if required by the user). The right side panel (as viewed from front panel) contains the RJ-12 6-contact modular jack connector receptacle for digital (RS-232) communications and analog signal output. This connector also provides the alarm output control for a remote/auxiliary alarm signal. The contacts (from top to bottom) are:

1: 4 – 20 mA analog output (positive)
2: Alarm output
3: Digital data transmission
4: Digital input
5: Common ground (signal returns)
6: 0 to 5 V analog output (positive)

The digital communications cable provided as a standard accessory is to be inserted into this receptacle for interconnection to a computer (for data downloading or to reprogram parameters). The analog output cable is provided with flying leads for interconnection with other data processing and/or control systems.

WARNING: The modular jack receptacle on the side of the *personal*DataRAM should be used only for communications with computers and alarm circuitry. **Do not, under any circumstance, connect any communications equipment (e.g., telephone) to this receptacle.**

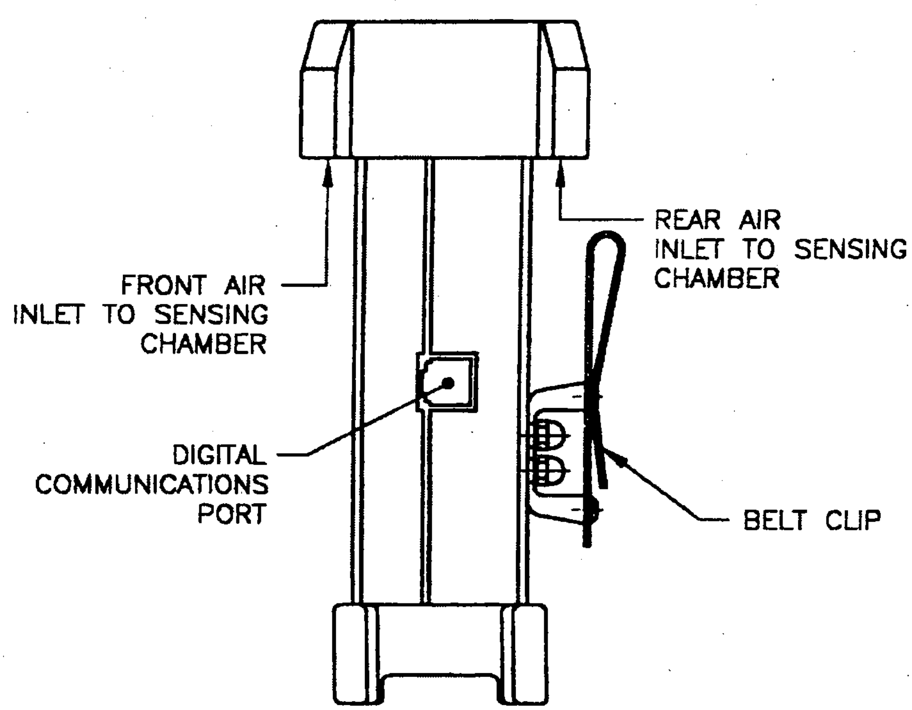


Figure 5 – RIGHT SIDE PANEL (MODEL pDR–1000AN)
(SHOWN WITH BELT CLIP ATTACHED)

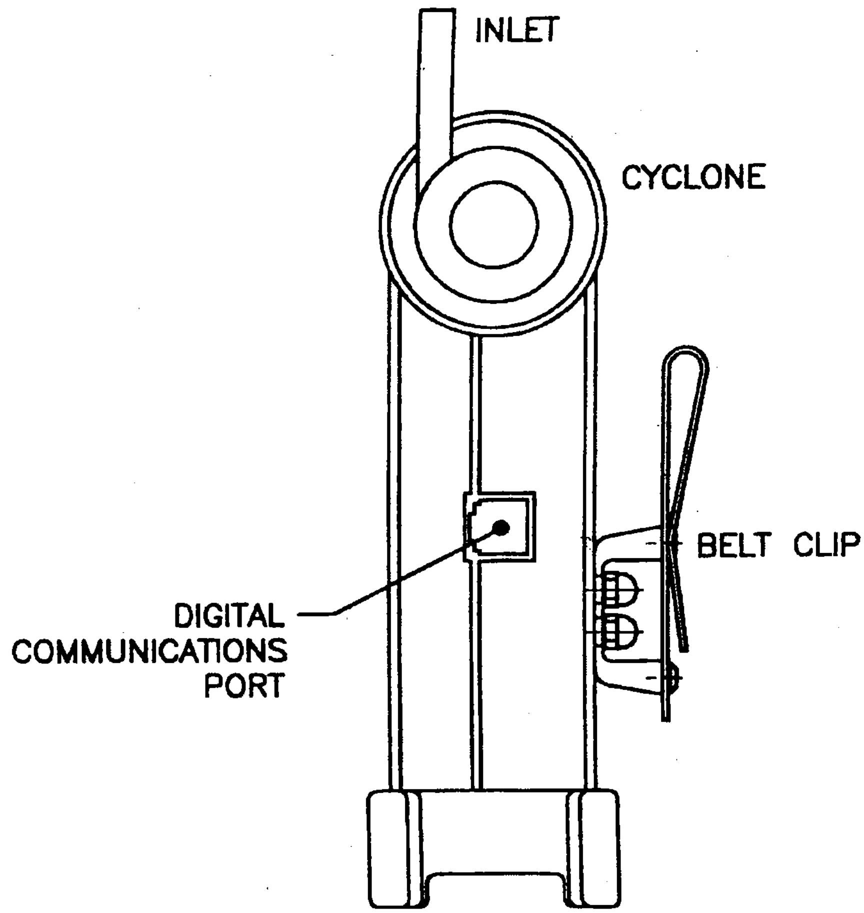


Figure 6 – RIGHT SIDE VIEW (MODEL pDR-1200)
(SHOWN WITH BELT CLIP ATTACHED)

5.4 Back Panel and Belt Clip

The back panel consists of a label with important user information on safety procedures and certifications, model and serial numbers, etc. and is provided with mounting hardware for the attachment of the belt clip kit (see Figures 5 or 6 for mounting configuration of the belt clip).

5.5 Sensing Chamber

Referring to Figure 1 or 2, the upper mid-section of the *personal*DataRAM contains the optical sensing chamber. This chamber is the only internal section that the user should access for maintenance purposes (see Section 12.2).

On the model *p*DR-1000AN, air enters the sensing chamber through the two slot shaped inlets (one on the front and other on the back) under the protective bumper. During instrument operation those two openings should remain unobstructed in order to ensure free access of the surrounding air. When the model *p*DR-1000AN is used as personal monitor, i.e., clipped to a person's belt, the rear air inlet opening may be partially obstructed, but care should be exercised in ensuring that the front air inlet remains free of any obstructions.

On the model *p*DR-1200, air enters the sensing chamber through the opening in the cyclone receptacle cup (black cup on right side of sensing chamber), passes through the photometric stage, and exits through the opening in the filter holder receptacle cup (black cup on left side of sensing chamber), after which the air passes through the filter.

6.0 PREPARATION FOR OPERATION

6.1 Battery Installation

When shipped from the factory, the *personal*DataRAM will arrive without its replaceable 9V battery installed. Two fresh alkaline batteries (Duracell® type MN1604) are factory packed separately in the carrying case, one of which should be installed in the *personal*DataRAM when preparing it for operation.

NOTE: Whenever the *personal*DataRAM is to be left unused for an extended time (i.e. longer than a month), the 9V battery should be removed from the unit.

Removing the battery will lose neither the program, time/date keeping, nor stored data.

To install the battery proceed as follows:

- Hold the *personal*DataRAM upside down.
- Loosen thumbscrew that secures the battery compartment cover (see Figure 3 or 4), and remove that cover.

- Observe battery polarity and the back panel battery orientation pattern (the negative battery terminal is the one closer to the side of the instrument).
- Insert the battery by sliding it in until it bottoms out. It should protrude slightly above the bottom surface of the instrument.
- Place battery compartment cover over battery and, while pushing down the cover firmly (taking care that the cover seats flush on the bottom surface of the *personal*DataRAM), tighten thumbscrew securely.

6.2 Battery Replacement

Normally, only a 9V Duracell® type MN1604 alkaline batteries should be used with the *personal*DataRAM in accordance the MSHA intrinsic safety approval.

Only fresh batteries should be used in order to ensure the maximum operating time. The *personal*DataRAM shuts itself off whenever the battery voltage falls below 6 volts (while retaining all programming and data). A fresh 9V alkaline battery, at room temperature, should provide typically 20 hours of continuous operation (please note that not all manufacturers produce batteries of equal capacity). Intermittent operation should extend the total running time because of partial battery recovery effects.

The approximate remaining battery capacity is indicated by the *personal*DataRAM (see Section 8.2) in increments of 1%, starting from 99%. If the remaining battery capacity is 40% or less, immediate restarting after shut off is automatically inhibited to prevent incomplete runs. If, nevertheless, a new run is to be initiated with low remaining battery capacity, do not shut off the *personal*DataRAM at the end of the previous run (i.e., remain in the Ready Mode, see section 7.0).

When significantly extended operating times are required (beyond the typical 20 hours), the use of either lithium or zinc-air batteries can be considered. The use of such alternative battery types can provide about 2 to 3 times longer operation than alkaline batteries.

6.3 AC Power Supply

A universal line voltage AC to DC power supply (Thermo Electron model *p*DR-AC) is provided as standard accessory with the *personal*DataRAM. This power supply can be used with any line with a voltage between 100 and 240 VAC (50 to 60 Hz). When using that power supply, its output plug should be inserted into the external DC receptacle at the base of the *personal*DataRAM (see Figure 3 or 4). Insertion of that connector automatically disables the internal 9V battery of the instrument. Removal of the *p*DR-AC plug from the instrument automatically re-connects the internal 9V battery.

NOTE: Before plugging in or unplugging the external power supply, the *personal*DataRAM must be shut off.

6.4 Rechargeable Battery Module

A rechargeable battery pack (Thermo Electron model *p*DR-BP) is available as an optional accessory. This unit attaches directly to the base of the *personal*DataRAM.

The *p*DR-BP contains a sealed nickel-metal-hydride battery (NiMH), which provides typically 72 hours of continuous operation between successive charges (for 3-hour charging).

The use of the *personal*DataRAM, in combination with the *p*DR-BP connected to the AC power line ensures totally uninterruptible operation over an indefinite period. In this operating mode, line power interruptions lasting up to 72 hours have no effect on measurement run continuity.

To attach the *p*DR-BP to the *personal*DataRAM, the instrument should be shut off. Carefully plug the *p*DR-BP into the external DC receptacle on the *personal*DataRAM. Rotate the large thumbscrew at the opposite end of the *p*DR-BP tightening it firmly. The *p*DR-BP can be recharged by means of the AC power supply of the *personal*DataRAM.

Detailed instructions for the use of the rechargeable battery module are furnished with that accessory.

6.5 Zeroing the personalDataRAM

One of the most important steps to be performed by the user before initiating a measurement run with the *personal*DataRAM is to zero the instrument. This is required to ensure maximum accuracy of concentration measurements, especially at low levels, i.e. below about 0.1 mg/m^3.

During the 2-minute pre-run automatic zeroing sequence (see Section 8.1), the *personal*DataRAM registers its own optical background, stores that level in its memory, and then subtracts that background from all measured concentration values, until the zero is updated again by the user.

Although zeroing can be performed as often as desired (e.g., before every run), in practice it should not be necessary to do so more than once-a-month or even less frequently, except if average particulate concentrations should exceed about 0.5 mg/m^3.

6.5.1 Zeroing the model *p*DR-1000AN

Zeroing of the model *p*DR-1000AN requires a particle-free environment such as a clean room, clean bench, duct or area directly downstream of a HEPA filter, or the *p*DR-1000AN Z-Pouch (standard accessory). In some cases, a very clean, well air-conditioned office may offer a sufficiently low particle concentration environment (i.e., ≤ 5 μg/m³) for zeroing, as determined by another monitor (e.g., Thermo Electron DataRAM 4).

To zero the model *p*DR-1000AN by means of its Z-Pouch, proceed as follows:

- Wipe the outside surfaces of the *p*DR-1000AN to remove as much dust from those surfaces as possible before placing the instrument inside the Z-Pouch.
- In a reasonably clean environment, open the zipper of the Z-Pouch and place the *p*DR-1000AN inside it. Close the zipper shut.
- Open the small nipple on the Z-Pouch, and insert the fitting of the hand pump/in-line filter unit into the nipple.
- Start pumping the hand-pump until the Z-Pouch begins to bulge, and proceed with the steps in Section 8.1, pressing the keys of the instrument through the wall of the Z-Pouch. Then slowly continue to pump to maintain positive pressure within the Z-Pouch.
- After completing the zeroing (step 2. of Section 8.1) procedure, open the Z-Pouch zipper and remove the *p*DR-1000AN. Close the zipper and flatten the Z-Pouch while plugging its nipple, in order to prevent dust contamination of the interior of the Z-Pouch.
- The *p*DR-1000AN is now zeroed and ready for a measurement run.

6.5.2 Zeroing the model *p*DR-1200

To provide the particle-free air required to zero the *p*DR-1200, either of two methods can be used: a) place the instrument on a clean-air bench or in a clean room, or b) connect to the cyclone inlet the green zeroing filter cartridge supplied with the *p*DR-1200. In either case, proceed as follows:

- After implementing either of the two methods, above, run the attached pump for at least one minute (e.g., at 2 liters/minute), and then proceed as described in Section 8.1 of this instruction manual, while continuing to run the pump (or leaving the unit in the clean air environment).
- Once the CALIBRATION: OK message appears on the *p*DR-1200 display, stop the pump and disconnect the zeroing filter cartridge from the cyclone inlet (or remove *p*DR-1200 from clean bench/room).
- The *p*DR-1200 is now zeroed and ready for a measurement run.

Note: While the *p*DR-1200 is used to monitor high dust concentrations (≥ 0.5 mg/m³), the flow through its sensing chamber should not be stopped before purging it, which can be done by connecting the green zeroing filter to the cyclone inlet and continuing to run the pump for about 2 minutes before shutting it off. This is to prevent dust contamination of the sensing chamber.

6.6 *p*DR-1200 Filter Holder Installation

The 37-mm filter holder provided with the *p*DR-1200 must be installed before operation of the instrument, in order to connect a sampling pump. To install the filter holder, remove protective cover, and insert the open collar over the black attachment cup with the external o-ring, on the left side of the *p*DR-1200 sensing chamber. Ensure complete insertion.

To replace the membrane filter separate the two sections of the plastic holder prying them apart with screwdriver or a coin. Make sure to place backing under the membrane filter before rejoining the two plastic rings.

7.0 OPERATING MODES

The *personal*DataRAM has several different operating modes which will be described in what follows. The specific commands and displays within each of these operating modes will be explained in detail in Section 8.0. A complete flow chart of keystrokes and screens is provided in Section 16.0.

7.1 Start-Up Mode

The *personal*DataRAM enters the Start-Up Mode as soon as the instrument is switched on. The user then has the choice to:
a) Wait before proceeding;
b) Zero the instrument and check its readiness; or
c) Proceed directly to the Ready Mode.

7.2 Ready Mode

Once the *personal*DataRAM is in the Ready Mode, the user is presented with the following alternatives:
a) Start a run immediately, or after any of the subsequent steps;
b) Review (by scrolling the display) all operating parameters, status and diagnostic data;
c) Activate or deactivate the logging function; activate, select (instantaneous or STEL), or deactivate alarm;
d) Program parameters or output logged data through a computer.

7.3 Run and Logging Mode

The Run Mode is the measurement/logging mode. The user can operate the *personal*DataRAM in this mode either with or without data logging. For example, the instrument may be used first as a survey monitor without logging, for walk-through assessment of an industrial plant, before deciding where to set up the unit for continuous monitoring and logging.

7.3.1 Data Logging

In order to activate the logging function, the unit must be in (or returned to) the Ready Mode (see Section 8.2).

If data logging has been enabled, the data will be logged in the next free (unrecorded) tag or data set. For example, if data had been recorded previously in tags # 1, 2 and 3 then, when a new run is initiated, the new data will be stored in tag #4. The data can be separated into number of sets (tags) up to a total of 99.

Any number of individual data points can be stored in a given tag, i.e. up to a maximum of 13,000 points (i.e. the total memory capacity of the *personal*DataRAM) assuming that no other data had been logged in other tags. This means that the total memory capacity of 13,000 data points can be grouped into any number of the available 99 data sets (tags).

7.3.2 Clearing of Memory

Data recorded in the *personal*DataRAM memory can be erased either through an external PC command using the Thermo Electron *p*DR-COM Custom Communications software provided as a standard accessory, or resetting the instrument (see Section 8.5). The PC method permits to erase the data in any number of selected tags, whereas the resetting method results in the deletion of all data stored in the *personal*DataRAM.

7.3.3 Run Mode Display and Commands

When a measurement run has been initiated (see Section 8.3), the user has the following display choices:

a) Instantaneous and time-averaged concentrations (both on the same screen);
b) Elapsed run time, and run start time and date (both on the same screen);
c) Maximum displayed concentration from run start, and time/date at which current maximum occurred;
d) Short term excursion limit (STEL) from run start, and time/date at which current STEL occurred;
e) Remaining battery charge, and (if logging function is enabled) remaining free memory.
f) Analog output concentration range (if enabled)

The user can command the termination of the run at any time returning it to the Ready Mode. To download logged data into a PC, the *personal*DataRAM must be in the Ready Mode. No changes in the program parameters or operating conditions can be made while in the Run Mode.

The *personal*DataRAM can be shut off from any of the three operating modes. Even if shut off while in the Run Mode, the instrument will save all stored data.

8.0 OPERATION

8.1 Start-Up

	KEY	DISPLAY	NOTES
1.	**ON/OFF**	START ZERO:ENTER GO TO RUN: NEXT	Before starting a run with the *personal*DataRAM, zero it (see Section 6.5) and key **ENTER** while the unit is exposed to particle-free air. Alternatively, key **NEXT** to go to RUN/READY mode. If **ENTER** is keyed:
2.	**ENTER**	ZEROING V2.00	Keep clean air flowing while ZEROING is displayed* for 1.1 min., followed by one of these screens:
		CALIBRATION: OK	or,
		BACKGROUND HIGH	or,
		MALFUNCTION	If CALIBRATION: OK, then go to step 3. If one of the other two screens is displayed, consult Section 12.0.
3.	**NEXT**	START RUN: ENTER READY: NEXT	To start a measurement run key **ENTER** (Section 8.3, step 1). To set up for a run and scroll logging/operating parameters, key **NEXT** (see Section 8.2).
4.	**ON/OFF**	TURN OFF PDR? Y:ENTER N:NEXT	Keying **ON/OFF** while the unit is operating will elicit this message to prevent accidental shut off. To confirm shut down, key **ENTER**. To continue operation, key **NEXT**.

*The number following the V on the screen refers to the installed firmware version.

8.2 Setting Up For A Run (Ready Mode)

	KEY	DISPLAY	NOTES
1.	**NEXT**	LOGGING DISABLED	This screen indicates the logging status. To enable the logging function, key **ENTER**. Toggling of the on/off logging status can be done by keying ENTER.
2.	**ENTER**	LOG INTRVL 600s TAG#: 4	This message indicates that logging is enabled. Example is for 10-min log period, selected through the PC (see Section 9.0), and next free tag is #4.
3.	**NEXT**	ALARM: OFF	This screen indicates the alarm status. Keying **ENTER** repeatedly toggles through the 3 alarm modes:
4.	**ENTER**	ALARM: INSTANT LEVEL:1.50 mg/m^3	This enables the alarm based on the real-time concentration. The level (e.g. 1.50 mg/m^3) must be set on the PC.
5.	**ENTER**	ALARM: STEL LEVEL:0.50 mg/m^3	This enables the alarm based on the 15-min STEL value. The level (e.g. 0.50 mg/m^3) must be set on the PC.
6.	**NEXT**	ANALOG OUTPUT: DISABLED	This screen indicates the analog signal output status. Keying ENTER will enable the analog output. Toggling the analog output on/off can be done by keying **ENTER**:
7.	**ENTER**	ANALOG OUTPUT: 0 – 0.400 mg/m^3	This enables the analog output. The concentration range (e.g., 0 – 0.400 mg/m^3) must be set on the PC.
8.	**NEXT**	CAL FACTOR: 1.00 DIS AVG TIME 10s	This screen displays the calibration factor and the display averaging time. Edit via PC

9.	**NEXT**	BATTERY LEFT 83% MEMORY LEFT 96%	This screen displays the remaining battery charge, and the remaining percentage of free memory.
10.	**NEXT**	CONNECT TO PC	When this screen has been selected, the operating parameters can be edited and/or the logged data can be downloaded via the PC (see Section 9.0). If **NEXT** is keyed again, the screen returns to RUN/READY:
11.	**NEXT**	START RUN: ENTER READY: NEXT	The instrument is now ready to run following the procedure in section 8.3.

8.3 Measurement Run Procedure

	KEY	DISPLAY	NOTES
1.	**ENTER**	LOGGING DISABLED	or, if logging was enabled:
		LOG INTRVL 600s TAG #: 4	Logging status will be displayed for 3 seconds.
		CONC*0.047 mg/m^3 TWA 0.039 mg/m^3	After a 3-second delay, the concentration screen appears values shown here are examples). CONC is the real-time and TWA is the time-averaged concentration. The "*" appears only if logging has been enabled.
2.	**EXIT**	TERMINATE RUN? Y:ENTER N:EXIT	To terminate the current run and return to the Ready Mode, key **ENTER**. To continue the run, key **EXIT**.
3.	EXIT	CONC*0.047 mg/m^3 TWA 0.039 mg/m^3	Keying **NEXT** successively scrolls the display to show various run values (elapsed run time, maximum, STEL, etc.). Keying **EXIT** returns to the concentration display.

4.	**NEXT**	ET 06:12:49 ST 08:18:26MAY15	This screen shows the elapsed run time (ET) and the run start time/date (ST).
5.	**NEXT**	MAX: 0.113 mg/m^3 T 10:08:44 MAY15	This screen shows the maximum concentration of current run and time/date of occurrence.
6.	**NEXT**	STEL:0.058 mg/m^3 T 09:59:22 MAY15	This screen shows the 15-min STEL value of the current run and the time/date of occurrence.
7.	**NEXT**	BATTERY LEFT 83%	or, if logging was enabled:
		BATTERY LEFT 83% MEMORY LEFT 96%	This screen shows the amount of usable charge left in the battery and, if logging has been enabled, the overall amount of free memory left.
8.	**NEXT**	ANALOG OUTPUT: 0 – 0.400 mg/m^3	This screen shows the status of the analog signal output, and the range, if this output has been enabled.
9.	**NEXT**	CONC*0.047 mg/m^3 TWA 0.039 mg/m^3	The last **NEXT** command returns the display to the concentration screen.
10.	**EXIT**	TERMINATE RUN? Y:ENTER N:NEXT	As indicated in step 2, to end current run, key **ENTER**, to return to the Ready Mode:
11.	**ENTER**	START RUN: ENTER READY: NEXT	This keystroke terminates the current run and returns the unit to the Ready Mode.

If during a run the instrument memory is filled completely, or if all 99 tags have been used, the run is automatically terminated and the display will indicate:

RUN TERMINATED
FULL MEMORY

If a new run is initiated after the memory has been filled, the *personal*DataRAM can be operated only as a monitor without logging. The memory must then be cleared (see Section 7.3.2) first before logging can be enabled again.

8.4 Abbreviated Run Start/Stop Instructions

To power-up and start a measurement run without zeroing and without logging, proceed as follows:

- Key sequentially **ON/OFF, NEXT** and **ENTER**.

To terminate run and shut down, proceed as follows starting from the concentration screen (otherwise key **EXIT** first):

- Key sequentially **EXIT, ENTER, ON/OFF** and **ENTER.**

8.5 Resetting Procedure

The *personal*DataRAM memory can be reset through commands entered on its own keypad (i.e. without requiring a PC).

Resetting accomplishes the following:

- Erases all stored data from memory;
- Resets all parameters and operating conditions to their default values and conditions; and
- Cancels the zero correction offset.

WARNING: THE RESET TEST WILL ERASE ALL DATA STORED IN MEMORY AND SET ALL PARAMETERS TO FACTORY DEFAULT SETTINGS. <u>DOWNLOAD ANY DATA BEFORE THE RESET PROCEDURE.</u>

The procedure to reset the instrument is as follows:

Starting with the unit shut off, press the **EXIT** and **ENTER** keys at the same time, and while holding down those two keys, press **ON/OFF**. The screen will then indicate: PDR SELF-TEST...
and several diagnostic screens will appear in rapid sequence (see Section 16.0, Resetting/Electronics Checking Mode), ending in the message TESTING COMPLETE. The unit will shut off. When turned on again, the *personal*DataRAM memory will have been reset, as described above.

The **default** values and operating conditions of the *personal*DataRAM are:

- Logging period (LOG INTRVL): 60 seconds
- Logging status: disabled (LOGGING DISABLED)
- Alarm level: 1 mg/m^3

- Alarm status: disabled (ALARM: OFF)
- Analog output: 0 to 4 mg/m^3
- Analog output status: disabled (ANALOG OUTPUT :DISABLED)
- Real-time display averaging time (DIS AVG TIME): 10 seconds
- Calibration factor (CAL FACTOR): 1.00

When turning on the *personal*DataRAM after resetting the instrument, it should be zeroed (see steps 1 and 2 of Section 8.1) before a run is initiated. Otherwise, its internal optical background level will not be subtracted from the indicated concentration readings. Alternatively, if the instrument is not zeroed after resetting, it will indicate its unsubtracted optical background when run under particle free conditions.

9.0 COMMUNICATIONS WITH COMPUTER

9.1 Hardware and Software Requirements

The computer requirements to install the software provided with the *personal*DataRAM (Thermo Electron *p*DR-COM) are the following:

- IBM-PC compatible
- 486, Pentium, or better processor
- Minimum operating system: Windows 95™ or better
- ≥ 8 MB of RAM
- 2 MB of hard drive space
- CD-ROM drive
- VGA or higher resolution monitor

NOTE: When large files are logged in the *personal*DataRAM in one single tag, a faster computer speed is required to handle the data. For example, if all 13,000 data points are logged in one tag, a Pentium I or II processor with a minimum speed of 166 MHz will be required. If, however, the maximum number of data points per tag is 1,000 or below, a 33 MHz, 486 DX processor will suffice.

Thermo Electron custom hardware and software (provided as standard accessories):

- Digital communications cable (Thermo Electron model pDR-DCC)
- CD-ROM disk (Thermo Electron model 100034-00)

9.2 Software Installation Procedure

To install the Thermo Electron provided software in the computer, proceed as follows:

1. Insert the CD-ROM disk labeled "*p*DR-COM" into computer.

2. For Windows 95™ or higher users, select **Start** and then **Run**.
3. Type in on the **Command Line**: **x: install** (where "x" is the CD-ROM drive).
4. The message "**Do you wish to install pDR-COM?**" will appear. Click **OK** to continue, or **Cancel**.
5. A message appears allowing the option to change the default directory:
6. "**C:\PDRCOM**". It is advisable to leave the default directory (unless you address the hard drive by a different letter), and select **OK**.
7. After a successful installation, the message "**Installation Complete!**" will appear.

9.3 Communication Between personalDataRAM and Computer

To effect the communication between the *personal*DataRAM (via the *p*DR-COM software installed in the computer as described in the preceding section) and the PC, proceed as follows:

1. Connect the *personal*DataRAM to one of the computer's serial ports using the *p*DR-DCC cable provided by Thermo Electron. This cable has a 9-pin female connector for the computer port.

2. Key **ON/OFF** the *personal*DataRAM and then key **NEXT** repeatedly until CONNECT TO PC is displayed on the *personal*DataRAM.

3. On the computer, double click on the ***p*DR-COM** icon. A four-tabbed notebook display should appear. Click on the **Com Port Select** and select the port to which the pDR-DCC cable has been connected.

4. From the four-tabbed notebook displayed on the computer screen select the tab with the desired option. The options are:

- **Main:** This page allows the user to input the *personal*DataRAM serial number (or any other desired label), and select the Serial Com Port.

- **Logged data:** This page allows the user to download, tabulate, print data, or transfer to a CSV file the data stored in the *personal*DataRAM. This page also serves to display real-time numerical data when the computer is connected to the *personal*DataRAM in the Run Mode.

- **Graph data:** This page enables the downloading and graphing of stored data to the computer screen and to a printer. In the Run Mode, this page displays the real-time data in graphic format.

- **Configure *p*DR:** This screen allows the user to edit the operating/logging parameters. Click on the item to be edited and select or type in the new value.

To review the parameter values currently programmed into the *personal*DataRAM, click on **Get configuration.** After editing the parameters, click on **Set configuration** to input the new values into the *personal*DataRAM program.

Most operations within *p*DR-COM are self-evidently labeled, including fly-over dialog boxes. In addition, instructions may be found in the On-line Help files by selecting **Help** and then **Contents.**

The following operating/logging parameters of the *personal*DataRAM are selected (edited) via the computer:

- Current date (month and day of the month)
- Current time (hour, minute and second)
- Display averaging time (1 to 60 seconds, in 1-second increments)
- Calibration factor (0.01 to 9.99, in 0.01 increments)
- Logging interval (1 to 14,400 seconds, in 1-second increments)
- Analog output full scale concentration (0.1, 0.4, 1, 4, 10, 40, 100, or 400 mg/m^3)
- Analog output status (enabled, or disabled) (can also be selected directly through *personal*DataRAM keyboard, see Section 8.2)
- Alarm level (0.001 to 409.599 mg/m3, in 1-µg/m^3 increments)
- Alarm mode (Off, Instantaneous, or STEL) (can also be selected directly through *personal*DataRAM keyboard, see Section 8.2)

The serial number of the *personal*DataRAM is transferred automatically to the PC and displayed on its screen.

In addition, the user can input any other identification for the instrument (up to 20 characters).

9.4 Real-Time RS-232 Output

During the RUN mode, the *personal*DataRAM can communicate real-time concentration data through its serial port via the *p*DR-COM software package. This software application decodes the data and displays it on the computer screen in both graphical and tabulated form.

In order to use this output with some other application, the following information will enable the user to decipher the encoded output signal.

The communication settings for the digital output of the *personal*DataRAM are:

- Baud rate: 4800 bps or 9600 bps
- Data bits: 8
- Stop bits: 1
- Parity: none
- Flow control: Xon/Xoff

Every second during a run, the *personal*DataRAM serial port will output a sixteen-character code. It consists of two brackets with 14 hexadecimal digits between them, representing sum check (2 digits), sensed concentration (8 digits), and calibration factor (%, 4 digits). The concentration in $\mu g/m^3$ is obtained by multiplying the sensed concentration times the calibration factor and dividing by 100.

10.0 ANALOG SIGNAL OUTPUT

10.1 Analog Output Description

The *personal*DataRAM incorporates the capability to provide both a voltage and a current signal output directly proportional to the sensed concentration of airborne particulates. Both these analog signal outputs are concurrently available. These outputs are provided, principally, for fixed-point applications with hard-wired installations, such as for continuous HVAC monitoring and control.

The particulate concentration range corresponding to the output voltage and current ranges (0 to 5 V and 4 to 20 mA) can be user selected (via a PC). The most sensitive range available is 0 to 0.100 mg/m^3, and the least sensitive range is 0 to 400 mg/m^3. For example, if the user selects the analog output range of 0 to 0.400 mg/m^3 then the analog output signal levels, at a concentration of 0.200 mg/m^3, would be 2.5 V and 12 mA.

Selection of the concentration range of the analog output must be performed on the PC. This range is independent of the digital display, data logging and real-time digital output range which are controlled automatically (auto-ranging).

Enabling the analog output increases the current consumption from the power source (battery or power supply) of the *personal*DataRAM by typically 5 mA when no load is connected to the analog signal current output. If such a load is connected then the current consumption of the *personal*DataRAM further increases by the magnitude of the output signal current (up to a maximum increment of 20 mA). Therefore, when not using the analog output, it is advisable to disable that output (see Section 8.2) in order to minimize power consumption (this is important only when powering the *personal*DataRAM from a battery source).

10.2 Analog Output Connection

The *personal*DataRAM is provided with a cable (model *p*DR-ANC) which has a 6-contact plug at one end and flying leads at the other. There are 4 leads for the analog and alarm outputs. The additional two contacts of the connector are used only for digital communication with a PC, for which a separate cable (model *p*DR-DCC) is provided.

Counting from top to bottom on the *personal*DataRAM connector receptacle, contact #1 is the positive 4 – 20 mA analog output, contact #2 is the alarm output, contact #5 is the common ground (return for all signals), and contact #6 is the positive 0 – 5 V analog output.

For the 0 – 5 V output signal, the externally connected load must have an impedance of more than 200 kilo-ohms. For the 4 – 20 mA output signal, the externally connected load must have an impedance of less than 200 ohms when powering the *personal*DataRAM with a battery, or less than 300 ohms when using the its AC supply.

Since both voltage and current outputs are present at the same time, both can be used concurrently, if so required.

The accuracy of the analog output signals is better than 1% of the reading with respect to the digital reading.

11.0 ALARM

11.1 Alarm Description and Operation

The *personal*DataRAM alarm function is provided both as an audible signal as well as an electrical output. The audible alarm consists of a series of beeps generated by an on-board piezo-transducer. The electrical output, available at the digital communications port, consists of a 1 Hz square wave signal which can be used to trigger/activate other equipment through an appropriate interface (consult with the factory).

The alarm function can be enabled/disabled by the user through the *personal*DataRAM keyboard (see Section 8.2). Setting of the alarm level must be performed on the PC (see Section 9.0).

The alarm is triggered whenever the preset alarm level is exceeded based either on: a) the displayed real-time concentration, if ALARM: INSTANT was selected (see Section 8.2), or b) a 15-minute running average concentration, if ALARM: STEL was selected. When the concentration falls below that level the alarm condition stops. While the alarm is on the user can stop it (i.e. silence the alarm) by pressing any key of the *personal*DataRAM. If the concentration continues to exceed the set alarm level after 10 seconds, however, the alarm restarts.

11.2 Alarm Output

A pulsed voltage output is available on the *personal*DataRAM in synchronism with the audible signal. This signal consists of a 1 Hz square wave with an amplitude level of 5 V pp. An externally connected load should have an impedance of no less than 100 kilo-ohms. This alarm output signal is available at pins 2 and 5 (counting from top to bottom) of the 6-contact output/communications port on the side of the *personal*DataRAM (see Figure 5 or 6).

11.3 Remote Alarm Unit

An alarm relay unit (Thermo Electron model *p*DR-RA) is available as an optional accessory for the *personal*DataRAM. The *p*DR-RA, when connected to the alarm output of the *personal*DataRAM, provides a switched output triggered by the alarm signal of the monitor. This switched output (up to 8 amperes, 250 volts) can be used to activate or deactivate other equipment (e.g. ventilation systems, machinery, etc.), or to control remotely located (by wire connection) alarm indicators (e.g. buzzers, lights, etc.).

12.0 MAINTENANCE

12.1 General Guidelines

The *personal*DataRAM is designed to be repaired at the factory. Access to the internal components of the unit by others than authorized personnel voids warranty. The exception to this rule is the occasional cleaning of the optical sensing chamber.

Unless a MALFUNCTION message is displayed, or other operational problems occur, the *personal*DataRAM should be returned to the factory once every two years for routine check out, testing, cleaning and calibration.

12.2 Cleaning of Optical Sensing Chamber

Continued sampling of airborne particles may result in gradual build-up of contamination on the interior surfaces of the sensing chamber components. This may cause an excessive rate of increase in the optical background. If this background level becomes excessive, the *personal*DataRAM will alert the user at the completion of the zeroing sequence, as indicated in Section 8.1, by the display of a BACKGROUND HIGH message. If this message is presented, the *personal*DataRAM can continue to be operated providing accurate measurements. However, it is then advisable to clean the interior of the sensing chamber at the first convenient opportunity, proceeding as indicated below.

12.2.1 Model *p*DR-1000AN

- Remove the two screws on the top of the large protective bumper that covers the sensing chamber (see Figure 1);
- Remove the large protective bumper by lifting it firmly upwards and away from the sensing chamber;
- Remove the socket-head screws on the front and back black covers that were exposed by removal of the large top bumper. Lift away the freed front and back covers of the sensing chamber; set them aside carefully and such that they can be reattached in the same position as they were previously; avoid touching the dull black side of these plates;

- Using filtered (particle-free) pressurized air, blow the inside of the sensing chamber taking great care in not marring or scratching any of the exposed surfaces;
- Reposition the two sensing chamber cover plates in the same location (front and back) as they had been originally. Insert and tighten socket head screws firmly making sure that the two plates are aligned perfectly with the top of the sensing chamber;
- Reposition large protective bumper over sensing chamber pushing down until properly seated. Insert the two top screws holding down the bumper and tighten gently (do not over-tighten);
- Check optical background by zeroing the *p*DR-1000AN as indicated in Section 8.1. If the sensing chamber cleaning was performed correctly, the message CALIBRATION: OK should be displayed at the end of the zeroing period.

12.2.2 Model *p*DR-1200

- Remove the two screws (one in the front and one in the back) holding the front and back gasketed covering plates of the sensing chamber, and set these plates aside, such that they may be reattached in the same location as they were previously.
- Using filtered (particle-free) pressurized air, blow the inside of sensing chamber taking great care in not marring or scratching any of the exposed surfaces.
- Reposition the two sensing chamber cover plates in the same location (front and back) as they had been originally. Insert and tighten socket head screws firmly making sure that the two plates are aligned perfectly with the top of the sensing chamber.
- Check optical background by zeroing the pDR-1200 as indicated in Section 8.1. If the sensing chamber cleaning was performed correctly, the message CALIBRATION: OK should be displayed at the end of the zeroing period.

12.3 Cyclone Cleaning (Model *p*DR-1200 only)

The cyclone will require occasional cleaning. It is advisable to do so whenever the sensing chamber of the *p*DR-1200 is cleaned (see above). To clean the cyclone, remove it from its black attachment cup on the sensing chamber, and unscrew the grit pot (narrower knurled end). Use clean pressurized air to blow out the grit pot and through all openings of cyclone body. Reattach grit pot to cyclone body and insert cyclone body into attachment cup making sure it is fully inserted.

13.0 CALIBRATION

13.1 Factory Calibration

Each *personal*DataRAM is factory calibrated against a set of reference monitors that, in turn, are periodically calibrated against a gravimetric standard traceable to the National Institute of Standards and Testing (NIST).

The primary factory reference method consists of generating a dust aerosol by means of a fluidized bed generator, and injecting continuously the dust into a mixing chamber from which samples are extracted concurrently by two reference filter collectors and by two master real-time monitors (Thermo Electron DataRAM 4) that are used for the routine calibration of every *personal*DataRAM.

The primary dust concentration reference value is obtained from the weight increase of the two filters due to the dust collected over a measured period of time, at a constant and known flow rate. The two master real-time monitors are then adjusted to agree with the reference mass concentration value (obtained from averaging the measurements of the two gravimetric filters) to within ±1%.

Three primary, NIST traceable, measurements are involved in the determination of the reference mass concentration: the weight increment from the dust collected on the filter, the sampling flow rate, and the sampling time. Additional conditions that must be met are: a) suspended dust concentration uniformity at all sampling inlets of the mixing chamber; b) identical sample transport configurations leading to reference and instrument under calibration; and c) essentially 100% collection efficiency of filters used for gravimetric reference for the particle size range of the test dust.

The test dust used for the Thermo Electron factory calibration of the *personal*DataRAM is SAE Fine (ISO Fine) supplied by Powder Technology, Inc. It has the following physical characteristics (as dispersed into the mixing chamber):

- Mass median aerodynamic particle diameter: 2 to 3 μm
- Geometric standard deviation of lognormal size distribution: 2.5
- Bulk density: 2.60 to 2.65 g/cm3
- Refractive index: 1.54

13.2 Field Gravimetric Calibration

If desired, the *personal*DataRAM can be calibrated gravimetrically for a particular aerosol (dust, smoke, mist, etc.) under field conditions (actual conditions of use). To effect such calibration in the particle environment of interest, proceed as indicated below.

For field calibration of the model *p*DR-1000AN, a personal type filter sampler is placed side-by-side (collocated) to the *p*DR-1000AN to be calibrated, and the two units should be started simultaneously. For the model *p*DR-1200, its own filter and attached pump can be conveniently used for the same purpose.

- Weigh and load into filter holder a fresh membrane filter.
- Start pump.
- Immediately turn on *personal*DataRAM and start a run such that the pump and the *personal*DataRAM are started nearly simultaneously.

The duration of this comparison run should be sufficient to collect a mass of at least 1 mg on the reference filter (in order to permit accurate weighing of the collected mass by means of an analytical balance). The time-weighted average (TWA) reading of the *personal*DataRAM can be used to estimate the required sampling time to collect the above-mentioned mass on the filter. To estimate the required sampling time (ET as measured on the *personal*DataRAM) in minutes, read the TWA value (see Section 8.3) after an elapsed time (ET) of one minute or more, and apply the following relationship:

$$ET \geq 500/TWA$$

For example, if TWA = 2.5 mg/m^3, then ET ≥ 200 minutes (approximately 3 hours). If the TWA value changes significantly as the run proceeds, recalculate the required ET accordingly.

At the end of the run (after time ET has elapsed), record TWA, ET and the flow rate Q used to sample the air. Weigh the filter on an analytical balance and obtain Δm, the mass increment due to the collected particles.

Calculate the average gravimetric concentration C, as follows:

$$C = 1000\ \Delta m/ETxQ$$

Compare the recorded value of TWA and the calculated value C, and calculate the calibration factor to be programmed into the *personal*DataRAM (see Section 9.0) as follows:

$$CAL\ FACTOR = C/TWA$$

For example, if C was found to be 3.2 mg/m^3, and TWA had been determined to be 2.5 mg/m^3, the CAL FACTOR equals 1.28. Select this value on the PC, as described in Section 9.0. This completes the gravimetric calibration of the *personal*DataRAM for a specific aerosol.

13.3 Scattering Coefficient Calibration

Users interested in using the *personal*DataRAM for scattering coefficient measurements (e.g., for atmospheric visibility monitoring) should contact the factory. A special primary Rayleigh scattering calibration for such purpose can be performed by the factory.

13.4 Internal Span Check

The zeroing procedure (see Section 8.1) and the resulting normal diagnostic display of "CALIBRATION: OK" (step 2) informs the user that the instrument's calibration agrees with the original factory setting. This is an internal span check that consists of an automatic comparison between the initial (factory) optical background of the *personal*DataRAM (registered in its non-volatile memory), and the current optical background sensed during the zeroing sequence.

14.0 PARTICLE SIZE CLASSIFICATION (model *p*DR-1200 only)

The particle size selective cyclone of the *p*DR-1200 provides the user with two important capabilities: a) to measure the particulate matter concentration of a specific aerodynamic size fraction, and b) to determine the mass median size of a particle population. These two applications will be discussed in what follows. For both these applications, a variable measured flow rate pump is required, such as the model *p*DR-PU (for which a separate instruction manual is provided).

14.1 Size Fractionated Monitoring

The *p*DR-1200 can be used to monitor a specific particle size fraction below a selectable cut off equivalent aerodynamic diameter. The particle size cut point can be selected by adjustment of the sampling flow rate. The higher the flow rate through the cyclone the smaller the cut off particle diameter. Figure 7 is a graph showing the dependence of the particle cut off size in micrometers as a function of the sampling flow rate in liters per minute. The cut off size is the particle aerodynamic diameter at which the collection efficiency of the cyclone is 50%, or conversely, the size at which the cyclone transmission is 50%. For example, to obtain a particle size cut off of 2.5 μm (i.e., PM2.5), the required sampling flow rate is 4 liters/minute. A that flow rate only particles smaller than (approximately) 2.5 μm are allowed to pass into the *p*DR-1200 sensing stage, to be monitored and then to be collected on the filter.

As can be seen on Fig. 7, the lowest particle size cut for the GK 2.05 cyclone included with the *p*DR-1200 is about 1 μm, and the largest is about 12 μm. For particle size classification outside this range, consult with the factory.

14.2 Particle Sizing

The selectable particle size capability of the cyclone, in combination with the concentration measuring capability of the photometric system of the *p*DR-1200 permits the user to determine the mass median aerodynamic particle diameter of an aerosol, i.e., of the airborne particle population being sampled.

One simple procedure to determine the median particle size is as follows (please refer to the graph of Fig. 7):

- Remove cyclone from its black attachment cup and set cyclone aside
- Start pump and sample aerosol at a flow rate between 2 and 4 liters/minute
- Press ON key on pDR-1200 panel and after about one minute key NEXT and then ENTER
- After an elapsed time (ET) of about one minute, read and note TWA concentration
- Shut off pump
- Plug in cyclone into its attachment cup

- Start pump and run at about 1 liter/minute. Observe real-time concentration (CONC) reading
- Increase flow rate very slowly and gradually until CONC reading is one-half of the initial concentration measured without the cyclone. Continue sampling at this flow rate for about one minute and confirm that TWA reading is about one-half of the initial one. Otherwise readjust flow rate. Note final flow rate at which the TWA value has decreased to one-half the value noted without the cyclone.
- Enter the final flow rate for which the TWA value is one-half of the initial value into the graph of Fig. 7 and read the corresponding D50 particle size in micrometers. This represents the mass median particle diameter of the aerosol.

For example, if the TWA value without the cyclone was 0.8 mg/m^3, and the flow rate (with the cyclone attached) required to reduce the TWA to 0.4 mg/m^3 is 2 liters/minute, the mass median particle size (as obtained from the curve of Fig. 7) is approximately 5.5 μm.

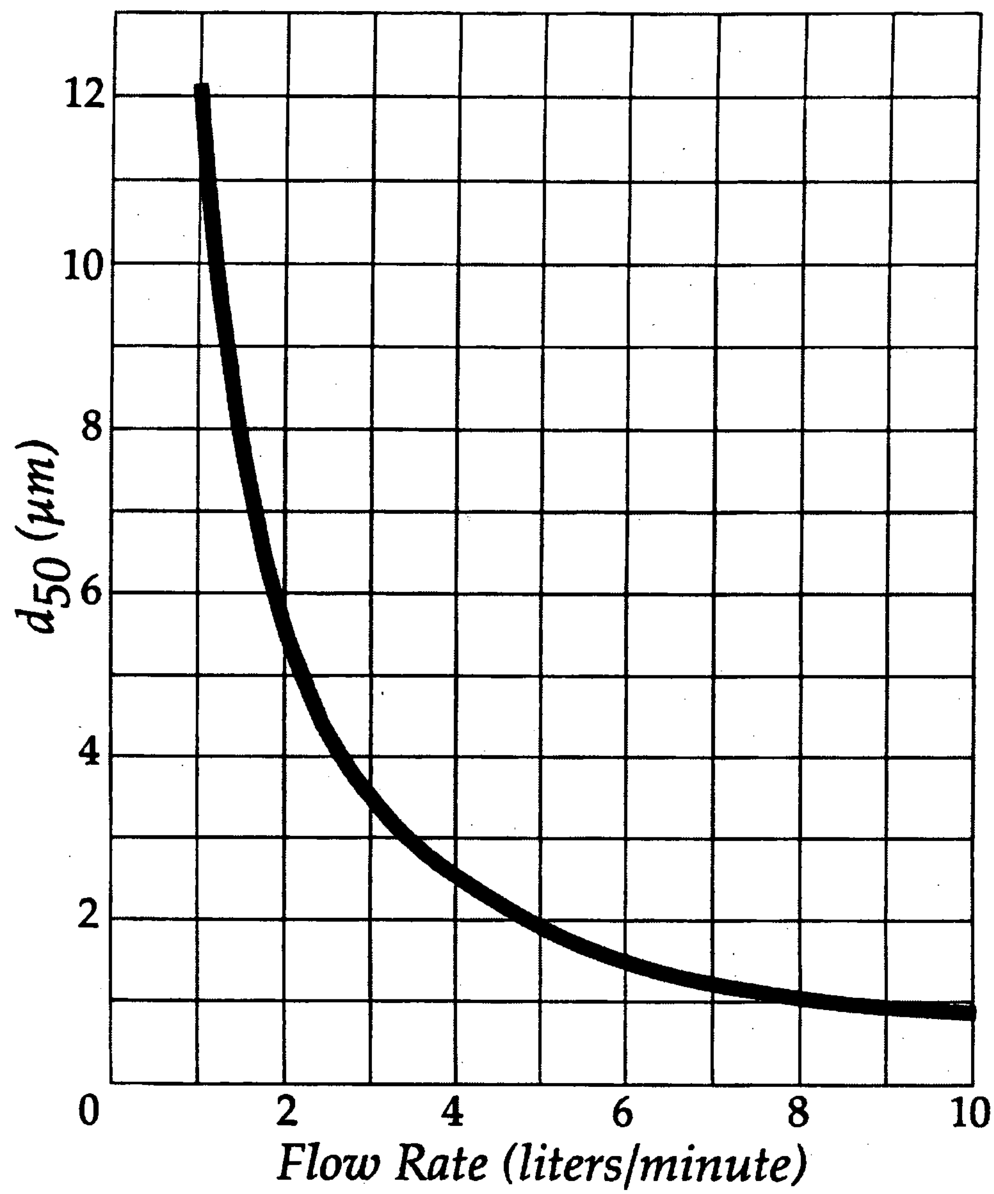


Figure 7. GK 2.05 Cyclone Cut Point (d_{50}) as a Function of Flow Rate

15.0 CONVERSION BETWEEN *personal*DataRAM VERSIONS

The *personal*DataRAM user has the option to convert from a model *p*DR-1000AN to a model *p*DR-1200 or vice versa using the appropriate conversion kit. To convert from a *p*DR-1000AN to a pDR-1200 (i.e., from a passive air sampling configuration to an active one), the user requires the model *p*DR-AS conversion kit. To convert from a *p*DR-1200 to a *p*DR-1000AN (i.e., from an active air sampling configuration to a passive one), the user requires the model *p*DR-UB conversion kit.

15.1 Conversion Procedure From *p*DR-1000AN to *p*DR-1200

To effect this conversion, use model *p*DR-AS conversion kit. As you remove parts from the *p*DR-1000AN, in order to attach the conversion kit components, store these parts carefully for possible future re-conversion. Proceed as follows:

- Remove the two screws on the top of the large protective bumper that covers the sensing chamber (see Figure 1). This bumper is not used on the *p*DR-1200;
- Remove the large protective bumper by lifting it firmly upwards and away from the sensing chamber;
- Reinsert in the upper two threaded holes and tighten the two screws that had held the protective bumper;
- Remove the socket-head screws on the front and back black covers that were exposed by removal of the large top bumper. Lift away the freed front and back covers of the sensing chamber; store them carefully for future use, ensuring that their surfaces are not scratched or marred;
- Position one of the two gasketed (soft rubber) sensing chamber cover plates provided in the conversion kit on the front side of the sensing chamber. Insert and tighten the included socket head screw firmly making sure that the plate is aligned perfectly with the top of the sensing chamber. Similarly, attach the other cover plate on the back side of the sensing chamber;
- Identify the two black cups of the *p*DR-AS conversion kit. One of them has an external o-ring (filter holder cup), and the other has no o-ring (cyclone cup); refer to Figures 2 and 4 for the location of these cups on the *p*DR-1200 sensing chamber. These cups can be installed on either side of the sensing chamber, i.e., the cyclone can be either on the left or the right side of the sensing chamber (Figure 2 shows the case where the cyclone is on the right side);
- Attach one cup to the left side of the sensing chamber using the two black socket head screws. Tighten screws firmly. Similarly, attach the other cup to the right side of the sensing chamber;
- Take the cyclone/filter holder unit provided as part of the conversion kit, and separate the 37-mm plastic filter holder from the metal cyclone by firmly pulling the two units apart;
- Carefully slide the large open end of the plastic filter holder over the cup with the external o-ring, previously attached to the sensing chamber. Ensure that the cup is fully inserted into the filter holder;

- Carefully insert the large diameter open end of the metal cyclone into the other cup on the opposite side of the sensing chamber. The cyclone inlet (small short metal tube on side of cyclone) can be oriented as desired (upwards, as shown in Figure 2, sideways, downwards, etc.). Ensure that the cyclone is fully inserted into the cup;
- When ready to operate, connect a length of tubing between the barbed fitting at the downstream end of the plastic filter holder and the pump to be used in combination with the *p*DR-1200.
- Perform a zeroing sequence (see Sections 6.5.2 and 8.1) before starting a run. This completes the conversion of the *p*DR-1000AN to the *p*DR-1200.

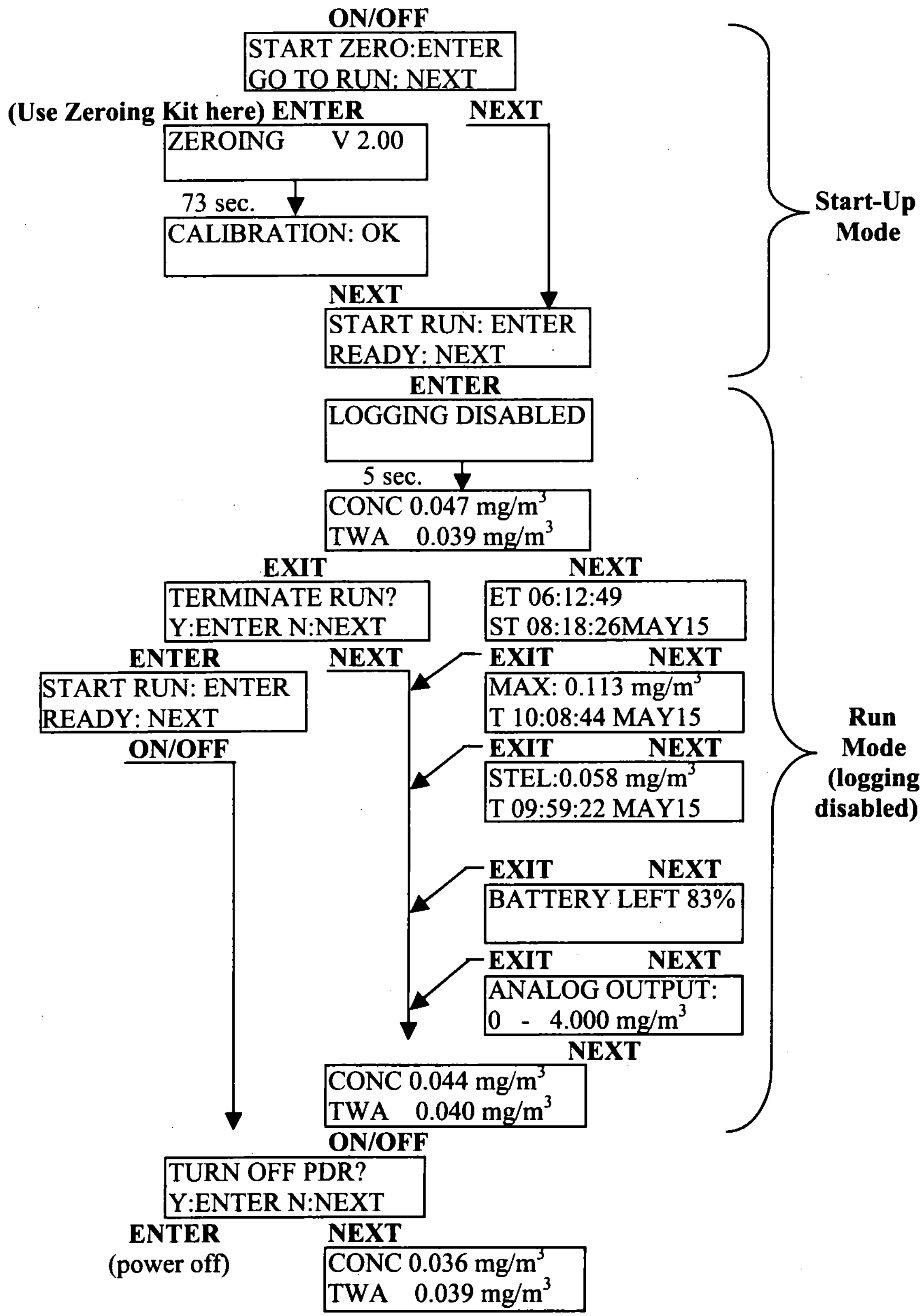
15.2 Conversion Procedure from *p*DR-1200 to *p*DR-1000AN

To effect this conversion use model *p*DR-UB conversion kit. As you remove parts from the *p*DR-1200, in order to attach the conversion kit components, store these parts carefully for possible future re-conversion. Proceed as follows:

- Pull off both the cyclone and the filter holder from their respective cups on the two sides of the sensing chamber;
- Loosen the two screws that hold each of the two cups on the sides of the sensing chamber (total of 4 screws), and remove the two side cups;
- Loosen the single screw on each of the two (front and back) gasketed sealing covers enclosing the sensing chamber, and remove the two covers;
- Identify the two flat sensing chamber cover plates provided in the conversion kit; one face of each of each of these two plates has a dull black finish (antireflective); avoid touching those surfaces;
- Position one of the two sensing chamber cover plates over the open front of the sensing chamber with the dull surface on the inside, and such that the hole in the plate is aligned with the corresponding threaded mounting hole on the upper wall of the sensing chamber. Insert and tighten firmly black socket head screw provided with the conversion kit, making sure that the plate is aligned perfectly with the top of the sensing chamber. Similarly, attach the other cover plate to the rear of the sensing chamber, with the dull surface facing inward;
- Loosen and remove the two small screws on the top surface of the sensing chamber;
- Position large protective bumper (provided in the conversion kit) over sensing chamber pushing down until properly seated. Insert the two top screws (two shiny Phillips-head screws provided in the conversion kit) into the two holes in the bumper while holding down the bumper, and tighten gently (do not over-tighten) making sure that the heads of these screws are well inside their cavities in the bumper;
- Perform a zeroing sequence (see Sections 6.5.1 and 8.1) before starting a run. This completes the conversion from a *p*DR-1200 to a *p*DR-1000AN.

16.0 SEQUENCE OF KEYSTROKES AND SCREENS (*p*DR-1000AN/1200, ADR-1200S and HPM-1000)

Start-Up and Survey Run Mode (Without Data Logging)



Start-Up, Set-Up and Run Mode (With Data Logging)

Start-Up Mode

ON/OFF

START ZERO:ENTER
GO TO RUN: NEXT

(Use Zeroing Kit here) **ENTER**

ZEROING V 1.00

73 sec.

CALIBRATION: OK

NEXT

NEXT

START RUN: ENTER
READY: NEXT

Set-Up (Ready) Mode

NEXT

LOGGING DISABLED

ENTER

LOG INTRVL 600s
TAG#: 4

NEXT

ALARM: OFF

ENTER

ALARM: INSTANT
LEVEL:0.50 mg/m^3

ENTER

ALARM: STEL
LEVEL:0.50 mg/m^3

NEXT

NEXT

ANALOG OUTPUT
0 - 4.000 mg/m^3

NEXT

CAL FACTOR: 1.00
DIS AVG TIME 10s

NEXT

BATTERY LEFT 83%
MEMORY LEFT 96%

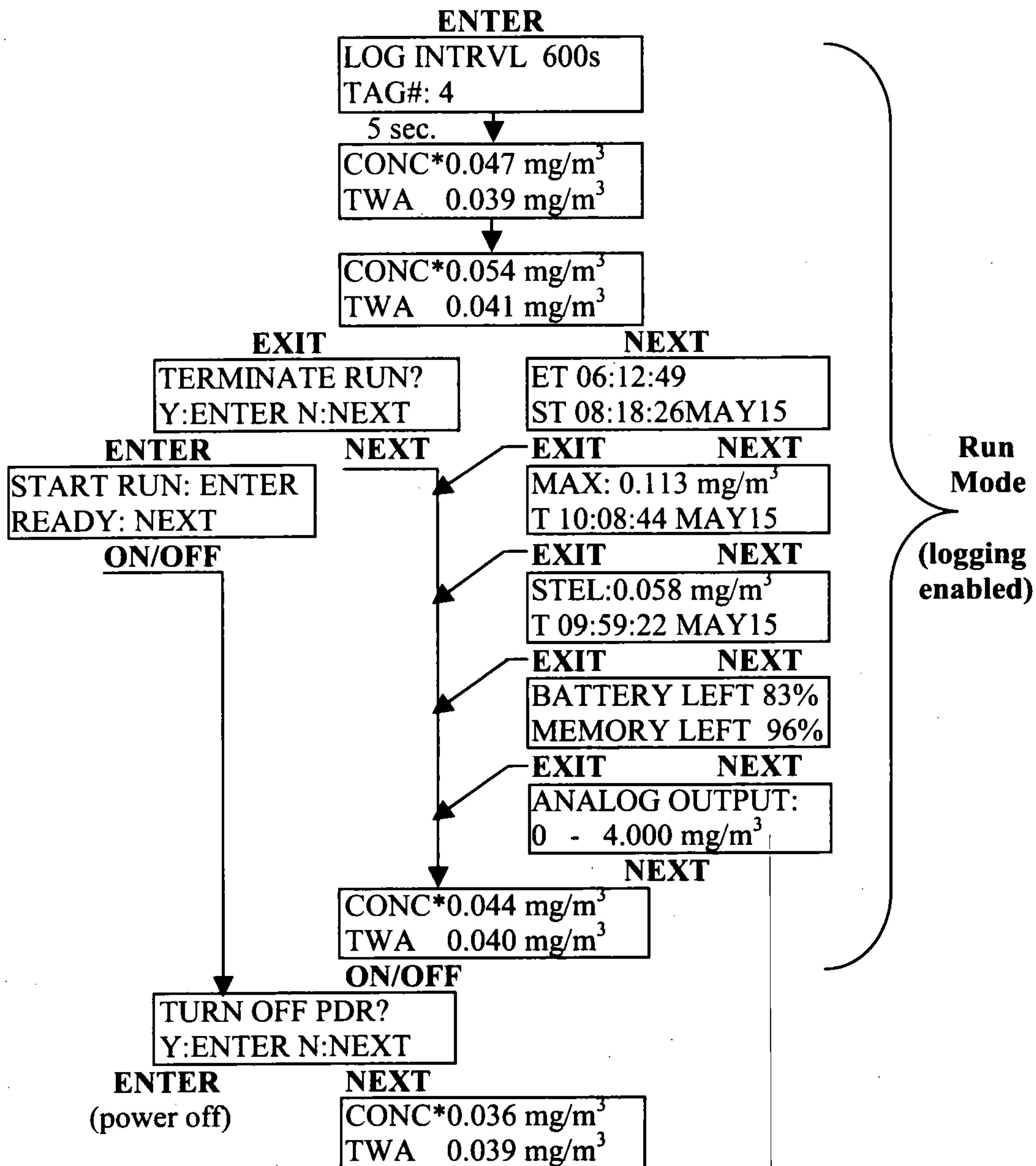
NEXT

CONNECT TO PC

NEXT

START RUN: ENTER
READY:NEXT

(Continues on next page)


ENTER
LOG INTRVL 600s
TAG#: 4
5 sec.
CONC*0.047 mg/m3
TWA 0.039 mg/m3
CONC*0.054 mg/m3
TWA 0.041 mg/m3
EXIT
TERMINATE RUN?
Y:ENTER N:NEXT
NEXT
ET 06:12:49
ST 08:18:26MAY15
ENTER
START RUN: ENTER
READY: NEXT
ON/OFF
NEXT
EXIT NEXT
MAX: 0.113 mg/m3
T 10:08:44 MAY15
EXIT NEXT
STEL:0.058 mg/m3
T 09:59:22 MAY15
EXIT NEXT
BATTERY LEFT 83%
MEMORY LEFT 96%
EXIT NEXT
ANALOG OUTPUT:
0 - 4.000 mg/m3
NEXT
CONC*0.044 mg/m3
TWA 0.040 mg/m3
ON/OFF
TURN OFF PDR?
Y:ENTER N:NEXT
ENTER
(power off)
NEXT
CONC*0.036 mg/m3
TWA 0.039 mg/m3
Run
Mode
(logging
enabled)

Resetting/Electronic Checking Mode

EXIT + ENTER
\+
ON/OFF

PDR SELF-TEST... TESTING ALARM
↓
PDR SELF-TEST... TESTING SERIAL
↓
PDR SELF-TEST... TESTING CLOCK
↓
PDR SELF-TEST... TESTING A/D
↓
PDR SELF-TEST... TESTING D/A
↓
PDR SELF-TEST... TESTING MEMORY
↓
PDR SELF-TEST... TESTING COMPLETE
↓

Automatic Sequence (30 – 40 sec.)

(automatic power off)

NOTE: After the preceding resetting sequence, the instrument should be zeroed; otherwise its optical background will remain unsubtracted.

17.0 SERVICE LOCATIONS

For additional assistance, Environmental Instruments Division has service available from exclusive distributors worldwide. Contact one of the phone numbers below for product support and technical information.

866-282-0430 Toll Free
508-520-0430 International

ATTACHMENT E-2.

SAMPLING AND ANALYSIS PLAN

Air Monitoring Sampling and Analysis Plan - Metals

Corporation Yard Landfill Clean Closure, Folsom, CA

	Event	AM1		AM2		AM3		AM4		AM5	
		Primary	FB	Primary	FB	Primary	FB	Primary	FB	Primary	FB
Pre-Construction	1	1		1	1	1		1		1	
	2	1		1		1		1		1	
Constr. Week 1 (Start-up Period)	3	1	1	1		1		1		1	
	4	1		1		1		1		1	
	5	1		1		1	1	1		1	
	6	1		1		1		1		1	
	7	1		1		1		1		1	1
Constr. Week 2 (Start-up Period)	8	1	1	1		1		1		1	
	9	1		1		1		1		1	
	10	1		1		1		1		1	
	11	1		1		1		1	1	1	
	12	1		1		1		1		1	
Subtotals =		**12**	**2**	**12**	**1**	**12**	**1**	**12**	**1**	**12**	**1**

	Event	Upwind		Downwind	
		Primary	FB	Primary	FB
Constr. Week 3	13	1		1	
	14	1	1	1	
	15	1		1	
Constr. Week 4	16	1		1	
	17	1		1	1
	18	1		1	
Constr. Week 5	19	1		1	
	20	1		1	
	21	1	1	1	
Constr. Week 6	22	1		1	
	23	1		1	
	24	1		1	
Constr. Week 7	25	1		1	
	26	1		1	
	27	1	1	1	
Constr. Week 8	28	1		1	
	29	1		1	
	30	1		1	
Constr. Week 9	31	1		1	1
	32	1		1	
	33	1		1	
Constr. Week 10	34	1		1	
	35	1		1	
	36	1		1	
Constr. Week 11	37	1		1	
	38	1		1	
	39	1		1	
Constr. Week 12	40	1		1	1
	41	1		1	
	42	1		1	
Subtotals =		**30**	**3**	**30**	**3**

Metal Samples

Primary Samples =	125
Field Blank (FB) Samples =	13
Total Metal Samples =	**138**

	Event	AM1		AM2		AM3		AM4		AM5	
		Primary	FB	Primary	FB	Primary	FB	Primary	FB	Primary	FB
Post-Construction	43	1		1		1		1	1	1	

Notes

Analyze metals on each filter collected during pre-Constr., start-up, and post-Constr. periods

Analyze metals daily on upwind filter and downwind filter with highest average PM10 during Constr. period

Analyze metals on all Field Blank (FB) filters

Air Monitoring Sampling and Analysis Plan - Asbestos

Corporation Yard Landfill Clean Closure, Folsom, CA

	Event	AM1	
		Primary	FB
Pre-Construction	1	1	
	2	1	1
Constr. Week 1 (Start-up Period)	3	1	
	4	1	
	5	1	
	6	1	
	7	1	1
Constr. Week 2 (Start-up Period)	8	1	
	9	1	
	10	1	
	11	1	
	12	1	
	Subtotals =	12	2

	Event	AM1	
		Primary	FB
Constr. Week 3	13	1	
	14	1	
	15	1	
Constr. Week 4	16	1	
	17	1	
	18	1	1
Constr. Week 5	19	1	
	20	1	
	21	1	
Constr. Week 6	22	1	
	23	1	
	24	1	
Constr. Week 7	25	1	
	26	1	
	27	1	
Constr. Week 8	28	1	
	29	1	
	30	1	
Constr. Week 9	31	1	
	32	1	
	33	1	
Constr. Week 10	34	1	
	35	1	
	36	1	1
Constr. Week 11	37	1	
	38	1	
	39	1	
Constr. Week 12	40	1	1
	41	1	
	42	1	
	Subtotals =	30	3

	Event	AM1	
		Primary	FB
Post-Construction	43	1	

Asbestos Samples

Primary Samples =	43
Field Blank (FB) Samples =	5
Total Asbestos Samples =	**48**

F

BROWN AND CALDWELL

APPENDIX F.

CONFIRMATION SAMPLING AND ANALYSIS PLAN

Corporation Yard Landfill Clean Closure

Folsom, California

TABLE OF CONTENTS

FIGURES

ATTACHMENT

1.0 INTRODUCTION

Clean closure construction activities at the City of Folsom Corporation Yard Landfill located at 1300 Leidesdorff Street in Folsom, California (Site) include excavation and removal of fill. Confirmation sampling and analysis shall be conducted by the construction contractor (Contractor) under contract with the City of Folsom (Owner) to document that all fill has been removed and residual concentrations of target parameters do not exceed the cleanup goals established for solid media at the Site. This sampling and analysis plan (SAP) presents the objectives, target parameters, cleanup goals, approach, sampling methods, laboratory analyses, and quality assurance/quality control (QA/QC).

1.1 Objectives

The objectives of the confirmation SAP are to:

- Present a statistically based approach for identifying quantity and location of samples;
- Describe specific requirements for collecting and analyzing samples;
- Confirm that fill is removed and residual concentrations of target parameters are below the cleanup goals from the Site; and
- Provide an iterative procedure to excavate and sample specific areas to achieve final clean closure certification.

1.2 Target Parameters

The landfill waste and former landfill sewage treatment plant pond liner will be removed during construction and there are no indications that underlying dredge tailings have been impacted by Site use. The target parameters in soil/solid media to evaluate during clean closure activities, therefore, are primarily based on elevated groundwater parameters: metals; nitrate; and sulfate. The target metals consist of the 17 metals specified in Title 22 of the California Code of Regulations (22 CCR): antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, silver, thorium, vanadium, and zinc. These metals are referred to as the CAM 17 list.

1.3 Cleanup Goals

The cleanup goals are the primary criteria for determining that fill and any impacted soil have been successfully removed. Thus, if sample concentrations exceed the cleanup goals, further excavation shall be conducted in specific areas until the concentrations are below the cleanup goals. Cleanup goals for metals (CAM 17 list), nitrate, and sulfate in soil/solid media will be proposed in a separate document. The cleanup goals will be developed from statistical analysis of the background soil sampling results from the pre-design field investigation conducted in February 2008.

Cleanup Goals for Target Parameters	
Parameter	**Cleanup Goal (mg/kg)**
Antimony	TBD
Arsenic	TBD
Barium	TBD
Beryllium	TBD
Cadmium	TBD
Chromium	TBD
Cobalt	TBD
Copper	TBD
Lead	TBD
Mercury	TBD
Molybdenum	TBD
Nickel	TBD
Selenium	TBD
Silver	TBD
Thallium	TBD
Vanadium	TBD
Zinc	TBD
Soluble Nitrate as NO_3	TBD
Soluble Sulfate as SO_4	TBD

2.0 CONFIRMATION SAMPLING APPROACH

The confirmation SAP approach is based on the *Sampling Strategies and Statistical Training Materials for Part 201 Cleanup Criteria* prepared by the State of Michigan, Department of Environmental Quality (MDEQ) in 2002. The MDEQ document uses statistical random strategies that employ a grid to facilitate the unbiased selection of sampling points and accepted statistical tools for evaluating the resultant data. The strategies provide a 95-percent confidence level of verifying the presence or absence of hot spots in remediated areas.

2.1 Sample Quantity and Locations

The MDEQ confirmation sampling protocol begins by calculating a grid interval based on the size of the sample area to be remediated and a Site Factor (SF). A different grid interval calculation is provided for each sample area size as shown in the following table. As shown on Figure F-1, the main landfill covers approximately 140,000 ft^2 (3.2 ac) and the uncontrolled fill area covers approximately 50,000 ft^2 (1.1 ac) for a total of 190,000 ft^2 (4.4 ac). Therefore, the grid interval equation for large sample areas was used as shown below.

Grid Intervals Based on Sample Area Size			
Sample Area	**Size (ac)**	**Size (ft^2)**	**Grid Interval (ft)**
Small	Up to 0.25	Up to10,890	Up to 29
Medium	0.25 to 3	10,890 to 130,680	15 to 50
Large	3 +	130,680 +	30 +

$$GI_{Large\ Area} = \sqrt{\frac{A\pi}{SF}} \quad \text{where } GI = \text{grid interval, } A = \text{sample area, } SF = \text{site factor}$$

Summary of Input Parameters and Result			
Sample Area	**Size (ft^2)**	**SF (ft)**	**Grid Interval (ft)**
Main Landfill + Uncontrolled Fill	190,000	870	25

The SF is defined as the length of the area to be grid which is approximately 870 ft. The resulting grid interval was calculated to be 26.2 ft. For simplicity, a grid interval of 25 ft was selected.

Once the grid interval is calculated, the MDEQ protocol continues by superimposing a grid on a map of the remediation area. Each intersection point of the grid is a "node" where samples may be potentially collected. Using a 25-foot grid interval across the landfill sample areas produces a total population of 336 nodes, or potential sampling points, as shown in Figure F-2. Individual nodes can be identified by the Cartesian coordinate system referenced to the origin located southwest of the Site (e.g., X5, Y6). The grid shall be established in the field prior to sampling by a surveyor and shall be maintained until clean closure certification is received.

The MDEQ protocol recommends sampling a minimum of nine samples per remediation area or 25% of the nodes, whichever is larger. A quantity of 84 sampling points was calculated based on 25 percent of the 336 nodes. Prior to confirmation sample collection, 84 node locations shall be randomly selected from the total population of 336 possible node locations by the Owner's Representative. The method of random node selection (e.g., Minitab statistical software output) shall be documented in a short memo to regulatory agencies. Note that the random selection is not presented at this time to avoid influencing the Contractor in conducting clean closure activities.

2.2 Iterative Procedure for Achieving Cleanup Goals

Confirmation sample analytical results shall be compared to the cleanup goals. If all confirmation sample results are at or below cleanups in a specific area, then the remediation (i.e., excavation) for that specific area shall be considered complete. Once a specific area has achieved cleanup goals, the necessary precautions shall be taken to protect that area from recontamination during remediation in adjacent areas.

If any confirmation sample result exceeds a cleanup goal, the extent of the impacted area to be remediated shall be delineated based on additional sampling as shown in Figure F-3. Samples shall be collected from four adjacent nodes (unless previously sampled) and shall be analyzed only for the target parameter(s) that exceeded the corresponding cleanup goal. If any of the four step-out samples contain the subject parameter(s) above the cleanup goal, then additional step-out samples shall be collected and analyzed. This process shall be repeated until the area containing the subject parameter(s) above the cleanup goal has been delineated. The impacted area shall be defined to extend to half-way between a sample location that yielded a parameter concentration above a cleanup goal and a sample location that yielded a parameter concentration below or equal to a cleanup goal.

Once the impacted area is delineated through step-out sampling and analysis, the impacted area shall be remediated (i.e., undergo a second round of excavation). The area that underwent a second remediation shall be re-sampled at the same horizontal locations of the primary confirmation samples as located by the surveyor. If the results of the "re-confirmation" samples collected after the second remediation phase are at or below cleanup goals, then the remediation for the impacted area shall be considered complete. If results of the re-confirmation samples exceed a cleanup goal, the area shall undergo a third (and final) remediation followed by a final round of step-out sampling. When all impacted areas have passed confirmation sampling (or completed a third round of remediation), the Site remediation is considered complete.

3.0 SAMPLING METHODS

This section summarizes field methods the Contractor shall follow for establishment of the sampling grid, sample collection and handling, equipment decontamination, and documentation.

3.1 Establishment of Sampling Grid

Prior to collecting samples, the Contractor shall establish a sampling grid at the Site as shown on Figure F-2. Note that grid node (X6, Y21) is collocated with groundwater monitoring well FCY-5. The Contractor shall arrange for a California-licensed land surveyor to survey all nodes of the grid relative to an established monument. Horizontal positions shall be measured to the nearest 0.1 foot. Vertical positions (after initial excavation) shall be measured to the nearest half foot. The labeling for the surveyed points shall correspond to the node coordinates shown in Figure F-2.

The Contractor shall collect a primary sample at the 84 node locations randomly selected. Random number generation, and thus, sample location selection shall be the responsibility of the Owner's Representative. The Owner's Representative shall perform the random number generation for a given area only after the Contractor communicates that remediation in that area is complete. At each sample location, the Contractor shall collect a soil sample from ground surface to approximately 4 inches below ground surface (bgs). For the purposes of this sampling plan, a soil sample refers to solid media associated with underlying dredge tailings. The sample may be collected by scooping with a stainless steel or plastic disposable shovel, spoon, or hand trowel or similar equipment approved by the Owner's Representative.

3.2 Sample Collection

The following standard operating procedures (SOPs) are provided in Attachment F-1 and provide detailed guidance:

- Soil Sampling
- Sample Handling;
- Sample Preservation;
- Equipment Decontamination;
- Field Notes and Documentation; and
- Investigation Derived Waste Handling Procedures.

These SOPs are generally consistent with the following state and federal guidance documents for soil sampling and sample handling.

- Department of Toxic Substances Control, California Environmental Protection Agency, 1999. *Preliminary Endangerment Assessment Guidance Manual.* June 1999.

- U.S. Environmental Protection Agency, 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA.* Interim Final, October 1988.

- U.S. Environmental Protection Agency, 1990. *Preparation of a U.S. EPA Region 9 Field Sampling Plan for Private and State-Lead Superfund Projects.* Document Control No. 9QA-06-89, 1990.

The Contractor may seek clarification on sampling procedures by referring to these regulatory documents.

The Contractor shall be responsible for performing all sampling and related activities described in this plan in accordance with the SOPs and under the observation of the Owner's Representative. The Contractor shall ultimately provide all certified laboratory analytical reports and chain-of-custody forms to the Owner's Representative for final approval.

In addition to primary samples, the Contractor shall collect QA/QC samples consisting of field replicate samples and matrix spikes/matrix spike duplicates (MS/MSD) samples. One field replicate sample and one MS/MSD sample shall be collected for every 20 primary samples, or fraction thereof. This requirement increases the total sample quantity by 10%. Note that if step-out and re-confirmations samples are required, QA/QC samples must be collected at the same frequency. The field replicate and MS/MSD samples shall be analyzed for the same target parameters as the primary samples. The field replicate and MS/MSD samples shall be collected from the same depth interval and within 1 foot of the primary sample. If a sufficient sample volume cannot be collected for the field replicate or MS/MSD sample, the Contractor shall randomly select another node location for field replicate or MS/MSD sample collection.

Between each sample collection, the Contractor shall employ rigorous decontamination procedures. Sampling equipment that is reused shall be cleaned with soap and water in a triple-rinse wash. The first wash shall consist of scrubbing the equipment with a non-phosphate detergent and water. The water shall be changed regularly to minimize carrying residue into the next wash. For the second wash, the Contractor shall rinse the equipment in clear tap or de-ionized water. Again, the water shall be changed frequently to minimize carrying residue into the next wash. For the third wash, the Contractor shall rinse the equipment in de-ionized or distilled water only. After cleaning, equipment shall be stored on a clean surface such as plastic sheeting. The Contractor shall document the disposal method of the decontamination water and may use the water for dust control.

Each sample shall be packaged in a clean, laboratory supplied glass jar with a screw-on cover. The sample containers shall be labeled with the sample identification, sample date and time, and the sampler's initials and placed in an iced cooler for transport under chain-of-custody to an analytical laboratory. The sample identification shall consist of the grid node coordinates (e.g., a sample collected at node location (X10,Y16) shall be identified as "X10Y16").

As samples are collected, the Contractor shall record the sample information in the field logbook and on a chain-of-custody form. The chain-of-custody form shall include the sample identification as described previously, date and time of sampling, quantity and type of containers, and list of analyses to be performed. These documents shall be completed onsite and shall accompany the samples through transportation and laboratory analysis.

4.0 LABORATORY ANALYSES

The Contractor shall submit the samples to an analytical laboratory that is certified by the Environmental Laboratory Accreditation Program (ELAP), administered by the California Department of Health Services. The laboratory must have a current ELAP certification for analysis of the target metals by U.S. EPA Methods 6010B, 6020, and 300.

The Contractor may not direct the laboratory to use alternate laboratory methods unless the Contractor has received prior written approval from the Owner's Representative and regulatory agencies.

The laboratory shall crush and homogenize each sample prior to analysis. To assess its analytical performance, the Contractor's laboratory shall implement QA/QC procedures. For each batch of samples (i.e., samples that are prepared and analyzed together), the laboratory shall conduct the following activities:

- Review the chain-of-custody documentation;
- Check holding time compliance;
- Determine whether adequate or required batch QC samples were analyzed and reported according to method specifications (i.e., method blanks, laboratory control samples [LCS], and MS/MSD samples);
- Assess LCS and laboratory control sample duplicate (LCSD) sample recoveries and relative percent differences (RPDs);
- Evaluate method blank contamination; and
- Assess MS/MSD recoveries and RPDs.

The laboratory shall document the results of the activities listed above in the laboratory narrative portion of the standard data package. For 10 percent of all samples, the laboratory shall submit a full data validation package to the Owner's Representative. The data validation package shall meet the Level IV requirements of the Contract Laboratory Program (CLP) specified in the *National Functional Guidelines for Inorganic Data Review, 540-R-01-008* prepared by the U.S. EPA in July 2002.

5.0 QA/QC CRITERIA

The QA/QC criteria in this Confirmation Sampling Plan are specified for the analytical methods, replicate samples, and split samples.

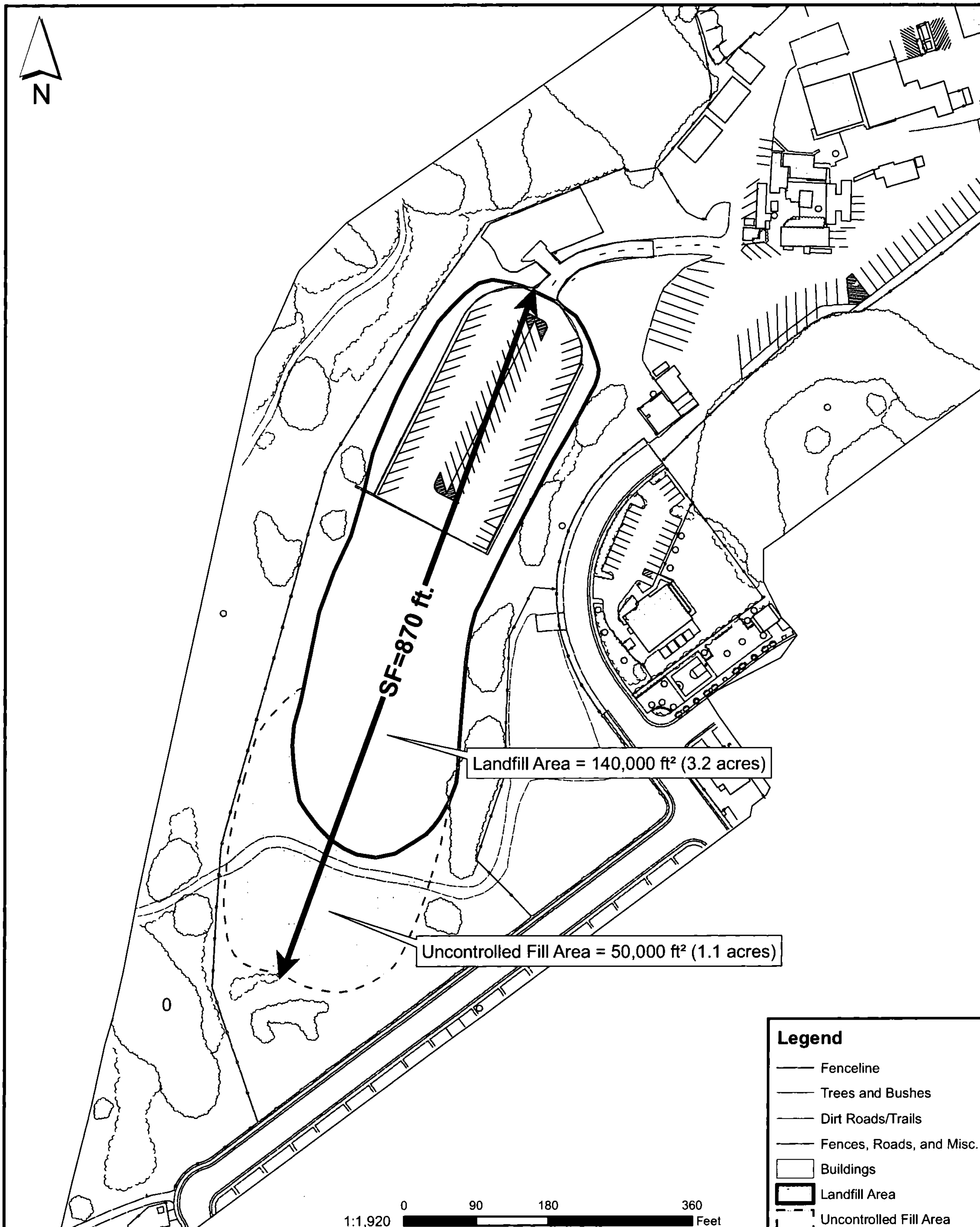
- <u>Analytical Methods</u>: The acceptable QA/QC criteria are provided in the following tables for each analytical method and target parameter.
- <u>Field Replicate Samples</u>: If either the primary sample or the field replicate sample contains concentrations of target parameters that exceed cleanup goals, then that sample location shall require additional remediation according to the procedures previously specified.

QA/QC Criteria for Analytical Methods – Metals						
			LCS/LCSD		MS/MSD	
Analytical Method	Metal	PQL (mg/kg)	Recovery (%)	RPD (%)	Recovery (%)	RPD (%)
EPA 6010B	Antimony	2.5	75 -125	30	75 - 125	30
EPA 6020/7000	Arsenic	10	75 -125	25	75 - 125	30
EPA 6010B	Barium	2	80 -120	20	75 - 125	25
EPA 6010B	Beryllium	0.5	75 -125	25	75 - 125	30
EPA 6010B	Cadmium	0.5	75 -125	25	75 - 125	30
EPA 6010B	Chromium	1	75 -125	25	75 - 125	30
EPA 6010B	Cobalt	1	75 -125	25	75 - 125	30
EPA 6010B	Copper	1	75 -125	25	75 - 125	30
EPA 6010B	Lead	2.5	75 -125	25	75 - 125	30
EPA 7471	Mercury	0.1	75 -125	25	75 - 125	25
EPA 6010B	Molybdenum	1	75 -125	25	75 - 125	30
EPA 6010B	Nickel	1	75 -125	25	75 - 125	30
EPA 6020/7000	Selenium	0.25	80 -120	20	75 - 125	25
EPA 6010B	Silver	0.5	75 -125	25	75 - 125	30
EPA 6020/7000	Thallium	1	75 -125	25	75 - 125	30
EPA 6010B	Vanadium	1	75 -125	25	75 - 125	30
EPA 6010B	Zinc	1	75 -125	25	75 - 125	30

PQL = practical quantitation limit

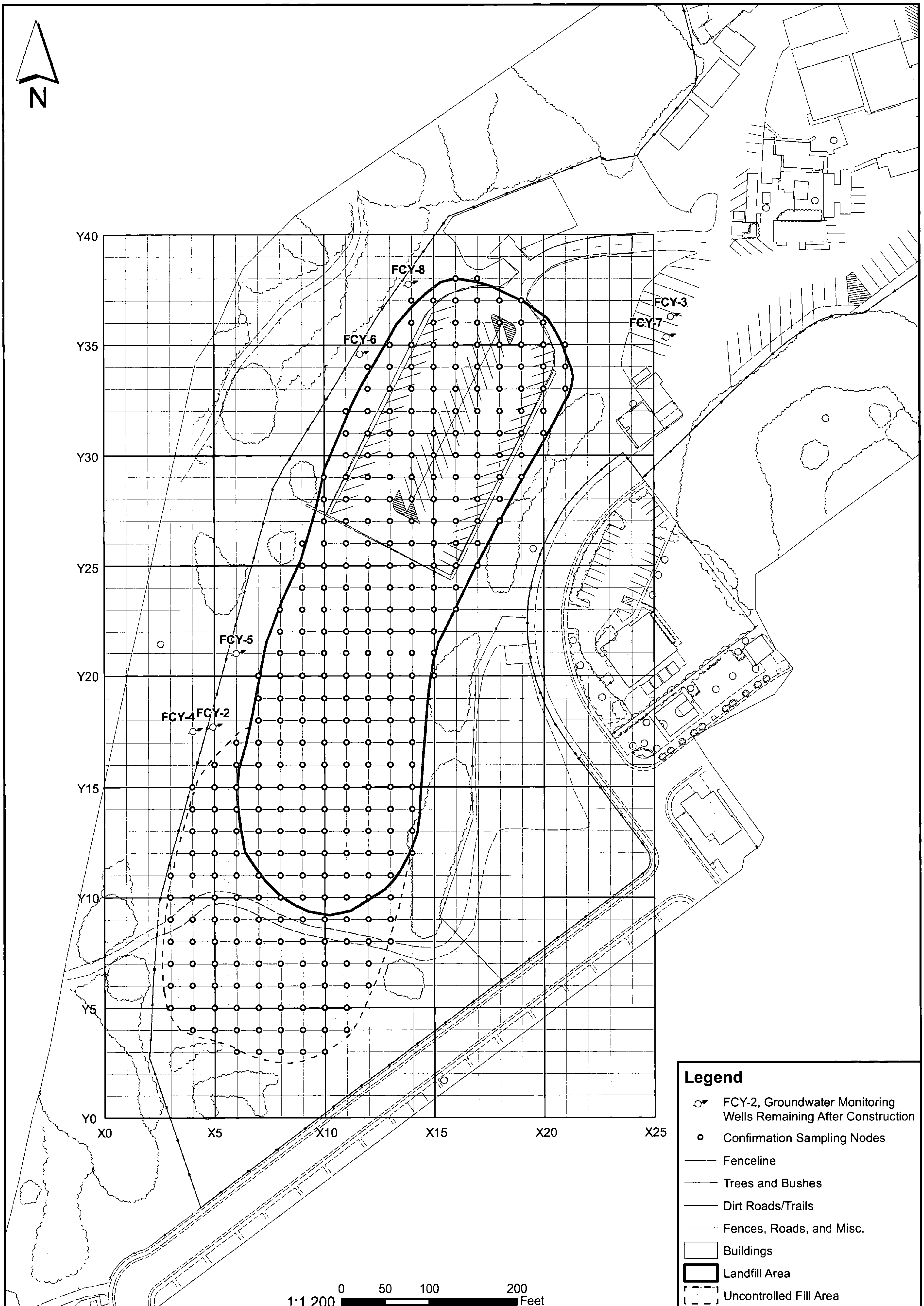
QA/QC Criteria for Analytical Methods – Other Parameters						
			LCS/LCSD		MS/MSD	
Analytical Method	Metal	PQL (mg/L)	Recovery (%)	RPD (%)	Recovery (%)	RPD (%)
EPA 300(1)	Nitrate	0.5	75 -125	25	75 -125	30
EPA 300(1)	Sulfate	1.0	75 -125	25	75 -125	30

(1) DI WET sample prep. (waste extraction test sample preparation using de-ionized water)



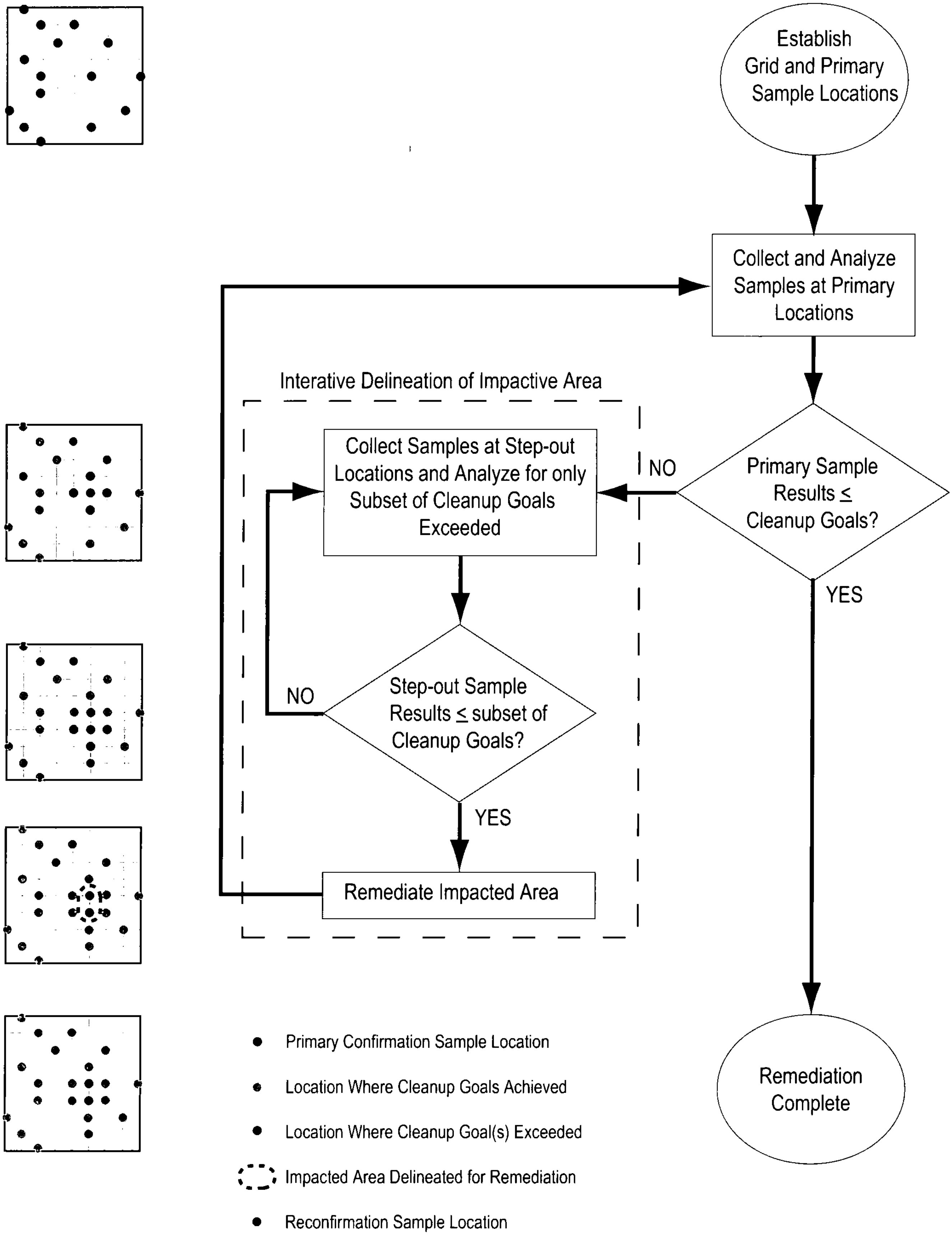
	PROJECT	TITLE	
BROWN AND CALDWELL	134473	Site Factor for Confirmation Sampling Grid	Figure
	DATE	SITE	
	1-24-08	Corporation Yard Landfill Clean Closure, Folsom, CA	F-1

FILE: \\Bcsac-nas01\GIS\Folsom\Folsom Landfill\Figure F-1 - Site Factor for Confirmation Sampling Grid.mxd



BROWN AND CALDWELL	PROJECT 134473	TITLE Grid and Nodes for Possible Confirmation Sampling	Figure F-2
	DATE 1-24-08	SITE Corporation Yard Landfill Clean Closure, Folsom, CA	

FILE: \\Bcsac-nas01\GIS\Folsom\Folsom Landfill\Figure F-2 - Grid and Nodes for Possible Confirmation Sampling.mxd



BROWN AND CALDWELL

PROJECT	TITLE	Figure
134473	Interative Procedure for Achieving Cleanup Goals	F-3
DATE 2-4-08	SITE Corporation Yard Landfill, Folsom, CA	

P:\134000\134473 - Folsom Landfill Clean Closure\Clean Closure Plan\Figures

ATTACHMENT F-1.

STANDARD OPERATING PROCEDURES (SOPs)

Soil Sampling

Sample Handling

Sample Preservation

Equipment Decontamination

Field Notes and Documentation

Investigation Derived Waste Handling Procedures

Brown and Caldwell
Standard Operating Procedure

Soil Sampling

Revision 1.1
Revision Date: October 9, 2001

Prepared/Revised by:	**Wendy Linck** Name	**October 9, 2001** Date
Senior QA Review:	Gary Lucas Name	10/26/01 Date
Regional Quality Officer:	David Van Winkle Name	October 26, 2001 Date

SOIL SAMPLING

TABLE OF CONTENTS

1.0 PURPOSE

The objective of this standard operating procedure (SOP) is to provide standardized methods for the field collection of soil samples using manual or rig-assisted techniques.

2.0 SCOPE AND APPLICABILITY

This procedure specifies the methods to be followed by the field personnel for the collection of surface and subsurface soil samples. The collection techniques and equipment selected are dependent on the nature of subsurface soil conditions (i.e., degree of consolidation and moisture content), depth of the desired sample, type of sample required, type of soil being sampled, and analytical and/or geotechnical laboratory testing methods that will be requested for the sample.

Soil samples are used to determine the physical, hydrogeologic, and chemical properties of site soil. Analytical data aid in the characterization of the site, identification of hazardous substance source areas, and determination of the nature and extent of contamination. Typically a project Work Plan will be prepared that details sample locations, numbers, analytical methods, and specific field techniques that may be required. Different SOPs will be referenced in the Work Plan to provide detailed descriptions of how each procedure will be conducted. The project Work Plan may or may not include a field sampling plan (FSP) and Quality Assurance Project Plan (QAPP) based on client requirements. Proper sampling techniques, proper selection of sampling equipment, and proper decontamination procedures as outlined in the project Work Plan eliminates cross-contamination and introduction of contaminants from external sources.

Detailed records will be maintained during sampling activities, particularly with respect to location, depth, color, odor, lithology, hydrogeologic characteristics, and readings derived from field monitoring equipment. These records will be prepared following the Brown and Caldwell SOP for Field Documentation. All soils are classified in the field by a geologist, hydrogeologist, or soil scientist using the Unified Soil Classification System (USCS), and as described in SOP 3.0 Field

Classification and Description of Soils. Color of the samples is determined in the field using a Munsell Color Chart.

3.0 RESPONSIBILITIES

The Project Manager develops or directs the preparation of a Work Plan, which describes the sampling procedures to be used and ensures that the procedures achieve the objectives of the investigation.

The Field Supervisor ensures that soil samples are collected according to procedures outlined in the project Work Plan or provides rational and justifiable decisions in circumstances where deviations from the project Work plan are necessary due to field conditions or unforeseen problems. The field supervisor also ensures that samples are handled, labeled, and shipped according to procedures outlined in the project Work Plan.

Field personnel are responsible for implementing this SOP as stated, and following the Work Plan requirements for sampling, QA/QC sample collection and frequency, and following other Brown and Caldwell SOPs for field sample shipment and handling.

4.0 DEFINITIONS

<u>Surface soil</u> is generally considered to be the top 6 inches of a soil horizon profile (i.e., soil from 0-to-6-inches below ground surface [bgs]). Depending on the program or project, however, soil to 2 feet bgs may be considered surface soil. For the purposes of this procedure, surface soil represents the soil occurring from 0- to- 6-inches bgs.

<u>Subsurface soil</u> represents the soil occurring between surface soil and bedrock.

<u>Composite soil samples</u> are combinations of aliquots collected at various sample locations, or at various depths at a single location. Analysis of composite samples yields a value representing an average over the various sampled sites or depths from which individual samples were collected.

Discrete soil samples are discrete aliquots from distinct sampling intervals, of a specific size, that are representative of one specific sample location at a specific point in time.

Continuous samplers are devices that allow a soil specimen to enter a split barrel during drilling. Both plastic and steel liners can be used inside the sample tube to retain the sample. In some formations, the soil sample may be considered "undisturbed."

Split-barrel samplers collect samples by driving a 1.5-inch nominal inner diameter (typical), split barrel into a soil formation with a 140-pound hammer dropped 30 inches. For environmental applications, 2-, 2.5- and 3-inch inner diameter split barrels are not uncommon. If a standard 1.5-inch split barrel is used, the number of blows to drive the last 1 foot of the sample are referred to as the standard penetration resistance or N-value. See ASTM D-1586 for the specification for this type of sampler. Another type of split barrel sampler is the core barrel. A core barrel is longer and usually wider in diameter than the typical split barrel samplers and used on hollow stem auger drill rigs. Core barrels are usually 5 feet long and approximately 4-inch outside diameter, which sit into the leading auger and collect soil while drilling. Core barrels are typically unlined.

Ring-lined samplers are split barrels lined with removable rings. The rings are thin-walled and arranged in 1-, 2- or 6-inch increments to section the recovered soil sample. This device is used to collect soil samples for environmental applications and to collect relatively undisturbed soils in stiff and hard cohesive soils where it is not possible to push a sampler. See ASTM D3550 for the specification for this type of additional sampler.

Thin-walled tubes are used to recover relatively undisturbed soil samples by pressing the tubes into soil either hydraulically, or with a Denison or Pitcher sampler.

5.0 REQUIRED MATERIALS

Equipment used during manual collection of surface or subsurface soil samples may include a wide variety of tools depending upon the type of sampling and methods being used. This equipment can include, but is not limited to the following:

- Hand lens
- Stainless steel spoons/trowels and stainless steel hand augers
- Stainless steel split-spoon, split-barrel or continuous sampler
- Brass or stainless steel sampling sleeves, if applicable
- Encore™ Sampler T-bar and samplers (5 gram or 25 gram size), if applicable
- Field Balance accurate to 0.01 gram and VOA vials, and preservatives for field preservation of VOC vials under EPA 5035, if applicable
- Stainless steel bowls and pans, if applicable
- Silicon Tape, strapping tape, duct tape
- Field notebook or logbook
- Ball point pen
-
- Paper towels or Kimwipes
- Aluminum foil
- Teflon sheets
- Appropriate decontamination equipment
- Appropriate health and safety equipment
- Appropriate sample containers and labels, sample coolers and ice
- Chain of Custody forms
- Munsell soil color charts and grain size charts

6.0 PROCEDURE

This section identifies important preparations that should be made before initiating a soil sampling event and describes the steps that should be followed during soil sample collection at environmental sites.

Surface soil samples are defined in this procedure as samples collected from 0 to 6 inches below ground surface (bgs) or the first 2 inches of soil below a surficial layer of vegetation. These samples can be obtained easily using manual methods (i.e., a spade, trowel and scoop, or hand-auger). Surface soil samples can also be obtained with the assistance of a drilling rig equipped with a split-barrel sampler. The split-barrel sampler may be either unlined or lined with brass or stainless steel thin-wall sleeves.

Subsurface soil samples to be collected from depths greater than 6 inches bgs can be obtained manually using a hand-auger, a drilling rig, or excavating device (e.g., backhoe). A split-barrel sampler can be employed to depths in excess of 100 feet bgs with the assistance of a drilling rig. An excavating device can provide bulk soil samples from the ground surface to the limits of the excavator (typically 15 to 25 feet bgs . For bulk soil sampling at greater depths in unsaturated soils, a bucket auger rig may be used.

Composite soil samples are combinations of aliquots collected at various sample locations, or at various depths at a single location. Analysis of composite samples yields a value representing an average over the various sampled sites or depths from which individual samples were collected. Composite soil sampling is typically used in sampling soil for the characterization of investigation derived waste for disposal purposes. Other uses of composite sampling is in characterization of large surface area where a material may have been distributed.

6.1. Preparation for Soil Sample Collection

Preparation for the field collection of surface and subsurface soil samples shall commence with an assessment of ground surface conditions (e.g., undeveloped, vegetated or not vegetated, paved or unpaved, type and thickness of any pavement present) and subsurface conditions (e.g., soil types present, degree of consolidation, moisture content, depth of groundwater). Information available to assess these conditions may include regional soil survey reports by the USDA Natural Resources Conservation Service and/or borehole or test-pit/trench logs maintained during previous geological, geotechnical, or environmental investigations.

If a point designated for soil sample collection is overlain by abundant vegetation, it may be necessary to clear the area before sampling to provide access. If the sampling point is overlaid with concrete pavement, it is necessary to arrange for a cement cutter/corer to remove the paving material prior to sampling (cement cutting services are available through construction support or drilling subcontractors).

Prior to field collection of soil samples, the Project Manager (PM), Task Manager (as appropriate), and field personnel shall also perform the following tasks.

- Conduct a general site reconnaissance in accordance with the site-specific safety and health plan.
- Mark or identify all sampling locations using stakes, markers, or flags. If required, a proposed sampling location may be adjusted based on access, property boundaries, surface obstructions, and subsurface utilities.
- Determine the extent of the monitoring and sampling effort, analytical methods to be requested for each sample, sample container types required, sampling methods to be used, and specific equipment and supplies necessary to conduct the monitoring and sampling.
- Prepare all field forms as appropriate (field logbooks, pre-prepared Chain of Custody records and labels, etc.)
- Determine required monitoring equipment (e.g., photoionization detector, vapor detection tubes) and personal protective equipment (PPE) required for the health and safety of personnel.
- Obtain the necessary sampling and monitoring equipment and ensure it is in working order.
- Prepare field sampling schedules, provide these schedules to the client (if required), subcontractors, and regulatory agencies (if required), and

coordinate field sampling activities with their designated representatives.

- Perform an underground utility clearance of all staked sampling locations prior to excavating or drilling.
- Conduct a readiness review to the tier necessary as defined by the PM following Brown and Caldwell's SOP for Readiness Reviews.

6.2. Manual Soil Sample Collection

The following sections describe the specific steps that the environmental engineer/geologist shall follow when collecting surface and subsurface soil samples.

6.2.1. Collection of Surface Soil Samples

Tools such as spades, shovels, trowels, scoops, or spoons can be used to collect most surface soil samples, however, the sampler should be certain the sampling tools are not made out of a material that may effect the sample results (e.g., galvanized metal should not be used to collect metals samples and plastic should not be used to collect semivolatile organic samples).

For densely packed soils, and to collect discrete surface soil samples, it may be necessary to use a hand auger (Section 6.2.2), or a drilling rig (Section 6.3). Also, if relatively undisturbed samples are required, a flat, pointed, mason trowel can be used to cut a block sample of the desired soil. The procedure is as follows:

1. Prior to beginning sampling, don clean disposable nitrile or latex surgical gloves and impervious outer gloves to prevent cross-contamination and to provide personal protection. New gloves should be donned for sample collection at each new location or whenever gloves are torn or otherwise compromised.
2. Carefully remove the top layer of vegetation, soil or debris to the desired sample depth with a decontaminated spade, shovel, or equivalent.

3. Using a decontaminated, stainless steel scoop, plastic spoon, or trowel, remove and discard a thin layer of soil from the area that came in contact with the spade. Also discard any pebbles, roots and other large objects that may be present in the sample material.

4. If a composite sample is required, place the sample into a stainless steel or other appropriate container and mix thoroughly to obtain a homogenous sample representative of the entire depth interval sampled. However, volatile organic samples are the exception; samples being analyzed for volatile organic compounds must be taken from discrete locations prior to mixing. This practice is necessary to prevent loss of volatile constituents and to preserve, to the extent practicable, the physical integrity of the volatile fraction. The process of homogenization is described below. After homogenization, place the sample into an appropriate container, as specified in the project Work Plan, and secure the cap tightly.

   - If the sample is to be analyzed for volatile organic compounds (VOCs), transfer a portion of the sample directly (i.e., without homogenization) into the appropriate sample container with a stainless steel spoon, plastic spoon, or equivalent, and secure the container cap tightly. The sample container should be sealed with Teflon sheeting and capped with rubber caps in order to prevent VOCs from escaping. Alternatively, sampling using EPA Method 5035 may be used (Section 6.4).

   - Place a sample from each sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into the appropriate sample container(s) and secure the cap tightly.

   5.0 Homogenization of the sample for remaining parameters may be necessary to create a representative sample volume if sample heterogeneity is not being evaluated. Moisture content, sediments, and waste materials may inhibit the ability to achieve complete mixing prior to filling sample containers. Therefore, when homogenization is requested, it is extremely important that soil samples be mixed as thoroughly as possible to ensure that the sample is a representative as possible of the sample location. When homogenization is requested, the following procedure should be followed:

5.1 The soil is extruded from the sampling apparatus (i.e., drive sampler) or collected by a stainless steel trowel and emptied into the decontaminated stainless steel tray or bowl. Homogenization should be accomplished by then mixing with a decontaminated stainless steel or Teflon® instrument.

5.2 The method of choice for mixing is referred to as quartering and can be performed in a bowl or tray of an appropriate material (material depends on the parameters to be analyzed for). The soil in the sample pan is divided into quarters. Each quarter is mixed, then all quarters are mixed into the center of the pan. This procedure is followed several times until the sample is adequately mixed. If round bowls are used for sample mixing, adequate mixing is achieved by stirring the material in a circular fashion and occasionally turning the material over.

5.3 The extent of mixing required will depend on the nature of the sample and should be done to achieve a consistent physical appearance prior to filling sample containers.

5.4 Once mixing is completed, the sample should be divided in half and containers should be filled by scooping sample material alternatively from each half.

5.5 Potential Problems

(1) The higher the moisture or clay content, the more difficult it is to homogenize the sample.

(2) A true homogenization of soil, sediment, or sludge samples is almost impossible to accomplish under field conditions.

6. If a composite sample is not required, then the soil can be transferred directly into the sample containers. Attach a sample label to the container using the sample numbering system described in the Project Work Plan and the sample identification numbers generated for the specific locations.

7. Describe the sample following procedures outlined in Brown and Caldwell's SOP for Borehole Logging.

8. Record required field logbook and sample custody information as specified in Brown and Caldwell's SOP for Field Documentation. Package the samples and prepare for transfer or shipment in accordance with Brown and Caldwell's SOP for Environmental Sample Handling.

9. Mark the sample location with a numbered stake or other type of marker. If possible, photograph the sample location.

10. Sketch the sample location in the field logbook. If the proposed sampling point was relocated due to conditions encountered in the field, indicate both the original and actual sample locations on the site map, and record the reason for its relocation in the logbook.

11. Decontaminate sampling equipment in accordance with Brown and Caldwell's SOP for Equipment Decontamination.

12. After a sampling round is complete, survey all sample locations to determine the ground surface elevation and horizontal coordinates.

6.2.2. Soil Sampling with a Hand Auger

The equipment used for this manual method of soil sampling consists of an auger, a series of extensions, and a T-handle. The auger is used to bore a shallow hole to the desired sampling depth. The auger is then withdrawn, and the sample is collected by inserting a manual drive sampler (split-barrel) with brass or stainless steel sampler sleeves, and driving ahead of the auger hole. The typical sampler is a single shoe that contains one 6-inch sleeve or two 3-inch sleeves. Several types of hand augers are available, including tube, continuous-flight (screw), and posthole augers.

- With continuous-flight augers, the sample can be collected directly from the flights. Continuous-flight augers are satisfactory for use when a composite of the complete soil column is desired. This is not appropriate for depth discrete sampling.
- Posthole augers have limited utility for sample collection because they are designed to cut through fibrous, rooted, and/or swampy soils.

The following procedure is provided for manual collection of soil samples with a tube auger, as shown in Attachment A.

1. Don clean disposable nitrile or latex surgical gloves to prevent cross-contamination and to provide personal protection. New gloves should be donned for sample collection at each new location or whenever gloves are torn or otherwise compromised.

2. Check and clear each subsurface soil sample location prior to intrusive activities using as-built drawings, geophysical surveys (e.g. ground penetrating radar), or have clearances performed by the local utility company.

3. Clear the area to be sampled of any surface debris (e.g., twigs, rocks, litter). If a surface soil sample is to be collected, the environmental engineer/geologist shall follow the procedure for surface soils presented in Section 6.2.1. Before advancing the auger, it may be advisable to remove the first 3 to 6 inches of surface soil over a radius of approximately 6 inches around the borehole.

4. Attach the auger bit to a drill rod extension, and attach the T-handle to the drill rod.

5. Begin augering, periodically removing and depositing accumulated soils into an appropriate investigation-derived waste storage or transfer container. Temporary storage on plastic sheeting is appropriate, if identified in a project Work Plan or Waste Management Plan.

6. After reaching the desired depth, slowly and carefully remove the auger from the borehole.

7. Decontaminate the split-barrel sampler and sleeves (if required) in accordance with Brown and Caldwell's SOP for Equipment Decontamination. Place the decontaminated sampler sleeve(s) into the sampler barrel. The sampler barrels are generally 6 inches in length and can hold one 6-inch or two 3-inch sleeves. Assemble the sampler by aligning both sides of the barrel and then attaching the drive shoe and head to the barrel's bottom and top, respectively. Some drive samplers are a two-piece unit – the shoe, which contains the sleeve and the head. For these samplers, the head is aligned with the shoe and threaded onto the head. The impact driver is threaded onto the head. Extensions may be added between the impact driver and the sampler for depths greater than 2 feet.

8. If a lined soil sampler is to be used, decontaminate the sample sleeves according to Brown and Caldwell's SOP for Equipment

Decontamination. Store decontaminated sample sleeves in aluminum foil or on clean plastic sheeting as project requirements dictate prior to assembling the split-barrel sampler.

9. Carefully lower the drive assembly into the borehole, then drive it until the sleeve(s) are advanced into the undisturbed soil below the borehole.

10. Retrieve the sampler from the borehole and disassemble it. Remove the sample from the unlined sampler and transfer it to the appropriate container(s) or remove the sleeve from the sampler, and submit each sample sleeve as stipulated in the Project Work Plan.

11. For sample sleeves, seal the ends of each sample sleeve with Teflon™ sheeting and tightly fitting plastic end caps. The end caps shall then be held in place with silicone tape or other U.S. EPA-approved sealing tape. Electrical or duct tape **shall not** be used.

12. For sampling using EPA Method 5035, samples may be collected directly from the middle or bottom sleeve with the EnCore™ sampler, or aliquots placed into VOA vials and preserved as discussed in Section 6.4.

13. If another sample is to be collected at a greater depth in the same borehole, reattach the auger bit to the drill and assembly, and follow the steps above. Decontaminate the auger between samples.

14. Attach a sample label(s) to the container(s) using the sample numbering system described in the Project Work Plan and the sample identification numbers generated for the specific locations.

15. Abandon the borehole according to applicable state, county, and local regulations and Brown and Caldwell's SOP for Borehole Abandonment and Monitoring Well Destruction.

16. Follow Steps 7 through 12 of Section 6.2.1.

If vertical composite samples are desired, aliquots of soil should be collected at more than one sampling depth and placed in a single collection container prior to mixing. Mixing is then performed using the procedures outlined in the surface soil composition section (Section 6.2).

6.3. Subsurface Soil Sampling with a Drilling Rig

Most often, when subsurface soil sampling is required at depths exceeding 5 feet bgs, a drilling subcontractor is used to help obtain the samples. Several drilling methods may be employed to collect the samples. Regardless of the drilling method, a 2-inch or 2.5-inch internal diameter split-barrel sampler (Attachment B) is often used to collect samples at depth. The split barrel sampler is attached to the appropriate drive-weight assembly, is positioned at the desired sampling depth and driven by repeated blows of a 140-pound hammer with a free-fall of 30 inches in general accordance with ASTM D1586 or with a pneumatic air hammer. Generally, split-barrel samples are 18 inches in length, but longer samples are also available.

Soil samples to be submitted to an analytical laboratory for testing may be collected in an unlined split-barrel sampler and transferred to sample containers as appropriate for shipment to the laboratory. However, the preferable method is to collect soil samples using a split-barrel sampler lined with thin-wall brass or stainless steel sleeves. This method allows for the collection of samples for chemical and physical properties or geotechnical analysis. Soil samples to be analyzed for metals shall be collected in stainless steel sleeves. Six-inch, 3-inch, or combinations of both sizes of sleeves can be used to line the split-barrel sampler. The procedures are outlined in the following sections.

Some of the procedures included in the following subsections are performed by the drilling subcontractor. Any procedure that deals with the apparatus (e.g. drill rig, split barrel samplers, drill rods) and services (e.g. drilling the boring and collection of soil samples) provided by the drilling subcontractor is operated by that subcontractor, who is qualified to do so.

6.3.1. Split-barrel sampler

1. Don clean disposable surgical nitrile or latex gloves to prevent cross-contamination and to provide personal protection. New gloves should be donned for sample collection at each new location or whenever gloves are torn or otherwise compromised.

2. Clear the ground surface of any surface debris (e.g., twigs, rocks, litter) or pavement prior to initiating drilling and sampling operations.

3. Decontaminate the split-barrel sampler and sleeves in accordance with Brown and Caldwell's SOP for Equipment Decontamination.

4. Place the decontaminated sampler sleeve(s) into the sampler barrel. Assemble the sampler by aligning both sides of the barrel and then attaching the drive shoe and head to the barrel's bottom and top, respectively.

5. Attach the soil sampler to the drill rod assembly and advance it 18 inches bgs or the total length of the sampler.

6. Retrieve the sampler from the borehole and disassemble it. Remove the bottom 6 inches of the sample from the unlined sampler and transfer it to the appropriate containers. If sample sleeves are used and full recovery is achieved, typically, the middle sleeve shall constitute the soil sample for analytical analysis. The ends of the middle sleeve should be quickly noted for lithological descriptions, the sample prepared for shipment and the remaining soil from the remaining sleeves used to describe the soil for that drive interval. The sleeve used for analytical analysis is dependent on the purpose of the sampling. Consult the PM for direction. If the soil is the litholgically the same throughout the interval, the less disturbed sample should be used for analytical analysis. The number of sleeves to be sent depends upon project analytical requirements. The top

sleeve or top portion of the sampler is often material that has fallen back in the borehole and is not characteristic of the sample depth. If inadequate sample recovery is obtained, use material from the bottom sleeve first, followed by whatever material is in other sleeves, or attempt to recollect the sample. Sleeve samples shall also be packaged and handled in accordance with Brown and Caldwell's SOP for Environmental Sample Handling.

7. When collecting subsurface soil samples, advance the drill bit and rod assembly to the top of the next desired sampling interval. After removing any excess cuttings from the borehole and tripping the drill bit out of the borehole, attach the empty decontaminated soil sampler to the drill rod assembly and lower it into the borehole.

8. Mark the drill rods in successive 6-inch increments so that the advance of the soil sampler can be easily observed by the environmental engineer/geologist. Advance the split-barrel sampler the required distance (generally 18 inches) with blows from the hammer.

9. Count the number of blows applied for each 6-inch increment of sampler advance into subsurface soils and record this information on the borehole log in accordance with Brown and Caldwell's SOP for Field Documentation and Borehole Logging. Sampler refusal is generally indicated if more than 50 blows are required to advance the sampler 6 inches.

10. If an orientated geotechnical sample is required, mark each of the sample sleeves, if used, with a "T" and a "B," using a wax crayon or a pen with indelible ink, to indicate stratigraphic "top" and "bottom," respectively. Log the exposed soil at the ends of each sample sleeve other than the lowest in accordance with Brown and Caldwell's SOP for Borehole Logging.

11. Without disturbing the sample, seal the ends of each sample sleeve with Teflon sheeting and tightly fitting plastic end caps. The end caps may then be held in place with silicone tape.

12. If another soil sample is to be collected at a greater depth in the same borehole, drill to the desired depth, reattach the split-barrel sampler to the drill rod assembly, and follow Steps 5 through 8 above. Be sure to decontaminate the sampler between samples.

13. Label sample sleeves using the sample numbering system described in the Project Work Plan and the sample identification numbers generated for the specific locations. The sample identification number for split-barrel samples shall include the sample depth, accounting for the appropriate incremental depth based on the location of the sleeve within the split-barrel sampler. Record other required field logbook information as specified in Brown and Caldwell's SOP for Field Documentation.

14. Follow Steps 15 and 16 of Section 6.2.2.

6.3.2. Continuous sampler (Physical characterization only – not for analytical sampling)

1. Don clean, disposable nitrile or latex surgical gloves to prevent cross-contamination and provide personal protection. New gloves will be donned for sample collection at each location, or whenever gloves are torn or otherwise compromised.

2. Using the drilling equipment (e.g., hollow stem augers), advance the soil boring to the depth immediately above the sampling interval.

3. Attach the continuous sampler to the rods or cable and insert into the hollow-stem augers (or casing) and lower it to the bottom of the borehole.

4. Advance the sampler ahead of the augers into the undisturbed sampling interval.

5. Retrieve and split open the sampler.

6. Log the samples in accordance with Brown and Caldwell's SOP for Borehole Logging.

6.4. Field Sampling Using EPA 5035

Collection and storage of soils for VOC analysis using current US EPA methodology has changed since the promulgation of SW846 Method 5035. The EnCore™ Sampler is one of three collection options promulgated from the change in SW846 Method 5035. The other two collections are Acid Preservation and Methanol Preservation. The other two methods are employed only if field constraints are such that samples cannot be shipped and received by a laboratory within 24 to 36 hours of sampling. EPA Method 5035 calls for the preservation of samples if analysis cannot occur within 48 hours. To allow adequate time for the laboratory to preserve the samples if necessary, the laboratory should receive them within **24 to 36 hours of collection**. This section describes the proper procedures and methods to be employed in the collection and shipment of soil samples collected under EPA Method 5035.

Innovative Technologies (1-888-411-0757) is at this time the only supplier of the Encore™ sampler. Detailed information from Innovative Technologies about the Encore sampler™ is provided in Attachment C.

6.4.1. Collection of samples for Low Level Analyses (> 1 μg/Kg)

Each sample point requires two 5g samplers, one 25g sampler or one 5g sampler for screening and/or high level analysis, one dry weight cup, one T-handle and paper towels. The number of samplers required may be different from these typical numbers based on the QAPP requirements for the project. The Project chemist should be consulted in determining the number of Encore™ samplers required for the project. The procedure is as follows:

1. Remove sampler and cap from package and attach T-handle to sampler body. Make sure that the sampler is locked into place in the T-handle.

2. Quickly push sampler into a freshly exposed surface of soil until the sampler is full. The sampler is full when the o-ring is visible in the hole on the side of the T-handle.

3. Use paper towel to quickly wipe the sampler head so that the cap can be tightly attached.

4. Push cap on with a twisting motion to attach cap.

5. Place sampler into the package.

6. Fill out label and attach to the package, where specified for the label..

7. Repeat procedure for the other two samplers.

8. Collect dry weight sample – fill container. If other samples (non-Encore™) are collected for the same sampling interval, the dry weight sample may be designated and analyzed using the other sample.

9. Store samplers at 4 degrees Celsius.

10. Ship sample containers with plenty of ice to the laboratory. Samples must arrive at the laboratory **within 40 hours** of collection.

6.4.2. Acid Preservation Sampling for Low Level Analyses (≥ 1 µg/kg).

This procedure should be done in the field <u>only</u> if field constraints prevent shipment to the laboratory such that the laboratory cannot perform the analysis within 48 hours (or samples will not arrive within 24 to 36 hours of collection).

Each sample point requires the following equipment:

1. One 40ml VOA vial with acid preservative (for field testing of soil pH).

2. Two pre-weighted 40ml VOA vials with acid preservative and stir bar (for lab analysis).

3. Two pre-weighted 40 ml VOA vials with water and stir bar (in case samples effervesces).

4. One pre-weighted jar that contains methanol or a pre-weighted empty jar accompanied with a pre-weighted vial that contains methanol (for screening sample and/or high level analysis).

5. One dry weight cup.

6. One 2 oz jar with NaHSO4 acid preservative (in case additional acid is needed due to high soil pH).

7. One scoop capable to deliver about one gram of solid sodium bisulfate.

8. pH paper.

9. Weighing balance that weighs to 0.01 gram (filed balances may not reliably weigh to 0.01 gram).

10. Set of balance weights used in daily balance calibration.

11. Gloves for working with pre-weighted sample vials.

The field chemistry procedure for testing effervescing capacity of soils is as follows:

1. Place 5 grams of soil into vial that contains acid preservative and no stir bar.

2. Do not cap this vial as it may EXPLODE upon interaction with the soil.

3. Observe the sample for gas evolution (due to carbonates in the soil).

4. If vigorous or sustained gas evolution occurs, then acid preservation is not acceptable to preserve the sample. In this case, the samples need to be collected in the VOA vials with only water and a stir bar. The vials with acid preservative CANNOT be used.

5. If a small amount or no gas evolution occurs, then acid preservation is acceptable to preserve the sample. Keep this testing vial for use in the buffering testing detailed below. In this case, the samples need to be collected in the VOA vials with the acid preservative and a stir bar.

The field chemistry procedure for testing buffering capacity of soils is as follows:

1. If acid preservation is acceptable for sampling soils than the sample vial that was used in the effervescing testing can be used here for testing the buffering capacity of the soil.

2. Cap the vial that contains 5 grams of soil, acid preservative and no stir bar from Step #1 in the effervescing testing.

3. Shake the vial gently to attempt to make a homogenous solution.

4. When done, open the vial and check the pH of the acid solution with the pH paper.

5. If the pH paper reads below 2 then the sampling can be conducted in the two pre-weighted 40 ml VOA vials with the acid preservative and stir bar. Since the pH was below 2, it is not necessary to add additional acid to the vials.

6. If the pH paper reads above 2, then additional acid needs to be added to the sample.

7. Use the jar with the solid sodium bisulfate acid and add another gram of acid to the sample.

8. Cap the vial and shake thoroughly again.

9. When done, open the vial and check the pH of the acid solution with a new piece of pH paper.

10. If the pH paper reads below 2 then the sampling can be conducted in the two pre-weighted 40 ml VOA vials with the acid preservative and stir bar and one extra gram of acid.

11. Make a note of the extra gram of acid needed so the same amount of extra acid can be added to the vials the lab will analyze.

12. If the pH paper reads above 2, then add another gram of acid and repeat this procedure one more time.

The procedure for collection of samples is as follows:

1. Wear gloves during all handling of pre-weighed vials.

2. Quickly collect a 5 gram sample using a cut off plastic syringe or other coring device designed to deliver 5 grams of soil from a freshly exposed surface of soil.

3. Carefully wipe exterior of sample collection device with clean paper towel.

4. Quickly transfer to the appropriate VOA vial, extruding with caution so that the solution does not splash out of the vial.

5. Add more acid if necessary (this is based on the buffering testing discussed on the previous section).

6. Use the paper towel and quickly remove any soil off of the vial threads.

7. Cap vial and weigh the jar to the nearest 0.01 gram.

8. Record exact weight on the sample label.

The procedure for collection of soil samples is as follows:

1. Wear gloves during all handling of pre-weighed vials.

2. Weigh the vial with methanol preservative in it to 0.01 gram. If the weight of the vial with methanol varies by more than 0.01 gram from the original weight recorded on the vial - discard the vial. If the weight is within tolerance it can be used for soil preservation below.

3. Tare the empty jar or the jar that contains the methanol preservative.

4. Quickly collect a 25 gram or 5 gram sample using a cutoff plastic syringe or other coring device designed to deliver 25 gram or 5 gram of soil from a freshly exposed surface of soil. The 25 gram or 5 gram is dependent on who is doing the sampling and who is doing the laboratory analysis.

5. Carefully wipe the exterior of the collection device with clean papa towel.

6. Quickly transfer the soil to an empty soil jar that contains methanol. If extruding into a jar that contains methanol be careful not splash the methanol outside of the vial. Again, the type of jar received is dependent on who is doing the laboratory analysis.

7. If the jar used to collect the soil plug was empty before the soil was added, immediately preserve with the methanol provided – using only one vial of methanol preservative per sample jar.

8. Use the paper towel and remove any soil off of the vial treads and cap the jar.

9. Weigh the jar with the soil in it to 0.10 gram and record the weight on the sample label.

10. Collect dry weight sample – fill container.

11. Store samples at 4 degrees Celsius.

12. Ship containers with plenty of ice and per DOT regulation to the laboratory.

6.5. Bulk Soil Sampling

Large volumes of soil are generally not required for environmental investigations. However, soil samples may be collected in bulk with a backhoe from test-pits or trenches to a maximum depth of approximately 15 to 25 feet . A bucket auger may be used to collect bulk soil samples to maximum depths of 250 feet if the soils are unsaturated.

If bulk sampling is required for a given project, the procedure for sample collection will be provided in the project Work Plan. In general, any bulk sampling conducted on a project will follow the procedures discussed under the sections above. Whether samples will be composited into stainless steel bowls, collected under EPA 5035, or into sample sleeves will be determined and described in the project Work Plan.

7.0 QUALITY ASSURANCE/QUALITY CONTROL

In order to assess the accuracy and precision of the field methods and laboratory analytical procedures, quality assurance/quality control (QA/QC) surface and subsurface soil samples are collected during the sampling program according to the project Work Plan. QA/QC samples may be labeled with QA/QC identification numbers or fictitious identification numbers if blind submittal is desired, and are sent to the laboratory with the other samples for analyses. The frequency, types, and locations of QA/QC samples are specified in the project Work Plan. Examples of QA samples are equipment rinsate samples, duplicate samples, matrix spike/matrix spike duplicate samples, performance evaluation samples, and laboratory blind duplicate samples.

7.1. Equipment Rinsate Samples

An equipment rinsate sample is intended to check if decontamination procedures have been effective and to assess potential contamination resulting from containers, preservatives, sample handling and laboratory analysis. Procedures for collection are as follows:

1. Rinse the decontaminated sampling apparatus with deionized water. Allow the rinsate to drain from the sampling apparatus directly into the sample bottle.

2. Add any preservatives associated with the soil sample analytical methods to the rinsate sample.

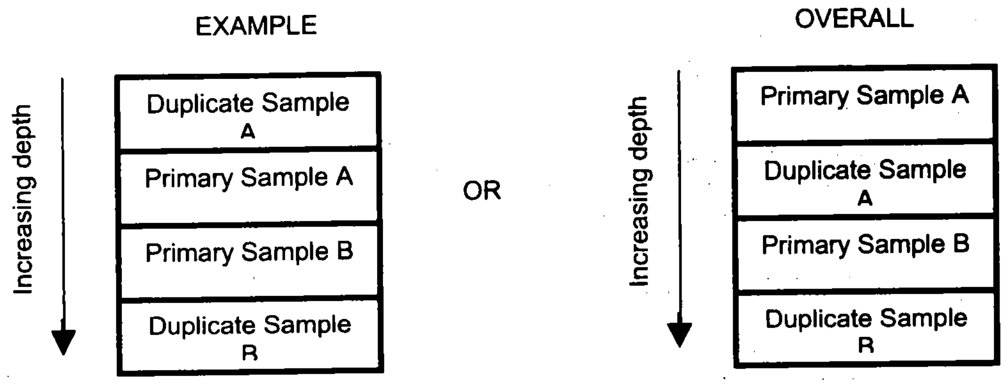
3. Specify (on the COC) the same analytical methods for rinsate samples as is specified for the soil samples.

4. For validation reasons, assign the rinsate sample an identification number and label as rinsate samples, not as blanks.

5. Place the rinsate sample in a chilled cooler and ship it to the laboratory with the other samples.

7.2. Duplicate Samples

Duplicate samples are collected to assess the precision of field and laboratory components of field samples and matrix heterogeneity. Duplicate samples are similar to split samples and should be collected like split samples. Project specifications will determine if the duplicate samples are homogenized. If so, proceed with the instructions for homogenization in Section 6.2.1. Otherwise, the collection of duplicate samples will be collected in the next consecutive sample. For example, if a 18-inch long split barrel contains three 6-inch long full sleeves of soil. The middle sleeve is designated as the primary sample, then the next sleeve, either the top or bottom sleeve must be the duplicate sample. The collection of duplicate samples is more complex, when more sleeves are needed for analyses. For example, for the same split barrel and three full sleeves of soil, two sleeves are necessary for the primary analyses (i.e. A and B). In this scenario the duplicate is the next sleeve. The middle sleeve can be designated as Primary Sample A, the top sleeve as the duplicate for Primary Sample A and the third sleeve as Primary Sample B. The duplicate for Primary Sample B must be collected from the top sleeve in the next split barrel, which means the sampler must be driven again into the soil from the point where the last sampler stopped. The example and the overall relationship of collection of the primary and duplicate soil samples are illustrated below.



To maximize the information available in assessing total precision, collect duplicate samples from locations suspected of the highest contaminant concentration. Use field measurements (such as HNu data) or visual observations, past sampling results, and historical information to select appropriate locations for duplicate analyses.

The duplicate sample is handled and preserved in the same manner as the primary sample and assigned a sample number, stored in a chilled cooler, and shipped to the laboratory with the other samples. Whenever possible, the sample identification numbers for the characteristic sample and its duplicate are independent such that the receiving laboratory is not able to distinguish which samples are duplicates prior to analysis.

7.3. Matrix Spike/Matrix Spike Duplicate Samples

An extra volume of sample media may be collected during the sampling event for performance of matrix spike (MS)/matrix spike duplicate (MSD) analyses by the laboratory to assess laboratory accuracy, precision, and matrix interference. Following shipment of the samples to the laboratory, the laboratory prepares MS and MSD samples by homogenizing the soil matrix collected in the field and splitting the material into three separate sets of containers. Note that sample aliquots for volatile analysis are not homogenized. The laboratory spikes the split samples with appropriate analytes prior to performing the extraction in order to evaluate the total of the spiked compound and whatever quantity of the compound may be present in the sample. Results of the analyses are compared with the results of the primary sample and the known concentrations of the spike compounds. The percent recovery and relative percent difference are calculated and results are used to evaluate the precision and accuracy of the analytical method for various labeled "extra volume samples for MS/MSD." The sample volumes required for these analyses should be coordinated with the laboratory and are described in the project Work Plan.

7.4. Performance Evaluation Samples

Performance evaluation or pre-spiked soil samples may be used to assess laboratory extraction efficiency and accuracy in constituent identification and quantification. Because these samples are helpful in assessing the potential bias of analytical methods, they are also commonly used to evaluate the accuracy of non-standard methods or mobile laboratory procedures. These samples are generally prepared by an independent laboratory and shipped in pre-sealed containers to the field to be included with the samples sent to the laboratory performing the analysis of site soil samples. As for field blanks, these spiked samples are generally limited to organic constituents. The analytes of interest and corresponding analyte concentrations for the spike samples must be specified in the request to the independent laboratory providing the samples in accordance with the project Work Plan. These samples are assigned an identification number, stored in a chilled cooler, and shipped blind to the laboratory with the other samples.

7.5. Laboratory Blind Duplicate Samples

If appropriate, or required by program Quality Assurance, laboratory blind duplicate samples may also be used to assess laboratory accuracy in constituent identification and quantification. Laboratory blind duplicate samples consist of two or more representative sample volumes from one heterogeneous soil sample obtained from one sampling location. Equal volumes of representative aliquots from the mixture are submitted to two or more laboratories for analysis. The results of each laboratory are compared as a check on the laboratory accuracy. Because two samples are analyzed, environmental variability and precision (from one location to another) are included in this assessment.

The laboratory blind duplicate sample volume collected by the sampling team is preserved, packaged and submitted for analysis in the same manner as the other characteristic samples in accordance with the project Work Plan.

7.6. Other Sample Types

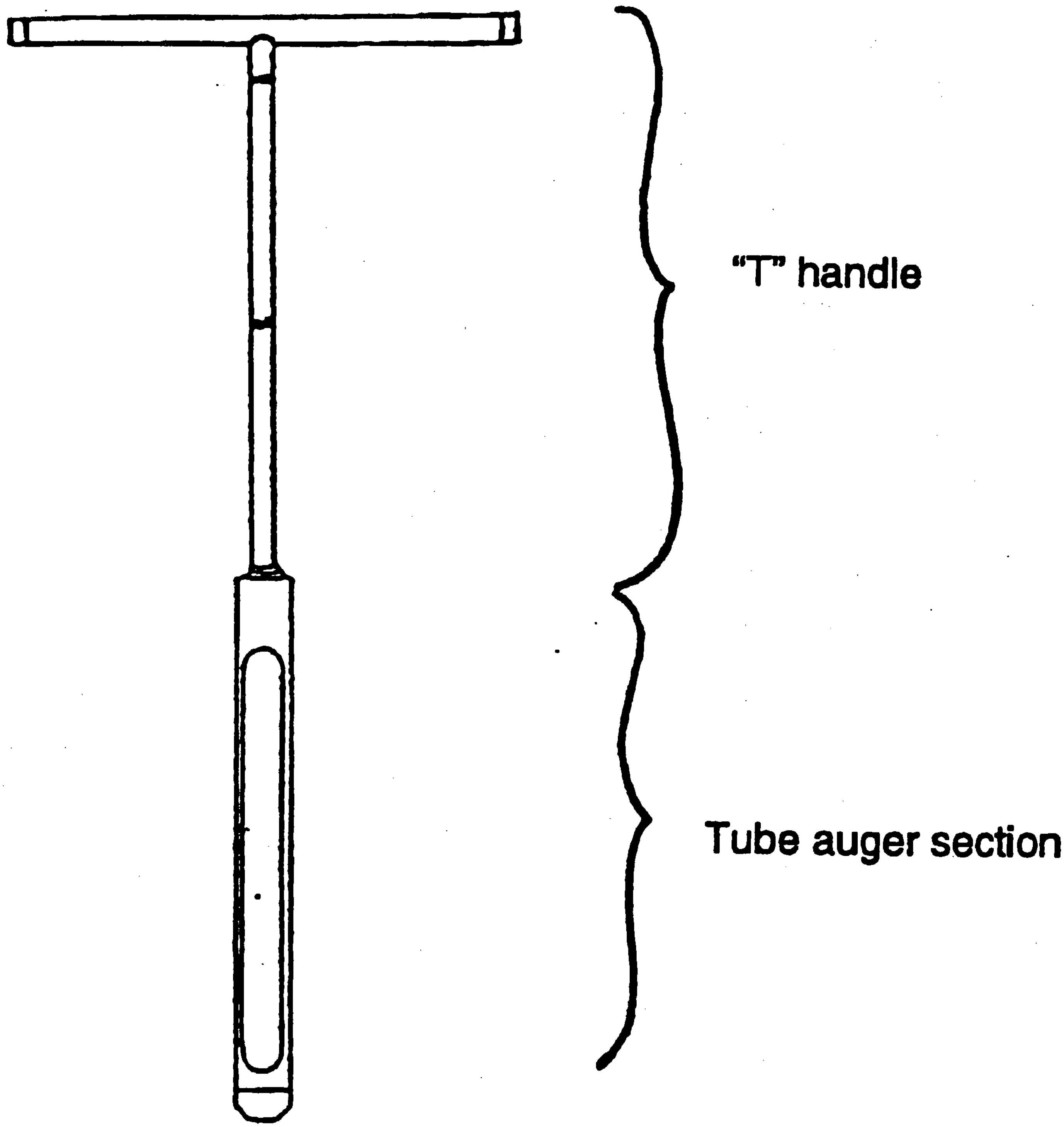
Ambient or background samples are used to assess the range of concentrations of potential contaminants and naturally occurring inorganic compounds in the vicinity of the site which are not the result of site activities. These samples are collected from areas not believed impacted by historical site operations (i.e., away from source areas and upwind).

The ambient or background samples are collected at the locations and depths specified in the project Work Plan. If the locations are not specified, a nearby park or other area void of industrial activity, for example, may be suitable for collection of ambient samples. The soil type should be as close as possible to the onsite characteristic samples. If appropriate, information can be obtained from various state and local agencies (e.g. USDA Natural Resources Conservation Service) that could aid in selection of ambient soil sampling locations. Ambient soil samples should be collected following the same procedure as that used for the onsite soil samples.

ATTACHMENT A

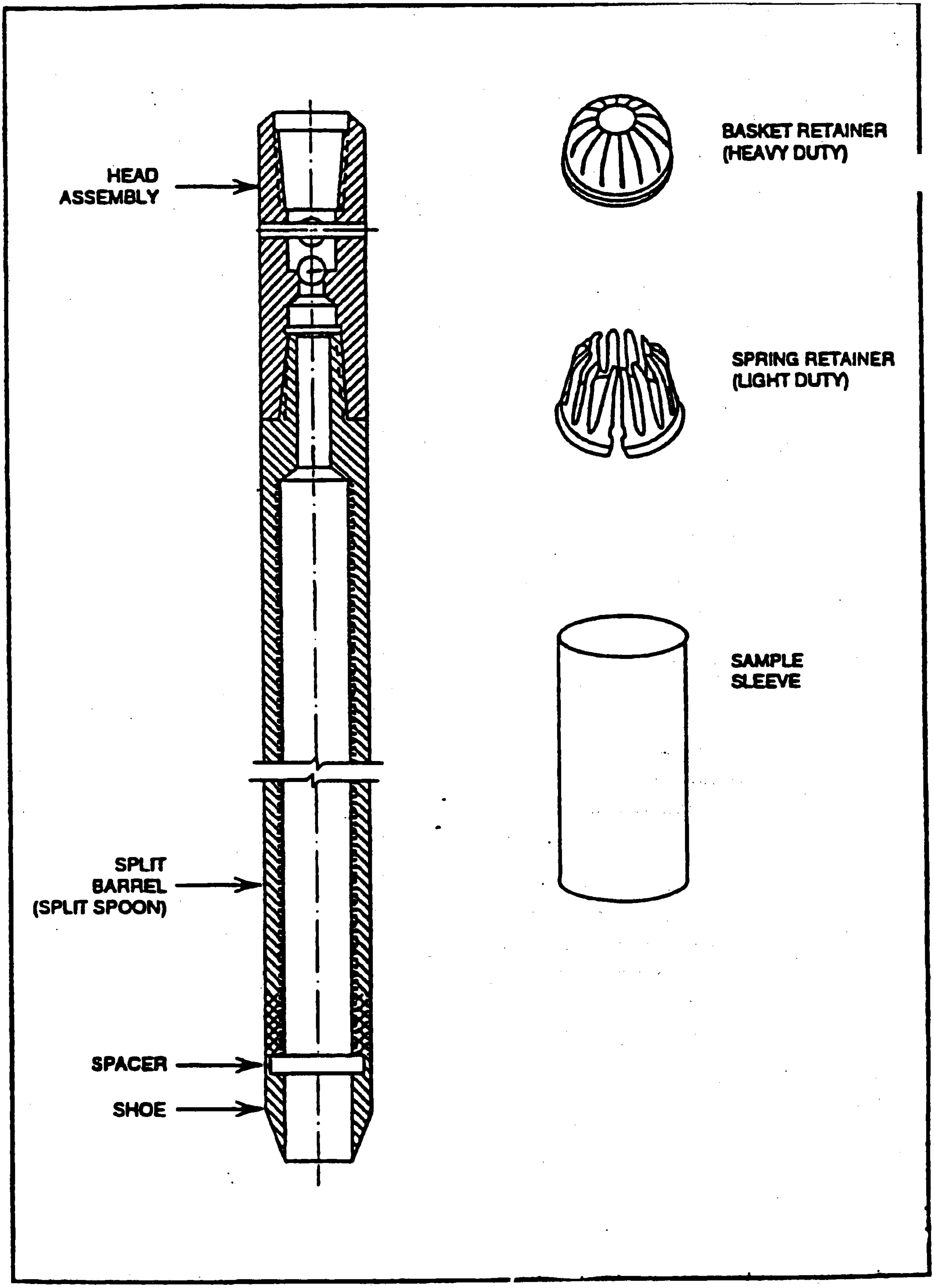
TUBE AUGER

TUBE AUGER



ATTACHMENT B

SPLIT-BARREL SAMPLER



HEAD
ASSEMBLY
SPLIT
BARREL
(SPLIT SPOON)
SPACER
SHOE
BASKET RETAINER
(HEAVY DUTY)
SPRING RETAINER
(LIGHT DUTY)
SAMPLE
SLEEVE

ATTACHMENT C

ENCORE™ SAMPLER INFORMATION

Disposable
En Core® Sampler

En Novative Technologies, Inc.
1241 Bellevue Street
Green Bay, WI 54302
Telephone: 920-465-3960 • Toll Free: 1-888-411-0757
Fax: 920-465-3963

SAMPLING PROCEDURES

USING THE En Core® T-HANDLE

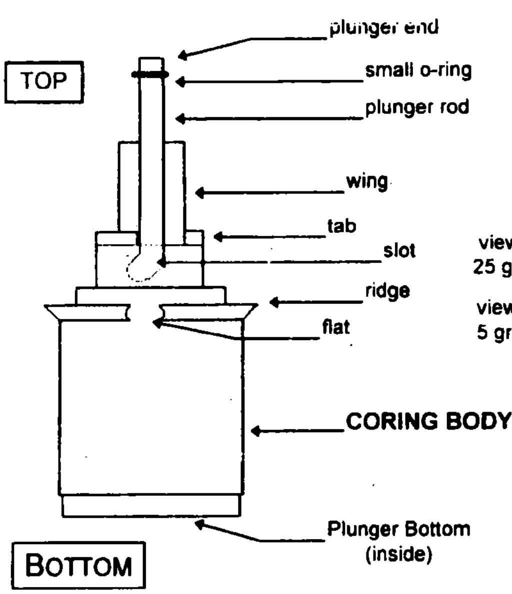
NOTE:

1. En Core Sampler is a ***SINGLE USE*** *device. It cannot be cleaned and/or reused.*

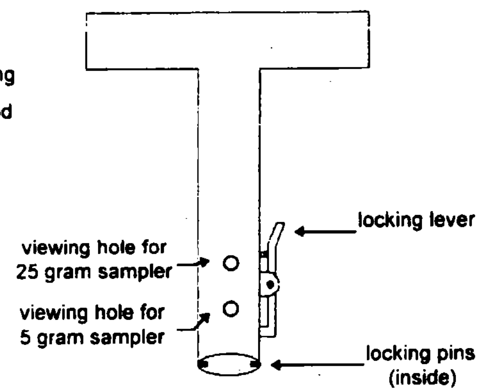
2. En Core Sampler is designed to store soil. Do not use En Core Sampler to store solvent or free product!

3. En Core Sampler must be used with En Core® T-Handle and/or En Core® Extrusion Tool exclusively. (These items are sold separately.)

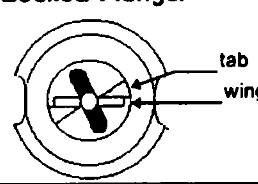
En Core Sampler



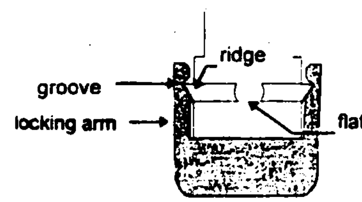
En Core T-Handle



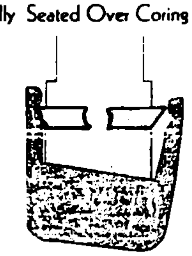
Locked Plunger



Sampler Correctly Capped
(Locking Arm Grooves Seated Over Coring Body Ridge)



Sampler Incorrectly Capped
(Cap Appears Crooked; Locking Arm Grooves Not Fully Seated Over Coring Body Ridge)



BEFORE TAKING SAMPLE:

1. Hold **coring body** and push **plunger rod** down until **small o-ring** rests against **tabs**. This will assure that plunger moves freely.

2. Depress **locking lever** on En Core T-Handle. Place coring body, **plunger end** first, into open end of T-Handle, *aligning the (2) slots on the coring body with the (2)* ***locking pins*** *in the T-Handle.* Twist coring body clockwise to lock pins in slots. Check to ensure Sampler is locked in place. Sampler is ready for use.

TAKING SAMPLE:

3. Turn T-Handle with T-up and coring body down. This positions plunger bottom flush with bottom of coring body (ensure that plunger bottom is in position). Using T-Handle, push Sampler into soil until coring body is completely full. When full, small o-ring will be centered in T-Handle **viewing hole**. Remove Sampler from soil. Wipe excess soil from coring body exterior.

4. Cap coring body while it is still on T-handle. ***Push*** **cap over flat** area of **ridge** ***and twist*** to lock cap in place. CAP MUST BE SEATED TO SEAL SAMPLER (see diagram).

PREPARING SAMPLER FOR SHIPMENT:

5. Remove the capped Sampler by depressing locking lever on T-Handle while twisting and pulling Sampler from T-Handle.

6. Lock plunger by rotating extended plunger rod fully counter-clockwise until **wings** rest firmly against tabs (see plunger diagram).

7. Attach completed circular label (from En Core Sampler bag) to cap on coring body.

8. Return full En Core Sampler to zipper bag. Seal bag and put on ice.

Disposable En Core® Sampler

EXTRUSION PROCEDURES

USING THE En Core® EXTRUSION TOOL

CAUTION! Always use the Extrusion Tool to extrude soil from the En Core Sampler. If the Extrusion Tool is not used, the Sampler may fragment, causing injury.

1. Use a pliers to break locking arms on cap of En Core Sampler. Do not remove cap at this time. **(CAUTION: Broken edges will be sharp.)**

2. To attach En Core Sampler to En Core Extrusion Tool: Depress locking lever on Extrusion Tool and place Sampler, plunger end first, into open end of Extrusion Tool, *aligning slots on coring body with pins in Extrusion Tool.* Turn coring body clockwise until it locks into place. Release locking lever.

3. Rotate and gently push Extrusion Tool plunger knob clockwise until plunger slides over wings of coring body. (When properly positioned plunger will not rotate further.)

4. Hold Extrusion Tool with capped Sampler pointed upward so soil does not fall out when cap is removed. To release soil core, remove cap from Sampler and push down on plunger knob of En Core Extrusion Tool. Remove and properly dispose of En Core Sampler.

Warranty and Disclaimers

IMPORTANT: FAILURE TO USE THE EN CORE™ SAMPLER IN COMPLIANCE WITH THE WRITTEN INSTRUCTIONS PROVIDED HEREIN VOIDS ALL EXPRESS AND IMPLIED WARRANTIES, INCLUDING WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

PRINCIPLE OF USE. The En Core Sampler Cartridge System is a volumetric sampling system designed to collect, store and deliver a soil sample. The En Core Sampler comes in two sizes for sample volumes of approximately 25 or 5 grams. There are four components: the cartridge with a movable plunger; a cap with two locking arms; a T-handle (purchased separately); and an extrusion handle (purchased separately). NOTE: The En Core Sampler is designed to store soil. It is not designed to store solvent or free product.

The soil is stored in a sealed headspace-free state. The seals are achieved by three special Viton® * o-rings, two located on the plunger and one on the cap of the Sampler. **At no time and under no condition should these o-rings be removed or disturbed.**

QUALITY CONTROL. The cartridge is sealed in an airtight package to prevent contamination prior to use. Due to the stringent quality control requirements associated with the use of this system, the disposable cartridge is designed to be used only once.

WARRANTY. En Novative Technologies, Inc. ("En Novative Technologies") warrants that the En Core Sampler shall perform consistent with the research conducted under En Novative Technologies' approval, within thirty (30) days from the date of delivery, provided that the Customer gives En Novative Technologies prompt notice of any defect or failure to perform and satisfactory proof thereof. THIS WARRANTY DOES NOT APPLY TO THE FOLLOWING, AS SOLELY DETERMINED BY EN NOVATIVE TECHNOLOGIES: (a) Damage caused by accident, abuse, mishandling or dropping; (b)Samplers that have been opened, taken apart or mishandled; (c)Samplers not used in accordance with the directions; and (d)Damages exceeding the cost of the sampler. Seller warrants that all En Core Samplers shall be free from defects in title. THE FOREGOING WARRANTIES ARE IN LIEU OF ALL OTHER WARRANTIES, WHETHER ORAL, WRITTEN, EXPRESSED, IMPLIED OR STATUTORY, INCLUDING ANY INFORMATION PROVIDED BY SALES REPRESENTATIVES OR IN MARKETING LITERATURE. IMPLIED WARRANTIES OF FITNESS AND MERCHANTABILITY SHALL NOT APPLY. En Novative Technologies' warranty obligations and Customer's remedies, except as to title, are solely and exclusively as stated herein.

LIMITATION OF LIABILITY. IN NO EVENT SHALL EN NOVATIVE TECHNOLOGIES BE LIABLE FOR ANTICIPATED PROFITS, INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES, INCLUDING, BUT NOT LIMITED TO, DAMAGES FOR LOSS OF REVENUE, DOWN TIME, REMEDIATION ACTIVITIES, REMOBILIZATION OR RESAMPLING, COST OF CAPITAL, SERVICE INTERRUPTION OR FAILURE OF SUPPLY, LIABILITY OF CUSTOMER TO A THIRD PARTY, OR FOR LABOR, OVERHEAD, TRANSPORTATION, SUBSTITUTE SUPPLY SOURCES OR ANY OTHER EXPENSE, DAMAGE OR LOSS, INCLUDING PERSONAL INJURY OR PROPERTY DAMAGE. En Novative Technologies' liability on any claim of any kind shall be replacement of the En Core Sampler or refund of the purchase price. En Novative Technologies shall not be liable for penalties of any description whatsoever. In the event the En Core Sampler will be utilized by Customer on behalf of a third party, such third party shall not occupy the position of a third-party beneficiary of the obligation or warranty provided by En Novative Technologies, and no such third party shall have the right to enforce same. All claims must be brought within one (1) year of shipment, regardless of their nature.

En Novative Technologies, Inc.
1241 Bellevue St.
Green Bay, WI 54302
Telephone: 920-465-3960 • Toll Free: 1-888-411-0757
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The En Core® Sampler is covered by One or More of the Following U.S. Patents: 5,343,771; 5,505,098; 5,517,868; 5,522,271. Other U.S. and Foreign Patents Pending.

* Viton® is a registered trademark of DuPont Dow Elastomers.

Brown and Caldwell
Standard Operating Procedure
Environmental Sample Handling

Revision 1.0
Revision Date: January 5, 2000

Prepared/Revised by:	Diane Henry Name	January 5, 2000 Date
Senior QA Review:	Jay Lucas Name	10/26/01 Date
Regional Quality Officer:	Dave Van Winkle Name	October 26, 2001 Date

ENVIRONMENTAL SAMPLE HANDLING

TABLE OF CONTENTS

1.0 OBJECTIVE

The objective of this procedure is to establish a uniform method for the handling of environmental samples. This includes the procurement of the appropriate sample containers and preservatives, chain of custody procedures and the use of appropriate sample shipment methods.

2.0 SCOPE AND APPLICABILITY

This procedure will be used during the collection of all types of environmental media that include, but are not limited to, groundwater, surface water and soil. Handling of air samples is not addressed in the current version of this procedure.

3.0 RESPONSIBILITIES

The Project Manager (PM), or designee, will have the responsibility to oversee and ensure that the handling of samples is in accordance with this SOP and any site-specific or project specific planning documents. The field sampling personnel will be responsible for the understanding and implementation of this SOP during all field activities, as well as, obtaining the appropriate field logbooks, forms, and records necessary to complete the field activities. Field personnel will ensure all field activities are documented completely at the end of each field day. Field personnel are responsible for assuring that the original documentation (or copies of the field log book, if needed for another project at the same site), are filed at the end of the field project, or during a long project (greater than a month) every couple of weeks.

4.0 DEFINITIONS

<u>EnCore® Sampler</u> – Sampler designed for collecting Volatile Organic Carbon (VOC) samples.

<u>PPE</u> – Personal Protective Equipment

5.0 REQUIRED MATERIALS

The materials required for this SOP include the following:

- Bound field log books
- Black waterproof and/or indelible ink pens
- Field forms
- Chain of Custody forms
- Sample Labels

6.0 METHOD

The following method outlines general considerations for sample handling in the field and maintaining sample custody after collection.

Environmental samples are collected in the field in order to evaluate whether conditions in soil gas, soil, surface water, or groundwater are hazardous. These samples therefore, should be handled with the utmost care to maintain integrity so that analytical data represents as closely as possible, field conditions. In addition, sample chain of custody is extremely important for establishing that sample integrity was maintained between field crew and laboratory.

Details regarding collection of samples are provided in other SOPs (e.g., soil sampling SOP). General considerations for handling during sampling are:

- Always wear proper PPE when handling samples.
- Sample receptacles or containers should be wrapped in a way that is protective of both surrounding containers and the container the sample is in.
- Always check and document procedures well in field logbooks or sampling forms. There is never "too much information".

Samples must be stabilized for transport from the field to the laboratory through the use of the proper sample containers and preservation techniques. This is due to the potential changes in chemical quality that may occur after samples are collected. Sample containers and preservation are discussed in the Sample Preservation SOP.

Great care must be exercised in the sampling and handling of volatile compounds (e.g. VOCs or volatile gases) in order to minimize the introduction of sampling bias. This bias is caused largely through the loss of volatile constituents. Special handling procedures are described in respective sampling SOPs for the handling of aqueous and non-aqueous samples that should be followed in order to minimize the loss of volatile constituents.

Non-aqueous samples for VOC analysis should be placed in the appropriate container as quickly as possible following their collection. Consideration should be given to trimming soil samples that have been in contact with the air and the sampling device in order to minimize the loss of VOCs and inadvertent sample contamination, respectively. Some agencies require the use of USEPA Method 5035 (or similar) that utilizes containerization in a special sampler (EnCore® or equivalent), or field methanol preservation using specially prepared containers. Lastly, the sample container should be cooled immediately after it is filled.

6.1 Sample Labels

Sample labels are required on all sample containers for the primary purpose of sample identification. Specific field data need not be recorded on the labels. The sample labels should contain the following information:

- Sample or location identification number (i.e., well number, boring number/depth, or arbitrary sample number)
- Analysis to be performed

- Preservative (even if only keeping sample chilled)
- Project name and number
- Date and time of sample collection
- Details of samplers (initials, etc.)

It is recommended that the sample label be preprinted in the office on adhesive labels prior to initiation of the sampling program. Tape should NOT be used to cover any label or seal the ends of soil sleeves. Recent studies indicate that most commercially available tapes contain VOCs and that there is the potential for contamination from the tapes.

6.2 Chain-of-Custody

The goal of implementing chain-of-custody procedures is to ensure that the sample is traceable from the time that it is collected until it, or its derived data, are used. Samples would be considered to be "in custody" under the following conditions:

- It is in personal possession.
- It is in personal view after being in personal possession.
- It was in personal possession when it was properly secured.
- It is in a designated secure area.

6.2.1 Chain-of-Custody Forms

A chain-of-custody form may be initiated at the time that the sample containers are filled or, at a minimum, when the sample containers leave the site at which they are prepared, usually that of the analytical laboratory supplying the containers. Additionally, chain-of-custody forms may be specially prepared with some initial information for the project and specific analytical methods listed prior to field work to decrease the amount of information that has to be recorded in the field. However, in this event, actual sample collection information should be recorded only in the field after the sample has been collected.

It is important that the field personnel completely fill out the applicable sections of the form. Chain of custody forms should be numerically sequenced with a number clearly indicated on the form. The chain-of-custody forms should be placed in shipping containers, protected from moisture using plastic bags (e.g., Ziploc®), and should accompany the containers during shipment to the laboratory. Chain-of-custody forms included in any shipping container should only reflect those samples that are in that container. The field personnel collecting the samples will be responsible for the custody of the samples until transport to the laboratory. Sample transfer requires the individuals relinquishing and receiving the samples to sign, date and note the time of transfer on the chain-of-custody forms. The chain-of-custody is considered to be complete after it has been received and signed in by the analytical laboratory. A copy of the chain-of-custody record should be maintained by the field personnel along with the other field records.

Common carriers (i.e., Federal Express) are not expected to sign the chain-of-custody form. However, the bill of lading or airbill becomes part of the chain-of-custody record in the event that a common carrier is used to transport the samples. Airbill or bill of lading numbers should be recorded on the chain-of-custody forms.

6.2.2 Chain-of-Custody Seals

Chain-of-custody seals or evidence tape may be used on the sample containers in order to demonstrate that the sample containers have not been opened or otherwise tampered with. While not required on all projects, PMs should consider using custody seals to demonstrate sample integrity. Chain-of-custody seals or evidence tape, if used, should be affixed to each sample container as soon after sample collection as is possible. An additional use of chain of seals would be on the outside of the shipping container. For particularly sensitive projects subject to potential legal action, serial numbers that are printed on chain-of-custody seals should be recorded on the chain-of-custody record.

Some projects require custody seals on the outside of the cooler. Commonly, two seals are required. The seals do not necessarily need to be custody tape, but any type of tape that can be used to record the date and initials of the packager. The seals should be placed at two points along the front of the cooler at the point where the lid meets the body of the cooler.

6.3 Sample Shipment

Shipment of samples to an analytical laboratory is usually required upon completion of sample collection. Proper packaging is necessary in order to protect the sample containers, to maintain the samples at a temperature of 4°C, and to comply with all applicable transportation regulations.

In general, samples are shipped using packaging that is supplied by the analytical laboratory. The packaging normally includes a shippable insulated box such as an ice cooler and contains protective internal packaging materials such as foam sleeves or bubble wrap. Some laboratories use proprietary sample packaging with integral internal packaging. In either case, provisions need to be made for maintaining the temperature of the samples either with the use of ice packs or ice. Care should be taken to ensure that the sample bottles are adequately protected from breakage during shipments. Samples should be secured tightly with bubble wrap or other suitable packing media and covered with plastic bags. Ice should be added to the shipping container only after the samples have been secured with packing media. Ice should never be used to provide separation between sample bottles. Once packed, the cooler should be secured shut by wrapping duct or fiber reinforced tape completely around the cooler. If custody seals are placed on the outside of the cooler as described above in Section 5.2, then the wrapping tape should be wrapped around the cooler to cover each seal without obliterating serial numbers, signatures or other significant data.

Regulations must be observed regarding the shipment of Dangerous Goods. Sample containers and certain field equipment may be defined as Dangerous Goods such that special requirements must be followed for their shipment. Air shipment of Dangerous Goods is regulated by the International Air Transport Association (IATA) as described in "Dangerous Goods Regulations". Shipment by ground is regulated by the U.S. Department of Transportation (DOT). Furthermore, individual shippers (e.g., Federal Express) may have additional requirements for Dangerous Goods shipment. The shipment of Dangerous Goods must be consistent with the instruction and authorization of the analytical laboratory shipping and receiving coordinator and the Health and Safety director.

Environmental samples, including groundwater samples, are currently exempt from Hazardous Goods regulations. 40 CFR 261.40(d) states, "A sample of solid waste or a sample of water, soil, or air which is collected for the sole purpose of testing to determine its characteristics or composition is not subject to this Part or Parts 262 through 267 or Part 124 of this chapter or to the notification requirements of Section 3010 of RCRA." Therefore, no special regulations are required to be followed for the shipment of environmental samples from the field. However, sample containers should be properly packed such that inadvertent spillage does not occur during shipment (e.g., any discharge spouts should be tapped closed). Samples of NAPL do not fall under this exemption.

Specific regulations do exist, however, for the shipment of many reagents that are commonly used as preservatives and decontamination agents. Consequently, the shipment to the field site of "empty" sample containers containing small quantities of preservatives must be conducted in accordance with the regulations. The most significant limitations for the shipment of preservatives (IATA, 1992) involve those for nitric acid in which only small quantities (<0.5L) of low concentration (<20%) nitric acid can be shipped in any given shipment.

7.0 QUALITY ASSURANCE/QUALITY CONTROL

Quality assurance for sample handling centers upon following procedures outlined above and double checks as samples are collected. Checks should be performed either by 1) the field personnel, or, preferably, 2) by a project chemist or other personnel that constantly check field chain of custody forms versus laboratory receipt acknowledgment forms, discuss condition of samples as received by laboratory personnel, and communicate constantly with the laboratory project manager to prevent quality assurance issues from starting or becoming significant problems should they occur.

8.0 REFERENCES

United States Environmental Protection Agency, 1984, Soil Sampling Quality Assurance Users Guide, EPA/600/4-84/043.

United States Environmental Protection Agency, 1986, RCRA Ground-Water Monitoring Technical Enforcement Guidance Document, OSWER-9950.1.

United States Environmental Protection Agency, 1987, A Compendium of Superfund Field Operations Methods, EPA/600/P-87/001.

United States Environmental Protection Agency, 1992, RCRA Ground-Water Monitoring: Draft Technical Guidance, EPA/600/R-92/001.

9.0 ATTACHMENTS

None.

Brown and Caldwell
Standard Operating Procedure

Sample Preservation
Revision 1.0
Revision Date: May 11, 2001

Prepared/Revised by:	Wendy Linck Name	May 11, 2001 Date
Senior Quality Manager Review:	 Name	10/26/01 Date
Regional Quality Officer :	 Name	October 26, 2001 Date

SAMPLE PRESERVATION

TABLE OF CONTENTS

1.0 OBJECTIVES

The objective of this standard operating procedure (SOP) is to establish procedures that allow the chemical integrity of a sample is maintained from time of collection until chemical analysis.

2.0 APPLICABILITY

This SOP documents the procedures and chemicals to be used for the preservation of field samples. The environmental media addressed in this SOP include soil, sediment, solid waste, and aqueous samples. These procedures apply to all Project team personnel and subcontractors involved with the collection, shipping and chemical analysis of environmental samples.

3.0 RESPONSIBILITY

The Project Manager (PM), or designee, shall ensure that the sampling procedures used, including provisions for proper storage, preservation and shipping, are adequate to maintain sample integrity until custody is assumed by the laboratory. The PM shall develop or direct the preparation of a detailed sampling plan for sampling air, water, biota, sediment, soil, or waste, which shall describe the procedures used to preserve samples during the interval from sampling until receipt by the laboratory.

The Project Chemist (PC), or designee, shall ensure that the samples are collected in terms of the analytical methods and compliance with sampling protocols. For smaller projects, the PC and the Field Supervisor may be the same person. The field supervisor or PC also are responsible for maintaining adequate supplies of containers and preservatives. The PM will determine the roles and personnel for each project.

The Field Supervisor or his or her designate shall be responsible for ensuring the competence of field sampling personnel and their training. The field supervisor shall ensure that specified preservation and storage procedures are followed during sampling and during shipment to the laboratory.

The field sampling personnel will be responsible for the understanding and implementation of this SOP during all field activities. Field personnel are also responsible for checking the collected samples, and verifying that they are preserved with prescribed range.

4.0 REQUIRED MATERIALS

The materials required for this SOP include the following:

- Sample Containers,
- pH instrument or Litmus paper with appropriate pH range,
- Field notebook, and
- Sampling forms (e.g. Chain of Custody Records, sample labels).

5.0 DEFINITIONS

Maximum Holding Time. Maximum Holding Time is the maximum length of time that may elapse before sample preparation (extraction or digestion) or analysis is completed. It is calculated from the date and time of collection in the field. Holding times are usually measured to the nearest day with the exception of those analyses that must be completed within 24 or 48 hours.

Preservation. Preservation refers to temperature control and/or pH adjustment procedures performed to prevent or slow the loss of target analytes through precipitation, volatilization, decomposition, or biodegradation.

Temperature. Temperature is defined as the temperature within the refrigerator, cooler or ice chest that holds the samples. Samples shall be held at 4 degrees Celsius (°C) (± 2° C represents the acceptable range).

6.0 METHODS

Proper communication between the project manager and the analytical laboratory is essential prior to sampling, preferably in writing. This necessary so that the proper type and number of containers and preservatives can be specified and so that all technical and regulatory requirements can be met regarding the analyses.

Field personnel should coordinate in writing with the laboratory at least two weeks before the sample container kits are to be shipped from the lab to identify the analytes to be requested. The information exchange between lab and field personnel include the project identification, sample kit shipment address, QA/QC regulatory requirements, required turnaround requirements, and the number and type of laboratory analyses.

Most chemical and biological reactions and many physical processes are slowed by lowering the temperature. Therefore, as a general rule, all samples need to be cooled at the time of collection and maintained slightly above freezing until preparation for final analysis. This restriction is not critical in the case of metals analysis since most metals exist in the form of involatile salts with the exception of liquid mercury and organometallic compounds such as tetraethyl lead, which still need to be kept cold. Hexavalent chromium is kept cold to slow its reduction to trivalent chromium.

Soil samples and other solid samples, including sediments, sludges, and solid waste, shall be preserved by cooling to 4°, ± 2° C. Soil and solid samples require no other preservatives. However, analysis must be performed within the method-specific holding time requirements.

Aqueous samples may be presumed to be homogenous and amenable to chemical preservation. In addition to keeping such samples cold, the following general approaches shall be employed depending on the analyte(s):

- Volatile acids (HCN, H_2S) are rendered involatile in the presence of strong base (NaOH, pH greater than [>] 12);
- Volatile bases (ammonia) are rendered involatile in the presence of strong acid (H_2SO_4, pH less than [<] 2);
- Biodegradation of organic compounds is retarded under strongly acidic conditions (HCl or H_2SO_4, pH < 2);
- Dehydrohalogenation (loss of HCl) of chlorinated solvents is counteracted in the presence of acid (HCl, pH < 2);
- Oxidation of target analytes by the chlorine found in drinking water is eliminated by destroying the chlorine with a reducing agent such as sodium thiosulfate; and
- Many soluble metal salts tend to adhere to the walls of the container or they form precipitates with time. This can be prevented by the addition of nitric acid to a pH of < 2, which maintains the metals as soluble nitrate salts.

Groundwater samples for dissolved metals analysis are filtered (usually with a 0.45 micron filter) before preservation with the appropriate preservative. The filtrate is added directly to the plastic container, which has been supplied with the proper amount of preservative.

With the exception of the stainless-steel sleeves used to capture soil boring samples, all sample containers will be supplied in advance by the subcontracting laboratories.

The required chemical preservatives for aqueous samples will normally be added to the appropriate containers by the subcontracting laboratories before delivery to the field. There are two reasons why already-preserved containers are preferred. First, the laboratory scheduled to perform the analysis maintains control over sample integrity and container cleanliness and, second, field crews are generally not equipped to "appropriately handle" hazardous chemicals like hydrochloric acid. However, it may become necessary to add additional preservation to achieve the proper pH.

For most constituents in groundwater, preservation can be checked by pouring a slight amount of water from the collection vessel over pH Litmus paper. For more volatile constituents (i.e. VOCs, dissolved gases), this procedure is not recommended. Instead an extra sample bottle that contains the same preservative should be filled and then tested. Field personnel shall ensure all field activities are documented completely at the end of each field day.

Sample preservatives should be identified on the chain of custody (COC).

Solid samples, whether in metal sleeves, wide-mouth glass jars, or other containers, will be labeled and secured appropriately, then placed immediately in an ice chest containing sufficient ice to maintain a temperature range of 4° ± 2° C through delivery to the laboratory.

Sufficient ice chests and quantities of ice to manage all samples collected during the day (or shift) shall be maintained at the sampling site.

Samples are maintained in ice or, if available, in refrigerators, within a range of 4° ± 2° C, from the time the sample control manager assumes custody until the samples are packed for shipment and relinquished to the shipper or other transport agent.

All samples are shipped in ice chests packed with sufficient ice to maintain a temperature range of 4° ± 2° C for at least 24 hours.

Temperature checks are placed in the cooler for the laboratory to check the temperature upon arrival at the lab. A temperature check is provided by the laboratory and shall be placed in the middle of the samples within the cooler. The temperature check should be labeled as such and added to the COC to record that it was placed into the cooler. If the laboratory did not provide a temperature check as requested or the sampling team runs out of checks, temperature checks can be made in the field. A temperature check is a 40-mililiter VOA, without preservative, filled with deionized water.

The receiving laboratory will measure the temperature within the ice chest immediately upon assuming custody of a shipment of samples. This temperature will be noted on the chain-of-custody form. Temperatures in excess of 6° C will be reported immediately to the project chemist. After consultation with the PM, the PC will communicate whether re-sampling is necessary.

With respect to procedures for maintaining a temperature range of 4° ± 2° C, aqueous samples will be treated as described above, for solid samples.

Table 1 is a listing of the common analyses with associated containers, preservatives, and holding times. The analyses and associated other data shown in Table 1 give a general background regard what is required. However, when particular analytical procedures are specified in planning documents, it is best to check directly with the cited method to make sure sample vessels and preservatives are correct.

7.0 REFERENCES

American Public Health Association, 1985. Standard Methods for the Examination of Water and Wastewater, 16th Edition.

40 CFR 136, Code of Federal Regulations, dated July 1, 1990.

State of California, 1989. Leaking Underground Fuel Tank Field Manual: Guidelines for Site Assessment, Cleanup, and Underground Storage Tank Closure, Leaking Underground Fuel Tank Task Force.

United Stated Environmental Protection Agency (USEPA), 1991. Statement of Work for Organics Analysis, Document Number OLMO1.0, USEPA Contract Laboratory Program, June.

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United States Environmental Protection Agency (USEPA), 1982. Methods for Chemical Analysis of Water and Wastes, EPA-600/4-82-055, December

8.0 ATTACHMENTS

Table 1. Sample Containers, Preservation Methods, and Analytical Holding Times

Table 1
Sample Containers, Preservation Methods, and Analytical Holding Times (1 of 2)

Parameter	Matrix	Container	Lid	Preservation	Maximum Holding Times	
					Extraction[a]	Analysis[b]
Metals	Water	500 ml polyethylene	Cap with Teflon® seal	HNO3 to pH<2; Ice to 4°C	-	6 months (Hg: 28 days)
	Soil	4 oz. glass jar	Teflon®-lined lids	Ice to 4°C	-	6 months (Hg: 28 days)
	Soil	Stainless steel sleeve	Teflon®-lined plastic end-caps	Ice to 4°C	-	6 months (Hg: 28 days)
Volatiles	Water	40 ml glass vials X 3	Cap with Teflon® septum	HCI to pH<2; Ice to 4°C	-	14 days
	Soil	EnCore sampler X 3	o-ring cap	Ice to 4°C; 48 hours to preserve with methanol or sodium bisulfate	-	14 days
	Soil	Stainless steel sleeve	Teflon®-lined plastic end-caps	Ice to 4°C	-	14 days
Purgeable Hydrocarbons	Water	1 liter glass amber jar	Cap with Teflon® septum	HCI to pH<2; Ice to 4°C	-	14 days
	Soil	EnCore sampler X 3	o-ring cap	Ice to 4°C	-	14 days
	Soil	Stainless steel sleeve	Teflon®-lined plastic end-caps	Ice to 4°C	-	14 days
Extractable Hydrocarbons	Water	1 liter glass amber jar X 2	Teflon®-lined caps	Ice to 4°C	7 days	40 days
	Soil	4 oz. glass jar	Teflon®-lined lids	Ice to 4°C	14 days	40 days
	Soil	Stainless steel sleeve	Teflon®-lined plastic end-caps	Ice to 4°C	14 days	40 days
Total Recoverable	Water	1 liter glass amber jar X 2	Teflon®-lined caps	H2SO4 to pH<2; Ice to 4°C	-	28 days
Petroleum Hydrocarbons	Soils	4 oz. glass jar	Teflon®-lined lids	Ice to 4°C	-	28 days
	Soil	Stainless steel sleeve	Teflon®-lined plastic end-caps	Ice to 4°C		28 days
	Soil (volatiles)	Encore sampler	o-ring cap	Ice to 4°C; methanol within 48 hours	-	14 days
Phenols	Water	I liter glass amber jar X2	Teflon®-lined caps	Ice to 4°C	7 days	40 days
	Soil	4 oz. glass jar	Teflon®-lined lids	Ice to 4°C	14 days	40 days
	Soil	Stainless steel sleeve	Teflon®-lined plastic end-caps	Ice to 4°C	14 days	40 days
Organochloride Pesticides	Water	1 liter glass amber jar X2	Teflon®-lined caps	Ice to 4°C	7 days	40 days
and PCBs	Soil	4 oz. glass jar	Teflon®-lined lids	Ice to 4°C	14 days	40 days
	Soil	Stainless steel sleeve	Teflon®-lined plastic end-caps	Ice to 4°C	14 days	40 days
Chlorinated Herbicides	Water	I liter glass amber jar X2	Teflon®-lined caps	Ice to 4°C	7 days	40 days
	Soil	4 oz. glass jar	Teflon®-lined lids	Ice to 4°C	14 days	40 days
	Soil	Stainless steel sleeve	Teflon®-lined plastic end-caps	Ice to 4°C	14 days	40 days
Semivolatiles	Water	I liter glass amber jar X2	Teflon®-lined caps	Ice to 4°C	7 days	40 days
	Soil	4 oz. glass jar	Teflon®-lined lids	Ice to 4°C	14 days	40 days
	Soil	Stainless steel sleeve	Teflon®-lined plastic end-caps	Ice to 4°C	14 days	40 days

Table 1
Sample Containers, Preservation Methods, and Analytical Holding Times (Page 2 of 2)

Parameter	Matrix	Container	Lid	Preservation	Maximum Holding Times Extraction[a]	Maximum Holding Times Analysis[b]
Dioxins and Furans	Water	I liter glass amber jar X2	Teflon®-lined caps	Ice to 4°C	28 days	40 days[a]
	Soil	4 oz. glass jar	Teflon®-lined lids	Ice to 4°C	28 days	40 days
	Soil	Stainless steel sleeve	Teflon®-lined plastic end-caps	Ice to 4°C	28 days	40 days
Polynuclear Aromatic Hydrocarbons	Water	I liter glass amber jar X2	Teflon®-lined caps	Ice to 4°C	7 days	40 days
	Soil	4 oz. glass jar	Teflon®-lined lids	Ice to 4°C	14 days	40 days
	Soil	Stainless steel sleeve	Teflon®-lined plastic end-caps	Ice to 4°C	14 days	40 days
Nitroaromatics and Nitroamines	Water	I liter glass amber jar X2	Teflon®-lined caps	Ice to 4°C	7 days	40 days
	Soil	4 oz. glass jar	Teflon®-lined lids	Ice to 4°C	14 days	40 days
	Soil	Stainless steel sleeve	Teflon®-lined plastic end-caps	Ice to 4°C	14 days	40 days
Nitroglycerine	Water	I liter glass amber jar X2	Teflon®-lined caps	Ice to 4°C	7 days	40 days
	Soil	4 oz. glass jar	Teflon®-lined lids	Ice to 4°C	14 days	40 days
	Soil	Stainless steel sleeve	Teflon®-lined plastic end-caps	Ice to 4°C	14 days	40 days
Anions (Cl, NO2-N, NO3-N, & SO4)	Water	250 ml polyethylene	Teflon®-lined caps	Ice to 4°C (Cl: none)	-	28 days (NO2:48 hrs)
	Soil	4 oz. glass jar	Teflon®-lined lids	Ice to 4°C (Cl: none)	c	28 days (NO2:48 hrs)
	Soil	Stainless steel sleeve	Teflon®-lined plastic end-caps	Ice to 4°C (Cl: none)	c	28 days (NO2:48 hrs)
Ignitability	Water	250 ml polyethylene	Teflon®-lined caps	none	none	none
	Soil	4 oz. glass jar	Teflon®-lined lids	none	none	none
	Soil	Stainless steel sleeve	Teflon®-lined plastic end-caps	none	none	none
Total Cyanide	Water	I liter polyethylene	Teflon®-lined caps	NaOH to pH>12; Ice to 4°C	c	14 days
	Soil	4 oz. glass jar	Teflon®-lined lids	Ice to 4°C	c	14 days
	Soil	Stainless steel sleeve	Teflon®-lined plastic end-caps	Ice to 4°C	c	14 days
Hexavalent Chromium	Water	I liter glass amber jar X2	Teflon®-lined caps	Ice to 4°C	c	24 hours
	Soil	4 oz. glass jar	Teflon®-lined lids	Ice to 4°C	30 days	4 days
	Soil	Stainless steel sleeve	Teflon®-lined plastic end-caps	Ice to 4°C	30 days	4 days
pH	Water	250 ml polyethylene	Teflon®-lined caps	none	-	immediate
	Soil	4 oz. glass jar	Teflon®-lined lids	none	c	immediate
	Soil	Stainless steel sleeve	Teflon®-lined plastic end-caps	none	c	immediate
Field Soil gas	Air or Soil gas	Tedlar bag	None	none	-	3 days
	Air or Soil gas	Summa Canister	None	none	-	14 days

Abbreviations:
ml = milliliter
oz = ounce

a = Starting from the date of collection
b = Starting from the date of extraction; if no extraction is involved, starting from the date of collection
c = Extraction may occur any time prior to analysis. Only the analysis holding time is monitored.

Brown and Caldwell
Standard Operating Procedure

Equipment Decontamination

Revision 1.1
Revision Date: October 9, 2001

Prepared/Revised by:	Wendy Linck Name	October 9, 2001 Date
Senior QA Review:	[signature] Name	10/26/01 Date
Regional Quality: Officer	[signature] Name	October 26, 2001 Date

EQUIPMENT DECONTAMINATION

TABLE OF CONTENTS

1.0 OBJECTIVES

The objective of this standard operating procedure (SOP) is to establish consistent methods to reduce or eliminate:

- Contamination and cross-contamination of environmental samples by sample equipment, other samples, or personnel.
- Health and environmental risk caused by the spread of contaminants.

2.0 APPLICABILITY

Decontamination should occur any time a sampling tool or instrument used in field investigations may contact sampled media, or personnel using the equipment. This procedure will be used in conjunction with use of reusable equipment during field activities associated with handling, sampling or measuring environmental media such as soil, groundwater, soil gas, or air. These procedures are to be implemented primarily on-site such as at the point of use or at a designated equipment decontamination station at the project site. Equipment decontamination should be completed before each use and prior to transporting off-site.

Examples of soil and groundwater sample collection equipment usually requiring decontamination includes pumps, bailers, oil/water interface tapes, tubing, hand augers, split spoon samplers, and other related equipment used for the collection of samples or the measurement of field parameters.

These procedures are general minimum standards. They may be modified or supplemented for a specific project by site-specific workplans or health and safety plans.

3.0 RESPONSIBILITY

The Project Manager, or designee, will have the responsibility to oversee and ensure that equipment decontamination procedures are implemented in accordance this SOP and any site-specific workplan, field sampling plan (FSP), quality assurance project plan (QAPP), and site safety plan (SSP). The field personnel will be responsible for the understanding and implementation of this SOP during all field activities, as well as, obtaining the appropriate field logbooks, forms and records necessary to complete the field activities.

4.0 DEFINITIONS

MSDS. Material Safety Data Sheets. These documents need to be kept on site, and discuss the physical and toxicological aspects for a particular substance used during decontamination.

Decontamination area. An area that is not expected to be contaminated and is upwind of the exclusion zone

Exclusion zone. The area in which contaminants are known or suspected to be present.

Measurement/monitoring equipment. Any equipment used to check or evaluate site conditions.

Potable. Drinkable.

Sampling equipment. Any equipment used during the process of sample collection.

SSHP. Site Safety and Health Plan. Plan written to coordinate and outline precautions that will be taken to initiate and monitor worker safety.

5.0 REQUIRED MATERIALS

The equipment and supplies required for this SOP include the following:

- Clean buckets or tubs to hold wash and rinse solutions of a size appropriate to the equipment to be decontaminated.
- Tap water.
- Deionized or distilled water (grade determined by project requirements. Many projects require "organic free" or ASTM Type II water).
- Long-handled brushes for scrubbing. Flat-bladed scrapers, garden type spray bottles (no oil lubricated parts).
- Non-phosphate detergent such as Alconox® or Liqui-Nox®.
- Plastic sheeting for the decontamination area.
- Department of Transportation certified drums to hold waste decontamination solutions and expendable supplies.
- Drum labels to properly identify the contents of the drum (more information about drum labels is included in the SOP for Investigation Derived Waste Handling Procedures)
- Plastic bags and/or aluminum foil to keep decontaminated equipment clean until the next use.
- Gloves, aprons, safety glasses, and any other PPE required in the SSHP.
- Towels and wipes.
- Dispensing bottles.
- Methanol (if required by the project work plan or quality assurance plan).
- Hexane (if required by the project work plan or quality assurance plan).
- Hot water high-pressure sprayer.
- Sump and collection system for waste derived liquids.

Some Work Plans or FSPs may include additional equipment rinses based on the contaminants being investigated. Examples of this are 0.1N nitric acid when cross-contamination from metals is a concern, and solvents such as methanol, isopropanol, or hexane, when cross-contamination from organics is a concern. If these are required, labeled inert dispensing bottles and Material Safety Data Sheets (MSDS) for these rinses will be necessary. Labels should be well marked. MSDS' should be filed on site and hazard communication needs to occur as outlined in the Site Safety Plan.

6.0 METHODS

Decontamination consists of physically removing contaminants from personnel or equipment. To prevent the transfer of harmful materials, procedures have been developed and are implemented before anyone enters a site and continue throughout site operations.

A decontamination plan should be based on the worst-case scenario (if information about the site is limited). The plan can be modified, if justified, by supplemental information. Initially, the decontamination plan assumes all protective clothing and equipment which leave the exclusion zone are contaminated. Based on this assumption, a system is established to wash and rinse all non-disposable equipment. Decontamination plans will be site-specific and presented in the SSHP for each site.

The decontamination area should be located, if possible, where decontamination fluids and soil wastes can be easily discarded or discharged after receipt of analytical results which determine if discharge parameters have been met. Decontamination wastewater should be managed in accordance with the Investigation Derived Waste Plan or as directed in the work plan or quality assurance plan. Wastewater will be collected and stored onsite until it can be properly disposed.

6.1 Decontamination Station Set-up

A decontamination pad should be established for cleaning of heavy equipment or large sampling tools. This pad can be a prefabricated area that already exists on site for washing large equipment, or can be constructed. If a prefabricated area

All sampling equipment used at the site must be cleaned prior to any sampling effort, after each sample is collected, and after the sampling effort is accomplished.

Removal of residual contamination consists of the following steps:

1) Place the item in the first bucket (detergent wash) and scrub the entire surface area of each piece of equipment to be decontaminated. Utilize scrub brushes to remove all visible contamination. Change the water periodically to minimize the amount of residue carried over into the second rinse.
2) Place the item in the second bucket (clear water rinse – tap or deionized water) and rinse. Change the water periodically to minimize the amount of residue carried over into the third rinse.
3) Place the item in the third bucket (deionized or distilled water) and repeat the rinsing procedure. Change water as necessary.
4) Unless the Work Plan or FSP directs additional rinses, place the item on a clean surface such as plastic sheeting to await reuse or packaging for storage (e.g., wrapping foil).

Additional rinses for field sampling equipment are sometimes called for in the Work Plan or FSP. These include a 0.1 N nitric acid rinse when cross contamination from metals is a concern, and a pesticide-grade solvent (e.g., methanol, isopropanal, or hexane) when organic contamination may be present. These rinses are applied with a wash bottle so that the stream of liquid has completely covered the area of surface of the equipment that may come in contact with the sample. The rinse should be conducted over a container to catch the runoff from the equipment. The nitric acid rinses, if required, should also be followed by a distilled water rinse, also applied with a wash bottle. Solvent rinses should be conducted from more polar (i.e., methanol) to less polar (i.e. hexane or methylene chloride), and allowed to air dry if at all possible. Application of the methanol and hexane rinses requires liberal amounts of hexane to remove the methanol. Under some circumstances (e.g., poor weather), complete air drying of equipment is impractical. In such a case, allowing the equipment to dry as long as practical followed by an organic free water rinse can be used. In some projects (few), equipment may need to be baked to complete the decontamination process. Typical items baked are stainless steel air sampling fittings, where typical decontamination practices are not sufficient to remove potential contamination. Other items that may be baked are soil sleeves. Items are baked at 160 degrees Celsius for a minimum of 8 hours. The requirement to bake items is a project specific requirement and should be specifically discussed in project specific planning documents.

6.4 Prevent Recontamination After Decontamination

After the decontamination process, equipment should be stored to preserve its clean state to the extent practical. The method will vary by the nature of the equipment. Protection measures include covering or wrapping in plastic or sealable plastic bags, or wrapping with oil-free aluminum foil.

6.5 Disposal of Contaminants and Spent Rinse Fluids

All washing and rinsing solutions are considered investigation derived waste and should be containerized. After use, gloves and other disposable PPE should also be containerized and handled as investigation derived waste. See SOP on Investigation Derived Waste Handling Procedures.

6.6 Record Keeping

The decontamination method should be documented within the field documentation designated for the project. Entries documenting the procedure used, fluids used, lot numbers for fluids, and any changes and approval for changes should be entered into a bound field notebook or on project-specific forms. Upon completion of the field activity, it is the responsibility of the field personnel to ensure the project/task manager receives copies of all of the field documentation.

7.0 REFERENCES

Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities. October 1985.

United States Environmental Protection Agency (U.S. EPA), 1990. Procedures to Schedule and Complete Sampling Activities in Cooperation with EPA Region VII Environmental Services Division. February.

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U.S. EPA, 1987. A Compendium of Superfund Field Operations Methods, Volumes I and II. EPA/540/P-87/001a&b.

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The Code of Federal Regulations, 1993. Title 29, 1910.120. July.

8.0 ATTACHMENTS

None.

1.0 OBJECTIVES

The objective of this standard operating procedure (SOP) is to establish a consistent method and format for the use and control of documentation generated during daily field activities. Field notes and records are intended to provide sufficient information that can be used to recreate the field activities, as well as, the collection of environmental data. Information placed in these documents and/or records shall be factual, detailed and objective.

2.0 SCOPE AND APPLICABILITY

This procedure will be used during all field activities, regardless of the purpose by all project team personnel and subcontractors who conduct field investigations. These activities may include, but are not limited to, all types of media sampling (soil vapor, soil, groundwater, wastewater, etc), utility clearance, well installation, sample point locating and surveys, site reconnaissance, free product removal, remediation, and waste handling.

3.0 RESPONSIBILITY

The Project Manager (PM), or designee, will have the responsibility to oversee and ensure that field documentation is collected in accordance with this SOP and any site-specific or project specific planning documents. The field sampling personnel will be responsible for the understanding and implementation of this SOP during all field activities, as well as, obtaining the appropriate field logbooks, forms and records necessary to complete the field activities. Field personnel shall ensure all field activities are documented completely at the end of each field day. Field personnel are responsible for tracking the location of all field documentation, including field logbooks. Field personnel are responsible for assuring that the original documentation (or copies of the field log book, if needed for another project at the same site), are filed at the end of the field project or during a long project (greater than month) every couple of weeks.

4.0 REQUIRED MATERIALS

The materials required for this SOP include the following:

- Bound field logbooks, and
- Black waterproof and/or indelible ink pens
- Field Forms

5.0 METHODS

This SOP primarily includes the documentation procedures for the field logbooks. However, procedures discussed in this SOP are applicable to all other types of field documentation collected, and should be universal in application. Details of other field records and forms (e.g. boring logs, sample labels, chain of custody records, and waste containment labels are discussed in the specific SOP associated with that particular field activity (e.g. borehole drilling, sample handling, investigative derived waste), and not covered in detail in this SOP.

5.1 Field Logbooks

Field personnel will keep accurate written records of their daily activities in a bound logbook that will be sufficient to recreate the project field activities without reliance on memory. This information will be recorded in chronological order. All entries will be legible, written in black waterproof or indelible ink, and contain accurate and inclusive documentation of field activities, including field data observations, deviations from project plans, problems encountered, and actions taken to solve the problem. Each page of the field logbook will be consecutively numbered, signed and dated by the field author(s). Pages should not be removed for any reason.

There should be no blank lines on a page. A single blank line or a partial blank line (such as at the end of a paragraph) should be lined to the end of the page. If only part of a page is used, the remainder of the page should have an "X" drawn across it.

In addition to documenting field activities, field logbooks will include, but are not limited to, the following:

- Date and time of activities,
- Site location
- Purpose of site visit,
- Site and weather conditions,
- Personnel present, including sampling crew, facility/site personnel and representatives (including site arrival and departure times),
- Subcontractors present,
- Regulatory agencies and their representatives (including phone numbers, site arrival and departure times),
- Level of health and safety protection,
- Sampling methodology and information,
- Sample Locations (sketches are very helpful),
- Source of sample(s), sample identifications, sample container types and preservatives used, and lot numbers for bottles and preservatives (if applicable and if not recorded on other forms or in a sample control logbook),
- A chronological description of the field observations and events,
- Specific considerations associated with sample acquisition (e.g., field parameter measurements, field screening data, HASP monitoring data, etc.) (if not recorded on another form),

- Wastes generated, containment units (including volumes, matrix, etc), and storage location (if not recorded on another form),
- Field quality assurance/quality control samples collection, preparation, and origin (if not recorded on other forms or in a sample control logbook),
- The manufacturer, model and serial number of field instruments (e.g., OVM, water quality, etc.) shall be recorded, if not using a calibration form. Also, source lot # and expiration date of standard shall be recorded if calibrated in the field.
- Well construction materials, water source(s), and other materials used on-site (if not recorded on another form).
- Sample conditions that could potentially affect the sample results,
- If deviating from plan, clearly state the reason(s) for deviation,
- Persons contacted and topics discussed,
- Documentation of exclusion zone set-up and location,
- Documentation of decontamination procedures, and
- Daily Summary.

Field situations vary widely. No general rules can specify the extent of information that must be entered in a logbook. However, records should contain sufficient information so that someone can reconstruct the field activity without relying on the collector's memory. Language used shall be objective, factual, and free of personal opinions. Hypothesis for observed phenomena may be recorded, however, they must be clearly indicated as such and only relate to the subject observation.

Logbooks will be assigned to a specific sampling team. If it is necessary to transfer the log book to alternative team member during the course of field work, the person relinquishing the log book will sign and date the log book at the time of transfer.

Field logbooks should consist of a bound book, in which the insertion or removal of pages will be visibly noticeable after the logbook has been assembled. Logbooks can be prepared by gluing or laminating pages together either at the left side or top of the page. If inclement weather is expected, logbooks may have plastic laminated front and back covers to protect the interior pages, and should not be broken apart for coping. Loose-leaf binding, such as comb binding is not considered hard binding. To maintain the integrity of the logbook, pages should be consecutively numbered prior to use. Logbook pages can be of any format, and may include blank pages for recording or field forms that are used for specific tasks. As an alternative, commercially bound and consecutive page numbered field logbooks may also be used.

5.2 Photographs

Photographs provide the most accurate demonstration of the field worker's observations. They can be significant to the field team during future inspections, informal meetings, and hearings. Photographs should be taken with a camera-lens system having a perspective similar to that afforded by the naked eye. Telephoto or wide-angle shots cannot be used in enforcement proceedings. Some industrial clients do not permit photographs on their sites. In industrial settings, confirm with the project manager that photographs are allowed.

A photograph must be documented if it is to be a valid representation of an existing situation. Therefore, for each photograph taken, several items shall be recorded in the field logbooks:

- Date and time photograph taken;
- Name of photographer;
- Site name, location, and field task;
- Brief description of the subject and the direction taken; and
- Sequential number of the photograph and the roll number.

5.3 Additional Field Forms/Records

Additional field records may be required for each specific field event. The use of these records and examples are described in other SOPs specific for the activity (e.g. Borehole Logging SOP, Groundwater Sampling and Purging SOP, etc.). These other records may include:

- Borehole Logs during drilling
- Well Construction and Development records (groundwater, soil vapor, extraction, etc.),
- Groundwater Purge and Sample Collection Records,
- Soil Vapor Purge and Sample Collection Records,
- Water Level Monitoring and Product Removal Records,
- NAPL Removal Records,
- Investigation Derived Waste (IDW) Tracking Records,
- Instrument Calibration Records, and
- Health and Safety Monitoring Records and sign-off sheets.

Prior to field activities, the field sampling personnel will coordinate with the Project Manager, or designee, to determine which additional records will be required for the specific field task. These additional records will be maintained in a field file or a three-ring notebook throughout the duration of the field activities, or included in a specially prepared site-specific notebook. If the field notebook is being created, the forms may be part of the laminated book.

6.0 CORRECTIONS

If an error is made in the field, logbook corrections will be made by drawing a single line through the error, entering the correct information, and initialing and dating the change. Materials that obliterate the original information, such as correction fluids and/or mark-out tapes, are prohibited. All corrections will be initialed and dated. Some projects require that a brief reason for the change must also be added where the correction was made. Ask the Project Manager, if this requirement is necessary.

7.0 DOCUMENTATION REVIEWS

Periodically, the Project Manager, or designee, will review the field logbooks pertaining to the activities under their supervision. The elements of this review will include technical content, consistency, and compliance with the project plans and SOPs. Discrepancies and errors identified during the review should be resolved between reviewer and author of the field documentation. Corrections and/or additions of information shall be initialed and dated by the field author or reviewer.

8.0 FIELD RECORD BACKUP

Periodically, the Project Manager, or designee, will determine if and when field logbooks and records need to be photocopied. Photocopies will be maintained in the project files, and can be used as backup in the event that the original field logbook or records are lost or damaged.

9.0 DOCUMENTATION ARCHIVE

At the completion of the project, all original field logbooks and records will be store in the project files in accordance with Brown and Caldwell procedures. Typically project files lifetimes are controlled and spelled out in contractual agreements with clients. Typically, project files are archived after project finalization and kept indefinitely in archive.

10.0 REFERENCES

None cited.

11.0 ATTACHMENTS

None listed.

Brown and Caldwell
Standard Operating Procedure

Investigation-Derived Waste
Handling Procedures

Revision 2.0
Revision Date: January 9, 2002

Prepared/Revised by:	Jim Atkinson/Lisa Skutecki Name	January 9, 2002 Date
Senior QA Review:	John Fulch Name	1/14/02 Date
Regional Quality Officer:	David Van Winkle Name	January 14, 2002 Date

INVESTIGATION DERIVED WASTE HANDLING PROCEDURES

TABLE OF CONTENTS

1.0 OBJECTIVES

The objective of this standard operating procedure (SOP) is to establish consistent methods to handle and manage all Investigation-Derived Waste (IDW), including:

- Solid waste, both hazardous and non-hazardous (e.g., soil cuttings, contaminated debris or equipment)
- Liquid waste both hazardous and non-hazardous (e.g., purge water, rinse water from decontamination, product removal)
- Personal Protective Equipment (e.g., gloves, spent respirator cartridges, chemical-resistant coveralls)

This SOP provides procedures and standards that are in addition to applicable regulatory requirements and industry standards.

2.0 APPLICABILITY

Investigation sampling activities may generate solid, liquid, and Personal Protective Equipment (PPE) waste. The IDW Handling Procedures SOP will be implemented primarily on-site.

3.0 RESPONSIBILITY

The Project Manager, or designee, will have the responsibility to oversee and ensure that the IDWs are properly handled and managed in accordance with this SOP and any site-specific or project-specific planning documents. Field personnel will be accountable for the comprehension and implementation of this SOP during all field activities, as well as obtaining the appropriate field logbooks, forms, labels, records and equipment needed to complete the field activities.

4.0 DEFINITIONS

Designated Waste: A solid or liquid waste which is not defined as hazardous, but which still may present a threat to groundwater, and which requires handling differently than a non-hazardous inert waste.

D.O.T.: – Department of Transportation. Typically referred to when specifying a type of container that is approved for transporting hazardous substances, either materials or waste, on streets.

Hazardous Waste: Soil, liquid, or other wastes generated from site investigations that exhibit toxic (human or ecological effects), ignitable, corrosive, or reactive characteristics as defined by applicable state or federal regulation or which is otherwise classified as hazardous. Such waste requires special handling and documentation of disposal.

IDW: – Investigation Derived Waste. Typically solid (e.g., soil) or liquid (e.g. groundwater, decontamination fluids) wastes resulting from field activities.

Non-hazardous Waste: A waste that does not exhibit characteristics of a hazardous waste and which is not otherwise classified as hazardous. Non-hazardous waste can be designated or inert waste.

PPE: – Personal Protective Equipment. Worn by workers when potential for exposure to hazardous materials exists.

SSHP: – Site Safety and Health Plan. Plan written to coordinate and outline precautions that will be taken to initiate and monitor worker safety.

5.0 REQUIRED MATERIALS

The equipment and supplies required for implementation of this SOP include the following:

- Containers for waste (e.g., 55-gallon open and closed top drums) and material to cover waste to protect from weather (e.g., plastic covering)

- Equipment (i.e., pumps, generators, water/interface level indicators, safety monitoring equipment)
- Hazardous /non-hazardous waste drum labels (weatherproof)
- Permanent marking pens
- Inventory forms for project file
- Plastic garbage bags, zip lock storage bags, roll of plastic sheeting
- Steel-toed boots, chemical resistant gloves, coveralls, safety glasses, and any other PPE required in the site-specific SSHP.

6.0 METHODS

The following methods are used to handle the IDW.

6.1 Labeling

Containers used to store IDW must be properly labeled. Two general conditions exist: 1) from previous studies or on-site data, waste characteristics are known to be either hazardous or non-hazardous; or 2) waste characteristics are unknown until additional data are obtained.

For situations where the waste characteristics are known, the waste containers should be packaged and labeled in accordance with California Code of Regulations (CCR), Sections 66262.30 to 66262.33, and any federal regulations that may govern the labeling of waste (e.g., CCR, Title 22, Section 66262.34).

The following information shall be placed on all non-hazardous waste labels:

- Description of waste (i.e., purge water, soil cuttings);
- Contact information (i.e., contact name and telephone number);
- Date when the waste was first accumulated.

The following information shall be placed on all hazardous waste labels:

- Description of waste (i.e., purge water, soil cuttings);
- Generator information (i.e., name, address, contact telephone number);
- EPA identification number (supplied by on-site client representative);
- Date when the waste was first accumulated.

When the final characterization of a waste is unknown, a notification label should be placed on the drum with the terms "waste characterization pending analysis" and the following information included on the label:

- Description of waste (i.e., purge water, soil cuttings);
- Contact information (i.e., contact name and telephone number);
- Date when the waste was first accumulated.

Once the waste has been characterized, the label should be changed as appropriate for a non-hazardous or hazardous waste.

Waste labels should be constructed of a weatherproof material and filled out with a permanent marker to prevent being washed off or becoming faded by sunlight. It is recommended that waste labels be placed on the side of the container, since the top is more subject to weathering. However, when multiple containers are accumulated together, it also may be helpful to include labels on the top of the containers to facilitate organization and disposal.

Each container of waste generated shall be recorded in the field notebook used by the person responsible for labeling the waste. After the waste is transported off-site (see sections 6.4 – 6.6 below), an appropriate record shall be made in the same field notebook to document proper disposition of IDW.

6.2 Types of Site Investigation Waste

Several types of waste are generated during site investigations that may require special handling. These include solid, liquid, and used PPE, as discussed further below.

6.2.1 Solid Waste

Soil cuttings and drilling mud generated during investigation activities shall be kept on-site in containers. Covers should be included on the containers and must be secured at all times and only open during filling activities. The containers shall be labeled in accordance with this SOP. An inventory containing the source, volume, and description of material put in the containers shall be logged on prescribed forms and kept in the project file.

6.2.2 Liquid Waste

Groundwater generated during monitoring well development, purging, and sampling can be collected in truck-mounted containers and/or other transportable containers (i.e., 55-gallon drums). Lids or bungs on drums must be secured at all times and only open during filling or pumping activities. The containers shall be labeled in accordance with this SOP. Waste that is generated during equipment decontamination shall be collected in a separate container. All waste containers shall be properly accounted for through an inventory process.

6.2.3 Personal Protective Equipment (PPE)

PPE that is generated throughout investigation activities shall be placed in plastic garbage bags and stored in secure containers. The containers shall be properly sealed and labeled according to this SOP. If the solid or liquid waste is characterized as hazardous waste, then the corresponding PPE should also be disposed as hazardous waste. If not, all PPE should be disposed as non-hazardous waste at an appropriate facility. Trash that is generated as part of field activities may be disposed of in regular collection facilities as long as the trash was not exposed to hazardous media.

6.3 Waste Accumulation On-Site

Solid, liquid, or PPE waste generated during investigation activities that are classified as non-hazardous or "characterization pending analysis" should be disposed of as soon as possible. Until disposal, such containers should be inventoried, stored as securely as possible, and inspected regularly, as a general good practice.

Solid, liquid, or PPE waste generated during investigation activities that are classified as hazardous shall not be accumulated on-site longer than 90 days. All hazardous waste containers shall be stored in a secured storage area. The following requirements for the hazardous waste storage area must be implemented:

- Proper hazardous waste signs shall be posted as required by CCR, Title 22, Section 66262.32, and any state statutes that may govern the labeling of waste (e.g., CCR, Title 22 Section 66264.14);
- Secondary containment to contain spills;
- Spill containment equipment must be available;
- Fire extinguisher;
- Adequate aisle space for unobstructed movement of personnel.

Weekly storage area inspections shall be performed and documented to ensure compliance with these requirements. Throughout the project, an inventory shall be maintained to itemize the type and quantity of the waste generated.

6.4 Waste Disposal

Solid, liquid, and PPE waste will be characterized for disposal through the use of client knowledge, laboratory analytical data created from soil or groundwater samples gathered during the field activities, and/or composite samples from individual containers.

All waste generated during field activities will be stored, transported, and disposed of according to applicable state, federal, and local regulations. All wastes classified as hazardous will be disposed of at a licensed treatment storage and disposal facility or managed in other approved manners.

In general, waste disposal should be carefully coordinated with the facility receiving the waste. Facilities receiving waste have specific requirements that vary even for non-hazardous waste, so characterization should be conducted to support both applicable regulations and facility requirements.

6.5 Regulatory Requirements

The following federal, and state regulations shall be used as resources for determining waste characteristics and requirements for waste storage, transportation, and disposal:

- Code of Federal Regulations (CFR), Title 40, Part 261
- CCR, Title 22, Section 66261 et. seq.
- CFR, Title 49, Parts 172, 173, 178, and 179

6.6 Waste Transport

A state of California certified hazardous waste hauler shall transport all wastes classified as hazardous. Typically, the facility receiving any waste can coordinate a hauler to transport the waste. Shipped hazardous waste shall be disposed of in accordance with all RCRA/USEPA requirements. All waste manifests or bills of lading will be signed either by the client or the client's designee, which can in special circumstances be the project manager if acting as an authorized agent for the client.

Any such agreements where a Brown and Caldwell employee acts as an agent for the client shall be reviewed and approved by corporate legal.

7.0 REFERENCES

U.S. EPA Guide to Management of Investigative-Derived Waste, Publication: 9345.3-03FS, April 1992.

California Code of Regulations, Title 22, Division 4.5, Environmental Health Standards for the Management of Hazardous Waste, periodically updated – use most current version.

Code of Federal Regulations, Title 40, Section 262.32, Standards Applicable to Generators of Hazardous Wastes, Subpart C – Pre-transport Requirements, Marking, periodically updated – use most current version.

8.0 ATTACHMENTS

Checklist for compliance with "Transportation and Manifesting" and "Accumulation and Storage of Wastes," pages 4A-2 through 4A-5 from Environmental Auditing: California Compliance Guide, published by ERM-West, Inc. and Specialty Technical Publishers, September 2001.

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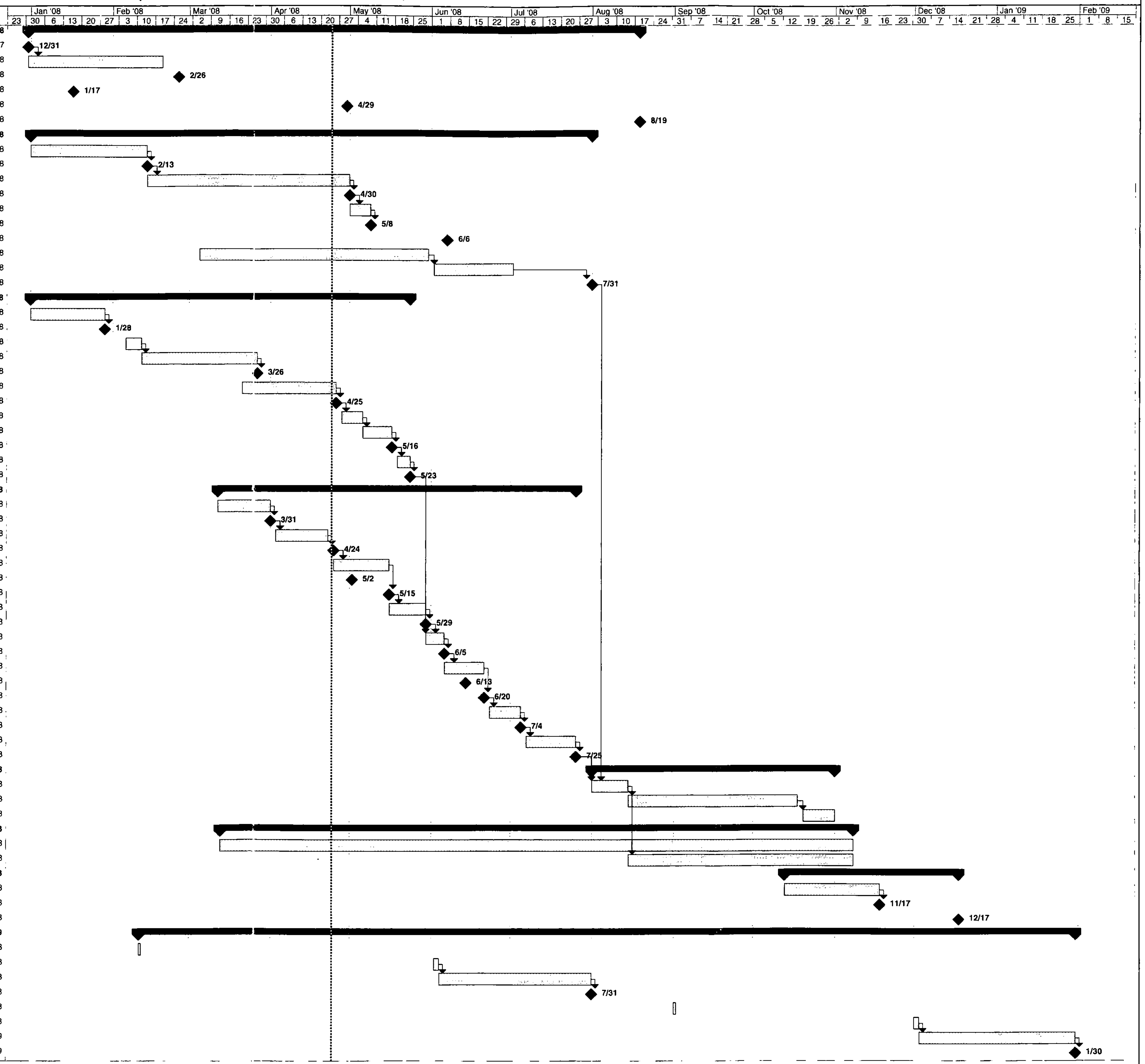
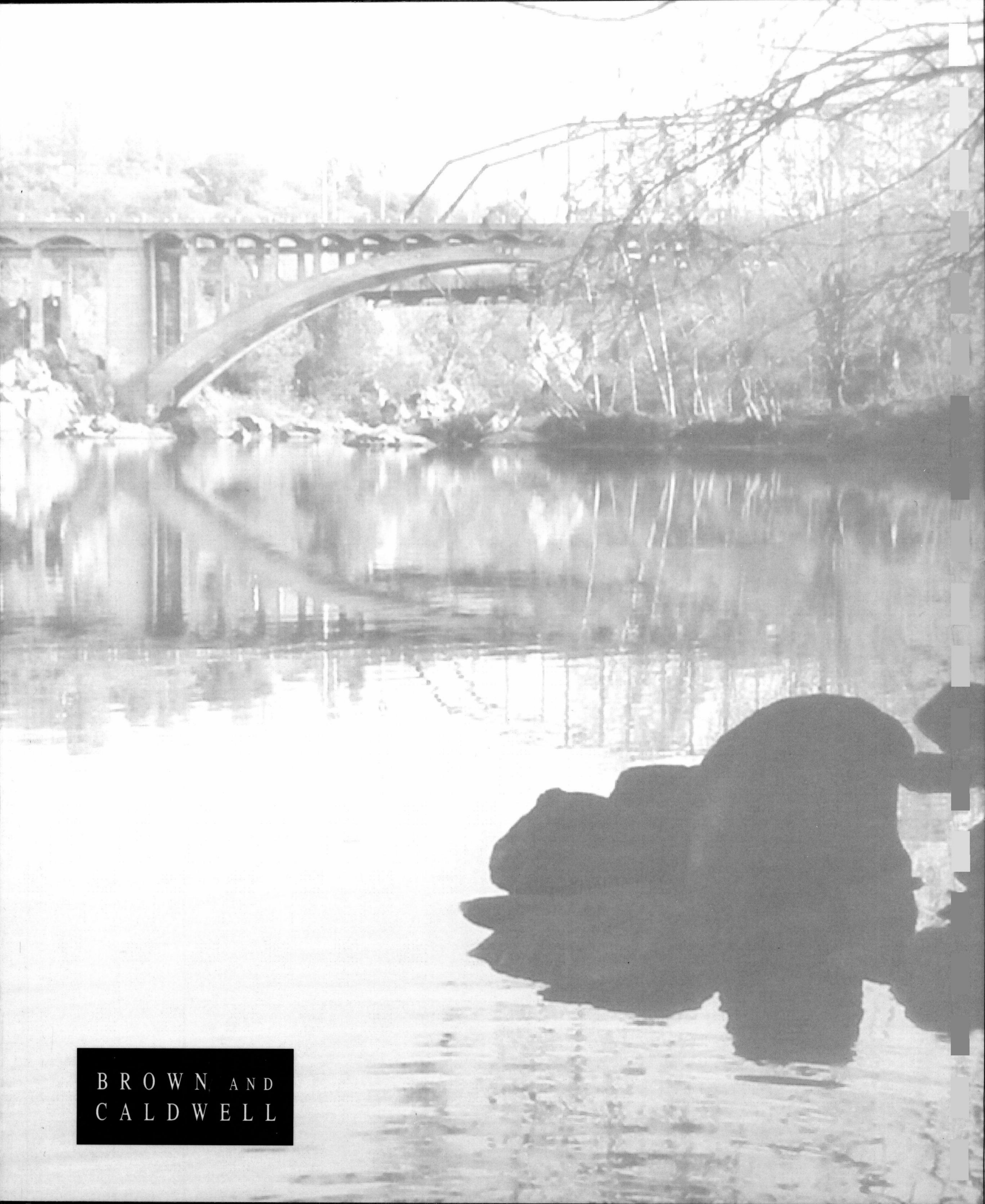
APPENDIX G.

PROJECT SCHEDULE

Corporation Yard Landfill Clean Closure, Folsom, CA

ID	Task Name	Duration	Start	Finish
1	**CEQA Process & Public Outreach**	**166 days**	**Mon 12/31/07**	**Tue 8/19/08**
2	**BC/City Deliverable: CEQA Initial Study**	0 days	Mon 12/31/07	Mon 12/31/07
3	Public Review of CEQA Initial Study	37 days	Mon 12/31/07	Tue 2/19/08
4	City Adopts Mitigated Negative Declaration	0 days	Tue 2/26/08	Tue 2/26/08
5	Public Meeting (Project Kickoff)	0 days	Thu 1/17/08	Thu 1/17/08
6	Public Meeting (Pre-Construction Period)	0 days	Tue 4/29/08	Tue 4/29/08
7	Public Meeting (Mid-Construction Period)	0 days	Tue 8/19/08	Tue 8/19/08
8	**Work Plan Preparation & Agency Permitting**	**153 days**	**Tue 1/1/08**	**Thu 7/31/08**
9	Prepare Draft Final AROWD/Clean Closure Plan	32 days	Tue 1/1/08	Wed 2/13/08
10	**BC/City Deliverable: Draft Final AROWD/Clean Closure Plan**	0 days	Wed 2/13/08	Wed 2/13/08
11	Agency Review of Draft Final AROWD/Clean Closure Plan	55 days	Thu 2/14/08	Wed 4/30/08
12	**Agency Deliverable: Comments on Draft Final AROWD/Clean Closure Plan**	0 days	Wed 4/30/08	Wed 4/30/08
13	Prepare Final AROWD/Clean Closure Plan	6 days	Thu 5/1/08	Thu 5/8/08
14	**BC/City Deliverable: Final AROWD/Clean Closure Plan**	0 days	Thu 5/8/08	Thu 5/8/08
15	**Agency Deliverable: Written Approval of Final AROWD/Clean Closure Plan**	0 days	Fri 6/6/08	Fri 6/6/08
16	RWQCB Prepare Draft Revised Waste Discharge Requirements (WDRs)	63 days	Wed 3/5/08	Fri 5/30/08
17	Public Review of Draft Revised WDRs	22 days	Mon 6/2/08	Tue 7/1/08
18	**RWQCB Deliverable: Final Revised WDRs**	0 days	Thu 7/31/08	Thu 7/31/08
19	**Design**	**104 days**	**Tue 1/1/08**	**Fri 5/23/08**
20	Prepare Pre-Design Investigation Work Plan	20 days	Tue 1/1/08	Mon 1/28/08
21	**BC/City Deliverable: Pre-Design Investigation Work Plan**	0 days	Mon 1/28/08	Mon 1/28/08
22	Conduct Pre-Design Investigation	4 days	Wed 2/6/08	Mon 2/11/08
23	Prepare Pre-Design Investigation Results Report	32 days	Tue 2/12/08	Wed 3/26/08
24	**BC/City Deliverable: Pre-Design Investigation Results Report**	0 days	Wed 3/26/08	Wed 3/26/08
25	Prepare Draft Design Documents (Drawings & Specifications)	26 days	Fri 3/21/08	Fri 4/25/08
26	**BC Deliverable: Draft Design Documents**	0 days	Fri 4/25/08	Fri 4/25/08
27	City Review of Draft Design Documents	6 days	Mon 4/28/08	Mon 5/5/08
28	Prepare Final Design Documents	9 days	Tue 5/6/08	Fri 5/16/08
29	**BC Deliverable: Final Design Documents**	0 days	Fri 5/16/08	Fri 5/16/08
30	Prepare Cost Estimate	5 days	Mon 5/19/08	Fri 5/23/08
31	**BC Deliverable: Cost Estimate**	0 days	Fri 5/23/08	Fri 5/23/08
32	**Bidding & Contracting**	**98 days**	**Wed 3/12/08**	**Fri 7/25/08**
33	Prepare Draft Request for Qualification (RFQ)	14 days	Wed 3/12/08	Mon 3/31/08
34	**BC Deliverable: Draft RFQ**	0 days	Mon 3/31/08	Mon 3/31/08
35	City Review of Draft RFQ	14 days	Thu 4/3/08	Tue 4/22/08
36	**City Deliverable: Final RFQ**	0 days	Thu 4/24/08	Thu 4/24/08
37	Prepare Statement of Qualification (SOQ)	15 days	Fri 4/25/08	Thu 5/15/08
38	Site Walk	0 days	Fri 5/2/08	Fri 5/2/08
39	**Contractor Deliverable: SOQ**	0 days	Thu 5/15/08	Thu 5/15/08
40	City Review Contractor SOQs	10 days	Fri 5/16/08	Thu 5/29/08
41	**City Deliverable: Notification of Qualified Contractors**	0 days	Thu 5/29/08	Thu 5/29/08
42	Prepare Bid Package (Front End Documents & Design Documents)	5 days	Fri 5/30/08	Thu 6/5/08
43	**BC/City Deliverable: Request for Bid**	0 days	Thu 6/5/08	Thu 6/5/08
44	Bid Preparation	11 days	Fri 6/6/08	Fri 6/20/08
45	Bid Walk	0 days	Fri 6/13/08	Fri 6/13/08
46	**Contractor Deliverable: Bid**	0 days	Fri 6/20/08	Fri 6/20/08
47	City Review Contractor Bids	10 days	Mon 6/23/08	Fri 7/4/08
48	**City Deliverable: Notification of Selected Contractor**	0 days	Fri 7/4/08	Fri 7/4/08
49	Contracting	15 days	Mon 7/7/08	Fri 7/25/08
50	**City/Contractor Deliverable: Executed Contract**	0 days	Fri 7/25/08	Fri 7/25/08
51	**Construction**	**66 days**	**Fri 8/1/08**	**Fri 10/31/08**
52	Mobilization & Site Preparation	10 days	Fri 8/1/08	Thu 8/14/08
53	Excavation & Confirmation Sampling	46 days	Fri 8/15/08	Fri 10/17/08
54	Final Grading & Demobilization	10 days	Mon 10/20/08	Fri 10/31/08
55	**Air Monitoring**	**172 days**	**Thu 3/13/08**	**Fri 11/7/08**
56	Meteorological Monitoring	172 days	Thu 3/13/08	Fri 11/7/08
57	Air Quality Monitoring	61 days	Fri 8/15/08	Fri 11/7/08
58	**Clean Closure Documentation & Agency Certification**	**48 days**	**Mon 10/13/08**	**Wed 12/17/08**
59	Prepare Clean Closure Results Report	26 days	Mon 10/13/08	Mon 11/17/08
60	**BC/City Deliverable: Clean Closure Results Report**	0 days	Mon 11/17/08	Mon 11/17/08
61	**Agency Deliverable: Written Certification of Clean Closure**	0 days	Wed 12/17/08	Wed 12/17/08
62	**Groundwater & Landfill Gas Monitoring & Reporting**	**255 days**	**Mon 2/11/08**	**Fri 1/30/09**
63	1Q 2008 Monitoring Event (groundwater elevation only)	1 day	Mon 2/11/08	Mon 2/11/08
64	2Q 2008 Monitoring Event	2 days	Mon 6/2/08	Tue 6/3/08
65	Prepare 2008 Semi-Annual Report	42 days	Wed 6/4/08	Thu 7/31/08
66	**BC/City Deliverable: 2008 Semi-Annual Report**	0 days	Thu 7/31/08	Thu 7/31/08
67	3Q 2008 Monitoring Event (groundwater elevation only)	1 day	Mon 9/1/08	Mon 9/1/08
68	4Q 2008 Monitoring Event	2 days	Mon 12/1/08	Tue 12/2/08
69	Prepare 2008 Annual Report	43 days	Wed 12/3/08	Fri 1/30/09
70	**BC/City Deliverable: 2008 Annual Report**	0 days	Fri 1/30/09	Fri 1/30/09

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Brown and Caldwell
Standard Operating Procedure
Field Notes and Documentation

Revision 1.0
Revision Date: May 11, 2001

Prepared/Revised by:	Wendy Linck Name	May 11, 2001 Date
Senior Quality Manager Reviewer:	Jay Lucas Name	10/26/01 Date
Regional Quality Manager Reviewer:	David Van Winkle Name	October 26, 2001 Date

FIELD NOTES

TABLE OF CONTENTS

exists, it needs have characteristics that allow for collecting fluids and solids that will fall off the large equipment. Decontamination pads can be constructed in a variety of ways, but things to consider during construction are the following:

- The pad will need to be constructed so it provides complete secondary containment. Hence all sides will require berms to prevent off pad migration of fluids. The berms need to be constructed by considering the balance between sump pump removal rates and the amount of fluid that will be generated.
- Fluids from decontamination processes cannot escape and be directly discharged vertically into the ground; hence if plastic sheeting is used it should be minimally double layered and thick (greater than 8 mil).
- The pad will have to drain in one general direction where a sump pump can collect fluids.
- The pad will need to be located near power and water, if possible. However, a generator can supply power and water can be trucked in.

For small equipment decontamination and PPE decontamination a smaller station is established, usually in the contaminant reduction zone, between the exclusion zone and buffer zone. For this station, clean buckets or tubs (5 gallon buckets are most common) should be used. There should be enough room within this area for storing used and unused drums. Buckets should be placed on plastic sheeting to prevent spillage to the ground, and to help keep the decontamination area and equipment as clean as possible. The buckets should be filled half to three-quarters full as follows:

Bucket 1	Tap water with non-phosphate detergent such as Liqui-Nox made up as directed by the manufacturer.
Bucket 2	Tap water or deionized water for rinsing
Bucket 3	Deionized or distilled water for the second rinsing

If additional rinses using wash or dispensing bottles are called for in the project-specific documents, an additional bucket to catch the discharge from the final rinse will be necessary.

A clean area, generally covered with plastic sheeting or large clean plastic bags, is also needed to set down decontaminated equipment prior to reuse or air drying and packaging for later use. A stainless steel rack (e.g., grill for barbecue) can often help drying activities.

After the decontamination area is set up, equipment decontamination is comprised of four general steps:

1) Removal of gross (visible) contamination
2) Removal of residual contamination
3) Prevention of recontamination, and
4) Disposal of wastes associated with the decontamination

6.2 Remove Gross Contamination

Gross contamination generally applies to soil sampling equipment, which may have significant residue clinging to the piece of equipment. This can be removed by dry brushing or scraping or by a high-pressure steam or water rinse often, in areas not grossly contaminated, steam washes may be all that is applied to larger equipment, such as drill casings. If utilizing high-pressure steam or water, the rinse water should be containerized as investigation derived waste. Since a significant amount of wastes may be generated, this operation is often best conducted on a decon pad, which has been designed as a secondary containment area to collect wastes.

6.3 Remove Residual Contamination

8.0 REFERENCES

U.S. Environmental Protection Agency, A Compendium of Superfund Field Operations Methods, EPA/540/P-87/001, December 1987.

U.S. Environmental Protection Agency, Compendium of ERT Soil Sampling and Surface Geophysics Procedures, EPA/540/ P-91/006, Interim Final, January 1991.

U.S. Environmental Protection Agency, Description and Sampling of Contaminated Soils - A Field Pocket Guide, EPA/625/P-12-91/902, November 1991.

American Society for Testing Materials, Annual Book of ASTM Standards, Section 4, Volume 4.08, Practice for Soil Investigation and Sampling by Auger Borings, ASTM D 1452-80 (1990), 1992.

American Society for Testing Materials, Annual Book of ASTM Standards, Section 4, Volume 4.08, Standard Method for Penetration Test and Split-Barrel Sampling of Soils, ASTM D 1586-84, 1992.

American Society for Testing Materials, Annual Book of ASTM Standards, Section 4, Volume 4.08, Standard Practice for Thin-walled Tube Sampling of Soils, ASTM D 1587-88, 1992.

American Society for Testing Materials, Annual Book of ASTM Standards, Section 4, Volume 4.08, Practice for Ring-Lined Barrel Sampling of Soils, ASTM D 3550-84 (1991), 1992.

American Society for Testing Materials, Annual Book of ASTM Standards, Section 4, Volume 4.08, Standard Practice for Preserving and Transporting Soil Samples, ASTM D 4220-89, 1992.

En Novative Technologies, Inc., SW846 Method 5035 Field Sampling Guide, February 1998.

9.0 ATTACHMENTS

A Tube Auger

B Split-Barrel Sampler

C En Core Sampler Information

9. Repeat sampling procedure for the duplicate VOA vial.

10. Collect dry weight sample – fill container.

11. Store samples at 4 degrees Celsius.

12. Ship containers with plenty of ice and per DOT regulations to the laboratory.

6.4.3. Encore™ Sampler Collection For High Level Analyses (> 200 µg/Kg)

Each sample point requires the following equipment:

1. One 25g sampler or one 5g sampler. (The sampler size used will be dependent on who is doing the sampling and who is doing the laboratory analysis).

2. One dry weight cup.

3. One T-handle.

4. Paper towels.

The procedure for collecting soil samples is as follows:

1. Remove sampler and cap from package and attach T-handle to sampler body. Make sure that the sampler is locked into place in the T-handle.

2. Quickly push sampler into a freshly exposed surface of soil until the sampler is full. The sampler is full when the o-ring is visible in the hole on the side of the T-handle.

3. Use paper towel to quickly wipe the sampler head so that the cap can be tightly attached.

4. Push cap on with a twisting motion to attach cap.

5. Place sampler into the package.

6. Fill out label and attach to the package, where specified for the label.

7. Collect dry weight sample – fill container. If other samples (non-Encore™) are collected for the same sampling interval, the dry weight sample may be designated and analyzed using the other sample.

8. Store samplers at 4 degrees Celsius.

9. Ship sample containers with plenty of ice to the laboratory. Samples must arrive at the laboratory **within 40 hours** of collection.

6.4.4. Methanol Preservation Sampling for High Level Analyses (≥ 200 μg/kg).

This procedure should be done in the field **only** if field constraints prevent shipment to the laboratory such that the laboratory cannot perform the analysis within 48 hours (or samples will not arrive within 24 to 36 hours of collection).

Methanol preservation of each sample point requires the following equipment:

1. One pre-weighted jar that contains methanol or a pre-weighted empty jar accompanied with a pre-weighted vial that contains methanol.

2. One dry weight cup.

3. Weighing balance that weighs to 0.01 gram (filed balances may not reliably weigh to 0.01 gram).

4. Set of balance weights used in daily balance calibration.

5. Gloves for working with pre-weighted sample vials.

6. Paper towels.