REVISED DRAFT
FEASIBILITY STUDY
TECHNICAL REPORT

CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

Prepared for:

Washington Department of Ecology
4601 N. Monroe, Suite 202
Spokane, Washington 99205-1295
(509) 456-2926

On Behalf of:

LEHIGH
HEIDELBERGCEMENT Group

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Prepared by:

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5 May 2005

GEOSYNTEC CONSULTANTS

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3 March 2005

William J. Fees, P.E.
Toxics Cleanup Program
Washington Department of Ecology
4601 North Monroe Street
Spokane, Washington 99205

Subject: Revised Draft Feasibility Study Technical Report
Closed Cement Kiln Dust Pile
Metaline Falls, Washington

Dear Mr. Fees:

In accordance with Task 4 of Agreed Order DE99HS-E941, Lehigh Cement Company (Lehigh) is pleased to submit for your review this Revised Draft Feasibility Study Technical Report (Revised dFSTR) for the Closed Cement Kiln Dust (CKD) Pile site (Site) in Metaline Falls, Washington. The Revised dFSTR describes the evaluation of the six alternatives for Site groundwater remedy.

Please call Mr. Smalstig at (714) 969-0800 with questions regarding this document.

Sincerely,

Brian Petty

Brian Petty
Staff Engineer

Eric Smalstig
Project Manager

Copy to: Elizabeth Mikols, Lehigh Cement Company
Andrew Fitz, Esq., Washington State Attorney General's Office
Tanya Barnett, Brown Reavis & Manning
Hank Landau, Geosphere

HR0196-12/MFW05-13_LTR.DOC

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5 May 2005

William J. Fees, P.E.
Toxics Cleanup Program
Washington Department of Ecology
4601 North Monroe Street
Spokane, Washington 99205

Subject: Replacement Pages for the Revised Draft Feasibility Study Technical Report
Closed Cement Kiln Dust Pile
Metaline Falls, Washington

Dear Mr. Fees:

On behalf of Lehigh Cement Company (Lehigh), GeoSyntec Consultants (GeoSyntec) is pleased to submit the enclosed replacement pages for the Revised Draft Feasibility Study Technical Report (Revised dFSTR). Your 27 April 2005 letter states that you have accepted the Revised dFSTR as satisfying Task 4 of Agreed Order DE99HS-E941 and plan to go forward with public comment. We are encouraged and optimistic about the progress on this project.

Since the submittal of the Revised dFSTR on 4 March 2005, we have changed certain portions of the Revised dFSTR based on Ecology comments. Ecology felt that certain portions of the document needed clarification. We are providing the enclosed replacement pages to supersede the following portions of the Revised dFSTR:

1. The Executive Summary, in its entirety.

2. The text of the Revised dFSTR, in its entirety.

3. Exhibit ES-4, 1.1-1, 3.2-1, 4.1-1 through 4.1-7, 4.7-1, and 4.8-1.

Please call Mr. Smalstig at (714) 969-0800 with questions regarding this document.

Sincerely,

Brian Petty

Brian Petty
Staff Engineer

Eric Smalstig
Project Manager

Copy to: Elizabeth Mikols, Lehigh Cement Company
Andrew Fitz, Esq., Washington State Attorney General's Office
Tanya Barnett, Cascadia Law
Hank Landau, Geosphere

REVISED DRAFT FEASIBILITY STUDY REPORT
LEHIGH CEMENT COMPANY
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

This document was prepared by the staff of GeoSyntec Consultants under the supervision of the engineers whose signatures appear hereon. The findings or professional opinions were prepared in accordance with generally accepted professional engineering and geologic practice. No attempt to verify the accuracy of the data provided by others was made. No warranty is expressed or implied.

MARK D. SCHULTHEIS
STATE OF WASHINGTON
REGISTERED PROFESSIONAL ENGINEER

#19575
exp. 4/16/06

Date: 3/03/05

Mark Schultheis, P.E., Peer Review

Eric Smalstig, Project Manager

EXECUTIVE SUMMARY
REVISED DRAFT FEASIBILITY STUDY TECHNICAL REPORT
LEHIGH CEMENT COMPANY CLOSED CKD PILE
METALINE FALLS, WASHINGTON

INTRODUCTION

This Revised draft Feasibility Study Technical Report (Revised dFSTR) documents the results of the evaluation of the groundwater-related remedial alternatives[1] for the Closed Cement Kiln Dust (CKD) Pile in Metaline Falls, Washington (Site). Lehigh Cement Company (Lehigh) developed the Revised dFSTR in accordance with the Model Toxics Control Act (MTCA) regulations in Washington Administrative Code (WAC) 173-340-350 et. seq. the Agreed Order AO No. DE99HS-E941A6 (1999 AO), between Lehigh (Lehigh) and the Washington Department of Ecology (Ecology).

BACKGROUND

Lehigh operated a Portland cement production plant in Metaline Falls, Washington, from the early 1900s until 1989. CKD was generated at the plant as a by-product of the cement production process. Lehigh periodically moved the dust by-product from the production plant to the CKD pile, which is between the former plant location and State Route 31 (see Exhibit ES-1). The Closed CKD Pile contains approximately 544,000 metric tons of material [Dames and Moore, 1995]. Lehigh owns the Closed CKD Pile.

Ecology began its regulatory oversight of the investigation/remediation of the Site in 1991. Lehigh has implemented remedial actions at the Site since 1996 to address potential exposure pathways as described in Exhibit ES-2. Specifically, the

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[1] This Feasibility Study (FS) evaluates remedial alternatives for addressing groundwater at the Metaline Falls Site. This is consistent with the 1999 Agreed Order No. DE-99HS-E941. This is appropriate as other potential risks have been addressed by previous remedial activities (e.g., direct contact with CKD prevented by approved cap placed on CKD pile). Surface water concerns will be addressed by the remediation of the CKD-affected groundwater that seeps to Sullivan Creek.

cover and surface water management facilities at the Closed CKD Pile adequately control these potential pathways:

- Direct contact;
- Inhalation;
- Precipitation-derived percolation into the CKD; and
- Surface water-derived infiltration to the CKD.

The CKD-affected groundwater downgradient of the Closed CKD Pile is localized and under property owned by Lehigh, except for a portion of Washington State Route 31. Additional details on the nature and extent of the affected groundwater are given in the Remedial Investigation (RI) Technical Report [GeoSyntec, 2001] and in the Interim Progress Report on Subsurface Treatability Study [GeoSyntec, 2000].

The CKD-affected groundwater flows north-northeasterly from the Closed CKD Pile, across the area downgradient of the Closed CKD Pile, and into Sullivan Creek. The area of the groundwater aquifer affected by CKD is not currently, nor is it anticipated to be, withdrawn for domestic use. Restrictive covenants will be recorded to ensure continued nonuse. Further groundwater remediation is required to bring the groundwater into compliance with cleanup standards. These actions will also protect surface water in Sullivan Creek.

FEASIBILITY STUDY

Lehigh conducted the Feasibility Study in accordance with the Ch.173-340 WAC and the 1999 AO. To provide the necessary technical information and analysis to select the groundwater remedy, GeoSyntec undertook literature reviews, document searches, conducted laboratory bench-scale and field pilot-scale treatability testing and prepared reports, technical memoranda, and design submittals for Ecology review including:

1. Interim Progress Report No. 1, Subsurface Treatability Study, GeoSyntec, submitted in 2000.

2. Feasibility Study Technical Memorandum (FSTM), GeoSyntec, submitted in 2003.

3. Pilot System In Situ Treatment Wall Design Drawings, GeoSyntec, submitted in 2001.

4. Pilot System In Situ Treatment Wall Construction Report, GeoSyntec, submitted in 2003.

5. Quarterly Project Status Reports, GeoSyntec, submitted in 2000, 2001, 2002, 2003, 2004, and 2005.

6. Project Status Meetings between Lehigh and Ecology in 2002, 2003, and 2004.

7. Supplement to the initial dFSTR, GeoSyntec, submitted in 2004.

Following submittal of the initial draft FSTR in November 2003, Lehigh and Ecology began discussions about additional Site investigations, based on Ecology's belief that data from additional investigations would bolster the dFSTR. In May 2004, Lehigh submitted the Supplement to the Draft Feasibility Study Technical Report and Technical Response to the Department of Ecology Request for Further Field Investigation [GeoSyntec, 2004] to address Ecology's data needs. Ecology then conducted a limited field investigation in July 2004. Ecology's investigation is documented in their letter report, dated 25 October 2004, and is included in the dFSTR (see Appendix B).

Groundwater Remedy Alternatives

The FSTM screened 20 groundwater remedy alternatives [GeoSyntec, 2003]. Lehigh determined that five alternatives passed the screening criteria and recommended that they be evaluated more extensively in the FSTR. After its review of the FSTM, Ecology recommended that the FSTR also include source abatement alternatives (i.e., Additional Source Control and Partial Source Removal[2]). The FS process, which included further discussions with Ecology, led to the inclusion of two more alternatives. It also led Lehigh to drop one alternative from further consideration and to consolidate three technologies into a single alternative. Accordingly, the following alternatives are evaluated in this Revised dFSTR – See Exhibit ES-3.

- Alternative #1 – Permeable Treatment Wall (PTW)
- Alternative #2 – Groundwater Control (GWC)
- Alternative #3 – Additional Source Control (ASC)
- Alternative #4 – Partial Source Removal (PSR)
- Alternative #5 – Funnel and Gate Treatment (FGT)
- Alternative #6 – Partial Additional Source Control (PASC)

PTW (*Alternative 1*) extends the existing Pilot System treatment zone along the east side of State Route 31. CKD-affected groundwater passes through a treatment zone prior to migrating to Sullivan Creek. To address possible gaps between the treatment panels, PTW includes a limited number of wells that will extract water. This groundwater will be routed back to the treatment zone.

GWC (*Alternative 2*) continues operation of the existing pilot PTW and adds extraction wells to capture the remaining CKD-affected groundwater plume. The extracted groundwater is treated aboveground to meet cleanup standards by reducing the pH and precipitating the arsenic. The treated groundwater is discharged to Sullivan Creek.

ASC (*Alternative 3*) includes a low permeability vertical barrier (i.e., slurry wall) hydraulically upgradient of the Closed CKD Pile to direct water away from the CKD, with dewatering wells on the upgradient side of the slurry wall to capture and re-route the water around the Closed CKD Pile. The slurry wall keys into the underlying aquitard that ranges from approximately sixty to 120 feet deep. The slurry wall and dewatering wells achieve source control by reducing the amount of water that contacts CKD. ASC generates less CKD-affected water, but does not eliminate it. Inherent

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[2] 6/11/03 Ecology correspondence to Eric Smalstig, GeoSyntec Consultants, and follow-up Ecology correspondence with Jay Manning, Esq., Brown Reavis & Manning, PLLC.

permeability and potential imperfections in the slurry wall, combined with possibility of water upwelling into the base of the Closed CKD Pile, prevent ASC from completely eliminating the generation of CKD-affected water. Thus, ASC includes downgradient groundwater extraction and aboveground treatment components. The downgradient systems are flexible, allowing modification over time as the benefits of the upgradient slurry wall and dewatering wells are realized.

PSR (*Alternative 4*) uses sheet piles to isolate and stabilize a portion of the toe of the Closed CKD Pile and then removes approximately 5,500 cubic yards to access the CKD that Ecology documented is in contact with groundwater under the toe [Ecology, 1997]. The PSR alternative also involves accessing CKD through the top deck of the Closed CKD Pile by removing a portion of the engineered cover, and excavating CKD using conventional slope back techniques. Excavating this area of CKD through the top deck involves removing approximately 260,000 cubic yards of CKD to access the CKD in contact with groundwater at the lower reaches of the pile [Ecology, 1997]. PSR requires the construction of a temporary storage area of about five acres in size, to hold the dangerous waste during excavation and backfilling. PSR places a non-reactive engineered fill and geotextile layers into the excavated area and then places the temporarily-stockpiled CKD back into the excavation. The CKD that does not fit back into the excavation will be hauled off-site for disposal. PSR includes reconstructing the breached and damaged engineered cover. Ecology suggested that the PSR evaluation include an assumption that only short-term groundwater treatment (five years) would be needed downgradient of the Closed CKD Pile after implementing the CKD removal operations of PSR. Lehigh has presented data and analysis showing that PSR will not be effective enough to obviate groundwater treatment over the long term. Lehigh developed two scenarios to evaluate PSR: scenario one assumes that the Site meets cleanup levels after five years and scenario two assumes that the Site needs indefinite treatment to meet clean up levels.

FGT (*Alternative 5*) installs a system of shallow (ten to twenty feet deep) subterranean slurry walls and gravel drainage layers downgradient of the Closed CKD Pile. The slurry walls and drainage layers funnel groundwater toward a central treatment corridor, where the water is treated in situ with the technology used in the Pilot System and described in *Alternative 1*, PTW. Although FGT is not a flexible alternative, FGT offers a higher degree of hydraulic control than PTW while still using in situ treatment technology tested in the Pilot System at the Site. A subsurface discharge corridor conveys the treated water to Sullivan Creek.

PASC (*Alternative 6*) pursues two concepts in remediation: source control and downgradient in situ treatment. PASC supplements the FGT remedy with a gravity drain installed under the Closed CKD Pile. The gravity drain is a source control technology that captures and redirects unaffected groundwater away from the Closed CKD Pile. The gravity drain intercepts water that would eventually contact and inundate the CKD. The amount of downgradient treatment will decrease with time as inundated CKD is dewatered due to the gravity drain and the transient drainage in the Closed CKD Pile reaches an equilibrium condition.

Evaluation Criteria

This Revised dFSTR uses the following criteria, identified in MTCA and the 1999 AO to evaluate each of the six alternatives.

- WAC 173-340-360(2)(a) Threshold Criteria:
  - Protect human health and the environment

  - Comply with cleanup standards

  - Comply with applicable federal and state requirements (ARARs)

  - Provide for compliance monitoring.

- WAC 173-340-360(2)(b) "Other Requirements":
  - Use permanent solutions to the maximum extent practicable (analysis is based on the disproportionate cost test described below)

  - Provide for a "reasonable restoration timeframe" to meet cleanup standards

  - Consider public concerns.

- WAC 173-340-360(3)(f) Evaluation Criteria (“Disproportionate Cost Analysis”):
  - Protectiveness
  - Permanence
  - Cost
  - Effectiveness over the long term
  - Management of short-term risks
  - Technical and administrative implementability
  - Consideration of public concerns (considered under “other requirements”)

- 1999 AO Additional Criterion:
  - Prevent Domestic Use of CKD-affected Groundwater.

Comparison of Alternatives

All alternatives meet the threshold criteria, so this summary omits that discussion. The comparison focuses on the differences between the alternatives, which involve the elements that MTCA considers under the analysis of cost-disproportionality. MTCA gives preference to permanent remedies. Lehigh’s evaluation shows that no permanent remedy exists for the Site. Lehigh understands that according to Ecology PSR is a permanent remedy given certain conditions. Although Lehigh and Ecology disagree whether PSR is permanent, they agree that it exhibits the highest degree of permanence of the alternatives evaluated in the Revised dFSTR. Therefore, Lehigh and Ecology agree that PSR is the baseline against which other alternatives are compared. Each of the alternatives except PSR (scenario one) is a long-term treatment based alternative. Therefore with respect to the restoration timeframe criterion each has the same ranking.

Protectiveness: All alternatives present some short-term risks during construction. However, the construction risks associated with PSR, and to a lesser extent ASC, are significant. PSR also has the largest volume of material (untreated CKD) requiring off-site disposal. ASC and GWC involve off-site disposal of non-hazardous treatment residuals. The other three alternatives (PTW, FGT, and PASC) do not generate wastes requiring off-site disposal. Finally, all alternatives are expected to reduce risks at the Site to the same degree and in approximately the same time frame, with the exception of the first PSR groundwater treatment scenario (i.e., PSR with short-term treatment). Under that scenario, PSR would reduce risks over a larger area than other alternatives. Considering the factors that contribute to protectiveness, PASC ranks highest, followed by PTW, GWC, FGT, and ASC. PSR ranks lowest under either groundwater treatment scenario.

Permanence: All alternatives provide a high degree of permanence because they treat (i.e., reduce toxicity and mobility of hazardous substances) groundwater by permanently neutralizing the pH and decreasing arsenic concentrations to meet cleanup levels. PSR, ASC, and PASC provide even higher degrees of permanence because they include source control components that reduce the volume of hazardous substances in groundwater. Because PSR has the potential for the greatest reduction in hazardous substance volume, it ranks the highest for permanence, followed by ASC, PASC, FGT, PTW, and GWC.

Cost: The least expensive alternative is GWC, followed by PTW, FGT, and PASC. ASC is two or three times more costly than GWC, and the cost of PSR is an order of magnitude higher than GWC.

Effectiveness Over the Long Term: All alternatives will be effective over the long term. All incorporate treatment technologies that have proven successful. In addition, PSR and PASC incorporate source control components that will reduce the volume of hazardous substances. However, PSR may lose some effectiveness over time, as hydrogeologic conditions at the Site change. ASC also incorporates source control in the form of a slurry wall, but it will be difficult to maintain this wall over the long term. If the wall deteriorates or fails, ASC will lose some of its effectiveness. The source control component of PASC is expected to remain reliable over time. On this criterion, PASC and PSR (groundwater treatment scenario one) rank highest, followed by PTW, GWC, FGT, and PSR (groundwater treatment scenario two). ASC ranks lowest.

Management of Short-Term Risks: PASC, PTW, GWC, and FGT use relatively conventional construction practices, each involving short-term risks that are easily managed. While ASC uses a conventional technology, there is a danger that construction will activate the historic landslide area. Thus, ASC poses significant short-term risks. PSR also uses conventional technologies, but applies them in a soft soil that is unstable and subject to liquefaction. Furthermore, PSR requires workers to excavate and manage very large volumes of CKD, a dangerous waste. Hundreds of truckloads of CKD will be transported off-site for disposal. Thus, PASC, PTW, GWC, and FGT rank the highest on this criterion. The ASC alternative ranks below these alternatives, and PSR ranks lowest.

Technical Implementability: While all of the alternatives can be implemented, PASC, PTW, GWC, and FGT present far fewer technical implementation challenges than either ASC or PSR. ASC requires work in the vicinity of the historic landslide. PSR requires handling significant quantities of CKD, excavating CKD under liquefiable conditions, counteracting CKD slope instability, transporting CKD on public roads, and temporarily storing CKD before either backfilling or shipping off-site for disposal. Thus, GWC, PTW, FGT, and PASC rank highest, while ASC and PSR rank lowest on this criterion.

Administrative Implementability: Lehigh owns the land needed to implement GWC, PTW, and FGT. It may need to acquire or obtain access to other land to implement PASC, ASC, and PSR. For PSR, Lehigh will need approximately five acres of land on which to temporarily store CKD. All alternatives will require Lehigh to obtain an NPDES permit to discharge treated groundwater, except for PTW. Considering these factors, PTW ranks the highest, followed by FGT, GWC, PASC, ASC (at approximately the same ranking), and finally PSR ranks the lowest.

Schedule: GWC has the shortest installation schedule, followed by FGT. PTW and PASC require approximately one additional month to install. ASC requires approximately two additional months. PSR has by far the longest construction schedule, approximately three years longer than the other alternatives.

Public Concerns: The public has not had an opportunity yet to review these alternatives. The MTCA process allows the public several opportunities to provide input on remedy selection. The public will have an opportunity to comment on this Revised dFSTR, and Ecology will address public concerns before finalizing this document. Therefore, public comments will be considered for each of the alternatives upon receipt of the comments, giving each alternative the same ranking at this time for this criterion.

Based on the factors in the disproportionate cost analysis, the cost of PSR, in terms of dollars, difficulty in implementation, and short-term risks, is disproportionate to its potential benefits under either groundwater treatment scenario. ASC also has a high degree of permanence, but has significant short-term risks and costs that are disproportionate to its benefits.

The most promising option for satisfying the MTCA and 1999 AO criteria is combining a practical and cost-effective source control method with downgradient groundwater control components. The PASC alternative adds an additional source control component, the gravity drain installed under the Closed CKD Pile, to the collection and treatment concept presented in the FGT alternative. The FGT components of the PASC alternative will achieve compliance with cleanup standards, whether the gravity drain is added or not. However, the gravity drain is practical, cost effective and reduces the volume of water that contacts the CKD. Despite the fact that the six alternatives meet the threshold evaluation criteria (Exhibit ES-4), PASC best balances the applicable remedy selection criteria. PASC will meet the cleanup standards with a significant degree of permanence and achieves the greatest benefit for the cost expended. PASC offers the following key advantages:

- Meets cleanup standards and ARARs, and therefore enhances the CKD closure systems to protect human health and the environment;

- Uses demonstrated and proven technologies that are technically and administratively implementable;

- Will reduce the volume of CKD-affected groundwater generated at the Site, giving this alternative one of the highest degrees of permanence;

- Avoids the short-term risks, implementability concerns, and high cost associated with PSR, the baseline alternative; and
- Includes practical and cost-effective source control, providing significant benefits at a proportionate cost.

Groundwater Remedy Recommendation

Because PASC meets the evaluation criteria, provides a source control component, is practical and implementable, has a high degree of permanence and achieves the greatest benefit for the cost expended, Lehigh proposes the PASC system as the preferred remedy for the Site. PASC meets MTCA threshold and balancing requirements. In addition, it is permanent to the maximum extent practicable. The components of PASC include:

- A gravity drain installed under the southern side of the Closed CKD Pile to intercept and divert groundwater from contacting the Closed CKD Pile;
- Downgradient hydraulic control to funnel the CKD-affected groundwater to the treatment zone;
- In situ treatment using a demonstrated technology;
- Construct the necessary support facilities in or around the Existing Building; and
- Institutional controls and additional monitoring activities, including: (a) warning signage; (b) fencing; (c) restrictive covenants; and (d) ongoing compliance monitoring.

Exhibit 4.8-1 presents a conceptual layout of the PASC remedy. The recommended PASC system use the following design and operating criteria:

- The gravity drain is a source control component that reduces the CKD-affected water requiring treatment;

- The groundwater treatment technology is a demonstrated technology that meets proposed cleanup levels and ARARs, and therefore protects human health and the environment;

- The treatment zone produces no residual waste that requires temporary on-site storage, transport and off-site disposal, thereby optimizing resource expenditures on operation and maintenance; and

- The funnel and gate components accommodate the complex hydrogeology at the Site by using engineered structures to direct water.

The PASC system will be maintained indefinitely.

Ecology will set the actual cleanup levels following finalization of the FSTR in the Cleanup Action Plan (CAP). Lehigh made the assumption for the purposes of this Revised dFSTR that Method A cleanup levels will apply to groundwater at the Site. Lehigh proposes the following with respect to cleanup standards:

- ***Cleanup Levels (CLs).*** The proposed cleanup levels relevant to the Site are pH in the range between 6.5 to 8.5, and a maximum arsenic concentration of 5.0 parts per billion.

- ***Point of Compliance (POC)***. Lehigh proposes a conditional point of compliance at a point downgradient of the PASC system and upgradient of Sullivan Creek. The POC follows the last treatment component of PASC and precedes Sullivan Creek.

The cleanup standards assumptions allowed Lehigh to evaluate and compare each alternative's ability to meet cleanup standards at the Site for the purposes of conducting a FS. The method of evaluating compliance with cleanup standards will be established during development of the monitoring program defined in the CAP and design phases of the project. As stated previously, Ecology will ultimately set the actual cleanup standards in the CAP.

SCHEDULE

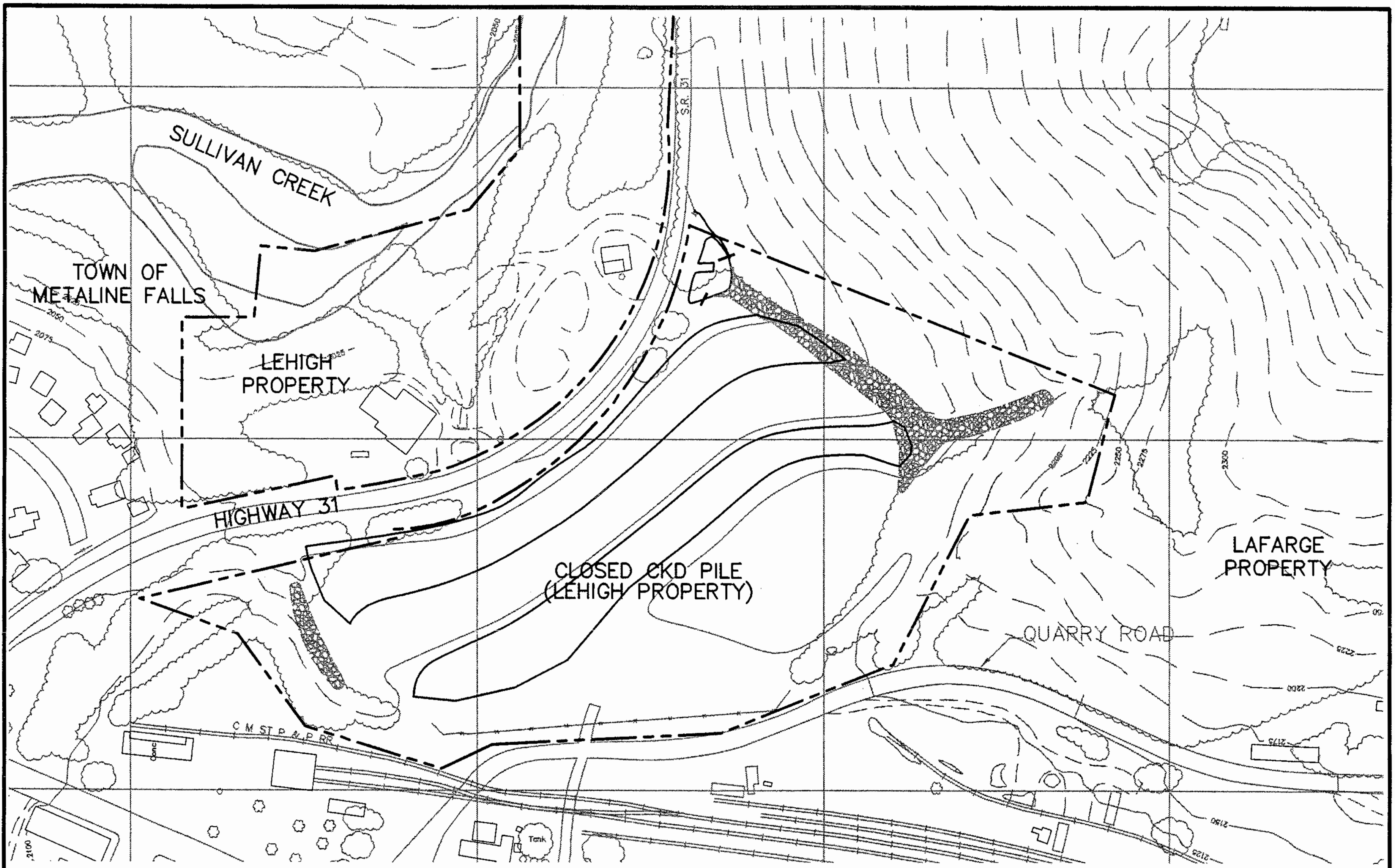
The actual construction schedule for the PASC Alternative will depend on:

- FSTR review process, including public comment;
- Preparation and approval of the draft CAP and consent decree;
- Regulatory review and permitting – particularly NPDES permitting;
- Specialty contractor availability; and
- Favorable weather conditions.

Lehigh analyzed the future project deliverables, scheduling milestones, and implementation timeframe for PASC. Lehigh believes that the PASC can be installed in summer 2006 (see Exhibit 6.4.1). Lehigh will work with Ecology to achieve this goal.

CONCLUSION

The preferred alternative, PASC, combines a source control component with in situ groundwater treatment that restores the localized groundwater downgradient of the Closed CKD Pile, allowing the Site to meet cleanup standards. PASC has a high degree of permanence, produces benefits that are not cost-disproportionate, is implementable, and uses a demonstrated treatment technology.



NOTE: CREEK ALIGNMENT IS APPROXIMATE.

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SITE MAP
LEHIGH CEMENT COMPANY CLOSED CKD PILE
METALINE FALLS, WASHINGTON

EXHIBIT NO.	ES-1
PROJECT NO.	HR0196-12
DATE:	OCTOBER 2003

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EXHIBIT ES-2
SITE REMEDIES
REVISED DRAFT FEASIBILITY STUDY TECHNICAL REPORT
LEHIGH CEMENT COMPANY CLOSED CKD PILE
METALINE FALLS, WASHINGTON

Goals	Remedy Component	Date of Implementation
Isolate CKD to prevent direct contact exposure pathway.	Source Control, 7-acre engineered composite cover, surface water management system, and access control (fences and warning signs).	1995-96
Isolate CKD to prevent dust inhalation exposure pathway and nuisance dust.	Source Control, 7-acre engineered composite cover, surface water management system, and access control (fence and warning signs).	1995-96
Isolate high pH groundwater seeps near Highway 31 to prevent direct contact exposure pathway.	WDOT deck extension, engineered backfill.	1998
Restore groundwater aquifer downgradient of CKD pile.	Pilot in-situ permeable wall treatment.	Started in 2002
	Full-scale groundwater remedy installation.	Could be as early as 2006
Stop appearance of localized seeps near Sullivan Creek to prevent direct exposure.	Full-scale groundwater remedy installation. Access control.	Could be as early as 2006

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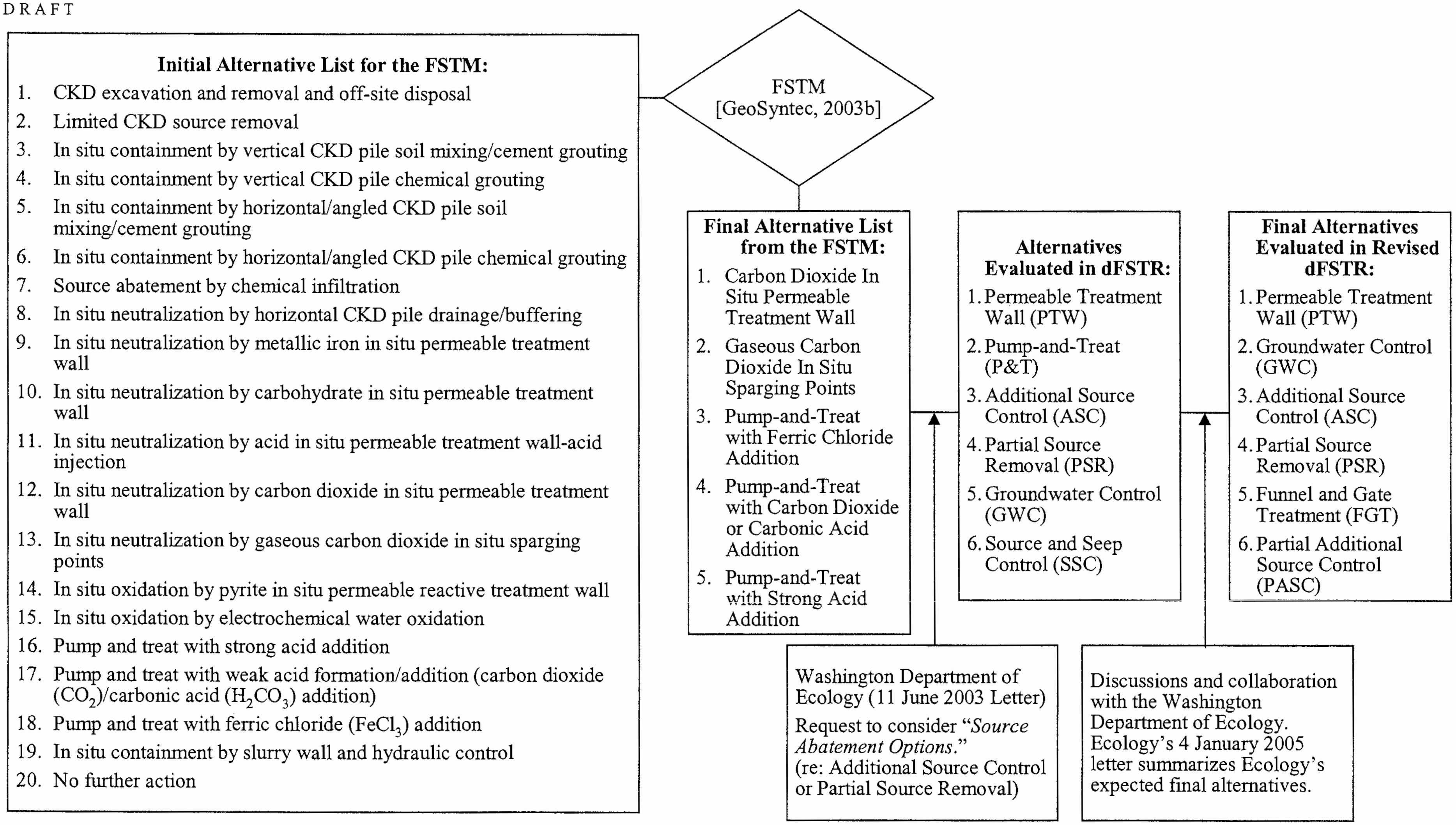

Initial Alternative List for the FSTM:

1. CKD excavation and removal and off-site disposal
2. Limited CKD source removal
3. In situ containment by vertical CKD pile soil mixing/cement grouting
4. In situ containment by vertical CKD pile chemical grouting
5. In situ containment by horizontal/angled CKD pile soil mixing/cement grouting
6. In situ containment by horizontal/angled CKD pile chemical grouting
7. Source abatement by chemical infiltration
8. In situ neutralization by horizontal CKD pile drainage/buffering
9. In situ neutralization by metallic iron in situ permeable treatment wall
10. In situ neutralization by carbohydrate in situ permeable treatment wall
11. In situ neutralization by acid in situ permeable treatment wall-acid injection
12. In situ neutralization by carbon dioxide in situ permeable treatment wall
13. In situ neutralization by gaseous carbon dioxide in situ sparging points
14. In situ oxidation by pyrite in situ permeable reactive treatment wall
15. In situ oxidation by electrochemical water oxidation
16. Pump and treat with strong acid addition
17. Pump and treat with weak acid formation/addition (carbon dioxide (CO_2)/carbonic acid (H_2CO_3) addition)
18. Pump and treat with ferric chloride ($FeCl_3$) addition
19. In situ containment by slurry wall and hydraulic control
20. No further action

FSTM
[GeoSyntec, 2003b]

Final Alternative List from the FSTM:

1. Carbon Dioxide In Situ Permeable Treatment Wall
2. Gaseous Carbon Dioxide In Situ Sparging Points
3. Pump-and-Treat with Ferric Chloride Addition
4. Pump-and-Treat with Carbon Dioxide or Carbonic Acid Addition
5. Pump-and-Treat with Strong Acid Addition

Alternatives Evaluated in dFSTR:

1. Permeable Treatment Wall (PTW)
2. Pump-and-Treat (P&T)
3. Additional Source Control (ASC)
4. Partial Source Removal (PSR)
5. Groundwater Control (GWC)
6. Source and Seep Control (SSC)

Final Alternatives Evaluated in Revised dFSTR:

1. Permeable Treatment Wall (PTW)
2. Groundwater Control (GWC)
3. Additional Source Control (ASC)
4. Partial Source Removal (PSR)
5. Funnel and Gate Treatment (FGT)
6. Partial Additional Source Control (PASC)

Washington Department of Ecology (11 June 2003 Letter)

Request to consider "*Source Abatement Options.*" (re: Additional Source Control or Partial Source Removal)

Discussions and collaboration with the Washington Department of Ecology. Ecology's 4 January 2005 letter summarizes Ecology's expected final alternatives.

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ALTERNATIVES FS SCREENING PROCESS
REVISED DRAFT FEASIBILITY STUDY TECHNICAL REPORT
LEHIGH CEMENT COMPANY CLOSED CKD PILE
METALINE FALLS, WASHINGTON

EXHIBIT NO. ES-3
PROJECT NO. HR0196-12
DATE MARCH 2005

EXHIBIT ES-4
COMPARATIVE ANALYSIS OF ADDITONAL SITE REMEDY ALTERNATIVES
LEHIGH CEMENT COMPANY CKD PILE
METALINE FALLS, WASHINGTON

	#1 – PTW	**#2 – GWC**	**#3 – ASC**	**#4 – PSR (Scenario 1)**	**#4 – PSR (Scenario 2)**	**#5 – FGT**	**#6 – PASC**
	In situ groundwater treatment with carbon dioxide via diffusion.	Combination of existing Pilot System and approximately 16 P&T extraction wells.	Slurry wall upgradient of closed CKD pile; upgradient dewatering; downgradient P&T.	Remove and replace the following closed CKD pile portions: toe using sheet piles; middle bulk excavation. Groundwater treatments using GWC for 5 years.	Remove and replace the following closed CKD pile portions: toe using sheet piles; middle via bulk excavation. Groundwater treatment using GWC indefinitely.	Funnel downgradient groundwater to treatment using the in situ PTW technology	FGT combined with a gravity drain to intercept water prior to water-CKD contact and divert it away from the Closed CKD Pile.
OVERALL RATING	MODERATE	HIGH	LOW	LOWEST	LOWEST	MODERATE	VERY HIGH
WAC THRESHOLD CRITERIA							
Protect Human Health and the Environment	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Comply with Cleanup Standards	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Comply with ARARs	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Provide for Compliance Monitoring							
Protection	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Performance	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Confirmation	Yes	Yes	Yes	Yes	Yes	Yes	Yes
OTHER WAC REQUIREMENTS							
Use of Permanent Solutions to the Maximum Extent Practicable	**Disproportionate Cost Analysis(1)**						
Protectiveness	Moderate-High	Moderate-High	High	Low	Low	Moderate-High	Highest
Permanence	High	High	Higher	Highest-Baseline(2)	Highest-Baseline(2)	High	Higher
Cost (in millions of dollars)(3)							
Implementation	$2.1	$1.1	$9.1 - $14	$17.4 - $24.2	$17.4 - $24.2	$2.3 - $2.6	$2.4 - $3.0
OMM	$2.2	$3.0	$3.2	$1.4	$3.0	$2.1	$2.1
Total	$4.3	$4.1	$12.3 - $17.2	$18.8 - $25.6	$20.4 - $27.2	$4.4 - 4.7	$4.5 - $5.1
Effectiveness over the Long Term	Moderate-High	Moderate-High	Moderate-Low	Low	High	Moderate-High	High
Management of Short-Term Risks	Easy	Easy	Difficult	Very Difficult	Very Difficult	Easy	Easy
Technical and Administrative Implementability	High	Moderate	Moderate – Low	Low	Low	Moderate	Moderate
Consideration of Public Concerns(4)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Disproportionate Cost Analysis Results	**Practicable, Moderate Permanence**	**Practicable, Moderate Permanence**	**Disproportionate Costs**	**Very Difficult, Disproportionate Costs**	**Very Difficult, Disproportionate Costs**	**Practicable, Moderate Permanence**	**Practicable, High Permanence**
Provide for a Reasonable Restoration Time Frame	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Consider Public Concerns(4)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
1999 AO(5) OBJECTIVES							
Prevent Domestic Use of CKD-Affected Groundwater	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes:
(1) As defined in Washington Administrative Code 173-340-360(3)(e)
(2) PSR has the highest degree of permanence. This Revised dFSTR evaluates the alternatives based on two groundwater treatment scenarios.
(3) Appendix E lists elements of the alternatives that were included in the cost estimates. Costs presented here for a 30-year project duration using a 7 percent discount rate. The detailed cost tables (Exhibits 4.1-8, 4.3-2, 4.4-2, 4.5-2, 4.6-2, 4.7-2, and 4.8-2), show results for other project durations and discount rates.
(4) The public will be provided with opportunities to comment on project documents. Ecology will address public comments before finalizing this document.
(5) Agreed Order DE99HS-E941

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1. INTRODUCTION

1.1 Terms of Reference

Lehigh Cement Company (Lehigh) submitted the first draft of this Feasibility Study Technical Report (dFSTR) to the Washington Department of Ecology (Ecology) in November 2003. Ecology reviewed the dFSTR and transmitted their comments on the dFSTR to Lehigh in a letter dated 13 July 2004. This document is the first revision of the dFSTR (Revised dFSTR). This Revised dFSTR addresses Ecology's comments on the first dFSTR and includes information and analyses that were compiled by Lehigh and Ecology subsequent to submittal of the first dFSTR.

This Revised dFSTR examines remedial alternatives for groundwater and groundwater-related impacts at the Lehigh Closed Cement Kiln Dust (CKD) Pile Site in Metaline Falls, Washington (the Site). The Site is owned by Lehigh. GeoSyntec Consultants (GeoSyntec) prepared this Revised dFSTR for submittal to Ecology on behalf of Lehigh. This dFSTR is one of a series of deliverables specified in Agreed Order No. DE99HS-E941 (1999 AO)[1].

1.2 Organization of the Feasibility Study Technical Report

The remainder of this Revised dFSTR is organized into the following sections:

- Section 2, *Background*, summarizes information from the Remedial Investigation (RI) and additional data gathered subsequent to preparation of the RI that is relevant to this Revised dFSTR.

- Section 3, *Regulatory Framework for Additional Remedy Alternative Selection*, describes relevant Washington Administrative Code (WAC) and 1999 AO requirements.

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[1] Exhibit 1.1-1, Agreed Order Compliance Checklist, notes the status of the deliverables required by the 1999 AO.

- Section 4, *Description of Alternative Groundwater Remedies,* describes the final six alternative groundwater remedies evaluated in this Revised dFSTR.

- Section 5, *Alternative Comparison*, uses the criteria described in WAC 173-340-360 and the 1999 AO to compare the six alternative groundwater remedies.

- Section 6, *Conclusions,* presents the conclusions of this 1999 AO deliverable.

References, exhibits, and appendices are included at the end of the document.

2. BACKGROUND

2.1 General

This section summarizes the background information contained in the Final RI Report [GeoSyntec, 2001], the Feasibility Study Technical Memorandum [GeoSyntec, 2003b], and the Supplement to the Draft Feasibility Study Report (Supplement) [GeoSyntec, 2004]. The information in Appendices A and B to this Revised dFSTR was obtained after the RI and FSTM were submitted. These appendices contain data relevant to the comparison of alternatives. Appendix A was originally submitted with the first draft of the dFSTR to describe pilot in situ carbon dioxide groundwater treatment system (Pilot System) performance as well as the additional investigation of areas downgradient of the Closed CKD Pile that occurred in Summer 2003. Appendix A now also includes an update section that documents data and events from November 2003 through February 2005. Appendix B contains Ecology’s report on their Summer 2004 investigation. Appendix C contains boring logs and geologic cross-sections developed from Lehigh’s Site investigation data.

2.2 Site Location and Layout

The Closed CKD Pile is in Metaline Falls, Washington, a town of approximately 200 people, approximately 100 miles north of Spokane and 13 miles south of the Canadian border (Exhibit 2.2-1). Seasonal temperature variation is significant, with monthly average temperature extremes ranging from below 10°F to above 90°F [GeoSyntec, 2001]. The Site mean annual precipitation is 28 in. [GeoSyntec, 2001].

The Closed CKD Pile lies on approximately 7 acres west of State Route 31. It rises approximately 90 ft above State Route 31 at 2H:1V (Horizontal to Vertical) to a gently sloping upper deck with a maximum elevation of approximately 2,132 feet mean sea level (ft MSL). To the east of State Route 31 is a floodplain that gently slopes toward Sullivan Creek about 250 to 300 ft east of the highway. The average elevation of the floodplain is 2,026 ft MSL.

Lehigh owns the land north and hydraulically downgradient of the Closed CKD Pile and has made several improvements since the Site environmental work began (Exhibit 2.2-1).

2.3 Site Environmental Data

2.3.1 Surface Water

Sullivan Creek drains a watershed of approximately 90,880 ac [EIP, 1999]. The maximum mean flow in the creek is approximately 650 cubic feet per second (cfs); the minimum mean flow is approximately 100 cfs. Maximum flows in the creek occur during the months of May and June; minimum flows occur during August and September. Fluctuations in creek flows are a result of seasonal rainfall and snowmelt, as well as releases from the Sullivan Lake Dam to Sullivan Creek upstream of the Site [USGS, 1999]. The dam controls the volume of water that flows into Sullivan Creek. Since 1954, the highest recorded water level increase in the Sullivan Creek USGS gauging station[2] upstream from the Site is 6.20 ft. Sullivan Creek adjacent to the Site is wider than where the gauging station is located. Thus, water level fluctuations adjacent to the Site are lesser than those measured at the gauging station. The average increase during peak flow periods (May and June) is approximately 4 ft. Sullivan Creek flows northwest past the Site to join the Pend Oreille River, less than a mile downstream of the Site.

2.3.2 Site Geology

Two geologic strata at the Site are relevant to this Revised dFSTR (Exhibit 2.3-1):

- Glacial Sediments. Overlying the bedrock[3] are glacial sediments composed of glaciofluvial (river terrace) and glaciolacustrine (glacial lake) sediments that consist of sandy silt and clayey silt. The glacial

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[2] USGS Sullivan Creek station at Metaline Falls, Station 12398000.

[3] See the RI for data about the bedrock, which is not considered relevant to this Revised dFSTR.

sediments are subject to landsliding. Immediately to the south of the Closed CKD Pile is an historic landslide [Dames and Moore, 1997] that is considered during the evaluation of alternatives. The historic landslide consists of disturbed sediments to an unknown depth along unknown slip planes. This area above the landslide rises in steep relief progressing south from the Closed CKD Pile.

- Holocene Alluvium. Sullivan Creek eroded a bowl into the glacial sediments. The creek deposited gravels with occasional cobbles and boulders and interspersed zones of more clayey, silty and sandy materials into the base of the bowl and on the floodplain. This layer is generally about 20 ft thick and overlays the glacial sediments.

CKD was placed in part over each of these geologic strata. In the southern and central portion of the now closed pile, boring logs from abandoned Monitoring Wells MW-11 and MW-3 indicate that CKD was placed in ravines incised into the glacial sediments [Dames and Moore, 1992, 1993]. In the central and northern portions of the pile area, CKD was placed directly over the Holocene alluvium. Appendix C contains boring logs and cross-sections of the Site.

2.3.3 Site Hydrogeology

The sources of groundwater at the Site are as follows (Exhibits 2.3-1 and 2.3-2):

- Precipitation. Rainfall and upgradient runoff infiltrates the glacial sediments, the landslide debris, and the Holocene alluvium to become groundwater.

- Glacial Sediments. Infiltrating precipitation generally seeps down and horizontally to the north and east through the Site area glacial sediments. Groundwater emerges from the glacial sediments as surface seeps along the sloping hillsides that form the bowl into which the CKD was placed. Groundwater migrates along sporadic lenses in the glacial sediments, and varies in amounts and locations according to season and precipitation intensity. Seepage from the landslide debris seeps into and beneath the Closed CKD Pile and then into the Holocene alluvium (i.e., sands and gravels) beneath the pile.

- Holocene Alluvium. Seepage from the glacial sediments and portions of the Closed CKD Pile affected by this seepage enters the Holocene alluvium beneath the pile. This groundwater then moves horizontally in a general northern and eastern direction, beneath State Route 31 and hence to Sullivan Creek. The depth to groundwater in the Holocene alluvium is approximately 2 to 3 ft below ground surface within the floodplain. The depth to groundwater increases to approximately 5 to 6 feet below ground surface near the toe of the Closed CKD Pile, where the ground surface is higher in elevation than the floodplain.

Lehigh and Ecology disagree regarding the degree of seepage into the sides of the Closed CKD Pile. The Supplement summarizes Lehigh's concept [GeoSyntec, 2004]. Appendix B of the Revised dFSTR contains information on Ecology's position on the relative amounts of seep flow and underlying alluvial floodplain groundwater flow. Nevertheless, this disagreement does not affect the feasibility study for the Site or the content of this Revised dFSTR. The relative amount of seep flow and underlying alluvial floodplain groundwater flow into the Closed CKD Pile is not discussed in this report.

2.3.4 CKD Effects on Groundwater

Ecology has overseen several environmental investigations at the Site since 1991. Lehigh collected samples from CKD, groundwater, surface water, seeps, soil, and sediment media. The Site sampling points are shown on Exhibit 2.3-3. The following is a summary of the effects of the Closed CKD Pile on the Site groundwater: [4]

- The Site groundwater table elevation under the Closed CKD Pile fluctuates seasonally and annually depending on precipitation and runoff conditions. During initial site investigations groundwater wells

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[4] See the RI Report submitted to Ecology in 2001 [GeoSyntec, 2001] and the Interim Progress Report on Subsurface Treatability Study submitted to Ecology in 2000 [GeoSyntec, 2000].

were installed into and through the regraded and compacted CKD pile. These groundwater wells were abandoned in preparation for final cover installation in 1996. Groundwater level data from those wells indicate that these fluctuations under the Closed CKD Pile typically do not exceed more than approximately one foot from the mean alluvial floodplain groundwater elevation.

- Groundwater inundates portions of the base of the Closed CKD Pile. The amount of inundated CKD increases when the groundwater level rises and decreases when groundwater level falls.

- The pH of groundwater that contacts the CKD increases as a result of the contact. The affected water subsequently moves into the groundwater, increasing its pH.

- Two other mechanisms are also contributing to groundwater effects from CKD. Water flows laterally into the buried sidewalls of the Closed CKD Pile, especially in the historic landslide area. Water is also trapped in the CKD matrix from infiltration prior to pile closure. This water drains from the CKD until moisture equilibrium within the CKD matrix is attained. The water eventually joins the underlying groundwater before it migrates north-northeasterly toward Sullivan Creek.

- The high pH groundwater causes naturally occurring arsenic in the Site soils to go into solution in the groundwater. Arsenic is not present in significant concentrations within the CKD.

- Downgradient groundwater is characterized by high pH[5], decreased oxidation reduction potential[6], and arsenic concentrations greater than 5 µg/L (or parts per billion (ppb)) (Exhibit 2.3-4).

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[5] In excess of the State water quality standard of 8.5 and, in some locations, higher than the State dangerous waste threshold of 12.5.

[6] Redox potential or Eh.

- Groundwater with elevated pH and arsenic levels seeps into and flows overland (in a localized area) into Sullivan Creek.

2.4 Site Regulatory History

The following summary describes the major regulatory actions at the Site since 1984, when CKD became subject to regulation under the state Dangerous Waste regulations:

- Prior to 1984, both the federal government and the State of Washington exempted CKD from regulation as a hazardous or dangerous waste. In 1984, the State of Washington withdrew its exemption and CKD became subject to regulation as a dangerous waste under the Hazardous Waste Management Act (Chapter 70.105 of the Revised Code of Washington (RCW)) and its implementing Regulations (Chapter 173-303 WAC). CKD is still exempt from the federal hazardous waste regulations (40 CFR 261.4(b)(8)).

- 1984 – Lehigh submitted a “Notification of Dangerous Waste Activities” form and Part A of its Dangerous Waste Permit Application to notify Ecology that CKD would be managed at the Metaline Falls facility. Upon submittal of the Part A application, the Lehigh cement plant became an interim status dangerous waste treatment, storage, and disposal (TSD) facility.

- 1984-1992 – Lehigh investigated options for the CKD. Lehigh evaluated the feasibility of CKD beneficial reuse or recycling, preliminarily assessed the Site characterization options, and compiled descriptions of potential closure options. Dames and Moore used the information as a basis for and to supplement their subsequent evaluations [Bovay, 1991 and 1992; Cemtech, 1991].

- 1992-93 – Lehigh conducted an investigation to characterize the CKD Pile and to evaluate the quality of groundwater beneath and adjacent to it, the results of which are described in Section 2.3.

- 1994-95 – Lehigh continued to explore closure options for the CKD pile. In a 1994 letter to Lehigh, Ecology concluded that the CKD Pile should be closed in place [Ecology, 1994].

- 1996 – Lehigh submitted its "Final Closure Plan Cement Kiln Dust Pile, Metaline Falls, Washington" (7 June 1996). Ecology approved the Closure Plan by letter dated 13 June 1996.

- 1996 – Lehigh implemented the approved closure plan by constructing a final cover on the surface of the CKD Pile to reduce surface water infiltration and by constructing a stormwater management system to convey surface water run-on and run-off.

- 1996 – Ecology issued Administrative Order No. DE96HS-E934 (1996 AO), requiring Lehigh to submit and implement a short-term post-closure care plan. The 1996 AO required two years of groundwater monitoring.

- 1997 – Lehigh submitted to Ecology a "Short-Term Postclosure Care Plan, Cement Kiln Dust (CKD) Pile, Metaline Falls, Washington," which documented Lehigh's plans for groundwater monitoring and maintenance of the final cover and stormwater management system during the "short-term" post-closure period.

- 1997 – Lehigh provided closure certification, including documentation of the construction of the final cover and stormwater management system, in the "Closure Report for Cement Kiln Dust (CKD) Pile, Metaline Falls, Washington," dated 17 June 1997. Post-closure care of the Site was required, because dangerous waste (CKD) remained on the Site after closure.

- 1997-98 – In accordance with the 1996 AO, Lehigh collected groundwater monitoring data on a monthly basis. Lehigh also inspected, maintained, and made routine repairs to the final cover and stormwater management system during this time period.

- 1998 – Lehigh conducted an emergency remedial action under Enforcement Order No. DE98-HS-E938 (1998 EO), consisting of grading and filling a low-lying portion of the Site then owned by the Washington Department of Transportation (WDOT). This interim action, referred to as the "WDOT Deck Extension," reduced the potential for direct contact with high pH groundwater surfacing in the area.

- 1999 – Lehigh submitted to Ecology the "Post-Closure Care Groundwater Monitoring Data Review, Closed Cement Kiln Dust Pile, Metaline Falls, Washington," a report summarizing post-closure groundwater monitoring data collected between December 1996 and December 1998. These data indicated that leachate was emanating from the Closed CKD Pile during the post-closure monitoring period, affecting groundwater beneath and downgradient of the Site as described in greater detail in Section 2.3.

Up to this point, Ecology had regulated the Closed CKD Pile as a TSD under Ch. 70.105 RCW. The monitoring data collected between 1996 and 1998 demonstrated that releases of hazardous substances were occurring at and downgradient of the Closed CKD Pile. Based on these data, Ecology and Lehigh began assessing potential remedial action at the Site.

- 1999 – Ecology and Lehigh signed an Agreed Order (No. DE99HS-E941) (1999 AO) under the Model Toxics Control Act (MTCA) in October 1999. Under the 1999 AO, Lehigh agreed (a) to perform a remedial investigation and feasibility study (RI/FS); and (b) upon approval of the RI/FS, to prepare a preliminary draft Cleanup Action Plan (pdCAP).

- 2001 – Lehigh submitted a Draft Final Remedial Investigation Report (Draft RI). The Draft RI compiled existing information and new environmental data collected over the previous two years. Lehigh prepared the Draft RI consistent with WAC 173-340-350(7).

- 2001 – Lehigh began conducting a feasibility study (FS). To evaluate potential cleanup technologies, Lehigh proposed and Ecology accepted bench scale tests for various treatment technologies. Carbon dioxide diffusion bench scale tests produced promising results.

- 2002 – Ecology shifted the Site from the Dangerous Waste Program to the Toxics Cleanup Program.

- 2002 – Lehigh installed the Pilot System to evaluate this innovative in situ carbon dioxide diffusion groundwater treatment technology.

- 2003 – As required by the 1999 AO, Lehigh submitted a Feasibility Study Technical Memorandum (FSTM) containing a preliminary screening of potential remedial technologies. Lehigh prepared the FSTM consistent with WAC 173-340-350(8)(b).

- 2003 – As required by the 1999 AO, Lehigh submitted the first dFSTR to Ecology. The first dFSTR evaluated the remaining alternatives that resulted from the screening documented in the FSTM and alternatives requested by Ecology.

- 2004 – Lehigh conducted further analyses of the Site's groundwater flow regime and how CKD affects groundwater at the Site. Lehigh submitted the Supplement to the Draft Feasibility Study Report to Ecology to share the results of the analyses.

- 2004 – Ecology conducted a Summer work program to collect additional site data.

2.5 Previous Site Remedial Actions

2.5.1 General

This section describes remedial actions that Lehigh previously implemented at the Site. The capital and operation and maintenance cost for these measures exceeds

$13 million (US $2005) over the years 1995 - 2004. Lehigh continues to operate and maintain these remedial measures in compliance with applicable regulations.

2.5.2 Source Control

In accordance with State Dangerous Waste Regulations, Lehigh closed the CKD Pile in 1995 – 1996 [D&M, 1997]. Closure involved reconfiguring and consolidating CKD deposits, installing an engineered final cover system, controlling surface water, and implementing institutional controls (See Exhibit 2.2-1). The Ecology-approved closure eliminated the primary adverse physical and chemical effects of the Site and eliminated direct contact with CKD as a human health and environmental risk. In addition, precipitation and surface run-on to the pile no longer contacts the CKD, decreasing water percolation through the pile and eliminating a mechanism for CKD to affect groundwater.

2.5.3 Downgradient Controls - Deck Extension

High pH groundwater daylighted in a low-lying area downgradient of the CKD Pile and adjacent to WDOT's working gravel deck. In 1998, Lehigh and Ecology recognized that this area posed an exposure risk and jointly developed a solution. Lehigh filled the low-lying area (Exhibit 2.2-1) 9 through 14 November 1998 consistent with the 1998 EO [GeoSyntec, 1998].

2.5.4 Pilot Test - In Situ Groundwater Treatment Wall

Lehigh installed a Pilot System in October through November 2002 (Exhibit 2.2-1). Previous reports submitted to Ecology include detailed descriptions of this treatment technology and the Pilot System [GeoSyntec, 2000, 2001, 2002, 2002, 2003a, and 2003b]. Appendix A includes an evaluation of the pilot treatment system performance.

2.5.5 Performance Evaluation

Pursuant to the 1996 AO and 1999 AO, Lehigh has performed surface water, groundwater, and systems monitoring, including:

- short-term post-closure monitoring (groundwater, surface water, and closure systems) on a monthly basis;
- long-term post-closure monitoring (groundwater, closure systems) on a quarterly basis with weekly visits to the Site;
- performance monitoring (groundwater) on a periodic basis to evaluate the Pilot System; and
- supplemental evaluations (groundwater and surface water, e.g., Sullivan Creek Assessment [EIP, 1999] and Pilot System performance studies (Appendix A)).

Results of the Site monitoring indicate that the closure systems are performing well. In 1999, Lehigh conducted an ecological assessment of Sullivan Creek, without Ecology oversight. The study [EIP, 1999] concludes that surface water in the creek is of excellent chemical and biological quality. However, the groundwater downgradient of the Closed CKD Pile, which discharges to Sullivan Creek, remains affected by high levels of pH and elevated arsenic concentrations.

2.6 Feasibility Study Technical Memorandum

The FSTM screened 20[7] groundwater remedy alternatives [GeoSyntec, 2003b]. Lehigh determined that five alternatives passed the screening criteria and recommended that they be evaluated more extensively in the FSTR. After its review of the FSTM, Ecology recommended that the FSTR also include source abatement

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[7] In accordance with WAC 173-340-350 (8)(b).

alternatives (i.e., Additional Source Control and Partial Source Removal[8]). The FS process, which included further discussions with Ecology, led to the inclusion of two more alternatives. It also led Lehigh to drop one alternative from further consideration and to consolidate three technologies into a single alternative. Accordingly, the following alternatives are evaluated in this Revised dFSTR – See Exhibit ES-3.

- Alternative #1 – Permeable Treatment Wall (PTW)
- Alternative #2 – Pump and Treat (P&T)
- Alternative #3 – Additional Source Control (ASC)
- Alternative #4 – Partial Source Removal (PSR)
- Alternative #5 – Funnel and Gate Treatment (FGT)
- Alternative #6 – Partial Additional Source Control (PASC)

This Revised dFSTR evaluates each of the six alternatives in detail in subsequent sections.

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[8] 6/11/03 Ecology correspondence to Eric Smalstig, GeoSyntec Consultants, and follow-up Ecology correspondence with Jay Manning, Esq., Brown Reavis & Manning, PLLC.

3. REGULATORY FRAMEWORK FOR ADDITIONAL REMEDY ALTERNATIVE SELECTION

3.1 Introduction

Lehigh prepared this Revised dFSTR under MTCA. The state statutes and regulations promulgated under MTCA guide the FS process, the evaluation of remedial alternatives, and subsequent remedy selection. This section of the Revised dFSTR describes the standards, criteria, and considerations guiding remedy selection.

3.2 Remedy Selection under MTCA

3.2.1 General

The process for identifying and evaluating cleanup alternatives is described in WAC 173-340-350 and -360. The general steps involved are:

- identification of alternatives;
- initial screening of alternatives; and
- evaluation of selected alternatives.

Lehigh completed the first two steps in the FSTM, which identified remedial alternatives and screened them to eliminate those that "so clearly do not meet the minimum requirements of WAC 173-340-360 that a more detailed analysis is unnecessary" [WAC 173-340-350(8)(b); see Feasibility Study Technical Memorandum for the Lehigh CKD pile, prepared by GeoSyntec and dated 22 May 2003]. This Revised dFSTR documents the third step.

As described in the following subsections, the MTCA rules specify criteria that must be used to evaluate selected alternatives.

3.2.2 Threshold Requirements

3.2.2.1 Introduction

A cleanup alternative must meet the minimum requirements specified in WAC 173-340-360(2). The following threshold requirements are used as evaluation criteria in this Revised dFSTR:

1. protect human health and the environment;
2. comply with cleanup standards;
3. comply with applicable federal and state laws; and
4. provide for compliance monitoring.

If a remedial alternative fails to meet any one of these threshold requirements, it must be eliminated from further consideration.

3.2.2.2 Protect Human Health and the Environment

The first threshold requirement, that the remedy protect human health and the environment, is also an evaluation criterion under the 1999 AO ("overall protection of human health and the environment"). Cleanup actions that attain cleanup levels at the applicable point of compliance, and comply with applicable state and federal laws, are presumed to be protective of human health and the environment [WAC 173-340-702(5)].

3.2.2.3 Cleanup Standards

The second threshold requirement is that the remedy meets MTCA cleanup standards. When a cleanup action is selected, cleanup standards are set for specific contaminants of concern and for each affected medium, such as groundwater. "Cleanup standards" consist of three elements:

- Cleanup levels (maximum allowable concentrations of a hazardous substance in a given medium) (see WAC 173-340-700(3)(a)).

- Point of compliance where compliance with the cleanup level will be measured (see WAC 173-340-700(3)(b)).

- Other regulatory requirements that apply to the site because of the type of action and/or location of the site ("applicable state and federal laws") (see WAC 173-340-700(3)(c)).

3.2.2.4 Cleanup Levels

Cleanup levels must:

- Ensure compliance with applicable state and federal laws, also known as Applicable or Relevant and Appropriate Requirements (ARARs, see Section 3.2.2.6).

- Prevent cross-contamination of other media (WAC 173-340-700(6)(b)).

- Not be set below the practical quantification limit achievable by a chemical analytical laboratory or the natural background concentration

Cleanup levels are established by using one of three methods described in MTCA. Ecology will set final cleanup levels in the Cleanup Action Plan (CAP). For purposes of the Revised dFSTR, Lehigh assumed that Method A cleanup levels will apply[9]. Lehigh used the Method A cleanup levels set forth in tables in the MTCA regulations. The table for groundwater is Table 720-1, codified at WAC 173-340-900. The assumption of cleanup levels for this Revised dFSTR allows the six alternatives to be evaluated for their ability to meet the cleanup levels.

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[9] Method A is used to establish cleanup levels at sites that have few hazardous substances. Numerical standards must be available either in MTCA or in applicable state or federal laws for all hazardous substances in the medium for which the Method A cleanup level is used.

To select cleanup levels for contaminated groundwater, it is important to determine whether the groundwater is potable. Under MTCA, groundwater is considered potable unless:

- the groundwater does not currently serve as a source of drinking water;
- the groundwater is not a potential future source of drinking water due to inadequate supply, naturally occurring contaminants, or great depth that makes groundwater use technically impossible; and
- it is unlikely that hazardous substances will be transported to a current or potential future source of drinking water in concentrations that exceed water quality criteria in chapter 173-200 WAC (WAC 173-340-720(2)).

Groundwater at the Site is not a current source of drinking water. Lehigh plans to record a restrictive covenant that prohibits withdrawal of groundwater for domestic purposes. Groundwater at the Site discharges to Sullivan Creek. Thus groundwater cleanup levels must be set to be protective of drinking water and surface water. Method A cleanup levels shall be at least as stringent as concentrations listed under WAC 173-340-720(3). For arsenic, the most stringent of these concentrations is the National Toxics Rule (NTR) concentration of 0.018 ppb which is less than the Method A level of 5ppb. The Method A level is derived from the arsenic background concentration of 5 ppb in groundwater. Since the NTR concentration of 0.018 ppb is less than the background concentration of approximately 5 ppb, the groundwater Method A cleanup level for arsenic of 5 ppb will apply. The pH cleanup level, based on the water quality criteria under WAC 173-201A WAC, ranges from 6.5 to 8.5 standard units.

3.2.2.5 Point of Compliance

Ecology will define the POC in the CAP. MTCA provides for the selection of either a “standard” or a “conditional” POC, depending on the medium at issue and other site-specific factors.

Under a standard POC, cleanup levels must be met everywhere, throughout a site. Specifically:

- “Site” is defined to include “any … area where a hazardous substance … has come to be located” (WAC 173-340-200).
- For groundwater, this includes meeting cleanup levels from the uppermost level of the saturated zone extending vertically to the lowest depth that could be affected by the site (WAC 173-340-720(8)(b)).

Ecology may grant a conditional POC for groundwater where it can be demonstrated that it is not practicable to meet the cleanup level throughout the Site within a reasonable restoration time frame. This practicability analysis is governed by the factors set out in WAC 173-340-350 and 360, and is described in greater detail below in Section 3.2.3. If a conditional POC is used, it must be set “as close as practicable to the source of hazardous substances” and must not exceed the property boundary unless the off-property exception of WAC 173-340-720(8)(d) applies. In addition, “all practicable methods of treatment” must be used.

As described in Section 4, there is not a practicable remedial alternative that will meet groundwater cleanup levels throughout the Site within a reasonable restoration time frame. Consequently, Lehigh proposes a conditional POC for groundwater at a location downgradient of the Closed CKD Pile and selected treatment facilities, but upgradient of Sullivan Creek. Ecology will define the POC in the CAP. The Revised dFSTR assumed the conditional POC briefly described as a basis to evaluate the alternatives against. The discussion in Sections 4 and 5 demonstrates that this location meets the requirements of WAC 173-340-720(8)(c) because: (1) a standard POC is not practicable; (2) it is as close as practicable to the source of the hazardous substances; (3) it does not exceed the property boundary; and (4) all practicable methods of treatment will be used. Each of the alternatives evaluated in this FS process incorporates treatment-based remedies. There is inherent variability involved in operating engineered treatment systems. The method of evaluating compliance with cleanup standards will be established during development of the monitoring program defined in the CAP and design phases of the project, and ultimately approved by Ecology.

Lehigh owns the land affected by the plume, including the proposed conditional POC for groundwater, with the exception of the State Route 31 and its right-of-way. As such, the off-property conditional POC exception of WAC 173-340-720(8)(d) need not be applied.

3.2.2.6 Applicable Federal and State Laws - ARARs

The third threshold requirement is that the remedy complies with applicable federal and state laws, which "include (a) all legally applicable requirements and (b) those requirements that the department determines are "relevant and appropriate requirements." These are referred to jointly as ARARs (WAC 173-340-710(1)). The 1999 AO also requires that this factor ("compliance with remedial action objectives (RAOs) and ARARs") be used in evaluating selected alternatives. "Relevant and appropriate requirements" include those cleanup standards, standards of control, and other environmental requirements, criteria, or limitations established under state or federal law that, while not legally applicable to the hazardous substance, cleanup action, location, or other circumstance at a site, address problems or situations sufficiently similar to those encountered at that site that their use is well suited to the particular site (WAC 173-340-710(4)). WAC 173-340-710(7) identifies a number of state and federal laws, compliance with which must be considered in the cleanup action selection process if applicable. Lehigh analyzed various ARARs, permits, and approvals that apply to the remedy alternatives described in this Revised dFSTR. Exhibit 3.2-1 summarizes Lehigh's analysis.

ARARs may include requirements to obtain permits or other regulatory approvals to conduct some part of the cleanup. Under MTCA, a person conducting a cleanup under an order or consent decree is exempt from any requirements to obtain state or local permits or approvals for the remedial action. (RCW 70.105D.090). However, Ecology must ensure compliance with the substantive provisions of any such state or local laws. This usually requires consultation with the state or local agency that administers the relevant law. Ecology will address these issues in more detail in the CAP.

MTCA has no exemption for any federal permits or approvals required to conduct the remedial action. Thus, Lehigh must obtain any required federal permits, and must meet the substantive provisions of any state or local laws that would, but for the MTCA exemption, require a permit or approval.

Lehigh has identified applicable state and local laws that, but for the MTCA exemption, might require a permit or approval to implement one or more of the six alternatives. Lehigh also has identified the federal laws that could require Lehigh to obtain permits or approvals to implement one or more alternatives. Depending on the alternative, the applicable federal, state, and local programs are, as follows:

- Federal:
    - Clean Water Act Section 404 dredge and fill permit and Rivers and Harbors Act Section 10 permit
    - Clean Water Act Section 402 NPDES permit
    - Clean Water Act Section 401 water quality certification

- State:
    - Hydraulics Project Approval
    - Aquatic Use Authorization
    - State Waste Discharge permit
    - Water Right permit

- Local:
    - Shoreline Management permit
    - Floodplain Management permit
    - Clearing/grading/building permit

In Exhibit 3.2-1, Lehigh shows the alternatives potentially subject to each of these federal, state, and local programs. Each alternative requires a combination of permits or is subject to certain restrictions. Lehigh’s preliminary research shows that there are no significant restrictions or permitting programs that would make any remedy difficult to implement. Specific permit issues are usually resolved during remedy design for MTCA Clean Ups. Of all the programs identified, the NPDES permitting process requires the most amount of time to complete, approximately six to nine months. Thus, the remainder of the Revised dFSTR emphasizes the NPDES process due to its effect on the project schedule.

3.2.2.7 Compliance Monitoring

The final threshold requirement is that any remedy implemented under MTCA must provide for "compliance monitoring." The 1999 AO also requires that this factor ("provision for compliance monitoring") be used in evaluating selected alternatives. Compliance monitoring consists of three different types of monitoring:

- Protection Monitoring: performed during remedy construction for protection of workers, the public, and the environment;
- Performance Monitoring: confirms that the remedy has met cleanup standards;
- Confirmation Monitoring: affirms that the remedy will be effective in the long term in meeting cleanup standards.

3.2.3 Other Requirements

3.2.3.1 Introduction

WAC 173-340-360(2)(b) defines conditions, referred to as "Other Requirements," that any remedy must meet in addition to the threshold requirements. They are:

1) use permanent solutions to the maximum extent practicable;

2) provide for a "reasonable restoration timeframe" to meet cleanup levels; and

3) consider public concerns.

3.2.3.2 Permanent Solutions to the Maximum Extent Practicable

3.2.3.2.1 General

MTCA does not require that a permanent cleanup action alternative be selected. Rather, Ecology must select a remedy that "uses permanent solutions to the maximum extent practicable." It must use the "disproportionate cost analysis" to determine whether a cleanup action alternative meets this requirement (WAC 173-340-360(3)(b)).

One of the criteria in the disproportionate cost analysis is permanence (WAC 173-340-360(3)(f)(ii)). This criterion is closely related to the concept of "permanent solution," but because differences between the two terms are important they are discussed separately in the Revised dFSTR.

3.2.3.2.2 Permanent Cleanup Action

"Permanent solution" or "permanent clean-up action" means a cleanup action that meets the cleanup standards of WAC 173-340-700 – 173-340-760 without further action being required at a site being cleaned up or at any other site involved with the cleanup action, other than the approved disposal of any residue from the treatment of hazardous substances (WAC 173-340-200 (definition of "permanent solution" or "permanent cleanup action")).

MTCA generally requires that the FS include at least one permanent cleanup action alternative to serve as a baseline against which other alternatives are evaluated to determine which is "permanent to the maximum extent practicable" (WAC 173-340-350(8)(c)(ii)). However, the FS need not include a permanent cleanup action alternative if none is "technically possible" (WAC 173-340-350(8)(c)(ii)(B)(II)). MTCA defines "technically possible" as "capable of being designed, constructed and implemented in a reliable and effective manner, regardless of cost" (WAC 173-340-200).

Ecology and Lehigh understand the term “permanent” differently, as explained below. However, this difference of opinion does not affect the evaluation of alternatives in this Revised dFSTR.

Lehigh believes that no “permanent” remedies exist for the Site because no treatment process has been identified that can completely render the CKD inert. As Lehigh understands MTCA, the only remedies that meet the definition of permanent are those that treat the hazardous substances, rendering them non-hazardous. Treatment may occur on-site or off-site, but the remedy will not qualify as permanent if any further remedial action (including monitoring, institutional controls, or maintenance) is required (see WAC 173-340-200).

For example, Lehigh does not believe that source removal and off-site disposal is a permanent remedy since further remedial action would be required to manage the removed hazardous substances at the disposal facility. Any CKD removed from the pile would have to be transported to a permitted disposal facility, which would in turn require engineering controls, monitoring, and possibly remediation. This is “further action.” Thus, in Lehigh’s view removal and off-site disposal cannot be a permanent solution.

Source removal or source isolation alternatives also would have to be supplemented with on-site groundwater remediation, another form of “further action.” Lehigh believes that the only way to eliminate the need for downgradient groundwater treatment is to remove the entire Closed CKD Pile and to render it completely inert. Unless all of the CKD is excavated and moved elsewhere, Lehigh believes that it is not technically possible to reduce contact between groundwater and the Closed CKD Pile sufficiently to result in groundwater meeting cleanup levels. Even after full pile removal, it will take many years for natural attenuation to cleanse the groundwater and subsurface materials, so that groundwater meets clean up levels throughout the Site. Lehigh has presented data and analysis that support this belief [GeoSyntec, 2004]. These analyses show that more than 99% of the contact must be eliminated before cleanup levels would be met. Since this level is not achievable, supplemental groundwater remediation would be required for an indefinite time period to meet cleanup levels. Such groundwater remediation is “further action,” which means that neither source removal nor source control is a permanent remedy.

Furthermore, even if groundwater ceased to contact the Closed CKD Pile, through some form of source control, MTCA would require engineering controls and long-term monitoring to maintain the long-term effectiveness of the source control alternative (WAC 173-340-360(3)(f)(iv) and 173-340-410(3)). Thus, because all of the partial source removal or source control options would require "further action" either at the Site or at an off-site disposal facility, Lehigh believes that none of them qualifies as a permanent remedy.

Ecology has indicated that it believes that PSR with off-site disposal and remediation of residual CKD-affected groundwater is a permanent remedy, even if the removed hazardous substances are not treated or destroyed. Based on conversations with Ecology, they believe that PSR is permanent remedy for the following reasons: the majority of CKD-water contact occurs where the base is inundated, and removing that base area will sufficiently reduce overall CKD-water contact; PSR could be designed and implemented with a high degree of reliability; the remaining CKD-water contact could be diluted by unaffected groundwater so that groundwater beneath the Closed CKD Pile meets cleanup levels; and greater than 99% effectiveness is not required for PSR to be permanent.

Although Ecology and Lehigh disagree whether there are any permanent cleanup action alternatives for this Site, they agree that PSR offers the greatest degree of "permanence," a concept described below in Section 3.2.3.2.4. MTCA requires that, if a permanent cleanup action alternative is not available, the alternative with the greatest degree of permanence shall be the baseline cleanup action alternative (WAC 173-340-360(3)(e)(ii)(B)). PSR therefore will be the baseline against which other alternatives are evaluated.

3.2.3.2.3 Disproportionate Cost Analysis

Under the disproportionate cost analysis, "costs are disproportionate to the benefits provided by a remedy if the incremental costs of the alternative over that of a lower cost alternative exceed the incremental degree of benefits achieved by the alternative over that of the other lower cost alternative" (WAC 173-340-360(3)(e)(i)).

The disproportionate cost analysis takes into consideration the following seven factors, which are adopted as evaluation criteria in this Revised dFSTR:

- protectiveness;
- permanence;
- cost;
- effectiveness over the long term;
- management of short-term risks;
- technical and administrative implementability; and
- public concerns.

The 1999 AO also requires that these factors (described in the Agreed Order as “overall protection of human health and the environment”; “permanent reduction of mobility, toxicity, and volume”; cost; “long-term effectiveness”; “short-term effectiveness”; “implementability”; and “community concerns”) be used in evaluating selected alternatives.

3.2.3.2.4 Permanence

As stated above, the second of these criteria, “permanence” is related, but not identical, to the concept of a “permanent” remedy. MTCA defines “permanence” as follows:

> *(ii) Permanence. The degree to which the alternative permanently reduces the toxicity, mobility or volume of hazardous substances, including the adequacy of the alternative in destroying the hazardous substances, the reduction or elimination of hazardous substance releases and sources of releases, the degree of irreversibility of waste treatment process, and the characteristics and quantity of treatment residuals generated.*

A cleanup action that requires further action to meet cleanup standards is not permanent, but it may still exhibit a high degree of permanence. For example, although Lehigh does not believe that PSR is permanent, Ecology and Lehigh agree that PSR has a high degree of permanence because it reduces the toxicity, mobility, and volume of hazardous substance releases. Because cleanup treatment components reduce the toxicity and mobility of hazardous substance releases, the treatment exhibits permanence.

The regulations require that the degree of permanence, even of non-permanent remedies, be considered during remedy selection. The Revised dFSTR evaluates the alternatives with respect to this characteristic, as well as the other criteria in the disproportionate costs analysis.

3.2.3.2.5 Cost

The Revised dFSTR presents costs for the alternatives in 2005 U.S. dollars. Lehigh developed three scenarios for the cost calculations. First, the standard thirty-year project duration with a seven percent discount rate is presented. Lehigh included a second scenario using a one hundred-year project duration because of the indefinite time period that most alternatives will need to operate. The second scenario uses a seven percent discount rate and a one hundred year period. Lehigh developed a third scenario based on Ecology comments and EPA guidance [EPA, 2000a]. EPA guidance suggests that a non-discounting scenario be presented only for comparison purposes. The third scenario uses the one hundred-year project duration. The cost estimates also included periodic replacement or rehabilitation costs for minor and major alternative components.

3.2.3.2.6 Restoration Time Frame

The reasonableness of a proposed restoration time frame—the period of time required to achieve cleanup levels at the POC—is determined by considering a number of factors, including those in WAC 173-340-360(4)(b):

- potential risks to human health and the environment;
- practicability of a shorter time frame;
- current use of the site, surrounding areas, and associated resources that may be affected by releases at the site;

- potential future use of the site, surrounding areas, and associated resources;
- availability of alternative water supplies;
- likely effectiveness and reliability of institutional controls;
- ability to control and monitor migration of hazardous substances from the site;
- toxicity of those substances; and
- natural processes that reduce concentrations of hazardous substances.

The 1999 AO also requires that this factor ("restoration time frame") be used in evaluating selected alternatives.

3.2.3.2.7 Public Concerns

Public concerns must be considered following the public participation process set out in WAC 173-340-600.

3.2.3.2.8 Agreed Order Criterion

The 1999 AO establishes the following additional criterion that is also used in this Revised dFSTR to evaluate alternatives: Prevent Domestic Uses of CKD-Affected Groundwater.

3.2.4 Groundwater Cleanup Requirements

The MTCA regulations contain specific requirements for cleanups that address contaminated groundwater in WAC 173-340-360(2)(c)(i):

> *Permanent ground water cleanup actions. A permanent cleanup action shall be used to achieve the cleanup levels for ground water in WAC 173-340-720 at the standard point(s) of compliance (see WAC 173-340-720(8)) where a permanent cleanup action is practicable or determined by the department to be in the public interest.*

As discussed above, Lehigh and Ecology disagree whether there is a permanent remedy for this Site. Even if PSR is a permanent remedy, it is not practicable because its costs are disproportionate to its benefits, as discussed below in Chapter 5.[10]

MTCA recognizes that permanent cleanup actions are not available or not practicable at all sites. When a permanent cleanup action is not selected for groundwater, Ecology must ensure that:

- highly mobile hazardous substances, liquid wastes, highly concentrated hazardous substances, or those that cannot be reliably contained are removed or treated (WAC 173-340-360(2)(c)(ii)(A)); and
- groundwater containment measures are implemented to avoid lateral and vertical expansion of the groundwater volume affected by the hazardous substance (WAC 173-340-360(2)(c)(ii)(B)).

As discussed below in Section 4, the six alternatives evaluated for the Site involve treatment components, which satisfies WAC 173-340-360(2)(c)(ii)(A). The

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[10] In 1994, Ecology concluded that full CKD Pile removal was not a viable option. The following quote contains Ecology's conclusion [Ecology, 1994]:

> "Ecology believes that excavation and/or treatment of the CKD waste pile to meet MTCA cleanup levels is not economically feasible. It is our opinion that the CKD waste pile should be closed in place…"

Closed CKD Pile cover is a containment measure, and each of the six alternatives uses techniques to control the spreading of the CKD-affected groundwater plume. Thus, each of the six alternatives meets the nonpermanent groundwater cleanup requirements of WAC 173-340-360(2)(c)(ii).

Section 4 presents the analysis of six groundwater remedy alternatives with respect to the aforementioned criteria. Section 5 contains the comparative analysis of the six alternatives.

4. EVALUATION OF ADDITIONAL GROUNDWATER SITE REMEDY ALTERNATIVES

4.1 General

The FSTM screened 20 groundwater remedy alternatives [GeoSyntec, 2003b]. Lehigh determined that five alternatives passed the screening criteria and recommended that they be evaluated more extensively in the FSTR. After its review of the FSTM, Ecology recommended that the FSTR also include source abatement alternatives (i.e., Additional Source Control and Partial Source Removal[11]). The FS process, which included further discussions with Ecology, led to the inclusion of two more alternatives. It also led Lehigh to drop one alternative from further consideration and to consolidate three technologies into a single alternative. Accordingly, the following alternatives are evaluated in this Revised dFSTR – See Exhibit ES-3.

- Alternative #1 – Permeable Treatment Wall (PTW)
- Alternative #2 – Pump and Treat (P&T)
- Alternative #3 – Additional Source Control (ASC)
- Alternative #4 – Partial Source Removal (PSR)
- Alternative #5 – Funnel and Gate Treatment (FGT)
- Alternative #6 – Partial Additional Source Control (PASC)

Section 4 presents descriptions of each of the six alternatives. The descriptions begin with features that are common to each of them, such as institutional controls, followed by the essential features of each alternative and the advantages and disadvantages of the alternative relative to each of the evaluation criteria identified in Section 3. As described in Section 3, each alternative is evaluated against the threshold requirements, other requirements, disproportionate cost analysis criteria, and the 1999 AO criteria. For purposes of the disproportionate costs analysis, Alternative # 4 – PSR, is used as the baseline remedy since it exhibits the highest degree of permanence. Exhibits 4.1-1 through 4.1-6 summarize the criteria evaluation of each alternative as

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[11] 6/11/03 Ecology correspondence to Eric Smalstig, GeoSyntec Consultants, and follow-up Ecology correspondence with Jay Manning, Esq., Brown Reavis & Manning, PLLC.

further discussed in this section[12]. Exhibit 4.1-7 summarizes the cost estimate results for the six alternatives for the three cost scenarios described in Section 3.2.3.2.5.

The engineering layouts of each alternative are presented in Exhibits 4.3-1, 4.4-1, 4.5-1, 4.6-1, 4.7-1, and 4.8-1. The layout and work elements for the alternatives are conceptual. The layouts are intended only for the purpose of illustration and are not meant as final design layouts. Ecology will draft the CAP following FSTR finalization.

4.2 Common Components

4.2.1 General

Although each of the six alternatives uses a different technical approach to remediate the Site, they share certain components. Specifically, each alternative includes institutional controls and compliance monitoring. These components are described once, under Alternative 1, and referenced in Alternatives 2 through 6.

4.2.2 Institutional Controls

Institutional controls are non-engineered mitigation measures that reduce the potential for human exposure to contaminated media. Institutional controls include:

- **Fencing –** restricts access to contaminated media and limits the potential for exposure (implemented in 1996 on the Closed CKD Pile and maintenance continues).

- **Education (Warning Signs)** – warns people of the potential for exposure (implemented in 1996 and maintenance continues).

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[12] See Nyer (1992) for a general discussion of alternative groundwater treatment technologies. EPA (1998) describes and compares alternative innovative groundwater treatment technologies including applications similar to those evaluated in this Revised dFSTR. EPA (2000) includes descriptions of case studies of groundwater remediation including sites and technologies that involve issues and processes similar to those addressed in this Revised dFSTR.

- **Restrictive Covenants –** where appropriate, Lehigh may file restrictive covenants noting specific conditions (e.g., high pH groundwater) and prohibiting certain uses.

4.2.3 Compliance Monitoring

Each of the alternatives includes provisions for compliance monitoring. Compliance monitoring has three components: protection monitoring, performance monitoring, and confirmation monitoring. To demonstrate protection monitoring, Lehigh will prepare worker health and safety plans and standard operating procedures. Performance monitoring consists of monitoring groundwater quality by using wells downgradient of the treatment systems. To demonstrate compliance with cleanup levels, groundwater monitoring wells will be located at the POC.

Lehigh has proposed cleanup levels for groundwater based on the beneficial use of Sullivan Creek (Sullivan Creek is considered a source of potable water, and groundwater flows into Sullivan Creek). As discussed above, Lehigh has proposed a conditional POC for groundwater between the treatment system of the various alternatives and Sullivan Creek. Ecology will locate the official POC in the CAP. Each of the alternatives evaluated in this FS process incorporates treatment-based remedies. There is inherent variability involved in operating engineered treatment systems. The method of evaluating compliance with cleanup standards will be established during development of the monitoring program defined in the CAP and design phases of the project, and ultimately approved by Ecology. Lehigh will report monitoring results to Ecology regularly, pursuant to provisions of the CAP and/or Consent Decree developed for the Site.

4.3 Permeable Treatment Wall (PTW)

4.3.1 PTW-Alternative Description

4.3.1.1 General

Alternative #1 – Permeable Treatment Wall (PTW) is a largely in situ technology that uses carbon dioxide diffusion into the CKD-affected groundwater to decrease pH of the groundwater. Treatment occurs within a trench excavated to intercept CKD-affected groundwater. The conceptual layout of this system is shown in Exhibit 4.3-1. Lehigh tested this technology in the pilot scale phase.

4.3.1.2 System Description

The PTW would be constructed to the east of State Route 31 and includes:

- Several trenches filled with coarse gravel, arranged in a line roughly parallel to Route 31 (approximately 1,500 cubic yards);
- Treatment trenches keyed into the underlying clay layer, which becomes the bottom of the treatment zone;
- Perforated plastic pipes buried in the treatment trench (approximately 3,000 lineal feet);
- Silicon tubing within the plastic pipes (approximately 60,000 lineal feet);
- A carbon dioxide source (approximately 28 tons of capacity);
- Mechanical and control systems;
- Control building;
- Barrier wall panels connecting the coarse gravel treatment zones;
- A limited number of groundwater extraction wells downgradient of the PTW to capture water that migrates through likely gaps in the treatment zone (See Section 4.3.1.3 for a more complete description); and
- The existing pilot carbon dioxide treatment system.

Exhibit 4.3-1 shows PTW components in plan and cross-sectional views, including a process diagram. Exhibit 4.3-1 does not show the limited number of groundwater extraction wells because their location and design would depend on the PTW construction. The PTW technology neutralizes pH in the CKD-affected groundwater. Carbon dioxide in the presence of water forms carbonic acid, which neutralizes hydroxide ions (the chemical cause for high pH in the Site groundwater) through the following reactions:

$$CO_2 + H_2O \rightarrow H_2CO_3 \qquad (4\text{-}1)$$

$$H_2CO_3 + OH^- \rightarrow H_2O + HCO_3^- \qquad (4\text{-}2)$$

The decrease in pH reduces soluble arsenic in the groundwater. The arsenic forms insoluble complexes, returning to the aquifer solids (i.e., soil matrix) from which it originated. These chemical processes are described in detail in the Interim Progress Report [GeoSyntec, 2000].

The treatment zone in the PTW is approximately 400 ft long by 18 to 20 ft deep, with in situ carbon dioxide delivery systems. The treatment zones are in alignment with the current Pilot System, and they use the demonstrated and reliable treatment-based technology of the Pilot System installed in 2002[13].

4.3.1.3 System Performance

The treatment zones of the PTW intercept CKD-affected groundwater[14] as it flows downgradient of the Closed CKD Pile. The carbonic acid (from in situ diffusion of carbon dioxide into the groundwater) neutralizes the high pH water entering the treatment zones. As a result of the reduced pH, arsenic in solution precipitates out (i.e., form insoluble complexes) in the alluvial soil downgradient of the treatment zone. The

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[13] See EPA (1999a through c) for a general description of the design, installation, and general performance of reactive barriers, which are similar in many ways to the PTW alternative.

[14] See EPA (1993) for a description of the performance of Passive Treatments Walls, a technology that is similar to that used in PTW. This reference also provides an exhaustive comparison of alternative remediation technologies.

groundwater treated in the treatment zone will meet cleanup levels for both pH and arsenic at a conditional POC located between the treatment zone and Sullivan Creek.

Lehigh evaluated a variety of neutralization agents to reduce the Site's groundwater pH, and determined that carbon dioxide is the most appropriate neutralization agent. In water, carbon dioxide forms carbonic acid, a weak acid. Other neutralization agents, such as hydrochloric acid, sulfuric acid, nitric acid, phosphoric acid and organic acids, have disadvantages with respect to system performance, including: storage and handling requirements for strong acids, over acidification potential, heat generation, production of regulated daughter compounds (e.g., chloride, sulfate, nitrate, phosphate), nutrient loading on Sullivan Creek (e.g., nitrogen, phosphorus), and further reducing redox potential, E_h, in situ. Reducing E_h would not result in arsenic precipitation and could cause the mobilization of other undesirable mineral constituents. The Pilot System has demonstrated that carbon dioxide treatment systems perform successfully at the Site by lowering pH, generally increasing E_h, and precipitating arsenic.

Because of certain design constraints of the diffusion tubing and physical limitations of the alignment, the PTW includes several treatment zone units, or segments (i.e., panels). Each of the treatment zone units is keyed into the low-permeability clay layer underlying the Site. Barrier panels, installed between the PTW segments and constructed of low-permeability material, divert untreated CKD-affected groundwater to the PTW treatment panels. Gaps in the treatment zone may occur due to construction challenges, such as limited visibility while installing system components under groundwater, the tendency of the thick plastic components to bend, and potentially not treating in the targeted location. Groundwater extraction wells downgradient of the treatment panels capture the groundwater that escapes treatment through the gaps in the treatment zone. Extracted groundwater can be treated aboveground and discharged into Sullivan Creek or routed back to the treatment zone. To avoid pump and treat (P&T) treatment residuals, the Revised dFSTR assumes that escaped groundwater will be routed to the treatment zone.

The change in pH in the treatment zone will precipitate a variety of minerals, in addition to arsenic minerals such as carbonates and silicates. Arsenic is a relatively small component of the groundwater that contains other dissolved solids. PTW treatment precipitates the arsenic as a small fraction of the overall mineral precipitate matrix. Treatment process modeling and stoichiometric calculations predict that arsenic will not accumulate in concentrations that exceed dangerous waste levels.

4.3.1.4 Construction Schedule

PTW design, contracting, and procurement requires approximately eight months. If required, approximately two months are needed to obtain regulatory approval for floodplain construction. PTW installation requires approximately five to six months. This estimated timeframe does not account for construction during inclement weather or winter conditions. The winter temperatures and hours of daylight in Metaline Falls adversely affect installation of the PTW, specifically the excavation of the trench, insertion of the perforated pipe into the treatment trench and construction of the barrier walls. Although possible, construction of PTW during the winter months is not advisable.

4.3.2 PTW-Protect Human Health and the Environment

The PTW will protect human health and the environment for the following reasons:

- ***Groundwater Quality.*** The PTW meets MTCA groundwater cleanup levels at a conditional POC. The Site-specific bench and pilot scale treatability studies [GeoSyntec, 2000, 2002, 2003a, and 2003b] demonstrated that this alternative effectively treats CKD-affected groundwater.

- ***ARAR Compliance***. The PTW complies with ARARs.

- ***Institutional Controls***. Lehigh will use institutional controls as described in Section 4.2.2.

4.3.3 PTW-Comply With Cleanup Standards

The Site-specific PTW bench scale and Pilot System test results established that this technology will meet cleanup standards assumed for the purposes of the Revised dFSTR, as follows:

- ***Cleanup Levels (CLs).*** The proposed groundwater cleanup levels for the Site are pH between 6.5 and 8.5, and maximum arsenic concentration of 5.0 ppb.

- ***Point of Compliance (POC)***. Lehigh proposes a conditional POC for groundwater at a point downgradient of the PTW treatment zone and upgradient of Sullivan Creek (Exhibit 4.3-1).

4.3.4 PTW-Comply With Applicable Federal and State Laws

The PTW complies with ARARs. Exhibit 3.2-1 presents a summary of ARARs that apply to this alternative.

4.3.5 PTW-Provide for Compliance Monitoring

Lehigh will provide compliance monitoring as outlined in Section 3.2.2.7. Lehigh will perform worker and public safety protection monitoring during construction when workers may be exposed to CKD-affected water and when the construction activities may disturb public areas (e.g., transportation on public streets). For performance and confirmational monitoring, Lehigh will use groundwater wells installed in accessible locations at the proposed conditional POC for groundwater. Standard groundwater monitoring wells will document the cleanup of the groundwater and demonstrate compliance with cleanup levels at the POC.

4.3.6 PTW-Use Permanent Solution to the Maximum Extent Practical

4.3.6.1 Introduction

This element for selection of cleanup actions requires consideration of the criteria used in the disproportionate cost analysis (WAC 173-340-360(3)). Each criterion in the disproportionate cost analysis is discussed below.

4.3.6.2 PTW-Protectiveness

As described in Section 4.3.2, PTW protects human health and the environment because it meets groundwater cleanup levels at a conditional groundwater POC. In addition, it complies with applicable state and federal laws.

4.3.6.3 PTW-Permanence

Permanent Solution. PTW is not a permanent solution. PTW requires maintenance, continual operation, and repairs, as needed, for an indefinite time period.

Permanence. PTW exhibits a high degree of permanence because it is a treatment-based technology that decreases pH and reduces the solubility (mobility) and toxicity of arsenic, obviating further groundwater treatment at the POC. In addition, it generates no treatment residuals[15] that require future management and/or disposal. However, PTW will not prevent the generation of high-pH groundwater at the Closed CKD Pile.

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[15] A general term adopted here to designate treatment-produced material or by-product (e.g., treatment solids), generated by this or other processes, that will have to be stored, potentially further treated, transported from the Site, and ultimately disposed of at an appropriate disposal facility.

4.3.6.4 PTW-Cost

The estimated present value cost to design and install a PTW is approximately \$2.1 million (US \$2005)[16] (see Exhibit 4.3-2). The estimated annual operating and maintenance cost is approximately \$150,000. Hence, the present value of this alternative for 30 years at an annual discount rate of seven percent is approximately \$4.3 million. Actual costs may vary depending on the details of the final PTW system design and implementation procedures. Exhibit 4.1-7 includes the estimated costs of the six alternatives for the three scenarios described in Section 3.2.3.2.5 (See Appendix E).

4.3.6.5 PTW-Effectiveness Over the Long Term

Based on the past performance of the Pilot System, Lehigh has a high degree of confidence that PTW will be effective over the long term. Lehigh will operate and maintain the PTW as long as necessary to maintain compliance with cleanup levels at the point of compliance. Lehigh also will provide a financial assurance mechanism to cover the long-term operation and maintenance. PTW components could be added or decommissioned as needed, and could be replaced, as necessary (with some difficulty due to the in situ nature of many of the PTW components). As such, the PTW will be effective over the long term.

4.3.6.6 PTW-Management of Short-Term Risks

There are few short-term risks associated with PTW. During construction of the PTW, workers may be exposed for a short time to high pH water, but this risk is common to each of the alternatives evaluated. The potential exposure to high pH water occurs while the treatment trench is open, allowing the CKD-affected groundwater to fill the treatment zone. Workers must take care when using heavy equipment and re-locating utility lines, including the municipal water line trending along the Sullivan

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[16] See EPA (2001) for a detailed discussion of the comparative costs and benefits of Permeable Reactive Walls (which are similar to the PTW) and Pump and Treat systems. Unless otherwise indicated, all costs are US \$ 2005.

Creek side of State Route 31, potential utilities to the existing building, a potential septic tank and associated features related to the existing building, and portions of stormwater conveyance pipe between the north culvert and Sullivan Creek. The risks posed are manageable with good construction safety practices. Construction and initial operation of the Pilot System created no significant short-term risk to workers or to the environment. Similarly, installation and operation of the PTW will also involve no significant construction or operation risks.

Construction during the winter months may increase the short-term risks associated with PTW. Since the trenching operation is performed in saturated conditions, short or dim daylight periods would pose additional safety concerns for workers. The winter conditions in Metaline Falls affect certain components of the PTW installation, specifically the perforated pipe installation in the treatment trench. Although possible, construction of PTW during the winter months is not advisable.

4.3.6.7 PTW-Technical and Administrative Implementability

4.3.6.7.1 Technical Implementability

Construction of several components is difficult in the winter months. The Pilot System installation demonstrated that the PTW is technically implementable during other times of the year.

4.3.6.7.2 Administrative Implementability

The PTW is administratively implementable. PTW does not require any Federal permit to discharge treated groundwater or to work near Sullivan Creek, although a local floodplain construction approval may be required. PTW produces no treatment residual that requires management. Lehigh owns all of the property needed to construct PTW.

4.3.6.8 PTW-Consideration of Public Concerns

The public will be given an opportunity to review and comment on the dFSTR. Ecology will consider all public comments before finalizing the dFSTR.

4.3.7 PTW-Provide a Reasonable Restoration Time Frame

Lehigh has proposed a conditional POC because PTW will not meet cleanup levels throughout the entire Site. It is difficult to precisely estimate when groundwater downgradient of the PTW will meet the cleanup levels for pH and arsenic at the conditional POC. However, the performance and confirmational monitoring components allow Lehigh and Ecology to monitor progress toward meeting groundwater restoration. The PTW will operate indefinitely to maintain compliance with cleanup standards.

The PTW will achieve compliance with groundwater cleanup levels at a conditional POC in approximately the same time frame as other alternatives evaluated in this Revised dFSTR. The detailed design phase will more fully evaluate the restoration time frame for the PTW.

4.3.8 PTW-Consider Public Concerns

The public will be given an opportunity to review and comment on the dFSTR. Ecology will consider all public comments before finalizing the dFSTR.

4.3.9 PTW-Prevent Domestic Use of CKD-Affected Groundwater

Lehigh will institute restrictive covenants to preclude domestic use of the groundwater.

4.4 Groundwater Control (GWC)

4.4.1 GWC-Alternative Description

4.4.1.1 General

Alternative #2 – Groundwater Control (GWC) combines the existing in situ permeable treatment wall Pilot System with P&T components to extract, treat, and discharge groundwater into Sullivan Creek. The P&T component addresses the CKD-affected groundwater that is not treated by the Pilot System. This approach offers certain advantages over either remedy by itself. In particular, it offers the advantages of in situ treatment via the Pilot System, combined with the flexibility of P&T construction around certain obstacles (e.g., the toe of the slope below the residential area near Sullivan Creek) and expandability, as needed. For the P&T component, an aboveground treatment process uses carbon dioxide to neutralize the high pH and ferric chloride to precipitate arsenic. The GWC collects the P&T precipitate containing arsenic for off-site disposal. The GWC discharges treated water into Sullivan Creek in compliance with an NPDES permit. Exhibit 4.4.1 shows the conceptual layout of the GWC system.

4.4.1.2 System Description

A GWC system includes the following components:

- An approximately 80-foot long in situ treatment zone (the existing Pilot System). No new panels are added.

- Groundwater extraction wells (approximately 16) to capture affected groundwater to the north and south of the Pilot System and pump it to a centralized, above-ground treatment system prior to discharge. The P&T components are described below.

Because P&T is a proven and commonly used technology[17], P&T is well-documented. The wealth of literature about P&T technology provides Lehigh abundant information to design, install, and operate an effective P&T system. A P&T system at the Site includes the following components:

- Groundwater extraction wells and collection manifold system;
- Above-ground treatment system;
- Discharge piping; and
- Waste storage area for temporary storage of treatment residuals pending transport off-site for disposal.

Exhibit 4.4-1 shows GWC components in plan and cross-sectional views. A conceptual process flow diagram is also included in the exhibit. Within the treatment system carbon dioxide forms carbonic acid in the presence of the CKD-affected water, which neutralizes the hydroxide ion (the chemical cause for high pH in the Site groundwater) through the reactions 4-1 and 4-2 presented in Section 4.3.1.2. As described in section 4.3.1.3, Lehigh selected carbon dioxide as the primary neutralizing agent to reduce the pH to levels that are conducive to ferric chloride ($FeCl_3$) treatment. $FeCl_3$ is commonly used as a coagulant in water treatment processes to remove colloidal metals [Reynolds, 1982]. Preliminary calculations show that a relatively small dosage (approximately 30 to 50 mg/L) of $FeCl_3$ is needed to achieve the proposed arsenic cleanup level. When mixed with water, $FeCl_3$ decomposes to yield hydrochloric acid and forms a dense, rapid settling floc composed mainly of ferric hydroxide, $Fe(OH)_3$:

$$FeCl_3 + 3\ H_2O \Rightarrow Fe(OH)_{3(s)} + 3\ Cl^- + 3\ H^+ \qquad (4\text{-}3)$$

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[17] See EPA (1997), which states that "A common approach to deal with contaminated ground water is to extract the contaminated water and treat it at the surface prior to discharge…". Keeley (1989) states that "One of the most commonly used ground-water remediation technologies is to pump contaminated water to the surface for treatment." See also EPA (1996). The Wisconsin Department of Natural Resources (WDNR – 1993) provides detailed information about pump and treat test technologies. Ecology has approved several cleanup actions that include covering the source and treating downgradient groundwater with pump and treat technology.

Since the H^+ reaction products are limited, the relatively small $FeCl_3$ dosage will not cause a significant change in the pH of the water. Lehigh will monitor the water's pH as part of the treatment process to adjust the carbon dioxide and $FeCl_3$ dosages, as needed. The use of ferric chloride to treat groundwater has several advantages. As a common water treatment process, ferric chloride is well understood and readily available in large quantities. Because the literature shows that the process works well over a range of field conditions, Lehigh did not test ferric chloride on the Site groundwater. However, geochemical modeling results indicate that the ferric chloride will be effective at treating the Site groundwater.

As shown in Exhibit 4.4-1, the GWC has a network of approximately 16 groundwater extraction wells (approximately 15 to 20 feet deep) placed between State Route 31 and Sullivan Creek. Preliminary modeling suggests that each well will pump between two and four gallons per minute (gpm). The final design will set the actual number and location of wells. The final design will also address hydraulic interaction between the wells and Sullivan Creek. Preliminary calculations indicate that the capture zone of the wells extends downgradient only for tens of feet (less than 50 ft). Options for addressing the hydraulic interaction include reducing the groundwater extraction rate when Sullivan Creek is at high water levels to limit drawing Sullivan Creek water into the system. Although not contemplated as part of the GWC, Lehigh could later install an impermeable slurry wall between the extraction wells and Sullivan Creek if hydraulic interaction persisted. The total extracted volume of approximately 55 gpm is pumped into a collection header, leading to the on-site treatment facility. The system generates an estimated 40 to 150 pounds per day of residual solids, depending on the CKD-affected groundwater influent chemical characteristics. Preliminary calculations and geochemical modeling predict that the residuals will not designate as dangerous waste. Following treatment described above, the treated water is discharged to Sullivan Creek under an NPDES permit. Treatment residuals are collected and transported off-site for disposal.

4.4.1.3 System Performance

The GWC system intercepts CKD-affected groundwater. The following explains how each primary component of the GWC system works together to achieve cleanup standards.

The Pilot System lowers the pH of the groundwater by diffusing carbon dioxide into the water. As a result of the reduced pH, arsenic in solution precipitates out in the soil downgradient of the Pilot System. The groundwater meets cleanup levels for pH and arsenic at a conditional POC between the Pilot System and Sullivan Creek.

The P&T components intercept CKD-affected groundwater as it flows downgradient of the Closed CKD Pile outside of the Pilot System treatment area, extract it with pumps, and treat it aboveground using carbon dioxide and ferric chloride. Carbon dioxide is the neutralization agent to lower pH, and ferric chloride precipitates the arsenic out of solution by forming insoluble complexes. See section 4.3.1.3 for the rationale Lehigh used to select carbon dioxide as the neutralizing agent. Section 4.4.1.2 provides details on the behavior of ferric chloride flocculent. Preliminary calculations show that the relatively small dosage of ferric chloride will not contribute significant dissolved chloride to the treated water stream.

The P&T components are between State Route 31 and Sullivan Creek to address the CKD-affected groundwater that is not treated by the Pilot System. Although the layout (see Exhibit 4.4-1) shows the P&T components adjacent to a portion of State Route 31, the alignment may change based on the Site conditions. An advantage of P&T is the flexibility to locate extraction points throughout the affected area, where they are most effective. P&T has added flexibility because Lehigh can optimize the location of extraction wells, based on performance monitoring results.

4.4.1.4 Construction Schedule

GWC design, contracting, and procurement requires approximately eight months. GWC permitting and obtaining regulatory approvals requires approximately six to nine months (see Exhibit 3.2-1 for the list of permits and regulatory approvals). GWC installation requires approximately three months. This estimated timeframe does not account for construction during inclement weather or winter conditions. Winter weather minimally affects the construction of GWC, so that time of year will not appreciably affect the schedule. However, construction of GWC during the winter months is not advisable.

4.4.2 GWC-Protect Human Health and the Environment

The GWC system will protect human health and the environment for the following reasons:

- ***Groundwater Quality.*** The GWC meets MTCA groundwater cleanup levels at a conditional POC.
- ***ARAR Compliance***. GWC complies with ARARs.
- ***Institutional Controls***. Lehigh will use institutional controls as described in Section 4.2.2.

4.4.3 GWC-Comply With Cleanup Standards

The GWC system complies with cleanup standards assumed for the purposes of the Revised dFSTR, as follows:

- ***Cleanup Levels (CLs).*** The proposed groundwater cleanup levels for the Site are pH between 6.5 and 8.5, and maximum arsenic concentration of 5.0 ppb.
- ***Point of Compliance (POC)***. Lehigh proposes a conditional POC for groundwater at a point between the GWC system and Sullivan Creek (Exhibit 4.4-1).

4.4.4 GWC-Comply With Applicable Federal and State Laws

The GWC complies with ARARs. Exhibit 3.2-1 presents a summary of ARARs that apply to this alternative.

Calculations show that treatment residuals generated by the P&T component will not designate as dangerous waste and will be managed in accordance with applicable solid waste regulations.

4.4.5 GWC-Provide for Compliance Monitoring

Lehigh will perform protection, performance, and confirmational monitoring as described in Section 4.3.5.

4.4.6 GWC-Use Permanent Solution to the Maximum Extent Practical

4.4.6.1 Introduction

This element for selection of cleanup actions requires consideration of the criteria used in the disproportionate cost analysis (WAC 173-340-360(3)). Each criterion in the disproportionate cost analysis is discussed below.

4.4.6.2 GWC-Protectiveness

As described in Section 4.4.2, GWC protects human health and the environment because it meets groundwater cleanup levels at a conditional groundwater POC. In addition, it complies with applicable state and federal laws. GWC will generate groundwater treatment residuals requiring management and off-site disposal.

4.4.6.3 GWC-Permanence

Permanent Solution. GWC is not a permanent solution. The Pilot System and P&T components require maintenance, operation, repairs, and replacement for the foreseeable future.

Permanence. The GWC system exhibits a high degree of permanence. It uses treatment-based technologies that obviate further groundwater treatment at the POC. The technology chemically neutralizes the high pH water, resulting in a permanent reduction in pH and lower solubility (mobility) and toxicity of arsenic. However, the process also produces treatment residuals requiring off-site management. According to WAC, the generation of treatment residuals does not affect the degree of permanence of this alternative. In addition, GWC will not prevent the generation of high-pH groundwater at the Closed CKD Pile.

4.4.6.4 GWC-Cost

The estimated present value cost to design and install a GWC is approximately $1.1 million (US $2005) (see Exhibit 4.4-2). The annual operating and maintenance cost is estimated to be approximately $230,000. Hence, the present value of this alternative for 30 years at an annual discount rate of seven percent is approximately $4.1 million. Actual costs may vary depending on the details of the final GWC system design and implementation procedures. Exhibit 4.1-7 includes the estimated costs of GWC for the three costing scenarios described in Section 3.2.3.2.5. See Appendix E for supporting information, including assumptions used in the cost analysis.

4.4.6.5 GWC-Effectiveness Over the Long Term

Based on the past performance of the Pilot System and the proven success of P&T, Lehigh has a high degree of confidence that GWC will be effective over the long term. Lehigh will operate, maintain, and replace the GWC as long as necessary to maintain compliance with cleanup standards. Lehigh also will provide a financial assurance mechanism to cover long-term operation and maintenance. The P&T components are easy to add, remove, or re-locate over the long term. As such, the GWC will be effective over the long term.

4.4.6.6 GWC-Management of Short-Term Risks

The GWC has few short-term risks associated with the Pilot System or the P&T components. Workers will encounter a small amount of CKD-affected groundwater during well development. Workers also will use heavy equipment and re-locate utility lines. The risks are manageable with good construction safety practices. P&T is a proven technology with known and manageable construction and operation risks. P&T operation poses no significant risks other than those associated with the treatment residuals produced and handled during ongoing operation and maintenance of the system. As with the other alternatives, it is best to avoid construction during winter conditions in Metaline Falls.

4.4.6.7 GWC-Technical and Administrative Implementability

4.4.6.7.1 Technical Implementability

The P&T component is a proven technology and is technically implementable. Construction involves less earth-moving and subsurface work than any other alternative, so that P&T is less subject to seasonal weather constraints than other alternatives. The more innovative and challenging component, the Pilot System, is already installed and operating at the Site.

4.4.6.7.2 Administrative Implementability

All components of GWC are administratively implementable. Lehigh will obtain an NPDES permit to discharge the treated water into Sullivan Creek. See Exhibit 3.2-1, which shows the permits and approvals needed for GWC. Lehigh's preliminary research suggests that GWC will meet the conditions connected with these permits and approvals. Lehigh owns all of the property needed to construct GWC.

4.4.6.8 GWC-Consideration of Public Concerns

The public will be given an opportunity to review and comment on the dFSTR. Ecology will consider all public comments before finalizing the dFSTR.

4.4.7 GWC-Provide a Reasonable Restoration Time Frame

Lehigh has proposed a conditional POC because GWC will not meet cleanup levels throughout the entire Site. It is difficult to precisely estimate when groundwater downgradient of the GWC will meet the cleanup levels for pH and arsenic at the conditional POC. However, the performance and confirmational monitoring components allow Lehigh and Ecology to monitor progress toward meeting groundwater restoration. The GWC will operate indefinitely to maintain compliance with cleanup standards.

The GWC will achieve compliance with groundwater cleanup levels at a conditional POC in approximately the same time frame as other alternatives evaluated in this Revised dFSTR. The detailed design phase will more fully evaluate the restoration time frame for the GWC.

4.4.8 GWC-Consider Public Concerns

The public will be given an opportunity to review and comment on the dFSTR. Ecology will consider all public comments before finalizing the dFSTR.

4.4.9 GWC-Prevent Domestic Use of CKD-Affected Groundwater

Measures to prevent domestic use of CKD-affected groundwater are discussed in Section 4.3.9.

4.5 <u>Additional Source Control (ASC)</u>

4.5.1 ASC-Alternative Description

4.5.1.1 General

Alternative #3 – Additional Source Control (ASC) diverts groundwater that flows around and into the Closed CKD Pile, reducing the amount of CKD-affected groundwater generated at the Site. ASC includes a low-permeability slurry wall that limits upgradient seepage water from entering the pile materials and a vertical dewatering system upgradient of the slurry wall that removes water that piles up against the upgradient side of the slurry wall. The dewatering system protects the wall, helps prevent re-activating the historic landslide by not allowing water to build up behind the slurry wall, and enhances the performance of the slurry wall. To treat CKD-affected water that continues to emanate from the Closed CKD Pile, ASC includes a downgradient P&T system. ASC discharges water into Sullivan Creek from the dewatering wells and treatment system under an NPDES permit. Exhibit 4.5.1 shows the conceptual layout of the ASC.

4.5.1.2 System Description

The ASC includes the following components:

- ***Slurry Wall.*** A slurry wall[18] about 2 ft wide is constructed hydrogeologically upgradient of the Closed CKD Pile and in soils and water unaffected by CKD. The slurry wall alignment is approximately 1,600 ft long and generally parallel to the current surface water control features along the southwestern and western extent of the Closed CKD Pile. The slurry wall is approximately 40 to 120 ft deep and would key into the low permeability glacial sediments (i.e., clay) that underlie the Site. The slurry wall is not constructed in one trench of approximately 1,600 ft in length. Trench installation occurs in segments, especially in the vicinity of the historic landslide where one long trench has the potentially to trigger a landslide or other slope stability issues.

- ***Upgradient Groundwater/Seepage Control.*** A necessary component of the slurry wall system is a dewatering system. It consists of a series of between approximately 10 and 15 groundwater dewatering wells upgradient of the slurry wall, each pumping up to approximately 15 gallons per minute, and toe drains at either end of the slurry wall. The groundwater wells and toe drains will drain the existing landslide area to enhance slope stability during construction of the slurry wall. During operation, they will preclude the development of high groundwater hydraulic pressure behind the wall. Such pressure would allow water to penetrate or overflow the wall and migrate into the Closed CKD Pile. The clean water extracted from the wells is discharged into Sullivan Creek via overland flow through existing the Site's surface water control features. Land not currently owned by

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[18] See Xanthakos (1979) for a very detailed description of the design, construction, and performance of slurry walls. ASTM (1985) includes numerous papers on slurry wall design, construction, and performance.

Lehigh will contain some of the upgradient groundwater/seepage control elements.

- ***Downgradient Groundwater Control.*** A downgradient P&T system will control and remediate affected groundwater. The P&T system is relatively flexible and easily modified over time as the slurry wall and upgradient groundwater/seepage control systems reduce the volume and the extent of the CKD-affected groundwater.

Exhibit 4.5-1 shows each of these components in plan and cross-sectional views.

4.5.1.3 System Performance

As explained above, the slurry wall and dewatering wells reduce the quantity of groundwater contacting the CKD by diverting groundwater around the pile. However, seepage of high pH and arsenic-containing groundwater downgradient of the Closed CKD Pile will continue, due to the following factors:

- ***Transient Drainage***[19] ***from the Closed CKD Pile***. Parts of the Closed CKD Pile are saturated. The saturated portions of the pile will continue to drain until the moisture content of the pile is in equilibrium with gravity drainage forces. GeoSyntec analyzed the Closed CKD Pile using finite element modeling techniques. The modeling results estimate that transient drainage will continue for decades, but that the rate will drop to approximately 10 percent of its current rate in 50 to 100 years [GeoSyntec, 2004].

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[19] Transient drainage is described in DOE/AL (1999) as follows: "The term 'transient drainage' was used to differentiate short-term seepage from disposal embankments from long-term seepage, which was expected to occur at smaller rates than short-term seepage." See the numerous case histories regarding transient drainage considerations in complying with groundwater cleanup standards. Stein et al (2000) describe a case history for which they predict that transient drainage from a tailing pond would continue for 50 to 70 years after closure.

- ***Slurry Wall Performance***. The slurry wall will not eliminate groundwater contact with CKD. Consequently, affected groundwater will migrate from the pile, due to the following reasons:
  - Slurry Wall Seepage. Although slurry walls can be substantially less permeable than other soils at the Site, no slurry wall is truly impermeable[20]. The Site conditions such as the slurry wall depth, the historic landslide, steep terrain, and segmented installation exacerbate permeability issues with the ASC slurry wall. Common practice achieves a hydraulic conductivity of about 10^{-7} cm/sec (i.e., water passes through the slurry wall material at this or greater rates depending on the hydraulic head on the slurry wall). In spite of even the highest construction standards, some imperfections may remain in the as-constructed slurry wall, especially at the depths envisioned for ASC. Upgradient groundwater will seep through these imperfections and move through the CKD.
  - Groundwater upwelling into the base of the Closed CKD Pile. The slurry wall will be keyed into the clay layer that exists under the Closed CKD Pile. Although the clay is relatively impermeable, it will not hydraulically isolate the upgradient and downgradient sides of the slurry wall. Water will continue to pass under the slurry wall, but at a significantly slower rate than water passes through that area currently. The groundwater elevation under the CKD will equilibrate with the water on the upgradient side of the slurry wall. Additionally, wet seasons will cause high groundwater elevations in the Holocene alluvium, upwelling into the CKD that overlies these alluvial materials.

Thus, ASC will reduce, but not eliminate, the amount of downgradient groundwater that requires treatment. A P&T system will treat the CKD-affected groundwater. As the downgradient groundwater quality improves, Lehigh will reduce

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[20] See EPA (1998b) for a recent evaluation of the performance of engineered subsurface barriers, including slurry walls, at waste sites.

the number of extraction wells in the P&T system. Once CKD saturation equilibrium is obtained and transient drainage ceases, a few groundwater extraction wells will operate indefinitely to treat affected groundwater arising from slurry wall imperfections and groundwater upwelling.

This evaluation assumes the placement of a slurry wall with supplemental dewatering to control as much of the source as possible. If, however, one wished to reduce the size of the wall, the information herein provides a basis for analysis of these lesser alternatives. With a lesser alternative comes reduced control, diminishing the benefits of the alternative. See Exhibit 4.5-2 and Appendix E for more detailed information on cost and assumptions.

4.5.1.4 Construction Schedule

ASC design, contracting, and procurement requires approximately eight months. ASC permitting and obtaining regulatory approvals requires approximately six months to one year (see Exhibit 3.2-1 for the list of permits and regulatory approvals). ASC installation requires approximately seven months. This estimated timeframe does not account for construction during inclement weather or winter conditions. The winter conditions in Metaline Falls adversely affect installation of ASC, specifically slurry wall construction, dewatering well network and drainage installation, and some P&T elements. When working with time frames for tasks that last longer than six months, the construction schedule may bridge over into a second construction season. As explained earlier, it is not advisable to install components of the ASC during the winter.

4.5.2 ASC-Protect Human Health and the Environment

The ASC alternative protects human health and the environment for the following reasons:

- ***Groundwater Quality.*** The slurry wall and upgradient groundwater/seepage control components, combined with downgradient P&T components, will meet MTCA groundwater cleanup levels at a conditional POC.

- ***ARAR Compliance***. ASC will comply with ARARs .

- ***Institutional Controls***. Lehigh will use institutional controls as described in Section 4.2.2.

4.5.3 ASC-Comply With Cleanup Standards

The ASC will comply with cleanup standards assumed for the purposes of the Revised dFSTR, as follows:

- ***Cleanup Levels (CLs).*** The proposed groundwater cleanup levels for the Site are pH between 6.5 and 8.5, and maximum arsenic concentration of 5.0 ppb.

- ***Point of Compliance (POC)***. Lehigh proposes a conditional POC for groundwater between the P&T system components and Sullivan Creek (Exhibit 4.5-1).

4.5.4 ASC-Comply With Applicable Federal and State Laws

The ASC will comply with ARARs. A summary of ARARs that apply to this alternative is presented in Exhibit 3.2-1.

The slurry wall and upgradient groundwater/seepage control components alone will not achieve cleanup standards for reasons detailed in Section 4.5.1.3, but they would reduce the amount of water that the P&T components must treat. As discussed in previous sections, the P&T components will meet cleanup standards. Calculations show that treatment residuals generated by the P&T component will not designate as dangerous waste and will be managed in accordance with applicable solid waste regulations.

4.5.5 ASC-Provide for Compliance Monitoring

Lehigh will perform protection, performance, and confirmational monitoring as described in Section 4.3.5.

4.5.6 ASC-Use Permanent Solution to the Maximum Extent Practical

4.5.6.1 Introduction

This element for selection of cleanup actions requires consideration of the criteria used in the disproportionate cost analysis (WAC 173-340-360(3)). Each criterion in the disproportionate cost analysis is discussed below.

4.5.6.2 ASC-Protectiveness

As described in Section 4.5.2, ASC protects human health and the environment because it meets groundwater cleanup levels at a conditional groundwater POC. In addition, it complies with applicable state and federal laws. ASC will reduce the amount of CKD-affected groundwater flowing downgradient from the Closed CKD Pile. ASC involves short-term risks, especially due to construction in the historic landslide and on the Closed CKD Pile. ASC installation includes measures to reduce the potential for reactivating landslides or compromising the stability of the Closed CKD Pile. Because ASC incorporates P&T components, it will generate groundwater treatment residuals requiring management and off-site disposal.

4.5.6.3 ASC-Permanence

Permanent Solution. The ASC is not a permanent solution. The upgradient groundwater/seepage control components require continual operation and maintenance. The slurry wall will not stop all groundwater contact with CKD. The downgradient P&T components require maintenance, operation, repair, and replacement, as needed, for the foreseeable future.

Permanence. The ASC exhibits a higher degree of permanence than treatment technologies alone because it reduces releases from the Closed CKD Pile and treats groundwater affected by ongoing future releases from the Pile. The degree of permanence exhibited by each ASC component is as follows:

- ***Slurry Wall***. Because the slurry wall reduces the volume of hazardous substances generated at the Site, it achieves a high degree of permanence. However, the slurry wall's performance may diminish over time. As with any geologic material, the materials of the slurry wall will change as a result of natural processes, including change of moisture content and the ongoing geomorphic changes such as deformation associated with historic landslides through which the slurry wall would be constructed.

- ***Groundwater Extraction Wells and Seepage Control Features***. These have a degree of permanence because they help reduce the volume of hazardous substances generated at the Site.

- ***P&T***. P&T exhibits a high degree of permanence. It uses treatment-based technologies that obviate further groundwater treatment at the POC. The technology chemically neutralizes the high pH water, resulting in a permanent reduction in pH and lower solubility and toxicity of arsenic. The process also produces treatment residuals requiring off-site management.

4.5.6.4 ASC-Cost

The estimated present value cost to design and install ASC would range from $9.1 to $14 million (US $2005) (see Exhibit 4.5-2). The annual operating and maintenance cost is estimated to be approximately $240,000. Hence, the present value of this alternative for 30 years at an annual discount rate of seven percent is estimated to range from $12.3 to $17.2 million. Actual costs may vary depending on the details of the final ASC system design and implementation procedures. Exhibit 4.1-7 includes the estimated costs of ASC for the three costing scenarios described in Section 3.2.3.2.3. See Appendix E for supporting information, including assumptions used in the cost analysis.

4.5.6.5 ASC-Effectiveness Over the Long Term

While the slurry wall will reduce the amount of groundwater entering the Closed CKD Pile, over time its performance may diminish. If that happens, this alternative will rely more heavily on P&T components to maintain compliance with cleanup standards. As explained in Section 4.4.1, the P&T components have proven to be successful. In addition, they are flexible, allowing adjustments in changing conditions. Thus, Lehigh has a high degree of certainty that the P&T components of ASC will be successful over the long term, but a lower degree of certainty with regard to the slurry wall component.

Lehigh will operate and maintain the ASC as long as necessary to maintain compliance with cleanup standards. Lehigh also will provide a financial assurance mechanism to cover long-term operation and maintenance.

4.5.6.6 ASC-Management of Short-Term Risks

The short-term risks associated with constructing the ASC include those commonly associated with extensive use of heavy construction equipment. Short-term risks also include the potential to reactivate the historical landslide to the south of the Closed CKD Pile, as well as slope stability concerns associated with heavy equipment working on or near the 2:1 (horizontal to vertical) slopes of the Closed CKD Pile. The risks posed are manageable with good construction safety practices, but earthwork in the area of the historic landslide requires extreme caution. Dewatering mitigates some of the concerns. Segmented installation to avoid opening long trenches that cause stability issues also mitigates some of the concerns. As with the other alternatives, it is best to avoid construction during winter conditions in Metaline Falls.

P&T is a proven technology with known and manageable construction and operation risks. There are no significant short-term risks involved in P&T construction.

4.5.6.7 ASC-Technical and Administrative Implementability

4.5.6.7.1 Technical Implementability

The ASC alternative uses proven technologies and is technically implementable. Construction involves significant earth-moving and subsurface work and construction techniques that are difficult in winter weather. While ASC construction is difficult in the winter months, ASC is technically implementable during other times of the year.

4.5.6.7.2 Administrative Implementability

It is not clear whether the ASC systems are administratively implementable. An NPDES permit is required for discharging treated water from the P&T and from upgradient dewatering wells. See Exhibit 3.2-1, which shows the permits and approvals needed for ASC. Lehigh's preliminary research suggests that ASC will meet the conditions connected with these permits and approvals. However, portions of ASC likely will extend off Lehigh-owned property (e.g., slurry wall alignment along Quarry Road). Lehigh not know whether using this land is feasible.

4.5.6.8 ASC-Consideration of Public Concerns

The public will be given an opportunity to review and comment on the dFSTR. Ecology will consider all public comments before finalizing the dFSTR.

4.5.7 ASC-Provide a Reasonable Restoration Time Frame

Lehigh has proposed a conditional POC because ASC will not meet cleanup levels throughout the entire Site. It is difficult to precisely estimate when groundwater downgradient of the ASC will meet the cleanup levels for pH and arsenic at the conditional POC. However, the performance and confirmational monitoring components allow Lehigh and Ecology to monitor progress toward meeting groundwater restoration. The ASC will operate indefinitely to maintain compliance with cleanup standards.

The ASC will achieve compliance with groundwater cleanup levels at a conditional POC in approximately the same time frame as other alternatives evaluated in this Revised dFSTR. The detailed design phase will more fully evaluate the restoration time frame for the ASC.

4.5.8 ASC-Consider Public Concerns

The public will be given an opportunity to review and comment on the dFSTR. Ecology will consider all public comments before finalizing the dFSTR.

4.5.9 ASC-Prevent Domestic Use of CKD-Affected Groundwater

Measures to prevent domestic use of CKD-affected groundwater are discussed in Section 4.3.9.

4.6 Partial Source Removal (PSR)

4.6.1 PSR-Alternative Description

4.6.1.1 General

Alternative #4 – Partial Source Removal (PSR) removes CKD from certain areas of the Closed CKD Pile to reduce the amount of CKD in contact with groundwater based on Ecology interpretations of areas of inundation [Ecology, 1997]. Reducing CKD-water contact reduces the generation of CKD-affected groundwater. PSR also includes P&T components to treat affected groundwater that continues to emanate from the pile. Complete elimination of the CKD-water contact would be very difficult. Ecology believes that PSR will achieve sufficient removal of CKD-water contact to obviate groundwater treatment after residual groundwater effects are remediated. Although the exact time period that residual effects would attenuate is uncertain, Lehigh applied a five-year timeframe to Ecology's belief for the purposes of the Revised dFSTR. The five-year timeframe allows Ecology's PSR scenario to be costed and evaluated using the remedy selection criteria.

Lehigh believes that even implemented with a high degree of effectiveness, PSR will not result in groundwater remediation over the long-term and therefore, groundwater treatment would continue indefinitely. Lehigh has presented data and analysis that shows that PSR would need to be greater than 99% effective at removing the CKD-water contact. Lehigh also demonstrated that only full Closed CKD Pile removal will achieve this level of effectiveness because of the various mechanisms for water-CKD contact [GeoSyntec, 2004].

This section evaluates both Ecology's and Lehigh's views of the time needed for subsequent groundwater treatment. Both PSR groundwater treatment scenarios use the same CKD removal, inert backfill, and off-site disposal components, but the groundwater treatment duration differs.

Removal operations target CKD near the toe of the Closed CKD Pile and CKD inundated by groundwater in the lowest reaches of the pile. Sheet piles around the toe area isolate and stabilize the toe, followed by excavation of the CKD. The analysis examined two excavation methods for the lower reaches of the Closed CKD Pile: (1) conventional slope-back excavation through the top of the Closed CKD Pile, and (2) a coffer dam type system, using vertical shoring installed through the top of the Closed CKD Pile to allow excavation of a near-vertical shaft.

The conventional slope-back technique has significant advantages over the coffer dam system, as follows:

- Excavating the silt-like CKD using a vertical shaft poses significant safety concerns;

- The vertical distance between the top and lower reaches of the Closed CKD Pile is between 60 and 100 feet. Advancing shoring to these depths on the Closed CKD Pile would be difficult;

- The footprint of the targeted area, approximately 330 feet by 120 feet, is a rather large area to stabilize with a system of vertical shoring that requires structural integrity;

- Cross braces needed to provide horizontal support to the vertical shoring will impede the maneuvering of the excavation equipment;

- Advancing shoring through the top of the Closed CKD Pile may destabilize the slopes of the Closed CKD Pile;

- Large objects, such as boulders, will interfere with shoring advancement; and

- Various excavation contractors[21] suggest that a conventional slope-back technique offers more control over the excavation and safety aspects of the project.

4.6.1.2 System Description

The excavation at the toe of the Closed CKD Pile likely requires advance WDOT approval because of its proximity to State Route 31. Prior to excavation activities, land would also be secured for the purposes of construction and operation of a temporary storage facility approximately five acres in size. The storage location contains the excavated CKD in a lined pad in preparation for CKD replacement back into the excavations. The storage location is equipped with horizontal perforated pipes to collect drainage from the CKD, dust control water, and precipitation. Cover components from the Closed CKD Pile will be salvaged for re-use to the extent practical at a nearby location. A truck staging and cleaning area is also needed to handle the approximately 13,000 truck trips that result from PSR.

PSR then removes and replaces the following areas of the Closed CKD Pile and includes the listed components:

- ***Toe of Closed CKD Pile.*** Exhibit 4.6-1 shows the following general steps that will be taken to implement this alternative:

    1. Install dewatering wells at the downgradient toe adjacent to State Route 31.

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[21] Lehigh and Ecology consulted several earthworks contractors during evaluation of PSR. The contractors provided input on PSR constructability, safety, and cost.

2. Access the top of the Closed CKD Pile and cut away the engineered cover system. Salvage components as much as possible.

3. Place about 500 ft of sheet piles upgradient of the affected zone.

4. Excavate approximately 5,500 cubic yards of CKD to the east of the sheet piles.

5. Transport the 5,500 cubic yards of CKD using approximately 280 trucks to a temporary storage location.

6. Put approximately 2,800 cubic yards of high-permeability engineered backfill into the bottom of the hole, surround it with geotextile filter fabric, and overlay it with a low-permeability soil cover.

7. Bring approximately 2,700 cubic yards CKD back from temporary storage, via approximately 140 trucks, and backfill with the excavated CKD.

8. Dispose of approximately 2,800 cubic yards of excess CKD in off-site landfill.

9. Reconstruct the engineered cap over the Closed CKD Pile.

- ***Lower CKD Saturated Zones.*** To access the lower reaches of the pile and ensure stable CKD slopes inside of the excavation, conventional excavation entails excavating about half of the entire pile, or approximately 260,000 cubic yards. Such excavation requires the following general steps:

1. Install groundwater dewatering wells at the downgradient toe and upgradient side of the Closed CKD Pile to lower the groundwater level below the CKD.

2. Access the top of the Closed CKD Pile and cut away the engineered cover system. Salvage components as much as possible.

3. Excavate approximately 260,000 cubic yards of CKD to the east of the sheet piles.

4. Slope the excavation sides at a 2:1 (horizontal: vertical) slope, as excavation proceeds (see Exhibit 4.6-1) and removes the inundated CKD.

5. Transport the 260,000 cubic yards of CKD using approximately 13,000 trucks to a temporary storage location.

6. Put approximately 7,000 cubic yards of high-permeability engineered backfill into the bottom of the hole, surround it with geotextile filter fabric, and overlay it with a low-permeability soil cover.

7. Bring approximately 253,000 cubic yards CKD back from temporary storage, via approximately 12,500 trucks, and backfill with the excavated CKD.

8. Dispose of approximately 7,000 cubic yards of excess CKD in off-site landfill.

9. Reconstruct the engineered cap over the Closed CKD Pile.

- ***GWC.*** Install GWC as described in Section 4.4.1.

4.6.1.3 System Performance

PSR will excavate CKD from the base of the Closed CKD Pile, thus reducing the amount of CKD in contact with groundwater. This, in turn, will decrease the volume of CKD-affected groundwater. The P&T components downgradient from the Closed CKD Pile will intercept affected groundwater, extract it with pumps, and treat it aboveground by using carbon dioxide and ferric chloride. Carbon dioxide is the neutralization agent to lower pH, and ferric chloride precipitates the arsenic out of solution by forming insoluble complexes. See section 4.3.1.3 for the rationale Lehigh used to select carbon dioxide as the neutralizing agent. Section 4.4.1.2 provides details on the behavior of ferric chloride flocculent. Preliminary calculations show that the relatively small dosage of ferric chloride will not contribute significant dissolved chloride to the treated water stream.

Ecology and Lehigh disagree about the duration of groundwater treatment needed to meet cleanup standards. Ecology believes that removing the two areas of saturated CKD shown on Exhibit 4.6-1 will result in groundwater that meets cleanup levels after short-term flushing. The Revised dFSTR assigns a time-period of five years to the short-term flushing.

Lehigh believes that, to meet cleanup standards, groundwater treatment will be required indefinitely [GeoSyntec, 2004]. Although removing much of the CKD in contact with groundwater will reduce the production of CKD-affected groundwater, water will continue to enter the Pile from other sources. Lehigh presented information showing that water enters the Pile via deep and side seeps. Even if all saturated portions of the CKD were removed so that no more water contacted CKD, transient drainage would still occur for decades (see Section 4.5.1.3). The elevated pH of this transient drainage will cause groundwater downgradient of the Closed CKD Pile to exceed cleanup standards.

This Revised dFSTR evaluates both groundwater treatment scenarios, five years and indefinite. For purposes of evaluating PSR under Ecology's groundwater treatment scenario, Lehigh assumes that cleanup levels will be met in groundwater throughout the Site after five years, at which time treatment will stop. The five-year assumption also allows Lehigh to prepare a cost estimate for this scenario. For purposes of evaluating PSR under the second groundwater treatment scenario, Lehigh believes that treatment must continue indefinitely to maintain compliance with cleanup levels at a conditional groundwater POC. In both scenarios, Lehigh will treat affected groundwater by using a GWC consisting of the Pilot System and P&T components installed downgradient of the Closed CKD Pile.

During installation of PSR, the contractors will perform soft soil excavation construction quality assurance tests. While the contractors will estimate the amounts of CKD removed, it is not possible to calculate the percentage of the inundated CKD removed.

The PSR alternative evaluation assumes that much of the contact between CKD and groundwater will be removed by excavating and replacing two areas of CKD inundation. If desired, the information provides a basis for analyzing the removal of less inundated CKD. With a lesser alternative comes reduced control, reducing the benefits of the alternative. Please see Exhibit 4.6-2 and Appendix E for more detailed information on cost and assumptions.

4.6.1.4 Construction Schedule

PSR design, contracting, and procurement requires approximately eight months. Procurement of the approximately five acres of temporary storage requires approximately six to nine months. PSR permitting and obtaining regulatory approvals requires approximately six months to one year (see Exhibit 3.2-1 for the list of permits and regulatory approvals). Building the approximately five-acre temporary storage area requires approximately one month. Excavation, removal, and backfill require approximately twenty-five to thirty months. Cleaning the five-acre temporary storage area requires approximately two months. Cover reconstruction requires approximately seven months. Hence, the total installation time for PSR is approximately thirty-five to forty months. This estimated timeframe does not account for construction during inclement weather or winter conditions. The winter temperatures and hours of daylight in Metaline Falls may adversely affect PSR during installation. When working with time frames for tasks that last longer than six months, the construction schedule may bridge over into a second construction season. As explained earlier, it is not advisable to implement PSR during the winter.

4.6.2 PSR-Protect Human Health and the Environment

The PSR alternative protects human health and the environment for the following reasons:

- ***Groundwater Quality.*** Under the first groundwater treatment scenario, it is assumed that PSR meets MTCA groundwater cleanup levels at a standard POC after five years. Under the second scenario, PSR meets MTCA groundwater cleanup levels at a conditional POC.

- ***ARAR Compliance***. PSR will comply with ARARs.

- ***Institutional Controls***. Lehigh will use institutional controls as described in Section 4.2.2.

4.6.3 PSR-Comply With Cleanup Standards

PSR will comply with cleanup standards assumed for the purposes of the Revised dFSTR, as follows:

- ***Cleanup Levels (CLs).*** The proposed groundwater cleanup levels for the Site are pH between 6.5 and 8.5, and maximum arsenic concentration of 5.0 ppb.

- ***Point of Compliance (POC)***. Under the first scenario, Ecology presumes a standard POC is used, and groundwater meets cleanup levels throughout the Site after five years. Under the second scenario, groundwater meets cleanup levels at a groundwater conditional POC between the P&T components and Sullivan Creek (Exhibit 4.6-1).

4.6.4 PSR-Comply With Applicable Federal and State Laws

PSR complies with ARARs. A summary of ARARs that apply to this alternative is presented in Exhibit 3.2-1.

Calculations show that treatment residuals generated by the P&T component will not designate as dangerous waste and will be managed in accordance with applicable solid waste regulations.

4.6.5 PSR-Provide for Compliance Monitoring

Lehigh will conduct protection, performance, and confirmational monitoring as described in Section 4.3.5.

Because the CKD removal activities of PSR pose special safety concerns for workers, Lehigh's construction monitoring plan will include additional protection monitoring during construction. Additional worker training and equipment will help mitigate work space hazards associated with excavation in soft materials in a landslide area. Along with these hazards, the nature of the excavation increases the exposure of workers to CKD and CKD-affected water, requiring additional worker safety and protection monitoring.

4.6.6 PSR-Use Permanent Solution to the Maximum Extent Practical

4.6.6.1 Introduction

This element for selection of cleanup actions requires consideration of the criteria used in the disproportionate cost analysis (WAC 173-340-360(3)). Each criterion from the disproportionate cost analysis is discussed below.

4.6.6.2 PSR-Protectiveness

As described in Section 4.6.2, PSR will protect human health and the environment by meeting cleanup standards. Under the first groundwater treatment scenario, PSR will attain groundwater cleanup levels throughout the entire Site. Under the second scenario, PSR will attain groundwater cleanup levels at a conditional POC. In addition, PSR complies with applicable state and federal laws.

PSR does, however, pose significant safety risks during construction. It also requires managing approximately 270,000 cubic yards of CKD on a five-acre site pending transport to a disposal facility. Approximately 10,000 cubic yards of CKD will be disposed of at a remote off-site facility. Rail cars or loaded trucks could be used to transport the CKD to the disposal facility. Rail and truck transport of the CKD were evaluated for PSR. Truck transport was selected for PSR because it can be implemented more rapidly for less cost than rail transport at the Site. Reactivating the rail spur near the Closed CKD Pile would be time-consuming and expensive. Hundreds of trucks are needed transport the CKD several hundred miles on public roads to the disposal facility. In addition, because PSR incorporates P&T components, it will generate groundwater treatment residuals requiring management and off-site disposal.

4.6.6.3 PSR-Permanence

Permanent Solution. As noted above in Section 3.2, Lehigh and Ecology disagree whether PSR is a permanent solution. Ecology believes that it is, because it removes source material from the Site to an extent that groundwater treatment would not be required except to treat residual effects. For purposes of evaluating PSR in this revised dFSTR under the first scenario, given Ecology’s belief, Lehigh assumes that cleanup levels will be met in groundwater throughout the Site after five years, at which time treatment will stop.

Lehigh does not believe that PSR is a permanent solution because two types of “further action” will be required after CKD is excavated. First, the excavated CKD will have to be transported to a permitted off-site disposal facility, where it will be isolated and monitored in perpetuity. Second, Lehigh believes groundwater treatment and monitoring must continue indefinitely to meet cleanup levels at a conditional POC for groundwater.

Permanence. PSR exhibits a higher degree of permanence than the other alternatives, because it has the greatest potential to reduce the volume of hazardous substances at the Site by removing CKD in contact with groundwater. The GWC components of PSR also permanently reduce the toxicity and mobility of hazardous substances by lowering pH and precipitating arsenic out of groundwater. Assuming that the PSR effectively removes CKD from inundated areas, PSR has the highest degree of permanence, and is therefore the baseline alternative to compare with the other alternatives.

4.6.6.4 PSR-Cost

Using the first groundwater treatment scenario, the present value of this alternative for 30 years at an annual discount rate of seven percent would range from $18.8 to $25.6 million (see Exhibit 4.6-2). The estimated cost to design and install PSR ranges from $17.4 to $24.2 million (US $2005). The first five years, while GWC operates, have an estimated annual operating and maintenance costs of $230,000. After five years, the estimated annual operating and maintenance costs is $53,000.

Under the second groundwater treatment scenario the present value is between $20.4 and $27.2 million. The estimated cost to design and install PSR ranges from $17.4 to $24.2 million (US $2005). Annual operating and maintenance costs are estimated to total $230,000.

Exhibit 4.1-7 includes the estimated costs of PSR for the three project-duration and discount-rate costing scenarios described in Section 3.2.3.2.3. See Appendix E for supporting information, including assumptions used in the cost analysis.

4.6.6.5 PSR-Effectiveness Over the Long Term

PSR will be effective over the long term under either groundwater treatment assumption. Removing CKD in contact with groundwater will reduce risks at the Site by decreasing the amount of CKD-impacted groundwater. In addition, P&T is a reliable technology for remediating residual CKD-impacted groundwater, and the Pilot System has already proven successful at remediating groundwater at this Site. Lehigh will operate and maintain the GWC components as long as necessary to maintain compliance with cleanup standards. P&T components could be added or decommissioned as needed, and could easily be replaced as necessary. Lehigh would provide a financial assurance mechanism to cover long-term operation and maintenance.

4.6.6.6 PSR-Management of Short-Term Risks

PSR has significant short-term construction risks. Because of the construction requirements, implementing this alternative has significant challenges, as follows:

- CKD is a soft soil that is prone to sliding along the excavation side slopes.

- Controlling subsidence during excavation is difficult. Surface subsidence will compromise the integrity of the existing cover systems.

- Advancing sheet piles into the toe of the Closed CKD Pile may destabilize the face of the Closed CKD Pile.

- Dust control methods such as watering the CKD produce large areas of worker exposure risks. Additionally, water usage may reduce CKD stability.

- Without sufficient dewatering, the CKD is likely to liquefy in response to vibration and heavy equipment movement, producing unstable slopes and an extreme safety hazard.

- Prior to backfilling or disposal, the excavated and stored CKD requires large-scale mitigation and containment measures. The approximately 13,000 truck loads needed to transport approximately 270,000 cubic yards to the temporary storage site will be stopped and cleaned to reduce CKD tracking off-site. In the process of excavating such a large volume of the pile, PSR will require approximately five acres for temporary storage. The lined storage pad of about five acres collects water that drains from the CKD. This water will require handling and treatment. Dust will be controlled using tarps and water. After the excavation is complete, a slightly lesser number of trucks will transport the CKD back for backfilling into the excavated pile. Additional trucks will then transport the excess CKD to an off-site landfill for disposal. The abandoned temporary storage facility requires a thorough decontamination procedure. The land surrounding and below the storage pad requires testing to confirm that CKD was not transferred to the five acre storage location.

4.6.6.7 PSR-Technical and Administrative Implementability

4.6.6.7.1 Technical Implementability

Although PSR is technically implementable, it poses the greatest construction challenges. The construction methods are conventional and technically implementable, but as discussed above excavating approximately 270,000 cubic yards of CKD, much of it soft and saturated, presents significant safety concerns for workers and equipment. Lehigh will select highly experienced workers and sub-contractors and require that progress is slow and in accordance with plans that mitigate risks.

Additionally, the PSR techniques do not offer flexibility to remove more CKD once the saturated portions of the bottom of the Closed CKD Pile are exposed; the targeted areas are decided prior to implementation, and the excavation is tailored to address the target areas. Lehigh will determine the areal extent of the excavation beforehand to maintain the necessary excavation side slopes prior to installation. If saturated CKD extended beyond the excavation footprint, it will not be possible to remove this additional saturated CKD without re-configuring the entire excavation.

4.6.6.7.2 Administrative Implementability

PSR requires significant administrative efforts to secure access to property needed to execute the alternative, more extensive than those noted for ASC. The project involves much heavy equipment, storage area(s) for the excavated CKD, and drainage structures for the dewatering wells and water expelled from the stored CKD. It is not known whether Lehigh can obtain access or title to the approximately five acres of land needed to store the excavated CKD. An NPDES permit is required to discharge treated water from the GWC and from the construction activities (i.e., dewatering, CKD drainage, etc.).

See Exhibit 3.2-1, which shows the permits and approvals needed for GWC. Lehigh's preliminary research suggests that PSR will meet the conditions connected with these permits and approvals.

4.6.6.8 PSR-Consideration Public Concerns

The public will be given an opportunity to review and comment on the dFSTR. Ecology will consider all public comments before finalizing the dFSTR.

4.6.7 PSR-Provide a Reasonable Restoration Time Frame

Under the first groundwater treatment scenario, groundwater will meet cleanup levels throughout the Site at a standard POC within five years. As described in Section 4.6.1, Lehigh believes that groundwater treatment continues indefinitely. Under the second scenario, it is difficult to precisely estimate when groundwater will meet cleanup levels for at the proposed conditional POC for groundwater, but that timeframe is not expected to be longer than other alternatives. The performance and confirmational monitoring components allow Lehigh and Ecology to monitor progress. The detailed design phase will more fully evaluate the restoration time frame for PSR.

4.6.8 PSR-Consider Public Concerns

The public will be given an opportunity to review and comment on the dFSTR. Ecology will consider all public comments before finalizing the dFSTR.

4.6.9 PSR-Prevent Domestic use of CKD-Affected Groundwater

Measures to prevent domestic use of CKD-affected groundwater are discussed in Section 4.3.9.

4.7 Funnel and Gate Treatment (FGT)

4.7.1 FGT-Alternative Description

4.7.1.1 General

Alternative #5 – Funnel and Gate Treatment (FGT) intercepts the CKD-affected groundwater on the east side of State Route 31 and passively funnels the water to an in situ treatment zone. After treatment, the water migrates through a subsurface discharge corridor and enters Sullivan Creek. FGT includes a system of subterranean slurry walls installed downgradient of the Closed CKD Pile. The slurry walls funnel water toward a central treatment zone, using the in situ neutralization technology discussed in Section 4.3.1. Subterranean gravel walls (French drains) on the upgradient side of the slurry walls help convey water along the slurry wall funnel to the treatment zone. The FGT gravel drainage layer components will help to conduct water to the treatment corridor. Although FGT is not a flexible alternative (i.e., once installed, the system cannot be moved), the FGT uses engineered subsurface components to gain control of the hydrogeologically complex area between State Route 31 and Sullivan Creek. Whereas PTW is prone to gaps in treatment, FGT treats water in a treatment corridor that reduces the potential for gaps. Exhibit 4.7-1 shows the conceptual layout of FGT.

4.7.1.2 System Description

The FGT description contained in this section is preliminary. System details may be modified during the design phase to enhance system performance. For example, slurry walls are a component of FGT that may be modified. Other impermeable materials such as high density polyethylene (HDPE) will be considered for use in the funnel, as will several different slurry compositions with various permeabilities and resistance to high pH water. FGT includes the main components described in this section. The FGT components are installed in a progression that begins near Sullivan Creek and moves upgradient. This construction sequence begins with installing the treatment zone and discharge corridor. Then the program builds other components that are designed to channel the upgradient water into the treatment zone. FGT general components include:

- ***Slurry Wall Funnel.*** Slurry walls[22] about 2 ft wide are constructed downgradient of the Closed CKD Pile. An earthen platform a few feet thick elevates the working surface above the shallow groundwater table. The increased slurry elevation within the platform area provides the vertical distance required to increase the pressure that the slurry will exert on the formation to reduce the potential for soil sidewall collapses and slurry wall voids. The slurry walls are aligned across the CKD-affected groundwater plume to capture and direct it to the treatment zone. The slurry walls key into the upper few feet of the low-permeability glacial sediments (i.e., clay) that underlie the Site at a depth of approximately 10 to 20 ft. The slurry composition, likely a bentonitic slurry, will accommodate high pH conditions.

- ***Gravel Wall.*** The gravel wall French drains are upgradient and within several feet of the slurry wall funnel walls. The gravel drains stop short of the ends of the slurry wall funnels to avoid the potential for CKD-affected water to migrate around the ends of the funnel. The approximately two-foot wide gravel walls key into the top of the low-permeability glacial sediments (i.e., clay) that underlie the Site at a depth of approximately 10 to 20 ft. They will be installed by excavating trenches and backfilling them with a biodegradable slurry to hold the trenches open. Gravel displaces the slurry as it fills the trench. Geotextile filter fabric will likely line the upgradient side of the gravel wall. The ground surface will be completed with a horizontal barrier to water percolation.

- ***Treatment Zone Side Walls.*** The depth of the treatment zone side walls is about the same depth as the slurry wall funnel. The treatment zone side walls will possess structural characteristics to allow bulk excavation of the treatment zone. The side walls will retain the soil outside the treatment zone. The treatment zone components are placed

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[22] See Xanthakos (1979) for a very detailed description of the design, construction, and performance of slurry walls. ASTM (1985) includes numerous papers on slurry wall design, construction, and performance.

after the treatment zone is excavated and dewatered so that the full treatment zone is exposed and accessible.

- ***Treatment Zone.*** The treatment zone lies at the mouth of the funnel and consists of several in situ neutralization segments installed in series. The segments are built after the corridor is excavated in bulk and dewatered. The structural side walls allow maneuvering inside of the treatment zone, greatly improving the ease of constructability compared with the open water-filled trench encountered during Pilot System installation. Estimates show that five to seven segments provide sufficient treatment capacity.

- ***Discharge into Sullivan Creek.*** After treatment, water migrates through a subsurface discharge corridor to Sullivan Creek. Armoring the discharge location by using material that mimics the current rubble-strewn creek bank protects the creek bank from erosion.

- ***Performance Monitoring and Control Systems.*** Performance monitoring wells installed upgradient, between, and downgradient of the treatment segments evaluate the treatment system's performance. The data monitoring and delivery system design allows Lehigh to adjust the amount of treatment to meet cleanup standards without over- or under-treatment.

See Section 4.3.1.2 for discussion of the in situ treatment technology. Data from the Pilot System shows that pH is neutralized and that arsenic precipitates within the treatment zone. The rapid treatment that the Pilot System achieves supports the location of the treatment zone relatively close to Sullivan Creek.

4.7.1.3 System Performance

Although they may involve similar materials, the FGT slurry walls vary considerably from the ASC slurry walls in their construction, performance, and reliability. The FGT slurry walls are installed to relatively shallow depths using conventional excavation equipment, whereas the ASC slurry walls are installed to much greater depths using more cumbersome and complicated excavation equipment. ASC slurry walls are also installed along the toe of a historic landslide, unlike the FGT walls. To avoid activating the historical landslide by excavating a continuous trench, the ASC slurry wall is installed in alternating segments placed end to end. ASC slurry walls require detailed construction quality assurance procedures to install alternating segments without gaps between the segments, especially as depth increases. Conversely, FGT slurry walls are installed in a relatively open and flat space where trench collapses are less likely and could be controlled. Therefore, Lehigh has a significantly higher degree of confidence in the FGT slurry wall performance.

The FGT slurry wall funnel and gravel wall intercept CKD-affected groundwater and passively direct the water into an in situ treatment zone, where carbon dioxide neutralizes the high pH water. See Section 4.3.1.3 for a comparison of the different neutralizing agents that Lehigh considered. With the lower pH, arsenic in solution precipitates (i.e., forms insoluble complexes) in and immediately downgradient of the treatment zone. The discharge into Sullivan Creek from the treatment zone will meet cleanup levels for both pH and arsenic.

The FGT greatly reduces the concern over gaps in the PTW and provides a greater amount of hydraulic control.

On the upgradient side of the funnel, the gravel walls in the design of the FGT (see Exhibit 4.7-1) reduce the potential for water buildup in front of the slurry wall that could otherwise potentially overtop it. On the downgradient side of the funnel, water level fluctuations are relatively small because the upgradient dam at Sullivan Lake controls Sullivan Creek flow (Section 2.3.1). Under this fluctuation regime, water from Sullivan Creek will not overwhelm the discharge corridor and enter the treatment zone. The final design will accommodate these concerns.

4.7.1.4 Construction Schedule

FGT design, contracting, and procurement requires approximately eight months. FGT permitting and obtaining regulatory approvals requires approximately six months to one year (see Exhibit 3.2-1 for the list of permits and regulatory approvals). FGT installation requires approximately four to five months. Installation schedules for FGT accommodate restrictions on construction in the vicinity of Sullivan Creek that permit such construction only during certain months of the year, July and August at the

Site, to protect water resources. The winter temperatures and hours of daylight in Metaline Falls would adversely affect installation of the FGT. Although possible, construction of FGT during the winter months is not advisable.

4.7.2 FGT-Protect Human Health and the Environment

The FGT will protect human health and the environment for the following reasons:

- ***Groundwater Quality.*** The FGT will meet MTCA groundwater cleanup levels at a conditional POC. The Site-specific bench and pilot scale treatability studies [GeoSyntec, 2000, 2002, 2003a, and 2003b] demonstrated the effectiveness of the in situ treatment concept.

- ***ARAR Compliance***. FGT complies with ARARs.

- ***Institutional Controls***. Lehigh will use institutional controls as described in Section 4.2.2.

4.7.3 FGT-Comply With Cleanup Standards

The Site-specific bench and pilot scale treatability studies [GeoSyntec, 2000, 2002, 2003a, and 2003b] demonstrated the effectiveness of the in situ treatment concept. The FGT will meet cleanup standards assumed for the purposes of the Revised dFSTR, as follows:

- ***Cleanup Levels (CLs).*** The proposed groundwater cleanup levels for the Site are pH between 6.5 and 8.5, and maximum arsenic concentration of 5.0 ppb.

- ***Point of Compliance (POC)***. Lehigh proposes a conditional POC for groundwater at a point downgradient of the FGT treatment zone and upgradient of Sullivan Creek (Exhibit 4.7-1).

4.7.4 FGT-Comply With Applicable Federal and State Laws

The FGT complies with ARARs. Exhibit 3.2-1presents a summary of ARARs that apply to this alternative.

4.7.5 FGT-Provide for Compliance Monitoring

Lehigh will conduct protection, performance, and confirmation monitoring as described in Section 4.3.5.

4.7.6 FGT-Use Permanent Solution to the Maximum Extent Practical

4.7.6.1 Introduction

This element for selection of cleanup actions requires consideration of the criteria used in the disproportionate cost analysis (WAC 173-340-360(3)). Each criterion in the disproportionate cost analysis is discussed below.

4.7.6.2 FGT-Protectiveness

As described in Section 4.7.2, FGT will protect human health and the environment because it meets groundwater cleanup levels at a conditional groundwater POC. In addition, it complies with applicable state and federal laws. This alternative will not produce treatment residuals.

4.7.6.3 FGT-Permanence

Permanent Solution. FGT is not a permanent solution. The FGT requires indefinite maintenance, operation, repair and replacement, as needed.

Permanence. The FGT exhibits a high degree of permanence because it uses a treatment-based technology that obviates further treatment at the POC. The technology chemically neutralizes the high pH water, resulting in a permanent reduction in pH and lower solubility (mobility) and toxicity of arsenic. The FGT generates no treatment residuals. The FGT can dewater portions of the Closed CKD Pile under certain conditions. Dewatering the CKD also has a high degree of permanence because it reduces hazardous substance releases.

4.7.6.4 FGT-Cost

The estimated present value cost to design and install an FGT is approximately $2.3 to 2.6 million (US $2005) (see Exhibit 4.7-2). The annual operating and maintenance cost is estimated to be approximately $150,000. Hence the present value of this alternative for 30 years at an annual discount rate of seven percent is approximately $4.4 to 4.7 million. Actual costs may vary depending on the details of the final FGT system design and implementation procedures. Exhibit 4.1-7 includes the estimated costs of FGT for the three costing scenarios described in Section 3.2.3.2.3. See Appendix E for supporting information, including assumptions used in the cost analysis.

4.7.6.5 FGT-Effectiveness Over the Long Term

Lehigh will operate and maintain the FGT as long as needed to maintain compliance with cleanup standards. FGT groundwater control uses slurry walls, a primarily passive system. Slurry wall imperfections are expected to be less than for ASC because of the relatively shallow FGT target depths (see Section 4.7.1.3). FGT treatment is primarily a passive system, and because it incorporates a treatment technology that has proven successful at the Site, Lehigh has a high degree of confidence that it will be reliable over the long term. Lehigh will provide a financial assurance mechanism to cover the long-term operation and maintenance. The design allows Lehigh to add, replace, or remove FGT components over time, as needed, although the in-situ design poses some challenges. As such, the FGT is effective over the long term.

4.7.6.6 FGT-Management of Short-Term Risks

Few short-term risks are associated with FGT. Construction of the FGT has a potential for short-term exposure to high pH water, as is common with each of the alternatives. During FGT construction the potential exposure to high pH water occurs due to open trenches that will fill with water. Dewatering of the treatment zone during excavation and construction will reduce the potential for contact with CKD-affected groundwater. The water will be treated on-site prior to disposal or discharge. Workers will use heavy equipment and may relocate utility lines. Deliberate scheduling and protective measures will reduce the risks from the relatively rapidly flowing water when work occurs near Sullivan Creek. The risks posed are manageable with good construction safety practices.

Construction during the winter months will increase the short-term risks associated with FGT. Since the trenching operation is performed in saturated conditions, short or dim daylight periods increase safety concerns for workers. The winter conditions in Metaline Falls affect certain components of the FGT installation, specifically the perforated pipe installation in the treatment zone. Construction of FGT during the winter months is not advisable.

4.7.6.7 FGT-Technical and Administrative Implementability

4.7.6.7.1 Technical Implementability

As noted above, winter construction is not recommended for certain components. FGT is technically implementable during other times of the year.

4.7.6.7.2 Administrative Implementability

The FGT is administratively implementable. See Exhibit 3.2-1, which shows the permits and approvals needed for GWC. FGT requires an NPDES permit to discharge treated water into Sullivan Creek during construction and for long-term operation. Federal permits or regulatory approvals will apply to work along the banks of Sullivan Creek. Lehigh’s research suggests that FGT will meet the conditions connected with these permits and approvals.

4.7.6.8 FGT-Consideration of Public Concerns

The public will be given an opportunity to review and comment on the dFSTR. Ecology will consider all public comments before finalizing the dFSTR.

4.7.7 FGT-Provide a Reasonable Restoration Time Frame

Although the alternative will clean up much of the groundwater, this alternative will not achieve clean up levels everywhere throughout the Site. Therefore, Lehigh proposes a conditional POC. It is difficult to precisely estimate when groundwater will meet the cleanup levels for pH and arsenic at the proposed conditional POC for groundwater. However, performance and confirmational monitoring allow Lehigh and Ecology to monitor progress. In addition, redundant systems, both for treatment and for performance monitoring, are designed into the FGT alternative to assist in achieving compliance and conducting compliance monitoring. The FGT achieves compliance with groundwater cleanup levels at a conditional POC in approximately the same time frame as other alternatives evaluated in this Revised dFSTR. The restoration time frame for FGT will be further refined during detailed design.

4.7.8 FGT-Consider Public Concerns

The public will be given an opportunity to review and comment on the dFSTR. Ecology will consider all public comments before finalizing the dFSTR.

4.7.9 FGT-Prevent Domestic Use of CKD-Affected Groundwater

Measures to prevent domestic use of CKD-affected groundwater are discussed in Section 4.3.9.

4.8 Partial Additional Source Control (PASC)

4.8.1 PASC-Alternative Description

4.8.1.1 General

Alternative #6 – Partial Additional Source Control (PASC) combines two remediation concepts: source control and downgradient in situ treatment. PASC supplements the FGT remedy with a gravity drain installed under the southern side of the Closed CKD Pile. The gravity drain is a source control technology that redirects unaffected groundwater away from the Closed CKD Pile, so that it will not contact the CKD. The gravity drain, working in concert with the FGT gravel drainage layer components will help to control the water flux within the floodplain alluvial aquifer. As the gravity drain redirects water to the FGT gravel layers and the gravel layers remove water by conducting it to the treatment zone, the groundwater surface may be lowered slightly within the alluvial aquifer. This control of the water flux within the alluvial aquifer has the potential to reduce a small amount of water in contact with the CKD under certain groundwater flow regime scenarios. This could reduce the volume of CKD-affected groundwater. The amount of downgradient treatment required will decrease with time as the gravity drain dewaters the area and as transient drainage through the CKD reaches an equilibrium condition. Exhibit 4.8.1 shows the conceptual layout of this alternative.

4.8.1.2 System Description

PASC combines the FGT components described above in Section 4.7 with a gravity drain. Lehigh will install a perforated drain pipe under the southernmost margins of the Closed CKD Pile using horizontal directional drilling techniques. The gravity drain will be installed at depths that mostly target water under the static groundwater levels observed in Monitoring Well MW-8 and PM-13, abandoned Monitoring Wells MW-5 and MW-6, and abandoned Piezometers P-2, P-7, and P-8 (See Exhibit 2.3-3). The southern side of the Closed CKD Pile presents the best opportunity to redirect clean water away from the Closed CKD Pile because much of the water passing through the Site enters via subsurface flow from the uplands south of this area. The gravity drain in this location also acts as a hydraulic control to reduce the potential for CKD-affected water to by-pass the southern edge of the slurry wall funnel.

Because the gravity drain intercepts water before it enters the Closed CKD Pile, gravity drainage should meet water quality criteria for discharge into Sullivan Creek without treatment. The design will include the flexibility to convey the water to the treatment zone, if needed or desired.

The gravity drain will be installed as follows:

- Access the insertion point on the northern side of State Route 31 where the drainage will connect with the gravel wall of the FGT, if desired.
- Prepare the surface for drilling. This may include excavating a small pit for drilling, and preparing the insertion angle for the drill rods. Drilling begins in a down-angle direction before reaching target depth, at which point the hole traverses below the groundwater on the south side of the Closed CKD Pile.
- Directionally drill the pilot hole for the drain pipe in a location approximately shown on Exhibit 4.8-1. The hole will be installed at depths that are below the expected groundwater table, except for the upgradient side of the drain where it ascends sharply to exit the southern side of the Closed CKD Pile.
- The exit point may be completed in a surface monument or cut off and capped below grade. Lehigh will likely complete the drain in a manner that will provide future access to the pipe.
- Pull the perforated drain pipe back down through the pilot hole using the drilling equipment. Preliminarily, Lehigh estimates that the pipe will likely be 4-in. diameter, but it may be up to 6-in. diameter. Larger diameter pipes beyond 6-in. involve significantly more powerful and costly drilling methods to achieve the necessary boring diameter. Directing the placement of the drain is also harder with larger pipe.
- The pipe will not be perforated for a certain distance from the insertion point. The non-perforated section helps transmit the drained water to the FGT instead of allowing it to percolate back into the groundwater.

Exhibit 4.8-1 shows the conceptual layout of the PASC components.

4.8.1.3 System Performance

The gravity drain lies in the alluvium, between the CKD and the underlying clay aquitard. The gravity drain intercepts water flowing into the southern edge of the Site and conveys it near the southern tip of the slurry wall system. If the water requires treatment, the gravity drain empties it into the slurry wall funnel for eventual treatment.

Installation of the gravity drain under deep portions of the Closed CKD Pile is not recommended. The deep portions of CKD lie in areas associated with a higher density of large-diameter sediments than the southern side. Large size aggregate such as cobbles and boulders impede or stop directional drills. If a gravity drain was attempted in the deep area and intersected a deep portion of the CKD, the drain will not lower the water level below the CKD. Thus, it will not provide source control for the still submerged CKD. Furthermore, this CKD-affected water cannot be discharged into Sullivan Creek without treatment. The FGT component may not be equipped to handle the additional treatment burden, requiring substantial and impractical scale-up.

As discussed in Section 4.7, the FGT design addresses concerns related to water overtopping the slurry wall and to Sullivan Creek water entering the treatment zone during periods of high flow. The gravity drain may contribute more water to the slurry wall funnel than the FGT alone will contribute. The final design will accommodate these variables assuming the gravity drain location shown in Exhibit 4.8-1 is approximately where it will be installed.

The FGT component includes performance monitoring wells that measure groundwater treatment performance through the treatment system. This information allows Lehigh to adjust the amount of carbon dioxide delivered to the water and to comply with cleanup levels.

4.8.1.4 Construction Schedule

PASC design, contracting, and procurement requires approximately eight months. PASC permitting and obtaining regulatory approvals requires approximately six months to one year (see Exhibit 3.2-1 for the list of permits and regulatory approvals). PASC installation requires approximately four to five months. Installation schedules for the FGT component accommodate restrictions on construction in the vicinity of Sullivan Creek that permit such construction only during certain months of the year, July and August at the Site, to protect water resources. The winter temperatures and hours of daylight in Metaline Falls would adversely affect installation of the PASC. Although possible, construction of PASC during the winter months is not advisable.

4.8.2 PASC-Protect Human Health and the Environment

The PASC protects human health and the environment for the following reasons:

- ***Groundwater Quality.*** The PASC meets MTCA groundwater cleanup levels at a conditional POC. The Site-specific bench and pilot scale treatability studies [GeoSyntec, 2000, 2002, 2003a, and 2003b] demonstrated that the in situ treatment technology is effective.

- ***ARAR Compliance***. PASC complies with ARARs.

- ***Institutional Controls***. Lehigh will use institutional controls as described in Section 4.2.2.

4.8.3 PASC-Comply With Cleanup Standards

The PASC will meet cleanup standards assumed for the purposes of the Revised dFSTR, as follows:

- ***Cleanup Levels (CLs).*** The proposed groundwater cleanup levels for the Site are pH between 6.5 and 8.5, and maximum arsenic concentration of 5.0 ppb.

- ***Point of Compliance (POC)***. Lehigh proposes a conditional POC for groundwater at a point downgradient of the PASC treatment zone and upgradient of Sullivan Creek (Exhibit 4.8-1).

4.8.4 PASC-Comply With Applicable Federal and State Laws

The PASC complies with ARARs. Exhibit 3.2-1 presents a summary of ARARs that apply to this alternative.

4.8.5 PASC-Provide for Compliance Monitoring

Lehigh will perform protection, performance, and confirmational monitoring as described in Section 4.3.5.

4.8.6 PASC-Use Permanent Solution to the Maximum Extent Practical

4.8.6.1 Introduction

This element for selection of cleanup actions requires consideration of the criteria used in the disproportionate cost analysis (WAC 173-340-360(3)). Each criterion in the disproportionate cost analysis is discussed below.

4.8.6.2 PASC-Protectiveness

As described in Section 4.7.2, FGT alone protects human health and the environment because it meets groundwater cleanup levels at a conditional groundwater POC. In addition, it complies with applicable state and federal laws. The gravity drain component of PASC reduces the amount of groundwater entering the Closed CKD Pile, thus limiting the volume of CKD-affected groundwater requiring treatment. This alternative will not produce treatment residuals that must be transported to a disposal facility.

4.8.6.3 PASC-Permanence

Permanent Solution. PASC is not a permanent solution. The PASC will have to be indefinitely maintained, operated, and replaced, as needed.

Permanence. PASC exhibits a higher degree of permanence than alternatives that rely solely on treatment for two reasons. The gravity drain intercepts water before it contacts the CKD, so that the water remains unaffected. This reduces the volume of hazardous substances generated at the Site. PASC also uses a treatment-based technology that chemically neutralizes the high pH water, resulting in a permanent reduction in pH and lower solubility (mobility) and toxicity of arsenic. The PASC generates no treatment residuals. The gravity drain has no moving parts and requires minimal maintenance. However, the in situ treatment zone requires maintenance, repair, and periodic replacement of parts.

4.8.6.4 PASC-Cost

The estimated present value cost to design and install PASC is approximately $2.4 to 3.0 million (U.S. $2005) (see Exhibit 4.8-2). The annual operating and maintenance cost is estimated to be approximately $150,000. Hence the present value of this alternative for 30 years at an annual discount rate of seven percent is approximately $4.4 to 5.1 million. Actual installation costs may vary depending on the details of the final PASC system design and implementation procedures. The operating and maintenance costs may decrease over time depending on the effectiveness of the gravity drain at intercepting water. Exhibit 4.1-7 includes the estimated costs of PASC for the three costing scenarios described in Section 3.2.3.2.3. See Appendix E for supporting information, including assumptions used in the cost analysis.

4.8.6.5 PASC-Effectiveness Over the Long Term

PASC will be effective over the long term. It uses a treatment technology that has proven successful at the Site. Over time, the gravity drain will reduce the amount of CKD-affected groundwater requiring treatment. Thus, there is a high degree of certainty that this alternative will be successful.

Lehigh will operate and maintain the PASC as long as necessary to maintain compliance with cleanup standards. Lehigh will provide a financial assurance mechanism to cover long-term operation and maintenance. Lehigh can add, replace or decommission PASC components as needed, although the in situ nature of the components poses some challenges.

4.8.6.6 PASC-Management of Short-Term Risks

Short-term risks associated with the slurry wall systems and the in situ treatment zone are discussed in section 4.7.6.6. The PASC gravity drain adds some construction risks due to the drilling equipment. During installation, water will emerge at the installation point. As long as the water is clean, as expected, no special measures to protect workers are needed. The risks posed by the FGT components and the gravity drain are manageable with good construction safety practices. As with the other alternatives, it would be best to avoid construction during winter conditions in Metaline Falls.

4.8.6.7 PASC-Technical and Administrative Implementability

4.8.6.7.1 Technical Implementability

While winter months pose difficulties for construction, the PASC is technically implementable during other times of the year.

4.8.6.7.2 Administrative Implementability

The PASC is administratively implementable. See Exhibit 3.2-1, which shows the permits and approvals needed for GWC. Lehigh's research suggests that PASC will meet the conditions connected with these permits and approvals. The FGT components are discussed in Section 4.7.6.7.2. The discharge from the gravity drain may also be covered by an NPDES permit. With the exception of the gravity drain, all of the PASC components reside on Lehigh property. Lehigh will require permission to install and maintain the drain under State Route 31.

See Exhibit 3.2-1, which shows the permits and approvals needed for GWC. Lehigh's preliminary research suggests that PASC will meet the conditions connected with these permits and approvals.

4.8.6.8 PASC-Consideration of Public Concerns

The public will be given an opportunity to review and comment on the dFSTR. Ecology will consider all public comments before finalizing the dFSTR.

4.8.7 PASC-Provide a Reasonable Restoration Time Frame

The treated groundwater from PASC will meet cleanup standards. It is difficult to precisely estimate when all groundwater will meet the cleanup levels for pH and arsenic at the conditional POC for groundwater. Performance and confirmational monitoring allow Lehigh and Ecology to monitor progress. In addition, redundant systems, both for treatment and for performance monitoring, are designed into the PASC alternative to assist in achieving compliance and conducting compliance monitoring. Lehigh will operate PASC indefinitely to maintain compliance with cleanup standards. PASC achieves compliance with groundwater cleanup levels at a conditional POC in approximately the same time frame as other alternatives evaluated in this Revised dFSTR. The restoration time frame for PASC will be further evaluated during detailed design.

4.8.8 PASC-Consider Public Concerns

The public will be given an opportunity to review and comment on the dFSTR. Ecology will consider all public comments before finalizing the dFSTR.

4.8.9 PASC-Prevent Domestic Use of CKD-Affected Groundwater

Measures to prevent domestic use of CKD-affected groundwater are discussed in Section 4.3.9.

5. COMPARATIVE ANALYSIS OF ALTERNATIVES

5.1 Introduction

The six alternatives described in this Revised dFSTR resulted from a thorough collaborative FS process between Lehigh and Ecology. The FSTM screened a list of 20 alternatives. Lehigh and Ecology refined the initial list to yield the six alternatives evaluated in this Revised dFSTR:

- Alternative #1 – Permeable Treatment Wall (PTW)
- Alternative #2 – Pump and Treat (P&T)
- Alternative #3 – Additional Source Control (ASC)
- Alternative #4 – Partial Source Removal (PSR)
- Alternative #5 – Funnel and Gate Treatment (FGT)
- Alternative #6 – Partial Additional Source Control (PASC)

Section 4 of this Revised dFSTR describes how each of the remedy selection criteria applies to the six alternatives. This section compares the evaluation results for the alternatives to arrive at alternative rankings with respect to the remedy selection criteria. Exhibit ES-4 summarizes the rankings.

5.2 Threshold Requirements

As described in Section 4 of this Revised dFSTR, the six alternatives meet the following threshold requirements defined in WAC 173-340-360(2):

- protect human health and the environment;
- comply with cleanup standards;
- comply with applicable federal and state laws; and
- provide for compliance monitoring.

By meeting threshold requirements, the six alternatives passed initial evaluation and were analyzed according to the remaining evaluation criteria. The remainder of this section compares the alternatives using those remaining criteria. With respect to the provision for compliance monitoring, each of the alternatives evaluated in this FS process incorporates treatment-based remedies. There is inherent variability involved in operating engineered treatment systems. The method of evaluating compliance with cleanup standards will be established during development of the monitoring program defined in the CAP and design phases of the project, and ultimately approved by Ecology.

5.3 Use Permanent Solution to the Maximum Extent Practical

5.3.1 Introduction

The disproportionate cost analysis (WAC 173-340-360(3)) criteria evaluations are compared for each alternative in this section. The disproportionate cost analysis criteria are:

- protectiveness;
- permanence;
- cost;
- effectiveness over the long term;
- management of short-term risks;
- technical and administrative implementability; and
- public concerns.

5.3.2 Protectiveness

Each of the alternatives meets cleanup standards, and thus meets the threshold criteria to protect human health and the environment. Under the cost-disproportianailty analysis, protectiveness goes beyond meeting clean up levels. For example, protectiveness additionally examines the degree to which risks are reduced, the time required to reduce risks and risks from implementing the alternative.

PSR poses the greatest short-term risks because it breaches the engineered cover, exposing the formerly Closed CKD Pile to the environment and to workers implementing the alternative. To execute PSR, the formerly Closed CKD Pile and the new temporary dangerous waste storage area for CKD remain open for twenty-five to thirty months, not including winter down-times. PSR also poses serious risks to workers during construction activities on the soft, saturated, and unstable CKD. ASC also involves significant construction risks due to the installation of a slurry wall across the disturbed sediments in the historic landslide area. The remaining alternatives pose short-term risks, but to a far lesser degree. Short-term risks are the greatest for PSR. ASC has the second greatest short-term risks. PASC, FGT, and PTW each have similar short-term risks that are significantly less than for PSR and ASC. GWC has the lowest short-term risk.

If PSR met groundwater cleanup levels throughout the Site in five years, as assumed in the first groundwater treatment scenario, then it would reduce environmental risks to a greater degree than other alternatives, and increases its protectiveness over the long-term. Under the second groundwater treatment scenario, in which groundwater treatment continues indefinitely and groundwater cleanup levels are met at a conditional POC, PSR reduces environmental risks to the same degree that other downgradient treatment–based alternatives do.

Alternatives that require off-site disposal of the CKD waste decrease the overall protectiveness of the remedy. PSR will require the largest volume of off-site disposal, followed by ASC and GWC. PSR disposes of approximately 10,000 cubic yards of CKD, a State dangerous waste as well as approximately 1,000 to 1,500 pounds of non-dangerous waste groundwater treatment residuals. ASC and GWC also produce non-dangerous waste groundwater treatment residuals, approximately 1,000 to 2,000 pounds per year. The alternatives that rely on the in situ carbon dioxide treatment system (PTW, FGT, and PASC) do not produce treatment wastes that must be disposed off-site. ASC, PTW, FGT, and PASC do involve non-dangerous waste excavation spoils that will also need to be managed, but will likely not be disposed off-site.

Considering all the factors that contribute to protectiveness, PASC ranks highest in terms of this criterion. ASC ranks next highest in terms of protectiveness, followed by PTW, GWC, and FGT. The PSR alternative, under both scenarios, ranks the lowest in terms of protectiveness, with the first PSR groundwater treatment scenario being slightly more protective than the second PSR groundwater treatment scenario.

5.3.3 Permanence

According to Lehigh's understanding of MTCA, a remedy, which produces waste for off-site disposal and does not treat the waste and render it harmless (i.e., untreated CKD), is not a permanent remedy. The off-site location is engaged in monitoring and possible future action. PSR, under Lehigh's analysis, is not a permanent remedy because it will not be effective at obviating future groundwater treatment needs. Ecology believes that PSR is permanent. Both Lehigh and Ecology agree that PSR has the highest degree of permanence and that, of the three alternatives that appreciably reduce the amount of CKD-affected water that is generated, PSR exhibits the highest degree of permanence. PSR removes CKD from groundwater, thereby reducing future generation of CKD-affected groundwater. Although other remedies, such as ASC and PASC, re-route water away from the Closed CKD Pile and accomplish source control, the effects are expected to be less than for PSR. Therefore, for the purposes of this disproportionate cost analysis, PSR is the baseline remedy. ASC and PASC exhibit the next greatest degree of permanence because they include a source control component. For ASC the amount of reduction depends, in part, on the size of the slurry wall and effectiveness of the dewatering. The degree of permanence of the PASC depends on the effectiveness of the gravity drain in diverting water away from the CKD. PASC also generates no treatment residuals requiring off-site management.

All six alternatives exhibit a high degree of permanence because they irreversibly treat (i.e., reduce toxicity and mobility of hazardous substances) groundwater by permanently neutralizing the pH and decreasing arsenic levels to meet cleanup levels.

As explained in Section 4, Lehigh's evaluation of the Site shows that none of the six alternatives is a permanent remedy. Regardless, the MTCA regulations require that the analysis rank the alternatives in order of their degree of permanence, with the remedy exhibiting the highest degree of permanence identified as the "baseline" remedy against which the other alternatives are compared. Therefore, PSR is the baseline alternative because it exhibits the highest degree of permanence. ASC and PASC are next, followed by FGT, PTW, and lastly, GWC, in order of decreasing degree of permanence.

5.3.4 Cost

The cost comparisons use a 30-year project duration and seven percent discount rate. Exhibit 4.1-8 shows calculation results for the other cost scenarios described in Section 3.2.3.2.3. The cost of GWC is slightly less than PTW, FGT, and PASC (see Exhibit ES-4). ASC is two or three times more costly than GWC, followed by both PSR scenarios, which is an order of magnitude more expensive than PTW, GWC, FGT, and PASC. All of the alternatives involve indefinite operation and maintenance costs. The only exception is the first groundwater treatment scenario for PSR. Under that scenario, PSR costs include operation, maintenance, and monitoring costs for five years plus monitoring costs for another three years.

The ability to effectuate treatment flexibly in a variety of locations is a critical advantage of the alternatives that employ P&T, especially in this geologic setting. PTW does not offer this advantage; once the trench is installed, the treatment zone cannot be relocated without difficulty, expense, and interruption of treatment. Alternatives with in-situ treatment zones have cost estimates that include periodic treatment zone section replacement. Further, the Site and construction technique constraints prevent a continuous line of in situ carbon dioxide diffusion treatment panels for PTW. The cost estimates for alternatives with P&T components make provisions for relocation or addition of extraction wells. GWC offers some cost benefit related to monitoring, transporting and disposing a lesser amount of treatment residuals (both treated water and solids), compared to P&T alone. This is because GWC incorporates the existing Pilot System.

ASC and PASC will reduce the long-term costs by reducing the volume of water that requires treatment, depending on the effectiveness of the source control components. The actual reduction is not quantifiable at this stage, so that any savings are not included in the cost estimates.

The other cost scenarios shown in Exhibit 4.1-8 are presented for comparison purposes only based on EPA guidance [EPA, 2000a]. The discounted 100-year project duration cost estimates show the same general results as the discounted thirty-year project duration discussed above. The non-discounted 100-year project duration estimates, which do not reflect realistic conditions, ascribe the lowest cost to PTW. In order of ascending costs, FGT, PASC, the first PSR groundwater treatment scenario, and GWC are next. ASC and the second PSR groundwater treatment scenario are the most costly.

5.3.5 Effectiveness Over the Long Term

If installed, operated, and maintained appropriately, each of the six alternatives will be effective over the long term because all six alternatives incorporate downgradient treatment technologies that have proven successful. The treatment components of these alternatives are accessible and are operated, maintained, and replaced as necessary over the long term. However, for the PSR alternative (especially under scenario one where downgradient treatment is operated for a short period), where only portions of the CKD are removed from the water contact, changes in hydrogeologic conditions over the long term will likely decrease the alternative's long term effectiveness. These hydrogeologic changes include landslide shifts and/or a series of heavy water years that create CKD-water contact where none existed at the time of implementation.

Likewise, while the treatment components increase effectiveness over the long term, the source control component of ASC may not contribute to the long-term effectiveness of this alternative. The main component of the ASC alternative, the slurry wall, is not easily accessible. If the slurry wall fails or deteriorates, as it is expected to do over time, then ASC will rely more heavily on the treatment components. In addition, the slurry wall deterioration may lead to focused breakthrough of groundwater retained behind the wall, allowing the water to contact CKD in areas not previously exposed to water contact. Thus, ASC will not be any more effective over the long term, and may be less, than the alternatives that rely solely on treatment (PTW, GWC, and FGT). The source control components of PASC are expected to remain reliable over the long term.

Therefore, PASC and PSR with long term downgradient treatment rank the highest in terms of long-term effectiveness, followed by PTW, GWC, FGT, and PSR with short term treatment and ASC.

5.3.6 Management of Short-Term Risks

PASC, PTW, GWC, and FGT use relatively conventional construction practices, each involving risks that are manageable. These four alternatives rank equally with respect to this criterion (each ranks “easy” on Exhibit ES-4). ASC uses a conventional technology (i.e., slurry wall and dewatering wells). However, because of the danger of activating the historic landslide, ASC has significant short-term risks to workers. Hence, ASC ranks “difficult” on Exhibit ES-4.

PSR uses conventional excavation technologies, but applies them in a soft soil that is unstable and susceptible to liquefaction. PSR opens the engineered cover, thereby exposing the workers and potentially the surrounding population to large amounts of CKD. PSR targets approximately 270,000 cubic yards of CKD for removal. Those 270,000 cubic yards require handling, transport using thousands of loaded truck trips, and temporary storage on approximately 5 acres of lined containment with associated environmental controls. Hundreds of truckloads then move a portion of the CKD to a remote facility for off-site disposal. The rest of the CKD is replaced, recontoured, and the cover systems are reconstructed. Hence, PSR presents significant short-term risk and construction dangers, so that it ranks “very difficult” on Exhibit ES-4.

5.3.7 Technical and Administrative Implementability

Technical Implementability. Each of the alternatives is technically implementable. Each alternative involves a certain amount of complexity in installation. PASC, PTW, GWC, and FGT are less complex than ASC or PSR, which include several significant concerns related to construction. ASC involves work in the vicinity of the historic landslide. PSR involves handling significant quantities of CKD, excavating CKD under liquefiable conditions, counteracting CKD slope instability, transporting CKD on public roads with a large amount of truck traffic, temporarily storing CKD, then returning it to the Site for backfilling and disposing of the amount that no longer fits in the excavation to an off-site disposal facility.

Administrative Implementability. Each of the alternatives is theoretically administratively implementable. Various components of administrative effort will be required for such items as: preparing and recording restrictive covenants, obtaining permits and regulatory approvals, land acquisition/leasing/easements, pertinent to the respective alternative. Land acquisition/leasing/easements required by PSR, ASC, and PASC may be difficult and have the potential to significantly increase the project costs and time needed to implement the alternatives.

PTW ranks the highest for administrative implementability because it does not require the additional effort required to obtain an NPDES permit for discharges of treated groundwater to Sullivan Creek, which is required for the other five alternatives (see Exhibit 3.2-1). Nor would PTW necessitate residuals management such as profiling the waste, and subsequent off-site transport. Lehigh owns all of the land needed to implement GWC, PTW, and FGT, facilitating the administrative implementability of these alternatives. PASC requires permission for a right of way under State Route 31 for the gravity drain. For ASC, the slurry wall and seepage control system may impose administrative difficulty, given portions of the slurry wall and drainage well network must be built on land Lehigh does not own. Lastly, for PSR, the need to obtain approximately five acres for temporary storage of the CKD during the excavation and backfilling phases makes PSR implementation administratively difficult. Since the CKD is regulated as dangerous waste under state law, it will have to be managed in accordance with the dangerous waste regulations while being temporarily stored. This will make PSR more difficult to implement administratively. Each alternative requires the same amount of administrative effort to prepare and record restrictive covenants to preclude the domestic use of water.

Schedule. Section 4 presents the schedules for three major tasks. Except for PTW (which, based on Lehigh's preliminary research, does not need individual permits apart from the MTCA cleanup process regulatory approvals and potential floodplain construction approval), the tasks are: (1) design, contracting, and procurement; (2) permitting; and (3) installation. The alternatives have similar design, contracting, and procurement and permitting schedules. However, they differ significantly with respect to installation schedules. GWC has the shortest installation schedule, followed by FGT. FGT requires less time to install than PTW and PASC, each of which could be installed more rapidly than ASC. PSR requires significantly longer installation time than the other five remedies. It is wise to concurrently work on several of the tasks and sub-tasks involved in permitting and design. Some of the information generated is needed for other tasks and it will expedite implementation. As noted elsewhere, certain tasks should not be implemented during the winter, so that delays could push project execution into a subsequent construction season. Barring unexpected delays in permitting processes, the alternatives require approximately the following amounts of time from CAP finalization to be installed and operational:

- PTW – 12 months;
- GWC – 10 to 11 months;
- ASC – 13 to 14 months;
- PSR – 48 months;
- FGT – 10 to 11 months; and
- PASC – 11 to 12 months.

5.3.8 Public Concerns

The MTCA public review process will give the public several opportunities for input to the remedy selection process. The public will also have the opportunity to review and comment on the project documents. Ecology will address public concerns before finalizing this document. Therefore, public comment will be considered for each of the alternatives, giving them the same ranking for this criterion.

5.3.9 Disproportionate Cost Analysis Results

WAC 173-340-360(3)(e) requires that the alternatives be ranked in order of permanence. In this case, using the assumptions presented in this Revised dFSTR, the alternatives rank as follows in terms of permanence:

1) PSR
2) PASC, ASC
3) FGT, PTW, and GWC

Each of the alternatives includes groundwater treatment for some future time period. None of the alternatives are permanent. PSR groundwater treatment scenario one requires groundwater treatment to occur only over the short-term. Lehigh presented data and analysis supporting its belief that an unattainable degree of effectiveness is required to achieve cleanup standards without long-term groundwater treatment. Specifically, elimination of at least 99% of the CKD-groundwater contact is required to achieve cleanup standards [GeoSyntec, 2004]. Nevertheless, PSR is the “baseline cleanup action alternative" for comparison with the other alternatives. The disproportionate cost test is described in WAC 173-340-360(3)(e)(i) as follows:

> *Test: Costs are disproportionate to benefits if the incremental costs of the alternative over that of a lower cost alternative exceed the incremental degree of benefits achieved by the alternative over that of the other lower cost alternative.*

Although PSR is the baseline alternative in terms of its degree of permanence, PSR is very difficult to implement and its cost is disproportionate to the benefits of the alternative. PSR involves significant risks in the short term and difficulties in implementation. PSR also effectively destroys the engineered cover. Accessing the inundated CKD at the base of the Closed CKD Pile involves very complex construction systems. Expanding the excavation to remove more CKD than planned once the base is reached requires that the entire excavation be restarted to yield the proper excavation. Based on the current Ecology interpretations of the inundated portions of the Closed CKD Pile, PSR displaces about 270,000 cubic yards, approximately half of the pile. In addition, PSR costs about two to three times more than the ASC alternative and an order of magnitude more than PASC and the other alternatives. Estimates show PSR installation to cost approximately $17 to $24 million. Although not quantifiable, PSR reduces the generation of groundwater requiring treatment. Even if groundwater treatment was no longer necessary immediately following CKD excavation, estimates show that PSR would still be more costly than any of the other five alternatives operating indefinitely. Thus, PSR is impracticable and risky, and its cost in terms of dollars, implementability, and short-term risks is disproportionate to the benefits provided. Furthermore, contractors have recommended that PSR not be attempted at the Site.

The ASC cost is also disproportionate to the benefits achieved (see Exhibit ES-4). The incremental increase in cost over GWC, FGT, PTW, and PASC is substantial. The estimates show that ASC costs between $9.1 to $14 million in capital expense, of which the source control components cost $8 to $13 million and the downgradient groundwater control and common components total approximately $4.3 million in present value. As downgradient groundwater control alone will achieve cleanup standards in the same time frame as the ASC, the ASC alternative would require spending $8 to $13 million with limited environmental benefit. Assuming optimistically that the slurry wall reduces the volume of affected groundwater by

50 percent, then the present value cost savings realized by adding the downgradient groundwater control components would be approximately $600,000. This amount reflects reduced treatment costs such as pumping, chemical usage, and solids handling. Spending an additional $8 to $13 million on the capital costs of the ASC components alone, to save at best $600,000 over an uncertain volume of the CKD-affected groundwater plume, is a disproportionate cost. PASC will also achieve source control using passive systems (i.e., gravity drain) at approximately one-third the cost of ASC.

PASC, a more cost-effective alternative, offers a more promising option to meet applicable remedy selection criteria. PASC includes a source control component, the gravity drain, combined with the passive funnel system of slurry walls to direct the groundwater to an in situ treatment zone. The FGT components of PASC achieve compliance with cleanup standards, whether the gravity drain is added or not. However, the gravity drain is a relatively cost effective method to reduce the volume of water that contacts the CKD.

PASC, PTW, GWC, and FGT have similar costs, and all meet cleanup standards. In addition, all four reduce the mobility and toxicity of hazardous substances. However, PASC (and to a lesser extent, FGT) has a higher degree of permanence than PTW and GWC because it also reduces the volume of hazardous substances in groundwater. PASC offers this additional permanence without greatly elevating costs, implementability concerns, or short-term risks. Based on the disproportionate cost analysis provided in WAC 173-340-360(3)(e), PASC uses permanent solutions to the maximum extent practicable.

5.4 Provide a Reasonable Restoration Time Frame

Section 4 presented an analysis of restoration time frames for the alternatives in accordance with MTCA and the 1999 AO. All six alternatives provide for a reasonable restoration time frame. Except for the first groundwater treatment scenario used for PSR, all alternatives will meet cleanup standards in the same approximate time frame. Under the first PSR groundwater treatment scenario, the treatment component would allow the alternative to achieve cleanup standards initially at the conditional POC. Moreover, under this scenario, the cleanup standards at a standard POC would be met in approximately five years. However, as discussed above, Lehigh believes this assumption is unrealistic. It is more realistic to assume that, because PSR removes only part of the CKD in contact with groundwater and does not address potential for sidewall seeps intrusion into the Closed CKD Pile or other long term changes in hydrogeologic conditions, treatment would instead continue indefinitely. Therefore all alternatives would meet cleanup standards, at a conditional point of compliance, in the same approximate time frame.

5.5 Consider Public Concerns

The MTCA public review process will give the public several opportunities for input to the remedy selection process. The public will also have the opportunity to review and comment on the project documents. Ecology will address public concerns before finalizing this document. Therefore, public comment will be considered for each of the alternatives, giving them the same ranking for this criterion.

5.6 Prevent Domestic use of CKD-Affected Groundwater

Section 4 evaluates the alternatives based on this criterion. This is not a discriminating factor because under each alternative Lehigh will record restrictive covenants that will prohibit the domestic use of CKD-affected water on its land (see Exhibit ES-4).

5.7 Results of Comparative Analysis

Although GWC is the most cost-effective alternative that will satisfy the MTCA criteria, PASC balances the applicable remedy selection criteria in a way that meets cleanup standards, provides a significant degree of permanence, and reduces the short-term risks, implementability concerns, and high cost associated with PSR. PASC is recommended as the final remedy at the Site in preference to GWC, FGT, PTW, ASC, or PSR. Exhibits 4.1-1 through 4.1-6 present the evaluations of each alternative with respect to the selection criteria, and a comparative summary. Overall, PASC ranked “very high” in relation the other alternatives, with GWC ranking “high.” Although PTW and FGT rank “high” as well, the relative inflexibility of these systems, combined with the higher capital (construction) costs, place them lower in rank when compared to GWC. Although PASC costs slightly more than PTW and FGT, PASC includes a source control with a high degree of permanence that is not cost-disproportionate.

PASC offers the following key advantages:

- Meets cleanup levels and ARARs and therefore provides protection of human health and the environment;
- Uses demonstrated and proven technologies that are technically and administratively implementable;
- Has a high degree of permanence because it will permanently reduce the toxicity and mobility of arsenic in groundwater;
- Reduces the volume generated of CKD-affected groundwater;
- Avoids the construction risks, technical implementability problems, and high cost of PSR; and
- Exhibits a high amount of benefit for the costs incurred.

6. CONCLUSIONS

6.1 Feasibility Study Conclusions

Ecology began its regulatory oversight of the investigation/remediation of the Site in 1991. Lehigh has implemented remedial actions at the Site since 1996 to address potential CKD exposure pathways including direct contact, inhalation, and water infiltration into the Closed CKD Pile. These actions were completed under the authority of hazardous waste management regulations, and were characterized as "CKD Pile Closure." They have been effective and important remedial measures. The closure "source control" measures, the cover and surface water management facilities, have performed as designed.

After the completion of the above-noted remedial measures, groundwater (including its potential impact on Sullivan Creek) remained the medium of concern. Consequently, Ecology required Lehigh to address the CKD-affected groundwater downgradient of the Closed CKD Pile. Significant investigatory work, documented in a series of reports and culminating in the Remedial Investigation Report, determined that the CKD-affected groundwater exceeds MTCA cleanup levels for pH and arsenic. In addition to investigatory work, Lehigh conducted a significant interim action in 1998, when it re-graded the WDOT "deck" to fill low areas where seeps of high pH groundwater ponded, posing a potential risk of direct contact.

This Revised dFSTR evaluates six alternatives, screened from a list of 20, and recommends a remedy in accordance with Washington Administrative Code (WAC) 173-340-350 et. seq. and the 1999 AO. After a thorough evaluation and comparison of the alternatives using the MTCA and 1999 AO criteria, and several discussions and meetings with Ecology over the past year, Lehigh concludes that Partial Additional Source Control (PASC) (a combination of source control and downgradient in situ groundwater treatment) provides the most effective and practical remedy for the Site. The PASC alternative balances applicable remedy selection criteria in a way that meets cleanup standards and best comply with Washington State procedures, regulations and laws.

PASC:

- Implements a practical source control technology that reduces the volume of water that contacts CKD, decreasing the size of the CKD-affected groundwater plume over the long term;

- Uses a demonstrated groundwater treatment technology that will meet cleanup levels and ARARs, and therefore protects human health and the environment;

- Exhibits a high degree of permanence because it provides in situ groundwater treatment that irreversibly treats the constituents of concern (pH and arsenic), permanently reducing their toxicity and mobility;

- Exerts a great degree of control over the groundwater, reducing the potential for gaps in treatment;

- Has a construction cost that is reasonable when compared to the less practical and more risky PSR and ASC alternatives;

- Produces no residual waste; and

- Achieves the greatest benefit for the least cost.

For these reasons, Lehigh recommends PASC as the Site remedy.

6.2 Next Steps

Following finalization of the FSTR, Ecology drafts the CAP. The CAP outlines final design elements for the Site groundwater remedy. Lehigh incorporates the design elements described in the CAP into the final design documents. The design documents show details such as the actual remedy component layout, operating parameter calculations, and design details of the selected alternative.

Lehigh will install and operate the remedy components in compliance with the documents prepared during detailed design, as follows:

- Site Operations Plan, including Operation and Maintenance Manual;
- Compliance Monitoring Plan;
- Health and Safety Plan;
- Contingency Plan; and
- Conditions of required permits and regulatory approvals.

Ecology will review and approve these documents during the design phase prior to initiation of remedy installation field activities.

6.3 <u>Implementation Schedule</u>

Lehigh is committed to implementing the selected groundwater remedy as soon as feasible. Exhibit 6.4-1 presents a preliminary schedule for design, procurement, and installation of system components for the PASC remedy. Actual construction depends on:

- Regulatory review and permitting time frames (primarily the NPDES process);

- Coordinated public participation; and

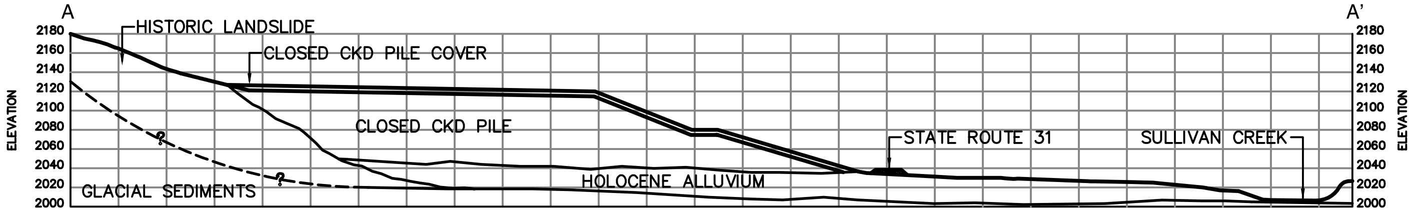
- Favorable weather conditions.

The schedule will be updated during the final remedy selection process, as well as during the design and procurement phases, in preparation for full-scale field installation.

EXHIBIT 1.1-1

AGREED ORDER COMPLIANCE CHECKLIST
AGREED ORDER NO. DE99HS-E941
FINAL DRAFT FEASIBILITY STUDY TECHNICAL REPORT
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON
(UPDATED MAY 2005)

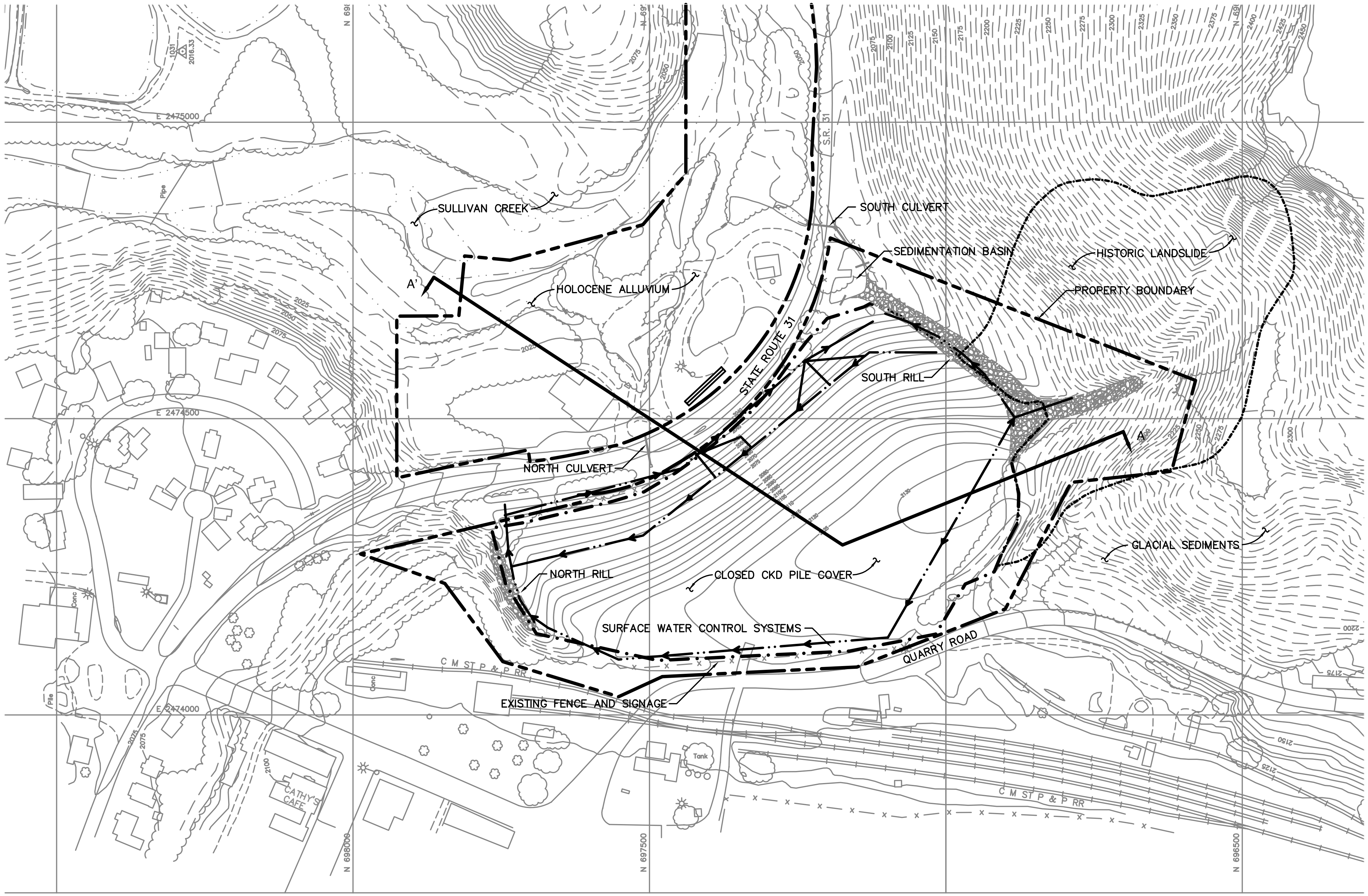
DELIVERABLE NO.	ITEM	A.O. TASK	COMPLANCE DATE	SUBMITTAL DATE
1	Draft Work Plan for Remedial Investigation and Feasibility Study	1	6 Oct 1999	6 Oct 1999
2	Final Work Plan for Remedial Investigation and Feasibility Study	1	15 Oct 1999	15 Oct 1999
3	Begin Implementation of RI and FS	2	1 Nov 1999	1 Nov 1999
4	Draft Remedial Investigation Technical Report	3	15 Feb 2000	15 Feb 2000
5	Final Remedial Investigation Technical Report	3	5 Oct 2001	5 Oct 2001
6	Pilot Treatment Construction Report	4	4 Apr 2003	3 Apr 2003
7	Feasibility Study Technical Memorandum	4	23 May 2003	22 May 2003
8	Feasibility Study Technical Report	4		
8a	Draft Feasibility Study Technical Report	4	7 Nov 2003	12 Nov 2003
8b	Revised Draft Feasibility Study Technical Report	4	4 March 2005	4 March 2005
8c	**Final Revised Draft Feasibility Study Technical Report**	**4**	**5 May 2005**	**5 May 2005**
9	Draft Cleanup Action Plan	-		
10	Final Cleanup Action Plan	-		
11	Responsive Summary	-		
12	Break Ground to Install Remedy	-		
13	Remedy Installation Complete	-		
PERIODIC SUBMITTALS				
PS	RI/FS Progress Reports		Quarterly	

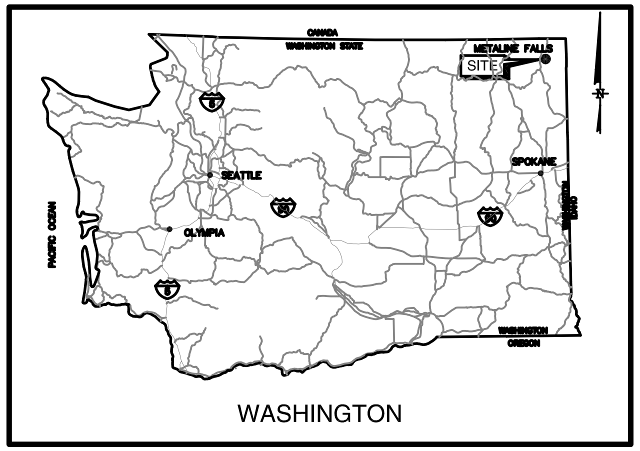


SECTION A-A'

LEGEND

CLOSED CKD PILE (EXTENTS)
SURFACE WATER CONTROL SYSTEMS
PILOT SYSTEM
EXISTING FENCE AND SIGNAGE
PROPERTY BOUNDARY





LOCATION MAP

100 50 0 100 200
SCALE IN FEET

DRAFT

LEHIGH
HEIDELBERGCEMENT Group

GEOSYNTEC CONSULTANTS
2100 MAIN STREET, SUITE 150
HUNTINGTON BEACH, CALIFORNIA 92648
TELEPHONE: (714) 969-0800

PROJECT:
LEHIGH CEMENT COMPANY CLOSED CKD PILE
METALINE FALLS, WASHINGTON
REVISED DRAFT FEASIBILITY STUDY TECHNICAL REPORT

TITLE:
SITE LOCATION, LAYOUT AND EXISTING CLOSURE WORKS

DATE:	MARCH 2005	CHECKED BY:	JAC	SCALE:	AS SHOWN	EXHIBIT NO:
DESIGN BY:	EDS	REVIEWED BY: (PROJ. MGR.)	TRS	JOB NO.:	HR0196-12	2.2-1
DRAWN BY:	SLB	DOCUMENT NO:		FILE NO:	0196F118	

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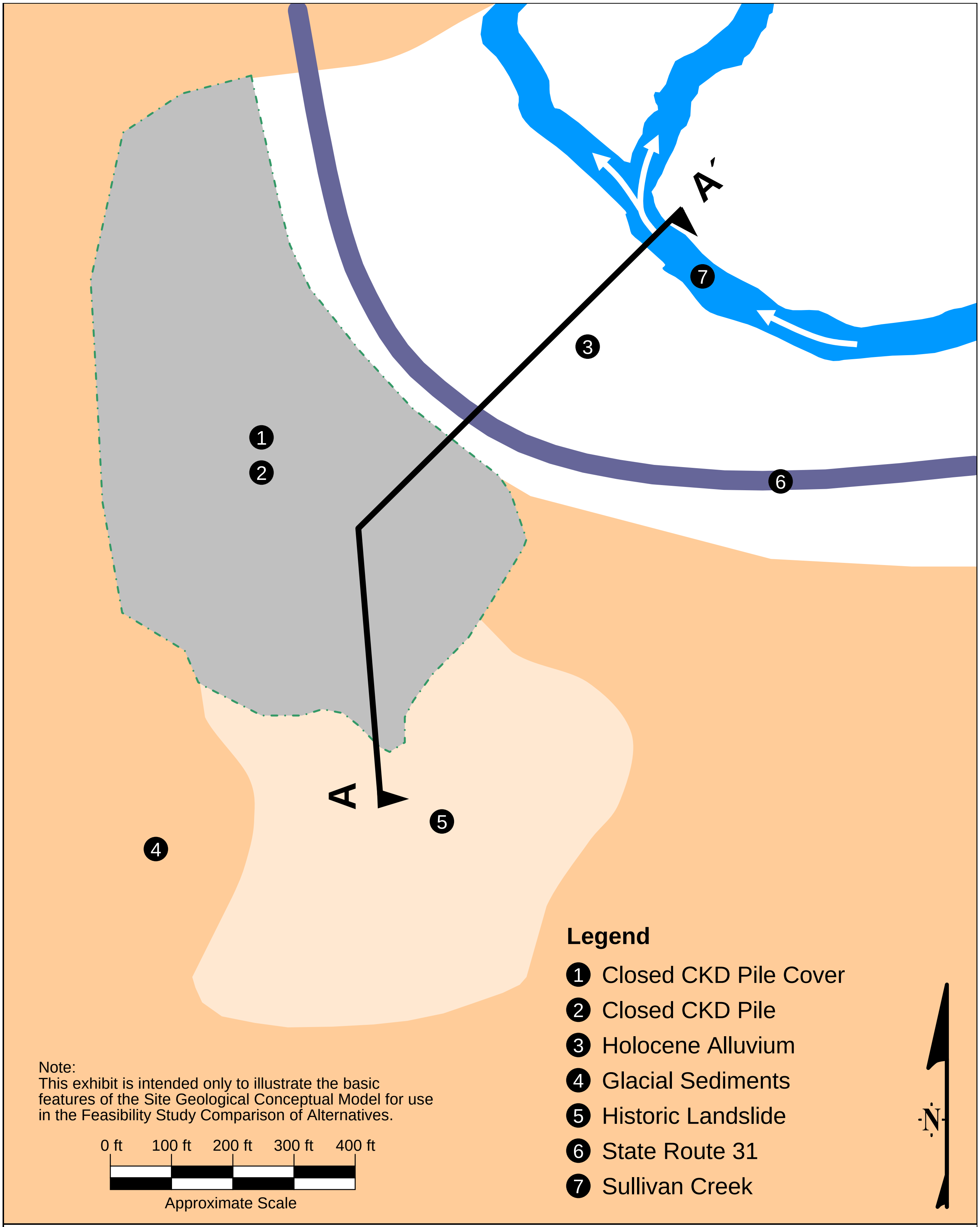
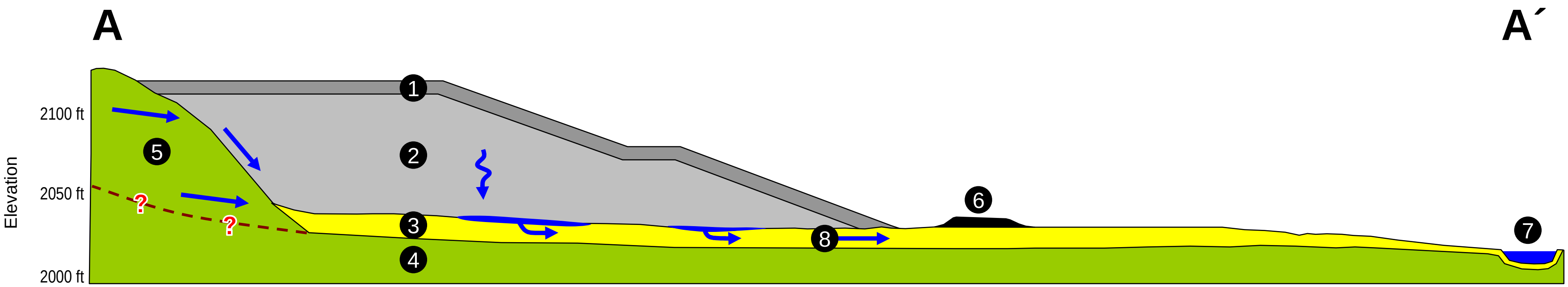


Note:
This exhibit is intended only to illustrate the basic features of the Site Geological Conceptual Model for use in the Feasibility Study Comparison of Alternatives.

GEOSYNTEC CONSULTANTS

CONCEPTUAL SITE GEOLOGY
REVISED DRAFT FEASIBILITY STUDY TECHNICAL REPORT
LEHIGH CEMENT COMPANY CLOSED CKD PILE
METALINE FALLS, WASHINGTON

EXHIBIT NO.	2.3-1
PROJECT NO.	HR0196-12
DATE	MARCH 2005



Legend

- ❶ Closed CKD Pile Cover
- ❷ Closed CKD Pile
- ❸ Holocene Alluvium
- ❹ Glacial Sediments
- ❺ Historic Landslide
- ❻ State Route 31
- ❼ Sullivan Creek
- ❽ Estimated Groundwater Flow Direction

0 ft 50 ft 100 ft 150 ft 200 ft

Approximate Scale

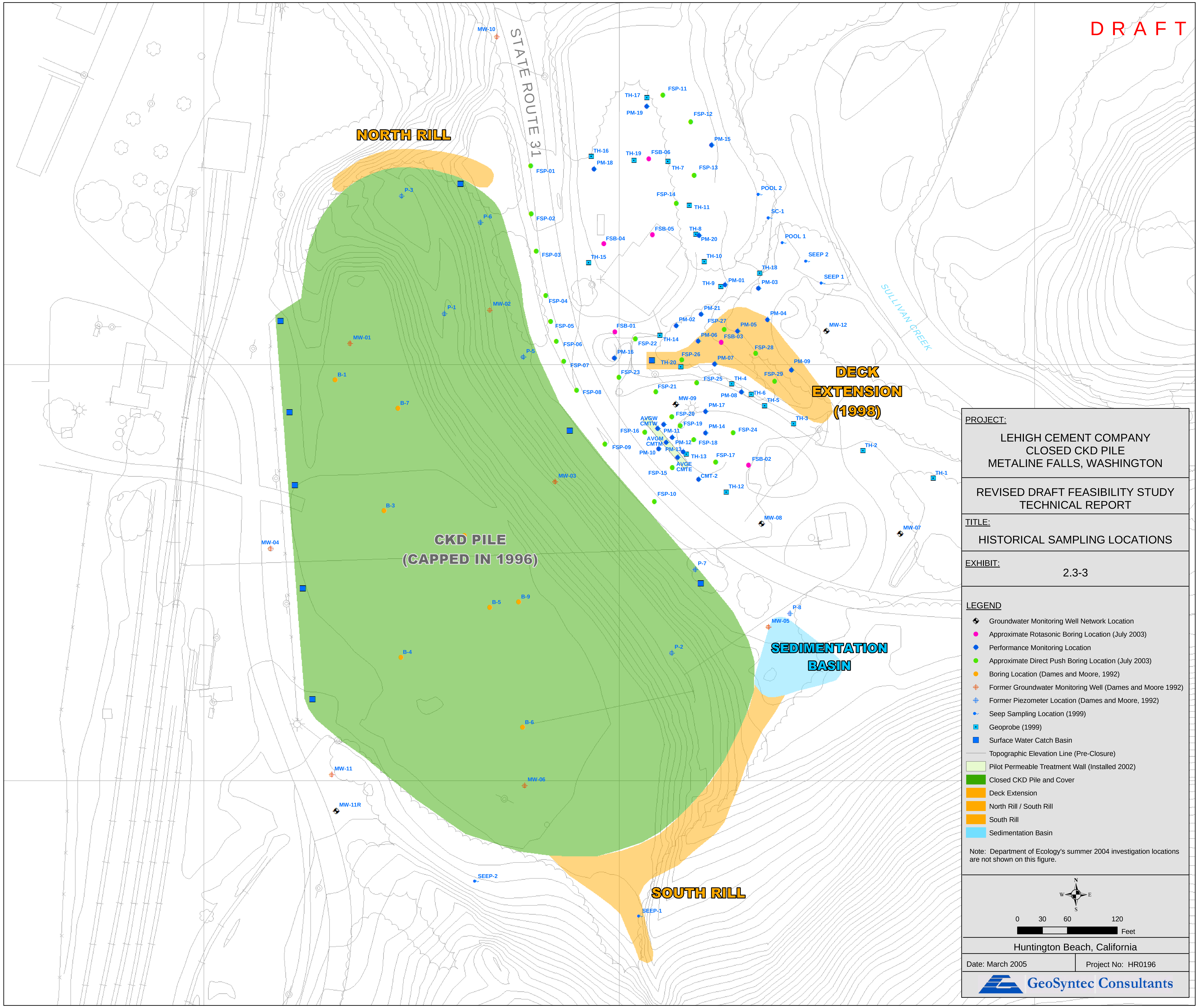
Note:
This exhibit is intended only to illustrate the basic features of the Site Hydrogeologic Conceptual Model for use in the Feasibility Study Comparison of Alternatives.

GEOSYNTEC CONSULTANTS

CONCEPTUAL SITE HYDROGEOLOGY
REVISED DRAFT FEASIBILITY STUDY TECHNICAL REPORT
LEHIGH CEMENT COMPANY CLOSED CKD PILE
METALINE FALLS, WASHINGTON

EXHIBIT NO.	2.3-2
PROJECT NO.	HR0196-12
DATE	MARCH 2005

DRAFT



PROJECT:

LEHIGH CEMENT COMPANY
CLOSED CKD PILE
METALINE FALLS, WASHINGTON

REVISED DRAFT FEASIBILITY STUDY
TECHNICAL REPORT

TITLE:

HISTORICAL SAMPLING LOCATIONS

EXHIBIT:

2.3-3

LEGEND

- ⊕ Groundwater Monitoring Well Network Location
- ● Approximate Rotasonic Boring Location (July 2003)
- ◆ Performance Monitoring Location
- ● Approximate Direct Push Boring Location (July 2003)
- ● Boring Location (Dames and Moore, 1992)
- ⌗ Former Groundwater Monitoring Well (Dames and Moore 1992)
- ⌗ Former Piezometer Location (Dames and Moore, 1992)
- • Seep Sampling Location (1999)
- ▣ Geoprobe (1999)
- ■ Surface Water Catch Basin
- — Topographic Elevation Line (Pre-Closure)
- ☐ Pilot Permeable Treatment Wall (Installed 2002)
- 🟩 Closed CKD Pile and Cover
- 🟧 Deck Extension
- 🟧 North Rill / South Rill
- 🟧 South Rill
- 🟦 Sedimentation Basin

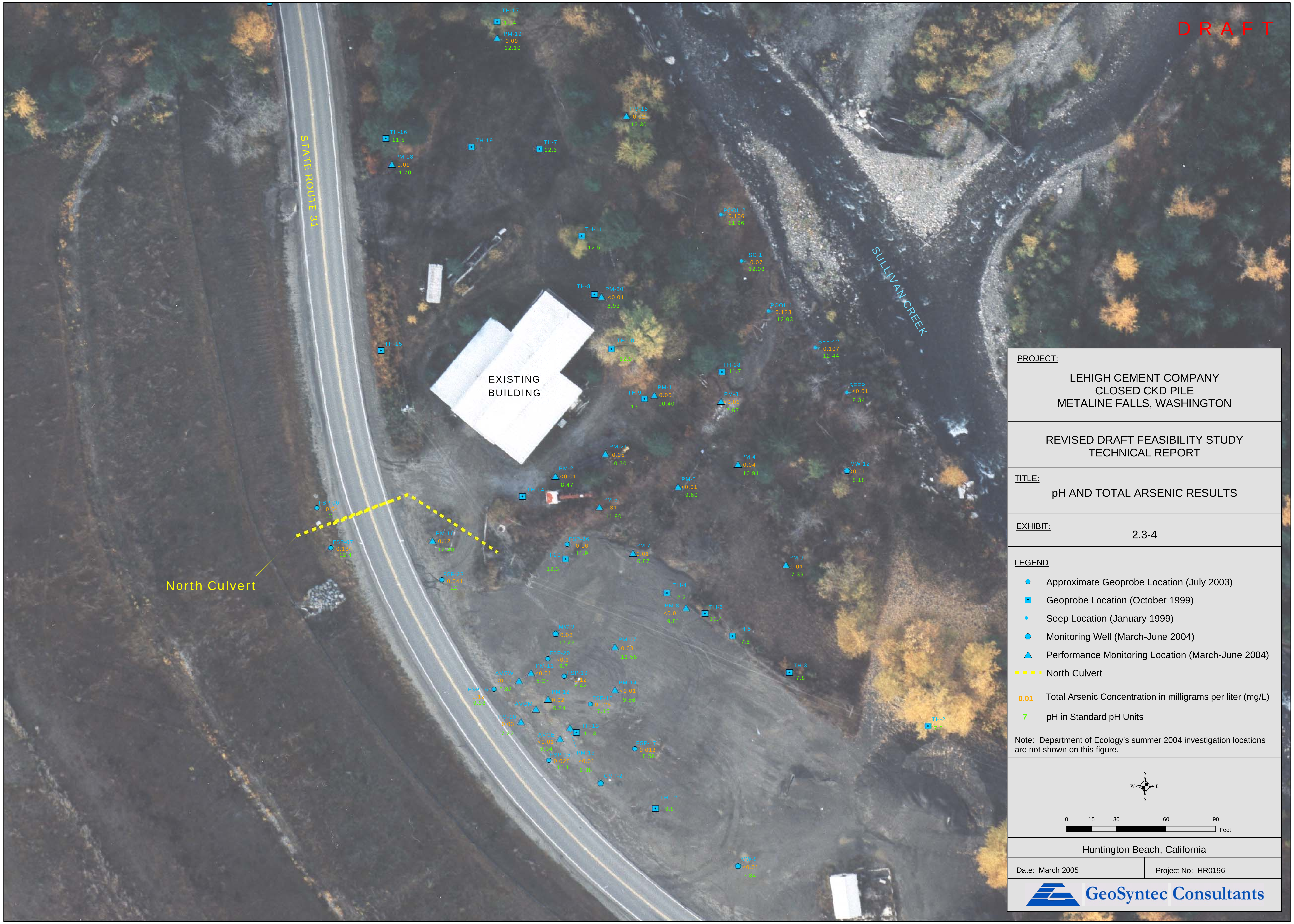
Note: Department of Ecology's summer 2004 investigation locations are not shown on this figure.

Huntington Beach, California

Date: March 2005

Project No: HR0196

GeoSyntec Consultants



PROJECT:

LEHIGH CEMENT COMPANY
CLOSED CKD PILE
METALINE FALLS, WASHINGTON

REVISED DRAFT FEASIBILITY STUDY
TECHNICAL REPORT

TITLE:

pH AND TOTAL ARSENIC RESULTS

EXHIBIT:

2.3-4

LEGEND

- ● Approximate Geoprobe Location (July 2003)
- ▣ Geoprobe Location (October 1999)
- • Seep Location (January 1999)
- ⬟ Monitoring Well (March-June 2004)
- ▲ Performance Monitoring Location (March-June 2004)
- - - - North Culvert
- 0.01 Total Arsenic Concentration in milligrams per liter (mg/L)
- 7 pH in Standard pH Units

Note: Department of Ecology's summer 2004 investigation locations are not shown on this figure.

Huntington Beach, California

Date: March 2005

Project No: HR0196

GeoSyntec Consultants

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EXHIBIT 3.2-1
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
REVISED DRAFT FEASIBILITY STUDY TECHNICAL REPORT
LEHIGH CEMENT COMPANY CLOSED CKD PILE
METALINE FALLS, WASHINGTON

ARAR	ALT. # 1 - PTW	ALT. # 2 - GWC	ALT. # 3 – ASC	ALT. # 4 - PSR	ALT. # 5 – FGT	ALT. # 6 – PASC
Section 404 Dredge and Fill Permit	Likely Not Applicable	Likely Not Applicable	Likely Not Applicable	Likely Not Applicable	Applicable – Would be Met	Applicable – Would be Met
Section 10 Rivers and Harbors Act	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Applicable – Would be Met	Applicable – Would be Met
Section 401 Water Quality Certification	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Applicable – Would be Met	Applicable – Would be Met
Surface Water Quality Standards	Applicable – Would be Met	Applicable – Would be Met	Applicable – Would be Met	Applicable – Would be Met	Applicable – Would be Met	Applicable – Would be Met
Shoreline Management Act	Not Applicable	Applicable – Would be Met	Applicable – Would be Met	Applicable – Would be Met	Applicable – Would be Met	Applicable – Would be Met
Floodplain Management Act	Applicable – Would be Met	Applicable – Would be Met	Applicable – Would be Met	Applicable – Would be Met	Applicable – Would be Met	Applicable – Would be Met
Critical Areas Ordinance	Applicable – Would be Met	Applicable – Would be Met	Applicable – Would be Met	Applicable – Would be Met	Applicable – Would be Met	Applicable – Would be Met
State Dangerous Waste Regulations	Not Applicable	Probably Not Applicable – Treatment Solids not Expected to Designate as Dangerous Waste	Probably Not Applicable – Treatment Solids not Expected to Designate as Dangerous Waste	Applicable – CKD Removed from a Closed Facility, Stored Temporarily, Disposed off-site. CKD Pile (re-) Closure Follows – Would be Met.	Not Applicable	Not Applicable
State Waste Discharge Regulations	Not Applicable	Applicable to Treated Water Discharged to Sullivan Creek – Would be Met	Applicable to Treated Water Discharged to Sullivan Creek – Would be Met	Applicable to Treated Water Discharged to Sullivan Creek – Would be Met	Applicable to Treated Water Discharged to Sullivan Creek and to Groundwater – Would be Met	Applicable to Treated Water Discharged to Sullivan Creek and to Groundwater – Would be Met
Clean Water Act/ NPDES	Possibly Applicable to Construction Stormwater if Disturbed Area Exceeds One Acre – Would be Met	Applicable to Treated Water Discharged to Sullivan Creek – Would be Met	Applicable to Construction Stormwater and Treated Water Discharged to Sullivan Creek – Would be Met	Applicable to Construction Stormwater and Treated Water Discharged to Sullivan Creek – Would be Met	Applicable to Construction Stormwater and Treated Water Discharged to Sullivan Creek – Would be Met	Applicable to Construction Stormwater and Treated Water Discharged to Sullivan Creek – Would be Met
National Toxics Rule	Site background levels govern	Site background levels govern	Site background levels govern	Site background levels govern	Site background levels govern	Site background levels govern
Hydraulics Project Approval	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Applicable – Would be Met	Applicable – Would be Met
Aquatic Use Authorization	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Potentially Applicable – Would be Met	Potentially Applicable – Would be Met
Water right permit	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

EXHIBIT 4.1-1
ALTERNATIVE #1 EVALUATION
PERMEABLE TREATMENT WALL (PTW)
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

PTW Component	Description
PTW	400-ft extension of the current 80-ft Pilot System. The PTW treats groundwater with carbon dioxide in situ via diffusion tubing installed in the subsurface.
Operation and Maintenance	Carbon dioxide stored in a tank at the Site. Carbon dioxide storage and diffusion network require maintenance.
Short Term Compliance Monitoring	Site-wide quarterly groundwater monitoring.
Long-Term Compliance Monitoring	Groundwater monitoring at the point of compliance.
New Institutional Controls	Fence and warning signs; restrictive covenants.

Criteria	Comments	Rating
Protect Human Health and the Environment	Groundwater pH is decreased and arsenic is precipitated. Downgradient groundwater would meet cleanup standards, providing added protection to Sullivan Creek. No treatment residuals are formed requiring management.	Yes
Comply with Cleanup Standards	Demonstrated PTW technology used to treat Site groundwater.	Yes
Comply with ARARs	PTW complies with ARARs.	Yes
Provide for Compliance Monitoring • Protection • Performance • Confirmation	Protection – Provision of Health and Safety Plans during construction Performance – Groundwater monitoring wells downgradient to monitor progress Confirmation – POC groundwater monitoring wells	Yes Yes Yes
Use of Permanent Solutions to the Maximum Extent Practicable(1)	**Disproportionate Cost Analysis(1)**	
Protectiveness	Able to meet the cleanup standards. Minor implementation risks.	Moderate-High
Permanence	Treatment-based, indefinite treatment.	High
Cost (in millions of dollars)(2) Implementation OMM Total	See Appendix E for details.	 $2.1 $2.2 $4.3
Effectiveness over the Long-Term	Active components.	Moderate-High
Management of Short-Term Risks	Demonstrated installation techniques.	Easy
Technical and Administrative Implementability	Experience from the Pilot System. Installation on Lehigh's property. Light permitting.	High
Consideration of Public Concerns(3)	Public will have the opportunity to review and provide comment on alternatives.	Yes
Disproportionate Cost Analysis Results	**Practicable, Moderate Permanence**	
Provide for a Reasonable Restoration Time Frame	The restoration timeframe for a conditional POC would be similar to other alternatives.	Yes
Consider Public Concerns(3)	Public will have the opportunity to review and provide comment on alternatives.	Yes
Prevent Domestic Use of CKD-Affected Groundwater	Meets cleanup levels; restrictive covenant.	Yes

Note: (1) PSR has the highest degree of permanence.
(2) Costs presented here for a 30-year project duration using a 7 percent discount rate. The detailed cost tables show results for other project durations and discount rates.
(3) The public will be provided with opportunities to comment and provide input regarding the alternatives. Ecology will address public comments before finalizing this document.

EXHIBIT 4.1-2
ALTERNATIVE #2 EVALUATION
GROUNDWATER CONTROL (GWC)
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

GWC Component	Description
GWC	Combination of the Pilot System in its current operational mode and 16 extraction wells installed between Highway 31 and Sullivan Creek. Approximately 55 gpm of groundwater is treated aboveground using carbon dioxide and ferric chloride before discharge to Sullivan Creek.
Operation and Maintenance	Diffusion network, chemical storage, extraction wells and treatment system operation and maintenance required.
Short Term Compliance Monitoring	Site-wide groundwater quarterly monitoring plus discharge monitoring.
Long-Term Compliance Monitoring	Groundwater monitoring at the point of compliance. Discharge monitoring.
New Institutional Controls	Fence and warning signs; restrictive covenants.

Criteria	Comments	Rating
Protect Human Health and the Environment	Groundwater pH is decreased and arsenic is precipitated. Downgradient groundwater would meet cleanup standards, providing added protection to Sullivan Creek. Lesser treatment residuals are formed.	Yes
Comply with Cleanup Standards	PTW and P&T are demonstrated and proven technologies to treat Site groundwater.	Yes
Comply with ARARs	GWC complies with ARARs.	Yes
Provide for Compliance Monitoring • Protection • Performance • Confirmation	Protection – Provision of Health and Safety Plans during construction Performance – Groundwater monitoring wells downgradient to monitor progress Confirmation – POC groundwater monitoring wells	Yes Yes Yes
Use of Permanent Solutions to the Maximum Extent Practicable[1]	**Disproportionate Cost Analysis**[1]	
Protectiveness	Able to meet the cleanup standards. Minor implementation risks.	Moderate-High
Permanence	Treatment-based, indefinite treatment.	High
Cost (in millions of dollars)[2] Implementation OMM Total	See Appendix E for details.	 $1.1 $3.0 $4.1
Effectiveness over the Long-Term	Active components.	Moderate-High
Management of Short-Term Risks	Conventional, rapid installation.	Easy
Technical and Administrative Implementability	Straightforward installation. Lehigh property, NPDES, other permits.	Moderate
Consideration of Public Concerns[3]	Public will have the opportunity to review and provide comment on alternatives.	Yes
Disproportionate Cost Analysis Results	**Practicable, Moderate Permanence**	
Provide for a Reasonable Restoration Time Frame	The restoration timeframe for a conditional POC would be similar to other alternatives.	Yes
Consider Public Concerns[3]	Public will have the opportunity to review and provide comment on alternatives.	Yes
Prevent Domestic Use of CKD-Affected Groundwater	Meets cleanup levels; restrictive covenant.	Yes

Note: (1) PSR has the highest degree of permanence.
(2) Costs presented here for a 30-year project duration using a 7 percent discount rate. The detailed cost tables show results for other project durations and discount rates.
(3) The public will be provided with opportunities to comment and provide input regarding the alternatives. Ecology will address public comments before finalizing this document.

EXHIBIT 4.1-3
ALTERNATIVE #3 EVALUATION
ADDITIONAL SOURCE CONTROL (ASC)
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

ASC Component	Description
ASC	A combination of an upgradient slurry wall, upgradient groundwater extraction, and downgradient P&T.
Operation and Maintenance	Upgradient groundwater control and discharge maintenance. Chemical storage, extraction wells and treatment system operation and maintenance required.
Short Term Compliance Monitoring	Site-wide quarterly groundwater monitoring plus discharge monitoring.
Long-Term Compliance Monitoring	Groundwater monitoring at the point of compliance. Discharge monitoring.
New Institutional Controls	Fence and warning signs; restrictive covenants.

Criteria	Comments	Rating
Protect Human Health and the Environment	ASC uses downgradient P&T to treat the affected groundwater that continues despite the slurry wall and upgradient dewatering.	Yes
Comply with Cleanup Standards	Slurry wall reduces groundwater volume that contacts CKD, and P&T is a proven technology to treat groundwater to meet cleanup standards.	Yes
Comply with ARARs	ASC complies with ARARs.	Yes
Provide for Compliance Monitoring • Protection • Performance • Confirmation	Protection – Provision of Health and Safety Plans during construction Performance – Groundwater monitoring wells downgradient to monitor progress Confirmation – POC groundwater monitoring wells	Yes Yes Yes
Use of Permanent Solutions to the Maximum Extent Practicable(1)	**Disproportionate Cost Analysis**(1)	
Protectiveness	Decreases CKD-affected water generation. Able to meet the cleanup standards. Moderate to high implementation risks.	High
Permanence	Source control plus treatment-based component, indefinite treatment.	Higher
Cost (in millions of dollars)(2) Implementation OMM Total	See Appendix E for details.	 \$9.1-\$14 \$3.2 \$12.3-\$17.2
Effectiveness over the Long-Term	Active components.	Moderate-Low
Management of Short-Term Risks	Dangerous conditions, especially in the landslide area.	Difficult
Technical and Administrative Implementability	Non-Lehigh property, NPDES, other permits.	Moderate-Low
Consideration of Public Concerns(3)	Public will have the opportunity to review and provide comment on alternatives.	Yes
Disproportionate Cost Analysis Results	**Disproportionate Costs**	
Provide for a Reasonable Restoration Time Frame	The restoration timeframe for a conditional POC would be similar to other alternatives.	Yes
Consider Public Concerns(3)	Public will have the opportunity to review and provide comment on alternatives.	Yes
Prevent Domestic Use of CKD-Affected Groundwater	Meets cleanup levels; restrictive covenant.	Yes

Note: (1) PSR has the highest degree of permanence.
(2) Costs presented here for a 30-year project duration using a 7 percent discount rate. The detailed cost tables show results for other project durations and discount rates.
(3) The public will be provided with opportunities to comment and provide input regarding the alternatives. Ecology will address public comments before finalizing this document.

EXHIBIT 4.1-4
ALTERNATIVE #4 EVALUATION
PARTIAL SOURCE REMOVAL (PSR)
SCENARIO 1: GROUNDWATER TREATMENT FOR FIVE YEARS
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

PSR Component	Description
PSR	Removal and replacement of the toe and middle of the Closed CKD Pile with inert material; downgradient GWC.
Operation and Maintenance	After implementation and initial inspections, no sustained operation of the Closed CKD Pile required. GWC maintenance for 5 years.
Short Term Compliance Monitoring	Downgradient groundwater monitoring.
Long-Term Compliance Monitoring	Groundwater monitoring at the point of compliance.
New Institutional Controls	Fence and warning signs; restrictive covenants.

Criteria	Comments	Rating
Protect Human Health and the Environment	Short-term risks. GWC treats downgradient groundwater until standard POC cleanup.	Yes
Comply with Cleanup Standards	PSR results in compliance with clean-up standards.	Yes
Comply with ARARs	PSR complies with ARARs.	Yes
Provide for Compliance Monitoring • Protection • Performance • Confirmation	Protection – Provision of Health and Safety Plans during construction Performance – Indirectly using groundwater monitoring wells downgradient to monitor progress Confirmation – POC groundwater monitoring wells	 Yes Yes Yes
Use of Permanent Solutions to the Maximum Extent Practicable[(1)]	**Disproportionate Cost Analysis**[(1)]	
Protectiveness	Significant risks include: opening the Closed CKD Pile, handling CKD, excavation of the CKD, transportation. PSR also includes off-site disposal.	Low
Permanence	No groundwater treatment required after five years.	Highest-Baseline
Cost (in millions of dollars)[(2)] Implementation OMM Total	See Appendix E for details.	 $17.4-$24.2 $1.4 $18.8-$25.6
Effectiveness over the Long-Term	Unlikely potential for no downgradient GWC after 5 years[(1)].	Low
Management of Short-Term Risks	Significant risks.	Very Difficult
Technical and Administrative Implementability	Technical concerns, significant risks, non all on Lehigh property, several years to implement, significant permitting.	Low
Consideration of Public Concerns[(3)]	Public will have the opportunity to review and provide comment on alternatives.	Yes
Disproportionate Cost Analysis Results	**Very Difficult, Disproportionate Costs**	
Provide for a Reasonable Restoration Time Frame	The restoration timeframe for a conditional POC would be similar to other alternatives. Standard POC uncertain.	Yes
Consider Public Concerns[(3)]	Public will have the opportunity to review and provide comment on alternatives.	Yes
Prevent Domestic Use of CKD-Affected Groundwater	Meets cleanup levels; restrictive covenant.	Yes

Note:
(1) PSR has the highest degree of permanence.
(2) Costs presented here for a 30-year project duration using a 7 percent discount rate. The detailed cost tables show results for other project durations and discount rates.
(3) The public will be provided with opportunities to comment and provide input regarding the alternatives. Ecology will address public comments before finalizing this document.

EXHIBIT 4.1-5
ALTERNATIVE #4 EVALUATION
PARTIAL SOURCE REMOVAL (PSR)
SCENARIO 2: INDEFINITE GROUNDWATER TREATMENT PERIOD
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

PSR Component	Description
PSR	Removal and replacement of the toe and middle of the Closed CKD Pile with inert material; downgradient GWC.
Operation and Maintenance	After implementation and initial inspections, no sustained operation of the Closed CKD Pile required. GWC required for indefinite future time period.
Short Term Compliance Monitoring	Downgradient groundwater monitoring.
Long-Term Compliance Monitoring	Groundwater monitoring at the point of compliance.
New Institutional Controls	Fence and warning signs; restrictive covenants.

Criteria	Comments	Rating
Protect Human Health and the Environment	Short-term risks, long-term compliance.	Yes
Comply with Cleanup Standards	PSR will result in compliance with clean-up standards.	Yes
Comply with ARARs	PSR would comply with ARARs.	Yes
Provide for Compliance Monitoring • Protection • Performance • Confirmation	Protection – Provision of Health and Safety Plans during construction Performance – Indirectly using groundwater monitoring wells downgradient to monitor progress Confirmation – POC groundwater monitoring wells	Yes Yes Yes
Use of Permanent Solutions to the Maximum Extent Practicable(1)	**Disproportionate Cost Analysis(1)**	
Protectiveness	Significant risks include: opening the Closed CKD Pile, handling CKD, excavation of the CKD, transportation. PSR also includes off-site disposal.	Low
Permanence	Potential source removal, indefinite treatment-based GWC.	Highest-Baseline
Cost (in millions of dollars)(2) Implementation OMM Total	See Appendix E for details.	 $17.4-$24.2 $3.0 $20.4-$27.2
Effectiveness over the Long-Term	No downgradient GWC after 5 years(1).	High
Management of Short-Term Risks	Significant risks.	Very Difficult
Technical and Administrative Implementability	Technical concerns, significant risks, non all on Lehigh property, several years to implement, significant permitting.	Low
Consideration of Public Concerns(3)	Public will have the opportunity to review and provide comment on alternatives.	Yes
Disproportionate Cost Analysis Results	**Very Difficult, Disproportionate Costs**	
Provide for a Reasonable Restoration Time Frame	The restoration timeframe for a conditional POC would be similar to other alternatives. Standard POC uncertain.	Yes
Consider Public Concerns(3)	Public will have the opportunity to review and provide comment on alternatives.	Yes
Prevent Domestic Use of CKD-Affected Groundwater	Meets cleanup levels; restrictive covenant.	Yes

Note:
(1) PSR has the highest degree of permanence.
(2) Costs presented here for a 30-year project duration using a 7 percent discount rate. The detailed cost tables show results for other project durations and discount rates.
(3) The public will be provided with opportunities to comment and provide input regarding the alternatives. Ecology will address public comments before finalizing this document.

EXHIBIT 4.1-6
ALTERNATIVE #5 EVALUATION
FUNNEL AND GATE TREATMENT (FGT)
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

FGT Component	Description
FGT	Downgradient funnel and gate to PTW treatment technology. Potential minor dewatering of the Closed CKD Pile.
Operation and Maintenance	Carbon dioxide storage for groundwater treatment. Maintenance of the carbon dioxide storage and diffusion network.
Short Term Compliance Monitoring	Site-wide quarterly groundwater monitoring plus discharge monitoring.
Long-Term Compliance Monitoring	Groundwater monitoring at the point of compliance. Discharge monitoring.
New Institutional Controls	Fence and warning signs; restrictive covenants.

Criteria	Comments	Rating
Protect Human Health and the Environment	Treats water using PTW technology.	Yes
Comply with Cleanup Standards	FGT uses demonstrated PTW technology to treat Site groundwater.	Yes
Comply with ARARs	FGT would comply with ARARs.	Yes
Provide for Compliance Monitoring • Protection • Performance • Confirmation	 Protection – Provision of Health and Safety Plans Performance – Groundwater monitoring wells along treatment flowpath Confirmation – POC groundwater monitoring wells	 Yes Yes Yes
Use of Permanent Solutions to the Maximum Extent Practicable(1)	**Disproportionate Cost Analysis(1)**	
Protectiveness	Conditional POC.	Moderate-High
Permanence	Able to meet the cleanup standards. Minor implementation risks.	High
Cost (in millions of dollars)(2) Implementation OMM Total	See Appendix E for details.	 \$2.3-\$2.6 \$2.1 \$4.4-\$4.7
Effectiveness over the Long-Term	Passive treatment components.	Moderate-High
Management of Short-Term Risks	Conventional installation.	Easy
Technical and Administrative Implementability	Relatively straightforward installation. Lehigh property, NPDES, other permits.	Moderate
Consideration of Public Concerns(3)	Public will have the opportunity to review and provide comment on alternatives.	Yes
Disproportionate Cost Analysis Results	**Practicable, Moderate Permanence**	
Provide for a Reasonable Restoration Time Frame	The restoration timeframe for a conditional POC would be similar to other alternatives.	Yes
Consider Public Concerns(3)	Public will have the opportunity to review and provide comment on alternatives.	Yes
Prevent Domestic Use of CKD-Affected Groundwater	Meets cleanup levels; restrictive covenant.	Yes

Note: (1) PSR has the highest degree of permanence.
(2) Costs presented here for a 30-year project duration using a 7 percent discount rate. The detailed cost tables show results for other project durations and discount rates.
(3) The public will be provided with opportunities to comment and provide input regarding the alternatives. Ecology will address public comments before finalizing this document.

EXHIBIT 4.1-7
ALTERNATIVE #6 EVALUATION
PARTIAL ADDITIONAL SOURCE CONTROL (PASC)
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

PASC Component	Description
PASC	FGT plus a gravity drain to intercept water upgradient of the Closed CKD Pile.
Operation and Maintenance	Same as FGT, plus occasional gravity drain assessment.
Short Term Compliance Monitoring	Site-wide quarterly groundwater monitoring plus discharge monitoring.
Long-Term Compliance Monitoring	Groundwater monitoring at the point of compliance. Discharge monitoring.
New Institutional Controls	Fence and warning signs; restrictive covenants.

Criteria	Comments	Rating
Protect Human Health and the Environment	PASC would treat groundwater like the FGT and also reduce CKD-affected water generation.	Yes
Comply with Cleanup Standards	PASC uses demonstrated PTW technology to treat Site groundwater.	Yes
Comply with ARARs	PASC would comply with ARARs.	Yes
Provide for Compliance Monitoring • Protection • Performance • Confirmation	Protection – Provision of Health and Safety Plans Performance – Same as FGT plus additional existing wells to evaluate gravity drain performance. Confirmation – POC groundwater monitoring wells	Yes Yes Yes
Use of Permanent Solutions to the Maximum Extent Practicable(1)	**Disproportionate Cost Analysis**(1)	
Protectiveness	Decreases CKD-affected water generation. Able to meet the cleanup standards. Minor implementation risks.	Highest
Permanence	Source control. Treatment-based technology, indefinite treatment.	Higher
Cost (in millions of dollars)(2) Implementation OMM Total	See Appendix E for details.	 \$2.4-\$3.0 \$2.1 \$4.5-\$5.1
Effectiveness over the Long-Term	Passive treatment components. Source control components.	High
Management of Short-Term Risks	Conventional installation.	Easy
Technical and Administrative Implementability	Relatively straightforward installation. Mostly Lehigh property except for State Route 31, NPDES, other permits.	Moderate
Consideration of Public Concerns(3)	Public will have the opportunity to review and provide comment on alternatives.	Yes
Disproportionate Cost Analysis Results	**Practicable, High Permanence**	
Provide for a Reasonable Restoration Time Frame	The restoration timeframe for a conditional POC would be similar to other alternatives.	Yes
Consider Public Concerns(3)	Public will have the opportunity to review and provide comment on alternatives.	Yes
Prevent Domestic Use of CKD-Affected Groundwater	Meets cleanup levels; restrictive covenant.	Yes

Note: (1) PSR has the highest degree of permanence.
(2) Costs presented here for a 30-year project duration using a 7 percent discount rate. The detailed cost tables show results for other project durations and discount rates.
(3) The public will be provided with opportunities to comment and provide input regarding the alternatives. Ecology will address public comments before finalizing this document.

EXHIBIT 4.1-8
COMPARISON OF ESTIMATED ALTERNATIVE COSTS
LEHIGH CEMENT COMPANY CLOSED CKD PILE
METALINE FALLS, WASHINGTON

	ALT. # 1 PTW	ALT. # 2 GWC	ALT. # 3 ASC	ALT. # 4 PSR (Scenario 1)	ALT. # 4 PSR (Scenario 2)	ALT. # 5 FGT	ALT. # 6 PASC
Capital Cost	\$2.1	\$1.1	\$9.1 - \$14	\$17.4 - \$24.2	\$17.4 - \$24.2	\$2.3 - \$2.6	\$2.4 - \$3.0
O&M	\$0.15	\$0.23	\$0.24	\$0.23 / 0.06(1)	\$0.23	\$0.15	\$0.15
Periodic Cost(2)	\$0.60	\$0.35	\$0.35	–	\$0.35	\$0.60	\$0.60
30-Year Present Cost (discount rate 7%)	\$4.3	\$4.1	\$12.3 - \$17.2	\$18.8 - \$25.6	\$20.4 - \$27.2	\$4.4 - \$4.7	\$4.5 - \$5.1
100-Year Present Cost (discount rate 7%)	\$4.6	\$4.6	\$12.7 - \$17.6	\$19 - \$25.8	\$20.9 - \$27.7	\$4.8 - \$5.1	\$4.9 - \$5.5
100-Year Cost (non-discounted)	\$20.7	\$26.2	\$35.2 - \$40.1	\$24.2 - \$31	\$42.5 - \$49.3	\$20.9 - \$21.2	\$21 - \$21.6

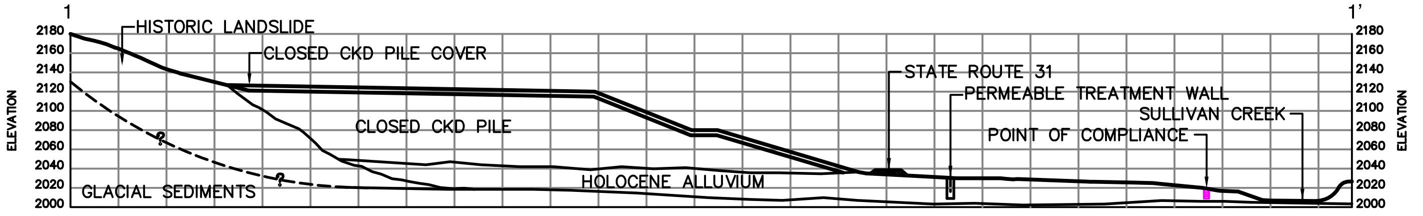
Notes: Cost is in millions of dollars.

PSR Scenario 1 – Using Ecology's assumption, groundwater will meet clean-up levels in five years without further treatment.

PSR Scenario 2 – Groundwater will not meet clean-up levels without indefinite treatment.

(1) \$230,000 per year for first five years of operation, \$60,000 per year thereafter.

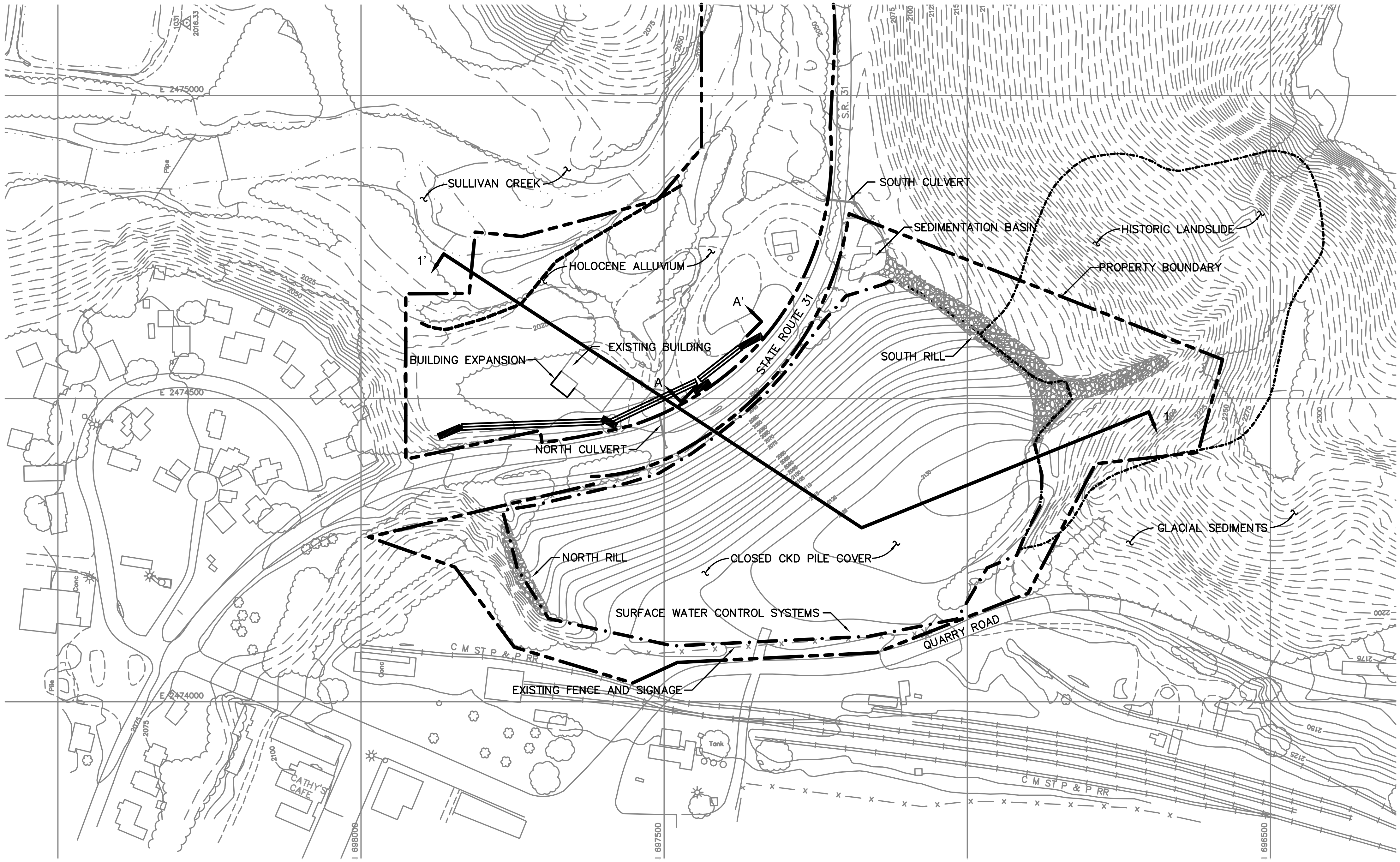
(2) Periodic cost assessed every fifteen years for large replacement items (i.e., aboveground treatment systems, buried PTW segments, etc.)



SECTION 1-1'

LEGEND

- CLOSED CKD PILE (EXTENTS)
- HISTORIC LANDSLIDE
- POINT OF COMPLIANCE
- PERMEABLE TREATMENT WALL (PTW) – TREATMENT PANEL
- PERMEABLE TREATMENT WALL (PTW) – BARRIER PANEL
- EXISTING FENCE AND SIGNAGE
- PROPERTY BOUNDARY



NOTES:

1. EXTRACTION WELLS TO BE ADDED TO ADDRESS GAPS IN TREATMENT, AS NEEDED.
2. THE ALTERNATIVE LAYOUT SHOWN ON THIS EXHIBIT IS INTENDED ONLY FOR THE PURPOSE OF ILLUSTRATION AND ONLY TO SUPPORT THE FEASIBILITY STUDY COMPARISON OF ALTERNATIVES. IF THIS ALTERNATIVE WERE TO BE SELECTED PURSUANT TO THE FEASIBILITY STUDY, THE ACTUAL REMEDY LAYOUT, LOCATION, EXTENT, AND DESIGN DETAILS WOULD BE PREPARED AND OUTLINED IN THE CLEAN–UP ACTION PLAN AND FINAL DESIGN DOCUMENTS. ACCORDINGLY, THE LOCATION, LAYOUT AND DETAILS OF ALTERNATIVE COMPONENTS AS SHOWN HERE WILL VARY.

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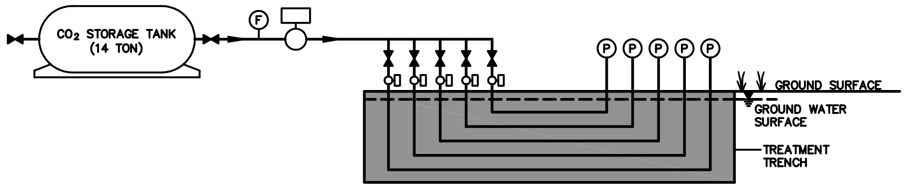
SCALE IN FEET

LEGEND

Ⓕ	FLOW INDICATOR
	PRESSURE REGULATOR
Ⓟ	PRESSURE INDICATOR
⋈	VALVE



CONCEPTUAL PROCESS DIAGRAM

SECTION A-A'

NOT TO SCALE

DRAFT

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GEOSYNTEC CONSULTANTS
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TELEPHONE: (714) 969–0800

PROJECT:
LEHIGH CEMENT COMPANY CLOSED CKD PILE
METALINE FALLS, WASHINGTON
REVISED DRAFT FEASIBILITY STUDY TECHNICAL REPORT

TITLE:
ALTERNATIVE #1
PERMEABLE TREATMENT WALL (PTW)

DATE: JANUARY 2005	CHECKED BY:	JAC	SCALE:	AS SHOWN	EXHIBIT NO:
DESIGN BY: EDS	REVIEWED BY: (PROJ. MGR.)	TRS	JOB NO.:	HR0196–12	4.3–1
DRAWN BY: SLB	DOCUMENT NO:		FILE NO:	0196F102	

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EXHIBIT 4.3-2
PERMEABLE TREATMENT WALL (PTW) COST ESTIMATE
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

ESTIMATED CAPITAL COSTS	ESTIMATED QUANTITY	UNIT	ESTIMATED UNIT COST	ESTIMATED TOTAL	Notes
1. PTW System Construction	400	lf	$ 3,100	$ 1,240,000	Approximately 400 feet PTW, 140 feet barrier walls, 20 feet deep
2. PTW alignment lithologic borings	11	each	$ 3,100	$ 33,000	Approximately 1 boring every 50 feet
3. Groundwater Monitoring Wells Installation	5	each	$ 6,300	$ 32,000	Approximately 20 feet deep
4. Compliance Monitoring Wells Installation	4	each	$ 6,300	$ 25,000	
5. Carbon Dioxide Tank and Enclosure	1	each	$ 41,000	$ 41,000	Additional tank to supplement existing, includes installation
6. Fencing and Signage	1	ls	$ 24,000	$ 24,000	
CONSTRUCTION COST SUBTOTAL ESTIMATE				$ 1,400,000	
7. Permitting	1	ls		$ 20,000	
8. Design (Plans and Specifications)	10	%		$ 140,000	
9. CM/CQA	10	%		$ 140,000	
10. Bonding	1	%		$ 14,000	
Subtotal				**$ 1,710,000**	
Contingency	**20**	**%**		**$ 342,000**	
TOTAL CAPITAL COST ESTIMATE				**$ 2,100,000**	

ESTIMATED O&M COSTS	ESTIMATED QUANTITY	UNIT	ESTIMATED UNIT COST	ESTIMATED TOTAL	Notes
1. Labor	160	hour	$ 100	$ 16,000	System maintenance
2. Groundwater Treatment Costs	365	days	$ 170	$ 62,050	Includes chemicals and utilities
3. Quarterly Groundwater Monitoring	4	event	$ 7,000	$ 28,000	Includes sampling and analytical costs
4. Quarterly Reporting	4	event	$ 5,000	$ 20,000	Includes sampling and analytical costs
Subtotal				**$ 126,000**	
Contingency	**20**	**%**		**$ 25,200**	
YEARLY O&M COST ESTIMATE				**$ 150,000**	

30-YEAR PRESENT COST ESTIMATE	**$4,300,000**	Discount rate = 7%

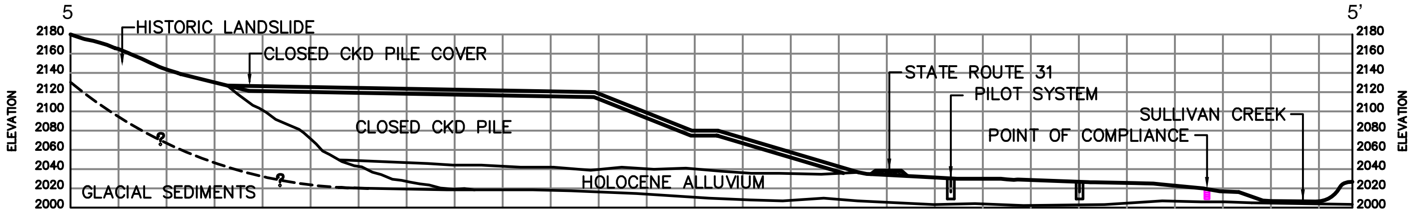
COST ESTIMATE SCENARIOS FOR COMPARISON PURPOSES ONLY	
Installation Cost plus 100 years of Operation (Discount rate = 7%)	$4,600,000
Installation Cost plus 100 years of Operation (Non-Discount)	$20,700,000

General Assumptions

Costs presented in 2005 US dollars ($US 2005)

CM/CQA - Construction Management/Construction Quality Assurance

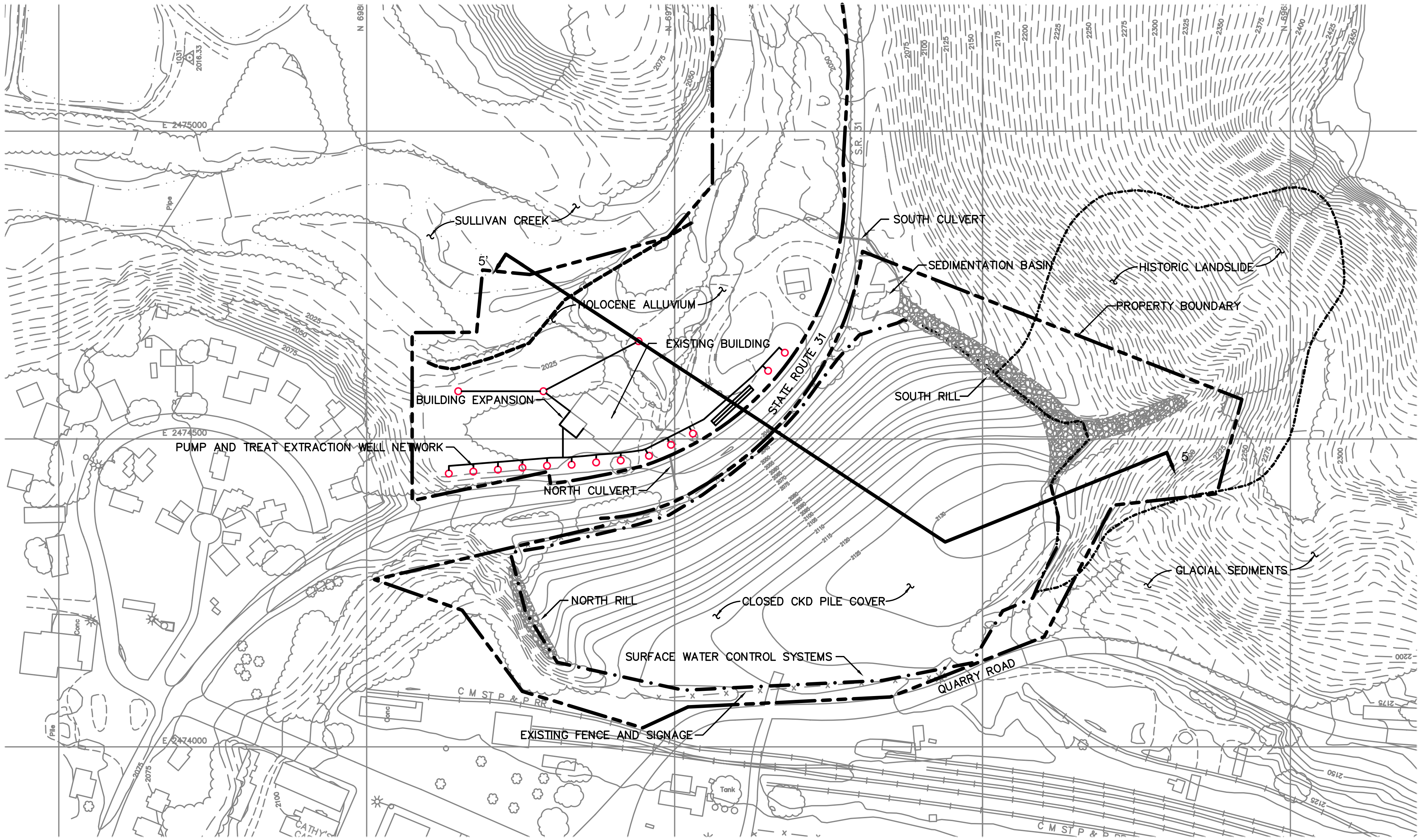
A periodic cost ($600,000) is assessed every 15 years for large replacement items (e.g., buried carbon dioxide systems, carbon dioxide tank, etc.)



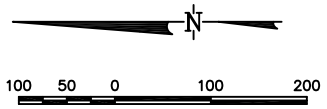
SECTION 5-5'

LEGEND

CLOSED CKD PILE	— · — · —
HISTORIC LANDSLIDE	·-·-·-·-·-·-
POINT OF COMPLIANCE	- - - - -
PILOT SYSTEM	▭
PUMP AND TREAT EXTRACTION WELL NETWORK	○ ○ ○
EXISTING FENCE AND SIGNAGE	— × — × —
PROPERTY BOUNDARY	— — —



NOTE: THE ALTERNATIVE LAYOUT SHOWN ON THIS EXHIBIT IS INTENDED ONLY FOR THE PURPOSE OF ILLUSTRATION AND ONLY TO SUPPORT THE FEASIBILITY STUDY COMPARISON OF ALTERNATIVES. IF THIS ALTERNATIVE WERE TO BE SELECTED PURSUANT TO THE FEASIBILITY STUDY, THE ACTUAL REMEDY LAYOUT, LOCATION, EXTENT, AND DESIGN DETAILS WOULD BE PREPARED AND OUTLINED IN THE CLEAN-UP ACTION PLAN AND FINAL DESIGN DOCUMENTS. ACCORDINGLY, THE LOCATION, LAYOUT AND DETAILS OF ALTERNATIVE COMPONENTS AS SHOWN HERE WILL VARY.



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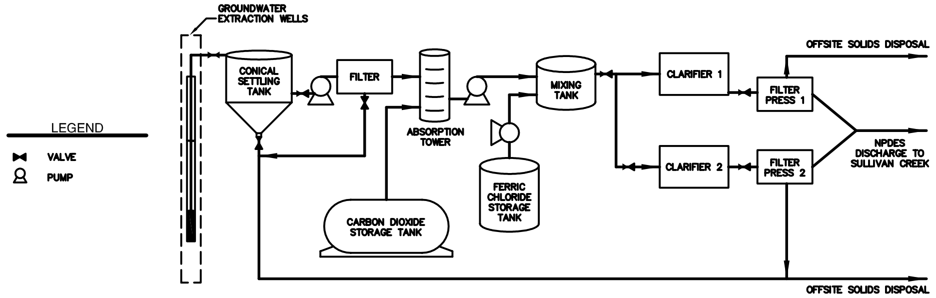

CONCEPTUAL PROCESS DIAGRAM

NOT TO SCALE

DRAFT

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PROJECT:
LEHIGH CEMENT COMPANY CLOSED CKD PILE
METALINE FALLS, WASHINGTON
REVISED DRAFT FEASIBILITY STUDY TECHNICAL REPORT

TITLE:
ALTERNATIVE #2
GROUNDWATER CONTROL (GWC)

DATE:	MARCH 2005	CHECKED BY:	JAC	SCALE:	AS SHOWN	EXHIBIT NO:
DESIGN BY:	EDS	REVIEWED BY: (PROJ. MGR.)	TRS	JOB NO.:	HR0196-12	4.4-1
DRAWN BY:	SLB	DOCUMENT NO:		FILE NO:	0196F114	

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EXHIBIT 4.4-2
GROUNDWATER CONTROL (GWC) COST ESTIMATE
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

ESTIMATED CAPITAL COSTS	ESTIMATED QUANTITY	UNIT	ESTIMATED UNIT COST	ESTIMATED TOTAL	Notes
1. Groundwater Extraction Well Installation	16	wells	$ 7,039	$ 110,000	Approximately 20 feet deep
2. Extraction Pumps	18	each	$ 2,801	$ 50,000	Includes equipment and installation labor, 2 spares
3. Earthworks	1	ls	$ 13,660	$ 10,000	Piping trenches and treatment system pad and components
4. Extraction Piping	1,100	lf	$ 15	$ 20,000	To treatment system and treated outfall, includes installation
5. Electrical Conduit and Wiring	1,700	lf	$ 10	$ 20,000	Supply power to pumps, heaters, and treatment system
6. Groundwater Treatment System	1	each	$ 417,364	$ 420,000	Carbon dioxide and ferric chloride groundwater treatment
7. Additional Carbon Dioxide Tank and Enclosure	1	each	$ 40,638	$ 40,000	Pilot operation plus pump and treat
8. Compliance Monitoring Wells Installation	4	each	$ 6,271	$ 30,000	
9. Fencing and Signage	1	ls	$ 24,000	$ 24,000	
CONSTRUCTION COST SUBTOTAL ESTIMATE				$ 724,000	
10. Permitting	1	ls		$ 50,000	
11. Design (Plans and Specifications)	10	%		$ 72,400	
12. CM/CQA	10	%		$ 72,400	
13. Bonding	1	%		$ 7,240	
14. Liquid Waste Disposal	1,000	gal	$ 5	$ 5,000	
Subtotal				**$ 930,000**	
Contingency	**15**	**%**		**$ 139,500**	
TOTAL CAPITAL COST ESTIMATE				**$ 1,100,000**	

ESTIMATED O&M COSTS	ESTIMATED QUANTITY	UNIT	ESTIMATED UNIT COST	ESTIMATED TOTAL	Notes
1. Labor	260	hour	$ 100	$ 26,000	System maintenance
2. Extraction Pump/Well Maintenance	1	each	$ 15,000	$ 15,000	Includes redevelopment and servicing
3. Groundwater Treatment Costs	365	day	$ 160	$ 58,400	Includes chemicals and utilities
4. Quarterly Groundwater Monitoring	4	event	$ 7,000	$ 28,000	Includes sampling and analytical costs
5. Quarterly Reporting	4	event	$ 5,000	$ 20,000	Report of quarterly results
6. Monthly NPDES Sampling and Reporting	12	mo	$ 3,000	$ 36,000	Sampling of discharge
7. Waste Disposal	25	ton	$ 700	$ 17,500	Treatment Residuals
Subtotal				**$ 200,900**	
Contingency	**15**	**%**		**$ 30,135**	
YEARLY O&M COST ESTIMATE				**$ 230,000**	

30-YEAR PRESENT COST ESTIMATE	**$ 4,100,000**	Discount rate = 7%

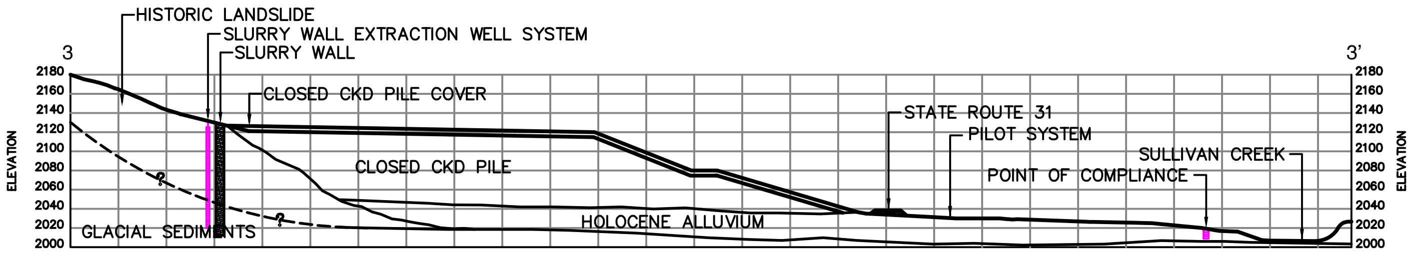
COST ESTIMATE SCENARIOS FOR COMPARISON PURPOSES ONLY	
Installation Cost plus 100 years of Operation (Discount rate = 7%)	$4,600,000
Installation Cost plus 100 years of Operation (Non-Discount)	$26,200,000

General Assumptions

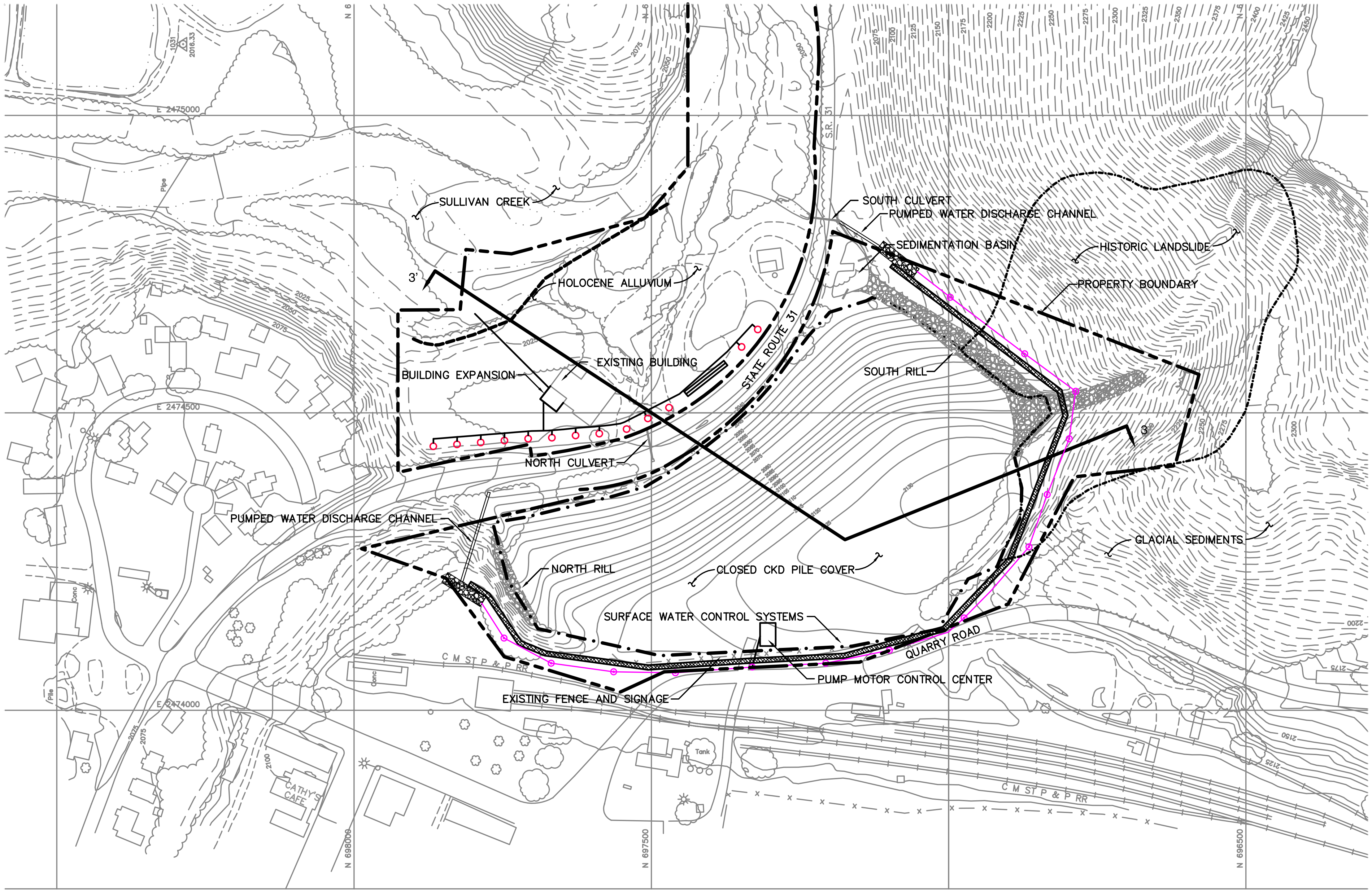
Costs presented in 2005 US dollars ($US 2005)

CM/CQA - Construction Management/Construction Quality Assurance

A periodic cost ($350,000) is assessed every 15 years for large replacement items (e.g., groundwater treatment systems, etc.)



SECTION 3-3'



LEGEND

CLOSED CKD PILE (EXTENTS)	— · — · —
HISTORIC LANDSLIDE	-·-·-·-·-·-
PILOT SYSTEM	▭
POINT OF COMPLIANCE	- - - - - -
GROUNDWATER EXTRACTION WELL NETWORK	○ ○ ○
SLURRY WALL ⓐ	▨
SLURRY WALL EXTRACTION WELL SYSTEM ⓑ	—⊙———⊙—
SLURRY WALL END DRAIN	▩
EXISTING FENCE AND SIGNAGE	— × — × —
PROPERTY BOUNDARY	—— — — ——

ⓐ THE ACTUAL ALIGNMENT OF THE SLURRY WALL AND EXTRACTION WELLS WOULD BE VARIED TO ADDRESS PHYSICAL AND CONSTRUCTION CONSTRAINTS. FOR EXAMPLE, THE SLURRY WALL MIGHT BE RELOCATED TO THE WEST OF THE QUARRY ROAD.

ⓑ THE PURPOSE OF THESE GROUNDWATER WELLS WOULD BE TO CONTROL GROUNDWATER ELEVATION BEHIND THE SLURRY WALL, DURING CONSTRUCTION AND DURING OPERATION. INSTALL AT APPROXIMATELY 100-FT SPACING. THE LOCATIONS SHOWN ON THE DRAWING ARE CONCEPTUAL.

NOTE: THE ALTERNATIVE LAYOUT SHOWN ON THIS EXHIBIT IS INTENDED ONLY FOR THE PURPOSE OF ILLUSTRATION AND ONLY TO SUPPORT THE FEASIBILITY STUDY COMPARISON OF ALTERNATIVES. IF THIS ALTERNATIVE WERE TO BE SELECTED PURSUANT TO THE FEASIBILITY STUDY, THE ACTUAL REMEDY LAYOUT, LOCATION, EXTENT, AND DESIGN DETAILS WOULD BE PREPARED AND OUTLINED IN THE CLEAN-UP ACTION PLAN AND FINAL DESIGN DOCUMENTS. ACCORDINGLY, THE LOCATION, LAYOUT AND DETAILS OF ALTERNATIVE COMPONENTS AS SHOWN HERE WILL VARY.

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SCALE IN FEET

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TELEPHONE: (714) 969-0800

PROJECT:
LEHIGH CEMENT COMPANY CLOSED CKD PILE
METALINE FALLS, WASHINGTON
REVISED DRAFT FEASIBILITY STUDY TECHNICAL REPORT

TITLE:

ALTERNATIVE #3
ADDITIONAL SOURCE CONTROL (ASC)

DATE:	MARCH 2005	CHECKED BY:	JAC	SCALE:	AS SHOWN	EXHIBIT NO:
DESIGN BY:	EDS	REVIEWED BY: (PROJ. MGR.)	TRS	JOB NO.:	HR0196-12	4.5-1
DRAWN BY:	SLB	DOCUMENT NO:		FILE NO:	0196F144	

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EXHIBIT 4.5-2
ADDITIONAL SOURCE CONTROL (ASC) COST ESTIMATE
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

ESTIMATED CAPITAL COSTS	ESTIMATED QUANTITY	UNIT	ESTIMATED UNIT COST (LOW)	ESTIMATED UNIT COST (HIGH)	ESTIMATED LOW TOTAL	ESTIMATED HIGH TOTAL	Notes
1. Slurry Cut-Off Wall	192,000	sf	$ 30	$ 50	$ 5,800,000	$ 9,600,000	Deep trench, landslide area
2. Slurry Wall End Drains	2	each	$ 24,000	$ 24,000	$ 48,000	$ 48,000	For dewatering discharge.
3. Upgradient Groundwater Dewatering/ Water Conveyance	14	wells	$ 23,000	$ 23,000	$ 322,000	$ 322,000	In unaffected groundwater
4. Carbon Dioxide Tank and Enclosure	1	each	$ 41,000	$ 41,000	$ 41,000	$ 41,000	Additional tank to supplement existing, includes installation
5. P&T Groundwater Extraction Well Installation	13	wells	$ 7,000	$ 7,000	$ 91,000	$ 91,000	Approximately 20 feet deep
6. Extraction Pumps for P&T	15	each	$ 2,800	$ 2,800	$ 42,000	$ 42,000	Includes equipment and installation labor, 2 spares
7. Earthworks for P&T	1	ls	$ 13,660	$ 13,660	$ 14,000	$ 14,000	Piping trenches and treatment system pad and components
8. Extraction Piping for P&T	900	lf	$ 15	$ 15	$ 14,000	$ 14,000	To treatment system and treated outfall, includes installation
9. Electrical Conduit and Wiring for P&T	1,500	lf	$ 10	$ 10	$ 15,000	$ 15,000	Supply power to pumps, heaters, and treatment system
10. Groundwater Treatment System	1	each	$ 420,000	$ 420,000	$ 420,000	$ 420,000	Carbon dioxide and ferric chloride groundwater treatment
11. Compliance Monitoring Well Installation	4	each	$ 6,300	$ 6,300	$ 25,000	$ 25,000	
12. Fencing and Signage	1	ls	$ 24,000	$ 24,000	$ 24,000	$ 24,000	
CONSTRUCTION COST SUBTOTAL ESTIMATE					$ 6,900,000	$ 10,700,000	
13. Permitting	1	ls			$ 50,000	$ 70,000	
14. Design and Site Investigation (Plans and Specifications)	4	%			$ 276,000	$ 428,000	
15. CM/CQA	4	%			$ 276,000	$ 428,000	
16. Bonding	1	%			$ 69,000	$ 107,000	
Subtotal					**$ 7,600,000**	**$ 11,700,000**	
Contingency	**20**	**%**			**$ 1,520,000**	**$ 2,340,000**	
TOTAL CAPITAL COST ESTIMATE					**$ 9,100,000**	**$ 14,000,000**	

ESTIMATED O&M COSTS	ESTIMATED QUANTITY	UNIT	ESTIMATED UNIT COST	ESTIMATED TOTAL	Notes
1. Labor	400	hour	$ 100	$ 40,000	System maintenance
2. Extraction Pump/Well Maintenance	1	each	$ 25,000	$ 25,000	Includes redevelopment and servicing
3. Groundwater Treatment Costs	365	day	$ 100	$ 36,500	Includes chemicals and utilities
4. Quarterly Groundwater Monitoring	4	event	$ 7,000	$ 28,000	Includes sampling and analytical costs
5. Quarterly Reporting	4	event	$ 5,000	$ 20,000	Report of quarterly results
6. Monthly NPDES Sampling and Reporting	12	mo	$ 3,000	$ 36,000	Sampling of discharge
7. Waste Disposal	14	ton	$ 700	$ 9,800	Treatment Residuals
8. Dewatering Costs	131400	kWh	$ 0.10	$ 13,140	Electrical
Subtotal				**$ 210,000**	
Contingency	**15**	**%**		**$ 31,500**	
YEARLY O&M COST ESTIMATE				**$ 240,000**	

30-YEAR PRESENT COST ESTIMATE RANGE	**$ 12,300,000**	**to**	**$ 17,200,000**	Discount rate = 7%

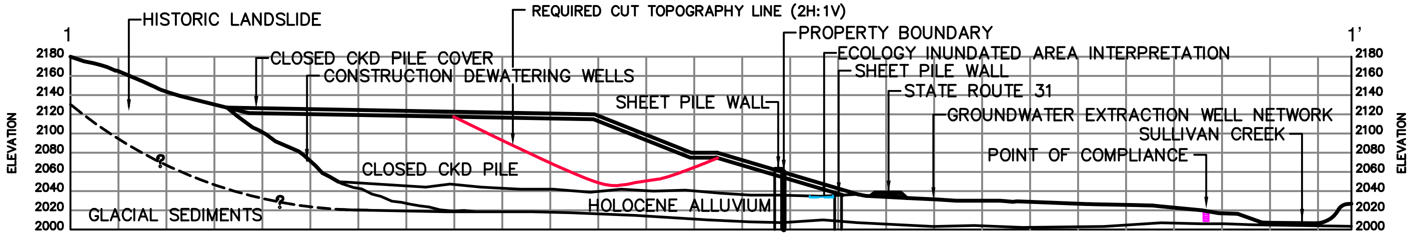
COST ESTIMATE SCENARIOS FOR COMPARISON PURPOSES ONLY			
Installation Cost plus 100 years of Operation (Discount rate = 7%)	$12,700,000	to	$17,600,000
Installation Cost plus 100 years of Operation (Non-Discount)	$35,200,000	to	$40,100,000

General Assumptions

Costs presented in 2005 US dollars ($US 2005)

CM/CQA - Construction Management/Construction Quality Assurance

A periodic cost ($350,000) is assessed every 15 years for large replacement items (e.g., groundwater treatment systems, etc.)



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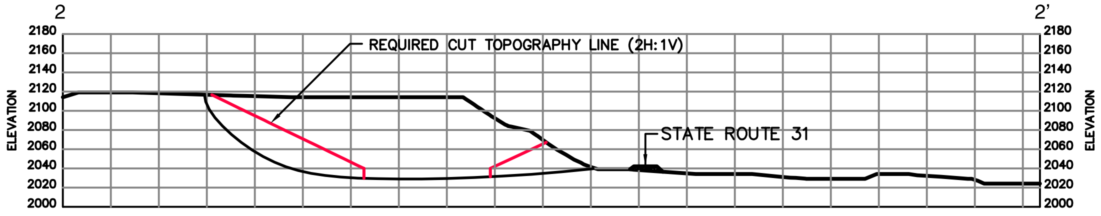
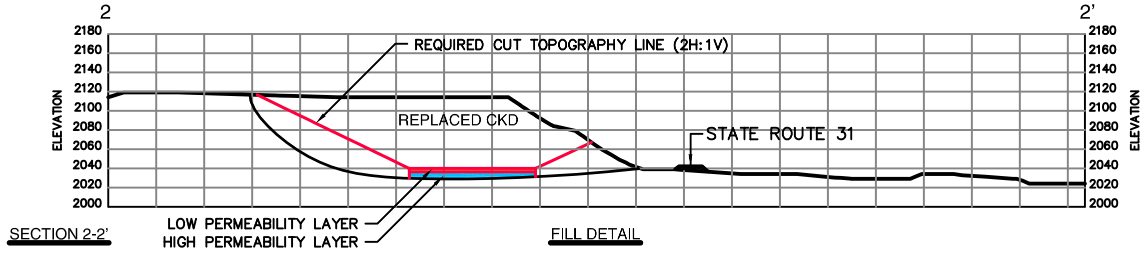
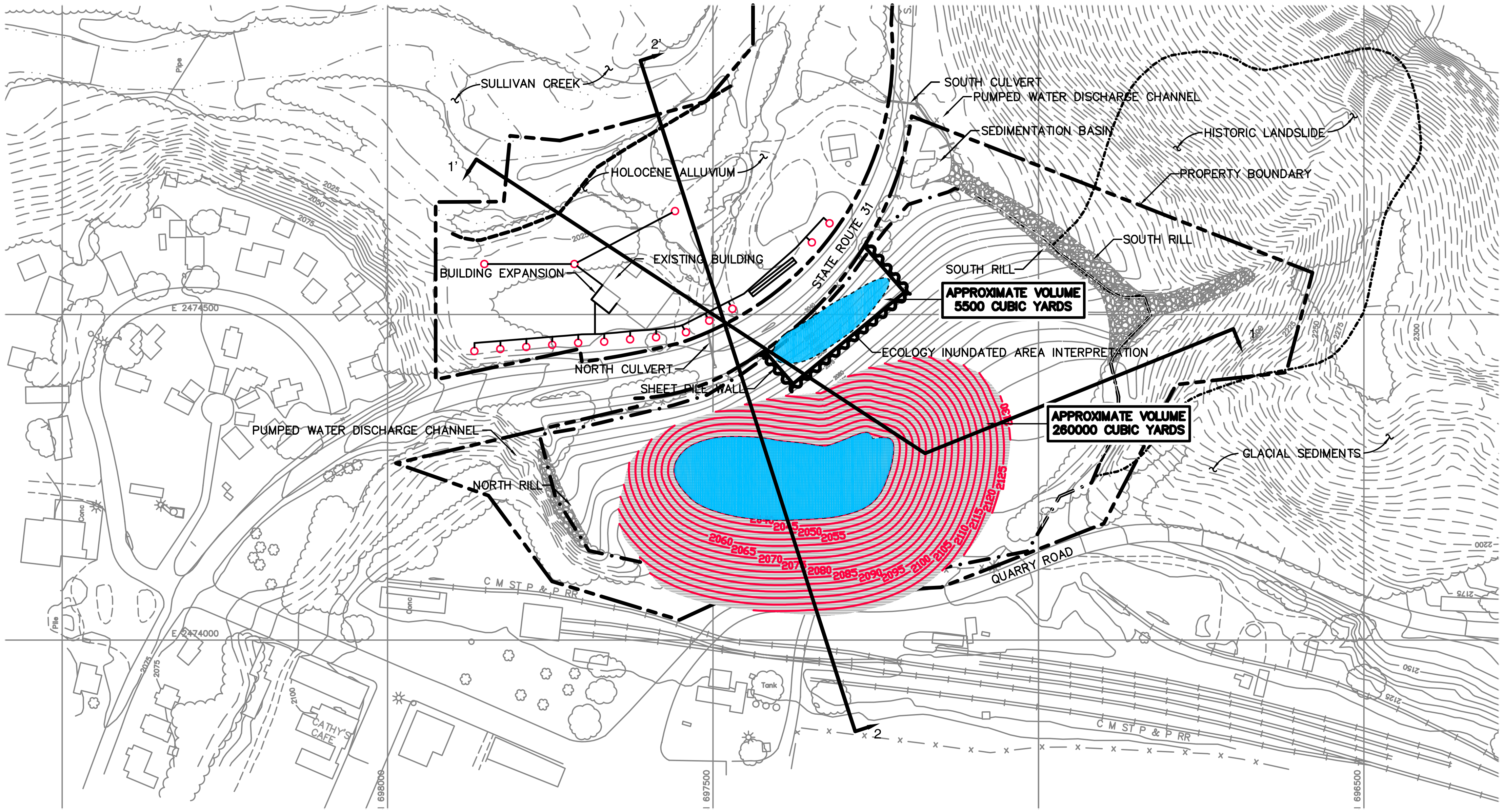


CUT DETAIL

SECTION 2-2'



FILL DETAIL



LEGEND

CLOSED CKD PILE (EXTENTS)	— · — · —
HISTORIC LANDSLIDE	·−·−·−·−·
PILOT SYSTEM	▭
POINT OF COMPLIANCE	▬ ▬ ▬
GROUNDWATER EXTRACTION WELL NETWORK	○ ○ ○
EXISTING FENCE AND SIGNAGE	──
PROPERTY BOUNDARY	━ ━ ━
ECOLOGY–INTERPRETED AREA OF INUNDATION	🟦
EXCAVATION TOPOGRAPHY LINE	──

NOTE: THE ALTERNATIVE LAYOUT SHOWN ON THIS EXHIBIT IS INTENDED ONLY FOR THE PURPOSE OF ILLUSTRATION AND ONLY TO SUPPORT THE FEASIBILITY STUDY COMPARISON OF ALTERNATIVES. IF THIS ALTERNATIVE WERE TO BE SELECTED PURSUANT TO THE FEASIBILITY STUDY, THE ACTUAL REMEDY LAYOUT, LOCATION, EXTENT, AND DESIGN DETAILS WOULD BE PREPARED AND OUTLINED IN THE CLEAN–UP ACTION PLAN AND FINAL DESIGN DOCUMENTS. ACCORDINGLY, THE LOCATION, LAYOUT AND DETAILS OF ALTERNATIVE COMPONENTS AS SHOWN HERE WILL VARY.

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SCALE IN FEET

LEHIGH
HEIDELBERGCEMENT Group

GEOSYNTEC CONSULTANTS
2100 MAIN STREET, SUITE 150
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TELEPHONE: (714) 969-0800

PROJECT:
LEHIGH CEMENT COMPANY CLOSED CKD PILE
METALINE FALLS, WASHINGTON
REVISED DRAFT FEASIBILITY STUDY TECHNICAL REPORT

TITLE:
ALTERNATIVE #4
PARTIAL SOURCE REMOVAL (PSR)

DATE: MARCH 2005	CHECKED BY:	JAC	SCALE:	AS SHOWN	EXHIBIT NO:
DESIGN BY: EDS	REVIEWED BY: (PROJ. MGR.)	TRS	JOB NO.:	HR0196-12	4.6-1
DRAWN BY: SLB	DOCUMENT NO:		FILE NO:	0196F140	

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EXHIBIT 4.6-2
PARTIAL SOURCE REMOVAL (PSR) COST ESTIMATE
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

ESTIMATED CAPITAL COSTS	ESTIMATED QUANTITY	UNIT	ESTIMATED UNIT COST (LOW)	ESTIMATED UNIT COST (HIGH)	ESTIMATED LOW TOTAL	ESTIMATED HIGH TOTAL	Notes
1. CKD Investigative Borings	8	each	$ 16,000	$ 20,000	$ 128,000	$ 160,000	8 borings to approximately 100 feet deep
2. Buy / Rent Temporary Storage Area for CKD	1	ls	$ 50,000	$ 50,000	$ 50,000	$ 50,000	
3. Build Temporary Storage for the Excavated CKD	24,000	sy	$ 16	$ 32	$ 384,000	$ 768,000	
4. Dewatering, Treatment, and Discharge	150	day	$ 1,000	$ 1,200	$ 150,000	$ 180,000	
5. Toe Excavation (Sheet Piles)	5,500	cy	$ 20	$ 30	$ 110,000	$ 165,000	
6. Place Inert Backfill (Toe)	2,800	cy	$ 10	$ 20	$ 28,000	$ 56,000	
7. Replace CKD from Toe	2,700	cy	$ 15	$ 20	$ 41,000	$ 54,000	Assumes 100% compaction for purposes of Revised dFSTR
8. Lower CKD Excavation	260,000	cy	$ 15	$ 20	$ 3,900,000	$ 5,200,000	
9. Place Inert Backfill (Lower CKD)	7,000	cy	$ 15	$ 20	$ 105,000	$ 140,000	
10. Replace CKD from the Large Excavation	253,000	cy	$ 15	$ 20	$ 3,800,000	$ 5,060,000	Assumes 100% compaction for purposes of Revised dFSTR
11. Replace Cover	34,000	sy	$ 60	$ 80	$ 2,040,000	$ 2,720,000	For abandoned boreholes and excavation area
12. GWC Installation	1	each	$ 720,000	$ 720,000	$ 720,000	$ 720,000	For abandoned boreholes and excavation area
13 Compliance Monitoring Wells Installation	4	each	$ 6,300	$ 6,300	$ 25,000	$ 25,000	
14 Fencing and Signage	1	ls	$ 24,000	$ 24,000	$ 24,000	$ 24,000	
CONSTRUCTION COST SUBTOTAL ESTIMATE					$ 11,500,000	$ 15,300,000	
14. Permitting	1	ls			$ 50,000	$ 80,000	
15. Design and Site Investigation (Plans and Specifications)	4	%			$ 460,000	$ 612,000	
16. CM/CQA	4	%			$ 460,000	$ 612,000	
17. Bonding	1	%			$ 115,000	$ 153,000	
18. CKD Disposal	9,800	cy	$ 200	$ 350	$ 1,960,000	$ 3,430,000	For the purposes of this Revised dFSTR, only CKD that is displaced by the inert backfill will be disposed.
Subtotal					**$ 14,500,000**	**$ 20,200,000**	
Contingency	**20**	**%**			**$ 2,900,000**	**$ 4,040,000**	
TOTAL CAPITAL COST ESTIMATE					**$ 17,400,000**	**$ 24,200,000**	

ESTIMATED O&M COSTS INCLUDING GWC TREATMENT	ESTIMATED QUANTITY	UNIT	ESTIMATED UNIT COST	ESTIMATED TOTAL	Notes
1. Labor	260	hour	$ 100	$ 26,000	System maintenance
2. Extraction Pump/Well Maintenance	1	each	$ 15,000	$ 15,000	Includes redevelopment and servicing
3. Groundwater Treatment Costs	365	day	$ 160	$ 58,400	Includes chemicals and utilities
4. Monthly NPDES Sampling and Reporting	12	mo	$ 3,000	$ 36,000	Sampling of discharge
5. Waste Disposal	25	ton	$ 700	$ 17,500	
6. Quarterly Groundwater Monitoring	4	event	$ 7,000	$ 28,000	Includes sampling and analytical costs
7. Quarterly Reporting	4	event	$ 5,000	$ 20,000	Report of quarterly results
Subtotal				**$ 200,900**	
Contingency	**15**	**%**		**$ 30,135**	
YEARLY O&M COST ESTIMATE				**$ 230,000**	

SCENARIO 1 - ESTIMATED O&M COSTS AFTER THE INITIAL FIVE YEARS OF OPERATION (ECOLOGY ASSUMPTION)	ESTIMATED QUANTITY	UNIT	ESTIMATED UNIT COST	ESTIMATED TOTAL	Notes
1. Quarterly Groundwater Monitoring	4	event	$ 7,000	$ 28,000	Includes sampling and analytical costs
2. Quarterly Reporting	4	event	$ 5,000	$ 20,000	Report of quarterly results
Subtotal				**$ 48,000**	
Contingency	**15**	**%**		**$ 7,200**	
YEARLY O&M COST ESTIMATE				**$ 60,000**	

SCENARIO 1 (Ecology assumes that groundwater treatment will not be required after five years)

30-YEAR PRESENT COST ESTIMATE (Discount rate = 7%)	**$ 18,800,000**	**to**	**$ 25,600,000**
COST ESTIMATE SCENARIOS FOR COMPARISON PURPOSES ONLY			
Installation Cost plus 100 years of Operation (Discount rate = 7%)	$19,000,000	to	$25,800,000
Installation Cost plus 100 years of Operation (Non-Discount)	$24,200,000	to	$31,000,000

SCENARIO 2 (Lehigh believes that groundwater treatment will be required for an indefinite future time period)

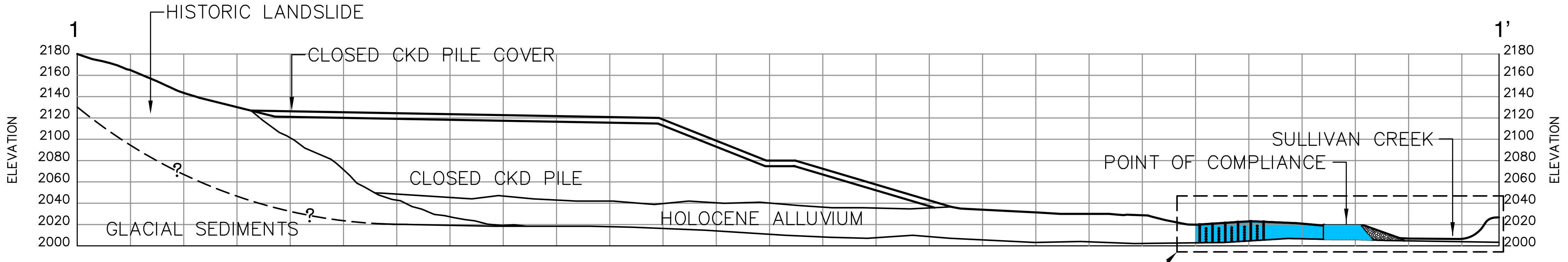
30-YEAR PRESENT COST ESTIMATE (Discount rate = 7%)	**$ 20,400,000**	**to**	**$ 27,200,000**
COST ESTIMATE SCENARIOS FOR COMPARISON PURPOSES ONLY			
Installation Cost plus 100 years of Operation (Discount rate = 7%)	$20,900,000	to	$27,700,000
Installation Cost plus 100 years of Operation (Non-Discount)	$42,500,000	to	$49,300,000

General Assumptions

Costs presented in 2005 US dollars ($US 2005)

CM/CQA - Construction Management/Construction Quality Assurance

Scenario 2 includes a periodic cost ($350,000) is assessed every 15 years for large replacement items (e.g., groundwater treatment systems, etc.)



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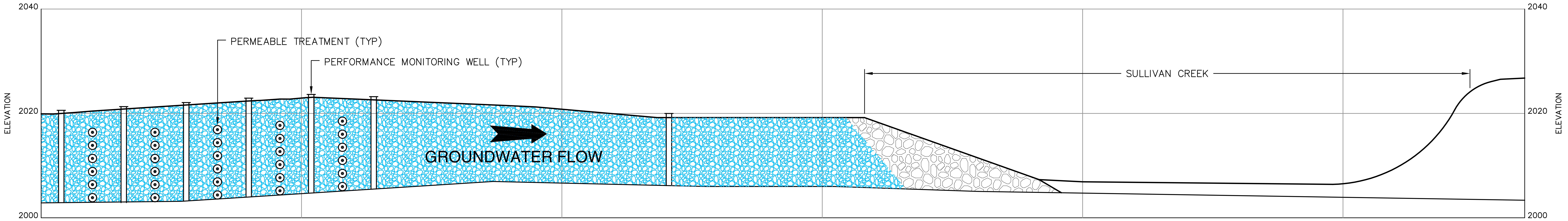
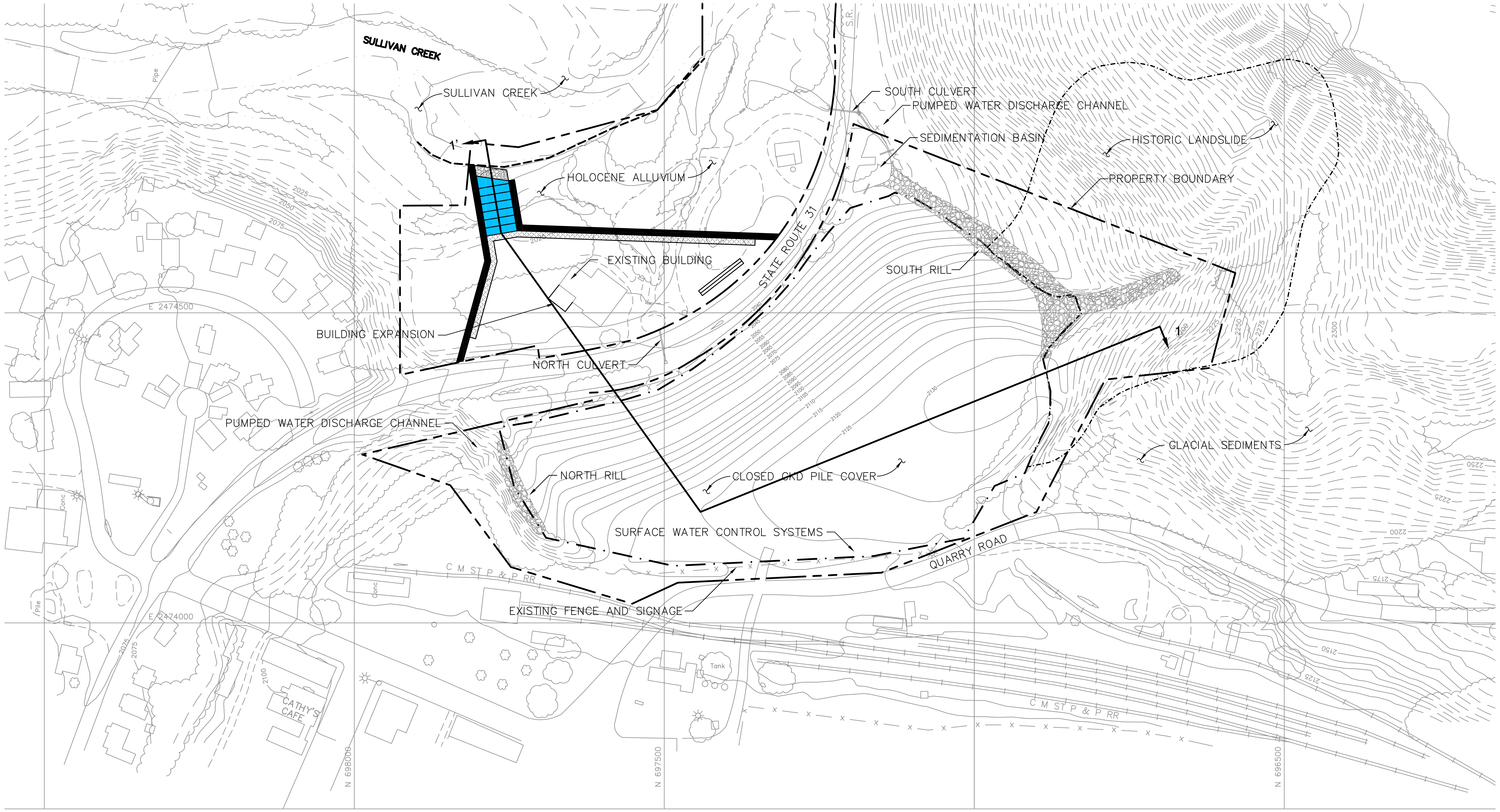


DETAIL 1

LEGEND

CLOSED CKD PILE (EXTENTS)	—·—·—
HISTORIC LANDSLIDE	-·-·-·-·-
PROPERTY BOUNDARY	— — —
SLURRY WALL	▨
FRENCH DRAIN	▨
GRAVEL CORRIDOR	🟦
PERMEABLE TREATMENT	▥
RIP RAP	▨
POINT OF COMPLIANCE	- - - - -
EXISTING FENCE AND SIGNAGE	— x — x —



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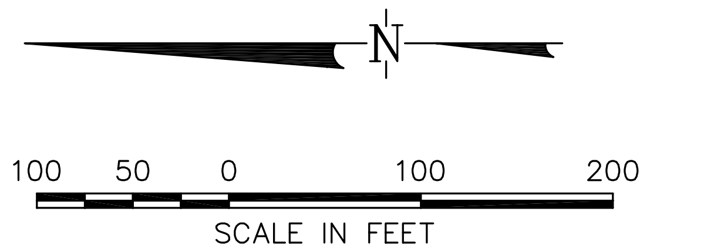

SCALE IN FEET

LEHIGH
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TELEPHONE: (714) 969-0800

PROJECT:
LEHIGH CEMENT COMPANY CLOSED CKD PILE
METALINE FALLS, WASHINGTON
REVISED DRAFT FEASIBILITY STUDY TECHNICAL REPORT

TITLE:
ALTERNATIVE #5
FUNNEL AND GATE TREATMENT (FGT)

DATE:	MARCH 2005	CHECKED BY:	SCALE:	AS SHOWN	EXHIBIT NO:	4.7-1
DESIGN BY:		REVIEWED BY: (PROJ. MGR.)	JOB NO.:	HR0196-12		
DRAWN BY:		DOCUMENT NO:	FILE NO:	0196F145		

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EXHIBIT 4.7-2
FUNNEL AND GATE TREATMENT (FGT) COST ESTIMATE
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

ESTIMATED CAPITAL COSTS	ESTIMATED QUANTITY	UNIT	ESTIMATED UNIT COST (LOW)	ESTIMATED UNIT COST (HIGH)	ESTIMATED LOW TOTAL	ESTIMATED HIGH TOTAL	Notes
1. Earthen Platform for Slurry Wall Installation	5300	cy	$ 3	$ 3	$ 18,000	$ 18,000	Approximately 3 ft tall, 40 ft wide, 1200 ft long, plus compaction
2. Slurry Walls (Cement Bentonite)	17500	sf	$ 10	$ 15	$ 175,000	$ 263,000	Approximately 700 ft long, 25 ft deep
3. Slurry Diaphragm Walls	8750	sf	$ 50	$ 75	$ 438,000	$ 656,000	Approximately 350 ft long, 25 ft deep
4. Gravel	11963	cy	$ 11	$ 11	$ 134,000	$ 134,000	French Drain And Cooridor
5. Excavate Drainage Wall	1296	cy	$ 2	$ 2	$ 3,000	$ 3,000	Approximately 700 ft long, 25 ft deep, 2 ft thick
6. Backfill Drainage Wall with Gravel	1296	cy	$ 6	$ 6	$ 8,000	$ 8,000	FE loader, 200 ft haul, 35 cf bucket
7. Treatment and Discharge Cooridor Excavation	10667	cy	$ 1	$ 1	$ 12,000	$ 12,000	FE loader, bulk bank measure, short haul (80 ft x 200 ft x 18 ft)
8. Corridor Dewatering and Treatment	80	day	$ 1,000	$ 1,000	$ 80,000	$ 80,000	Drainage trench, pumping 8 hours/day, recycle to pilot PTW
9. Install Carbon Dioxide Treatment System	400	lf	$ 1,000	$ 1,000	$ 400,000	$ 400,000	Approximately 80 ft long, 5 treatment walls
10. Surficial Termination of Treatment Pipes	1	ls	$ 50,000	$ 50,000	$ 50,000	$ 50,000	
11. Backfill Cooridor with Gravel	10667	cy	$ 2	$ 2	$ 24,000	$ 24,000	
12. Rip-Rap Installation into Sullivan Creek	560	cy	$ 42	$ 42	$ 24,000	$ 24,000	Random, machine-placed broken stone (100 ft x 50 ft x 3 ft)
13. Instrumentation and Controls	1	ls	$ 50,000	$ 50,000	$ 50,000	$ 50,000	
14. Performance Monitoring Wells Installation	12	each	$ 1,000	$ 1,000	$ 12,000	$ 12,000	Approximately 20 feet deep in gravel cooridor
15. Compliance Monitoring Wells Installation	5	each	$ 6,271	$ 6,271	$ 31,000	$ 31,000	Approximately 20 feet deep in floodplain
16. Carbon Dioxide Tank and Enclosure	1	each	$ 40,638	$ 40,638	$ 41,000	$ 41,000	Additional tank to supplement existing, includes installation
17. Fencing and Signage	1	ls	$ 24,000	$ 24,000	$ 24,000	$ 24,000	
CONSTRUCTION COST SUBTOTAL ESTIMATE					$ 1,500,000	$ 1,800,000	
18. Permitting	1	ls			$ 60,000	$ 60,000	
19. Design (Plans and Specifications)	10	%			$ 150,000	$ 180,000	
20 CM/CQA	10	%			$ 150,000	$ 180,000	
21. Bonding	1	%			$ 15,000	$ 18,000	
Subtotal					**$ 1,900,000**	**$ 2,200,000**	
Contingency	**20**	**%**			**$ 380,000**	**$ 440,000**	
TOTAL CAPITAL COST ESTIMATE					**$ 2,300,000**	**$ 2,600,000**	

ESTIMATED O&M COSTS	ESTIMATED QUANTITY	UNIT	ESTIMATED UNIT COST		
1. Labor	160	hour	$ 100	$ 16,000	System maintenance
2. Groundwater Treatment Costs	365	days	$ 170	$ 62,050	Includes chemicals and utilities
3. Quarterly Groundwater Monitoring	4	event	$ 7,000	$ 28,000	Includes sampling and analytical costs
4. Quarterly Reporting	4	event	$ 5,000	$ 20,000	Includes sampling and analytical costs
Subtotal				**$ 126,000**	
Contingency	**20**	**%**		**$ 25,200**	
YEARLY O&M COST ESTIMATE				**$ 150,000**	

30-YEAR PRESENT COST ESTIMATE RANGE $4,400,000 to $4,700,000

Discount rate = 7%

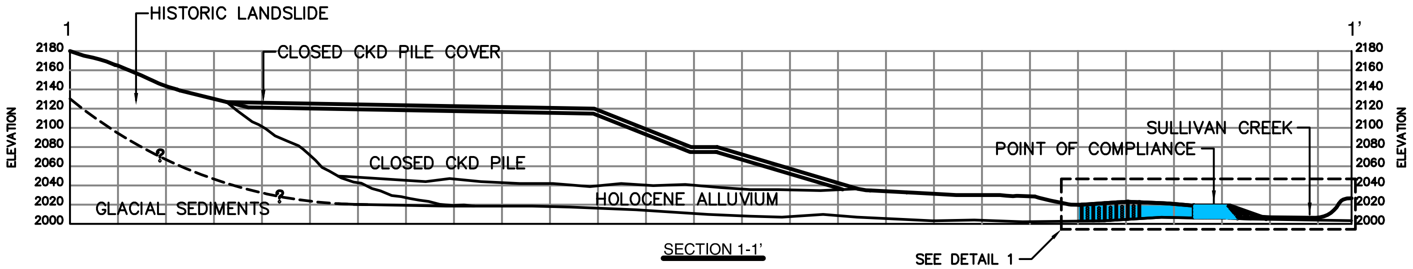
COST ESTIMATE SCENARIOS FOR COMPARISON PURPOSES ONLY			
Installation Cost plus 100 years of Operation (Discount rate = 7%)	$4,800,000	to	$5,100,000
Installation Cost plus 100 years of Operation (Non-Discount)	$20,900,000	to	$21,200,000

General Assumptions

Costs presented in 2005 US dollars ($US 2005)

CM/CQA - Construction Management/Construction Quality Assurance

A periodic cost ($600,000) is assessed every 15 years for large replacement items (e.g., buried carbon dioxide systems, acrbon dioxide tank, slurry wall)



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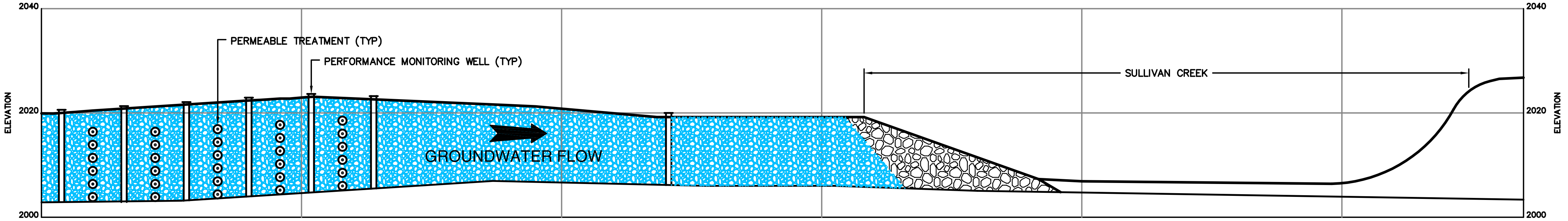
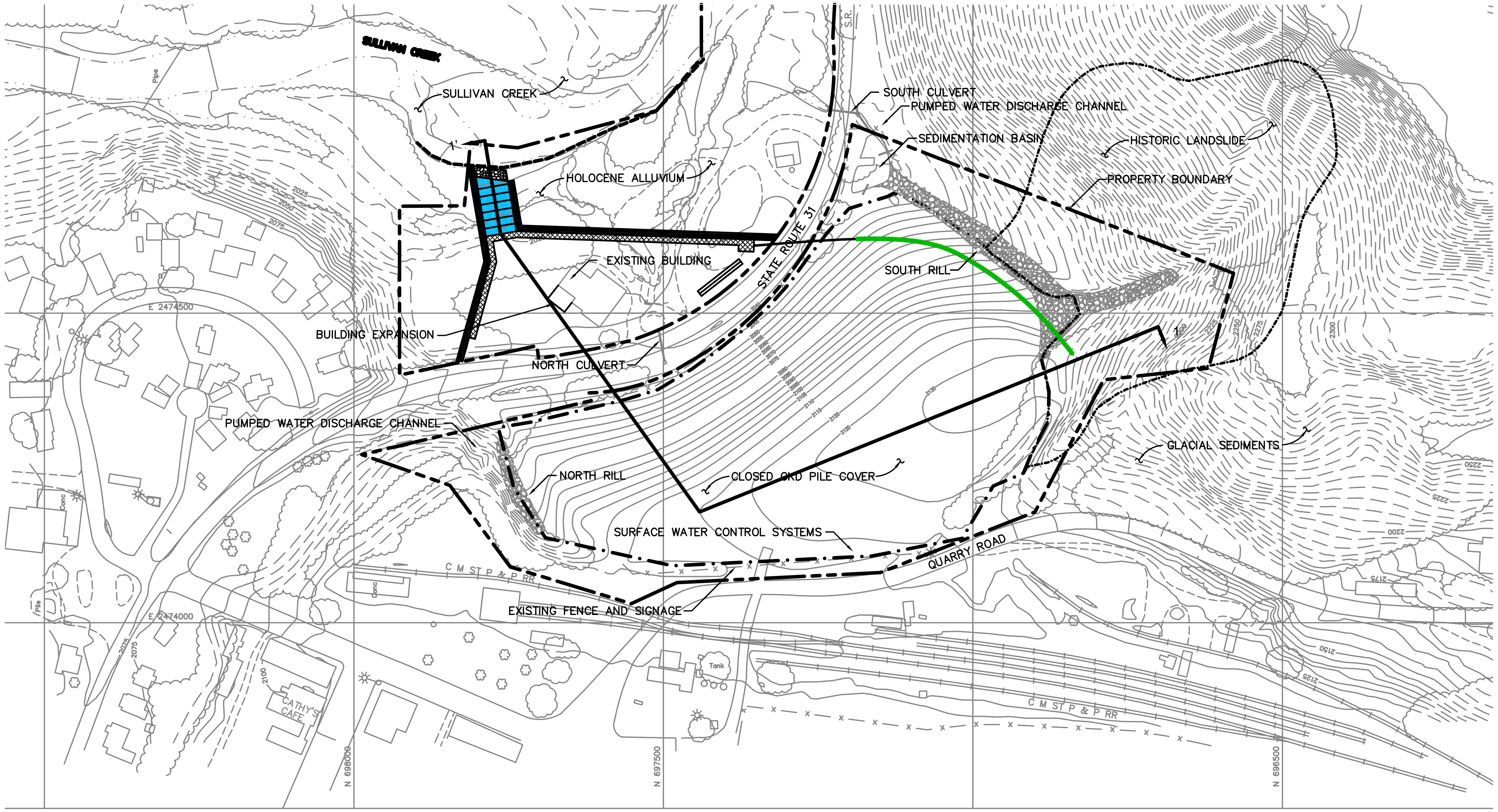


DETAIL 1

LEGEND	
CLOSED CKD PILE (EXTENTS)	— · — · —
HISTORIC LANDSLIDE	- · - · - · -
PROPERTY BOUNDARY	— — —
SLURRY WALL	▬
FRENCH DRAIN	▨
GRAVEL CORRIDOR	🟦
PERMEABLE TREATMENT	▥
RIP RAP	▨
GRAVITY DRAIN	🟩
POINT OF COMPLIANCE	- - - -
EXISTING FENCE AND SIGNAGE	— × — × —



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SCALE IN FEET

LEHIGH
HEIDELBERGCEMENT Group

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PROJECT:
LEHIGH CEMENT COMPANY CLOSED CKD PILE
METALINE FALLS, WASHINGTON
REVISED DRAFT FEASIBILITY STUDY TECHNICAL REPORT

TITLE:
ALTERNATIVE #6
PARTIAL ADDITIONAL SOURCE CONTROL (PASC)

DATE: MARCH 2005	CHECKED BY:	SCALE: AS SHOWN	EXHIBIT NO:
DESIGN BY:	REVIEWED BY: (PROJ. MGR.)	JOB NO.: HR0196-12	4.8-1
DRAWN BY:	DOCUMENT NO:	FILE NO: 0196F143	

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EXHIBIT 4.8-2
PARTIAL ADDITIONAL SOURCE CONTROL (PASC) COST ESTIMATE
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

ESTIMATED CAPITAL COSTS	ESTIMATED QUANTITY	UNIT	ESTIMATED UNIT COST (LOW)	ESTIMATED UNIT COST (HIGH)	ESTIMATED LOW TOTAL	ESTIMATED HIGH TOTAL	Notes
1. Site Preparation for Gravity Drains	1	ls	$ 5,000	$ 10,000	$ 5,000	$ 10,000	Either a pit or a platform, plus a vault
2. Gravity Drains Mobilization	1	ls	$ 10,000	$ 20,000	$ 10,000	$ 20,000	Drill rig, crew, and support truck
3. Gravity Drains	670	lf	$ 120	$ 200	$ 80,000	$ 134,000	1 drain, approximately 550 ft long, 120 ft vertical
4. Earthen Platform for Slurry Wall Installation	5300	cy	$ 3	$ 3	$ 18,000	$ 18,000	Approximately 3 ft tall, 40 ft wide, 1200 ft long, plus compaction
5. Slurry Walls (Cement Bentonite)	17500	sf	$ 10	$ 15	$ 175,000	$ 263,000	Approximately 700 ft long, 25 ft deep
6. Slurry Diaphragm Walls	8750	sf	$ 50	$ 75	$ 438,000	$ 656,000	Approximately 350 ft long, 25 ft deep
7. Gravel	11963	cy	$ 11	$ 11	$ 134,000	$ 134,000	French Drain And Cooridor
8. Excavate Drainage Wall	1296	cy	$ 2	$ 2	$ 3,000	$ 3,000	Approximately 700 ft long, 25 ft deep, 2 ft thick
9. Backfill Drainage Wall with Gravel	1296	cy	$ 6	$ 6	$ 8,000	$ 8,000	FE loader, 200 ft haul, 35 cf bucket
10. Treatment and Discharge Cooridor Excavation	10667	cy	$ 1	$ 1	$ 12,000	$ 12,000	FE loader, bulk bank measure, short haul (80 ft x 200 ft x 18 ft)
11. Corridor Dewatering and Treatment	80	day	$ 1,000	$ 1,000	$ 80,000	$ 80,000	Drainage trench, pumping 8 hours/day, recycle to pilot PTW
12. Install Carbon Dioxide Treatment System	400	lf	$ 1,000	$ 1,000	$ 400,000	$ 400,000	Approximately 80 ft long, 5 treatment walls
13. Surficial Termination of Treatment Pipes	1	ls	$ 50,000	$ 50,000	$ 50,000	$ 50,000	
14. Backfill Cooridor with Gravel	10667	cy	$ 2	$ 2	$ 24,000	$ 24,000	
15. Rip-Rap Installation into Sullivan Creek	560	cy	$ 42	$ 42	$ 24,000	$ 24,000	Random, machine-placed broken stone (100 ft x 50 ft x 3 ft)
16. Instrumentation and Controls	1	ls	$ 50,000	$ 50,000	$ 50,000	$ 50,000	
17. Performance Monitoring Wells Installation	12	each	$ 1,000	$ 1,000	$ 12,000	$ 12,000	Approximately 20 feet deep in gravel cooridor
18. Compliance Monitoring Wells Installation	5	each	$ 6,271	$ 6,271	$ 31,000	$ 31,000	Approximately 20 feet deep in floodplain
19. Carbon Dioxide Tank and Enclosure	1	each	$ 40,638	$ 40,638	$ 41,000	$ 41,000	Additional tank to supplement existing, includes installation
20. Fencing and Signage	1	ls	$ 24,000	$ 24,000	$ 24,000	$ 24,000	
CONSTRUCTION COST SUBTOTAL ESTIMATE					$ 1,600,000	$ 2,000,000	
21. Permitting	1	ls			$ 60,000	$ 60,000	
22. Design (Plans and Specifications)	10	%			$ 160,000	$ 200,000	
23. CM/CQA	10	%			$ 160,000	$ 200,000	
24. Bonding	1	%			$ 16,000	$ 20,000	
Subtotal					**$ 2,000,000**	**$ 2,500,000**	
Contingency	**20**	**%**			**$ 400,000**	**$ 500,000**	
TOTAL CAPITAL COST ESTIMATE					**$ 2,400,000**	**$ 3,000,000**	

ESTIMATED O&M COSTS	ESTIMATED QUANTITY	UNIT	ESTIMATED UNIT COST		
1. Labor	160	hour	$ 100	$ 16,000	System maintenance
2. Groundwater Treatment Costs	365	days	$ 170	$ 62,050	Includes chemicals and utilities
3. Quarterly Groundwater Monitoring	4	event	$ 7,000	$ 28,000	Includes sampling and analytical costs
4. Quarterly Reporting	4	event	$ 5,000	$ 20,000	Includes sampling and analytical costs
Subtotal				**$ 126,000**	
Contingency	**20**	**%**		**$ 25,200**	
YEARLY O&M COST ESTIMATE				**$ 150,000**	

30-YEAR PRESENT COST ESTIMATE RANGE	**4,500,000**	**to**	**5,100,000**	Discount rate = 7%

COST ESTIMATE SCENARIOS FOR COMPARISON PURPOSES ONLY			
Installation Cost plus 100 years of Operation (Discount rate = 7%)	$4,900,000	to	$5,500,000
Installation Cost plus 100 years of Operation (Non-Discount)	$21,000,000	to	$21,600,000

General Assumptions

Costs presented in 2005 US dollars ($US 2005)

CM/CQA - Construction Management/Construction Quality Assurance

A periodic cost ($600,000) is assessed every 15 years for large replacement items (e.g., buried carbon dioxide systems, carbon dioxide tank, slurry wall, etc.)

EXHIBIT 6.3-1
SCHEDULE MILESTONES: PASC DESIGN, PROCUREMENT, AND INSTALLATION
REVISED DRAFT FEASIBILITY STUDY TECHNICAL REPORT
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

The following schedule is provided for illustrative purposes. Although the schedules differ, PTW, GWC, ASC, PSR, and FGT possess similar scheduling steps. ASC and PSR may represent to largest scheduling departures because of their time to implement, which may bridge construction seasons.

Task	Begin	End
Feasibility Study Technical Report (FSTR)		
Revised dFSTR Submitted to Ecology	**4 March 2005**	
Ecology review of Revised Draft FSTR	March 2005	April 2005
Finalize the Revised Draft FSTR	April 2005	May 2005
Public Comment/Public Hearing on dFSTR	May 2005	June 2005
Responsiveness Summary/ Final FSTR Issued	June 2005	
Cleanup Action Plan (CAP)		
Draft CAP/ Construction Permits/ SEPA (DNS or Mitigated DNS)	June 2005	August 2005
Public Comment/ Public Hearing on dCAP	August 2005	September 2005
Responsiveness Summary/ CAP	September 2005	October 2005
Consent Decree Issued	October 2005	
Draft Consent Decree (CD)		
Public Comment/ Public Hearing on CD	August 2005	September 2005
Responsiveness Summary/ Final CD	September 2005	October 2005
Permit for Building the CO2 Tank Enclosure		
Preparing and Submitting JARPA for Enclosure Construction	March 2005	July 2005
Obtaining Pend Oreille shoreline, floodplain, and building permits	July 2005	September 2005
NPDES Permit		
Prepare NPDES Documentation (2 - 3 months)	April 2005	June 2005
Ecology/ EPA Documentation Review (3 - 6 months)	July 2005	January 2006
Permit Issued	January 2006	
Other Potential Permits/Regulatory Approvals for the Remedy		
Prepare and Submit JARPA for Remedy Implementation	March 2005	September 2005
USCOE 404 Permitting	September 2005	January 2006
Fish and Wildlife Hydraulics Project Approval	September 2005	October 2005
Department of Natural Resources Aquatic Use Authorization	September 2005	November 2005
Pend Oreille County shoreline, floodplain, and building permits	September 2005	November 2005
Ecology Section 401 Certification	September 2005	March 2006
Design Report		
Design and Report	March 2005	June 2005
Plans and Specifications	June 2005	August 2005
Ecology Review of the Design Report	August 2005	September 2005
Public Comment/ Public Hearing on Design Report	September 2005	October 2005
Responsiveness Summary/ Final Design Report	October 2005	November 2005
Procurement (Bid/ Negotiate/ Contract)		
Aboveground Structural Contractor	June 2005	August 2005
CO2 Tank	November 2005	May 2006
Specialty Contractors	November 2005	January 2006
Mechanical Contractor	December 2005	January 2006
Electrical / System Controls Contractor	December 2005	January 2006
Other Contractor(s)	February 2006	April 2006
Initial Mobilization	April 2006	May 2006
REMEDY IMPLEMENTATION		
Build New CO2 Tank Enclosure (includes foundation)	March 2006	April 2006
Install New CO2 Tank (includes transport)	May 2006	June 2006
Remedy Treatment System Construction	May 2006	September 2006
Conduct work affecting Sullivan Creek during the "fish window"	July 2006	July 2006
Commissioning	September 2006	September 2006
Remedy Completion	**September 2006**	

NOTES

DNS - Determination of Non-Significance
NPDES - National Pollution Discharge Elimination System
JARPA - Joint Aquatic Resources Permit Application
USCOE - United States Corps of Engineers
CO2 - Carbon Dioxide

APPENDIX A

PILOT TREATMENT WALL STUDY
2003 WORK PROGRAM DESCRIPTION AND SUMMARY OF FINDINGS
INCLUDES UPDATE (2003 – CURRENT)

DRAFT FEASIBILITY STUDY TECHNICAL REPORT
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

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PILOT TREATMENT WALL STUDY
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METALINE FALLS, WASHINGTON

A.1. INTRODUCTION

A.1.1 Terms of Reference

This appendix describes the work conducted in 2003 in support of the preparation of the feasibility study (FS) and presents a summary of investigatory results and analyses. This report was prepared for the Lehigh Cement Company (Lehigh) Closed Cement Kiln Dust (CKD) Pile (Site) located in Metaline Falls, Washington (see Exhibit A-1) by GeoSyntec Consultants (GeoSyntec). The 2003 work program described in Sections A.1 through A.4 was conducted during the FS phase of Agreed Order No. DE99HS-E941 (AO). GeoSyntec has continued to collect data and perform work in support of the FS since the original submittal of this appendix to the draft Feasibility Study Technical Report (dFSTR) in November 2003. Section A.5 of this appendix summarizes work conducted from November 2003 to present. This appendix and its attachments form Appendix A of the Revised draft Feasibility Study Technical Report (Revised dFSTR) submitted in March 2005.

A.1.2 Background

Since 1989, extensive environmental work has been conducted at the Site, including extensive site characterization, closure of the CKD pile, post-closure care and monitoring, and filling of low-lying areas downgradient of the closed CKD pile. In 1999, GeoSyntec conducted a focused remedial investigation (RI) at the Site [GeoSyntec, 2001]. The results of the RI confirmed that groundwater quality in certain areas downgradient of the CKD pile is characterized by high pH, decreased oxidation-reduction potential (redox potential or E_h), and elevated arsenic concentrations.

Following the RI, GeoSyntec performed a series of treatability studies and geochemical evaluations to evaluate methods for treating groundwater affected by the CKD pile. This work complemented investigations into other approaches that would isolate the CKD materials from groundwater contact. Interim Progress Report No. 1 [GeoSyntec, 2000], which was submitted to Ecology in 2000, documents the treatability tests. Treatability studies were conducted to evaluate potential methods for treating groundwater with high pH, decreased redox potential, and elevated arsenic levels. GeoSyntec evaluated several methods, including treating the groundwater with carbon dioxide, pyrite, and carbohydrate. Key conclusions of the treatability studies included:

- Geochemical models predicted that decreasing pH and concurrently increasing E_h would reduce pH and arsenic levels for the Site.
- Treatability test data indicated that carbon dioxide treatment effectively decreased the pH of Site groundwater to the desired range.
- Treatability test data indicated that Site groundwater carbon dioxide treatment increased E_h.
- Based on technical research and results from chemical analysis, pyrite treatment is a potential source of heavy metals, including arsenic, in Site groundwater.
- Treatment of Site groundwater with carbohydrate (i.e., wood chips) produced unfavorable conditions during treatability tests (e.g., contaminant addition, foaming) that made it infeasible for full-scale groundwater treatment.
- Based on thermochemical calculations, heat generation from Site groundwater pH neutralization with carbon dioxide would likely be manageable at field scale. Temperature increases were not noticeable during treatability tests.
- Treatability test data indicated that significant carbonate alkalinity is present in Site groundwater, requiring more carbon dioxide than would be required for the same pH groundwater absent carbonates.
- Geochemical evaluations of the soluble calcium carbonate suggested that this compound will not precipitate in the groundwater if the pH of Site groundwater is decreased by carbon dioxide treatment.

- Based on laboratory data, naturally-occurring Site solids (native soils) contain measurable arsenic concentrations. Arsenic leaching into groundwater treated with carbon dioxide during treatability tests was not detectable.

Based on the treatability study results and following approval from Ecology, Lehigh decided to further evaluate in-situ groundwater carbon dioxide treatment to treat Site groundwater. Lehigh and GeoSyntec designed a pilot in-situ groundwater carbon dioxide treatment system, also referred to as the pilot permeable treatment wall (Pilot System), and installed the Pilot System in fall 2002. Installation and early operation (from 14 November 2002 through 31 January 2002) is described in the Pilot Groundwater Treatment System Construction Report [GeoSyntec, 2003a]. The Pilot System was installed in a trench approximately 80 ft long and 18 ft deep into the underlying aquitard. The submerged treatment system contains six perforated pipes that contain tubing to diffuse carbon dioxide to groundwater. The pipes were buried at approximate 2-ft spacing, starting at 16 ft below ground surface (bgs). Carbon dioxide is delivered to the tubing from a 14-ton capacity tank. Later, GeoSyntec produced the FS Technical Memorandum (FSTM), which further describes the Pilot System performance by using data collected over the first six months of operation (through May 2003).

Key conclusions of the Pilot System installation and first six months of operation include:

- Based on laboratory data and field measurements, the Pilot System decreased groundwater pH to neutral levels in the vicinity of the Pilot System.

- As was expected based on research, treatability studies, and geochemical modeling, arsenic concentrations decreased in groundwater in the vicinity of the Pilot System.

- The carbon dioxide tank and delivery system require manageable amounts maintenance, an important factor in a remote, unmanned location. In the absence of personnel on-Site, the automated control system was installed to monitor operating variables. Remote monitoring capabilities provide real-time insight into daily system operation.

- Because of the Pilot System design, carbon dioxide flows even in the event of power outages or other system interruptions such as restarting the control system. Treatment is also accomplished if a system segment is isolated due to equipment failure or maintenance.

In addition to the Pilot System performance evaluation component of the FSTM, the FSTM documented the initial screening of a variety of Site remediation alternatives. Based on the screening documented in the FSTM and subsequent discussions with Ecology, the remedies remaining for evaluation as part of the FS are:

- Carbon dioxide PTW;
- A combination of PTW and pump and treat with discharge into Sullivan Creek;
- Additional source control on the closed CKD pile;
- Partial source removal of the closed CKD pile;
- Downgradient funnel and gate groundwater treatment using carbon dioxide permeable treatment; and
- Downgradient funnel and gate groundwater treatment using carbon dioxide permeable treatment with a gravity drain under the southern side of the Closed CKD Pile.

To refine and update the data set used to evaluate Pilot System performance and to collect needed data for FS remedy evaluation in the FS, Lehigh and GeoSyntec designed the 2003 work program. GeoSyntec implemented the work program during July through September 2003.

A.1.3 2003 Work Program

In July 2003, GeoSyntec conducted the fieldwork component of the 2003 Work Program. Quarterly and supplemental groundwater monitoring were conducted in August and September 2003. The 2003 Work Program included the following elements:

1. **Additional Lithology and Groundwater Data Collection**: To better define the subsurface conditions and groundwater flow pattern at the Site, GeoSyntec collected lithology and groundwater data from locations around the Site, including the newly acquired property north-northwest of the existing toward the bluffs below the town of Metaline Falls (Exhibit A-1).

2. **Evaluation of the North Culvert as a Potential Preferential Pathway**: Based on Pilot System operation and Site history, there was concern that the north culvert was acting as a preferential pathway and consequently mixing with treated groundwater from the Pilot System. GeoSyntec investigated the North Culvert as a preferential pathway for groundwater flow.

3. **Northern Area Groundwater Quality Evaluation**: Lehigh recently acquired the property north of the existing building. To evaluate the quality and flow of the groundwater underlying this property, GeoSyntec collected field data and groundwater samples.

4. **Evaluation of Carbon Dioxide Sparging as a Groundwater Treatment Option**: To test the operation of the pilot carbon dioxide sparge points, GeoSyntec initiated carbon dioxide flow to the sparging cylinders that were installed as part of the Pilot System [GeoSyntec, 2003a].

5. **Extraction Wells/Capture Zone Evaluation**: To be used as an input in the pump and treat groundwater remedy evaluation portion of the FS, GeoSyntec performed a pump test and evaluated the test data.

6. **Groundwater Monitoring**: In addition to regular quarterly groundwater monitoring, GeoSyntec collected supplemental groundwater samples to evaluate PTW performance and groundwater in the northwest portion of the Site.

7. **Pilot System Operation Evaluation**: To evaluate the long-term feasibility of the Pilot System as a groundwater remedy, GeoSyntec evaluated and optimized the Pilot System.

8. **Pilot System Performance Evaluation**: To evaluate the performance of the Pilot System, GeoSyntec collected data to analyze the extent of the treated groundwater migration and the overall performance of the Pilot System.

9. **Pilot System Effects on Surrounding Soils Evaluation**: To evaluate if the Pilot System was affecting the downgradient saturated soil, GeoSyntec collected soil composition data.

10. **Purge Interval Operating Parameter Testing and Analysis**: During extended operation of the pilot (and full-scale) PTW, counterdiffusion could theoretically cause gases other than carbon dioxide dissolved in groundwater to accumulate in the tubing. This condition is addressed by periodically purging gas in the system. GeoSyntec collected data to evaluate gas compositions in the system.

A.1.4 Document Organization

The remainder of this appendix is organized into the following sections:

- Section A.2, *Work Description*, describes the 2003 work program.
- Section A.3, *Analysis and Findings*, evaluates the results as they apply to the Site and the FS remedy evaluation process.
- Section A.4, *Pilot Permeable Reactive Wall Evaluation,* describes the Pilot System installation, operation, and performance.

- Section A.5, *Update on Pilot System Operation and Performance*, provides data collected between November 2003 and February 2005.

Exhibits (tables and figures) and attachments are included at the end of this document.

A.2. 2003 WORK PROGRAM DESCRIPTION AND RESULTS

A.2.1 Introduction

The field work described in this section was performed to provide information on items outlined in Section A.1.3. Exhibit A-2 summarizes the investigations and the associated conclusions used in the remedy evaluation phase of the FS.

A.2.2 Subsurface Investigation

GeoSyntec performed a subsurface investigation that included installation of boring probes and groundwater monitoring locations. Exhibit A-3 shows the locations of the subsurface investigative points, which included:

- Six groundwater monitoring locations screened at depths between 15.5 to 22 feet (ft) (bgs) (PM-16, PM-17, PM-18, PM-19, PM-20, PM-21);
- Two temporary and subsequently abandoned groundwater monitoring locations in borings FSB-04 and FSB-06;
- Twenty-nine temporary direct push groundwater and/or soil probes (FSP-01 through FSP-29); and
- Six borings (FSB-01 through FSB-06).

The subsurface investigation also included the North Culvert investigation designed to evaluate the potential for the North Culvert to act as a preferential pathway for groundwater. The investigation, conducted on 31 July 2003, included the excavation of a trench across the buried North Culvert (see Exhibit A-3). Exhibit A-4 shows the culvert excavation trench log, which indicates that the culvert was observed to be above groundwater and buried in material that is similar to the surrounding native material. GeoSyntec also noted that the section of culvert observed during the investigation appeared to be a smooth-walled carbon steel pipe in good condition (i.e., no observed pitting). The trench was subsequently backfilled with the stockpiled excavation materials and compacted on 31 July 2003.

A.2.3 Field Data Collection Program

Exhibit A-2 summarizes the 2003 data collection program. Data was collected from the newly installed sampling locations, as well as previously established sampling locations. The data collected at the Site included groundwater elevation and field pH readings. GeoSyntec also collected lithologic data from the borings drilled in 2003. Exhibit A-5 presents the groundwater elevation and field groundwater pH readings from July 2003. Lithologic logs are included in the draft Feasibility Study Technical Report.

A.2.4 Sample Collection and Chemical Analysis

GeoSyntec collected soil, groundwater, and gas samples for laboratory analysis during July 2003. GeoSyntec collected groundwater samples by using low-flow groundwater sampling techniques and submitted them for laboratory analysis to provide data on groundwater quality and contaminant distribution as well as Pilot System performance. GeoSyntec collected soil samples for laboratory analysis to provide data for the evaluation of the potential effects of the Pilot System on surrounding soil. Gas samples were collected for laboratory analysis to provide data for the evaluation of accumulated gas in the Pilot System tubing. Exhibit A-6 summarizes the groundwater analytical data, Exhibit A-7 the soil analytical data, and Exhibit A-8 the gas analytical data. The laboratory reports are presented in Attachment 1.

Summer 2003 samples and the associated analytical methods requested for those samples are summarized in Exhibit A-2. Scheduled quarterly groundwater monitoring (MW-7, -8, -9, -11, and –12) was conducted in August 2003, and supplemental groundwater monitoring (PM-1 through -21) was conducted in August and September 2003.

A.2.5 Carbon Dioxide Sparge Point Test

In July 2003, GeoSyntec conducted a test of the carbon dioxide sparge points installed as a component of the Pilot System. The test consisted of opening the manual ball valve feeding carbon dioxide to the sparge points and observing the response of the sparge points in the trench. The test led to the following observations:

- With the valve approximately one-quarter open, GeoSyntec heard gas bubbling in the groundwater. Audible gas bubbling suggests that a significant volume of carbon dioxide is escaping into the atmosphere. Carbon dioxide bubbling to the surface represents a major inefficiency in gas delivery.

- GeoSyntec observed that the sparging process resulted in surface emission of a gas with a hydrogen sulfide odor (i.e., rotten eggs). Even at low flow rates, where the bubbling was inaudible, GeoSyntec smelled sulfur odors that were emitted from the Pilot System during sparging tests. GeoSyntec ceased sparging operations to research the cause of the odor. The odor threshold of hydrogen sulfide varies among individuals, but is generally reported as less than 10 parts per billion by volume (ppbv), with some individuals able to detect concentrations as low as 0.5 ppbv [McGavran, 2001].

Based on the hydrogen sulfide odors, GeoSyntec discontinued the sparge point testing and resolved to research the issue further before attempting further sparge point operation. Section A.3.6 presents findings from the research.

A.2.6 Pump Test

GeoSyntec performed a pumping test at the PM-16 groundwater monitoring location (a 4-in. diameter groundwater monitoring location screened from 6 to 16 ft bgs). The sand filter pack surrounding the well screen extends from 3.5 to 16.5 ft bgs. The underlying clay aquitard was encountered at 13.5 ft bgs. In addition to PM-16, FSP-23 was used to measure drawdown at a distance of 24.2 ft from the PM-16.

PM-16 was pumped with a submersible pump at rates ranging from 2.4 to 5 gallons per minute (gpm). Water was collected for in drums and in a tank for subsequent disposal off-site. Groundwater levels in PM-16 before, during, and after pumping were measured to the nearest 0.01 ft with an electronic water level sounder and a down hole pressure transducer equipped with a datalogger. Water levels were measured in FSP-23 before, during, and after pumping with the electronic water level sounder. Pumping test data was analyzed by using the AQTESOLV® computer program. The pump test results and interpretation are presented in Section A.3.7. GeoSyntec transmitted the raw pump test data to Ecology in electronic format [GeoSyntec, 2004].

A.2.7 Pilot Permeable Treatment Wall Operation and Maintenance

Operation of the Pilot System started on 15 November 2002. From start-up through 1 October 2003, the Pilot System operated for approximately 6,750 hours. The system was shut down on occasion to perform maintenance. Exhibit A-9 summarizes other significant dates with respect to the Pilot System installation, start-up, and first 11 months of operation.

GeoSyntec conducted a thorough evaluation and optimized the operation of the Pilot System in July 2003. Activities included:

- monitoring the system for carbon dioxide leaks with a portable Gastech® GT-208 gas analyzer equipped with a carbon dioxide detector;

- modifying the operation of the carbon dioxide tank temperature control system to accommodate demanding Site weather conditions;

- testing the carbon dioxide detectors for measurement drift;

- performing maintenance on the supervisory control and data acquisition (SCADA) system (i.e., pH probe cleaning and reconditioning, pressure transmitter testing, etc.);

- installing a power conditioner on the electrical feed to the system's programmable logic controller (PLC) to partially attenuate data noise caused by power fluctuations outside of the system; and

- modifying the gas distribution network by removing clear plastic components with glued seams that are potentially susceptible to leaks.

A.3. ANALYSIS AND FINDINGS

A.3.1 Introduction

The 2003 work program is described in Section A.2. This section contains the data analysis and associated findings of the 2003 work program.

A.3.2 Site Subsurface

The Site subsurface is generally composed of 5 to 20 ft of silts, sands, and gravels overlaying a silty clay confining layer. The silty clay has been encountered in borings advanced to sufficient depths across the Site. This data, combined with the geologic nature of the Site area, suggests that the confining layer is present below the Site to Sullivan Creek. Groundwater generally first occurs in the upper several feet below ground surface (bgs). Lithologic logs and cross-sections of the Site are included in Appendix C of the Revised dFSTR.

Although preferential pathways likely exist in the form of high-permeability channels underlying the Site, the North Culvert and its surrounding material do not appear to be a preferential pathway. As shown in Exhibit A-4, the North Culvert is amidst materials that are similar to those surrounding it. The culvert appeared to be in good condition at the excavation location, which suggests that it is conducting surface water under Highway 31 as intended and not discharging that water to the groundwater prior to its surface water destination.

A.3.3 Groundwater Elevation

Exhibit A-5 contains groundwater elevation data for summer 2003. The potentiometric surface contours generated using the water level data are displayed on Exhibits A-3 and A-12. Summer 2003 groundwater elevations had generally decreased since the previous measurements taken in April and May 2003 but were consistent with historical data. The overall direction of groundwater flow is perpendicular to the Pilot System alignment. The groundwater elevation data show that groundwater flows in a north-northeasterly direction from the closed CKD pile toward Sullivan Creek (see Exhibit A-3) with localized anomalies downgradient of the Pilot System. The localized anomalies consist of variable slopes of the groundwater potentiometric surface around the Pilot System. The anomalies could be due to several factors, including:

- The Site contains highly variable geologic conditions vertically and horizontally; and
- The gravel-filled Pilot System trench is of a different permeability than the surrounding floodplain material.

A.3.4 Groundwater pH Distribution

Groundwater pH field measurements are presented in Exhibit A-5 and analytical laboratory data in Exhibit A-6. pH measurements of samples collected from previously existing locations were generally consistent with historical data. The pH data collected from newly installed monitoring points combined with data for existing monitoring points are presented in Exhibit 2.3-5 of the Revised dFSTR. Exhibit A-10 shows time-series analytical laboratory pH readings from the Site groundwater monitoring wells (MW-07, MW-08, MW-09, MW-11, and MW-12). Exhibit A-10 illustrates that pH groundwater data have been relatively consistent since 1995, with the exception of the pH decrease observed in MW-8 following CKD pile closure.

Groundwater field measurements and laboratory results indicate that affected groundwater is present in the northern portion of the Site. Samples from the Site's northernmost groundwater monitoring locations (PM-15, PM-18 and PM-19) contained elevated pH and arsenic levels.

A.3.5 Groundwater Arsenic Distribution

Groundwater samples were collected and analyzed for arsenic at several permanent and temporary locations, as presented in Exhibit A-6.

Exhibit A-11 shows time-series analytical laboratory total arsenic data from the Site groundwater monitoring wells (MW-07, MW-08, MW-09, MW-11, and MW-12), and Exhibit 2.3-5 of the Revised dFSTR shows recent analytical arsenic data on a map of the Site.

Exhibit A-11 illustrates that arsenic groundwater data have been relatively consistent, with the exception of the decrease in arsenic concentration observed in MW-9 when low-flow sampling was initiated in 2000. The low-flow procedures were initiated to produce data more representative of groundwater conditions.

Recent reported total arsenic results, similar to pH results, indicate that affected groundwater is present in the northern portion of the Site. Total arsenic concentrations ranging from not detectable (<0.010 mg/L) to 0.278 mg/L were reported for samples collected from groundwater monitoring locations (PM-15, PM-16, PM-17, PM-18, PM-19, PM-20, and PM-21) in the northern portion of the Site .

A.3.6 Carbon Dioxide Sparge Point Data

As discussed in Section A.2.5, hydrogen sulfide was detected during the carbon dioxide sparge point tests. The detection of hydrogen sulfide can be explained as follows:

Sulfides are present in affected Site groundwater from dissolution of naturally occurring sulfides like pyrite (FeS), arsenopyrite (FeAsS), and orpiment (As_2S_3). When the groundwater pH is decreased, the sulfide ion (S^{--}) can participate in an acid-base reaction to form hydrogen sulfide (H_2S) according to Equation 1.

$$S^{--}\ (aq) + 2\ H^{+}\ (aq) = H_2S\ (aq) \qquad (1)$$

Exhibit A-8 contains gas data from samples collected from the Pilot System distribution system. The gas data show that hydrogen sulfide is formed as a byproduct of carbon dioxide groundwater treatment. Hydrogen sulfide emissions are not a concern during Pilot System operation due to its diffusion-based method of carbon dioxide delivery. Conversely, sparging carbon dioxide in the groundwater is an inefficient method of gas delivery because carbon dioxide is wasted when bubbles escape to the atmosphere. Sparging at the Site also causes other undesirable side effects, including surface emission of hydrogen sulfide. Sparging Site groundwater with carbon dioxide likely caused emissions of hydrogen sulfide into the atmosphere because bubbling carbon dioxide (to decrease pH) increased the driving force for hydrogen sulfide to partition into the bubble gas-phase (i.e., stripping the hydrogen sulfide from solution). The hydrogen sulfide partitions from the water into the bubbles and carried to the atmosphere. Based on the odors observed at the Site and the research and analysis of the hydrogen sulfide phenomenon, GeoSyntec does not plan to further operate the carbon dioxide sparge points. Actual hydrogen sulfide concentration data in the escaped data is not needed for the following reasons:

- Sparge points waste carbon dioxide because the groundwater does not consume the carbon dioxide rapidly enough to prevent carbon dioxide bubble escape to the atmosphere;

- Long-term full scale use of sparge points at the Site is also not feasible because they release odors (observed by GeoSyntec personnel) into the atmosphere that research indicates is hydrogen sulfide, which is a toxic gas and odor nuisance.

The diffusion-based Pilot System is not expected to release hydrogen sulfide to the atmosphere. The Pilot System relies on diffusion of carbon dioxide into groundwater, which does not produce bubbles that escape to the atmosphere. Without the gas bubbles providing the driving force for hydrogen sulfide to enter the gas phase, hydrogen sulfide is expected to remain dissolved according to Equation 1. Further, GeoSyntec has not observed the hydrogen sulfide odors during Pilot System operation.

A.3.7 <u>Pump Test Interpretation</u>

GeoSyntec experienced difficulties pumping at a constant rate from PM-16, but general observations include:

- PM-16 sustained an average pumping rate of 2.9 gpm for a period of over 6.5 hours;

- FSP-23, which is approximately 24 ft from PM-16, experienced a maximum measured drawdown of 0.16 ft due to the pumping at PM-16; and

- FSP-21, which is approximately 65 ft from PM-16, experienced no measurable drawdown.

AQTESOLV was used to evaluate the pumping test data. Depending on the numerical solution that is used, the resulting hydraulic conductivity value ranges from 25 to 95 ft/day, similar to results of previous tests performed at the Site [D&M, 1993]. These values are also consistent with the recorded PM-16 lithology.

A.4. PILOT SYSTEM PERFORMANCE EVALUATION

A.4.1 General

This section contains an evaluation of the performance of the Pilot System with regard to various evaluation parameters, including:

- Groundwater treatment performance (ability to lower pH and arsenic concentrations);
- Physical performance (i.e., ease of operation and maintenance requirements); and
- Potential impacts on downgradient soils.

In addition, an overall assessment of the effectiveness of the PTW is presented at the end of this section.

A.4.2 Groundwater Treatment Performance Evaluation

A.4.2.1 Introduction

This section describes the evaluation of the performance of the Pilot System to lower pH and arsenic concentration in Site groundwater. This evaluation was performed by analyzing pH and arsenic concentration data upgradient and downgradient of the Pilot System. In addition, chemical indicators (such as dissolved inorganic carbon) variations upgradient and downgradient of the trench were also analyzed to further evaluate the efficacy of the Pilot System. Groundwater analytical data used in this section are summarized in Exhibit A-6.

A map of the Pilot System treatment trench and the surrounding area is shown in Exhibit A-12. Cross-sections from within and through the Pilot System treatment trench are presented in Exhibits A-13, A-14, A-15, and A-16. It should be noted that although AVG-W, AVG-M, and AVG-E monitoring locations were installed in the treatment trench, only AVG-W and AVG-E remained intact following backfill and grading of the treatment trench area; AVG-M was rendered unusable for groundwater monitoring during installation of the Pilot System.

GeoSyntec monitored groundwater from upgradient locations (PM-10, FSP-15, and FSP-16), within-trench locations (AVG-W, AVG-E, CMT-W, CMT-M, and CMT-E), immediately downgradient locations (PM-11, PM-12, and PM-13), and farther downgradient (MW-9, FSP-19, FSP-18, followed by FSP-25, PM-17, and PM-14). Exhibit A-12 shows Cross-sections A-A’, B-B’, and C-C’ along flow paths that intersect the treatment trench. The data collected from these monitoring points were used to evaluate the ability of the Pilot System to treat groundwater.

A.4.2.2 Performance to Treat Groundwater pH and Arsenic

A.4.2.2.1 General

The goals of the Pilot System are to decrease groundwater pH and arsenic concentrations. Exhibits A-13, A-14, A-15, and A-16 show 18 July 2003 field pH measured in samples collected within and along flowpaths perpendicular to the Pilot System. Where available, summer 2003 dissolved arsenic laboratory data are presented along the flowpaths in Exhibits A-14, A-15, and A-16.

A.4.2.2.2 Performance in Decreasing Groundwater pH

Exhibits A-14, A-15, and A-16 show that elevated pH groundwater (9.5 to 11.5) enters the treatment trench. In the trench and immediately downgradient of the trench, pH decreases to between approximately 5.9 and 6.0. Then pH generally increases as groundwater migrates farther downgradient of the trench. Exhibit A-17 shows a graph of pH as a function of time upgradient, within, and downgradient of the trench.

Exhibit A-17 demonstrates the ability of the trench to reduce pH from approximately 12 to 12.5 units to 6 to 7 pH units at the Site. Increase of the pH farther downgradient of the trench is consistent with the mixing of treated water with untreated water that bypassed the treatment trench. pH measurements collected in CMT-1 (a multi-depth groundwater monitoring point) installed in August 2001 and deactivated in October 2002 when the Pilot System was installed, was used to represent groundwater pH levels before installation of the treatment trench.

A.4.2.2.3 Performance in Decreasing Arsenic in Groundwater

For the purposes of Pilot System performance evaluation, dissolved arsenic results were evaluated instead of total arsenic results since unfiltered samples (analyzed for total arsenic), especially those from temporary probe locations, contain particles from the soil matrix and may not be representative of the groundwater quality. Exhibits A-14, A-15, and A-16 display reported dissolved arsenic analytical data from recent samples collected along flow paths perpendicular to the Pilot System. Laboratory arsenic data from the 2003 work program samples show a trend similar to the pH data. Arsenic generally decreases in the Pilot System treatment trench and increases as distance from the trench increases.

Arsenic data are plotted as a function of time for the groundwater monitoring locations surrounding the Pilot System (PM-10, PM-11, PM-12, PM-13, PM-17, AVG-E, and AVG-W, and MW-9). The November 2001 groundwater sample from PM-10 was likely influenced by trenching, Pilot System installation, and elevated carbon dioxide flow rates that were used to test the Pilot System prior to start-up. However, subsequent lab data show a trend of arsenic decrease in the treatment trench and sustained low levels of arsenic in groundwater samples up to approximately 10 ft downgradient of the treatment trench. Exhibit A-18 shows time series dissolved arsenic laboratory data to illustrate the groundwater arsenic decrease since commencement of Pilot System treatment.

A.4.2.2.4 Conclusions Regarding Pilot System Efficacy in Decreasing Arsenic and pH Levels In Groundwater

Based on the data collected in summer 2003 and historical data collected since the start of operation of the Pilot System in November 2002, groundwater flowing into and through the Pilot System has the following characteristics:

- Based on field and analytical data, groundwater from upgradient of the Pilot System contains elevated pH levels and arsenic concentrations;

- Field and analytical data suggest that groundwater pH and arsenic concentrations are being decreased in the treatment trench and pH is generally meeting treatment goals;
- Decreases in groundwater pH result in decreased arsenic concentrations (as predicted by the treatability tests);
- In immediately downgradient monitoring locations, groundwater sample data indicate that they are largely composed of treated groundwater; and
- Farther downgradient sample data indicate that treated groundwater is mixing with untreated groundwater causing pH levels and arsenic concentrations to increase.

A.4.2.3 Groundwater Treatment Performance Indicator Evaluation

A.4.2.3.1 General

Arsenic and pH data are used to evaluate whether the Pilot System is accomplishing treatment goals. Dissolved inorganic carbon (DIC) and alkalinity data, which are discussed in this section, provide supplemental information on Pilot System performance, as explained below.

A.4.2.3.2 Groundwater Dissolved Inorganic Carbon (DIC) Evaluation

Once diffused into groundwater, carbon dioxide can be measured analytically in the form of DIC. Thus, the concentration of DIC in a given groundwater sample can be used to calculate the percent of that sample that is composed of groundwater that has been treated (i.e., subjected to carbon dioxide diffusion). Unlike pH, which is expressed on a nonlinear scale and may be affected by groundwater buffering, DIC is linearly related to the degree of treatment. Following a discussion of the value of DIC data in the FSTM, GeoSyntec submitted samples for DIC laboratory analysis during May 2003 groundwater monitoring and summer 2003 work.

The DIC concentration of a sample $[DIC]_S$ is related to the DIC concentration of treated water $[DIC]_T$ using Equation 2.

$$[DIC]_S = f_T\,[DIC]_T + f_B\,[DIC]_B \tag{2}$$

Equation 2 assumes that $[DIC]_S$ is equal to $[DIC]_T$ multiplied by the volume fraction of the sample represented by treated water, f_T, plus the background DIC concentration, $[DIC]_B$, multiplied by the volume fraction of the sample that is untreated water, f_B. Substituting $f_B = 1\text{-}f_T$ since the total volume fraction of a given sample of two waters, background and treated, is 1, the fraction of a sample that is treated water can be expressed in terms of f_T according to Equation 3.

$$f_T = \frac{[DIC]_S - [DIC]_B}{[DIC]_T - [DIC]_B} \tag{3}$$

Equations 2 and 3 can be used to calculate f_T if the background (i.e., upgradient) and treated (i.e., within the treatment trench) groundwater DIC data are available. The May 2003 sample data contains reported DIC concentrations from PM-10 (upgradient) and AVG-W and AVG-E (within the treatment trench). GeoSyntec calculated the mean concentration in the treatment zone, $[DIC]_T$, by averaging the DIC data reported for samples from AVG-E and AVG-W. For May 2003 samples results, the average treated water DIC concentration, $[DIC]_T$, was reported to be 335 mg/L and the PM-10 background DIC concentration, $[DIC]_B$, was 65 mg/L. These laboratory data were used, in conjunction with Equation 3 and downgradient DIC sample results, to calculate the percent of treated water (f_T multiplied by 100%) in samples collected from downgradient locations. Exhibit A-19 lists DIC concentrations for the May 2003 samples collected in the vicinity of the treatment trench along with the calculated percentage of treated groundwater using Equation 3. Negative values for f_T are interpreted as variations due to natural geochemical variability, or temporal variability. The laboratory DIC data are plotted in Exhibit A-20 as a function of distance from the treatment trench.

Based on experience and data variability, uncertainties of approximately 20% result from this calculation approach. Recognizing the inherent uncertainties, the May 2003 sample data indicate that:

- Samples from PM-11 and PM-12, which are just downgradient from the treatment zone, are treated groundwater; and

- PM-13 is mixing with untreated groundwater, likely due to its location at the edge of the Pilot System and the groundwater flow direction.

Based on the May 2003 evaluation and Exhibits A-19 and A-20, which display May 2003 laboratory DIC data from samples collected in the vicinity of the Pilot System, DIC can be used to evaluate the migration of treated groundwater over time. This approach could also be used as an indicator of the mechanical performance of the treatment trench. For example, a decrease in the fraction of treated groundwater in a given treatment zone location could be a diagnostic tool to detect leaks or other inefficiencies.

Laboratory DIC data for summer 2003 samples is plotted on Exhibits A-14, A-15, and A-16. DIC concentrations from samples collected downgradient of the Pilot System suggest that treated groundwater is migrating downgradient. The July DIC data for FSP-18 and FSP-20 groundwater samples indicate that they are mostly treated groundwater. FSP-19 data indicates that it is mostly untreated groundwater. (GeoSyntec collected these samples from direct push temporary groundwater sampling locations, and the data variability may be attributed to the nature of the unfiltered temporary location samples, which often contain soil particles. Additionally, GeoSyntec interrupted Pilot System operation for approximately three weeks in summer 2003 for maintenance, system diagnostics, and carbon dioxide refill.) Considering the factors that may have influenced the laboratory results, they demonstrate that the Pilot System is treating groundwater. Using the DIC calculation approach, downgradient well data are consistent with samples containing treated groundwater. As the distance from Pilot System increases, data suggest that treated groundwater mixes with untreated groundwater.

To further enhance use the DIC tracking approach outlined in this section, DIC data from a longer time interval are needed. By submitting samples for DIC analysis over several monitoring periods, historical trends can be evaluated for increases in DIC that would potentially indicate the arrival of treated groundwater at downgradient wells. This process was initiated in May 2003 during the initial quarterly monitoring event following DIC discussion in the FSTM, resulting in the evaluation in Exhibit A-19. The laboratory reports through November 2003 are presented in Attachment 1 and summarized in Exhibit A-6. Attachment 1 contains reports and results for November 2003 to present.

A.4.3 Physical Performance Evaluation

A.4.3.1 General

GeoSyntec conducted operation and maintenance as described in Section A.2.7. Based on observations during operation and maintenance procedures, the Pilot System is operating as designed. The system components required little maintenance following eight months of operation. Observations included:

- The carbon dioxide tank has been relatively trouble free;
- Refilling the carbon dioxide tank is a relatively straight-forward process (important at a remote site);
- Stainless steel flanges should be used at the junction where the tubing is connected at the terminus ends instead of the thermoplastic flanges for increased durability and should be replaced during a maintenance down-time period (Note: This was completed in November 2003);
- Gas flow site glass components are potential sources of leakage and are not needed for operation due to low amounts of condensation inside of the Pilot System carbon dioxide manifolds;
- The pH probes should be cleaned and calibrated (simple and straight-forward procedures) on a semiannual basis;
- Hydrogen sulfide, an odorous and potentially toxic compound, is produced as a by-product of treatment and was detected in the gas tubing; and
- One thorough yearly physical and visual evaluation is likely sufficient.

A.4.3.2 Permeable Treatment Wall Gas Purging Requirements Evaluation

GeoSyntec collected gas samples from each of the five operating Pilot System vertical pipes. The gas samples were collected from the terminus ends where purge valves are present. Exhibit A-8 tabulates the gas data. The laboratory reports are presented in Attachment 1. Based on the laboratory gas data and data from the carbon dioxide supplier, gas in the treatment system after approximately two weeks of operation can be characterized by:

- The supplier guarantees that the carbon dioxide is at least 99 volume percent pure upon delivery;
- Majority of the gas composition is carbon dioxide (96.6 to 97.5 volume percent)
- Trace concentrations of the sum of oxygen and argon (0.7 to 0.8 volume percent) and also nitrogen (1.9 to 2.6 volume percent); and
- Trace concentrations of hydrogen sulfide (non detect at 1 ppmv up to 3 ppmv).

The laboratory data show that the treatment gas, carbon dioxide, represents the major component of the gas. The laboratory data suggest that counterdiffusion, which occurs when dissolved gases in groundwater diffuse into the treatment tubing due to concentration gradients, may accumulate and that periodic purging may be advised. Reported oxygen and argon, and nitrogen concentrations could be partially attributable to dissolved atmospheric gases in groundwater (with the balance of atmospheric gases attributable to carbon dioxide supply impurities). The hydrogen sulfide concentrations are likely attributable to the hydrogen sulfide byproduct dissolved in the groundwater by treatment with the diffusion-based Pilot System. Based on these results, GeoSyntec recommends that time-series gas data be collected for the treatment gases to calculate the optimal purge interval, if a full-scale PTW is selected.

Hydrogen sulfide emissions from PTW are not expected to be a concern based on concentrations of metals levels in groundwater, the vapor pressure of hydrogen sulfide, and the diffusion coefficient of hydrogen sulfide in water. Although it may be created in the groundwater at very low concentrations during operation of the PTW, thermodynamics and chemical equilibria data indicate that hydrogen sulfide will not escape from groundwater and produce concentrations of concern at the ground surface. The mass transfer gradient needed for hydrogen sulfide to escape solution and vent to the atmosphere is not present in the PTW since PTW operation does not involve physical processes such as bubbling.

A.4.4 Pilot Treatment Downgradient Soil Effects

The Pilot System treats groundwater with carbon dioxide to decrease pH and precipitate arsenic. To evaluate the potential for adverse effects of downgradient soil due to the Pilot System, GeoSyntec collected downgradient soil samples and analyzed for metals and treatment byproducts. Soil sample data are tabulated in Exhibit A-7. Attachment 1 contains the laboratory reports. Based on geochemical modeling of carbon dioxide treatment and treatability test data, laboratory samples were analyzed for:

- arsenic by EPA Method 7060 to evaluate the arsenic precipitation from treated groundwater;

- manganese by EPA Method 6010B to evaluate potential manganese precipitation from treated groundwater;

- iron by EPA Method 6010B to evaluate potential manganese precipitation from treated groundwater; and

- sulfide by using a LECO instrument to evaluate treated groundwater potential sulfide byproducts.

FSP-18 and FSP-19 are locations downgradient of the Pilot System (Exhibit A-12). The FSP-18 and FSP-19 soil samples, which were from below the groundwater surface at depths of 12 and 8 ft bgs, respectively, were reported to contain:

- arsenic concentrations of 3.00 mg/kg and 4.36 mg/kg, which are similar to the average background arsenic concentration in soil of 3.3 mg/kg reported in the RI Report [GeoSyntec, 2001 and below the Wasington Model Toxics Control Act (MTCA) Method A soil cleanup level of 20 mg/kg [WAC 173-340];

- manganese concentrations of 353 mg/kg and 419 mg/kg, which are below the MTCA Method B soil cleanup level of 2,240 mg/kg established for the protection of groundwater [WAC 173-340];
- iron concentrations of 18,900 mg/kg and 20,100 mg/kg, which are below the EPA Region 9 preliminary remediation goal (PRG) of 23,000 for iron in residential soil (MTCA cleanup levels for iron are not available) [USEPA, 2002];
- sulfide was not detected by the laboratory at or greater than 0.010 percent.

Based on the results discussed above, no significant negative effects from the Pilot System were observed in the soils.

A.4.5 Pilot Permeable Treatment Wall Conclusions

Based on the measurements, results, and observations discussed in this section, conclusions regarding Pilot System performance include:

- Data indicate that the Pilot System is lowering pH and arsenic levels in groundwater;
- DIC data suggest that treated groundwater has migrated downgradient from the Pilot System;
- As downgradient distance from the Pilot System treatment trench increases, groundwater is increasingly mixed with untreated Site groundwater; and
- DIC is a useful parameter to track groundwater treated with carbon dioxide. It could be used to provide a performance indicator if full-scale PTW is selected.

The installation, first 27 months of operation, and associated data provide valuable insight into the PTW. Based on the PTW insight provided by the Pilot System, Lehigh and

GeoSyntec have evaluated its feasibility to meet remedy requirements for inclusion as a remedy in the Revised dFSTR. The previous sections included a description of Pilot System operation from installation through November 2003. The next section, A.5, provides an update that covers Pilot System operation and performance from November 2003 to February 2005.

A.5. UPDATE ON PILOT SYSTEM OPERATION AND PERFORMANCE (NOVEMBER 2003 – FEBRUARY 2005)

A.5.1 Introduction

GeoSyntec prepared the following section to summarize Pilot System operational observations and Site environmental data collected from November 2003 through February 2005 (corresponding to the time between the first dFSTR submittal and the revised dFSTR submittal). This section augments the data set presented in Sections A.1 through A.4.

A.5.2 Pilot System Operation

As of 25 February 2005, the Pilot System has operated approximately 16,400 hours since start-up in November 2002. In addition to routine maintenance, the Pilot System required the following maintenance procedures since November 2003:

- Small amounts of condensation collected in the submerged silicon tubing. Air was injected individually into the tubing to purge the condensate and air-dry the tubing in March 2004.

- Certain connections between the silicon tubing and the stainless steel carbon dioxide distribution plate had minor leaks. Leaks were caused by the tubing detached from their barbed connections. The loose silicon tubing was reattached to the connections and the remaining connections were monitored in November 2003.

- The upper PVC flanges in the distribution system became brittle after extended use. The PVC flanges were replaced with stainless steel flanges in May 2004.

- The front portion of the building that houses the carbon dioxide tank and computer system caught fire on 1 January 2005. The fire was not in the vicinity of the tank. Treatment was not interrupted, but the computer and data collection systems were not operational for approximately one week while the building was cleared for re-entry and electrical service was restored.

GeoSyntec restored the data collection systems and re-synchronized the computer with the PLC.

A.5.3 Pilot System pH and Arsenic Treatment Progress

Exhibits A-21 and A-22 contain water level, pH, dissolved arsenic, total arsenic, and dissolved inorganic carbon (DIC) data collected since November 2002. Exhibits A-23, A-24, and A-25 show time-series pH, dissolved arsenic, and DIC data (respectively) from monitoring well samples in the vicinity of the Pilot System. Exhibits A-23 and A-24 augment Exhibits A-17 and A-18, including data collected since those two exhibits were originally submitted. The data and time-series plots indicate the following trends in treatment:

- The Pilot System reduces the pH and dissolved arsenic concentrations in the groundwater that intersects the treatment zone. The Pilot System has consistently treated water to neutral pH and non-detect arsenic concentrations in the treatment zone (AVG-E and AVG-W) and immediately downgradient (PM-11 and PM-12).

- Water levels have remained relatively consistent over time (within approximately 2 ft vertical variation).

- DIC remains a good treatment tracking parameter for the Pilot System. The DIC data indicate that treated groundwater continues to migrate downgradient but is overwhelmed by untreated water that migrates around and side-gradient to the treatment zone. PM-13 data suggest that the northerly groundwater flow component results in untreated water migrating obliquely around the southeastern edge of the Pilot System treatment zone.

- The Feasibility Study Technical Memorandum included a discussion of some anomalous data (April 2003 groundwater monitoring data) that were believed at the time to be erroneous due to a sampling error. Those data were omitted from Exhibits A-17 and A-18 when Appendix A was first submitted in November 2003. Since November 2003, the Pilot System has operated during two rainy seasons and two dry seasons and the resulting data suggests that the April 2003 data were not erroneous. Rather, seasonal stormwater and runoff variations influenced the areas in the vicinity of the sampling locations. The previously omitted April 2003 data are included in Exhibits A-23 and A-24. Since November 2003, pH, dissolved arsenic, and DIC data fluctuate over time (see Exhibits A-23 through A-25). Fluctuations coincide with seasonal variations in precipitation. The data suggest that large amounts of precipitation recharging the shallow alluvial aquifer system result in a mounding around the treatment trench that "backs up" into PM-10 location.

A.5.4 Summary

The Pilot System continues to operate and effectively treat groundwater. Groundwater flow anomalies obscure the treatment effects downgradient and seasonal variations in stormwater infiltration cause a variable groundwater flow regime in the vicinity of the treatment zone trench. Thus, if the remedy selected for the Site includes a subsurface treatment zone, the design will accommodate stormwater infiltration so that it does not negatively effect treatment performance.

REFERENCES

Dames & Moore, Inc., 5 October 1993, Addendum Preliminary Site Characterization Report, Lehigh Portland Cement Company, Metaline Falls, Washington

GeoSyntec Consultants, 11 September 2000, Interim Progress Report No. 1, Subsurface Treatability Study, Lehigh Portland Cement Company, Metaline Falls, Washington.

GeoSyntec Consultants, 5 October 2001, Draft Final Remedial Investigation Report, Lehigh Portland Cement Company, Metaline Falls, Washington.

GeoSyntec Consultants, 3 April 2003a, Construction Report, Pilot Groundwater Treatment System, Lehigh Portland Cement Company, Metaline Falls, Washington.

GeoSyntec Consultants, 22 May 2003b, Feasibility Study Technical Memorandum, Closed Cement Kiln Dust Pile, Lehigh Portland Cement Company, Metaline Falls, Washington.

GeoSyntec Consultants, 30 July 2004, Correspondence from Eric Smalstig to Bill Fees containing various data, including raw pump test data.

Model Toxics Control Act (MTCA), Washington Administrative Code (WAC) 173-340.

McGavran, P., 2001. “Literature Review of the Health Effects Associated with the Inhalation of Hydrogen Sulfide,” Idaho Department of Environmental Quality, Boise, Idaho, June 19, 2001.

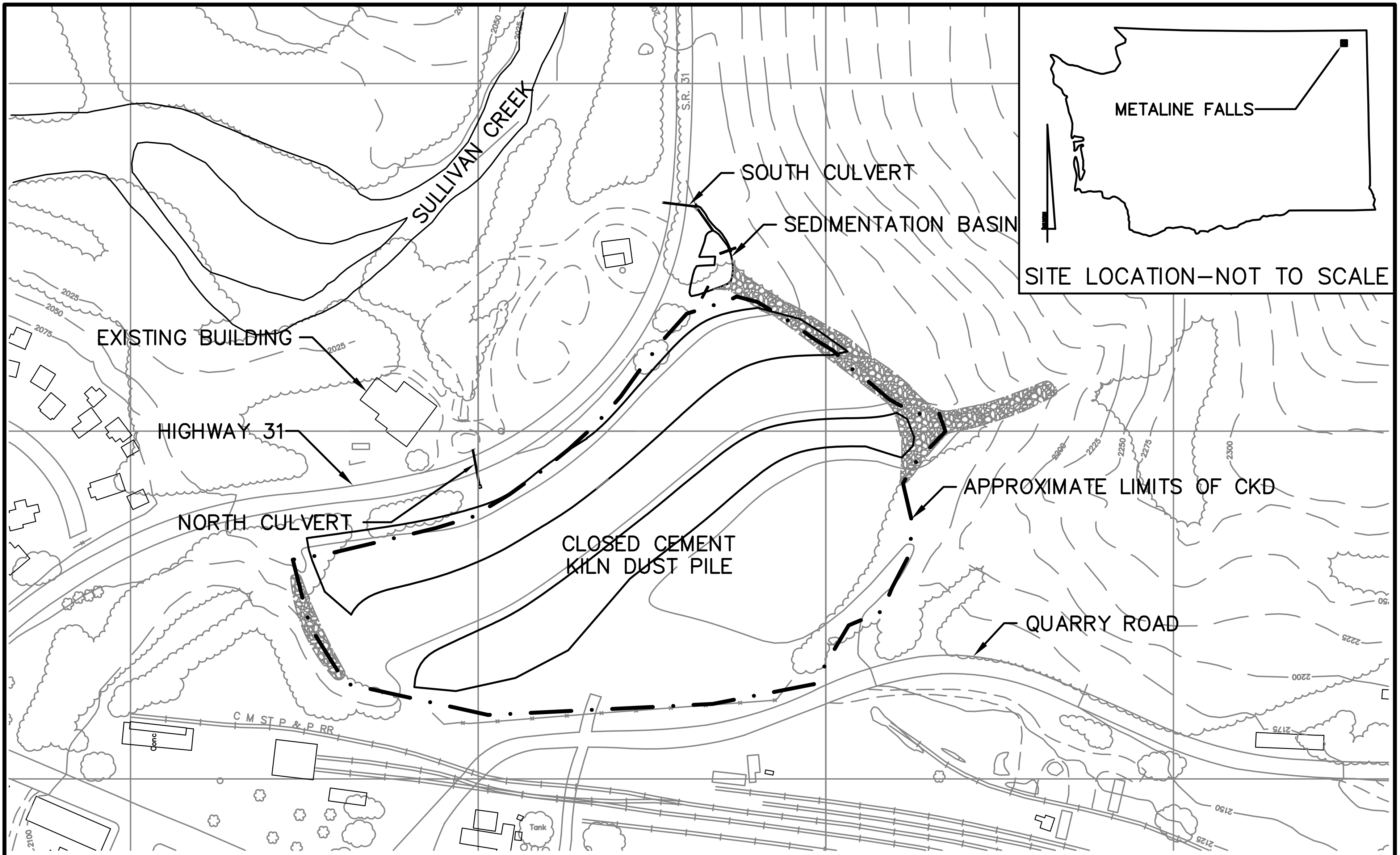
United States Environmental Protection Agency (USEPA), 2002, Region 9 Preliminary Remediation Goals for Residential Soil.

Washington State Department of Ecology (Ecology), Agreed Order No. DE99HS-E941 (AO), October 1999, with Lehigh Portland Cement Company.

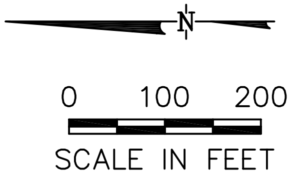
EXHIBITS FOR APPENDIX A

PILOT TREATMENT WALL STUDY
2003 WORK PROGRAM DESCRIPTION AND SUMMARY OF FINDINGS
INCLUDES UPDATE (2003 – CURRENT)

DRAFT FEASIBILITY STUDY TECHNICAL REPORT
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON



NOTE: CREEK ALIGNMENT IS APPROXIMATE.



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SITE LOCATION MAP
LEHIGH CEMENT COMPANY CLOSED CKD PILE
METALINE FALLS, WASHINGTON

EXHIBIT NO.	A–1
PROJECT NO.	HR0196–12
DOCUMENT NO.	
DATE:	OCTOBER 2003

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EXHIBIT A-2
2003 INVESTIGATION SUMMARY TABLE
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

TASK	INVESTIGATION	GOALS	SCOPE	CONCLUSIONS
1	Additional Lithology and Groundwater Data Collection	1) Evaluate the continuity of the clay aquitard underlying the Site. 2) Evaluate the soil layers above the clay aquitard for preferential pathways. 3) Determine if one distinct gravel layer runs through the Site and conducts the majority of the affected groundwater. 4) Evaluate the groundwater in new and existing monitoring locations.	• Site-wide Geologic/hyrogeologic evaluation • Topographic plotting • Developed cross-sections to include: – B-1, B-4, B-8, MW-1, MW-3, MW-4, MW-7, MW-8, MW-9, MW-11, MW-12 [D&M, 1992] – PM-1, PM-3, PM-4, PM-5, PM-7, PM-11, PM-12, PM-13 [GeoSyntec, 2001-2002] – FSB-01, FSB-03, FSB-04, FSP-2, FSP-9, FSP-11, FSP-16, FSP-20, FSP-23, FSP-25, PM-16, PM-18, PM-19, PM-20 [installed July 2003]	1) Clay underlying the Site was encountered in boreholes across the Site. 2) Various gradations and thicknesses of soil overly the clay aquitard, but major continuous channels are not apparent. 3) A silty gravel layer was encountered in most borings, but it varies in thickness. 4) Groundwater generally flows north-northeast at the Site.

EXHIBIT A-2 (continued)
2003 INVESTIGATION SUMMARY TABLE
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

TASK	INVESTIGATION	GOALS	SCOPE	CONCLUSIONS
2	Evaluation of the North Culvert to Act as a Potential Preferential Pathway	Investigate magnitude and chemistry of North Culvert flow.	• Upgradient Geoprobe locations FSP-6, FSP-7: – Lithologic logging – Groundwater field pH – GW 1 analytes – SOIL analytes (FSP-6) • Downgradient borehole FSB-01: – Lithologic logging • Downgradient Geoprobe locations FSP-21, FSP-22: – Lithologic logging – Groundwater field pH • Downgradient Geoprobe locations FSP-23, FSP-26 – Lithologic logging – Groundwater field pH – GW 1 analytes • Permanent monitoring location PM-16: – Lithologic logging – Groundwater field pH – GW 1 analytes	• Culvert is above the groundwater table under Highway 31. • Culvert appeared to be intact and in good condition. • Culvert is placed in bedding material that is similar to surrounding native material. • Culvert and its surrounding material do not appear to be a preferential pathway for groundwater transport under Highway 31. • Data indicate that the culvert is conveying surface water as intended, without leakage that is affecting downgradient groundwater.
3	Northern Area Groundwater Quality Evaluation	2) Evaluate the affected groundwater plume in the property aquired by Lehigh in Summer 2003.	• Boreholes FSB-04, FSB-05, FSB-06: – Lithologic logging – Groundwater field pH (FSB-04, FSB-06) • Geoprobe locations FSP-11, FSP-12, FSP-13, FSP-14: – Lithologic logging – Groundwater field pH (FSP-11, FSP-12) • Permanent monitoring locations PM-16, PM-18, PM-19, PM-20 – Groundwater field pH – GW 3 analytes	• Based on laboratory data and groundwater level measurements, groundwater from the northern portion of the Site (PM-15, PM-16, PM-18, PM-19, PM-20) exhibits characteristics of CKD affected groundwater.

EXHIBIT A-2 (continued)
2003 INVESTIGATION SUMMARY TABLE
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

TASK	INVESTIGATION	GOALS	SCOPE	CONCLUSIONS
4	Evaluation of Carbon Dioxide Sparging as a Groundwater Treatment Option	1) Evaluate the operation and performance of the pilot carbon dioxide sparge points.	• Configure pilot PTW to distribute all carbon dioxide to the sparge points • Initiate pilot carbon dioxide sparge point operation • Test operation at various carbon dioxide flow rates • Observe the sparge point operation in the field	• Carbon dioxide was escaping to the atmosphere before being consumed. • A hydrogen sulfide odor, likely attributable to hydrogen sulfide, was observed during sparging.
5	Extraction Wells/Capture Zone Evaluation	1) Evaluate groundwater flow properties at PM-16.	• Pumping tests performed at PM-16	• Extraction wells could likely maintain sufficient extraction rates to capture affected groundwater.
6	Groundwater Monitoring	1) Evaluate groundwater conditions across the Site, including at monitoring locations installed in Summer 2003.	• New monitoring locations PM-15, PM-16, PM-18, PM-19, PM-20 : – Future routine monitoring – GW 3 analytes • Site groundwater monitoring wells and PM-1 through 21 samples were collected during August and September 2003 – GW 3 analytes	• Initial data from monitoring locations installed in July 2003 indicates groundwater flowing in a north-northeasterly direction. • Continued collection of samples from various locations is planned to evaluate pilot PTW performance and groundwater effects.

EXHIBIT A-2 (continued)
2003 INVESTIGATION SUMMARY TABLE
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

TASK	INVESTIGATION	GOALS	SCOPE	CONCLUSIONS
7	Updated Evaluations of the Pilot PTW	1) Evaluate pilot PTW for defects and needed improvements. 2) Evaluate pilot treatment for overall initial performance.	• Evaluated system during site visit • Removed 10 soldered gas site glass joints • Installed new monitoring equipment – Power conditioner – pH probe reference electrodes (PM-10, PM-12, MW-9)	• Based on the first 11 months of operation, the pilot PTW requires little maintenance. • SCADA data fluctuations are reducible. • Removal of soldered joints in the distribution manifold make the system less susceptible to leaks.
8	Pilot PTW Performance Evaluation Update	1) Evaluate pilot PTW performance to treat groundwater	• Upgradient Geoprobe locations FSP-15, FSP-16: – Lithologic logging – Groundwater field pH – GW 2 analytes • Downgradient Geoprobe locations FSP-17, FSP-18, FSP-19, FSP-20 – Lithologic logging – Groundwater field pH – GW 2 analytes	• The pilot PTW treats groundwater in the treatment trench. • Treated is traveling to and beyond the PM-11, PM-12, and PM-13 monitoring locations. • Treated groundwater is mixing with untreated groundwater farther downgradient of the trench.
9	Evaluation of the Effects of the Pilot PTW on Surrounding Soils	1) Determine if downgradient soil is being affected by the treated groundwater.	• Geoprobe FSP-18, FSP-19 soil samples: – SOIL sanalytes	• Data indicates that treated groundwater is not depositing substantial amounts of metals or sulfides downgradient of the pilot PTW.

EXHIBIT A-2 (continued)
2003 INVESTIGATION SUMMARY TABLE
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

TASK	INVESTIGATION	GOALS	SCOPE	CONCLUSIONS
10	Purge Interval Operating Parameter Testing and Analysis	1) Evaluate pilot PTW accumulated gas composition. 2) Based on smell eminating from the carbon dioxide sparge points, test gas for hydrogen sulfide related to health.	• Gas samples PIPE AT201-8, PIPE AT203-10, PIPE AT204-12, PIPE AT205-14, PIPE AT206-16 analyzed for: – Oxygen + argon [ASTM D-1946] – Nitrogen [ASTM D-1946] – Methane [ASTM D-1946] – Carbon dioxide [ASTM D-1946] – Hydrogen sulfide [GC/FPD]	• Based on laboratory data, gases other than carbon dioxide are accumulating in the pilot PTW. • For long-term operation, purge intervals can be evaluating using multiple gas composition data points over time. • If the PTW is chosen, data will be collected to calculate if purging is necessary, and how often.

NOTES

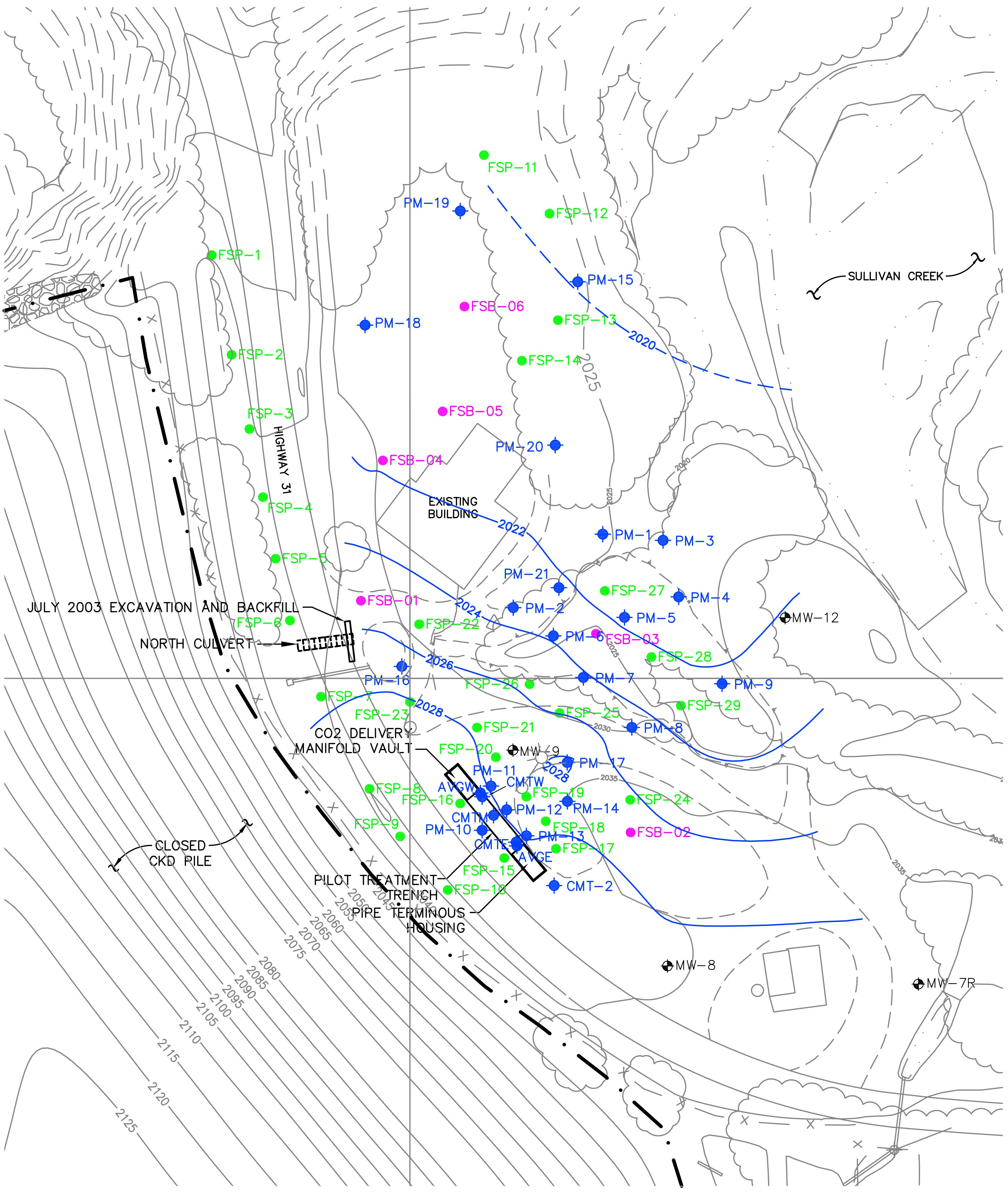
GW 1 includes:
- Metals [EPA 200.7]
- pH [EPA 150.1]
- E_h [EPA 2580]
- Alkalinity [EPA 2320]
- DIC [EPA 415.1]
- SEC [EPA 120.1]
- Sulfide [EPA 376.1]
- Major cations and anions [EPA 200.7, 300.0]
- Ammonia [EPA 350.3]
- Nitrite [EPA 300.0]

GW 2 includes
- Metals [EPA 200.7]
- pH [EPA 150.1]
- E_h [EPA 2580]
- Alkalinity [EPA 2320]
- DIC [EPA 415.1]
- SEC [EPA 120.1]
- Sulfide [EPA 376.1]
- Major cations and anions [EPA 200.7, 300.0]

GW 3 includes:
- Metals and silicon [EPA 200.7]
- pH [EPA 150.1]
- E_h [EPA 2580]
- Alkalinity [EPA 2320]
- DIC [EPA 415.1]
- SEC [EPA 120.1]
- Sulfide [EPA 376.1]
- Major cations and anions [EPA 200.7, 300.0]

SOIL includes:
- Iron, Manganese, Arsenic [EPA 6010B]
- Arsenic [EPA 7060]
- Sulfide [LECO]

GW – groundwater
SEC – Specific electrical conductance
DIC – Dissolved inorganic carbon
LECO – LECO Corporation analyzer



LEGEND

——1760——	EXISTING TOPOGRAPHY (FEET ABOVE M.S.L.)
⊕	GROUNDWATER MONITORING WELL
⊕	PERFORMANCE MONITORING LOCATION
●	APPROXIMATE DIRECT PUSH BORING LOCATIONS (JULY 2003)
●	APPROXIMATE ROTASONIC BORING LOCATIONS (JULY 2003)
——	JULY 2003 GROUNDWATER CONTOUR LINE (FEET ABOVE M.S.L)
— · — · —	CKD PERIMETER

GEOSYNTEC CONSULTANTS

SUMMER 2003 INVESTIGATIONS
LEHIGH CEMENT COMPANY CLOSED CKD PILE
METALINE FALLS, WASHINGTON

EXHIBIT NO.	A-3
PROJECT NO.	HR0196-12
DOCUMENT NO.	
DATE:	OCTOBER 2003

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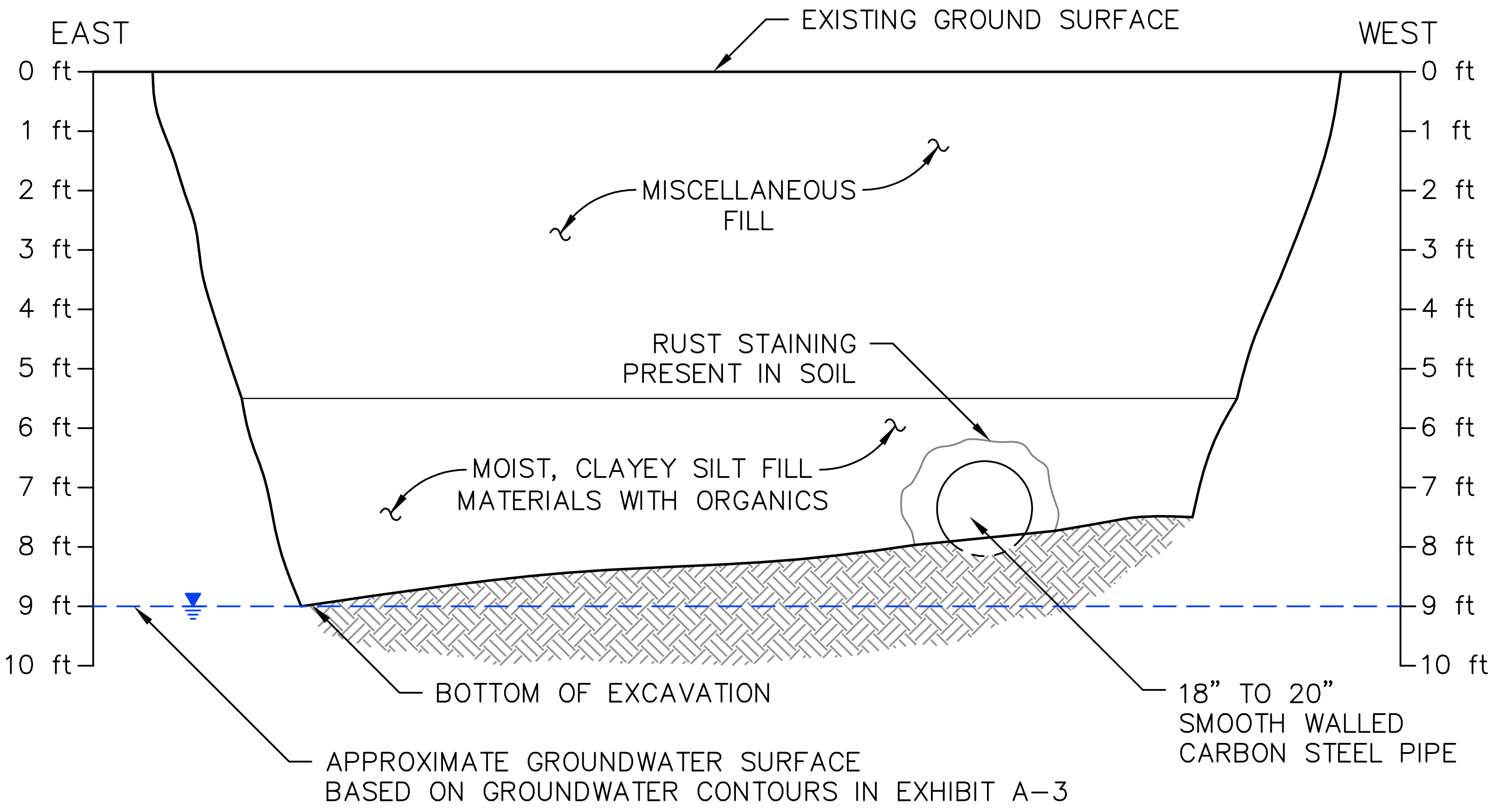
EXCAVATION CROSS SECTION
(FACING WEST TOWARD HIGHWAY 31)



DATE OF EXCAVATION: 31 JULY 2003
TIME BEGAN: 10:30 AM
TIME FINISHED: 2:30 PM

0 1.5 3
SCALE IN FEET

GEOSYNTEC CONSULTANTS

CULVERT EXCAVATION TRENCH LOG
SUMMER 2003 FIELDWORK
LEHIGH CLOSED CKD PILE
METALINE FALLS, WASHINGTON

EXHIBIT NO.	A-4
PROJECT NO.	HR0196-12
DOCUMENT NO.	MFW03-50
DATE:	OCTOBER 2003

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EXHIBIT A-5
JULY 2003 FIELD GROUNDWATER pH AND ELEVATION MEASUREMENTS CLOSED CEMENT KILN DUST PILE METALINE FALLS, WASHINGTON

	pH DATA		ELEVATION DATA	
LOCATION	DATE	pH (1)	DATE	ELEVATION (FT MSL)
SITE MONITORING WELL NETWORK				
MW-7	7/18/2003	7.75	7/31/2003	2029.58
MW-8	7/18/2003	7.75	7/31/2003	2028.85
MW-9	7/18/2003	12.6	7/31/2003	2027.87
MW-11	7/18/2003	NM	7/31/2003	NM
MW-12	7/18/2003	8.5	7/31/2003	2022.05
GROUNDWATER MONITORING LOCATIONS				
PM-1	7/18/2003	12.09	7/31/2003	2021.31
PM-2	7/18/2003	8.07	7/31/2003	2023.25
PM-3	7/18/2003	8.1	7/31/2003	2021.02
PM-4	7/18/2003	10.29	7/31/2003	2021.26
PM-5	7/18/2003	9.77	7/31/2003	2021.67
PM-6	7/18/2003	12.25	7/31/2003	2023.9
PM-7	7/18/2003	7.25	7/31/2003	2024.13
PM-8	7/18/2003	12.01	7/31/2003	2024.68
PM-9	7/18/2003	8.95	7/31/2003	2022.04
PM-10	7/18/2003	11.21	7/31/2003	2028.18
PM-11	7/18/2003	6.62	7/31/2003	2027.94
PM-12	7/18/2003	6.17	7/31/2003	2027.95
PM-13	7/18/2003	8.36	7/31/2003	2027.96
PM-14	7/18/2003	9.34	7/31/2003	2027.86
PM-15	7/18/2003	12.62	7/31/2003	2019.99
PM-16	7/18/2003	12.54	7/31/2003	2026.59
PM-17	7/18/2003	11.69	7/31/2003	2028.36
PM-18	7/18/2003	12.14	7/31/2003	2021.14
PM-19	7/18/2003	12.04	7/31/2003	2020.18
PM-20	7/18/2003	8.35	7/31/2003	2020.46
PM-21	7/18/2003	11.34	7/31/2003	2022.18
CMT-2-4'	7/18/2003	NM	7/31/2003	NM
CMT-2-8'	7/18/2003	NM	7/31/2003	NM
CMT-2-12'	7/18/2003	NM	7/31/2003	NM
CMT-2-16'	7/18/2003	NM	7/31/2003	NM
CMT-2-20'	7/18/2003	NM	7/31/2003	NM
PILOT PTW TRENCH MONITORING LOCATIONS				
WCMT-16'	7/18/2003	6.02	7/31/2003	NM
WCMT-13'	7/18/2003	6.09	7/31/2003	NM
WCMT-10'	7/18/2003	5.79	7/31/2003	NM
WCMT-7'	7/18/2003	5.92	7/31/2003	NM
MCMT-16'	7/18/2003	5.96	7/31/2003	NM
MCMT-13'	7/18/2003	6.02	7/31/2003	NM
MCMT-10'	7/18/2003	5.91	7/31/2003	NM
MCMT-7'	7/18/2003	5.84	7/31/2003	NM
ECMT-16'	7/18/2003	6.02	7/31/2003	NM
ECMT-13'	7/18/2003	5.79	7/31/2003	NM
ECMT-10'	7/18/2003	5.83	7/31/2003	NM
ECMT-7'	7/18/2003	5.74	7/31/2003	NM
AVG-W	7/18/2003	6.06	7/31/2003	2028.1
AVG-E	7/18/2003	5.91	7/31/2003	2028.09

EXHIBIT A-5 (continued)
JULY 2003 FIELD GROUNDWATER pH AND ELEVATION MEASUREMENTS
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

	pH DATA		ELEVATION DATA	
LOCATION	DATE	pH [(1)]	DATE	ELEVATION (FT MSL)
SUMMER 2003 TEMPORARY LOCATIONS				
FSP-03	7/18/2003	12	7/31/2003	NM
FSP-05	7/18/2003	12.5	7/31/2003	NM
FSP-06	7/18/2003	12.5	7/31/2003	NM
FSP-07	7/18/2003	13	7/31/2003	NM
FSP-08	7/18/2003	7.5	7/31/2003	NM
FSP-10	7/18/2003	8.75	7/31/2003	NM
FSP-12	7/18/2003	11	7/31/2003	NM
FSP-15	7/18/2003	9.5	7/31/2003	NM
FSP-16	7/18/2003	11.5	7/31/2003	NM
FSP-17	7/18/2003	7	7/31/2003	NM
FSP-18	7/18/2003	7.5	7/31/2003	NM
FSP-19	7/18/2003	7.5	7/31/2003	NM
FSP-20	7/18/2003	9.5	7/31/2003	NM
FSP-21	7/18/2003	10.05	7/31/2003	2027.9
FSP-22	7/18/2003	11.8	7/31/2003	NM
FSP-23	7/18/2003	12.03	7/31/2003	2028.09
FSP-24	7/18/2003	7.41	7/31/2003	NM
FSP-25	7/18/2003	12	7/31/2003	NM
FSP-26	7/18/2003	11.53	7/31/2003	NM
FSP-27	7/18/2003	10.2	7/31/2003	NM
FSP-28	7/18/2003	10.48	7/31/2003	NM
FSP-29	7/18/2003	8.36	7/31/2003	NM
FSB-04	7/18/2003	8.03	7/31/2003	2021.69
FSB-06	7/18/2003	9.78	7/31/2003	2020.16

NOTES

FT MSL - Feet above Mean Sea Level (NAVD 88)

NM - Not Measured

(1) Field pH measured with either a Myron 6P Ultrameter or pH paper.

EXHIBIT A-6
SELECT GROUNDWATER ANALYTICAL DATA SUMMARY
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

LOCATION	DATE	pH	DISSOLVED ARSENIC (mg/L)	TOTAL ARSENIC (mg/L)	TOTAL DIC (mg/L)
MAY 2003 SAMPLES					
MW-09	05/12/03	12.30	0.080	0.090	94.4
MW-09	05/12/03	12.32	0.112	0.108	NA
PM-02	05/12/03	8.33	0.007	0.007	75.2
PM-06	05/12/03	12.27	0.310	0.352	150.0
PM-07	05/12/03	7.01	< 0.006	0.015	324.0
PM-08	05/12/03	10.30	0.017	0.020	112.0
PM-10	05/12/03	10.25	0.044	0.048	65.5
PM-11	05/12/03	6.71	0.003	0.005	280.0
PM-12	05/12/03	6.40	0.007	0.014	378.0
PM-13	05/12/03	8.43	< 0.003	< 0.003	76.1
PM-14	05/12/03	9.73	0.006	0.005	66.4
AVG-E	05/12/03	5.66	< 0.003	< 0.003	364.0
AVG-W	05/12/03	5.72	< 0.003	< 0.003	308.0
JULY 2003 SAMPLES					
FSP-06	07/15/03	12.10	NA	0.040	69.8
FSP-07	07/15/03	12.40	NA	0.184	80.8
FSP-15	07/16/03	10.10	NA	0.028	17.0
FSP-16	07/17/03	9.98	NA	0.120	66.3
FSP-17	07/16/03	8.56	NA	0.013	25.4
FSP-18	07/17/03	7.15	NA	0.028	140.0
FSP-19	07/16/03	8.42	NA	0.120	50.4
FSP-20	07/17/03	9.70	NA	< 1	178.0
FSP-23	07/16/03	12.00	NA	< 1	56.1
FSP-23	07/17/03	10.10	NA	0.041	46.1
FSP-26	07/16/03	11.90	NA	0.160	39.3
PM-15	07/31/03	12.10	NA	0.180	70.9
PM-16	07/19/03	12.03	NA	0.139	46.7
PM-16	07/31/03	12.00	NA	0.185	95.3
PM-17	07/31/03	11.40	NA	0.051	25.9
PM-18	07/31/03	12.10	NA	0.181	114.0
PM-19	07/31/03	11.70	NA	0.221	129.0
PM-20	07/31/03	8.16	NA	< 0.01	54.6
PM-21	07/31/03	10.30	NA	0.065	19.9

EXHIBIT A-6 (continued)
SELECT GROUNDWATER ANALYTICAL DATA SUMMARY
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

LOCATION	DATE	pH	DISSOLVED ARSENIC (mg/L)	TOTAL ARSENIC (mg/L)	TOTAL DIC (mg/L)
AUGUST - SEPTEMBER 2003 SAMPLES					
MW-07	08/28/03	7.45	<0.01	<0.01	16.2
MW-08	08/28/03	7.49	<0.01	<0.01	61.8
MW-09	08/28/03	12.20	0.133	0.192	26.8
MW-11	08/28/03	7.45	<0.01	<0.01	48.9
MW-12	08/28/03	8.11	0.010	<0.01	43.3
MW-09	08/28/03	12.20	0.132	0.179	51.8
PM-16	08/28/03	12.46	NA	0.160	83.6
PM-01	09/04/03	12.10	0.215	0.212	173.0
PM-02	09/04/03	7.82	<0.01	0.014	36.3
PM-03	09/04/03	7.93	<0.01	<0.01	347.0
PM-04	09/04/03	11.80	0.096	0.091	67.6
PM-05	09/04/03	10.30	0.036	0.037	42.9
PM-06	09/04/03	11.80	0.366	0.350	71.3
PM-07	09/04/03	7.62	<0.01	0.024	102.0
PM-18	09/04/03	12.00	0.271	0.278	43.5
PM-19	09/04/03	12.00	0.208	0.224	87.7
PM-20	09/04/03	8.28	<0.01	<0.01	106.0
PM-21	09/04/03	9.92	0.038	0.048	18.6
PM-08	09/05/03	11.80	0.072	0.085	51.7
PM-09	09/05/03	8.62	<0.01	0.018	36.4
PM-10	09/05/03	12.02	0.188	0.177	43.5
PM-11	09/05/03	7.44	<0.01	0.012	111.0
PM-12	09/05/03	6.96	<0.01	0.033	134.0
PM-13	09/05/03	9.53	<0.01	<0.01	42.3
PM-14	09/05/03	9.08	<0.01	<0.01	21.9
PM-15	09/05/03	12.30	0.175	0.152	55.2
PM-17	09/05/03	11.98	0.065	0.058	21.8

NOTES

DIC - Dissolved Inorganic Carbon
mg/L - milligrams per liter
NA - Not Analyzed

EXHIBIT A-7
SOIL ANALYTICAL LABORATORY DATA SUMMARY
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

LOCATION	DATE	ARSENIC (mg/kg)	MANGANESE (mg/kg)	IRON (mg/kg)	SULFIDE (%)
FSP-06-05	07/15/03	4.46	470	18,900	<0.010
FSP-18-12	07/17/03	3.00	353	17,800	<0.010
FSP-19-8	07/17/03	4.36	419	20,100	<0.010

NOTES

mg/kg - milligrams per kilogram

EXHIBIT A-8
GAS ANALYTICAL LABORATORY DATA SUMMARY
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

LOCATION	DATE	CARBON DIOXIDE (%)	NITROGEN (%)	OXYGEN + ARGON (%)	METHANE (%)	HYDROGEN SULFIDE (ppmv)
PIPE AT201-8	08/01/03	97.3	2.0	0.7	< 0.1	2
PIPE AT203-10	08/01/03	96.6	2.6	0.8	< 0.1	3
PIPE AT204-12	08/01/03	97.2	2.1	0.7	< 0.1	< 1
PIPE AT205-14	08/01/03	97.5	1.9	0.7	< 0.1	< 1
PIPE AT206-16	08/01/03	97.3	2.0	0.7	< 0.1	< 1

NOTES

ppmv - parts per billion, by volume

EXHIBIT A-9
PILOT PERMEABLE TREATMENT WALL (PTW) SUMMARY INSTALLATION MILESTONES
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

DATE	MILESTONE
13 June 2000	Begin negotiations to purchase Grant and WDOT parcels (1)
January 2000	Begin Developing Pilot PTW Concept
January 2001	Present Pilot PTW to Ecology
15 July 2001	Pilot Treatment Wall Designed and Ready to Implement
26 August 2002	WDOT Approves Installation of Pilot PTW
7 October 2002	Pilot PTW Installation Commences
5 November 2002	Carbon Dioxide Tank Is Filled for the First Time
7 November 2002	Initial Start-Up of the Pilot PTW
7 November 2002	Pilot PTW Start-up Commissioning Period Commences
11 November 2002	PC and PLC Connected to Pilot PTW
14 November 2002	Start-Up Commissioning Complete, Begin Commissioning Period
15 November 2002	Pilot PTW System Installation Complete
18 November 2002	First Remote System Communication/Operation
14 December 2002	Treatment System Commissioning Complete, Extended Operation Begins
9 January 2003	GeoSyntec On-Site to Evaluate the Pilot PTW
20 March 2003	Thorough Pilot PTW Physical Evaluation
3 April 2003	Construction Report Submitted to Ecology
16 July 2003	Carbon Dioxide Tank Is Refilled
July 2003	Thorough Pilot PTW Physical Evaluation and Performance Evaluation
2 October 2003	Mechanical Contractor On-Site to Pressure Test Piping and Tubing. – During the evaluation, a leaking pipe joint was located and tightened. – Additional gas vents were also installed in the pilot PTW treatment units.
14 October 2003	Carbon Dioxide Tank Manufacturer Personnel On-Site to Evaluate the Tank Condition. – During the evaluation, temperature control system components were allocated more electrical current to enhance operation.
Present	Pilot PTW Continues to Operate

NOTES

WDOT	Washington Department of Transportation
Ecology	Washington Department of Ecology
(1)	Data showed that affected groundwater existed on the Grant and WDOT parcels

EXHIBIT A-10
HISTORICAL SITE MONITORING WELL pH DATA
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

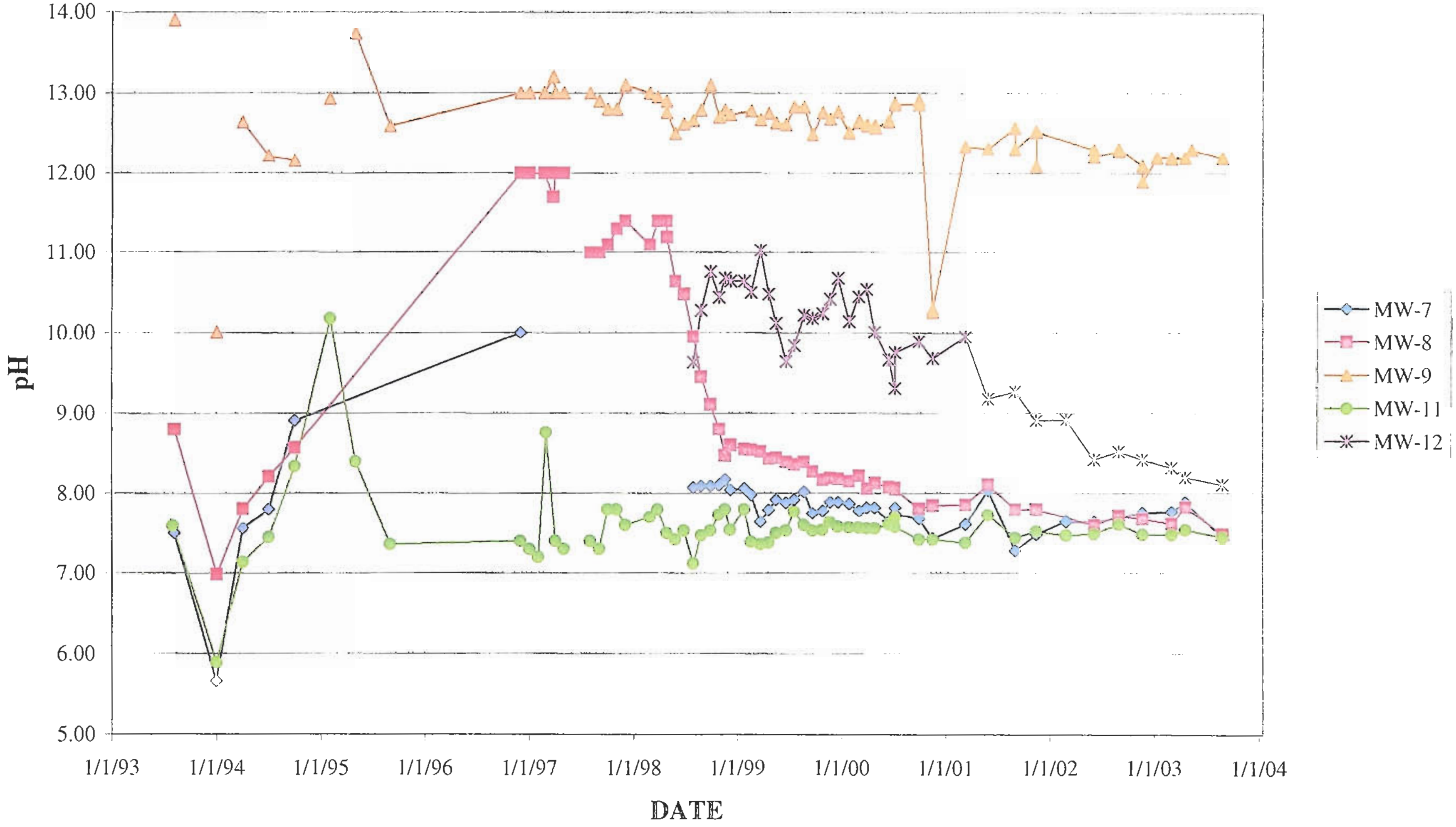
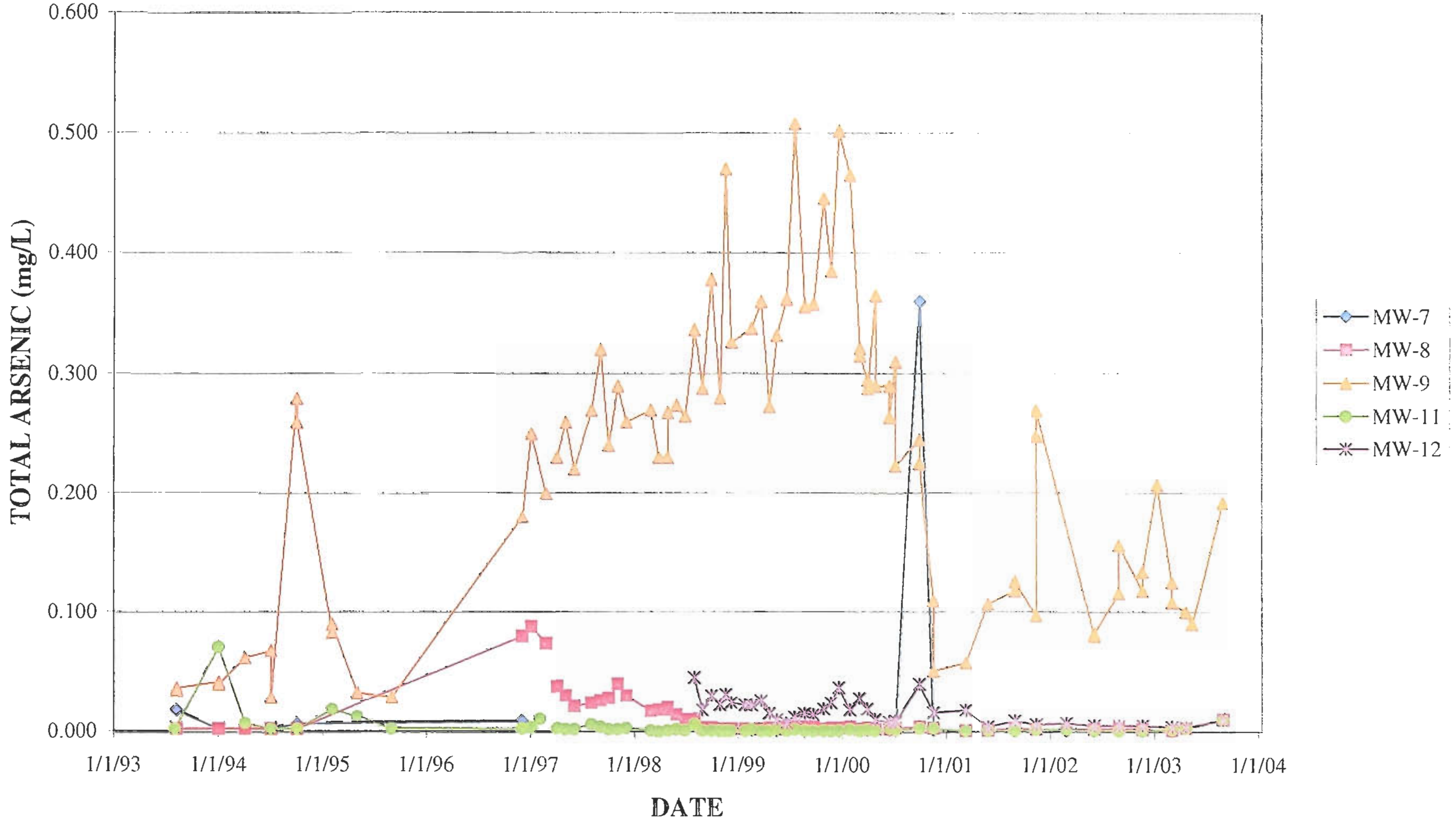
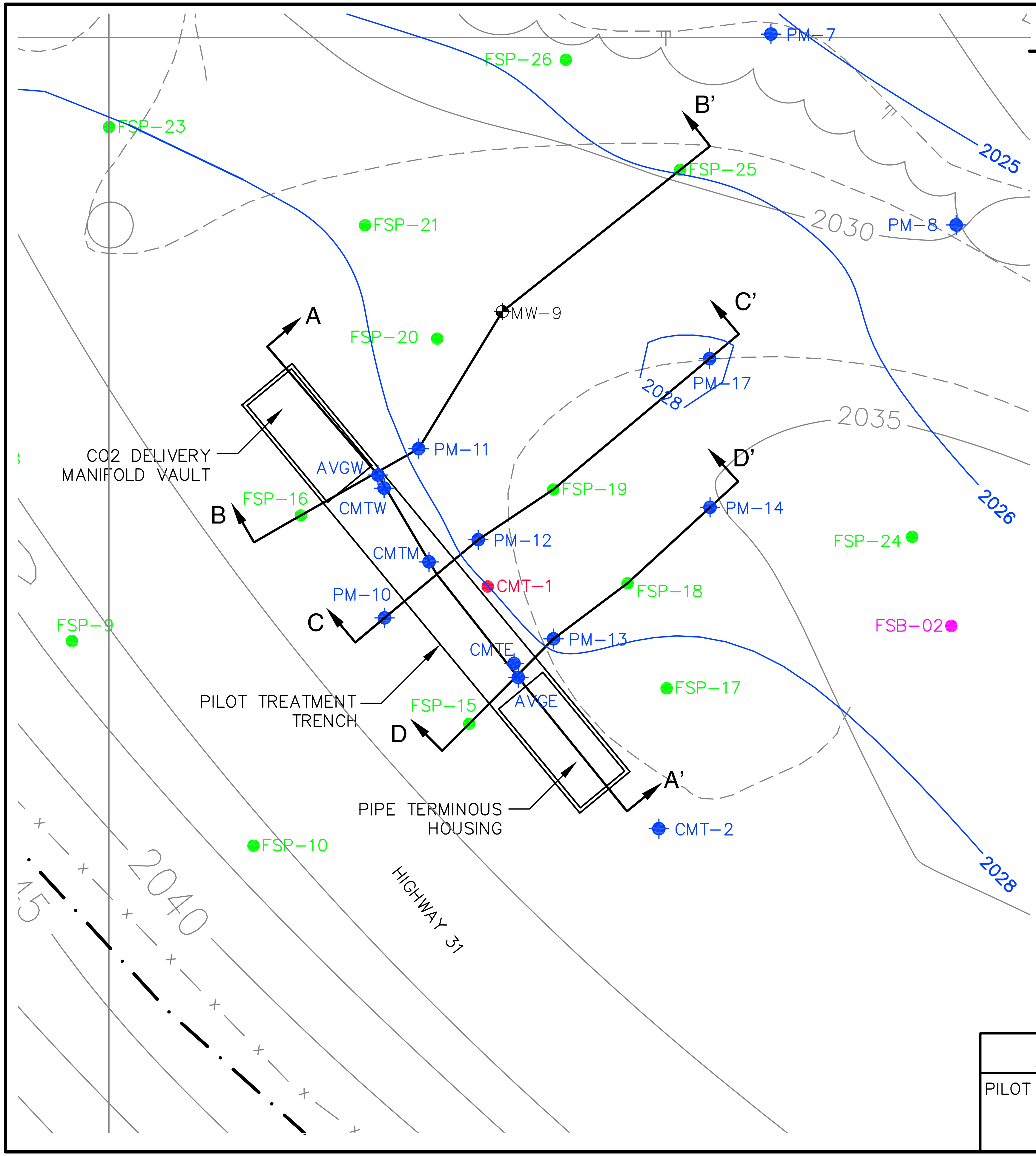


EXHIBIT A-11
HISTORICAL SITE MONITORING WELL TOTAL ARSENIC DATA
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON





LEGEND

—1760—	EXISTING TOPOGRAPHY (FEET ABOVE M.S.L.)
⊕	GROUNDWATER MONITORING WELL
⊕	PERFORMANCE MONITORING LOCATION
●	PERFORMANCE MONITORING LOCATION (DESTORYED IN OCTOBER 2002)
●	APPROXIMATE DIRECT PUSH BORING LOCATIONS (JULY 2003)
●	APPROXIMATE ROTASONIC BORING LOCATIONS (JULY 2003)
—2028—	JULY 2003 GROUNDWATER CONTOUR LINE (FEET ABOVE M.S.L)
— · — · —	CKD PERIMETER

N

0 10 20
SCALE IN FEET

GeoSyntec Consultants

PILOT PERMEABLE TREATMENT WALL AND SURROUNDING AREA
LEHIGH CEMENT COMPANY CLOSED CKD PILE
METALINE FALLS, WASHINGTON

EXHIBIT NO.	A-12
PROJECT NO.	HR0196-12
DOCUMENT NO.	
DATE:	OCTOBER 2003

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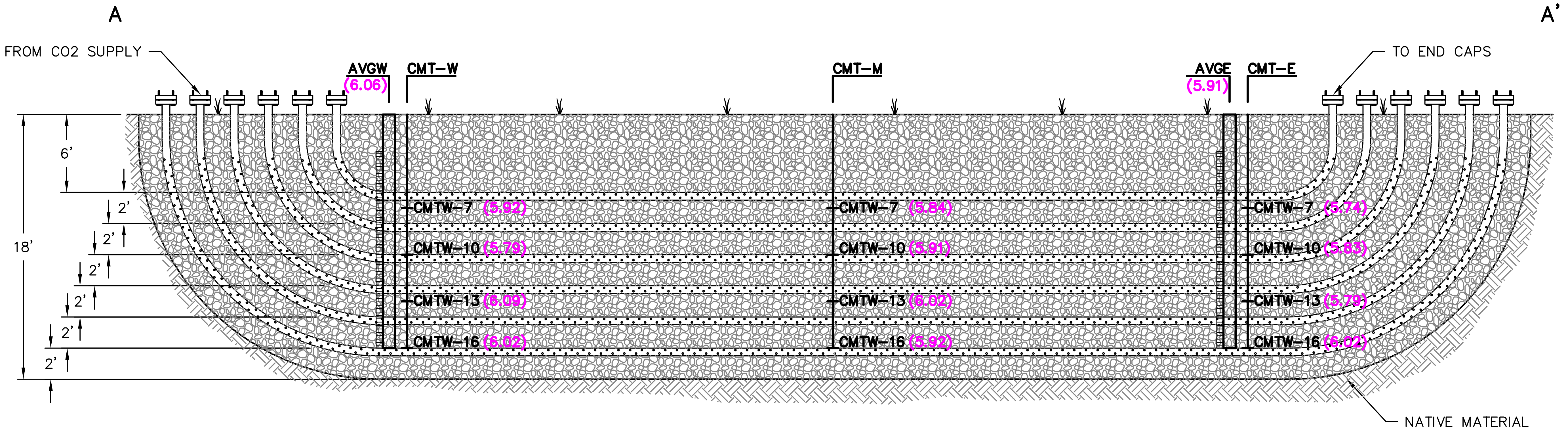

LEGEND

AVGW	TRENCH GROUNDWATER MONITORING LOCATION
CMT-W	MULTI-DEPTH TRENCH GROUNDWATER MONITORING LOCATION
(6.02)	FIELD pH MEASUREMENT (18 JULY 2003)

NOTE: DISTANCES SHOWN APPLY TO THE PILOT SYSTEM

GEOSYNTEC CONSULTANTS

CROSS-SECTION A-A'
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

EXHIBIT: A-13
PROJECT NO. HR0196-12
DOCUMENT NO.
DATE: OCTOBER 2003

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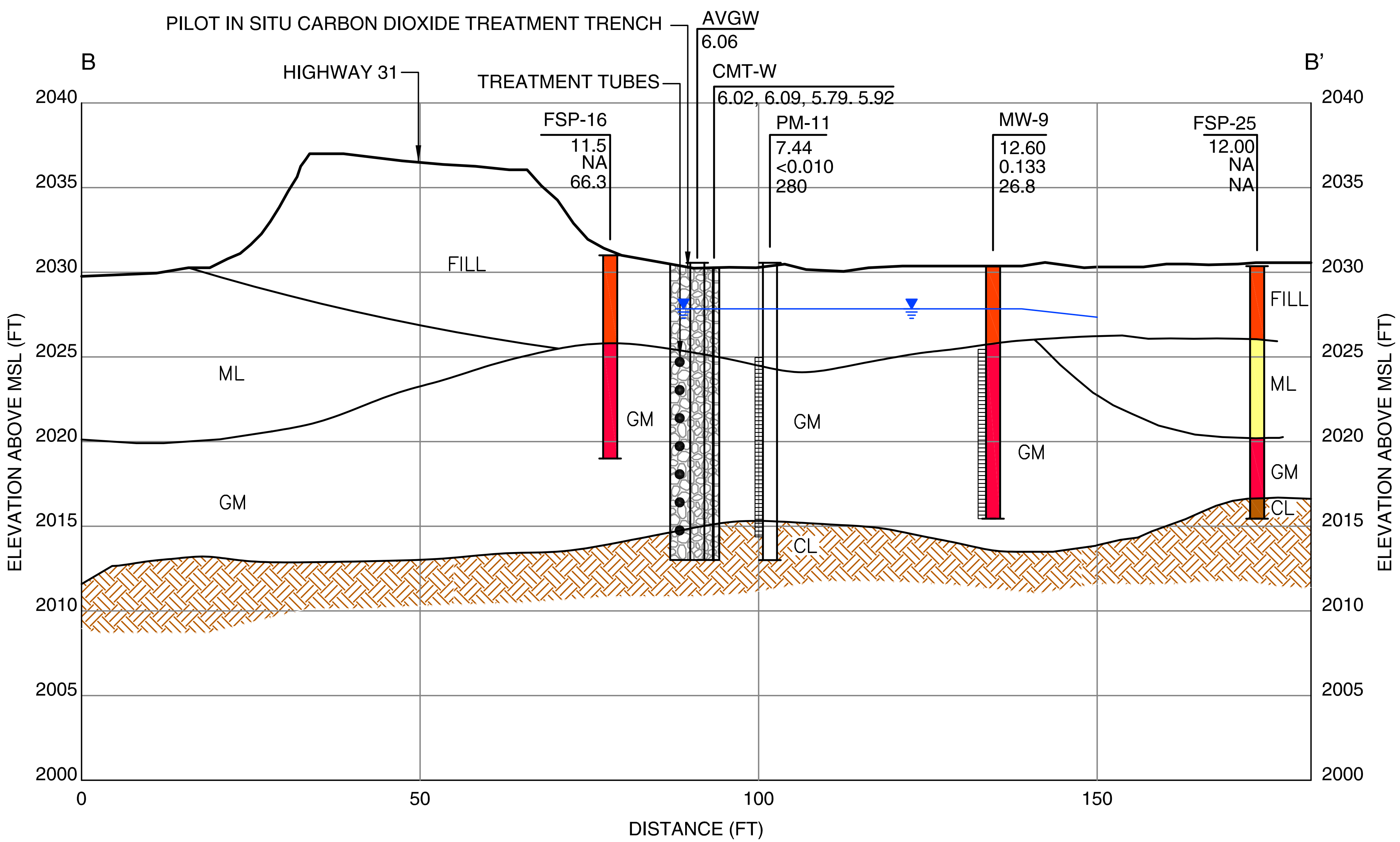
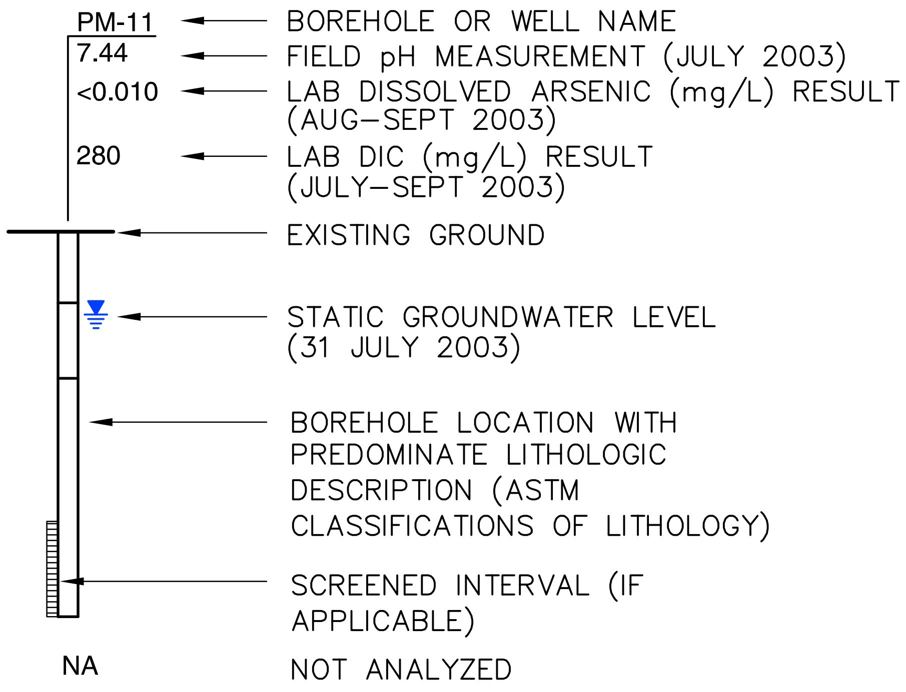


SECTION B-B'

EXPLANATION



NA NOT ANALYZED

ASTM CLASSIFICATIONS OF LITHOLOGY

🟨 ML – GRAVELLY SILT

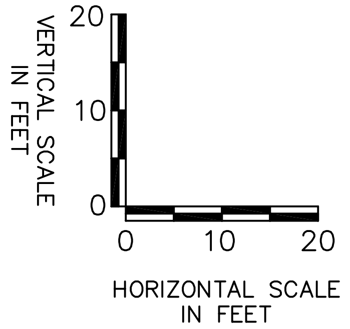
🟥 GM – WELL–GRADED SILTY GRAVEL

🟫 CL – SILTY CLAY

🟧 FILL – ARTIFICIAL FILL

▨ CONFINING SILTY CLAY LAYER

NOTE: NO LITHOLOGIC LOGGING OF PM–11 BOREHOLE



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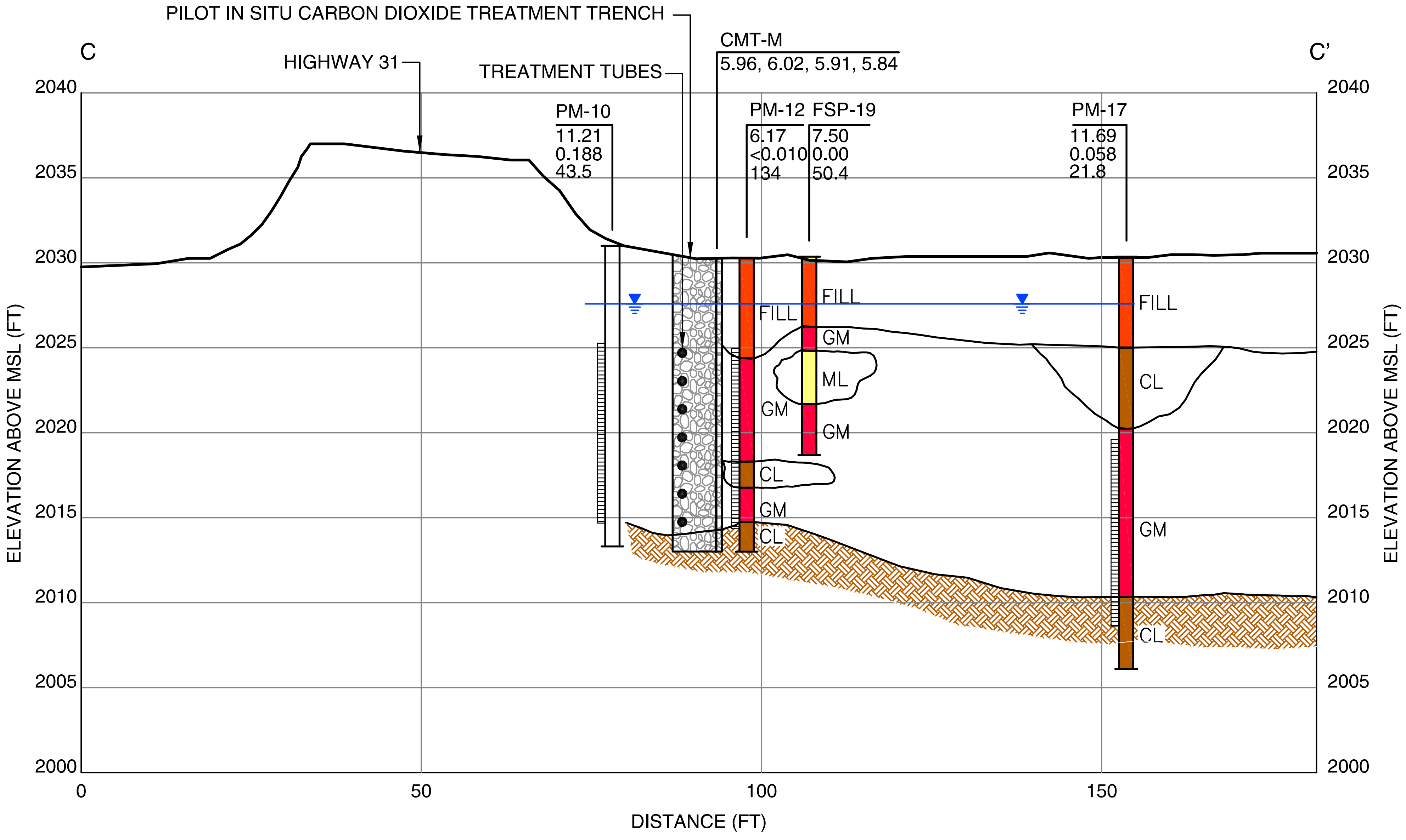
GEOSYNTEC CONSULTANTS

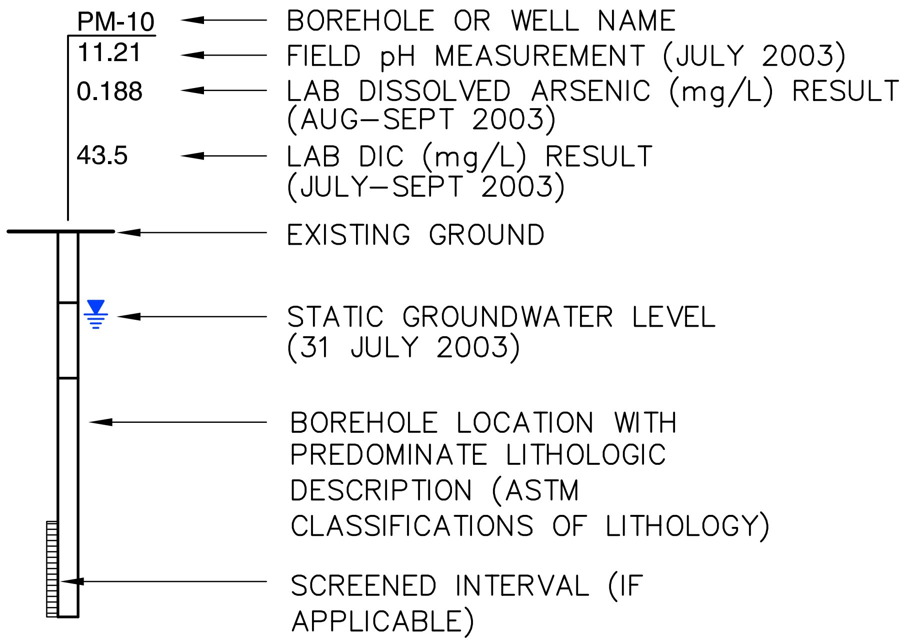
CROSS–SECTION B–B'
LEHIGH CEMENT COMPANY CLOSED CKD PILE
METALINE FALLS, WASHINGTON

EXHIBIT NO.	A–14
PROJECT NO.	HR0196–12
DOCUMENT NO.	
DATE:	OCTOBER 2003



SECTION C-C'

EXPLANATION



ASTM CLASSIFICATIONS OF LITHOLOGY

🟨 ML – GRAVELLY SILT

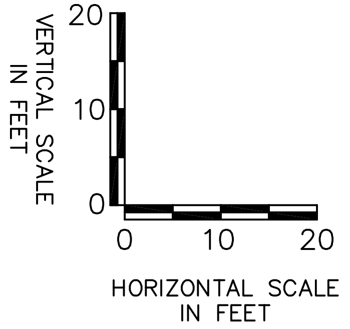
🟥 GM – WELL–GRADED SILTY GRAVEL

🟫 CL – SILTY CLAY

🟧 FILL – ARTIFICIAL FILL

▨ CONFINING SILTY CLAY LAYER

NOTE: NO LITHOLOGIC LOGGING OF PM–10 BOREHOLE



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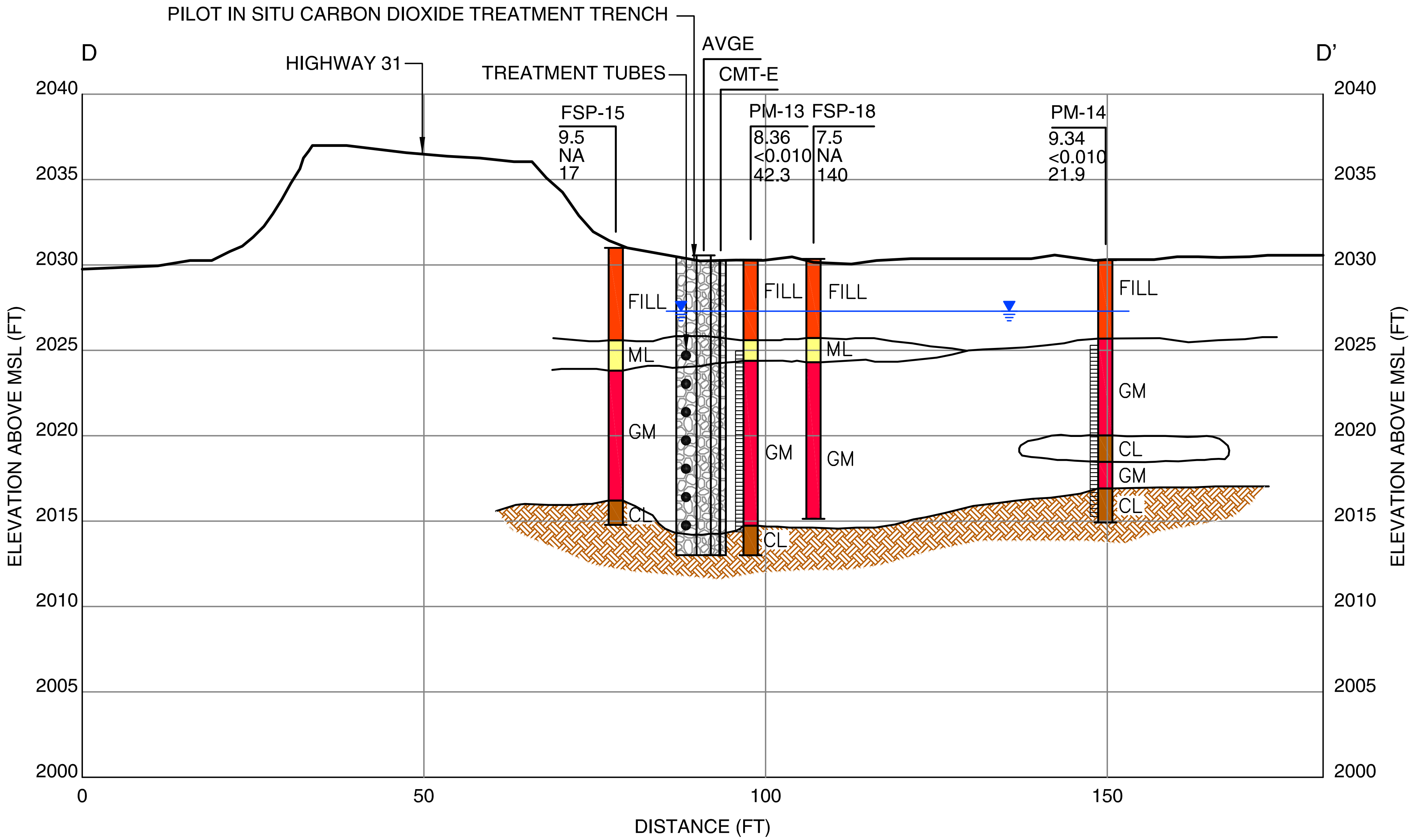
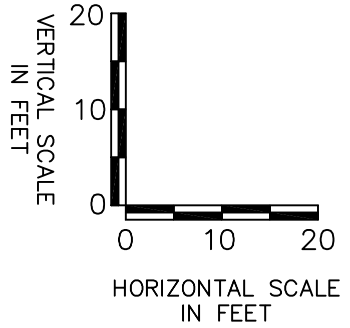
GeoSyntec Consultants

CROSS–SECTION C–C'
LEHIGH CEMENT COMPANY CLOSED CKD PILE
METALINE FALLS, WASHINGTON

EXHIBIT NO.	A–15
PROJECT NO.	HR0196–12
DOCUMENT NO.	
DATE:	OCTOBER 2003



SECTION D-D'



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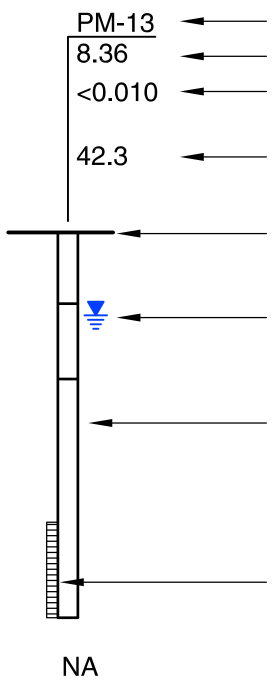
EXPLANATION



PM-13 ← BOREHOLE OR WELL NAME
8.36 ← FIELD pH MEASUREMENT (JULY 2003)
<0.010 ← LAB DISSOLVED ARSENIC (mg/L) RESULT (AUG–SEPT 2003)
42.3 ← LAB DIC (mg/L) RESULT (JULY–SEPT 2003)
EXISTING GROUND
STATIC GROUNDWATER LEVEL (31 JULY 2003)
BOREHOLE LOCATION WITH PREDOMINATE LITHOLOGIC DESCRIPTION (ASTM CLASSIFICATIONS OF LITHOLOGY)
SCREENED INTERVAL (IF APPLICABLE)
NA NOT ANALYZED

ASTM CLASSIFICATIONS OF LITHOLOGY

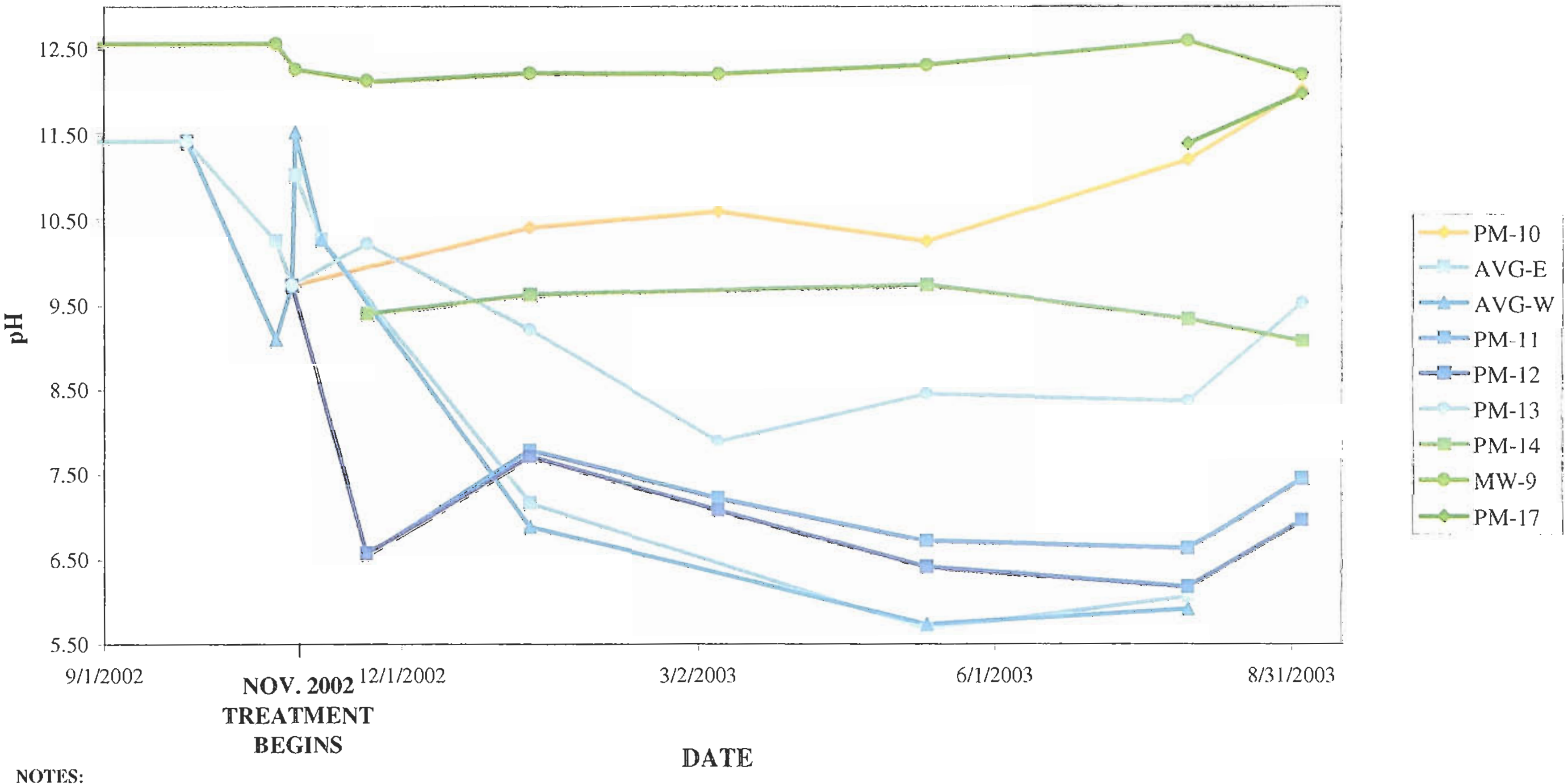
🟨	ML – GRAVELLY SILT
🟥	GM – WELL-GRADED SILTY GRAVEL
🟫	CL – SILTY CLAY
🟧	FILL – ARTIFICIAL FILL
▨	CONFINING SILTY CLAY LAYER

GEOSYNTEC CONSULTANTS

CROSS-SECTION D-D'
LEHIGH CEMENT COMPANY CLOSED CKD PILE
METALINE FALLS, WASHINGTON

EXHIBIT NO.	A-16
PROJECT NO.	HR0196-12
DOCUMENT NO.	
DATE:	OCTOBER 2003

EXHIBIT A-17
PILOT PERMEABLE TRENCH VICINITY TIME SERIES pH
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

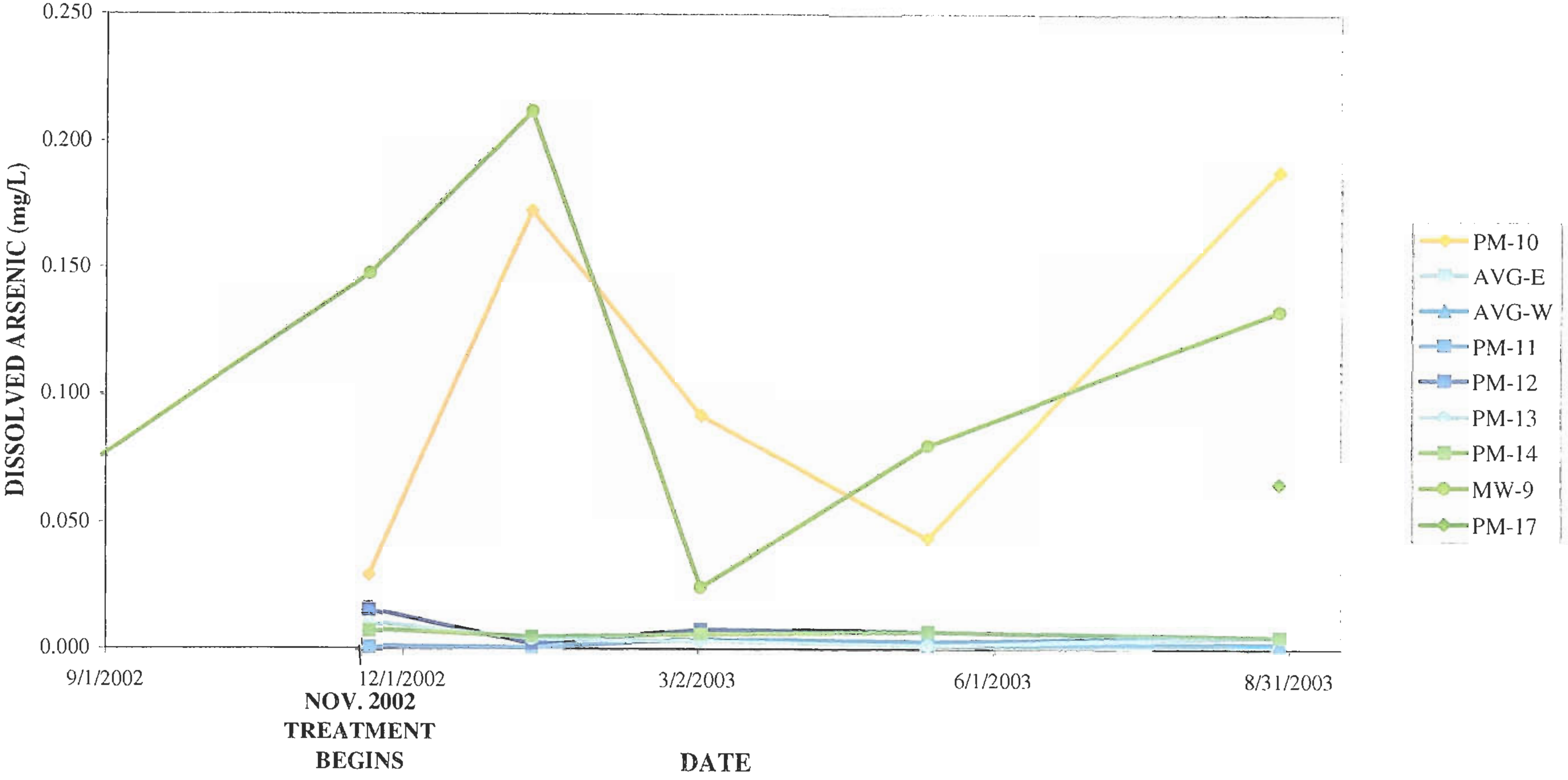


NOTES:

1) CMT-1 data used to represent pre-pilot PTW pH levels in vicinity of the trench.

2) The 20 April 2003 sampling data is omitted as discussed in the FSTM [GeoSyntec, 2003b].

EXHIBIT A-18
PILOT PERMEABLE TRENCH VICINITY TIME SERIES DISSOLVED ARSENIC
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON



NOTES:

1) The 20 April 2003 sampling data is omitted as discussed in the FSTM [GeoSyntec, 2003b].

EXHIBIT A-19
DISSOLVED INORGANIC CARBON RATIOS
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

LOCATION	DATE	TOTAL DIC (mg/L)	TREATED FRACTION, f_T (%)	pH
PM-10	05/12/03	65.5	0%	10.25
FSP-15	05/12/03	17.0	-18%	10.10
FSP-16	05/12/03	66.3	0%	9.98
AVG-E	05/12/03	364.0	110%	5.66
AVG-W	05/12/03	308.0	90%	5.72
MEAN OF AVGE AND AVGW		336.0	100%	-
PM-11	05/12/03	280.0	79%	6.71
PM-12	05/12/03	378.0	116%	6.40
PM-13	05/12/03	76.1	4%	8.43
FSP-17	05/12/03	25.4	-15%	8.56
FSP-18	05/12/03	140.0	28%	7.15
FSP-19	05/12/03	50.4	-6%	8.42
FSP-20	05/12/03	178.0	42%	9.70
MW-09	05/12/03	94.4	11%	12.30
MW-09 (DUPLICATE)	05/12/03	89.5	9%	12.32
PM-14	05/12/03	66.4	0%	9.73

NOTES

DIC - Dissolved Inorganic Carbon

f_T - defined in Equation 3 (multiplied by 100%)

EXHIBIT A-20
PILOT PERMEABLE TREATMENT TRENCH VICINITY MAY 2003
DISTANCE SERIES DISSOLVED INORGANIC CARBON
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

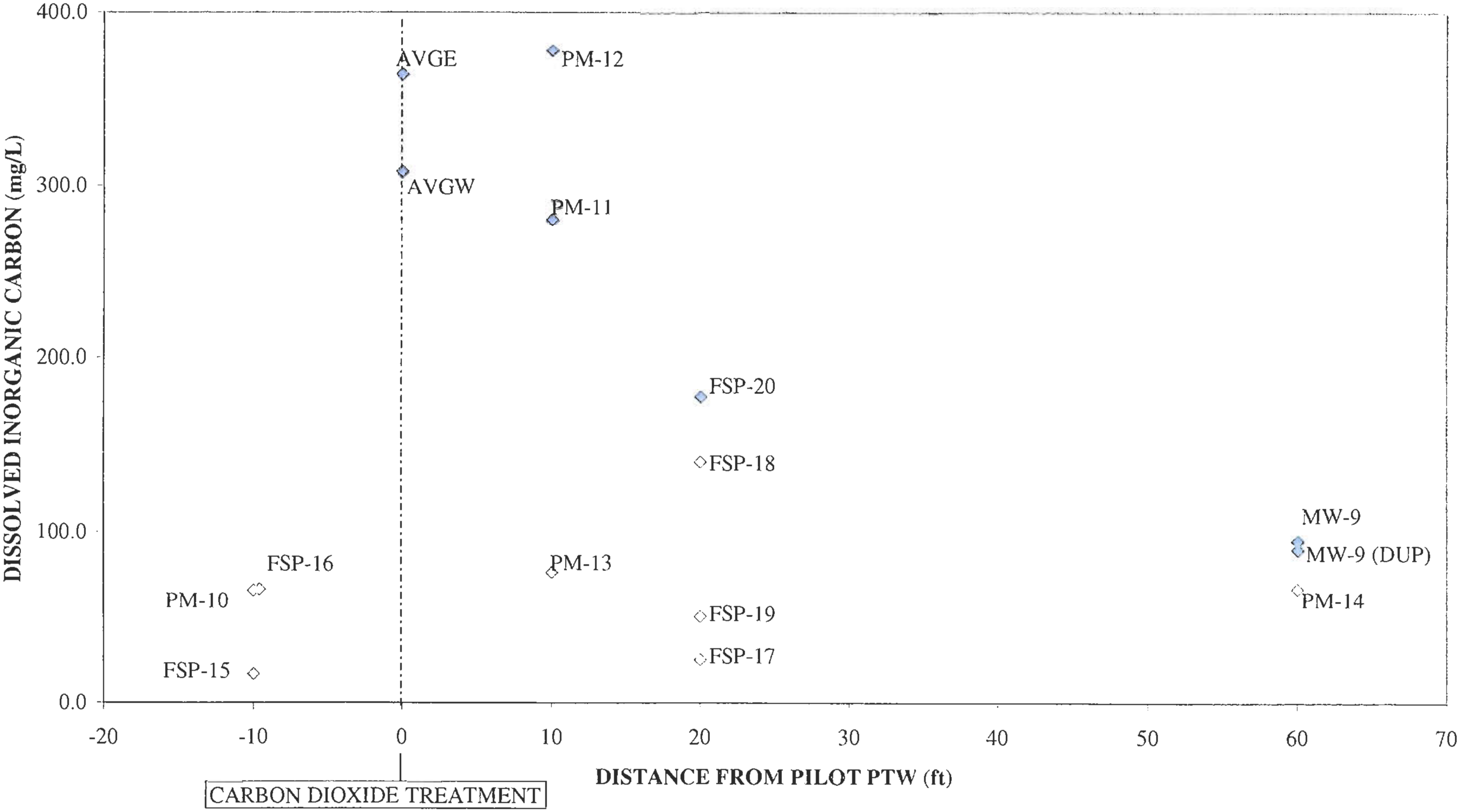


EXHIBIT A-21
GROUNDWATER ELEVATION DATA (THROUGH NOVEMBER 2004)
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

LOCATION	DATE												
	9/13/2002	11/21/2002	1/10/2003	3/1/2003	4/20/2003	5/12/2003	7/31/2003	8/26/2003	11/18/2003	4/5/2004	5/31/2004	7/20/2004	11/3/2004
PM-1	2021.42	2021.95	2021.87	NM	2021.9	NM	2021.31	2021.23	**2021.82**	**2021.88**	**2021.6**	**2021.2**	**2022.2**
PM-2	2023.33	2023.91	2023.91	NM	2023.94	2023.7	2023.25	2023.23	**2023.76**	**2023.89**	**2023.68**	**2023.3**	**2024.1**
PM-3	2021.09	2021.44	2021.29	NM	2021.42	NM	2021.02	2023	**2021.06**	**2021.77**	**2021.19**	**2020.95**	**2021.46**
PM-4	2021.32	2021.67	2021.63	NM	2021.67	NM	2021.26	2021.18	**2021.69**	**2021.63**	**2021.41**	**2021.15**	**2021.92**
PM-5	2021.76	2022.44	2022.46	NM	2022.51	NM	2021.67	2021.62	**2021.99**	**2022.08**	**2022.05**	**2021.56**	**2022.7**
PM-6	2023.74	2024.69	2025.02	NM	2024.69	2024.81	2023.9	2023.77	**2025.35**	**2025.25**	**2025.04**	**2023.97**	**2024.94**
PM-7	2024.15	2025.33	2025.26	NM	2025.7	2025.03	2024.13	2024.07	**2025.74**	**2025.89**	**2025.43**	**2024.24**	**2025.95**
PM-8	2024.92	2025.44	2025.42	NM	2025.5	2025.15	2024.68	2024.54	**2025.55**	**2025.5**	**2025.05**	**2024.53**	**2025.41**
PM-9	2022.03	2022.5	2022.62	NM	2022.73	NM	2022.04	2021.87	**2022.44**	**2022.27**	**2022.18**	**2021.83**	**2022.44**
PM-10	NI	2028.72	2028.91	NM	2028.72	2029.42	2028.18	2028.03	**2029.26**	**2029.66**	**2029.07**	**2028.43**	**2028.92**
PM-11	NI	2028.49	2028.67	NM	2028.49	2029.16	2027.94	2027.79	**2028.95**	**2029.54**	**2028.83**	**2028.22**	**2028.72**
PM-12	NI	2028.48	2028.68	NM	2028.48	2029.13	2027.95	2027.8	**2028.95**	**2029.5**	**2028.82**	**2028.21**	**2028.62**
PM-13	NI	2028.5	2028.88	NM	2028.5	2029.15	2027.96	2027.76	**2028.98**	**2029.65**	**2028.86**	**2028.22**	**2028.7**
PM-14	NI	2028.42	2028.64	NM	2029.47	2028.97	2027.86	2027.72	**2028.88**	**2029.32**	**2028.76**	**2028.1**	**2028.62**
PM-15	NI	2020.2	2020.28	NM	2020.54	NM	2019.99	2018.82	**2020.23**	**2020.29**	**2020.27**	**2020.12**	**2020.45**
PM-16	NI	NI	NI	NI	NI	NI	2026.59	2026.77	**2027.55**	**2027.77**	**2024.44**	**2027.14**	**2027.57**
PM-17	NI	NI	NI	NI	NI	NI	2028.36	2028.2	**2029.34**	**2029.37**	**2029.23**	**2028.61**	**2029.12**
PM-18	NI	NI	NI	NI	NI	NI	2021.14	2021	**2021.14**	**2020.85**	**2021.23**	**2021.07**	**2021.2**
PM-19	NI	NI	NI	NI	NI	NI	2020.18	2019.96	**2020.09**	**2021.04**	**2020.27**	**2020.09**	**2020.21**
PM-20	NI	NI	NI	NI	NI	NI	2020.46	2020.35	**2020.72**	**2020.37**	**2020.78**	**2020.67**	**2020.77**
PM-21	NI	NI	NI	NI	NI	NI	2022.18	2022.14	**2023.11**	**2023.36**	**2023.11**	**2022.35**	**2023.37**
AVGW	NI	NM	2028.83	NM	2029.74	2029.31	2028.1	NM	**2028.69**	**2029.23**	**2029.04**	**NM**	**2028.24**
AVGE	NI	NM	2028.82	NM	2029.7	2029.35	2028.09	NM	**2028.65**	**2029.14**	**2029.02**	**NM**	**2031.13**
MW-7R	2028.52	2030.43	2030.25	2030.04	2030.17	NM	2029.58	2029.45	**2030.47**	**2030.49**	**2029.69**	**2029.53**	**2030.37**
MW-8	2029.23	2029.38	2029.77	2030.26	2030.76	NM	2028.85	2028.67	**2029.34**	**2030.61**	**2029.76**	**2028.94**	**2029.28**
MW-9	2028.57	2028.64	2028.64	2028.74	2028.74	NM	2027.87	NM	**2028.99**	**2025.7**	**2028.8**	**2028.34**	**2028.7**
MW-11	2060.32	2059.86	NM	2060.89	2060.58	NM	NM	2061.15	**2061.15**	**2061.49**	**2060.45**	**2060.99**	**2060.41**
MW-12	2021.44	2022.49	2022.22	2022.32	2022.37	NM	2022.05	2021.97	**2022.33**	**2022.31**	**2022.24**	**2021.95**	**2022.4**
FSP-21	NI	NI	NI	NI	NI	NI	2027.9	NI	**NI**	**NI**	**NI**	**NI**	**NI**
FSP-23	NI	NI	NI	NI	NI	NI	2028.09	NI	**NI**	**NI**	**NI**	**NI**	**NI**
FSB-04	NI	NI	NI	NI	NI	NI	2021.69	NI	**NI**	**NI**	**NI**	**NI**	**NI**
FSB-06	NI	NI	NI	NI	NI	NI	2020.16	NI	**NI**	**NI**	**NI**	**NI**	**NI**

NOTES

Groundwater elevations are in feet above mean sea level

November 2003 - November 2004 data are presented in **BOLD**.

NM - Not Measured. Depth to groundwater was not measured at the location on the date listed.

NI - Not Installed. The monitoring location was not installed during the data listed. For example, PM-16 shows "NI" until 31 July 2003 because it was not installed until July 2003.

EXHIBIT A-22
PILOT SYSTEM PERFORMANCE GROUNDWATER ANALYTICAL DATA SUMMARY (THROUGH NOVEMBER 2004)
(NOVEMBER 2002 - NOVEMBER 2004)
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

LOCATION	DATE	pH	DISSOLVED ARSENIC (mg/L)	TOTAL ARSENIC (mg/L)	TOTAL DIC (mg/L)
MW-07	11/21/02	7.76	<0.001	<0.001	NA
MW-07	03/03/03	7.77	<0.001	<0.001	NA
MW-07	04/20/03	7.89	<0.003	<0.003	NA
MW-07	08/28/03	7.45	<0.01	<0.01	16.2
MW-07	11/21/03	8.10	<0.01	<0.01	56.1
MW-07	03/31/04	7.88	<0.01	<0.01	54.5
MW-07	06/01/04	8.02	<0.01	<0.01	66.3
MW-07	07/30/04	8.07	<0.01	<0.01	72.6
MW-07	11/04/04	7.26	<0.01	<0.01	100.0
MW-08	11/21/02	7.68	0.002	0.002	NA
MW-08	03/03/03	7.62	<0.001	<0.001	NA
MW-08	04/20/03	7.83	<0.003	0.003	NA
MW-08	08/28/03	7.49	<0.01	<0.01	61.8
MW-08	11/21/03	8.08	<0.01	<0.01	68.1
MW-08	03/31/04	7.84	<0.01	<0.01	71.4
MW-08	06/01/04	7.91	<0.01	<0.01	64.9
MW-08	07/30/04	8.11	<0.01	<0.01	70.8
MW-08	11/04/04	7.63	0.010	<0.01	73.0
MW-09	11/21/02	12.10	0.148	0.134	NA
MW-09	01/10/03	12.20	0.212	0.207	NA
MW-09	03/03/03	12.20	0.052	0.125	NA
MW-09	04/20/03	12.20	0.039	0.100	NA
MW-09	05/12/03	12.32	0.112	0.108	89.5
MW-09	08/28/03	12.20	0.133	0.192	94.4
MW-09	11/21/03	12.16	0.136	0.176	51.8
MW-09	03/31/04	12.23	0.065	0.084	133.0
MW-09D	03/31/04	12.17	0.059	0.073	58.6
MW-09	06/01/04	11.87	0.074	0.076	100.0
MW-09	07/30/04	11.10	0.082	0.141	76.9
MW-09D	07/30/04	11.10	0.072	0.119	78.9
MW-09	11/04/04	10.95	0.043	0.045	89.8
MW-09D	11/04/04	10.88	0.047	0.048	90.2
MW-11	11/21/02	7.48	0.001	0.001	NA
MW-11	03/02/03	7.48	0.001	0.002	NA
MW-11	04/20/03	7.54	<0.003	<0.003	NA
MW-11	08/28/03	7.45	<0.01	<0.01	48.9
MW-11	11/21/03	8.11	<0.01	<0.01	93.2
MW-11	03/31/04	7.82	<0.01	<0.01	95.2
MW-11	06/01/04	7.86	<0.01	<0.01	96.7
MW-11	07/30/04	7.93	<0.01	<0.01	98.3
MW-11	11/04/04	10.88	0.047	0.048	90.2

NOTES

DIC - Dissolved Inorganic Carbon
mg/L - milligrams per liter
D - Duplicate
NA - Not Analyzed

EXHIBIT A-22 (Continued)
PILOT SYSTEM PERFORMANCE GROUNDWATER ANALYTICAL DATA SUMMARY (THROUGH NOVEMBER 2004)
(NOVEMBER 2002 - NOVEMBER 2004)
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

LOCATION	DATE	pH	DISSOLVED ARSENIC (mg/L)	TOTAL ARSENIC (mg/L)	TOTAL DIC (mg/L)
MW-12	11/21/02	8.42	0.005	0.005	NA
MW-12	03/03/03	8.32	0.004	0.004	NA
MW-12	04/20/03	8.20	0.004	0.004	NA
MW-12	08/28/03	8.11	0.010	<0.01	43.3
MW-12	11/21/03	8.18	<0.01	<0.01	72.9
MW-12	03/31/04	8.18	<0.01	<0.01	78.2
MW-12	06/01/04	8.09	<0.01	<0.01	69.7
MW-12	07/30/04	8.20	0.011	<0.01	72.8
MW-12	11/04/04	6.84	0.011	<0.01	55.0
AVG-E	01/10/03	7.15	0.001	0.004	NA
AVG-E	04/20/03	5.71	<0.003	<0.003	320.0
AVG-E	05/12/03	5.66	<0.003	<0.003	364.0
AVG-E	11/21/03	6.04	<0.01	<0.01	85.6
AVG-E	04/07/04	6.04	<0.01	<0.01	271.0
AVG-E	07/30/04	6.45	0.016	0.016	214.0
AVG-E	11/05/04	6.27	<0.010	<0.010	123.0
AVG-W	01/10/03	6.87	0.002	0.006	NA
AVG-W	04/20/03	5.75	<0.003	<0.003	370.0
AVG-W	05/12/03	5.72	<0.003	<0.003	308.0
AVG-W	11/21/03	6.31	<0.01	<0.01	164.0
AVG-W	04/07/04	5.82	<0.01	<0.01	276.0
AVG-W	07/30/04	6.57	0.016	0.016	188.0
AVG-W	11/05/04	5.63	<0.010	<0.010	138.0
PM-01	01/10/03	11.61	0.106	0.084	NA
PM-01	04/20/03	11.00	0.070	0.071	159.0
PM-01	09/04/03	12.10	0.215	0.212	173.0
PM-01	11/23/03	10.80	0.098	0.102	176.0
PM-01	04/05/04	10.40	0.047	0.050	170.0
PM-01	07/29/04	10.67	0.124	0.107	117.0
PM-01	11/04/04	10.20	0.033	0.031	200.0
PM-02	04/20/03	8.56	0.003	0.004	66.4
PM-02	05/12/03	8.33	0.007	0.007	75.2
PM-02	09/04/03	7.82	<0.01	0.014	36.3
PM-02	11/22/03	8.23	<0.01	<0.01	72.1
PM-02	04/05/04	8.47	<0.01	<0.01	73.8
PM-02	07/29/04	8.25	0.018	0.018	56.5
PM-02	11/04/04	8.01	<0.01	<0.01	77.1
PM-03	01/10/03	7.77	0.333	0.001	NA
PM-03	04/20/03	7.98	0.031	<0.003	70.1
PM-03	09/04/03	7.93	0.017	<0.01	347.0
PM-03	11/23/03	8.03	0.117	<0.01	70.9
PM-03	04/07/04	7.67	0.022	<0.01	78.4
PM-04	01/10/03	10.70	0.026	0.068	NA
PM-04	03/09/03	10.70	0.014	0.074	NA
PM-04	04/20/03	10.75	0.017	0.045	128.0
PM-04	09/04/03	11.80	0.180	0.091	67.6
PM-04	11/23/03	11.70	0.152	0.118	129.0
PM-04	04/07/04	10.91	0.139	0.037	142.0

NOTES

DIC - Dissolved Inorganic Carbon
mg/L - milligrams per liter
NA - Not Analyzed

EXHIBIT A-22 (Continued)
PILOT SYSTEM PERFORMANCE GROUNDWATER ANALYTICAL DATA SUMMARY (THROUGH NOVEMBER 2004)
(NOVEMBER 2002 - NOVEMBER 2004)
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

LOCATION	DATE	pH	DISSOLVED ARSENIC (mg/L)	TOTAL ARSENIC (mg/L)	TOTAL DIC (mg/L)
PM-05	01/10/03	8.83	0.185	0.009	NA
PM-05	04/20/03	9.34	0.005	0.005	100.0
PM-05	09/04/03	10.30	0.036	0.037	42.9
PM-05	11/22/03	9.69	0.034	<0.01	137.0
PM-05	04/05/04	9.60	<0.01	<0.01	119.0
PM-06	11/22/02	11.82	0.542	0.452	NA
PM-06	01/10/03	11.70	0.552	0.582	NA
PM-06	03/09/03	11.60	0.525	0.568	NA
PM-06	04/20/03	12.00	0.372	0.372	179.0
PM-06	05/12/03	12.27	0.310	0.352	150.0
PM-06	09/04/03	11.80	0.366	0.350	71.3
PM-06	12/02/03	11.69	0.326	0.323	161.0
PM-06	04/05/04	11.90	0.325	0.308	198.0
PM-06	07/30/04	10.75	0.333	0.333	175.0
PM-06	11/04/04	11.60	0.228	0.239	170.0
PM-07	11/22/02	9.71	0.035	0.054	NA
PM-07	01/10/03	8.64	0.240	0.039	NA
PM-07	04/20/03	7.01	0.008	0.014	291.0
PM-07	05/12/03	7.01	<0.006	0.015	324.0
PM-07	09/04/03	7.62	<0.01	0.024	102.0
PM-07	11/22/03	8.28	<0.01	0.476	204.0
PM-07	04/05/04	6.87	<0.01	0.014	257.0
PM-07	07/30/04	7.98	0.016	0.031	224.0
PM-07	11/04/04	7.74	0.020	0.026	226.0
PM-08	11/22/02	10.70	0.050	0.051	NA
PM-08	01/10/03	10.30	0.020	0.029	NA
PM-08	04/20/03	9.51	0.011	0.025	130.0
PM-08	05/12/03	10.30	0.017	0.020	112.0
PM-08	09/05/03	11.80	0.072	0.085	51.7
PM-08	11/22/03	9.76	0.029	0.021	145.0
PM-08	04/05/04	9.81	<0.01	<0.01	184.0
PM-08	07/29/04	9.55	0.017	0.017	139.0
PM-08	11/04/04	8.26	0.024	0.058	176.0
PM-09	04/20/03	9.17	0.004	0.004	71.4
PM-09	09/05/03	8.62	<0.01	0.018	36.4
PM-09	12/02/03	8.40	0.017	0.015	101.0
PM-09	04/07/04	7.39	<0.01	0.011	109.0
PM-10	11/21/02	6.90	0.030	0.031	NA
PM-10	01/10/03	10.40	0.173	0.158	NA
PM-10	03/09/03	10.60	0.092	0.123	NA
PM-10	04/20/03	7.46	0.029	0.031	138.0
PM-10	05/12/03	10.25	0.044	0.048	65.5
PM-10	09/05/03	12.02	0.188	0.177	43.5
PM-10	11/21/03	7.35	<0.01	<0.01	201.0
PM-10	04/07/04	7.22	0.018	0.026	243.0
PM-10	07/30/04	9.46	0.117	0.117	113.0
PM-10	11/04/04	7.02	<0.01	0.021	112.0

NOTES

DIC - Dissolved Inorganic Carbon
mg/L - milligrams per liter
NA - Not Analyzed

EXHIBIT A-22 (Continued)

PILOT SYSTEM PERFORMANCE GROUNDWATER ANALYTICAL DATA SUMMARY (THROUGH NOVEMBER 2004)

(NOVEMBER 2002 - NOVEMBER 2004)

CLOSED CEMENT KILN DUST PILE

METALINE FALLS, WASHINGTON

LOCATION	DATE	pH	DISSOLVED ARSENIC (mg/L)	TOTAL ARSENIC (mg/L)	TOTAL DIC (mg/L)
PM-11	11/21/02	6.54	0.001	0.010	NA
PM-11	01/10/03	7.76	<0.001	0.012	NA
PM-11	03/09/03	7.21	0.004	0.004	NA
PM-11	04/20/03	6.64	<0.003	0.005	305.0
PM-11	05/12/03	6.71	0.003	0.005	280.0
PM-11	09/05/03	7.44	<0.01	0.012	111.0
PM-11	11/21/03	7.09	<0.01	<0.01	242.0
PM-11	04/07/04	6.27	<0.01	<0.01	316.0
PM-11	07/30/04	7.40	0.015	0.022	259.0
PM-11	11/04/04	6.94	<0.01	<0.01	124.0
PM-12	11/21/02	6.55	0.016	0.019	NA
PM-12	01/10/03	7.69	0.002	0.017	NA
PM-12	03/09/03	7.07	0.008	0.010	NA
PM-12	04/20/03	9.02	0.004	0.014	388.0
PM-12	05/12/03	6.40	0.007	0.014	378.0
PM-12	09/05/03	6.96	<0.01	0.033	134.0
PM-12	11/21/03	7.61	<0.01	<0.01	217.0
PM-12	04/07/04	6.24	0.011	0.024	336.0
PM-12	07/30/04	7.24	<0.01	0.026	306.0
PM-12	11/04/04	6.64	<0.01	0.023	329.0
PM-13	11/21/02	10.20	0.011	0.010	NA
PM-13	01/10/03	9.19	0.004	0.004	NA
PM-13	03/09/03	7.87	0.003	0.002	NA
PM-13	04/20/03	9.64	<0.003	<0.003	74.4
PM-13	05/12/03	8.43	<0.003	<0.003	76.1
PM-13	09/05/03	9.53	<0.01	<0.01	42.3
PM-13	11/21/03	9.70	<0.01	<0.01	124.0
PM-13	04/07/04	9.38	<0.01	<0.01	75.3
PM-13	07/30/04	9.04	0.014	0.014	58.3
PM-13	11/04/04	8.37	<0.01	<0.01	161.0
PM-14	11/21/02	9.71	0.008	0.008	NA
PM-14	01/10/03	9.61	0.005	0.005	NA
PM-14	04/20/03	6.45	0.005	0.005	75.0
PM-14	05/12/03	9.73	0.006	0.005	66.4
PM-14	09/05/03	9.08	<0.01	<0.01	21.9
PM-14	11/21/03	9.14	<0.01	<0.01	82.7
PM-14	04/07/04	9.56	<0.01	<0.01	78.0
PM-14	07/29/04	9.52	0.017	0.017	54.0
PM-14	11/04/04	9.65	<0.01	<0.01	72.1
PM-15	04/20/03	12.30	0.142	0.142	110.0
PM-15	09/05/03	12.30	0.175	0.152	55.2
PM-15	11/22/03	12.20	0.143	0.133	156.0
PM-15	04/05/04	12.30	0.121	0.118	109.0
PM-15	07/29/04	12.23	0.152	0.147	105.0
PM-15	11/04/04	12.00	0.115	0.116	183.0
PM-16	04/05/04	12.40	0.086	0.115	104.0
PM-16	07/30/04	12.40	0.113	0.151	81.5
PM-16	11/04/04	12.10	0.099	0.038	113.0

NOTES

DIC - Dissolved Inorganic Carbon
mg/L - milligrams per liter
NA - Not Analyzed

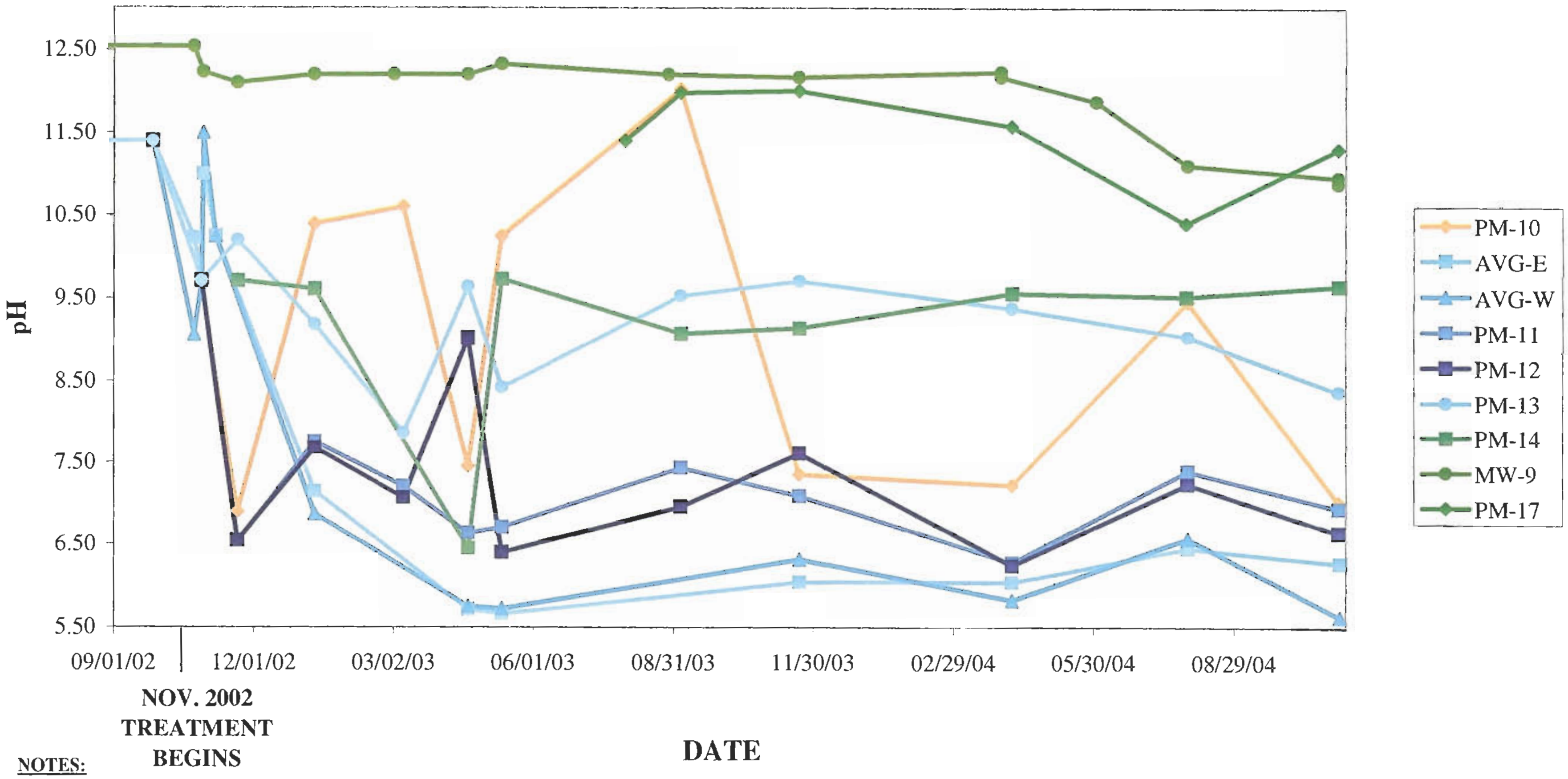
EXHIBIT A-22 (Continued)
PILOT SYSTEM PERFORMANCE GROUNDWATER ANALYTICAL DATA SUMMARY (THROUGH NOVEMBER 2004)
(NOVEMBER 2002 - NOVEMBER 2004)
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

LOCATION	DATE	pH	DISSOLVED ARSENIC (mg/L)	TOTAL ARSENIC (mg/L)	TOTAL DIC (mg/L)
PM-17	09/05/03	11.98	0.065	0.058	21.8
PM-17	11/21/03	12.00	0.071	0.079	83.5
PM-17	04/07/04	11.58	0.038	0.033	59.1
PM-17	07/29/04	10.40	0.042	0.042	60.1
PM-17	11/04/04	11.30	0.035	0.029	104.0
PM-18	09/04/03	12.00	0.271	0.278	43.5
PM-18	11/22/03	11.84	0.194	0.198	188.0
PM-18	04/05/04	11.70	0.106	0.094	106.0
PM-18	07/29/04	11.70	0.170	0.157	87.0
PM-18	11/04/04	11.20	0.074	0.076	184.0
PM-19	09/04/03	12.00	0.208	0.224	87.7
PM-19	11/22/03	12.20	0.153	0.144	150.0
PM-19	04/05/04	12.10	0.096	0.092	101.0
PM-19	07/29/04	12.00	0.130	0.121	91.0
PM-19	11/04/04	11.70	0.126	0.122	172.0
PM-20	09/04/03	8.28	<0.01	<0.01	106.0
PM-20	11/22/03	8.64	<0.01	<0.01	203.0
PM-20	04/05/04	8.92	<0.01	<0.01	135.0
PM-20	07/29/04	8.80	0.024	0.016	67.1
PM-20	11/04/04	8.50	<0.01	<0.01	191.0
PM-21	09/04/03	9.92	0.038	0.048	18.6
PM-21	11/22/03	9.72	0.043	0.038	59.2
PM-21	04/05/04	10.70	0.065	0.054	123.0
PM-21	07/30/04	10.00	0.071	0.061	70.6
PM-21	11/05/04	9.92	<0.01	0.010	46.4

NOTES

DIC - Dissolved Inorganic Carbon
mg/L - milligrams per liter
NA - Not Analyzed

EXHIBIT A-23
PILOT SYSTEM VICINITY TIME SERIES pH (THROUGH NOVEMBER 2004)
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON



NOTES:

1) CMT-1 data used to represent pre-Pilot System pH levels in vicinity of the trench.

EXHIBIT A-24
PILOT SYSTEM VICINITY TIME SERIES DISSOLVED ARSENIC (THROUGH NOVEMBER 2004)
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

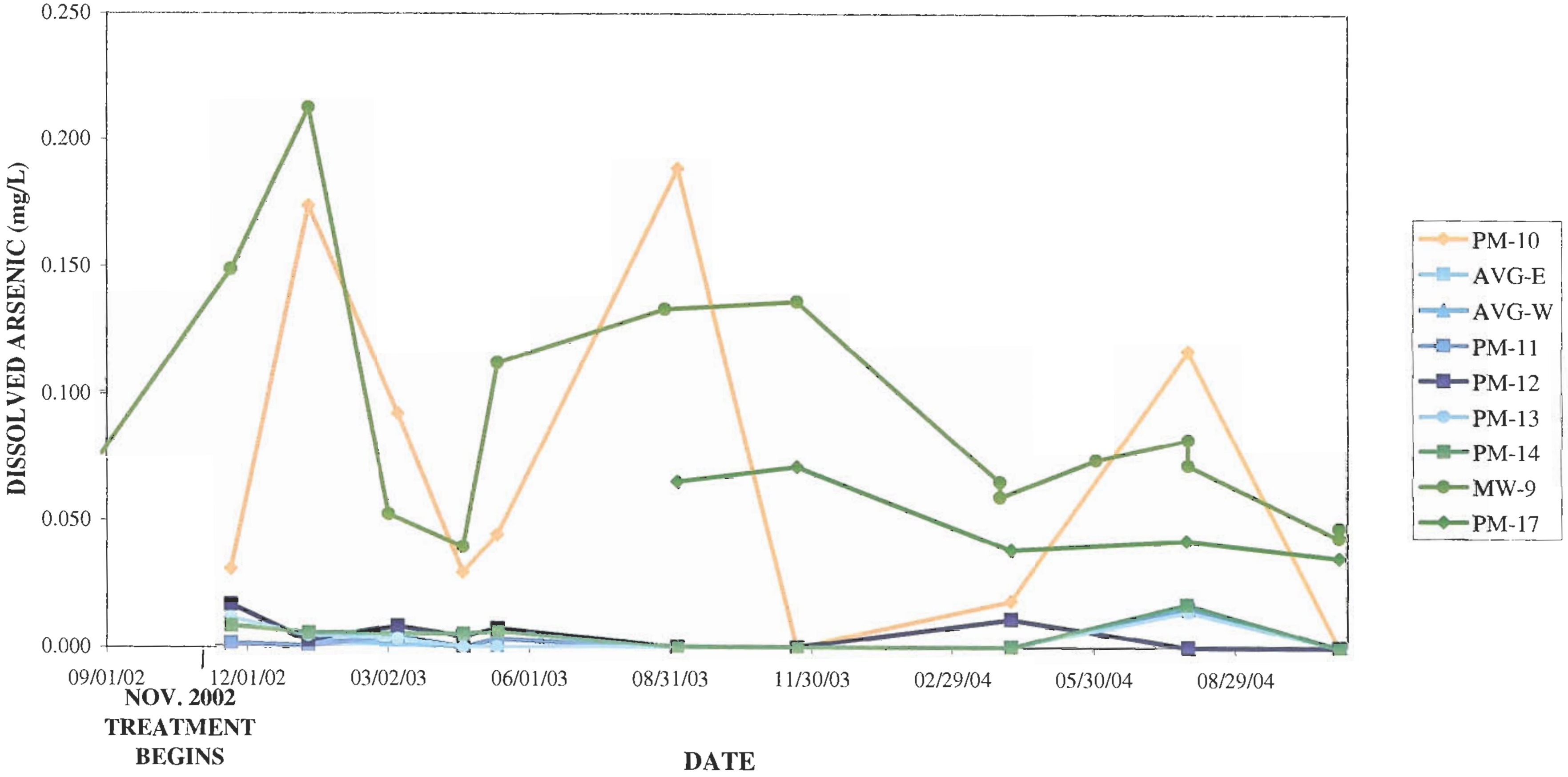
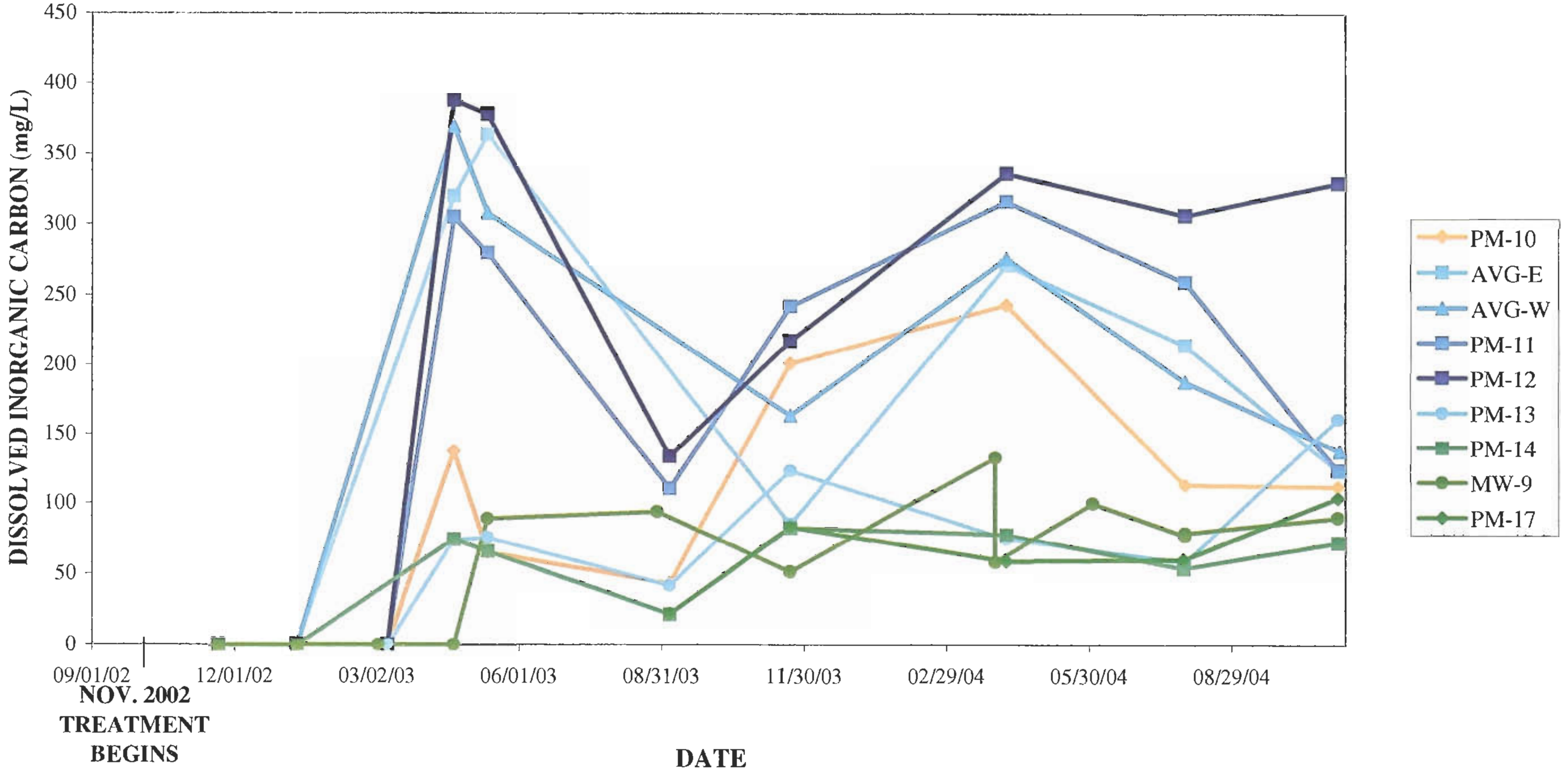


EXHIBIT A-25
PILOT SYSTEM VICINITY TIME SERIES DISSOLVED INORGANIC CARBON (THROUGH NOVEMBER 2004)
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON



ATTACHMENT 1 FOR APPENDIX A
ANALYTICAL LABORATORY DATA

PILOT TREATMENT WALL STUDY
2003 WORK PROGRAM DESCRIPTION AND SUMMARY OF FINDINGS
INCLUDES UPDATE (2003 – CURRENT)

DRAFT FEASIBILITY STUDY TECHNICAL REPORT
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

GROUNDWATER LABORATORY DATA
ATTACHMENT 1 FOR APPENDIX A

PILOT TREATMENT WALL STUDY
2003 WORK PROGRAM DESCRIPTION AND SUMMARY OF FINDINGS
INCLUDES UPDATE (2003 – CURRENT)

DRAFT FEASIBILITY STUDY TECHNICAL REPORT
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

CLIENT : GEOSYNTEC CONSULTANTS
PROJECT: HRO196-12
CLIENT SAMPLE ID: FSP-15
Sample Collected: 7/16/03 16:00
Sample Receipt : 7/21/03
Date of Report : 8/05/03

SVL JOB: 106755
SAMPLE: 343331

Matrix: WATERG

Determination	Result	Units	Dilution	Method	Analyzed
Alkalinity,CaCO3	380	mg CaCO3/L		2320	7/28/03
CO3, CaCO3	233	mg CaCO3/L		2320	7/28/03
Spec. Cond.	1120	umhos/cm		120.1	7/28/03
Eh (mV)	+68.1	mV		2580	7/28/03
HCO3, CaCO3	147	mg CaCO3/L		2320	7/28/03
pH	10.10			150.1	7/28/03
Calcium	130	mg/L		200.7	8/03/03
Chloride	9.25	mg/L	2	300.0	7/29/03
Fluoride	0.64	mg/L		300.0	7/29/03
Potassium	312	mg/L	10	200.7	8/04/03
Magnesium	33.3	mg/L		200.7	8/03/03
Sodium	17.1	mg/L		200.7	8/03/03
Sulfate, SO4	112	mg/L	10	300.0	7/29/03
Arsenic	0.028	mg/L		200.7	8/03/03
INORGANIC CARBON	17.0	mg/L		415.1	8/01/03

SAMPLE RECEIVED OUT OF HOLDING TIME FOR NO2,NO3,TDS

Reviewed By: ______ Date 8/5/03

8/05/03 15:12

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One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GEOSYNTEC CONSULTANTS
PROJECT: HRO196-12
CLIENT SAMPLE ID: FSP-16
Sample Collected: 7/17/03 9:30
Sample Receipt : 7/21/03
Date of Report : 8/05/03

SVL JOB: 106755
SAMPLE: 343332

Matrix: WATERG

Determination	Result	Units	Dilution	Method	Analyzed
Alkalinity,CaCO3	717	mg CaCO3/L		2320	7/28/03
CO3, CaCO3	412	mg CaCO3/L		2320	7/28/03
Spec. Cond.	2850	umhos/cm		120.1	7/28/03
Eh (mV)	+66.5	mV		2580	7/28/03
HCO3, CaCO3	306	mg CaCO3/L		2320	7/28/03
pH	9.98			150.1	7/28/03
Calcium	225	mg/L	10	200.7	8/03/03
Chloride	21.7	mg/L	5	300.0	7/29/03
Fluoride	1.61	mg/L	2	300.0	7/29/03
Potassium	888	mg/L	10	200.7	8/04/03
Magnesium	63.8	mg/L	10	200.7	8/03/03
Sodium	43.7	mg/L	10	200.7	8/03/03
Sulfate, SO4	519	mg/L	50	300.0	7/28/03
Arsenic	0.120	mg/L	10	200.7	8/03/03
INORGANIC CARBON	66.3	mg/L		415.1	8/01/03

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CLIENT : GEOSYNTEC CONSULTANTS
PROJECT: HRO196-12
CLIENT SAMPLE ID: FSP-17
Sample Collected: 7/16/03 14:00
Sample Receipt : 7/21/03
Date of Report : 8/05/03

SVL JOB: 106755
SAMPLE: 343327
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	Alkalinity,CaCO3	267	mg CaCO3/L		2320	7/28/03
T	CO3, CaCO3	20.4	mg CaCO3/L		2320	7/28/03
T	Spec. Cond.	1740	umhos/cm		120.1	7/28/03
T	Eh (mV)	+140	mV		2580	7/28/03
T	HCO3, CaCO3	247	mg CaCO3/L		2320	7/28/03
T	pH	8.56			150.1	7/28/03
T	Calcium	37.8	mg/L		200.7	8/03/03
T	Chloride	21.1	mg/L	5	300.0	7/28/03
T	Fluoride	0.25	mg/L		300.0	7/28/03
T	Potassium	121	mg/L	10	200.7	8/04/03
T	Magnesium	20.0	mg/L		200.7	8/03/03
T	Sodium	9.47	mg/L		200.7	8/03/03
T	Ammonia as N	1.05	mg/L		350.3	7/28/03
T	Nitrite-N	<0.050	mg/L		300.0	7/28/03
T	Nitrate-N	<0.050	mg/L		300.0	7/28/03
T	Sulfate, SO4	25.9	mg/L	2	300.0	7/28/03
T	Arsenic	0.013	mg/L		200.7	8/03/03
T	Iron	9.83	mg/L		200.7	8/03/03
T	Manganese	0.203	mg/L		200.7	8/03/03
T	INORGANIC CARBON	25.4	mg/L		415.1	7/31/03
D	Manganese	<0.020*	mg/L	10	200.7	8/03/03

Filtered fraction: 344202
*Elevated detection limit due to matrix interference.
SAMPLE RECEIVED OUT OF HOLDING TIME FOR NO2,NO3,TDS

Reviewed By:____________________ Date 8/5/03

8/05/03 15:12

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LIENT : GEOSYNTEC CONSULTANTS
ROJECT: HRO196-12
CLIENT SAMPLE ID: FSP-18
Sample Collected: 7/17/03 10:00
Sample Receipt : 7/21/03
Date of Report : 8/05/03

SVL JOB: 106755
SAMPLE: 343333

Matrix: WATERG

Determination	Result	Units	Dilution	Method	Analyzed
Alkalinity,CaCO3	773	mg CaCO3/L		2320	7/28/03
CO3, CaCO3	<1.0	mg CaCO3/L		2320	7/28/03
Spec. Cond.	1800	umhos/cm		120.1	7/28/03
Eh (mV)	+13.1	mV		2580	7/28/03
HCO3, CaCO3	773	mg CaCO3/L		2320	7/28/03
pH	7.15			150.1	7/28/03
Calcium	377	mg/L		200.7	8/03/03
Chloride	40.7	mg/L	10	300.0	7/28/03
Fluoride	<0.10	mg/L		300.0	7/29/03
Potassium	262	mg/L	10	200.7	8/04/03
Magnesium	89.9	mg/L		200.7	8/03/03
Sodium	48.3	mg/L		200.7	8/03/03
Sulfate, SO4	93.6	mg/L	10	300.0	7/28/03
Arsenic	0.028	mg/L		200.7	8/03/03
INORGANIC CARBON	140	mg/L		415.1	8/01/03

SAMPLE RECEIVED OUT OF HOLDING TIME FOR NO2,NO3,TDS

Reviewed By:________________ Date 8/5/03

8/05/03 15:12

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LIENT : GEOSYNTEC CONSULTANTS
ROJECT: HRO196-12
CLIENT SAMPLE ID: FSP-19
Sample Collected: 7/16/03 14:30
Sample Receipt : 7/21/03
Date of Report : 8/05/03

SVL JOB: 106755
SAMPLE: 343328

Matrix: WATERG

Determination	Result	Units	Dilution	Method	Analyzed
Alkalinity,CaCO3	587	mg CaCO3/L		2320	7/28/03
CO3, CaCO3	22.1	mg CaCO3/L		2320	7/28/03
Spec. Cond.	1720	umhos/cm		120.1	7/28/03
Eh (mV)	+153	mV		2580	7/28/03
HCO3, CaCO3	565	mg CaCO3/L		2320	7/28/03
pH	8.42			150.1	7/28/03
Calcium	487	mg/L	10	200.7	8/03/03
Chloride	23.8	mg/L	5	300.0	7/29/03
Fluoride	0.59	mg/L		300.0	7/29/03
Potassium	538	mg/L	10	200.7	8/04/03
Magnesium	153	mg/L	10	200.7	8/03/03
Sodium	42.3	mg/L	10	200.7	8/03/03
Sulfate, SO4	218	mg/L	25	300.0	7/28/03
Arsenic	0.120	mg/L	10	200.7	8/03/03
INORGANIC CARBON	50.4	mg/L		415.1	7/31/03

SAMPLE RECEIVED OUT OF HOLDING TIME FOR NO2,NO3,TDS

Reviewed By:________________________ Date 8/5/03
8/05/03 15:12

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IENT : GEOSYNTEC CONSULTANTS
ROJECT: HRO196-12
CLIENT SAMPLE ID: FSP-20
Sample Collected: 7/17/03 11:00
Sample Receipt : 7/21/03
Date of Report : 8/05/03

SVL JOB: 106755
SAMPLE: 343334

Matrix: WATERG

Determination	Result	Units	Dilution	Method	Analyzed
Alkalinity,CaCO3	1260	mg CaCO3/L		2320	7/28/03
CO3, CaCO3	445	mg CaCO3/L		2320	7/28/03
Spec. Cond.	3780	umhos/cm		120.1	7/28/03
Eh (mV)	-5.0	mV		2580	7/28/03
HCO3, CaCO3	816	mg CaCO3/L		2320	7/28/03
pH	9.52			150.1	7/28/03
Calcium	73.1	mg/L	10	200.7	8/03/03
Chloride	28.9	mg/L	10	300.0	7/29/03
Fluoride	0.43	mg/L	2	300.0	7/29/03
Potassium	1170	mg/L	10	200.7	8/04/03
Magnesium	52.4	mg/L	10	200.7	8/03/03
Sodium	62.9	mg/L	10	200.7	8/03/03
Sulfate, SO4	501	mg/L	50	300.0	7/28/03
Arsenic	<0.10*	mg/L	10	200.7	8/03/03
INORGANIC CARBON	110	mg/L		415.1	8/01/03

*Elevated detection limit due to matrix interference.
MPLE RECEIVED OUT OF HOLDING TIME FOR NO2,NO3,TDS

Reviewed By:______________________ Date 8/5/03

8/05/03 15:12

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LIENT : GEOSYNTEC CONSULTANTS
ROJECT: HRO196-12
CLIENT SAMPLE ID: FSP-20
Sample Collected: 7/17/03 14:00
Sample Receipt : 7/21/03
Date of Report : 8/05/03

SVL JOB: 106755
SAMPLE: 343337

Matrix: WATERG

Determination	Result	Units	Dilution	Method	Analyzed
Alkalinity,CaCO3	1340	mg CaCO3/L		2320	7/28/03
CO3, CaCO3	620	mg CaCO3/L		2320	7/28/03
Spec. Cond.	4090	umhos/cm		120.1	7/28/03
Eh (mV)	+42.6	mV		2580	7/28/03
HCO3, CaCO3	721	mg CaCO3/L		2320	7/28/03
pH	9.70			150.1	7/28/03
Calcium	23.4	mg/L	10	200.7	8/03/03
Chloride	30.6	mg/L		300.0	7/29/03
Fluoride	0.37	mg/L		300.0	7/29/03
Potassium	1260	mg/L	10	200.7	8/04/03
Magnesium	23.6	mg/L	10	200.7	8/03/03
Sodium	65.9	mg/L	10	200.7	8/03/03
Sulfate, SO4	556	mg/L	50	300.0	7/28/03
Arsenic	<0.10*	mg/L	10	200.7	8/03/03
INORGANIC CARBON	178	mg/L		415.1	8/01/03

*Elevated detection limit due to matrix interference.
MPLE RECEIVED OUT OF HOLDING TIME FOR NO2,NO3,TDS

Reviewed By: ______________________ Date 8/5/03

8/05/03 15:12

CLIENT : GEOSYNTEC CONSULTANTS
PROJECT: HRO196-12
LIENT SAMPLE ID: FSP-06
Sample Collected: 7/15/03 19:00
Sample Receipt : 7/21/03
Date of Report : 8/05/03

SVL JOB: 106755
SAMPLE: 343324
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	Alkalinity,CaCO3	1550	mg CaCO3/L		2320	7/28/03
T	CO3, CaCO3	750	mg CaCO3/L		2320	7/28/03
T	Spec. Cond.	7790	umhos/cm		120.1	7/28/03
T	Eh (mV)	+58.5	mV		~~2580~~	7/28/03
T	HCO3, CaCO3	<1.0	mg CaCO3/L		~~2320~~	7/28/03
T	pH	12.10			150.1	7/28/03
T	Calcium	7.91	mg/L		200.7	8/03/03
T	Chloride	27.3	mg/L	5	300.0	7/29/03
T	Fluoride	2.70	mg/L	5	300.0	7/28/03
T	Potassium	2130	mg/L	100	200.7	8/04/03
T	Magnesium	0.567	mg/L		200.7	8/03/03
T	Sodium	73.6	mg/L		200.7	8/03/03
T	Ammonia as N	2.64	mg/L		350.3	7/28/03
T	Nitrite-N	<0.050	mg/L		300.0	7/28/03
T	Nitrate-N	<0.050	mg/L		300.0	7/28/03
T	Sulfate, SO4	886	mg/L	50	300.0	7/28/03
T	Arsenic	0.040	mg/L		~~200.7~~	8/03/03
T	Iron	2.35	mg/L		~~200.7~~	8/03/03
T	Manganese	0.0804	mg/L		~~200.7~~	8/03/03
T	INORGANIC CARBON	69.8	mg/L		415.1	7/31/03
D	Manganese	<0.020*	mg/L	10	200.7	8/03/03

Filtered fraction: 344200
*Elevated detection limit due to matrix interference.
SAMPLE RECEIVED OUT OF HOLDING TIME FOR NO2,NO3,TDS

Reviewed By: ______________________ Date 8/5/03
8/05/03 15:12

SVL ANALYTICAL, INC.

Certificate: CA CERTIFICATE NO. 2080

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LIENT : GEOSYNTEC CONSULTANTS
ROJECT: HR0196-12
CLIENT SAMPLE ID: FSP-07
Sample Collected: 7/15/03 19:10
Sample Receipt : 7/21/03
Date of Report : 8/05/03

SVL JOB: 106755
SAMPLE: 343325
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	Alkalinity,CaCO3	3280	mg CaCO3/L		2320	7/28/03
T	CO3, CaCO3	1580	mg CaCO3/L		2320	7/28/03
T	Spec. Cond.	17000	umhos/cm		120.1	7/28/03
T	Eh (mV)	-16.9	mV		2580	7/28/03
T	HCO3, CaCO3	<1.0	mg CaCO3/L		2320	7/28/03
T	pH	12.40			150.1	7/28/03
T	Calcium	10.2	mg/L		200.7	8/03/03
T	Chloride	58.7	mg/L	10	300.0	7/28/03
T	Fluoride	1.74	mg/L	10	300.0	7/28/03
T	Potassium	4430	mg/L	100	200.7	8/04/03
T	Magnesium	1.06	mg/L		200.7	8/03/03
T	Sodium	170	mg/L		200.7	8/03/03
T	Ammonia as N	4.82	mg/L		350.3	7/28/03
T	Nitrite-N	<0.050	mg/L		300.0	7/28/03
T	Nitrate-N	1.15	mg/L		300.0	7/28/03
T	Sulfate, SO4	2350	mg/L	200	300.0	7/28/03
T	Arsenic	0.184	mg/L		200.7	8/03/03
T	Iron	2.34	mg/L		200.7	8/03/03
T	Manganese	0.289	mg/L		200.7	8/03/03
T	INORGANIC CARBON	80.8	mg/L		415.1	7/31/03
D	Manganese	<0.020*	mg/L	10	200.7	8/03/03

Filtered fraction: 344201
*Elevated detection limit due to matrix interference.
SAMPLE RECEIVED OUT OF HOLDING TIME FOR NO2,NO3,TDS

Reviewed By:______________________ Date 8/5/03

8/05/03 15:12

SVL ANALYTICAL, INC.

Certificate: CA CERTIFICATE NO. 2080

One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

LIENT : GEOSYNTEC CONSULTANTS
ROJECT: HRO196-12
CLIENT SAMPLE ID: FSP-23
Sample Collected: 7/16/03 15:40
Sample Receipt : 7/21/03
Date of Report : 8/05/03

SVL JOB: 106755
SAMPLE: 343330
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	Alkalinity,CaCO3	1400	mg CaCO3/L		2320	7/28/03
T	CO3, CaCO3	902	mg CaCO3/L		2320	7/28/03
T	Spec. Cond.	8630	umhos/cm		120.1	7/28/03
T	Eh (mV)	+1.8	mV		2580	7/28/03
T	HCO3, CaCO3	<1.0	mg CaCO3/L		2320	7/28/03
T	pH	12.00			150.1	7/28/03
T	Calcium	14.9	mg/L	10	200.7	8/03/03
T	Chloride	36.1	mg/L	10	300.0	7/29/03
T	Fluoride	1.76	mg/L	2	300.0	7/29/03
T	Potassium	2140	mg/L	100	200.7	8/04/03
T	Magnesium	2.40	mg/L	10	200.7	8/03/03
T	Sodium	86.5	mg/L	10	200.7	8/03/03
T	Ammonia as N	3.02	mg/L		350.3	7/28/03
T	Nitrite-N	<0.050	mg/L		300.0	7/29/03
T	Nitrate-N	0.056	mg/L		300.0	7/29/03
T	Sulfate, SO4	1130	mg/L	100	300.0	7/29/03
T	Arsenic	<0.10*	mg/L	10	200.7	8/03/03
T	Iron	11.7	mg/L	10	200.7	8/03/03
T	Manganese	0.427	mg/L	10	200.7	8/03/03
T	INORGANIC CARBON	56.1	mg/L		415.1	7/31/03
D	Manganese	0.0540	mg/L	10	200.7	8/03/03

Filtered fraction: 344204
*Elevated detection limit due to matrix interference.
SAMPLE RECEIVED OUT OF HOLDING TIME FOR NO2,NO3,TDS

Reviewed By:______________________ Date 8/5/03

8/05/03 15:12

SVL ANALYTICAL, INC. Certificate: CA CERTIFICATE NO. 2080
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

IENT : GEOSYNTEC CONSULTANTS
ROJECT: HRO196-12
CLIENT SAMPLE ID: FSP-23
Sample Collected: 7/17/03 11:40
Sample Receipt : 7/21/03
Date of Report : 8/05/03

SVL JOB: 106755
SAMPLE: 343335
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	Alkalinity,CaCO3	734	mg CaCO3/L		2320	7/28/03
T	CO3, CaCO3	467	mg CaCO3/L		2320	7/28/03
T	Spec. Cond.	3130	umhos/cm		120.1	7/28/03
T	Eh (mV)	+9.2	mV		2580	7/28/03
T	HCO3, CaCO3	266	mg CaCO3/L		2320	7/28/03
T	pH	10.10			150.1	7/28/03
T	Calcium	63.4	mg/L	10	200.7	8/03/03
T	Chloride	485	mg/L	100	300.0	7/29/03
T	Fluoride	0.33	mg/L		300.0	7/29/03
T	Potassium	360	mg/L	10	200.7	8/04/03
T	Magnesium	19.5	mg/L	10	200.7	8/03/03
T	Sodium	461	mg/L	10	200.7	8/03/03
T	Ammonia as N	0.930	mg/L		350.3	7/28/03
T	Nitrite-N	<0.050	mg/L		300.0	7/29/03
T	Nitrate-N	<0.050	mg/L		300.0	7/29/03
T	Sulfate, SO4	155	mg/L	10	300.0	7/29/03
T	Arsenic	0.041	mg/L		200.7	8/03/03
T	Iron	48.3	mg/L	10	200.7	8/03/03
T	Manganese	2.40	mg/L	10	200.7	8/03/03
T	INORGANIC CARBON	46.1	mg/L		415.1	8/01/03
D	Manganese	0.381	mg/L	10	200.7	8/03/03

Filtered fraction: 344205
SAMPLE RECEIVED OUT OF HOLDING TIME FOR NO2,NO3,TDS

Reviewed By: ______________________ Date 8/5/03

8/05/03 15:12

SVL ANALYTICAL, INC.
Certificate: CA CERTIFICATE NO. 2080
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

LIENT : GEOSYNTEC CONSULTANTS
ROJECT: HRO196-12
CLIENT SAMPLE ID: FSP-26
Sample Collected: 7/16/03 15:00
Sample Receipt : 7/21/03
Date of Report : 8/05/03

SVL JOB: 106755
SAMPLE: 343329
TOT/DIS
Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	Alkalinity,CaCO3	1320	mg CaCO3/L		2320	7/28/03
T	CO3, CaCO3	910	mg CaCO3/L		2320	7/28/03
T	Spec. Cond.	6540	umhos/cm		120.1	7/28/03
T	Eh (mV)	+18.7	mV		2580	7/28/03
T	HCO3, CaCO3	<1.0	mg CaCO3/L		2320	7/28/03
T	pH	11.90			150.1	7/28/03
T	Calcium	13.2	mg/L	10	200.7	8/03/03
T	Chloride	84.1	mg/L	25	300.0	7/28/03
T	Fluoride	1.51	mg/L	2	300.0	7/28/03
T	Potassium	1620	mg/L	100	200.7	8/04/03
T	Magnesium	4.93	mg/L	10	200.7	8/03/03
T	Sodium	91.0	mg/L	10	200.7	8/03/03
T	Ammonia as N	2.24	mg/L		350.3	7/28/03
T	Nitrite-N	<0.050	mg/L		300.0	7/28/03
T	Nitrate-N	<0.050	mg/L		300.0	7/28/03
T	Sulfate, SO4	702	mg/L	50	300.0	7/28/03
T	Arsenic	0.160	mg/L	10	200.7	8/03/03
T	Iron	33.9	mg/L	10	200.7	8/03/03
T	Manganese	0.753	mg/L	10	200.7	8/03/03
T	INORGANIC CARBON	39.3	mg/L		415.1	7/31/03
D	Manganese	0.238	mg/L	10	200.7	8/03/03

Filtered fraction: 344203
SAMPLE RECEIVED OUT OF HOLDING TIME FOR NO2,NO3,TDS

Reviewed By:______________________ Date 8/5/03
8/05/03 15:12

SVL ANALYTICAL, INC.

Certificate: CA CERTIFICATE NO. 2080

One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT:
CLIENT SAMPLE ID: PM-16
Sample Collected: 7/19/03 2:30
Sample Receipt : 8/06/03
Date of Report : 8/21/03

SVL JOB: 107014
SAMPLE: 346458

Matrix: WATER

Determination	Result	Units	Dilution	Method	Analyzed
Alkalinity,CaCO3	2110	mg CaCO3/L		2320	8/08/03
CO3, CaCO3	1120	mg CaCO3/L		2320	8/08/03
Spec. Cond.	10500	umhos/cm		120.1	8/08/03
Eh (mV)	+58.8	mV		2580	8/08/03
HCO3, CaCO3	<1.0	mg CaCO3/L		2320	8/08/03
pH	12.03			150.1	8/08/03
Calcium	4.55	mg/L		200.7	8/20/03
Chloride	39.7	mg/L	10	300.0	8/07/03
Fluoride	2.86	mg/L	10	300.0	8/07/03
Potassium	2570	mg/L	100	200.7	8/20/03
Magnesium	0.052	mg/L		200.7	8/20/03
Sodium	102	mg/L		200.7	8/20/03
Ammonia as N	2.49	mg/L		350.3	8/11/03
Nitrite-N	<0.050	mg/L		300.0	8/07/03
Nitrate-N	0.053	mg/L		300.0	8/07/03
Sulfate, SO4	1210	mg/L	100	300.0	8/07/03
Arsenic	0.139	mg/L		200.7	8/20/03
Iron	6.45	mg/L		200.7	8/20/03
Manganese	0.109	mg/L		200.7	8/20/03
Silica	115	mg/L	10	200.7	8/20/03
INORGANIC CARBON	46.7	mg/L		415.1	8/13/03

CalcTDS: 5339.6	TDS/Cond:	CATION SUM:	70.64meq/L	BALANCE
TDS/CalcTDS:	CalcTDS/Cond:	ANION SUM:	68.42meq/L	1.60%

FROM SVL JOB# 106755. SVL RECEIVED AN HNO3 AND UNPRESERVED CONTAINER. SVL WILL REANALYZE THE SAMPLE, USING THE CONTAINER LABELED HNO3 FOR GENERAL MINERAL PARAMETERS AND USE THE CONTAINER LABELED UNPRESERVED FOR METALS, PER EMAIL FROM BRIAN PETTY
NH-3: SVL PRESERVED FROM RAW SAMPLE.
ALKALINITY; NO2-N; NO3-N: SAMPLE RECEIVED AND ANALYZED PAST HOLDING TIME.

Reviewed By:________________ Date 8/21/03

8/21/03 14:03

SVL ANALYTICAL, INC.

Quality Control Report
Part I Prep Blank and Laboratory Control Sample

Client :GeoSyntec SVL JOB No: 107014

Analyte	Method	Matrix	Units	Prep Blank	True——LCS——Found		LCS %R	Analysis Date
Arsenic	200.7	WATER	mg/L	<0.010	1.00	0.959	95.9	8/20/03
Calcium	200.7	WATER	mg/L	<0.040	20.0	21.0	105.0	8/20/03
Iron	200.7	WATER	mg/L	<0.020	10.0	10.1	101.0	8/20/03
Potassium	200.7	WATER	mg/L	<1.0	30.0	30.4	101.3	8/20/03
Magnesium	200.7	WATER	mg/L	<0.040	20.0	20.3	101.5	8/20/03
Manganese	200.7	WATER	mg/L	<0.0020	1.00	1.01	101.0	8/20/03
Sodium	200.7	WATER	mg/L	<0.50	20.0	20.4	102.0	8/20/03
Silica	200.7	WATER	mg/L	<0.171	10.7	11.1	103.7	8/20/03
Chloride	300.0	WATER	mg/L	<0.20	5.00	5.00	100.0	8/07/03
Fluoride	300.0	WATER	mg/L	<0.10	2.50	2.48	99.2	8/07/03
Nitrite-N	300.0	WATER	mg/L	<0.050	2.50	2.50	100.0	8/07/03
Nitrate-N	300.0	WATER	mg/L	<0.050	2.50	2.51	100.4	8/07/03
Sulfate, SO4	300.0	WATER	mg/L	<0.30	10.0	10.3	103.0	8/07/03
Alkalinity,CaCO3	2320	WATER	mg/L	<1.0	53.2	57.6	108.3	8/08/03
pH	150.1	WATER		5.81	6.10	6.09	99.8	8/08/03
Spec. Cond.	120.1	WATER	umhos/cm	0.159	375	360	96.0	8/08/03
Eh (mV)	2580	WATER	mV	N/A	+228	+238	104.4	8/08/03
Ammonia as N	350.3	WATER	mg/L	<0.10	13.4	12.8	95.5	8/11/03
INORGANIC CARBON	415.1	WATER	mg/L	<1.0	5.00	5.60	112.0	8/13/03

LEGEND:

LCS = Laboratory Control Sample LCS %R = LCS Percent Recovery N/A = Not Applicable

8/21/03 12:25

SVL ANALYTICAL, INC.

Quality Control Report
Part II Duplicate and Spike Analysis

nt :GeoSyntec

SVL JOB No: 107014

				QC SAMPLE ID		Duplicate or MSD		Matrix Spike			Analysis
Test	Method	Matrix		Units	Result	Found	RPD%	Result	SPK ADD	%R	Date
As	200.7	WATER	1	mg/L	0.139	0.142	2.1	1.19	1.00	105.1	8/20/03
Ca	200.7	WATER	1	mg/L	4.55	4.83	6.0	25.0	20.0	102.3	8/20/03
Fe	200.7	WATER	1	mg/L	6.45	6.62	2.6	17.4	10.0	109.5	8/20/03
K	200.7	WATER	1	mg/L	2570	2580	0.4	2570	30.0	R >4S	8/20/03
Mg	200.7	WATER	1	mg/L	0.052	<0.040	200.0	20.9	20.0	104.2	8/20/03
Mn	200.7	WATER	1	mg/L	0.109	0.110	0.9	1.15	1.00	104.1	8/20/03
Na	200.7	WATER	1	mg/L	102	103	1.0	119	20.0	85.0	8/20/03
SiO2	200.7	WATER	1	mg/L	115	129	11.5	129	10.7	R >4S	8/20/03
Cl	300.0	WATER	1	mg/L	39.7	40.6	2.2	60.4	20.0	103.5	8/07/03
F	300.0	WATER	1	mg/L	2.86	3.00	4.8	20.9	20.0	90.2	8/07/03
NO2-N	300.0	WATER	1	mg/L	<0.050	<0.050	UDL	1.76	2.00	88.0	8/07/03
NO3-N	300.0	WATER	1	mg/L	0.053	0.051	3.8	1.99	2.00	96.9	8/07/03
SO4	300.0	WATER	1	mg/L	1210	1190	1.7	1730	500	104.0	8/07/03
ALK	2320	WATER	1	mg/L	2110	2060	2.4	N/A	N/A	N/A	8/08/03
CO3	2320	WATER	1	mg/L	1120	1160	3.5	N/A	N/A	N/A	8/08/03
HCO3	2320	WATER	1	mg/L	<1.0	<1.0	UDL	N/A	N/A	N/A	8/08/03
pH	150.1	WATER	1		12.03	12.03	0.0	N/A	N/A	N/A	8/08/03
COND	120.1	WATER	1	umhos/c	10500	10500	0.0	N/A	N/A	N/A	8/08/03
Eh	2580	WATER	1	mV	+58.8	+60.7	3.2	N/A	N/A	N/A	8/08/03
NH3-N	350.3	WATER	1	mg/L	2.49	2.42	2.9	3.38	1.00	89.0	8/11/03
ORG18D	415.1	WATER	1	mg/L	46.7	49.9	6.6	94.6	50.0	95.8	8/13/03

LEGEND:

RPD = (|SAM - DUP|/((SAM + DUP)/2) * 100)   UDL = Both SAM & DUP not detected.   *Result or *Found: Interference required dilution.

= (|SPK - MSD|/((SPK + MSD)/2) * 100)   M in Duplicate/MSD column indicates MSD.

SPIKE ADD column, A = Post Digest Spike;   %R = Percent Recovery N/A = Not Analyzed; R > 4S = Result more than 4X the Spike Added

QC Sample 1:   SVL SAM No.: 346458   Client Sample ID: PM-16

8/21/03 12:25

SVL ANALYTICAL, INC.
One Government Gulch - Kellogg, ID 83837-0929

SAMPLE RECEIPT CONFIRMATION

CLIENT: ERIC SMALSTIG
GEOSYNTEC CONSULTANTS
2100 MAIN STREET #150

HUNTINGTONBEACH CA 92648
FAX: (714)969-0820

From
SVL JOB No: 106755
Received: 7/21/03
Expected Due date: 8/03/03

SVL#	M	ClientID	Sampled	Time	By	Received	Sample Comments
343336	W	FSP-25	7/17/03	13:00	BP	7/21/03	SAMPLE RECEIVED OUT OF HOLDING TIME FOR NO2,NO3,TDS ON HOLD PER CLIENT
343337	W	FSP-20	7/17/03	14:00	BP	7/21/03	*Elevated detection limit due to matrix interference. SAMPLE RECEIVED OUT OF HOLDING TIME FOR NO2,NO3,TDS
343339	W	PM-16	7/19/03	2:30	BP	7/21/03	*Elevated detection limit due to matrix interference. SAMPLE RECEIVED OUT OF HOLDING TIME FOR NO2,NO3,TDS
344200*	W	FSP-06 ^D	7/15/03	19:00	BP	7/21/03	
344201*	W	FSP-07 ^D	7/15/03	19:10	BP	7/21/03	
344202*	W	FSP-17 ^D	7/16/03	14:00	BP	7/21/03	
344203*	W	FSP-26 ^D	7/16/03	15:00	BP	7/21/03	
344204*	W	FSP-23 ^D	7/16/03	15:40	BP	7/21/03	
344205*	W	FSP-23 ^D	7/17/03	11:40	BP	7/21/03	

*We track Total (^T), Tot. Rec. (^R), Pot. Diss. (^P) and Dissolved (^D) fractions separately. Field samples may appear twice.

ADDITIONAL COMMENTS FOR JOB: Sample Cooler/Container temp not measured upon receipt.
SVL CANNOT ANALYZE FOR SULFIDE...NOT ENOUGH SAMPLE

[X] These samples will be DISPOSED 45 days after job completion.
[ ] These samples will be ARCHIVED 45 days, then you will receive a letter requesting disposal options.

Please contact Crystal Sevy (208-784-1258) if you have questions regarding the receipt of these samples. 8/[illegible]/03 15:53

CONFIRMATION REPORT - MEMORY SEND

Time : AUG-07-03 11:14
Fax number: +2087830891
Name : SVL ANALYTICAL

Job : 068

Date : AUG-07 11:13

To : 917149690820

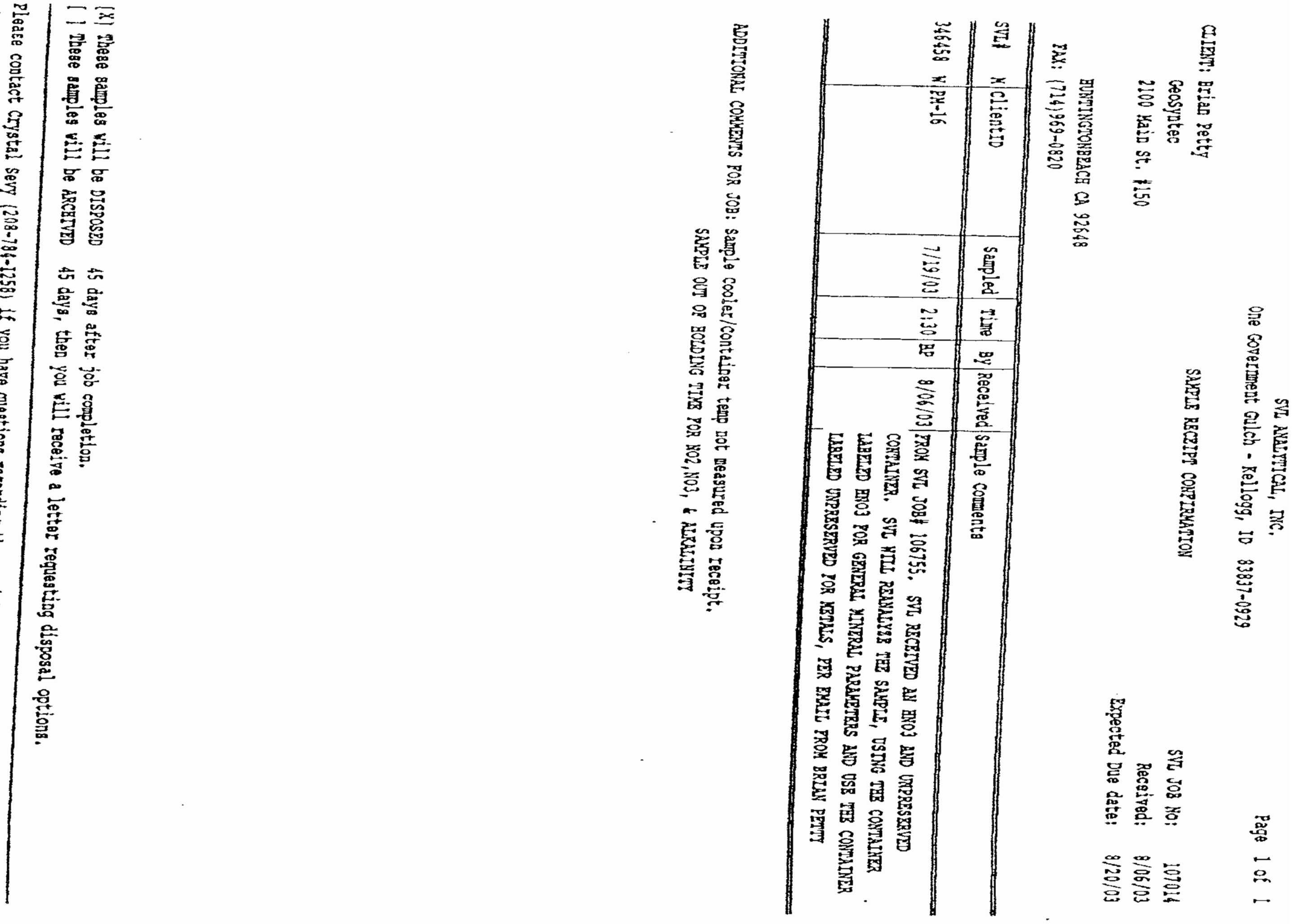
Doc. pages : 01

Start time : AUG-07 11:13

End time : AUG-07 11:14

Pages sent : 01

Job:068 *** SEND SUCCESSFUL ***



SVL ANALYTICAL, INC.
One Government Gulch - Kellogg, ID 83837-0929

Page 1 of 1

CLIENT: Brian Petty
GeoSyntec
2100 Main St. #150

HUNTINGTONBEACH CA 92648
FAX: (714)969-0820

SAMPLE RECEIPT CONFIRMATION

SVL JOB No: 107014
Received: 8/06/03
Expected Due date: 8/20/03

SVL#	M	ClientID	Sampled	Time	By	Received	Sample Comments
346458	W	PM-16	7/19/03	2:30	BP	8/06/03	FROM SVL JOB# 106755. SVL RECEIVED AN HNO3 AND UNPRESERVED CONTAINER. SVL WILL REANALYZE THE SAMPLE, USING THE CONTAINER LABELED HNO3 FOR GENERAL MINERAL PARAMETERS AND USE THE CONTAINER LABELED UNPRESERVED FOR METALS, PER EMAIL FROM BRIAN PETTY

ADDITIONAL COMMENTS FOR JOB: Sample Cooler/Container temp not measured upon receipt.
SAMPLE OUT OF HOLDING TIME FOR NO2,NO3, & ALKALINITY

[X] These samples will be DISPOSED 45 days after job completion.
[ ] These samples will be ARCHIVED 45 days, then you will receive a letter requesting disposal options.

Please contact Crystal Sevy (208-784-1258) if you have questions regarding the receipt of these samples. 8/07/03 8:38

SVL ANALYTICAL, INC.

Quality Control Report
Part I Prep Blank and Laboratory Control Sample

Client :GEOSYNTEC CONSULTANTS

SVL JOB No: 106755

nalyte	Method	Matrix	Units	Prep Blank	True	LCS Found	LCS %R	Analysis Date
Arsenic	200.7	WATER	mg/L	<0.010	1.00	1.06	106.0	8/03/03
Calcium	200.7	WATER	mg/L	<0.040	20.0	19.1	95.5	8/03/03
Iron	200.7	WATER	mg/L	<0.020	10.0	9.97	99.7	8/03/03
Potassium	200.7	WATER	mg/L	<1.0	30.0	30.9	103.0	8/04/03
Magnesium	200.7	WATER	mg/L	<0.040	20.0	20.7	103.5	8/03/03
Manganese	200.7	WATER	mg/L	<0.0020	1.00	0.993	99.3	8/03/03
Sodium	200.7	WATER	mg/L	<0.50	20.0	18.6	93.0	8/03/03
Chloride	300.0	WATER	mg/L	<0.20	5.00	4.90	98.0	7/28/03
Fluoride	300.0	WATER	mg/L	<0.10	2.50	2.44	97.6	7/28/03
Nitrite-N	300.0	WATER	mg/L	<0.050	2.50	2.48	99.2	7/28/03
Nitrate-N	300.0	WATER	mg/L	<0.050	2.50	2.45	98.0	7/28/03
Sulfate, SO4	300.0	WATER	mg/L	<0.30	10.0	9.70	97.0	7/28/03
Alkalinity,CaCO3	2320	WATER	mg/L	<1.0	53.2	56.9	107.0	7/28/03
pH	150.1	WATER		5.85	6.10	6.10	100.0	7/28/03
Spec. Cond.	120.1	WATER	umhos/cm	0.129	400	415	103.8	7/28/03
Eh (mV)	2580	WATER	mV	N/A	+228	+232	101.8	7/28/03
Ammonia as N	350.3	WATER	mg/L	<0.10	13.4	14.5	108.2	7/28/03
INORGANIC CARBON	415.1	WATER	mg/L	<1.0	10.0	9.70	97.0	7/31/03
Acidity	2310	WATER	mg/L	<1.0	N/A		N/A	8/01/03

LEGEND:

LCS = Laboratory Control Sample

LCS %R = LCS Percent Recovery

N/A = Not Applicable

Quality Control Report
Part II Duplicate and Spike Analysis

Client :GEOSYNTEC CONSULTANTS

SVL JOB No: 106755

			QC SAMPLE ID			Duplicate or MSD		Matrix Spike			Analysis
	Method	Matrix		Units	Result	Found	RPD%	Result	SPK ADD	%R	Date
s	200.7	WATERG	1	mg/L	0.040	0.038	5.1	1.14	1.00	110.0	8/03/03
a	200.7	WATERG	1	mg/L	7.91	7.82	1.1	26.0	20.0	90.5	8/03/03
e	200.7	WATERG	1	mg/L	2.35	2.51	6.6	12.3	10.0	99.5	8/03/03
	200.7	WATERG	1	mg/L	2130	1910	10.9	1890	30.0	R >4S	8/04/03
g	200.7	WATERG	1	mg/L	0.567	0.591	4.1	21.0	20.0	102.2	8/03/03
n	200.7	WATERG	1	mg/L	0.0804	0.0834	3.7	1.07	1.00	99.0	8/03/03
n	200.7	WATERG	2	mg/L	<0.020*	<0.020*	UDL	0.0640	1.00	6.4	8/03/03
a	200.7	WATERG	1	mg/L	73.6	74.8	1.6	90.7	20.0	85.5	8/03/03
l	300.0	WATERG	1	mg/L	27.3	26.8	1.8	37.1	10.0	98.0	7/29/03
	300.0	WATERG	1	mg/L	2.70	2.46	9.3	11.8	10.0	91.0	7/28/03
O2-N	300.0	WATERG	1	mg/L	<0.050	<0.050	UDL	1.71	2.00	85.5	7/28/03
O3-N	300.0	WATERG	1	mg/L	<0.050	<0.050	UDL	1.91	2.00	95.5	7/28/03
O4	300.0	WATERG	1	mg/L	886	904	2.0	1160	250	109.6	7/28/03
LK	2320	WATERG	1	mg/L	1550	1550	0.0	N/A	N/A	N/A	7/28/03
O3	2320	WATERG	1	mg/L	750	797	6.1	N/A	N/A	N/A	7/28/03
CO3	2320	WATERG	1	mg/L	<1.0	<1.0	UDL	N/A	N/A	N/A	7/28/03
H	150.1	WATERG	1		12.10	12.10	0.0	N/A	N/A	N/A	7/28/03
OND	120.1	WATERG	1	umhos/c	7790	7760	0.4	N/A	N/A	N/A	7/28/03
h	2580	WATERG	1	mV	+58.5	+57.8	1.2	N/A	N/A	N/A	7/28/03
H3-N	350.3	WATERG	1	mg/L	2.64	2.62	0.8	4.64	2.00	100.0	7/28/03
RG18D	415.1	WATERG	1	mg/L	69.8	70.0	0.3	124	50.0	108.4	7/31/03
CID	2310	WATERG	3	mg/L	1490	1450	2.7	N/A	N/A	N/A	8/01/03

ND:

= (|SAM - DUP|/((SAM + DUP)/2) * 100) UDL = Both SAM & DUP not detected. *Result or *Found: Interference required dilution.

RPD% = (|SPK - MSD|/((SPK + MSD)/2) * 100) M in Duplicate/MSD column indicates MSD.

SPIKE ADD column, A = Post Digest Spike; %R = Percent Recovery N/A = Not Analyzed; R > 4S = Result more than 4X the Spike Added

QC Sample 1: SVL SAM No.: 343324 Client Sample ID: FSP-06 ^T

QC Sample 2: SVL SAM No.: 344200 Client Sample ID: FSP-06 ^D

QC Sample 3: SVL SAM No.: 343339 Client Sample ID: PM-16

SVL ANALYTICAL

208-783-0891

CHAIN OF CUSTODY RECORD

Page 1 of 3

Client: GeoSyntec Consultants
Contact: Eric Smalstig
Address: 200 Main St. Suite 150
Huntington Beach CA 92648
Phone Number: 714-969-0800
FAX Number: 714-969-0820

NOTES:
1) Ensure proper container packaging.
2) Ship samples promptly following collection.
* 3) Designate Sample Reject Disposition
PO#: 1180146.12
Project Name: Metaline Falls

Table 1. -- Matrix Type
1 = Surface Water, 2 = Ground Water
3 = Soil/Sediment, 4 = Rinsate, 5 = Oil
6 = Waste, 7 = Other (Specify) ______

Samplers Signature:

FOR SVL USE ONLY
SVL JOB # 106755

Lab Name: SVL Analytical, Inc. (208) 784-1258 FAX (208) 783-0891
Address: One Government Gulch, Kellogg, ID 83837-0929

Sample ID	Collection		Miscellaneous				Preservative(s)						Analyses Required									Comments
	Date	Time	Collected by: (Init.)	Matrix Type From Table 1	No. of Containers	Sample Filtered ? Y/N	Unpreserved (Ice Only)	HNO3	HCL	H2SO4	NAOH	Other (Specify)	SEC, ORP, pH	As	DIC, S^{2-}	Total alkalinity, Alk, Alk Bicarb calc	Major cations (incl. K)	Major anions (Cl F SO4)	Fe (Total)	Mn (Dissolved + Total)	NH3, NO_2^-, NO_3^-, P gr	
1. FSP-06-5	7/15/03	1400	SP	3	|	N	1	1						X	S^{2-}				X	X		
2. FSP-02	|	710	|	2	2	N	1	1														HOLD
3. FSP-03		1730		2	|	N	1	1														HOLD
4. FSP-05		1800		2		N	1	1														HOLD
* 5. FSP-06		1900		2		N	1	1					X	X	X	X	X	X	X	X	X	
* 6. FSP-07		1910		2		N	1	1					X	X	X	X	X	X	X	X	X	
7. FSP-08	X	1930		2		N	1	1														HOLD
* 8. FSP-17	7/16/03	1400		2		N	1	1					X	X	X	X	X	X	X	X	X	
* 9. FSP-14	|	1430		2		N	1	1					X	X	X	X	X	X				
* 10. FSP-26	X	1500	X	2		N	1	1					X	X	X	X	X	X	X	X	X	

Relinquished by:	Date:	Time:	Received by:	Date:	Time:
Relinquished by:	Date:	Time:	Received by:	Date:	Time:

* Sample Reject: [ ] Return [ ] Dispose [ ] Store (30 Days)

White: LAB COPY Yellow: CUSTOMER COPY SVL-COC 12/95

SVL ANALYTICAL

CHAIN OF CUSTODY RECORD

Page 2 of 3

Client:
Contact:
Address: GLE P
Phone Number:
FAX Number:

NOTES:
1) Ensure proper container packaging.
2) Ship samples promptly following collection.
* 3) Designate Sample Reject Disposition
PO#:
Project Name:

Table 1. -- Matrix Type
1 = Surface Water, 2 = Ground Water
3 = Soil/Sediment, 4 = Rinsate, 5 = Oil
6 = Waste, 7 = Other (Specify) ______

Samplers Signature:

FOR SVL USE ONLY
SVL JOB # 106755

Lab Name: SVL Analytical, Inc. (208) 784-1258 FAX (208) 783-0891
Address: One Government Gulch, Kellogg, ID 83837-0929

Sample ID	Collection		Miscellaneous				Preservative(s)						Analyses Required									Comments
	Date	Time	Collected by: (Init.)	Matrix Type From Table 1	No. of Containers	Sample Filtered ? Y/N	Unpreserved (Ice Only)	HNO3	HCL	H2SO4	NAOH	Other (Specify)	SECORP, pH	As	DIC S^{2-}	Total alkalinity, Alk, Alk Bcab Cab	Major cations (incl. K)	Major anions (Cl, F, SO4)	Fe (total)	Mn Dissolved + Total	NH3, NO2-, NO3-, F-, 3/1 gc	
* 1. FSP-23	7/16/03	1540	BP	2	2	N	|	|					X	X	X	X	X	X	X	X	X	
* 2. FSP-15	7/16/03	1600	|	2	2	N	|	|					X	X	X	X	X	X				
* 3. FSP-16	7/17/03	0930	|	2	2	N	|						X	X	X	X	X	X				
* 4. FSP-18	|	1000	|	2	2	|	|	|					X	X	X	X	X	X				
* 5. FSP-20	|	1100	|	2	2	|	|	|					X	X	X	X	X	X				
6. FSP-18-12	|	1100	|	3	1	|	|							X	S				X	X		
* 7. FSP-23	|	1140	|	2	2	|	|	|					X	X	X	X	X	X	X	X	X	
8. FSP-25	|	1300	|	2	2	|	|	|													HOLD
* 9. FSP-20	|	1400	|	2	2	|	|	|					X	X	X	X	X	X				
10. FSP-26-4	|	1500	X	3	1	X	|														HOLD

Relinquished by: Date: Time: Received by: Date: Time:

Relinquished by: Date: Time: Received by: Date: Time:

* Sample Reject: [ ] Return [ ] Dispose [ ] Store (30 Days)

White: LAB COPY Yellow: CUSTOMER COPY

SVL ANALYTICAL

SEC – Conductivity
ORP – Redox (EH)
DIC – Diss. Inorganic Carbon

CHAIN OF CUSTODY RECORD

Page 3 of 3

Client:
Contact:
Address: GLP
Phone Number:
FAX Number:

NOTES:
1) Ensure proper container packaging.
2) Ship samples promptly following collection.
* 3) Designate Sample Reject Disposition
PO#:
Project Name:

Table 1. -- Matrix Type
1 = Surface Water, 2 = Ground Water
3 = Soil/Sediment, 4 = Rinsate, 5 = Oil
6 = Waste, 7 = Other (Specify)

Samplers Signature:

FOR SVL USE ONLY
SVL JOB # L06755

Lab Name: SVL Analytical, Inc. (208) 784-1258 FAX (208) 783-0891
Address: One Government Gulch, Kellogg, ID 83837-0929

Sample ID	Collection		Miscellaneous				Preservative(s)						Analyses Required									Comments
	Date	Time	Collected by: (Init.)	Matrix Type From Table 1	No. of Containers	Sample Filtered ? Y/N	Unpreserved (Ice Only)	HNO3	HCL	H2SO4	NAOH	Other (Specify)	SEC, ORP, pH	As	DIC, S^{2-}	Total alkalinity, Bicarb Alk	Major cations (incl. K)	Major anions (Cl, F, SO4)	Fe (total)	Mn (Dissolved + Total)	NH_3, NO_2, NO_3, F gc	
PM-16-9	7/17/03		BP	3	1	N	1															HOLD
2. PM-16-5				3	1	N	1															HOLD
3. FSP-21-10				3	1	N	1															HOLD
4. FSP-26-8				3	1	N	1															HOLD
5. FSP-19-8				3	1	N	1							X	S				X	X		
6. PM-16	7/[illegible]/03	0830		2	2	N	1	1					X	X	X	X	X	X				
7.																						
8.																						
9.																						
10.																						

Per Brian Pettys:
Major cations:
Ca, Mg, Na, K
Major ions:
Cl, F, SO4

As by GFAA (on soil only)
water by ICP
Soils to be run for As (GFAA),
Fe + Mn (ICP),
S= by LECO
gc 7/24/03

Relinquished by:	Date:	Time:	Received by:	Date:	Time:
Relinquished by:	Date:	Time:	Received by:	Date:	Time:

* Sample Reject: [ ] Return [ ] Dispose [ ] Store (30 Days)

White: LAB COPY Yellow: CUSTOMER COPY SVL-COC 12/95

SVL ANALYTICAL, INC.

Certificate: CA CERTIFICATE NO. 2080

One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT:
CLIENT SAMPLE ID: PM-15
Sample Collected: 7/31/03 7:41
Sample Receipt : 8/04/03
Date of Report : 8/20/03

SVL JOB: 106973
SAMPLE: 345929

Matrix: WATERG

Determination	Result	Units	Dilution	Method	Analyzed
Alkalinity,CaCO3	2640	mg CaCO3/L		2320	8/11/03
CO3, CaCO3	1420	mg CaCO3/L		2320	8/11/03
Spec. Cond.	12600	umhos/cm		120.1	8/07/03
Eh (mV)	-182	mV		2580	8/11/03
HCO3, CaCO3	<1.0	mg CaCO3/L		2320	8/11/03
pH	12.10			150.1	8/11/03
Calcium	3.80	mg/L		200.7	8/18/03
Chloride	54.6	mg/L	10	300.0	8/05/03
Fluoride	1.50	mg/L	10	300.0	8/05/03
Potassium	3140	mg/L	100	200.7	8/18/03
Magnesium	0.095	mg/L		200.7	8/18/03
Sodium	129	mg/L		200.7	8/18/03
Sulfide	2.30	mg/L		376.1	8/06/03
Sulfate, SO4	1670	mg/L	100	300.0	8/05/03
Arsenic	0.180	mg/L		200.7	8/18/03
Silicon	58.1	mg/L		200.7	8/18/03
INORGANIC CARBON	70.9	mg/L		415.1	8/07/03

Reviewed By:____________________ Date 8/20/03

8/20/03 11:11

SVL ANALYTICAL, INC.
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891
Certificate: CA CERTIFICATE NO. 2080

CLIENT : GeoSyntec
PROJECT:
CLIENT SAMPLE ID: PM-16
Sample Collected: 7/31/03 9:10
Sample Receipt : 8/04/03
Date of Report : 8/20/03

SVL JOB: 106973
SAMPLE: 345932
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	Alkalinity,CaCO3	2320	mg CaCO3/L		2320	8/11/03
T	CO3, CaCO3	1090	mg CaCO3/L		2320	8/11/03
T	Spec. Cond.	15400	umhos/cm		120.1	8/07/03
T	Eh (mV)	-167	mV		2580	8/11/03
T	HCO3, CaCO3	<1.0	mg CaCO3/L		2320	8/11/03
T	pH	12.00			150.1	8/11/03
T	Calcium	4.22	mg/L		200.7	8/18/03
T	Chloride	59.6	mg/L	10	300.0	8/05/03
T	Fluoride	1.60	mg/L	10	300.0	8/05/03
T	Potassium	3670	mg/L	100	200.7	8/18/03
T	Magnesium	0.177	mg/L		200.7	8/18/03
T	Sodium	145	mg/L		200.7	8/18/03
T	Ammonia as N	3.12	mg/L		350.1	8/05/03
T	Nitrite-N	<0.50*	mg/L	10	300.0	8/05/03
T	Nitrate-N	<0.050	mg/L		300.0	8/05/03
T	Sulfide	11.5	mg/L		376.1	8/06/03
T	Sulfate, SO4	1960	mg/L	100	300.0	8/05/03
T	Arsenic	0.185	mg/L		200.7	8/18/03
T	Iron	13.9	mg/L		200.7	8/18/03
T	Manganese	0.232	mg/L		200.7	8/18/03
T	Silicon	77.3	mg/L		200.7	8/18/03
T	INORGANIC CARBON	95.3	mg/L		415.1	8/07/03
D	Manganese	0.0033	mg/L		200.7	8/18/03
D	Silicon	68.3	mg/L		200.7	8/18/03

Filtered fraction: 345934
*Elevated detection limit due to matrix interference.
NO2-N,NO3-N: RECEIVED AND ANALYZED OUT OF HOLDING TIME.
AMMONIA-N: RAW SAMPLES RECEIVED;SVL PRESERVED AND ANALYZED.

Reviewed By:______________________ Date 8/20/03

8/20/03 11:11

SVL ANALYTICAL, INC.

Certificate: CA CERTIFICATE NO. 2080

Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT:
CLIENT SAMPLE ID: PM-17
Sample Collected: 7/31/03 8:50
Sample Receipt : 8/04/03
Date of Report : 8/20/03

SVL JOB: 106973
SAMPLE: 345931
Matrix: WATERG

Determination	Result	Units	Dilution	Method	Analyzed
Alkalinity,CaCO3	754	mg CaCO3/L		2320	8/11/03
CO3, CaCO3	506	mg CaCO3/L		2320	8/11/03
Spec. Cond.	4360	umhos/cm		120.1	8/07/03
Eh (mV)	-113	mV		2580	8/11/03
HCO3, CaCO3	<1.0	mg CaCO3/L		2320	8/11/03
pH	11.40			150.1	8/11/03
Calcium	5.48	mg/L		200.7	8/18/03
Chloride	22.2	mg/L	10	300.0	8/05/03
Fluoride	1.21	mg/L	10	300.0	8/05/03
Potassium	990	mg/L	100	200.7	8/18/03
Magnesium	0.047	mg/L		200.7	8/18/03
Sodium	47.7	mg/L		200.7	8/18/03
Sulfide	3.90	mg/L		376.1	8/06/03
Sulfate, SO4	394	mg/L	25	300.0	8/05/03
Arsenic	0.051	mg/L		200.7	8/18/03
Silicon	18.2	mg/L		200.7	8/18/03
INORGANIC CARBON	25.9	mg/L		415.1	8/07/03

Reviewed By: ______________________ Date 8/20/03

8/20/03 11:11

SVL ANALYTICAL, INC.
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

Certificate: CA CERTIFICATE NO. 2080

LIENT : GeoSyntec
PROJECT:
CLIENT SAMPLE ID: PM-18
Sample Collected: 7/31/03 5:45
Sample Receipt : 8/04/03
Date of Report : 8/20/03

SVL JOB: 106973
SAMPLE: 345926
Matrix: WATERG

Determination	Result	Units	Dilution	Method	Analyzed
Alkalinity,CaCO3	1890	mg CaCO3/L		2320	8/11/03
CO3, CaCO3	1340	mg CaCO3/L		2320	8/11/03
Spec. Cond.	9000	umhos/cm		120.1	8/07/03
Eh (mV)	+58.1	mV		2580	8/11/03
HCO3, CaCO3	<1.0	mg CaCO3/L		2320	8/11/03
pH	12.10			150.1	8/11/03
Calcium	3.99	mg/L		200.7	8/18/03
Chloride	50.3	mg/L	10	300.0	8/05/03
Fluoride	<0.20*	mg/L	2	300.0	8/05/03
Potassium	2390	mg/L	100	200.7	8/18/03
Magnesium	<0.040	mg/L		200.7	8/18/03
Sodium	156	mg/L		200.7	8/18/03
Sulfide	3.10	mg/L		376.1	8/06/03
Sulfate, SO4	1420	mg/L	100	300.0	8/05/03
Arsenic	0.181	mg/L		200.7	8/18/03
Silicon	42.4	mg/L		200.7	8/18/03
INORGANIC CARBON	114	mg/L		415.1	8/07/03

levated detection limit due to matrix interference.

Reviewed By: ____________ Date 8/20/03

8/20/03 11:11

CLIENT : GeoSyntec
PROJECT:
CLIENT SAMPLE ID: PM-19
Sample Collected: 7/31/03 6:08
Sample Receipt : 8/04/03
Date of Report : 8/20/03

SVL JOB: 106973
SAMPLE: 345927
Matrix: WATERG

Determination	Result	Units	Dilution	Method	Analyzed
Alkalinity,CaCO3	2220	mg CaCO3/L		2320	8/11/03
CO3, CaCO3	1530	mg CaCO3/L		2320	8/11/03
Spec. Cond.	10500	umhos/cm		120.1	8/07/03
Eh (mV)	+49.5	mV		2580	8/11/03
HCO3, CaCO3	<1.0	mg CaCO3/L		2320	8/11/03
pH	11.70			150.1	8/11/03
Calcium	3.06	mg/L		200.7	8/18/03
Chloride	49.0	mg/L	10	300.0	8/05/03
Fluoride	1.40	mg/L	10	300.0	8/05/03
Potassium	2830	mg/L	100	200.7	8/18/03
Magnesium	<0.040	mg/L		200.7	8/18/03
Sodium	120	mg/L		200.7	8/18/03
Sulfide	2.50	mg/L		376.1	8/06/03
Sulfate, SO4	1570	mg/L	100	300.0	8/05/03
Arsenic	0.221	mg/L		200.7	8/18/03
Silicon	44.4	mg/L		200.7	8/18/03
INORGANIC CARBON	129	mg/L		415.1	8/07/03

Reviewed By:________________ Date 8/20/03

8/20/03 11:11

SVL ANALYTICAL, INC.

Certificate: CA CERTIFICATE NO. 2080

One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT:
CLIENT SAMPLE ID: PM-20
Sample Collected: 7/31/03 7:09
Sample Receipt : 8/04/03
Date of Report : 8/20/03

SVL JOB: 106973
SAMPLE: 345928

Matrix: WATERG

Determination	Result	Units	Dilution	Method	Analyzed
Alkalinity,CaCO3	518	mg CaCO3/L		2320	8/11/03
CO3, CaCO3	<1.0	mg CaCO3/L		2320	8/11/03
Spec. Cond.	2740	umhos/cm		120.1	8/07/03
Eh (mV)	+193	mV		2580	8/11/03
HCO3, CaCO3	518	mg CaCO3/L		2320	8/11/03
pH	8.16			150.1	8/11/03
Calcium	139	mg/L		200.7	8/18/03
Chloride	30.9	mg/L	10	300.0	8/05/03
Fluoride	<1.0*	mg/L	10	300.0	8/05/03
Potassium	600	mg/L	100	200.7	8/18/03
Magnesium	27.2	mg/L		200.7	8/18/03
Sodium	68.2	mg/L		200.7	8/18/03
Sulfide	<1.0	mg/L		376.1	8/06/03
Sulfate, SO4	785	mg/L	50	300.0	8/05/03
Arsenic	<0.010	mg/L		200.7	8/18/03
Silicon	5.81	mg/L		200.7	8/18/03
INORGANIC CARBON	54.6	mg/L		415.1	8/07/03

Elevated detection limit due to matrix interference.

Reviewed By:______________________ Date 8/20/03

8/20/03 11:11

SVL ANALYTICAL, INC.

Certificate: CA CERTIFICATE NO. 2080

One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT:
CLIENT SAMPLE ID: PM-21
Sample Collected: 7/31/03 8:20
Sample Receipt : 8/04/03
Date of Report : 8/20/03

SVL JOB: 106973
SAMPLE: 345930
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	Alkalinity,CaCO3	431	mg CaCO3/L		2320	8/11/03
T	CO3, CaCO3	343	mg CaCO3/L		2320	8/11/03
T	Spec. Cond.	2780	umhos/cm		120.1	8/07/03
T	Eh (mV)	+4.6	mV		2580	8/11/03
T	HCO3, CaCO3	87.8	mg CaCO3/L		2320	8/11/03
T	pH	10.30			150.1	8/11/03
T	Calcium	25.7	mg/L		200.7	8/18/03
T	Chloride	74.2	mg/L	25	300.0	8/05/03
T	Fluoride	0.70	mg/L		300.0	8/05/03
T	Potassium	680	mg/L	100	200.7	8/18/03
T	Magnesium	5.53	mg/L		200.7	8/18/03
T	Sodium	130	mg/L		200.7	8/18/03
T	Ammonia as N	2.37	mg/L		350.1	8/05/03
T	Nitrite-N	<1.25*	mg/L	25	300.0	8/05/03
T	Nitrate-N	<0.050	mg/L		300.0	8/05/03
T	Sulfide	<1.0	mg/L		376.1	8/06/03
T	Sulfate, SO4	650	mg/L	50	300.0	8/05/03
T	Arsenic	0.065	mg/L		200.7	8/18/03
T	Iron	2.10	mg/L		200.7	8/18/03
T	Manganese	0.0539	mg/L		200.7	8/18/03
T	Silicon	11.6	mg/L		200.7	8/18/03
T	INORGANIC CARBON	19.9	mg/L		415.1	8/07/03
D	Manganese	0.0216	mg/L		200.7	8/18/03

Filtered fraction: 345933
*Elevated detection limit due to matrix interference.
NO2-N, NO3-N: RECEIVED AND ANALYZED OUT OF HOLDING TIME.
AMMONIA-N: RAW SAMPLES RECEIVED;SVL PRESERVED AND ANALYZED.

Reviewed By:______________________ Date 8/20/03

8/20/03 11:11

/L ANALYTICAL, INC.

Quality Control Report
Part I Prep Blank and Laboratory Control Sample

nt :GeoSyntec SVL JOB No: 106973

Analyte	Method	Matrix	Units	Prep Blank	True——LCS	——Found	LCS %R	Analysis Date
Arsenic	200.7	WATER	mg/L	<0.010	1.00	0.988	98.8	8/18/03
Calcium	200.7	WATER	mg/L	<0.040	20.0	21.2	106.0	8/18/03
Iron	200.7	WATER	mg/L	<0.020	10.0	10.1	101.0	8/18/03
Potassium	200.7	WATER	mg/L	<1.0	30.0	29.9	99.7	8/18/03
Magnesium	200.7	WATER	mg/L	<0.040	20.0	20.1	100.5	8/18/03
Manganese	200.7	WATER	mg/L	<0.0020	1.00	1.01	101.0	8/18/03
Sodium	200.7	WATER	mg/L	<0.50	20.0	20.4	102.0	8/18/03
Silicon	200.7	WATER	mg/L	<0.080	5.00	5.13	102.6	8/18/03
Chloride	300.0	WATER	mg/L	<0.20	5.00	4.89	97.8	8/05/03
Fluoride	300.0	WATER	mg/L	<0.10	2.50	2.40	96.0	8/05/03
Nitrite-N	300.0	WATER	mg/L	<0.050	2.50	2.54	101.6	8/05/03
Nitrate-N	300.0	WATER	mg/L	<0.050	2.50	2.60	104.0	8/05/03
Sulfate, SO4	300.0	WATER	mg/L	<0.30	10.0	9.58	95.8	8/05/03
Alkalinity,CaCO3	2320	WATER	mg/L	<1.0	53.0	57.5	108.5	8/11/03
pH	150.1	WATER		5.81	6.10	6.11	100.2	8/11/03
Spec. Cond.	120.1	WATER	umhos/cm	0.167	375	355	94.7	8/07/03
Eh (mV)	2580	WATER	mV	+5.6	+228	+236	103.5	8/11/03
INORGANIC CARBON	415.1	WATER	mg/L	<1.0	5.00	5.20	104.0	8/07/03
Sulfide	376.1	WATER	mg/L	<1.0	2.00	1.70	85.0	8/06/03
Ammonia as N	350.1	WATER	mg/L	<0.010	10.5	9.94	94.7	8/05/03

LEGEND:

LCS = Laboratory Control Sample LCS %R = LCS Percent Recovery N/A = Not Applicable

8/20/03 11:03

VL ANALYTICAL, INC.

Quality Control Report
Part II Duplicate and Spike Analysis

t :GeoSyntec SVL JOB No: 106973

			QC SAMPLE ID		Duplicate or MSD		Matrix Spike			Analysis
est	Method	Matrix	Units	Result	Found	RPD%	Result	SPK ADD	%R	Date
s	200.7	WATERG 1	mg/L	0.065	0.065	0.0	1.09	1.00	102.5	8/18/03
a	200.7	WATERG 2	mg/L	3.99	4.10	2.7	26.1	20.0	110.6	8/18/03
a	200.7	WATERG 1	mg/L	25.7	26.1	1.5	47.9	20.0	111.0	8/18/03
e	200.7	WATERG 1	mg/L	2.10	2.01	4.4	12.0	10.0	99.0	8/18/03
	200.7	WATERG 2	mg/L	2390	2250	6.0	5170	30.0	R >4S	8/18/03
	200.7	WATERG 1	mg/L	680	660	3.0	3420	30.0	R >4S	8/18/03
g	200.7	WATERG 2	mg/L	<0.040	<0.040	UDL	20.6	20.0	103.0	8/18/03
g	200.7	WATERG 1	mg/L	5.53	5.62	1.6	27.5	20.0	109.9	8/18/03
n	200.7	WATERG 1	mg/L	0.0539	0.0539	0.0	1.06	1.00	100.6	8/18/03
n	200.7	WATERG 3	mg/L	0.0033	0.0031	6.3	0.936	1.00	93.3	8/18/03
a	200.7	WATERG 2	mg/L	156	151	3.3	165	20.0	R >4S	8/18/03
a	200.7	WATERG 1	mg/L	130	131	0.8	144	20.0	R >4S	8/18/03
i	200.7	WATERG 1	mg/L	11.6	11.6	0.0	16.6	5.00	100.0	8/18/03
i	200.7	WATERG 3	mg/L	68.3	68.2	0.1	N/A	N/A	N/A	8/18/03
l	300.0	WATERG 1	mg/L	74.2	73.4	1.1	120	50.0	91.6	8/05/03
	300.0	WATERG 1	mg/L	0.70	0.67	4.4	2.36	2.00	83.0	8/05/03
O2-N	300.0	WATERG 1	mg/L	<1.25*	<1.25*	UDL	47.4	50.0	94.8	8/05/03
O3-N	300.0	WATERG 1	mg/L	<0.050	<0.050	UDL	2.00	2.00	100.0	8/05/03
O4	300.0	WATERG 1	mg/L	650	648	0.3	906	250	102.4	8/05/03
LK	2320	WATERG 1	mg/L	431	434	0.7	N/A	N/A	N/A	8/11/03
O3	2320	WATERG 1	mg/L	343	340	0.9	N/A	N/A	N/A	8/11/03
CO3	2320	WATERG 1	mg/L	87.8	93.5	6.3	N/A	N/A	N/A	8/11/03
H	150.1	WATERG 1		10.30	10.30	0.0	N/A	N/A	N/A	8/11/03
OND	120.1	WATERG 1	umhos/c	2780	2770	0.4	N/A	N/A	N/A	8/07/03
	2580	WATERG 1	mV	+4.6	+4.3	6.7	N/A	N/A	N/A	8/11/03
Rc.oD	415.1	WATERG 1	mg/L	19.9	18.8 M	125.2	81.7	50.0	123.6	8/07/03
H3-N	350.1	WATERG 1	mg/L	2.37	2.32	2.1	4.52	2.00	107.5	8/05/03

LEGEND:

RPD% = (|SAM - DUP|/((SAM + DUP)/2) * 100) UDL = Both SAM & DUP not detected. *Result or *Found: Interference required dilution.

RPD% = (|SPK - MSD|/((SPK + MSD)/2) * 100) M in Duplicate/MSD column indicates MSD.

SPIKE ADD column, A = Post Digest Spike; %R = Percent Recovery N/A = Not Analyzed; R > 4S = Result more than 4X the Spike Added

QC Sample 1: SVL SAM No.: 345930 Client Sample ID: PM-21 ^T
QC Sample 2: SVL SAM No.: 345926 Client Sample ID: PM-18
QC Sample 3: SVL SAM No.: 345934 Client Sample ID: PM-16 ^D

~~LABORATORIES, INC.~~
~~7440 LINCOLN WAY~~
~~GARDEN GROVE~~, CA 92841-1432
~~TEL: (714) 895-5494 • FAX: (714) 894-7501~~

SVL
Fax: 208-783-0891

10695

CHAIN OF CUSTODY RECORD

Date 31 July 2003
Page 1 of 1

NO3 NO3

Per Brian — CM y les discussed this last week
Same list as past jobs
JBM 8/4/03

oratory client: GeoSyntec Consultants
ress: 2100 Main St., Suite 150
Huntington Beach STATE CA ZIP 92648
4-969-0800 FAX: 714-969-0820 E-MAIL: bpetty@geosyntec.com
rnaround time: ☐ SAME DAY ☐ 24 HR ☐ 48 HR ☐ 72 HR ☐ 5 DAYS ☐ 10 DAYS [✓ Standard]
ecial requirements (additional costs may apply)
☐ RWQCB REPORTING ☐ COELT REPORTING
ecial instructions:

CLIENT PROJECT NAME / NUMBER: NH3 Tot + Diss Mn
PROJECT CONTACT:
SAMPLER(S): (SIGNATURE)
P.O. NO.:
LAB USE ONLY ☐☐-☐☐☐☐
COELT LOG CODE ☐☐☐☐
COOLER RECEIPT TEMP = °C

REQUESTED ANALYSES

GEIMS ID	SAMPLE ID	SAMPLING DATE	SAMPLING TIME	MATRIX	NO. OF CONT.	TPH (G)	TPH (D) or	BTEX / MTBE (8021B)	HALOCARBONS (8021B)	VOCs (8260B)	VOCs (5035 / 8260B) EnCore	SVOCs (8270C)	PEST (8081A)	PCBs (8082)	EDB / DBCP (504.1) or (8011)	NH3	TOTAL AND DISSOLVED MANGANESE	TOTAL IRON	SEC (ORP) pH	AS REDOX	DIC, S	Alkalinity/carb+bicarb	Major cations/anions
	PM-18	7/31/03	5:45	2	3														X	X	X	X	X
	PM-19		6:08	2	3														X	X	X	X	X
	PM-20		7:09	2	3														X	X	X	X	X
?	PM-15		7:41	2	3														X	X	X	X	X
	PM-21		8:20	2	3											X	X	X	X	X	X	X	X
we filter per Brian	PM-17		8:50	2	3														X	X	X	X	X
	PM-16		9:10	2	3											X	X	X	X	X	X	X	X
EAST 6'		7/31	11:00	Soil	1	on hold per Brian																	
EAST PIPE ~~5~~ 6' from container label		7/31	13:15	Soil	1				Dave W. telecom w/ Brian Petty														
EST PIPE 5.5'		7/31	12:45	Soil	1																		

SVL to filter + pres for Mn

Relinquished by: (Signature) Brian Petty	Received by: (Signature) Ontelia E. Hoy	Date: 8/1/02	Time: 4:00pm
Relinquished by: (Signature) Ontelia E. Hoy	Received by: (Signature) Ben Mart	Date: 8/4/02	Time: 1:50pm
Relinquished by: (Signature)	Received for Laboratory by: (Signature)	Date:	Time:

DISTRIBUTION: White with final report, Green to File, Yellow and Pink to Client.

Q&Q Graphic (714) 898-9702
09/10/01 Revision

SVL ANALYTICAL, INC. Certificate: CA CERTIFICATE NO. 2080
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: MW-7
Sample Collected: 8/28/03 9:00
Sample Receipt : 8/29/03
Date of Report : 9/16/03

SVL JOB: 107389
SAMPLE: 351224
TOT/DIS

Matrix: WATER

	Determination	Result	Units	Dilution	Method	Analyzed
T	Alkalinity,CaCO3	279	mg CaCO3/L		2320	9/10/03
T	CO3, CaCO3	<1.0	mg CaCO3/L		2320	9/10/03
T	Spec. Cond.	552	umhos/cm		120.1	9/04/03
T	Eh (mV)	+107	mV		2580	9/02/03
T	HCO3, CaCO3	279	mg CaCO3/L		2320	9/10/03
T	pH	7.45			150.1	8/29/03
T	TDS	291	mg/L		160.1	9/04/03
T	Turbidity	0.831	NTU'S		180.1	8/29/03
T	Calcium	70.0	mg/L		200.7	9/15/03
T	Chloride	0.68	mg/L		300.0	9/10/03
T	Potassium	6.0	mg/L		200.7	9/15/03
T	Magnesium	27.1	mg/L		200.7	9/15/03
T	Sodium	2.17	mg/L		200.7	9/15/03
T	Sulfide	<1.0	mg/L		376.1	9/04/03
T	Sulfate, SO4	16.5	mg/L		300.0	9/10/03
T	Arsenic	<0.010	mg/L		200.7	9/15/03
T	Chromium	<0.0060	mg/L		200.7	9/15/03
T	Iron	0.041	mg/L		200.7	9/15/03
T	Manganese	0.0103	mg/L		200.7	9/15/03
T	Phosphorus	<0.050	mg/L		200.7	9/15/03
T	Lead	<0.0050	mg/L		200.7	9/15/03
T	Silica	17.7	mg/L		200.7	9/15/03
T	INORGANIC CARBON	*16.2	mg/L		415.1	9/10/03
D	Arsenic	<0.010	mg/L		200.7	9/15/03
D	Chromium	<0.0060	mg/L		200.7	9/15/03
D	Lead	<0.0050	mg/L		200.7	9/15/03

CalcTDS:	312	TDS/Cond:		CATION SUM:	5.96meq/L	BALANCE
TDS/CalcTDS:	0.9	CalcTDS/Cond:		ANION SUM:	5.93meq/L	0.25%

Filtered fraction: 351230
*DISSOLVED INORGANIC CARBON

Reviewed By:______________________ Date 9/16/03

9/16/03 10:41

SVL ANALYTICAL, INC.
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

Certificate: CA CERTIFICATE NO. 2080

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: MW-8
Sample Collected: 8/28/03 8:30
Sample Receipt : 8/29/03
Date of Report : 9/16/03

SVL JOB: 107389
SAMPLE: 351225
TOT/DIS

Matrix: WATER

	Determination	Result	Units	Dilution	Method	Analyzed
T	Alkalinity,CaCO3	285	mg CaCO3/L		2320	9/10/03
T	CO3, CaCO3	<1.0	mg CaCO3/L		2320	9/10/03
T	Spec. Cond.	568	umhos/cm		120.1	9/04/03
T	Eh (mV)	+117	mV		2580	9/02/03
T	HCO3, CaCO3	285	mg CaCO3/L		2320	9/10/03
T	pH	7.49			150.1	8/29/03
T	TDS	322	mg/L		160.1	9/04/03
T	Turbidity	87.7	NTU'S		180.1	8/29/03
T	Calcium	70.2	mg/L		200.7	9/15/03
T	Chloride	1.62	mg/L		300.0	9/10/03
T	Potassium	11.3	mg/L		200.7	9/15/03
T	Magnesium	28.9	mg/L		200.7	9/15/03
T	Sodium	3.72	mg/L		200.7	9/15/03
T	Sulfide	<1.0	mg/L		376.1	9/04/03
T	Sulfate, SO4	19.0	mg/L		300.0	9/10/03
T	Arsenic	<0.010	mg/L		200.7	9/15/03
T	Chromium	<0.0060	mg/L		200.7	9/15/03
T	Iron	6.46	mg/L		200.7	9/15/03
T	Manganese	2.14	mg/L		200.7	9/15/03
T	Phosphorus	<0.050	mg/L		200.7	9/15/03
T	Lead	<0.0050	mg/L		200.7	9/15/03
T	Silica	16.7	mg/L		200.7	9/15/03
T	INORGANIC CARBON	*61.8	mg/L		415.1	9/10/03
D	Arsenic	<0.010	mg/L		200.7	9/15/03
D	Chromium	<0.0060	mg/L		200.7	9/15/03
D	Lead	<0.0050	mg/L		200.7	9/15/03

CalcTDS:	333	TDS/Cond:		CATION SUM:	6.64meq/L	BALANCE
TDS/CalcTDS:	1.0	CalcTDS/Cond:		ANION SUM:	6.14meq/L	3.91%

Filtered fraction: 351231
*DISSOLVED INORGANIC CARBON

Reviewed By:________________________ Date 9/16/03

9/16/03 10:41

SVL ANALYTICAL, INC. Certificate: CA CERTIFICATE NO. 2080
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: MW-9
Sample Collected: 8/28/03 11:00
Sample Receipt : 8/29/03
Date of Report : 9/16/03

SVL JOB: 107389
SAMPLE: 351226
TOT/DIS

Matrix: WATER

	Determination	Result	Units	Dilution	Method	Analyzed
T	Alkalinity,CaCO3	2330	mg CaCO3/L		2320	9/10/03
T	CO3, CaCO3	1230	mg CaCO3/L		2320	9/10/03
T	Spec. Cond.	11700	umhos/cm		120.1	9/04/03
T	Eh (mV)	-304	mV		2580	9/02/03
T	HCO3, CaCO3	<1.0	mg CaCO3/L		2320	9/10/03
T	pH	12.20			150.1	8/29/03
T	TDS	6500	mg/L		160.1	9/04/03
T	Turbidity	1.06	NTU'S		180.1	8/29/03
T	Calcium	4.15	mg/L		200.7	9/15/03
T	Chloride	44.1	mg/L	25	300.0	9/10/03
T	Potassium	2800	mg/L	100	200.7	9/15/03
T	Magnesium	<0.040	mg/L		200.7	9/15/03
T	Sodium	104	mg/L		200.7	9/15/03
T	Sulfide	2.14	mg/L		376.1	9/04/03
T	Sulfate, SO4	1380	mg/L	100	300.0	9/10/03
T	Arsenic	0.192	mg/L		200.7	9/15/03
T	Chromium	<0.0060	mg/L		200.7	9/15/03
T	Iron	0.786	mg/L		200.7	9/15/03
T	Manganese	0.0069	mg/L		200.7	9/15/03
T	Phosphorus	1.28	mg/L		200.7	9/15/03
T	Lead	<0.0050	mg/L		200.7	9/15/03
T	Silica	89.8	mg/L		200.7	9/15/03
T	INORGANIC CARBON	*26.8	mg/L		415.1	9/10/03
D	Arsenic	0.133	mg/L		200.7	9/15/03
D	Chromium	<0.0060	mg/L		200.7	9/15/03
D	Lead	<0.0050	mg/L		200.7	9/15/03

CalcTDS:	5840	TDS/Cond:		CATION SUM:	76.38meq/L	BALANCE
TDS/CalcTDS:	1.1	CalcTDS/Cond:		ANION SUM:	76.44meq/L	-0.04%

Filtered fraction: 351232
*DISSOLVED INORGANIC CARBON

Reviewed By: ______________________ Date 9/16/03

9/16/03 10:41

SVL ANALYTICAL, INC.
Certificate: CA CERTIFICATE NO. 2080
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: MW-11
Sample Collected: 8/28/03 10:15
Sample Receipt : 8/29/03
Date of Report : 9/16/03

SVL JOB: 107389
SAMPLE: 351227
TOT/DIS

Matrix: WATER

	Determination	Result	Units	Dilution	Method	Analyzed
T	Alkalinity,CaCO3	401	mg CaCO3/L		2320	9/10/03
T	CO3, CaCO3	<1.0	mg CaCO3/L		2320	9/10/03
T	Spec. Cond.	803	umhos/cm		120.1	9/04/03
T	Eh (mV)	+78.0	mV		2580	9/02/03
T	HCO3, CaCO3	401	mg CaCO3/L		2320	9/10/03
T	pH	7.45			150.1	8/29/03
T	TDS	504	mg/L		160.1	9/04/03
T	Turbidity	2.36	NTU'S		180.1	8/29/03
T	Calcium	108	mg/L		200.7	9/15/03
T	Chloride	3.15	mg/L		300.0	9/10/03
T	Potassium	3.2	mg/L		200.7	9/15/03
T	Magnesium	41.3	mg/L		200.7	9/15/03
T	Sodium	4.52	mg/L		200.7	9/15/03
T	Sulfide	<1.0	mg/L		376.1	9/04/03
T	Sulfate, SO4	51.0	mg/L	5	300.0	9/10/03
T	Arsenic	<0.010	mg/L		200.7	9/15/03
T	Chromium	<0.0060	mg/L		200.7	9/15/03
T	Iron	0.159	mg/L		200.7	9/15/03
T	Manganese	0.0051	mg/L		200.7	9/15/03
T	Phosphorus	<0.050	mg/L		200.7	9/15/03
T	Lead	<0.0050	mg/L		200.7	9/15/03
T	Silica	22.4	mg/L		200.7	9/15/03
T	INORGANIC CARBON	*48.9	mg/L		415.1	9/10/03
D	Arsenic	<0.010	mg/L		200.7	9/15/03
D	Chromium	<0.0060	mg/L		200.7	9/15/03
D	Lead	<0.0050	mg/L		200.7	9/15/03

CalcTDS:	480	TDS/Cond:	CATION SUM:	9.08meq/L	BALANCE
TDS/CalcTDS:	1.0	CalcTDS/Cond:	ANION SUM:	9.16meq/L	-0.44%

Filtered fraction: 351233
*DISSOLVED INORGANIC CARBON

Reviewed By:________________ Date 9/16/03
9/16/03 10:41

SVL ANALYTICAL, INC.

Certificate: CA CERTIFICATE NO. 2080

One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: MW-12
Sample Collected: 8/28/03 9:50
Sample Receipt : 8/29/03
Date of Report : 9/16/03

SVL JOB: 107389
SAMPLE: 351228
TOT/DIS

Matrix: WATER

	Determination	Result	Units	Dilution	Method	Analyzed
T	Alkalinity,CaCO3	284	mg CaCO3/L		2320	9/10/03
T	CO3, CaCO3	<1.0	mg CaCO3/L		2320	9/10/03
T	Spec. Cond.	1200	umhos/cm		120.1	9/04/03
T	Eh (mV)	+75.3	mV		2580	9/02/03
T	HCO3, CaCO3	284	mg CaCO3/L		2320	9/10/03
T	pH	8.11			150.1	8/29/03
T	TDS	668	mg/L		160.1	9/04/03
T	Turbidity	5.07	NTU'S		180.1	8/29/03
T	Calcium	53.8	mg/L		200.7	9/15/03
T	Chloride	182	mg/L	50	300.0	9/11/03
T	Potassium	47.5	mg/L		200.7	9/15/03
T	Magnesium	27.1	mg/L		200.7	9/15/03
T	Sodium	121	mg/L		200.7	9/15/03
T	Sulfide	<1.0	mg/L		376.1	9/04/03
T	Sulfate, SO4	27.6	mg/L	2	300.0	9/11/03
T	Arsenic	<0.010	mg/L		200.7	9/15/03
T	Chromium	<0.0060	mg/L		200.7	9/15/03
T	Iron	0.519	mg/L		200.7	9/15/03
T	Manganese	0.810	mg/L		200.7	9/15/03
T	Phosphorus	<0.050	mg/L		200.7	9/15/03
T	Lead	<0.0050	mg/L		200.7	9/15/03
T	Silica	9.51	mg/L		200.7	9/15/03
T	INORGANIC CARBON	*43.3	mg/L		415.1	9/10/03
D	Arsenic	0.010	mg/L		200.7	9/15/03
D	Chromium	<0.0060	mg/L		200.7	9/15/03
D	Lead	<0.0050	mg/L		200.7	9/15/03

CalcTDS:	642	TDS/Cond:	CATION SUM:	11.44meq/L	BALANCE
TDS/CalcTDS:	1.0	CalcTDS/Cond:	ANION SUM:	11.37meq/L	0.31%

Filtered fraction: 351234
*DISSOLVED INORGANIC CARBON

Reviewed By:_______________ Date 9/16/03

9/16/03 10:41

SVL ANALYTICAL, INC.

Certificate: CA CERTIFICATE NO. 2080

Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: MW-19
Sample Collected: 8/28/03 11:00
Sample Receipt : 8/29/03
Date of Report : 9/16/03

SVL JOB: 107389
SAMPLE: 351229
TOT/DIS

Matrix: WATER

	Determination	Result	Units	Dilution	Method	Analyzed
T	Alkalinity,CaCO3	2280	mg CaCO3/L		2320	9/10/03
T	CO3, CaCO3	1390	mg CaCO3/L		2320	9/10/03
T	Spec. Cond.	11800	umhos/cm		120.1	9/04/03
T	Eh (mV)	-322	mV		2580	9/02/03
T	HCO3, CaCO3	<1.0	mg CaCO3/L		2320	9/10/03
T	pH	12.20			150.1	8/29/03
T	TDS	6150	mg/L		160.1	9/04/03
T	Turbidity	1.05	NTU'S		180.1	8/29/03
T	Calcium	4.11	mg/L		200.7	9/15/03
T	Chloride	45.1	mg/L	25	300.0	9/11/03
T	Potassium	2810	mg/L	100	200.7	9/15/03
T	Magnesium	<0.040	mg/L		200.7	9/15/03
T	Sodium	104	mg/L		200.7	9/15/03
T	Sulfide	1.72	mg/L		376.1	9/04/03
T	Sulfate, SO4	1370	mg/L	100	300.0	9/11/03
T	Arsenic	0.179	mg/L		200.7	9/15/03
T	Chromium	<0.0060	mg/L		200.7	9/15/03
T	Iron	0.763	mg/L		200.7	9/15/03
T	Manganese	0.0072	mg/L		200.7	9/15/03
T	Phosphorus	1.28	mg/L		200.7	9/15/03
T	Lead	<0.0050	mg/L		200.7	9/15/03
T	Silica	88.7	mg/L		200.7	9/15/03
T	INORGANIC CARBON	*51.8	mg/L		415.1	9/10/03
D	Arsenic	0.132	mg/L		200.7	9/15/03
D	Chromium	<0.0060	mg/L		200.7	9/15/03
D	Lead	<0.0050	mg/L		200.7	9/15/03

CalcTDS:	5820	TDS/Cond:		CATION SUM:	76.64meq/L	BALANCE
TDS/CalcTDS:	1.1	CalcTDS/Cond:		ANION SUM:	75.36meq/L	0.84%

Filtered fraction: 351235
*DISSOLVED INORGANIC CARBON

Reviewed By:________________ Date 9/16/03

9/16/03 10:41

SVL ANALYTICAL, INC.

Quality Control Report
Part I Prep Blank and Laboratory Control Sample

ient :GeoSyntec

SVL JOB No: 107389

Analyte	Method	Matrix	Units	Prep Blank	True—LCS	—Found	LCS %R	Analysis Date
Arsenic	200.7	WATER	mg/L	<0.010	1.00	0.907	90.7	9/15/03
Calcium	200.7	WATER	mg/L	<0.040	20.0	20.9	104.5	9/15/03
Chromium	200.7	WATER	mg/L	<0.0060	1.00	1.01	101.0	9/15/03
Iron	200.7	WATER	mg/L	<0.020	10.0	10.2	102.0	9/15/03
Potassium	200.7	WATER	mg/L	<1.0	30.0	30.2	100.7	9/15/03
Magnesium	200.7	WATER	mg/L	<0.040	20.0	20.1	100.5	9/15/03
Manganese	200.7	WATER	mg/L	<0.0020	1.00	1.01	101.0	9/15/03
Sodium	200.7	WATER	mg/L	<0.50	20.0	20.6	103.0	9/15/03
Phosphorus	200.7	WATER	mg/L	<0.050	2.50	2.43	97.2	9/15/03
Lead	200.7	WATER	mg/L	<0.0050	1.00	0.980	98.0	9/15/03
Silica	200.7	WATER	mg/L	<0.171	10.7	11.1	103.7	9/15/03
Chloride	300.0	WATER	mg/L	<0.20	5.00	4.81	96.2	9/10/03
Sulfate, SO4	300.0	WATER	mg/L	<0.30	10.0	9.97	99.7	9/10/03
Alkalinity,CaCO3	2320	WATER	mg/L	<1.0	55.0	57.0	103.6	9/10/03
pH	150.1	WATER		7.27	6.10	6.08	99.7	8/29/03
Spec. Cond.	120.1	WATER	umhos/cm	0.327	375	349	93.1	9/04/03
Eh (mV)	2580	WATER	mV	N/A	+228	+236	103.5	9/02/03
INORGANIC CARBON	415.1	WATER	mg/L	<1.0	15.0	14.6	97.3	9/10/03
Sulfide	376.1	WATER	mg/L	<1.0	2.81	2.80	99.6	9/04/03
TDS	160.1	WATER	mg/L	<10	236	247	104.7	9/04/03
Turbidity	180.1	WATER	NTU'S	0.073	13.6	13.3	97.8	8/29/03

LEGEND:

LCS = Laboratory Control Sample

LCS %R = LCS Percent Recovery

N/A = Not Applicable

9/16/03 10:52

SVL ANALYTICAL, INC.

Quality Control Report
Part II Duplicate and Spike Analysis

ent :GeoSyntec SVL JOB No: 107389

			QC SAMPLE ID			Duplicate or MSD		Matrix Spike			Analysis
Test	Method	Matrix		Units	Result	Found	RPD%	Result	SPK ADD	%R	Date
As	200.7	WATER	1	mg/L	<0.010	<0.010	UDL	0.934	1.00	93.4	9/15/03
As	200.7	WATER	2	mg/L	<0.010	<0.010	UDL	1.02	1.00	102.0	9/15/03
Ca	200.7	WATER	1	mg/L	70.0	68.4	2.3	91.2	20.0	106.0	9/15/03
Cr	200.7	WATER	1	mg/L	<0.0060	<0.0060	UDL	0.995	1.00	99.5	9/15/03
Cr	200.7	WATER	2	mg/L	<0.0060	<0.0060	UDL	1.01	1.00	101.0	9/15/03
Fe	200.7	WATER	1	mg/L	0.041	0.036	13.0	10.0	10.0	99.6	9/15/03
K	200.7	WATER	1	mg/L	6.0	5.9	1.7	36.2	30.0	100.7	9/15/03
Mg	200.7	WATER	1	mg/L	27.1	26.6	1.9	47.0	20.0	99.5	9/15/03
Mn	200.7	WATER	1	mg/L	0.0103	0.0099	4.0	1.01	1.00	100.0	9/15/03
Na	200.7	WATER	1	mg/L	2.17	2.12	2.3	22.8	20.0	103.2	9/15/03
P	200.7	WATER	1	mg/L	<0.050	<0.050	UDL	2.44	2.50	97.6	9/15/03
Pb	200.7	WATER	1	mg/L	<0.0050	<0.0050	UDL	0.988	1.00	98.8	9/15/03
Pb	200.7	WATER	2	mg/L	<0.0050	<0.0050	UDL	0.9998	1.00	100.0	9/15/03
SiO2	200.7	WATER	1	mg/L	17.7	17.4	1.7	28.2	10.7	98.1	9/15/03
Cl	300.0	WATER	1	mg/L	0.68	0.76	11.1	2.68	2.00	100.0	9/10/03
SO4	300.0	WATER	1	mg/L	16.5	16.7	1.2	21.6	5.00	102.0	9/10/03
ALK	2320	WATER	1	mg/L	279	281	0.7	N/A	N/A	N/A	9/10/03
CO3	2320	WATER	1	mg/L	<1.0	<1.0	UDL	N/A	N/A	N/A	9/10/03
HCO3	2320	WATER	1	mg/L	279	281	0.7	N/A	N/A	N/A	9/10/03
pH	150.1	WATER	1		7.45	7.45	0.0	N/A	N/A	N/A	8/29/03
COND	120.1	WATER	1	umhos/c	552	541	2.0	N/A	N/A	N/A	9/04/03
Eh	2580	WATER	1	mV	+107	+110	2.8	N/A	N/A	N/A	9/02/03
ORG18D	415.1	WATER	1	mg/L	16.2	14.4	11.8	44.5	50.0	56.6	9/10/03
TDS	160.1	WATER	1	mg/L	291	332	13.2	N/A	N/A	N/A	9/04/03
	180.1	WATER	1	NTU'S	0.831	0.835	0.5	N/A	N/A	N/A	8/29/03

LEGEND:

RPD% = (|SAM - DUP|/((SAM + DUP)/2) * 100) UDL = Both SAM & DUP not detected. *Result or *Found: Interference required dilution.
RPD% = (|SPK - MSD|/((SPK + MSD)/2) * 100) M in Duplicate/MSD column indicates MSD.
SPIKE ADD column, A = Post Digest Spike; %R = Percent Recovery N/A = Not Analyzed; R > 4S = Result more than 4X the Spike Added
Control limits for MS recoveries apply only if the spike add is at least 0.25 times the concentration of the analyte in the sample.
Control limits for the RPD apply only if the concentration of the analyte in the sample is at least five times the reporting limit.

QC Sample 1: SVL SAM No.: 351224 Client Sample ID: MW-7 ^T
QC Sample 2: SVL SAM No.: 351230 Client Sample ID: MW-7 ^D

CHAIN OF CUSTODY RECORD

Page 1 of 1

Client: GeoSyntec
Contact: Brian Petty
Address:
Phone Number: 714-
FAX Number: 714-969-0820

NOTES:

1) Ensure proper container packaging.
2) Ship samples promptly following collection.
* 3) Designate Sample Reject Disposition

PO#:
Project Name: Lehigh

Table 1. -- Matrix Type
1 = Surface Water, 2 = Ground Water
3 = Soil/Sediment, 4 = Rinsate, 5 = Oil
6 = Waste, 7 = Other (Specify)

Samplers Signature: G. E. Hoy

FOR SVL USE ONLY
SVL JOB # 107389

Lab Name: SVL Analytical, Inc. (208) 784-1258 FAX (208) 783-0891
Address: One Government Gulch, Kellogg, ID 83837-0929

Sample ID	Collection		Miscellaneous				Preservative(s)						Analyses Required										Comments
	Date	Time	Collected by: (Init.)	Matrix Type From Table 1	No. of Containers	Sample Filtered ~~? Y/N~~	Unpreserved (Ice Only)	HNO3	HCL	H2SO4	NAOH	Other ~~(Specify)~~ ZnAc	Tubidity, Redox (EH), pH	Total As, Pb, Cr	dis As, Cr, Pb	total phosphate, DIC	total Alk, bicarb Alk.	Maj Cations (inc Na, K, Ca)	Maj Anions (incl Cl)	Mg, SO4, Si, Fe, Mn	Sulfide, TDS, spec elec conduc.	Carb. Alkalinity	
1. mw-7	8/28/03	09:00	dwsp	2	4	#3	#1	#3 #4				#2	X	X	X	X	X	X	X	X	X	X	SVL to preserve
2. mw-8	8/28/03	08:30			4	#3	#1	#3 #4				#2											for Total PO4 from
3. mw-9	8/28/03	11:00			4	#3	#1	#3 #4				#2											RAW
4. mw-11	8/28/03	10:15			4	#3	#1	#3 #4				#2											Bmr 8/29/03
5. mw-12	8/28/03	9:50			4	#3	#1	#3 #4				#2											
6. mw-19	8/28/03	11:00			4	#3	#1	#3 #4				#2											
7.																							
8.																							
9.																							
10.																							

Relinquished by: Gretchen E Hoy	Date: 8/28/03	Time: 12:50	Received by:	Date: 8/29/03	Time: 12:50
Relinquished by:	Date:	Time:	Received by:	Date:	Time:

* Sample Reject: [ ] Return [ ] Dispose [ ] Store (30 Days)

White: LAB COPY Yellow: CUSTOMER COPY SVL-COC 12/95

SVL ANALYTICAL, INC.
Certificate: CA CERTIFICATE NO. 2080
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: PM1
Sample Collected: 9/04/03 2:30
Sample Receipt : 9/08/03
Date of Report : 9/23/03

SVL JOB: 107516
SAMPLE: 352854
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	Alkalinity,CaCO3	2190	mg CaCO3/L		2320	9/10/03
T	CO3, CaCO3	1660	mg CaCO3/L		2320	9/10/03
T	Spec. Cond.	10900	umhos/cm		120.1	9/10/03
T	Eh (mV)	-246	mV		2580	9/09/03
T	HCO3, CaCO3	<1.0	mg CaCO3/L		2320	9/10/03
T	pH	12.10			150.1	9/09/03
T	TDS	6290	mg/L		160.1	9/11/03
T	Calcium	5.15	mg/L		200.7	9/19/03
T	Chloride	81.6	mg/L	25	300.0	9/15/03
T	Potassium	2930	mg/L	100	200.7	9/21/03
T	Magnesium	0.158	mg/L		200.7	9/19/03
T	Sodium	152	mg/L		200.7	9/19/03
T	Sulfide	2.10	mg/L		376.1	9/10/03
T	Sulfate, SO4	1710	mg/L	100	300.0	9/15/03
T	Aluminum	2.75	mg/L		200.7	9/19/03
T	Arsenic	0.212	mg/L	5	200.7	9/22/03
T	Iron	3.79	mg/L		200.7	9/19/03
T	Manganese	0.0561	mg/L		200.7	9/19/03
T	Phosphorus	2.22	mg/L	5	200.7	9/22/03
T	Silica	83.1	mg/L		200.7	9/19/03
T	INORGANIC CARBON	173	mg/L		415.1	9/17/03
D	Aluminum	2.67	mg/L		200.7	9/19/03
D	Arsenic	0.215	mg/L		200.7	9/22/03
D	Iron	3.01	mg/L		200.7	9/19/03
D	Manganese	0.0484	mg/L		200.7	9/19/03
D	Silica	80.9	mg/L		200.7	9/19/03

CalcTDS:	6410	TDS/Cond:	CATION SUM:	82.69meq/L	BALANCE
TDS/CalcTDS:	1.0	CalcTDS/Cond:	ANION SUM:	81.70meq/L	0.60%

Filtered fraction: 352874
INORGANIC CARBON IS DISSOLVED INORGANIC CARBON

Reviewed By: ______________________ Date 9/23/03

9/23/03 12:53

SVL ANALYTICAL, INC. Certificate: CA CERTIFICATE NO. 2080
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: PM2
Sample Collected: 9/04/03 3:00
Sample Receipt : 9/08/03
Date of Report : 9/23/03

SVL JOB: 107516
SAMPLE: 352855
TOT/DIS
Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	Alkalinity,CaCO3	315	mg CaCO3/L		2320	9/10/03
T	CO3, CaCO3	<1.0	mg CaCO3/L		2320	9/10/03
T	Spec. Cond.	967	umhos/cm		120.1	9/10/03
T	Eh (mV)	+62.9	mV		2580	9/09/03
T	HCO3, CaCO3	315	mg CaCO3/L		2320	9/10/03
T	pH	7.82			150.1	9/09/03
T	TDS	573	mg/L		160.1	9/11/03
T	Calcium	84.3	mg/L		200.7	9/19/03
T	Chloride	14.0	mg/L	2	300.0	9/15/03
T	Potassium	78.5	mg/L		200.7	9/19/03
T	Magnesium	22.4	mg/L		200.7	9/19/03
T	Sodium	28.9	mg/L		200.7	9/19/03
T	Sulfide	<1.0	mg/L		376.1	9/10/03
T	Sulfate, SO4	148	mg/L	10	300.0	9/15/03
T	Aluminum	0.142	mg/L		200.7	9/19/03
T	Arsenic	0.014	mg/L		200.7	9/22/03
T	Iron	0.197	mg/L		200.7	9/19/03
T	Manganese	0.905	mg/L		200.7	9/19/03
T	Phosphorus	0.256	mg/L		200.7	9/22/03
T	Silica	18.6	mg/L		200.7	9/19/03
T	INORGANIC CARBON	36.3	mg/L		415.1	9/11/03
D	Aluminum	0.021	mg/L		200.7	9/19/03
D	Arsenic	<0.010	mg/L		200.7	9/22/03
D	Iron	<0.020	mg/L		200.7	9/19/03
D	Manganese	0.186	mg/L		200.7	9/19/03
D	Silica	9.65	mg/L		200.7	9/19/03

CalcTDS:	601	TDS/Cond:		CATION SUM:	9.39meq/L	BALANCE
TDS/CalcTDS:	1.0	CalcTDS/Cond:		ANION SUM:	9.76meq/L	-1.93%

Filtered fraction: 352875
INORGANIC CARBON IS DISSOLVED INORGANIC CARBON

Reviewed By:________________ Date 9/23/03
9/23/03 12:53

SVL ANALYTICAL, INC.

Certificate: CA CERTIFICATE NO. 2080

One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: PM3
Sample Collected: 9/04/03 5:15
Sample Receipt : 9/08/03
Date of Report : 9/23/03

SVL JOB: 107516
SAMPLE: 352856
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	Alkalinity,CaCO3	261	mg CaCO3/L		2320	9/10/03
T	CO3, CaCO3	<1.0	mg CaCO3/L		2320	9/10/03
T	Spec. Cond.	1510	umhos/cm		120.1	9/10/03
T	Eh (mV)	+88.6	mV		2580	9/09/03
T	HCO3, CaCO3	261	mg CaCO3/L		2320	9/10/03
T	pH	7.93			150.1	9/09/03
T	TDS	962	mg/L		160.1	9/11/03
T	Calcium	153	mg/L		200.7	9/19/03
T	Chloride	104	mg/L	25	300.0	9/15/03
T	Potassium	145	mg/L		200.7	9/19/03
T	Magnesium	40.6	mg/L		200.7	9/19/03
T	Sodium	68.8	mg/L		200.7	9/19/03
T	Sulfide	<1.0	mg/L		376.1	9/10/03
T	Sulfate, SO4	404	mg/L	25	300.0	9/15/03
T	Aluminum	0.067	mg/L		200.7	9/19/03
T	Arsenic	<0.010	mg/L		200.7	9/22/03
T	Iron	0.134	mg/L		200.7	9/19/03
T	Manganese	0.964	mg/L		200.7	9/19/03
T	Phosphorus	0.074	mg/L		200.7	9/22/03
T	Silica	13.7	mg/L		200.7	9/19/03
T	INORGANIC CARBON	347	mg/L		415.1	9/11/03
D	Aluminum	<0.020	mg/L		200.7	9/19/03
D	Arsenic	<0.010	mg/L		200.7	9/22/03
D	Iron	<0.020	mg/L		200.7	9/19/03
D	Manganese	0.789	mg/L		200.7	9/19/03
D	Silica	12.7	mg/L		200.7	9/19/03

CalcTDS:	1110	TDS/Cond:	CATION SUM:	17.75meq/L	BALANCE
TDS/CalcTDS:	0.9	CalcTDS/Cond:	ANION SUM:	16.55meq/L	3.50%

Filtered fraction: 352876
INORGANIC CARBON IS DISSOLVED INORGANIC CARBON

Reviewed By:______________________ Date 9/23/03

9/23/03 12:53

SVL ANALYTICAL, INC.
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

Certificate: CA CERTIFICATE NO. 2080

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: PM4
Sample Collected: 9/04/03 4:30
Sample Receipt : 9/08/03
Date of Report : 9/23/03

SVL JOB: 107516
SAMPLE: 352857
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	Alkalinity,CaCO3	1350	mg CaCO3/L		2320	9/10/03
T	CO3, CaCO3	1150	mg CaCO3/L		2320	9/10/03
T	Spec. Cond.	6200	umhos/cm		120.1	9/10/03
T	Eh (mV)	-372	mV		2580	9/09/03
T	HCO3, CaCO3	<1.0	mg CaCO3/L		2320	9/10/03
T	pH	11.80			150.1	9/09/03
T	TDS	3610	mg/L		160.1	9/11/03
T	Calcium	3.76	mg/L		200.7	9/19/03
T	Chloride	80.4	mg/L	25	300.0	9/15/03
T	Potassium	1700	mg/L	100	200.7	9/21/03
T	Magnesium	0.109	mg/L		200.7	9/19/03
T	Sodium	104	mg/L		200.7	9/19/03
T	Sulfide	2.40	mg/L		376.1	9/10/03
T	Sulfate, SO4	916	mg/L	50	300.0	9/15/03
T	Aluminum	1.72	mg/L		200.7	9/19/03
T	Arsenic	0.091	mg/L	5	200.7	9/22/03
T	Iron	1.03	mg/L		200.7	9/19/03
T	Manganese	0.0160	mg/L		200.7	9/19/03
T	Phosphorus	1.15	mg/L	5	200.7	9/22/03
T	Silica	55.8	mg/L		200.7	9/19/03
T	INORGANIC CARBON	67.6	mg/L		415.1	9/11/03
D	Aluminum	1.55	mg/L		200.7	9/19/03
D	Arsenic	0.096	mg/L		200.7	9/22/03
D	Iron	0.711	mg/L		200.7	9/19/03
D	Manganese	0.0118	mg/L		200.7	9/19/03
D	Silica	53.1	mg/L		200.7	9/19/03

CalcTDS:	3750	TDS/Cond:	CATION SUM:	48.64meq/L	BALANCE
TDS/CalcTDS:	1.0	CalcTDS/Cond:	ANION SUM:	48.21meq/L	0.44%

Filtered fraction: 352877
INORGANIC CARBON IS DISSOLVED INORGANIC CARBON

Reviewed By: ________________ Date 9/23/03

9/23/03 12:53

SVL ANALYTICAL, INC. Certificate: CA CERTIFICATE NO. 2080
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: PM5
Sample Collected: 9/04/03 4:10
Sample Receipt : 9/08/03
Date of Report : 9/23/03

SVL JOB: 107516
SAMPLE: 352858
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	Alkalinity,CaCO3	693	mg CaCO3/L		2320	9/10/03
T	CO3, CaCO3	558	mg CaCO3/L		2320	9/10/03
T	Spec. Cond.	6240	umhos/cm		120.1	9/10/03
T	Eh (mV)	-128	mV		2580	9/09/03
T	HCO3, CaCO3	135	mg CaCO3/L		2320	9/10/03
T	pH	10.30			150.1	9/09/03
T	TDS	3580	mg/L		160.1	9/11/03
T	Calcium	10.5	mg/L		200.7	9/19/03
T	Chloride	1500	mg/L	500	300.0	9/15/03
T	Potassium	756	mg/L	10	200.7	9/21/03
T	Magnesium	1.62	mg/L		200.7	9/19/03
T	Sodium	742	mg/L		200.7	9/19/03
T	Sulfide	2.20	mg/L		376.1	9/10/03
T	Sulfate, SO4	435	mg/L	50	300.0	9/15/03
T	Aluminum	0.273	mg/L		200.7	9/19/03
T	Arsenic	0.037	mg/L		200.7	9/22/03
T	Iron	0.487	mg/L		200.7	9/19/03
T	Manganese	0.0348	mg/L		200.7	9/19/03
T	Phosphorus	0.721	mg/L		200.7	9/22/03
T	Silica	42.8	mg/L		200.7	9/19/03
T	INORGANIC CARBON	42.9	mg/L		415.1	9/11/03
D	Aluminum	0.104	mg/L		200.7	9/19/03
D	Arsenic	0.036	mg/L		200.7	9/22/03
D	Iron	0.290	mg/L		200.7	9/19/03
D	Manganese	0.0150	mg/L		200.7	9/19/03
D	Silica	34.2	mg/L		200.7	9/19/03

CalcTDS:	3960	TDS/Cond:	CATION SUM:	52.34meq/L	BALANCE
TDS/CalcTDS:	0.9	CalcTDS/Cond:	ANION SUM:	65.11meq/L	-10.87%

Filtered fraction: 352878
INORGANIC CARBON IS DISSOLVED INORGANIC CARBON

Reviewed By: ______________________ Date 9/23/03

9/23/03 12:53

SVL ANALYTICAL, INC.
Certificate: CA CERTIFICATE NO. 2080
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: PM6
Sample Collected: 9/04/03 3:25
Sample Receipt : 9/08/03
Date of Report : 9/23/03

SVL JOB: 107516
SAMPLE: 352859
TOT/DIS
Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	Alkalinity,CaCO3	1870	mg CaCO3/L		2320	9/10/03
T	CO3, CaCO3	1560	mg CaCO3/L		2320	9/10/03
T	Spec. Cond.	8570	umhos/cm		120.1	9/10/03
T	Eh (mV)	-13.0	mV		2580	9/09/03
T	HCO3, CaCO3	<1.0	mg CaCO3/L		2320	9/10/03
T	pH	11.80			150.1	9/09/03
T	TDS	5300	mg/L		160.1	9/11/03
T	Calcium	4.88	mg/L		200.7	9/19/03
T	Chloride	59.0	mg/L	10	300.0	9/15/03
T	Potassium	2310	mg/L	100	200.7	9/21/03
T	Magnesium	<0.040	mg/L		200.7	9/19/03
T	Sodium	158	mg/L		200.7	9/19/03
T	Sulfide	<1.0	mg/L		376.1	9/10/03
T	Sulfate, SO4	1510	mg/L	100	300.0	9/15/03
T	Aluminum	1.32	mg/L		200.7	9/19/03
T	Arsenic	0.350	mg/L	5	200.7	9/22/03
T	Iron	0.467	mg/L		200.7	9/19/03
T	Manganese	0.0141	mg/L		200.7	9/19/03
T	Phosphorus	3.33	mg/L	5	200.7	9/22/03
T	Silica	151	mg/L		200.7	9/19/03
T	INORGANIC CARBON	71.3	mg/L		415.1	9/11/03
D	Aluminum	1.05	mg/L		200.7	9/20/03
D	Arsenic	0.366	mg/L		200.7	9/22/03
D	Iron	0.286	mg/L		200.7	9/20/03
D	Manganese	0.0104	mg/L		200.7	9/20/03
D	Silica	157	mg/L		200.7	9/20/03

CalcTDS: 5560	TDS/Cond:	CATION SUM:	66.50meq/L	BALANCE
TDS/CalcTDS: 1.0	CalcTDS/Cond:	ANION SUM:	70.44meq/L	-2.88%

Filtered fraction: 352879
INORGANIC CARBON IS DISSOLVED INORGANIC CARBON

Reviewed By:________________ Date 9/23/03
9/23/03 12:53

SVL ANALYTICAL, INC.
Certificate: CA CERTIFICATE NO. 2080
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: PM7
Sample Collected: 9/04/03 3:50
Sample Receipt : 9/08/03
Date of Report : 9/23/03

SVL JOB: 107516
SAMPLE: 352860
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	Alkalinity,CaCO3	846	mg CaCO3/L		2320	9/10/03
T	CO3, CaCO3	<1.0	mg CaCO3/L		2320	9/10/03
T	Spec. Cond.	2480	umhos/cm		120.1	9/10/03
T	Eh (mV)	-66.2	mV		2580	9/09/03
T	HCO3, CaCO3	846	mg CaCO3/L		2320	9/10/03
T	pH	7.62			150.1	9/09/03
T	TDS	1580	mg/L		160.1	9/11/03
T	Calcium	187	mg/L		200.7	9/19/03
T	Chloride	198	mg/L	50	300.0	9/15/03
T	Potassium	238	mg/L	10	200.7	9/21/03
T	Magnesium	39.6	mg/L		200.7	9/19/03
T	Sodium	218	mg/L		200.7	9/19/03
T	Sulfide	<1.0	mg/L		376.1	9/10/03
T	Sulfate, SO4	310	mg/L	25	300.0	9/15/03
T	Aluminum	0.141	mg/L		200.7	9/19/03
T	Arsenic	0.024	mg/L		200.7	9/22/03
T	Iron	23.7	mg/L		200.7	9/19/03
T	Manganese	3.50	mg/L		200.7	9/19/03
T	Phosphorus	0.468	mg/L		200.7	9/22/03
T	Silica	28.6	mg/L		200.7	9/19/03
T	INORGANIC CARBON	102	mg/L		415.1	9/11/03
D	Aluminum	<0.020	mg/L		200.7	9/20/03
D	Arsenic	<0.010	mg/L		200.7	9/22/03
D	Iron	0.782	mg/L		200.7	9/20/03
D	Manganese	3.08	mg/L		200.7	9/20/03
D	Silica	24.7	mg/L		200.7	9/20/03

CalcTDS:	1790	TDS/Cond:		CATION SUM:	29.30meq/L	BALANCE
TDS/CalcTDS:	0.9	CalcTDS/Cond:		ANION SUM:	28.94meq/L	0.62%

Filtered fraction: 352880
INORGANIC CARBON IS DISSOLVED INORGANIC CARBON

Reviewed By: ______________________ Date 9/23/03
9/23/03 12:53

SVL ANALYTICAL, INC.
Certificate: CA CERTIFICATE NO. 2080
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: PM8
Sample Collected: 9/05/03 12:20
Sample Receipt : 9/08/03
Date of Report : 9/23/03

SVL JOB: 107516
SAMPLE: 352861
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	Alkalinity,CaCO3	1500	mg CaCO3/L		2320	9/10/03
T	CO3, CaCO3	1190	mg CaCO3/L		2320	9/10/03
T	Spec. Cond.	6560	umhos/cm		120.1	9/10/03
T	Eh (mV)	+94.8	mV		2580	9/09/03
T	HCO3, CaCO3	<1.0	mg CaCO3/L		2320	9/10/03
T	pH	11.80			150.1	9/09/03
T	TDS	3750	mg/L		160.1	9/11/03
T	Calcium	4.16	mg/L		200.7	9/19/03
T	Chloride	42.2	mg/L	10	300.0	9/15/03
T	Potassium	1680	mg/L	100	200.7	9/21/03
T	Magnesium	0.823	mg/L		200.7	9/19/03
T	Sodium	81.4	mg/L		200.7	9/19/03
T	Sulfide	2.90	mg/L		376.1	9/10/03
T	Sulfate, SO4	894	mg/L	50	300.0	9/15/03
T	Aluminum	0.678	mg/L		200.7	9/19/03
T	Arsenic	0.085	mg/L	5	200.7	9/22/03
T	Iron	1.20	mg/L		200.7	9/19/03
T	Manganese	0.0189	mg/L		200.7	9/19/03
T	Phosphorus	1.03	mg/L	5	200.7	9/22/03
T	Silica	63.7	mg/L		200.7	9/19/03
T	INORGANIC CARBON	51.7	mg/L		415.1	9/12/03
D	Aluminum	0.530	mg/L		200.7	9/20/03
D	Arsenic	0.072	mg/L		200.7	9/22/03
D	Iron	0.908	mg/L		200.7	9/20/03
D	Manganese	0.0152	mg/L		200.7	9/20/03
D	Silica	61.6	mg/L		200.7	9/20/03

CalcTDS:	3770	TDS/Cond:		CATION SUM:	47.00meq/L	BALANCE
TDS/CalcTDS:	1.0	CalcTDS/Cond:		ANION SUM:	49.81meq/L	-2.90%

Filtered fraction: 352881
INORGANIC CARBON IS DISSOLVED INORGANIC CARBON

Reviewed By:______________________ Date 9/23/03
9/23/03 12:53

SVL ANALYTICAL, INC.
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

Certificate: CA CERTIFICATE NO. 2080

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: PM9
Sample Collected: 9/05/03 11:50
Sample Receipt : 9/08/03
Date of Report : 9/23/03

SVL JOB: 107516
SAMPLE: 352862
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	Alkalinity,CaCO3	365	mg CaCO3/L		2320	9/10/03
T	CO3, CaCO3	30.2	mg CaCO3/L		2320	9/10/03
T	Spec. Cond.	3600	umhos/cm		120.1	9/10/03
T	Eh (mV)	-34.0	mV		2580	9/09/03
T	HCO3, CaCO3	335	mg CaCO3/L		2320	9/10/03
T	pH	8.62			150.1	9/09/03
T	TDS	1880	mg/L		160.1	9/11/03
T	Calcium	34.0	mg/L		200.7	9/19/03
T	Chloride	924	mg/L	200	300.0	9/15/03
T	Potassium	219	mg/L	10	200.7	9/21/03
T	Magnesium	32.1	mg/L		200.7	9/19/03
T	Sodium	501	mg/L		200.7	9/19/03
T	Sulfide	<1.0	mg/L		376.1	9/10/03
T	Sulfate, SO4	104	mg/L	5	300.0	9/15/03
T	Aluminum	<0.020	mg/L		200.7	9/19/03
T	Arsenic	0.018	mg/L		200.7	9/22/03
T	Iron	0.171	mg/L		200.7	9/19/03
T	Manganese	0.193	mg/L		200.7	9/19/03
T	Phosphorus	0.118	mg/L		200.7	9/22/03
T	Silica	7.91	mg/L		200.7	9/19/03
T	INORGANIC CARBON	36.4	mg/L		415.1	9/12/03
D	Aluminum	<0.020	mg/L		200.7	9/20/03
D	Arsenic	<0.010	mg/L		200.7	9/22/03
D	Iron	0.127	mg/L		200.7	9/20/03
D	Manganese	0.184	mg/L		200.7	9/20/03
D	Silica	7.70	mg/L		200.7	9/20/03

CalcTDS: 2050 TDS/Cond:
TDS/CalcTDS: 0.9 CalcTDS/Cond:

CATION SUM: 31.76meq/L
ANION SUM: 35.53meq/L

BALANCE
-5.60%

Filtered fraction: 352882
INORGANIC CARBON IS DISSOLVED INORGANIC CARBON

Reviewed By:______________________ Date 9/23/03
9/23/03 12:53

SVL ANALYTICAL, INC.

One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

Certificate: CA CERTIFICATE NO. 2080

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: PM10
Sample Collected: 9/05/03 3:15
Sample Receipt : 9/08/03
Date of Report : 9/23/03

SVL JOB: 107516
SAMPLE: 352863
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	Alkalinity,CaCO3	1560	mg CaCO3/L		2320	9/10/03
T	CO3, CaCO3	1090	mg CaCO3/L		2320	9/10/03
T	Spec. Cond.	7640	umhos/cm		120.1	9/10/03
T	Eh (mV)	-428	mV		2580	9/09/03
T	HCO3, CaCO3	<1.0	mg CaCO3/L		2320	9/10/03
T	pH	12.02			150.1	9/09/03
T	TDS	3940	mg/L		160.1	9/11/03
T	Calcium	39.2	mg/L		200.7	9/19/03
T	Chloride	37.7	mg/L	5	300.0	9/15/03
T	Potassium	1720	mg/L	100	200.7	9/21/03
T	Magnesium	15.4	mg/L		200.7	9/19/03
T	Sodium	71.4	mg/L		200.7	9/19/03
T	Sulfide	10.6	mg/L		376.1	9/10/03
T	Sulfate, SO4	1020	mg/L	100	300.0	9/15/03
T	Aluminum	16.5	mg/L		200.7	9/19/03
T	Arsenic	0.177	mg/L	5	200.7	9/22/03
T	Iron	34.3	mg/L		200.7	9/19/03
T	Manganese	0.785	mg/L		200.7	9/19/03
T	Phosphorus	2.49	mg/L	5	200.7	9/22/03
T	Silica	86.3	mg/L		200.7	9/19/03
T	INORGANIC CARBON	43.5	mg/L		415.1	9/12/03
D	Aluminum	3.86	mg/L		200.7	9/20/03
D	Arsenic	0.188	mg/L		200.7	9/22/03
D	Iron	1.52	mg/L		200.7	9/20/03
D	Manganese	0.0226	mg/L		200.7	9/20/03
D	Silica	45.5	mg/L		200.7	9/20/03

CalcTDS:	4060	TDS/Cond:	CATION SUM:	53.91meq/L	BALANCE
TDS/CalcTDS:	1.0	CalcTDS/Cond:	ANION SUM:	53.30meq/L	0.57%

Filtered fraction: 352883
INORGANIC CARBON IS DISSOLVED INORGANIC CARBON

Reviewed By: ______________ Date 9/23/03

9/23/03 12:53

SVL ANALYTICAL, INC.
Certificate: CA CERTIFICATE NO. 2080
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: PM11
Sample Collected: 9/05/03 2:45
Sample Receipt : 9/08/03
Date of Report : 9/23/03

SVL JOB: 107516
SAMPLE: 352864
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	Alkalinity,CaCO3	923	mg CaCO3/L		2320	9/10/03
T	CO3, CaCO3	<1.0	mg CaCO3/L		2320	9/10/03
T	Spec. Cond.	3320	umhos/cm		120.1	9/10/03
T	Eh (mV)	-14.2	mV		2580	9/09/03
T	HCO3, CaCO3	923	mg CaCO3/L		2320	9/10/03
T	pH	7.44			150.1	9/09/03
T	TDS	2270	mg/L		160.1	9/11/03
T	Calcium	94.5	mg/L		200.7	9/19/03
T	Chloride	31.7	mg/L	5	300.0	9/15/03
T	Potassium	848	mg/L	10	200.7	9/21/03
T	Magnesium	12.6	mg/L		200.7	9/19/03
T	Sodium	53.5	mg/L		200.7	9/19/03
T	Sulfide	<1.0	mg/L		376.1	9/10/03
T	Sulfate, SO4	662	mg/L	50	300.0	9/15/03
T	Aluminum	0.318	mg/L		200.7	9/19/03
T	Arsenic	0.012	mg/L		200.7	9/22/03
T	Iron	26.0	mg/L		200.7	9/19/03
T	Manganese	3.48	mg/L		200.7	9/19/03
T	Phosphorus	0.149	mg/L		200.7	9/22/03
T	Silica	26.6	mg/L		200.7	9/19/03
T	INORGANIC CARBON	111	mg/L		415.1	9/12/03
D	Aluminum	0.107	mg/L		200.7	9/20/03
D	Arsenic	<0.010	mg/L		200.7	9/22/03
D	Iron	16.1	mg/L		200.7	9/20/03
D	Manganese	3.34	mg/L		200.7	9/20/03
D	Silica	25.4	mg/L		200.7	9/20/03

CalcTDS:	2360	TDS/Cond:		CATION SUM:	31.59meq/L	BALANCE
TDS/CalcTDS:	1.0	CalcTDS/Cond:		ANION SUM:	33.11meq/L	-2.35%

Filtered fraction: 352884
INORGANIC CARBON IS DISSOLVED INORGANIC CARBON

Reviewed By: Date 9/23/03
9/23/03 12:53

SVL ANALYTICAL, INC.
Certificate: CA CERTIFICATE NO. 2080
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: PM12
Sample Collected: 9/05/03 2:10
Sample Receipt : 9/08/03
Date of Report : 9/23/03

SVL JOB: 107516
SAMPLE: 352865
TOT/DIS
Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	Alkalinity,CaCO3	935	mg CaCO3/L		2320	9/10/03
T	CO3, CaCO3	<1.0	mg CaCO3/L		2320	9/10/03
T	Spec. Cond.	3170	umhos/cm		120.1	9/10/03
T	Eh (mV)	-58.9	mV		2580	9/09/03
T	HCO3, CaCO3	935	mg CaCO3/L		2320	9/10/03
T	pH	6.96			150.1	9/09/03
T	TDS	2110	mg/L		160.1	9/11/03
T	Calcium	152	mg/L		200.7	9/19/03
T	Chloride	34.3	mg/L	5	300.0	9/15/03
T	Potassium	716	mg/L	10	200.7	9/21/03
T	Magnesium	16.4	mg/L		200.7	9/19/03
T	Sodium	52.7	mg/L		200.7	9/19/03
T	Sulfide	<1.0	mg/L		376.1	9/10/03
T	Sulfate, SO4	613	mg/L	25	300.0	9/15/03
T	Aluminum	0.327	mg/L		200.7	9/19/03
T	Arsenic	0.033	mg/L		200.7	9/22/03
T	Iron	57.7	mg/L		200.7	9/19/03
T	Manganese	4.82	mg/L		200.7	9/19/03
T	Phosphorus	0.611	mg/L		200.7	9/22/03
T	Silica	39.1	mg/L		200.7	9/19/03
T	INORGANIC CARBON	134	mg/L		415.1	9/12/03
D	Aluminum	0.056	mg/L		200.7	9/20/03
D	Arsenic	<0.010	mg/L		200.7	9/22/03
D	Iron	13.0	mg/L		200.7	9/20/03
D	Manganese	3.61	mg/L		200.7	9/20/03
D	Silica	32.5	mg/L		200.7	9/20/03

CalcTDS: 2310 TDS/Cond:
TDS/CalcTDS: 0.9 CalcTDS/Cond:

CATION SUM: 32.44meq/L
ANION SUM: 32.41meq/L

BALANCE
0.05%

Filtered fraction: 352885
INORGANIC CARBON IS DISSOLVED INORGANIC CARBON

Reviewed By: ______________ Date 9/23/03
9/23/03 12:53

SVL ANALYTICAL, INC.
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

Certificate: CA CERTIFICATE NO. 2080

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: PM13
Sample Collected: 9/05/03 1:45
Sample Receipt : 9/08/03
Date of Report : 9/23/03

SVL JOB: 107516
SAMPLE: 352866
TOT/DIS
Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	Alkalinity,CaCO3	311	mg CaCO3/L		2320	9/10/03
T	CO3, CaCO3	113	mg CaCO3/L		2320	9/10/03
T	Spec. Cond.	977	umhos/cm		120.1	9/10/03
T	Eh (mV)	-56.2	mV		2580	9/09/03
T	HCO3, CaCO3	198	mg CaCO3/L		2320	9/10/03
T	pH	9.53			150.1	9/09/03
T	TDS	606	mg/L		160.1	9/11/03
T	Calcium	8.55	mg/L		200.7	9/19/03
T	Chloride	11.8	mg/L	5	300.0	9/15/03
T	Potassium	256	mg/L	10	200.7	9/21/03
T	Magnesium	2.85	mg/L		200.7	9/19/03
T	Sodium	16.3	mg/L		200.7	9/19/03
T	Sulfide	<1.0	mg/L		376.1	9/10/03
T	Sulfate, SO4	92.7	mg/L	5	300.0	9/15/03
T	Aluminum	0.232	mg/L		200.7	9/19/03
T	Arsenic	<0.010	mg/L		200.7	9/22/03
T	Iron	1.11	mg/L		200.7	9/19/03
T	Manganese	0.0802	mg/L		200.7	9/19/03
T	Phosphorus	0.109	mg/L		200.7	9/22/03
T	Silica	4.95	mg/L		200.7	9/19/03
T	INORGANIC CARBON	42.3	mg/L		415.1	9/12/03
D	Aluminum	0.077	mg/L		200.7	9/20/03
D	Arsenic	<0.010	mg/L		200.7	9/22/03
D	Iron	0.436	mg/L		200.7	9/20/03
D	Manganese	0.0691	mg/L		200.7	9/20/03
D	Silica	4.24	mg/L		200.7	9/20/03

CalcTDS:	588	TDS/Cond:	CATION SUM:	8.02meq/L	BALANCE
TDS/CalcTDS:	1.0	CalcTDS/Cond:	ANION SUM:	8.47meq/L	-2.73%

Filtered fraction: 352886
INORGANIC CARBON IS DISSOLVED INORGANIC CARBON

Reviewed By: ____________________ Date 9/23/03

9/23/03 12:53

SVL ANALYTICAL, INC. Certificate: CA CERTIFICATE NO. 2080

One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: PM14
Sample Collected: 9/05/03 1:15
Sample Receipt : 9/08/03
Date of Report : 9/23/03

SVL JOB: 107516
SAMPLE: 352867
TOT/DIS
Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	Alkalinity,CaCO3	307	mg CaCO3/L		2320	9/10/03
T	CO3, CaCO3	50.4	mg CaCO3/L		2320	9/10/03
T	Spec. Cond.	1080	umhos/cm		120.1	9/10/03
T	Eh (mV)	-31.5	mV		2580	9/09/03
T	HCO3, CaCO3	256	mg CaCO3/L		2320	9/10/03
T	pH	9.08			150.1	9/09/03
T	TDS	687	mg/L		160.1	9/11/03
T	Calcium	19.3	mg/L		200.7	9/19/03
T	Chloride	29.3	mg/L	10	300.0	9/15/03
T	Potassium	272	mg/L	10	200.7	9/21/03
T	Magnesium	3.96	mg/L		200.7	9/19/03
T	Sodium	29.5	mg/L		200.7	9/19/03
T	Sulfide	<1.0	mg/L		376.1	9/10/03
T	Sulfate, SO4	124	mg/L	10	300.0	9/15/03
T	Aluminum	1.63	mg/L		200.7	9/19/03
T	Arsenic	<0.010	mg/L		200.7	9/22/03
T	Iron	4.04	mg/L		200.7	9/19/03
T	Manganese	0.192	mg/L		200.7	9/19/03
T	Phosphorus	0.214	mg/L		200.7	9/22/03
T	Silica	9.98	mg/L		200.7	9/19/03
T	INORGANIC CARBON	21.9	mg/L		415.1	9/12/03
D	Aluminum	0.094	mg/L		200.7	9/20/03
D	Arsenic	<0.010	mg/L		200.7	9/22/03
D	Iron	0.381	mg/L		200.7	9/20/03
D	Manganese	0.0509	mg/L		200.7	9/20/03
D	Silica	5.02	mg/L		200.7	9/20/03

CalcTDS:	687	TDS/Cond:	CATION SUM:	9.88meq/L	BALANCE
TDS/CalcTDS:	1.0	CalcTDS/Cond:	ANION SUM:	9.54meq/L	1.75%

Filtered fraction: 352887
INORGANIC CARBON IS DISSOLVED INORGANIC CARBON

Reviewed By:________________ Date 9/23/03

9/23/03 12:53

SVL ANALYTICAL, INC.
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891
Certificate: CA CERTIFICATE NO. 2080

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: PM15
Sample Collected: 9/05/03 3:40
Sample Receipt : 9/08/03
Date of Report : 9/23/03

SVL JOB: 107516
SAMPLE: 352868
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	Alkalinity,CaCO3	2530	mg CaCO3/L		2320	9/10/03
T	CO3, CaCO3	1510	mg CaCO3/L		2320	9/10/03
T	Spec. Cond.	12800	umhos/cm		120.1	9/10/03
T	Eh (mV)	-236	mV		2580	9/09/03
T	HCO3, CaCO3	<1.0	mg CaCO3/L		2320	9/10/03
T	pH	12.30			150.1	9/09/03
T	TDS	6800	mg/L		160.1	9/11/03
T	Calcium	3.46	mg/L		200.7	9/19/03
T	Chloride	60.2	mg/L	10	300.0	9/15/03
T	Potassium	3220	mg/L	100	200.7	9/21/03
T	Magnesium	<0.040	mg/L		200.7	9/19/03
T	Sodium	134	mg/L		200.7	9/19/03
T	Sulfide	2.60	mg/L		376.1	9/10/03
T	Sulfate, SO4	1910	mg/L	100	300.0	9/15/03
T	Aluminum	3.38	mg/L		200.7	9/19/03
T	Arsenic	0.152	mg/L	5	200.7	9/22/03
T	Iron	0.333	mg/L		200.7	9/19/03
T	Manganese	0.0042	mg/L		200.7	9/19/03
T	Phosphorus	1.42	mg/L	5	200.7	9/22/03
T	Silica	120	mg/L		200.7	9/19/03
T	INORGANIC CARBON	55.2	mg/L		415.1	9/12/03
D	Aluminum	3.39	mg/L		200.7	9/20/03
D	Arsenic	0.175	mg/L		200.7	9/22/03
D	Iron	0.325	mg/L		200.7	9/20/03
D	Manganese	0.0054	mg/L		200.7	9/20/03
D	Silica	118	mg/L		200.7	9/20/03

CalcTDS:	7160	TDS/Cond:		CATION SUM:	89.15meq/L	BALANCE
TDS/CalcTDS:	1.0	CalcTDS/Cond:		ANION SUM:	92.02meq/L	-1.58%

Filtered fraction: 352888
INORGANIC CARBON IS DISSOLVED INORGANIC CARBON

Reviewed By: ______________________ Date 9/23/03
9/23/03 12:53

SVL ANALYTICAL, INC.
Certificate: CA CERTIFICATE NO. 2080
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: PM17
Sample Collected: 9/05/03 1:30
Sample Receipt : 9/08/03
Date of Report : 9/23/03

SVL JOB: 107516
SAMPLE: 352869
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	Alkalinity,CaCO3	1260	mg CaCO3/L		2320	9/10/03
T	CO3, CaCO3	792	mg CaCO3/L		2320	9/10/03
T	Spec. Cond.	5960	umhos/cm		120.1	9/10/03
T	Eh (mV)	-318	mV		2580	9/09/03
T	HCO3, CaCO3	<1.0	mg CaCO3/L		2320	9/10/03
T	pH	11.98			150.1	9/09/03
T	TDS	2890	mg/L		160.1	9/11/03
T	Calcium	5.92	mg/L		200.7	9/19/03
T	Chloride	34.7	mg/L	5	300.0	9/15/03
T	Potassium	1440	mg/L	100	200.7	9/21/03
T	Magnesium	<0.040	mg/L		200.7	9/19/03
T	Sodium	61.4	mg/L		200.7	9/19/03
T	Sulfide	2.80	mg/L		376.1	9/10/03
T	Sulfate, SO4	684	mg/L	50	300.0	9/15/03
T	Aluminum	1.75	mg/L		200.7	9/19/03
T	Arsenic	0.058	mg/L	2	200.7	9/22/03
T	Iron	0.939	mg/L		200.7	9/19/03
T	Manganese	0.0141	mg/L		200.7	9/19/03
T	Phosphorus	0.620	mg/L	2	200.7	9/22/03
T	Silica	49.1	mg/L		200.7	9/19/03
T	INORGANIC CARBON	21.8	mg/L		415.1	9/15/03
D	Aluminum	1.71	mg/L		200.7	9/20/03
D	Arsenic	0.065	mg/L		200.7	9/22/03
D	Iron	0.794	mg/L		200.7	9/20/03
D	Manganese	0.0132	mg/L		200.7	9/20/03
D	Silica	48.1	mg/L		200.7	9/20/03

CalcTDS:	3110	TDS/Cond:		CATION SUM:	40.25meq/L	BALANCE
TDS/CalcTDS:	0.9	CalcTDS/Cond:		ANION SUM:	40.33meq/L	-0.10%

Filtered fraction: 352889
INORGANIC CARBON IS DISSOLVED INORGANIC CARBON

Reviewed By:______________________ Date 9/23/03
9/23/03 12:53

SVL ANALYTICAL, INC. Certificate: CA CERTIFICATE NO. 2080
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: PM18
Sample Collected: 9/04/03 1:05
Sample Receipt : 9/08/03
Date of Report : 9/23/03

SVL JOB: 107516
SAMPLE: 352870
TOT/DIS
Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	Alkalinity,CaCO3	2020	mg CaCO3/L		2320	9/10/03
T	CO3, CaCO3	1470	mg CaCO3/L		2320	9/10/03
T	Spec. Cond.	10200	umhos/cm		120.1	9/10/03
T	Eh (mV)	-237	mV		2580	9/09/03
T	HCO3, CaCO3	<1.0	mg CaCO3/L		2320	9/10/03
T	pH	12.00			150.1	9/09/03
T	TDS	5940	mg/L		160.1	9/11/03
T	Calcium	4.46	mg/L		200.7	9/19/03
T	Chloride	54.1	mg/L	10	300.0	9/15/03
T	Potassium	2640	mg/L	100	200.7	9/21/03
T	Magnesium	<0.040	mg/L		200.7	9/19/03
T	Sodium	148	mg/L		200.7	9/19/03
T	Sulfide	3.20	mg/L		376.1	9/10/03
T	Sulfate, SO4	1710	mg/L	100	300.0	9/15/03
T	Aluminum	3.08	mg/L		200.7	9/19/03
T	Arsenic	0.278	mg/L		200.7	9/22/03
T	Iron	0.215	mg/L		200.7	9/19/03
T	Manganese	0.0031	mg/L		200.7	9/19/03
T	Phosphorus	1.21	mg/L		200.7	9/22/03
T	Silica	95.3	mg/L		200.7	9/19/03
T	INORGANIC CARBON	43.5	mg/L		415.1	9/15/03
D	Aluminum	3.10	mg/L		200.7	9/20/03
D	Arsenic	0.271	mg/L		200.7	9/22/03
D	Iron	0.179	mg/L		200.7	9/20/03
D	Manganese	0.0030	mg/L		200.7	9/20/03
D	Silica	93.7	mg/L		200.7	9/20/03

CalcTDS:	6010	TDS/Cond:	CATION SUM:	74.89meq/L	BALANCE
TDS/CalcTDS:	1.0	CalcTDS/Cond:	ANION SUM:	77.43meq/L	-1.67%

Filtered fraction: 352890
INORGANIC CARBON IS DISSOLVED INORGANIC CARBON

Reviewed By:______________ Date 9/23/03
9/23/03 12:53

SVL ANALYTICAL, INC.
Certificate: CA CERTIFICATE NO. 2080
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: PM19
Sample Collected: 9/04/03 1:25
Sample Receipt : 9/08/03
Date of Report : 9/23/03

SVL JOB: 107516
SAMPLE: 352871
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	Alkalinity,CaCO3	2350	mg CaCO3/L		2320	9/10/03
T	CO3, CaCO3	1790	mg CaCO3/L		2320	9/10/03
T	Spec. Cond.	11000	umhos/cm		120.1	9/10/03
T	Eh (mV)	-156	mV		2580	9/09/03
T	HCO3, CaCO3	<1.0	mg CaCO3/L		2320	9/10/03
T	pH	12.00			150.1	9/09/03
T	TDS	6210	mg/L		160.1	9/11/03
T	Calcium	2.96	mg/L		200.7	9/19/03
T	Chloride	55.9	mg/L	10	300.0	9/15/03
T	Potassium	2980	mg/L	100	200.7	9/21/03
T	Magnesium	<0.040	mg/L		200.7	9/19/03
T	Sodium	125	mg/L		200.7	9/19/03
T	Sulfide	<1.0	mg/L		376.1	9/10/03
T	Sulfate, SO4	1890	mg/L	100	300.0	9/15/03
T	Aluminum	3.76	mg/L		200.7	9/19/03
T	Arsenic	0.224	mg/L		200.7	9/22/03
T	Iron	0.163	mg/L		200.7	9/19/03
T	Manganese	0.0052	mg/L		200.7	9/19/03
T	Phosphorus	1.57	mg/L		200.7	9/22/03
T	Silica	89.7	mg/L		200.7	9/19/03
T	INORGANIC CARBON	87.7	mg/L		415.1	9/15/03
D	Aluminum	3.76	mg/L		200.7	9/20/03
D	Arsenic	0.208	mg/L		200.7	9/22/03
D	Iron	0.133	mg/L		200.7	9/20/03
D	Manganese	0.0045	mg/L		200.7	9/20/03
D	Silica	89.7	mg/L		200.7	9/20/03

CalcTDS:	6690	TDS/Cond:		CATION SUM: 82.67meq/L	BALANCE
TDS/CalcTDS:	0.9	CalcTDS/Cond:		ANION SUM: 87.80meq/L	-3.01%

Filtered fraction: 352891
INORGANIC CARBON IS DISSOLVED INORGANIC CARBON

Reviewed By: ______________________ Date 9/23/03

9/23/03 12:53

SVL ANALYTICAL, INC.
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

Certificate: CA CERTIFICATE NO. 2080

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: PM20
Sample Collected: 9/04/03 12:20
Sample Receipt : 9/08/03
Date of Report : 9/23/03

SVL JOB: 107516
SAMPLE: 352872
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	Alkalinity,CaCO3	700	mg CaCO3/L		2320	9/10/03
T	CO3, CaCO3	<1.0	mg CaCO3/L		2320	9/10/03
T	Spec. Cond.	3660	umhos/cm		120.1	9/10/03
T	Eh (mV)	+73.9	mV		2580	9/09/03
T	HCO3, CaCO3	700	mg CaCO3/L		2320	9/10/03
T	pH	8.28			150.1	9/09/03
T	TDS	2440	mg/L		160.1	9/11/03
T	Calcium	90.2	mg/L		200.7	9/19/03
T	Chloride	32.9	mg/L	5	300.0	9/15/03
T	Potassium	1000	mg/L	10	200.7	9/21/03
T	Magnesium	18.4	mg/L		200.7	9/19/03
T	Sodium	79.1	mg/L		200.7	9/19/03
T	Sulfide	<1.0	mg/L		376.1	9/10/03
T	Sulfate, SO4	1050	mg/L	50	300.0	9/15/03
T	Aluminum	0.228	mg/L		200.7	9/19/03
T	Arsenic	<0.010	mg/L		200.7	9/22/03
T	Iron	0.684	mg/L		200.7	9/19/03
T	Manganese	0.766	mg/L		200.7	9/19/03
T	Phosphorus	0.115	mg/L		200.7	9/22/03
T	Silica	9.72	mg/L		200.7	9/19/03
T	INORGANIC CARBON	106	mg/L		415.1	9/15/03
D	Aluminum	0.022	mg/L		200.7	9/20/03
D	Arsenic	<0.010	mg/L		200.7	9/22/03
D	Iron	0.274	mg/L		200.7	9/20/03
D	Manganese	0.818	mg/L		200.7	9/20/03
D	Silica	8.59	mg/L		200.7	9/20/03

CalcTDS:	2720	TDS/Cond:		CATION SUM:	35.15meq/L	BALANCE
TDS/CalcTDS:	0.9	CalcTDS/Cond:		ANION SUM:	36.80meq/L	-2.29%

Filtered fraction: 352892
INORGANIC CARBON IS DISSOLVED INORGANIC CARBON

Reviewed By:______________ Date 9/23/03

9/23/03 12:53

SVL ANALYTICAL, INC.
Certificate: CA CERTIFICATE NO. 2080
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: PM21
Sample Collected: 9/04/03 2:10
Sample Receipt : 9/08/03
Date of Report : 9/23/03

SVL JOB: 107516
SAMPLE: 352873
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	Alkalinity,CaCO3	318	mg CaCO3/L		2320	9/10/03
T	CO3, CaCO3	184	mg CaCO3/L		2320	9/10/03
T	Spec. Cond.	2460	umhos/cm		120.1	9/10/03
T	Eh (mV)	-16.7	mV		2580	9/09/03
T	HCO3, CaCO3	134	mg CaCO3/L		2320	9/10/03
T	pH	9.92			150.1	9/09/03
T	TDS	1470	mg/L		160.1	9/11/03
T	Calcium	26.7	mg/L		200.7	9/19/03
T	Chloride	67.0	mg/L	10	300.0	9/15/03
T	Potassium	553	mg/L	10	200.7	9/21/03
T	Magnesium	6.43	mg/L		200.7	9/19/03
T	Sodium	112	mg/L		200.7	9/19/03
T	Sulfide	<1.0	mg/L		376.1	9/10/03
T	Sulfate, SO4	694	mg/L	50	300.0	9/15/03
T	Aluminum	0.264	mg/L		200.7	9/19/03
T	Arsenic	0.048	mg/L		200.7	9/22/03
T	Iron	0.832	mg/L		200.7	9/19/03
T	Manganese	0.0245	mg/L		200.7	9/19/03
T	Phosphorus	0.729	mg/L		200.7	9/22/03
T	Silica	14.9	mg/L		200.7	9/19/03
T	INORGANIC CARBON	18.6	mg/L		415.1	9/15/03
D	Aluminum	0.090	mg/L		200.7	9/20/03
D	Arsenic	0.038	mg/L		200.7	9/22/03
D	Iron	0.392	mg/L		200.7	9/20/03
D	Manganese	0.0200	mg/L		200.7	9/20/03
D	Silica	14.0	mg/L		200.7	9/20/03

CalcTDS:	1690	TDS/Cond:	CATION SUM:	20.96meq/L	BALANCE
TDS/CalcTDS:	0.9	CalcTDS/Cond:	ANION SUM:	22.69meq/L	-3.96%

Filtered fraction: 352893
INORGANIC CARBON IS DISSOLVED INORGANIC CARBON

Reviewed By:________________ Date 9/23/03

9/23/03 12:53

VL ANALYTICAL, INC.

Quality Control Report
Part I Prep Blank and Laboratory Control Sample

ent :GeoSyntec

SVL JOB No: 107516

Analyte	Method	Matrix	Units	Prep Blank	True	LCS Found	LCS %R	Analysis Date
Aluminum	200.7	WATER	mg/L	<0.020	1.00	0.991	99.1	9/19/03
Arsenic	200.7	WATER	mg/L	<0.010	1.00	1.11	111.0	9/22/03
Calcium	200.7	WATER	mg/L	<0.040	20.0	20.4	102.0	9/19/03
Iron	200.7	WATER	mg/L	<0.020	10.0	9.97	99.7	9/19/03
Potassium	200.7	WATER	mg/L	<1.0	30.0	30.7	102.3	9/19/03
Magnesium	200.7	WATER	mg/L	<0.040	20.0	19.7	98.5	9/19/03
Manganese	200.7	WATER	mg/L	<0.0020	1.00	1.02	102.0	9/19/03
Sodium	200.7	WATER	mg/L	<0.50	20.0	20.4	102.0	9/19/03
Phosphorus	200.7	WATER	mg/L	<0.050	2.50	2.55	102.0	9/22/03
Silica	200.7	WATER	mg/L	<0.171	10.7	11.0	102.8	9/19/03
Chloride	300.0	WATER	mg/L	<0.20	5.00	5.35	107.0	9/15/03
Sulfate, SO4	300.0	WATER	mg/L	<0.30	10.0	10.6	106.0	9/15/03
Alkalinity,CaCO3	2320	WATER	mg/L	<1.0	55.0	57.0	103.6	9/10/03
pH	150.1	WATER		5.61	6.10	6.13	100.5	9/09/03
Spec. Cond.	120.1	WATER	umhos/cm	0.251	375	368	98.1	9/10/03
Eh (mV)	2580	WATER	mV	N/A	+228	+234	102.6	9/09/03
INORGANIC CARBON	415.1	WATER	mg/L	<1.0	15.0	14.9	99.3	9/11/03
Sulfide	376.1	WATER	mg/L	<1.0	2.00	1.90	95.0	9/10/03
TDS	160.1	WATER	mg/L	<10	300	309	103.0	9/11/03

LEGEND:

LCS = Laboratory Control Sample
LCS %R = LCS Percent Recovery
N/A = Not Applicable

9/23/03 12:52

VL ANALYTICAL, INC.

Quality Control Report
Part II Duplicate and Spike Analysis

Client :GeoSyntec

SVL JOB No: 107516

			QC SAMPLE ID			Duplicate or MSD		Matrix Spike			Analysis
Test	Method	Matrix		Units	Result	Found	RPD%	Result	SPK ADD	%R	Date
l	200.7	WATERG	1	mg/L	2.75	2.79	1.4	3.86	1.00	111.0	9/19/03
l	200.7	WATERG	2	mg/L	0.318	N/A	N/A	1.47	1.00	115.2	9/19/03
l	200.7	WATERG	3	mg/L	2.67	2.71	1.5	3.68	1.00	101.0	9/19/03
l	200.7	WATERG	4	mg/L	0.107	N/A	N/A	1.14	1.00	103.3	9/20/03
s	200.7	WATERG	1	mg/L	0.212	0.213	0.5	1.38	1.00	116.8	9/22/03
s	200.7	WATERG	2	mg/L	0.012	N/A	N/A	1.22	1.00	120.8	9/22/03
s	200.7	WATERG	3	mg/L	0.215	0.211	1.9	1.22	1.00	100.5	9/22/03
s	200.7	WATERG	4	mg/L	<0.010	N/A	N/A	1.02	1.00	102.0	9/22/03
a	200.7	WATERG	1	mg/L	5.15	5.14	0.2	25.9	20.0	103.8	9/19/03
a	200.7	WATERG	2	mg/L	94.5	N/A	N/A	115	20.0	102.5	9/19/03
e	200.7	WATERG	1	mg/L	3.79	3.83	1.0	13.9	10.0	101.1	9/19/03
e	200.7	WATERG	2	mg/L	26.0	N/A	N/A	36.7	10.0	107.0	9/19/03
e	200.7	WATERG	3	mg/L	3.01	3.06	1.6	12.7	10.0	96.9	9/19/03
e	200.7	WATERG	4	mg/L	16.1	N/A	N/A	28.4	10.0	123.0	9/20/03
	200.7	WATERG	1	mg/L	2930	2870	2.1	2890	30.0	R >4S	9/21/03
	200.7	WATERG	2	mg/L	848	N/A	N/A	882	30.0	113.3	9/21/03
g	200.7	WATERG	1	mg/L	0.158	0.164	3.7	19.7	20.0	97.7	9/19/03
g	200.7	WATERG	2	mg/L	12.6	N/A	N/A	32.8	20.0	101.0	9/19/03
n	200.7	WATERG	1	mg/L	0.0561	0.0562	0.2	1.08	1.00	102.4	9/19/03
n	200.7	WATERG	2	mg/L	3.48	N/A	N/A	4.53	1.00	105.0	9/19/03
n	200.7	WATERG	3	mg/L	0.0484	0.0487	0.6	1.04	1.00	99.2	9/19/03
n	200.7	WATERG	4	mg/L	3.34	N/A	N/A	4.23	1.00	89.0	9/20/03
a	200.7	WATERG	1	mg/L	152	159	4.5	181	20.0	R >4S	9/19/03
a	200.7	WATERG	2	mg/L	53.5	N/A	N/A	74.2	20.0	103.5	9/19/03
P	200.7	WATERG	1	mg/L	2.22	2.21	0.5	5.15	2.50	117.2	9/22/03
P	200.7	WATERG	2	mg/L	0.149	N/A	N/A	3.38	2.50	129.2	9/22/03
P	200.7	WATERG	2	mg/L	0.149	N/A	N/A	2.61	2.50 A	98.4	9/22/03
SiO2	200.7	WATERG	1	mg/L	83.1	83.9	1.0	93.2	10.7	94.4	9/19/03
SiO2	200.7	WATERG	2	mg/L	26.6	N/A	N/A	38.6	10.7	112.1	9/19/03
SiO2	200.7	WATERG	3	mg/L	80.9	81.7	1.0	88.0	10.7	R >4S	9/19/03
SiO2	200.7	WATERG	4	mg/L	25.4	N/A	N/A	35.9	10.7	98.1	9/20/03
Cl	300.0	WATERG	1	mg/L	81.6	81.1	0.6	131	50.0	98.8	9/15/03
SO4	300.0	WATERG	1	mg/L	1710	1710	0.0	2290	500	116.0	9/15/03
ALK	2320	WATERG	1	mg/L	2190	2160	1.4	N/A	N/A	N/A	9/10/03
CO3	2320	WATERG	1	mg/L	1660	1520	8.8	N/A	N/A	N/A	9/10/03
HCO3	2320	WATERG	1	mg/L	<1.0	<1.0	UDL	N/A	N/A	N/A	9/10/03
pH	150.1	WATERG	1		12.10	12.10	0.0	N/A	N/A	N/A	9/09/03
COND	120.1	WATERG	1	umhos/c	10900	10800	0.9	N/A	N/A	N/A	9/10/03
Eh	2580	WATERG	1	mV	-246	-247	0.4	N/A	N/A	N/A	9/09/03
ORG18D	415.1	WATERG	1	mg/L	173	176	1.7	220	50.0	94.0	9/17/03
TDS	160.1	WATERG	1	mg/L	6290	6240	0.8	N/A	N/A	N/A	9/11/03

LEGEND:

RPD% = (|SAM - DUP|/((SAM + DUP)/2) * 100) UDL = Both SAM & DUP not detected. *Result or *Found: Interference required dilution.

RPD% = (|SPK - MSD|/((SPK + MSD)/2) * 100) M in Duplicate/MSD column indicates MSD.

SPIKE ADD column, A = Post Digest Spike; %R = Percent Recovery N/A = Not Analyzed; R > 4S = Result more than 4X the Spike Added

Control limits for MS recoveries apply only if the spike add is at least 0.25 times the concentration of the analyte in the sample.

Control limits for the RPD apply only if the concentration of the analyte in the sample is at least five times the reporting limit.

QC Sample 1: SVL SAM No.: 352854 Client Sample ID: PM1 ^T
QC Sample 2: SVL SAM No.: 352864 Client Sample ID: PM11 ^T
QC Sample 3: SVL SAM No.: 352874 Client Sample ID: PM1 ^D
QC Sample 4: SVL SAM No.: 352884 Client Sample ID: PM11 ^D

9/23/03 12:52

SVL ANALYTICAL

CHAIN OF CUSTODY RECORD

Page 1 of 2

Client: GeoSyntec
Contact: Brian Petty
Address: 2100 Main St.
Suite #150, HB CA 92648
Phone Number: 714-969-0800
FAX Number: 714-969-0820

NOTES:

1) Ensure proper container packaging.
2) Ship samples promptly following collection.
3) Designate Sample Reject Disposition

PO#:
Project Name: Lehigh

Table 1. -- Matrix Type
1 = Surface Water, 2 = Ground Water
3 = Soil/Sediment, 4 = Rinsate, 5 = Oil
6 = Waste, 7 = Other (Specify) ________

FOR SVL USE ONLY
SVL JOB # 107516

Samplers Signature: G. E. Hoy

Lab Name: SVL Analytical, Inc. (208) 784-1258 FAX (208) 783-0891
Address: One Government Gulch, Kellogg, ID 83837-0929

Sample ID	Collection		Miscellaneous				Preservative(s)						Analyses Required									Bottles: * #1 - 1 ltr. raw, unpres. #2 - 1 ltr. raw, ZnAc #3 - 500 ml - needs filt. #4 - 500 ml, unfil, w/HNO_3
	Date	Time	Collected by: (Init.)	Matrix Type From Table 1	No. of Containers	Sample Filtered ? Y/N	Unpreserved (Ice Only)	HNO3 ~~*~~ See note	HCL	H2SO4	NAOH	Other (Specify)	Eh, DIC, Tot Alk	Carb Alk, Bicarb Alk	Maj Cat (in Na, K, Ca)	Maj Anions (inc Cl)	Mg, SO4, Si, As,	Sulfide, Fe, Mn	Alum, Spec Elec Cond	TDS, pH	total phosphate	Comments by ICP per Brian Petty
1. PM1	9/4	2:30	GH	2	4	*	*	*				*	X	X	X	X	X	X	X	X	X	
2. PM2	9/4	3:00																				
3. PM3	9/4	5:15																				
4. PM4	9/4	4:30																				
5. PM5	9/4	4:10																				
6. PM6	9/4	3:25																				
7. PM7	9/4	3:50																				
8. PM8	9/5	12:20																				
9. PM9	9/5	11:50																				
10. PM10	9/5	3:15																				

Relinquished by: G. E. Hoy — Date: 9/8/03 — Time: 2:10 — Received by: Ben Mat — Date: 9/8/03 — Time: 2:10
Relinquished by: — Date: — Time: — Received by: — Date: — Time:

* Sample Reject: [ ] Return [ ] Dispose [ ] Store (30 Days)

White: LAB COPY Yellow: CUSTOMER COPY

SVL ANALYTICAL

CHAIN OF CUSTODY RECORD

Page 2 of 2

Client: GeoSyntec
Contact: Brian Petty
Address: 2100 Main St #150
Hunt Bch, CA 92648
Phone Number: 714-969-0800
FAX Number: 714-969-0820

NOTES:

1) Ensure proper container packaging.
2) Ship samples promptly following collection.
* 3) Designate Sample Reject Disposition

PO#:
Project Name: Lehigh

Table 1. -- Matrix Type
1 = Surface Water, 2 = Ground Water
3 = Soil/Sediment, 4 = Rinsate, 5 = Oil
6 = Waste, 7 = Other (Specify) ______

Samplers Signature: G. E. Hoy

FOR SVL USE ONLY
SVL JOB # 107516

Lab Name: SVL Analytical, Inc. (208) 784-1258 FAX (208) 783-0891
Address: One Government Gulch, Kellogg, ID 83837-0929

	Collection		Miscellaneous				Preservative(s)						Analyses Required									
Sample ID	Date	Time	Collected by: (Init.)	Matrix Type From Table 1	No. of Containers	Sample Filtered ? Y/N	Unpreserved (Ice Only)	HNO3 * See note	HCL	H2SO4	NAOH	Other (Specify)	Eh, DIC, Tot Alk	Carb Alk, Bicarb Alk	Maj Cat (inc. Na, K, Ca)	Maj Anions (incl Cl)	Mg, SO4, Si, As	Sulfide, Fe, Mn	Alum, Spec. Elec Cond	TDS, pH	total phosphate	Comments *see note pg. 1/2
1. PM11	9/5	2:45	gh	1	4	*	*	*				*	X	X	X	X	X	X	X	X	X	
2. PM12	9/5	2:10																				
3. PM13	9/5	1:45																				
4. PM14	9/5	1:15																				
5. PM15	9/5	3:40																				
6. PM17	9/5	1:30																				
7. PM18	9/4	1:05																				
8. PM19	9/4	1:25																				
9. PM20	9/4	12:20																				
10. PM21	9/4	2:10																				

Relinquished by:	G. E. Hoy	Date:	9/8/03	Time:	2:10	Received by:		Date: 9/8/03	Time: 2:10
Relinquished by:		Date:		Time:		Received by:		Date:	Time:

* Sample Reject: [ ] Return [ ] Dispose [ ] Store (30 Days)

White: LAB COPY Yellow: CUSTOMER COPY SVL-COC 12/95

SVL ANALYTICAL, INC. Certificate: CA CERTIFICATE NO. 2080
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: GW-1 MW-11
Sample Collected: 11/21/03 9:30
Sample Receipt : 11/24/03
Date of Report : 12/10/03

SVL JOB: 108796
SAMPLE: 366667
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	399	mg CaCO3/L		2320B	12/04/03
T	Spec. Cond.	834	umhos/cm		120.1	11/25/03
T	Eh (mV)	+248	mV		2580	11/25/03
T	pH	8.11			150.1	12/04/03
T	TDS	475	mg/L		160.1	11/25/03
T	Turbidity	0.415	NTU'S		180.1	12/01/03
T	Calcium	113	mg/L		200.7	12/09/03
T	Chloride	5.34	mg/L		300.0	12/08/03
T	Fluoride	0.11	mg/L		300.0	12/08/03
T	Potassium	2.7	mg/L		200.7	12/09/03
T	Magnesium	43.7	mg/L		200.7	12/09/03
T	Sodium	4.57	mg/L		200.7	12/09/03
T	Sulfide	<1.0	mg/L		376.1	11/25/03
T	Sulfate, SO4	63.1	mg/L	5	300.0	12/08/03
T	Arsenic	<0.010	mg/L		200.7	12/09/03
T	Chromium	<0.0060	mg/L		200.7	12/09/03
T	Iron	0.163	mg/L		200.7	12/09/03
T	Manganese	0.0060	mg/L		200.7	12/09/03
T	Lead	<0.0050	mg/L		200.7	12/09/03
T	Silica	23.3	mg/L		200.7	12/09/03
T	INORGANIC CARBON	93.2	mg/L		415.1	12/01/03
D	Arsenic	<0.010	mg/L		200.7	12/09/03
D	Chromium	<0.0060	mg/L		200.7	12/09/03
D	Iron	<0.020	mg/L		200.7	12/09/03
D	Manganese	<0.0020	mg/L		200.7	12/09/03
D	Lead	<0.0050	mg/L		200.7	12/09/03
D	Silica	22.6	mg/L		200.7	12/09/03

CalcTDS:	530	TDS/Cond:	CATION SUM:	9.52meq/L	BALANCE	
TDS/CalcTDS:	0.9	CalcTDS/Cond:	ANION SUM:	9.44meq/L	0.42%	

Filtered fraction: 366673
TURBIDITY(RECEIVED AND ANALYZED PAST HOLDING TIME)

Reviewed By: Kirby Gray Date 12/10/03
12/10/03 8:13

SVL ANALYTICAL, INC.

One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

Certificate: CA CERTIFICATE NO. 2080

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: GW-2 MW-12
Sample Collected: 11/21/03 10:00
Sample Receipt : 11/24/03
Date of Report : 12/10/03

SVL JOB: 108796
SAMPLE: 366668
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	305	mg CaCO3/L		2320B	12/04/03
T	Spec. Cond.	1050	umhos/cm		120.1	11/25/03
T	Eh (mV)	+191	mV		2580	11/25/03
T	pH	8.18			150.1	12/04/03
T	TDS	535	mg/L		160.1	11/25/03
T	Turbidity	0.883	NTU'S		180.1	12/01/03
T	Calcium	59.6	mg/L		200.7	12/09/03
T	Chloride	126	mg/L	25	300.0	12/08/03
T	Fluoride	0.17	mg/L		300.0	12/08/03
T	Potassium	52.8	mg/L		200.7	12/09/03
T	Magnesium	29.8	mg/L		200.7	12/09/03
T	Sodium	82.4	mg/L		200.7	12/09/03
T	Sulfide	<1.0	mg/L		376.1	11/25/03
T	Sulfate, SO4	29.3	mg/L	2	300.0	12/08/03
T	Arsenic	<0.010	mg/L		200.7	12/09/03
T	Chromium	<0.0060	mg/L		200.7	12/09/03
T	Iron	0.790	mg/L		200.7	12/09/03
T	Manganese	0.955	mg/L		200.7	12/09/03
T	Lead	<0.0050	mg/L		200.7	12/09/03
T	Silica	10.9	mg/L		200.7	12/09/03
T	INORGANIC CARBON	72.9	mg/L		415.1	12/01/03
D	Arsenic	<0.010	mg/L		200.7	12/09/03
D	Chromium	<0.0060	mg/L		200.7	12/09/03
D	Iron	0.027	mg/L		200.7	12/09/03
D	Manganese	0.878	mg/L		200.7	12/09/03
D	Lead	<0.0050	mg/L		200.7	12/09/03
D	Silica	10.2	mg/L		200.7	12/09/03

CalcTDS:	591	TDS/Cond:	CATION SUM:	10.44meq/L	BALANCE
TDS/CalcTDS:	0.9	CalcTDS/Cond:	ANION SUM:	10.26meq/L	0.87%

Filtered fraction: 366674
TURBIDITY(RECEIVED AND ANALYZED PAST HOLDING TIME)

Reviewed By: ______________________ Date 12/10/03
12/10/03 8:14

SVL ANALYTICAL, INC.
Certificate: CA CERTIFICATE NO. 2080
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: GW-3 MW-7
Sample Collected: 11/21/03 9:00
Sample Receipt : 11/24/03
Date of Report : 12/10/03

SVL JOB: 108796
SAMPLE: 366669
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	232	mg CaCO3/L		2320B	12/04/03
T	Spec. Cond.	467	umhos/cm		120.1	11/25/03
T	Eh (mV)	+208	mV		2580	11/25/03
T	pH	8.10			150.1	12/04/03
T	TDS	266	mg/L		160.1	11/25/03
T	Turbidity	0.245	NTU'S		180.1	12/01/03
T	Calcium	61.0	mg/L		200.7	12/09/03
T	Chloride	1.09	mg/L		300.0	12/08/03
T	Fluoride	0.14	mg/L		300.0	12/08/03
T	Potassium	3.3	mg/L		200.7	12/09/03
T	Magnesium	26.6	mg/L		200.7	12/09/03
T	Sodium	3.07	mg/L		200.7	12/09/03
T	Sulfide	<1.0	mg/L		376.1	11/25/03
T	Sulfate, SO4	34.6	mg/L	2	300.0	12/08/03
T	Arsenic	<0.010	mg/L		200.7	12/09/03
T	Chromium	<0.0060	mg/L		200.7	12/09/03
T	Iron	0.021	mg/L		200.7	12/09/03
T	Manganese	0.0025	mg/L		200.7	12/09/03
T	Lead	<0.0050	mg/L		200.7	12/09/03
T	Silica	11.9	mg/L		200.7	12/09/03
T	INORGANIC CARBON	56.1	mg/L		415.1	12/01/03
D	Arsenic	<0.010	mg/L		200.7	12/09/03
D	Chromium	<0.0060	mg/L		200.7	12/09/03
D	Iron	<0.020	mg/L		200.7	12/09/03
D	Manganese	0.0095	mg/L		200.7	12/09/03
D	Lead	<0.0050	mg/L		200.7	12/09/03
D	Silica	11.4	mg/L		200.7	12/09/03

CalcTDS:	299	TDS/Cond:	CATION SUM:	5.44meq/L	BALANCE
TDS/CalcTDS:	0.9	CalcTDS/Cond:	ANION SUM:	5.40meq/L	0.37%

Filtered fraction: 366675
TURBIDITY(RECEIVED AND ANALYZED PAST HOLDING TIME)

Reviewed By: Kirby Gray Date 12/10/03
12/10/03 8:14

SVL ANALYTICAL, INC.
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-089
Certificate: CA CERTIFICATE NO. 208

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: GW-4 MW-8
Sample Collected: 11/21/03 8:00
Sample Receipt : 11/24/03
Date of Report : 12/10/03

SVL JOB: 108796
SAMPLE: 366670
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	279	mg CaCO3/L		2320B	12/04/03
T	Spec. Cond.	563	umhos/cm		120.1	11/25/03
T	Eh (mV)	+223	mV		2580	11/25/03
T	pH	8.08			150.1	12/04/03
T	TDS	274	mg/L		160.1	11/25/03
T	Turbidity	30.8	NTU'S		180.1	12/01/03
T	Calcium	65.1	mg/L		200.7	12/09/03
T	Chloride	1.74	mg/L		300.0	12/08/03
T	Fluoride	0.19	mg/L		300.0	12/08/03
T	Potassium	11.2	mg/L		200.7	12/09/03
T	Magnesium	28.6	mg/L		200.7	12/09/03
T	Sodium	3.30	mg/L		200.7	12/09/03
T	Sulfide	<1.0	mg/L		376.1	11/25/03
T	Sulfate, SO4	23.0	mg/L	2	300.0	12/08/03
T	Arsenic	<0.010	mg/L		200.7	12/09/03
T	Chromium	<0.0060	mg/L		200.7	12/09/03
T	Iron	4.74	mg/L		200.7	12/09/03
T	Manganese	1.83	mg/L		200.7	12/09/03
T	Lead	<0.0050	mg/L		200.7	12/09/03
T	Silica	15.4	mg/L		200.7	12/09/03
T	INORGANIC CARBON	68.1	mg/L		415.1	12/01/03
D	Arsenic	<0.010	mg/L		200.7	12/09/03
D	Chromium	<0.0060	mg/L		200.7	12/09/03
D	Iron	<0.020	mg/L		200.7	12/09/03
D	Manganese	1.67	mg/L		200.7	12/09/03
D	Lead	<0.0050	mg/L		200.7	12/09/03
D	Silica	14.2	mg/L		200.7	12/09/03

CalcTDS:	343	TDS/Cond:	CATION SUM:	6.33meq/L	BALANCE
TDS/CalcTDS:	0.8	CalcTDS/Cond:	ANION SUM:	6.11meq/L	1.77%

Filtered fraction: 366676
TURBIDITY(RECEIVED AND ANALYZED PAST HOLDING TIME)

Reviewed By: Kesley Gray Date 12/10/03
12/10/03 8:14

SVL ANALYTICAL, INC.
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891
Certificate: CA CERTIFICATE NO. 2080

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: GW-5 MW-9
Sample Collected: 11/21/03 10:30
Sample Receipt : 11/24/03
Date of Report : 12/10/03

SVL JOB: 108796
SAMPLE: 366671
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	2170	mg CaCO3/L		2320B	12/04/03
T	Spec. Cond.	11400	umhos/cm		120.1	11/25/03
T	Eh (mV)	-337	mV		2580	11/25/03
T	pH	12.14			150.1	12/04/03
T	TDS	6180	mg/L		160.1	11/25/03
T	Turbidity	0.671	NTU'S		180.1	12/01/03
T	Calcium	4.17	mg/L		200.7	12/09/03
T	Chloride	46.2	mg/L	10	300.0	12/08/03
T	Fluoride	1.91	mg/L	10	300.0	12/08/03
T	Potassium	2960	mg/L	50	200.7	12/09/03
T	Magnesium	<0.040	mg/L		200.7	12/09/03
T	Sodium	110	mg/L		200.7	12/09/03
T	Sulfide	2.20	mg/L		376.1	11/25/03
T	Sulfate, SO4	1490	mg/L	100	300.0	12/08/03
T	Arsenic	0.169	mg/L		200.7	12/09/03
T	Chromium	<0.0060	mg/L		200.7	12/09/03
T	Iron	0.714	mg/L		200.7	12/09/03
T	Manganese	0.0067	mg/L		200.7	12/09/03
T	Lead	<0.0050	mg/L		200.7	12/09/03
T	Silica	87.7	mg/L		200.7	12/09/03
T	INORGANIC CARBON	131	mg/L		415.1	12/01/03
D	Arsenic	0.136	mg/L		200.7	12/09/03
D	Chromium	<0.0060	mg/L		200.7	12/09/03
D	Iron	0.603	mg/L		200.7	12/09/03
D	Manganese	0.0075	mg/L		200.7	12/09/03
D	Lead	<0.0050	mg/L		200.7	12/09/03
D	Silica	80.5	mg/L		200.7	12/09/03

CalcTDS: 6130 TDS/Cond:
TDS/CalcTDS: 1.0 CalcTDS/Cond:

CATION SUM: 80.77meq/L
ANION SUM: 75.68meq/L

BALANCE
3.25%

Filtered fraction: 366677
TURBIDITY(RECEIVED AND ANALYZED PAST HOLDING TIME)

Reviewed By: Kirby Gray Date 12/10/03
12/10/03 8:14

SVL ANALYTICAL, INC.
Certificate: CA CERTIFICATE NO. 2080
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: GW-15 MW-9(D)
Sample Collected: 11/21/03 10:30
Sample Receipt : 11/24/03
Date of Report : 12/10/03

SVL JOB: 108796
SAMPLE: 366672
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	2150	mg CaCO3/L		2320B	12/04/03
T	Spec. Cond.	11500	umhos/cm		120.1	11/25/03
T	Eh (mV)	-333	mV		2580	11/25/03
T	pH	12.16			150.1	12/04/03
T	TDS	5920	mg/L		160.1	11/25/03
T	Turbidity	0.713	NTU'S		180.1	12/01/03
T	Calcium	4.14	mg/L		200.7	12/09/03
T	Chloride	46.2	mg/L	10	300.0	12/08/03
T	Fluoride	1.98	mg/L	10	300.0	12/08/03
T	Potassium	2990	mg/L	50	200.7	12/09/03
T	Magnesium	<0.040	mg/L		200.7	12/09/03
T	Sodium	107	mg/L		200.7	12/09/03
T	Sulfide	2.30	mg/L		376.1	11/25/03
T	Sulfate, SO4	1480	mg/L	100	300.0	12/08/03
T	Arsenic	0.176	mg/L		200.7	12/09/03
T	Chromium	<0.0060	mg/L		200.7	12/09/03
T	Iron	0.713	mg/L		200.7	12/09/03
T	Manganese	0.0061	mg/L		200.7	12/09/03
T	Lead	<0.0050	mg/L		200.7	12/09/03
T	Silica	86.7	mg/L		200.7	12/09/03
T	INORGANIC CARBON	133	mg/L		415.1	12/01/03
D	Arsenic	0.130	mg/L		200.7	12/09/03
D	Chromium	<0.0060	mg/L		200.7	12/09/03
D	Iron	0.566	mg/L		200.7	12/09/03
D	Manganese	0.0061	mg/L		200.7	12/09/03
D	Lead	<0.0050	mg/L		200.7	12/09/03
D	Silica	83.4	mg/L		200.7	12/09/03

CalcTDS:	6140	TDS/Cond:		CATION SUM:	81.39meq/L	BALANCE
TDS/CalcTDS:	1.0	CalcTDS/Cond:		ANION SUM:	75.23meq/L	3.93%

Filtered fraction: 366678
TURBIDITY(RECEIVED AND ANALYZED PAST HOLDING TIME)

Reviewed By:______________________ Date 12/10/03
12/10/03 8:14

SVL ANALYTICAL, INC.

Quality Control Report
Part I Prep Blank ana Laboratory Control Sample

Client :GeoSyntec

SVL JOB No: 108796

Analyte	Method	Matrix	Units	Prep Blank	LCS		LCS %R	Analysis Date
					True	Found		
Arsenic	200.7	WATER	mg/L	<0.010	1.00	0.944	94.4	12/09/03
Calcium	200.7	WATER	mg/L	<0.040	20.0	19.8	99.0	12/09/03
Chromium	200.7	WATER	mg/L	<0.0060	1.00	0.944	94.4	12/09/03
Iron	200.7	WATER	mg/L	<0.020	10.0	10.5	105.0	12/09/03
Potassium	200.7	WATER	mg/L	<1.0	30.0	31.2	104.0	12/09/03
Magnesium	200.7	WATER	mg/L	<0.040	20.0	20.2	101.0	12/09/03
Manganese	200.7	WATER	mg/L	<0.0020	1.00	1.04	104.0	12/09/03
Sodium	200.7	WATER	mg/L	<0.50	20.0	20.1	100.5	12/09/03
Lead	200.7	WATER	mg/L	<0.0050	1.00	0.962	96.2	12/09/03
Silica	200.7	WATER	mg/L	<0.171	10.7	11.1	103.7	12/09/03
Chloride	300.0	WATER	mg/L	<0.20	5.00	4.86	97.2	12/08/03
Fluoride	300.0	WATER	mg/L	<0.10	2.50	2.56	102.4	12/08/03
Sulfate, SO4	300.0	WATER	mg/L	<0.30	10.0	9.82	98.2	12/08/03
ALKALINITY	2320B	WATER	mg/L	<1.0	55.0	59.4	108.0	12/04/03
pH	150.1	WATER		5.36	7.42	7.39	99.6	12/04/03
Spec. Cond.	120.1	WATER	umhos/cm	0.700	494	497	100.6	11/25/03
Eh (mV)	2580	WATER	mV	+225	+228	+238	104.4	11/25/03
INORGANIC CARBON	415.1	WATER	mg/L	<1.0	30.0	29.3	97.7	12/01/03
Sulfide	376.1	WATER	mg/L	<1.0	2.00	2.20	110.0	11/25/03
TDS	160.1	WATER	mg/L	<10	525	460	87.6	11/25/03
Turbidity	180.1	WATER	NTU'S	0.075	13.1	12.5	95.4	12/01/03

LEGEND:

LCS = Laboratory Control Sample

LCS %R = LCS Percent Recovery

N/A = Not Applicable

SVL ANALYTICAL, INC.

Quality Control Report
Part II Duplicate and Spike Analysis

Client :GeoSyntec

SVL JOB No: 108796

			QC SAMPLE ID			Duplicate or MSD		Matrix Spike			Analysis
st	Method	Matrix		Units	Result	Found	RPD%	Result	SPK ADD	%R	Date
As	200.7	WATERG	1	mg/L	<0.010	<0.010	UDL	0.967	1.00	96.7	12/09/03
As	200.7	WATERG	2	mg/L	<0.010	<0.010	UDL	0.942	1.00	94.2	12/09/03
Ca	200.7	WATERG	1	mg/L	113	111	1.8	131	20.0	90.0	12/09/03
Cr	200.7	WATERG	1	mg/L	<0.0060	<0.0060	UDL	0.940	1.00	94.0	12/09/03
Cr	200.7	WATERG	2	mg/L	<0.0060	<0.0060	UDL	0.922	1.00	92.2	12/09/03
Fe	200.7	WATERG	1	mg/L	0.163	0.148	9.6	10.4	10.0	102.4	12/09/03
Fe	200.7	WATERG	2	mg/L	<0.020	<0.020	UDL	10.3	10.0	103.0	12/09/03
K	200.7	WATERG	1	mg/L	2.7	2.6	3.8	34.1	30.0	104.7	12/09/03
Mg	200.7	WATERG	1	mg/L	43.7	42.8	2.1	62.0	20.0	91.5	12/09/03
Mn	200.7	WATERG	1	mg/L	0.0060	0.0061	1.7	1.02	1.00	101.4	12/09/03
Mn	200.7	WATERG	2	mg/L	<0.0020	<0.0020	UDL	1.01	1.00	101.0	12/09/03
Na	200.7	WATERG	1	mg/L	4.57	4.46	2.4	24.5	20.0	99.7	12/09/03
Pb	200.7	WATERG	1	mg/L	<0.0050	<0.0050	UDL	0.942	1.00	94.2	12/09/03
Pb	200.7	WATERG	2	mg/L	<0.0050	<0.0050	UDL	0.958	1.00	95.8	12/09/03
SiO2	200.7	WATERG	1	mg/L	23.3	22.7	2.6	33.9	10.7	99.1	12/09/03
SiO2	200.7	WATERG	2	mg/L	22.6	22.4	0.9	31.2	10.7	80.4	12/09/03
Cl	300.0	WATERG	1	mg/L	5.34	5.34	0.0	7.40	2.00	103.0	12/08/03
F	300.0	WATERG	1	mg/L	0.11	<0.10	200.0	1.94	2.00	91.5	12/08/03
SO4	300.0	WATERG	1	mg/L	63.1	63.9	1.3	90.8	25.0	110.8	12/08/03
ALK	2320B	WATERG	1	mg/L	399	397	0.5	N/A	N/A	N/A	12/04/03
pH	150.1	WATERG	1		8.11	8.09	0.2	N/A	N/A	N/A	12/04/03
COND	120.1	WATERG	1	umhos/c	834	843	1.1	N/A	N/A	N/A	11/25/03
Eh	2580	WATERG	1	mV	+248	+239	3.7	N/A	N/A	N/A	11/25/03
ORG18D	415.1	WATERG	1	mg/L	93.2	95.2	2.1	122	50.0	57.6	12/01/03
S^{-2}	376.1	WATERG	1	mg/L	<1.0		N/A		N/A	N/A	11/25/03
TDS	160.1	WATERG	1	mg/L	475	485	2.1	N/A	N/A	N/A	11/25/03
B	180.1	WATERG	1	NTU'S	0.415	0.432	4.0	N/A	N/A	N/A	12/01/03

LEGEND:

RPD% = (|SAM - DUP|/((SAM + DUP)/2) * 100) UDL = Both SAM & DUP not detected. *Result or *Found: Interference required dilution.

RPD% = (|SPK - MSD|/((SPK + MSD)/2) * 100) M in Duplicate/MSD column indicates MSD.

SPIKE ADD column, A = Post Digest Spike; %R = Percent Recovery N/A = Not Analyzed; R > 4S = Result more than 4X the Spike Added

Control limits for MS recoveries apply only if the spike add is at least 0.25 times the concentration of the analyte in the sample.

Control limits for the RPD apply only if the concentration of the analyte in the sample is at least five times the reporting limit.

QC Sample 1: SVL SAM No.: 366667 Client Sample ID: GW-1 ^T

QC Sample 2: SVL SAM No.: 366673 Client Sample ID: GW-1 ^D

SVL ANALYTICAL

te: #1/4 1 liter - unpreserved
#2/4 1 liter w/ ZnAc
#3/4 500 ml - none ⇒ requires lab filter + HNO_3
#4/4 500 ml - HNO_3

CHAIN OF CUSTODY RECORD

Page 1 of 1

Client: GEO SYNTEC
Contact: BRIAN PETTY
Address: 200 Main St. #150
HUNTINGTON BEACH, CA 92648
Phone Number: 714-969-0800
FAX Number: 714-969-0820

NOTES:
1) Ensure proper container packaging.
2) Ship samples promptly following collection.
3) Designate Sample Reject Disposition*
PO#:
Project Name: Lehigh

Table 1. -- Matrix Type
1 = Surface Water, [✓ 2 = Ground Water]
3 = Soil/Sediment, 4 = Rinsate, 5 = Oil
6 = Waste, 7 = Other (Specify) ____

Samplers Signature: G. Hoy / SP

FOR SVL USE ONLY
SVL JOB # 108796

Lab Name: SVL Analytical, Inc. (208) 784-1258 FAX (208) 783-0891
Address: One Government Gulch, Kellogg, ID 83837-0929

Sample ID	Collection		Miscellaneous				Preservative(s)						Analyses Required									Comments
	Date	Time	Collected by: (Init.)	Matrix Type From Table 1	No. of Containers	Sample Filtered ? Y/N	Unpreserved (Ice Only)	HNO3	HCL	H2SO4	NAOH	Other (Specify) ZnAC	turbidity	pH, Redox	Dis & Tot As, Pb, Cr	metals & Sil (200.7)	(incl dis. Mang, Fe)	eH (2580), Alk (2320)	Dic (415.1) SEC (120.1)	Sulfide (376.1), TDS	maj cat/an (200.7, 300.0)	
1. GW-1	11/21/03	0930	gh/sp	2	4	N	2	1				1	X	X	X	X	X	X	X	X	X	
2. GW-2		10:00																				
3. GW-3		0900																				
4. GW-4		0800																				
5. GW-5		1030																				2 vials HNO_3
GW-15		1030																				2 vials HNO_3
7.																						
8.																						
9.																						
10.																						

Relinquished by: Gretchen Hoy Date: Time: Received by: Date: 11/24/03 Time: 10:00
Relinquished by: Date: Time: Received by: Date: Time:

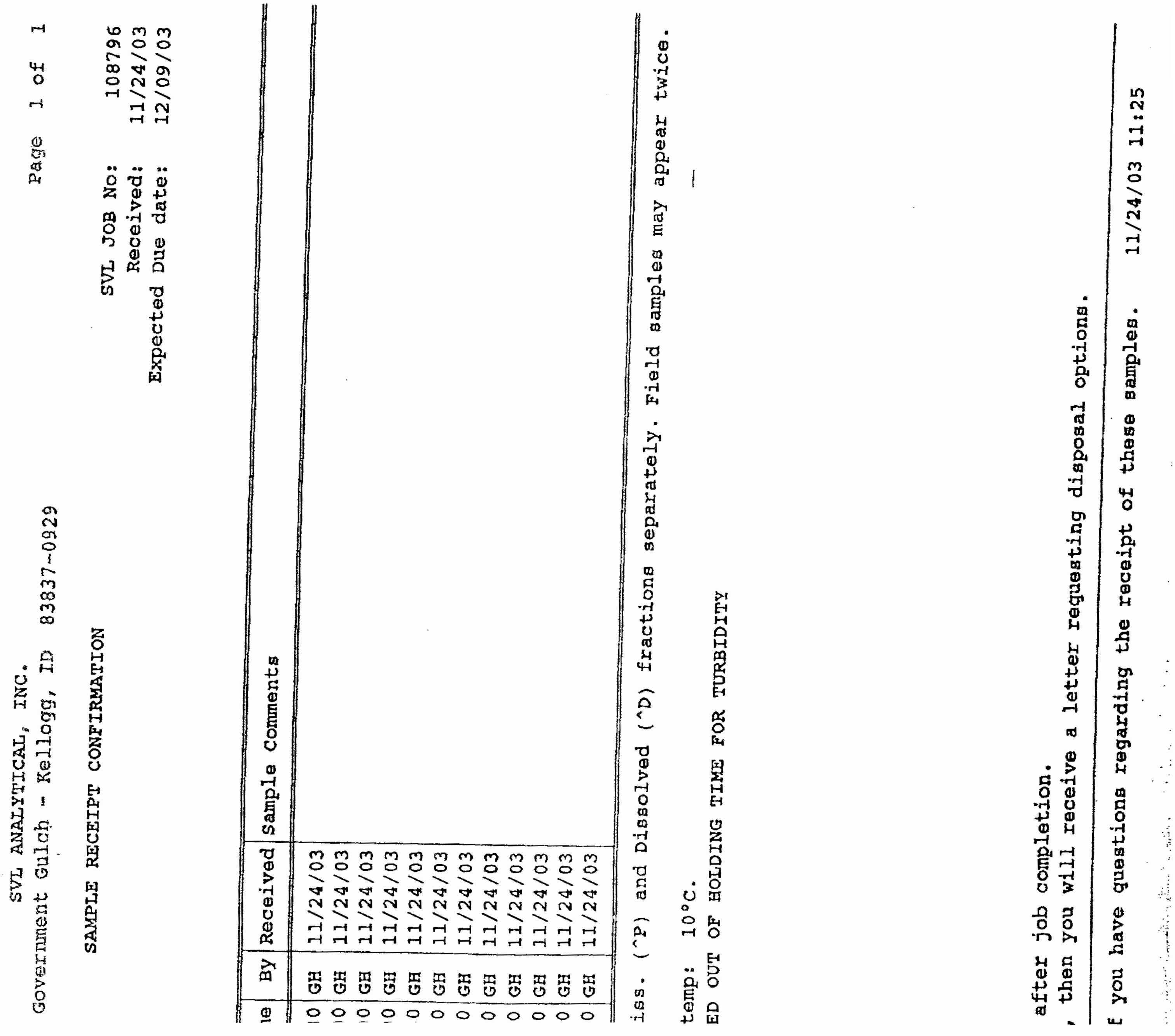
* Sample Reject: [ ] Return [ ] Dispose [ ] Store (30 Days)

White: LAB COPY Yellow: CUSTOMER COPY SVL-COC 12/95

TRANSMISSION VERIFICATION REPORT

TIME : 11/24/2003 13:34
NAME : SVL ANALYTICAL
FAX : 2087830891
TEL : 2087841258
SER.# : BROF3J496071

DATE,TIME	11/24 13:34
FAX NO./NAME	917149690820
DURATION	00:00:26
PAGE(S)	01
RESULT	OK
MODE	FINE ECM



SVL ANALYTICAL, INC.
Government Gulch - Kellogg, ID 83837-0929

Page 1 of 1

SAMPLE RECEIPT CONFIRMATION

SVL JOB No: 108796
Received: 11/24/03
Expected Due date: 12/09/03

le	By	Received	Sample Comments
0	GH	11/24/03	
0	GH	11/24/03	
0	GH	11/24/03	
0	GH	11/24/03	
0	GH	11/24/03	
0	GH	11/24/03	
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0	GH	11/24/03	
0	GH	11/24/03	
0	GH	11/24/03	
0	GH	11/24/03	
0	GH	11/24/03	

iss. (^P) and Dissolved (^D) fractions separately. Field samples may appear twice.

temp: 10°C.

ED OUT OF HOLDING TIME FOR TURBIDITY

after job completion.
, then you will receive a letter requesting disposal options.

f you have questions regarding the receipt of these samples. 11/24/03 11:25

SVL ANALYTICAL, INC.
Certificate: CA CERTIFICATE NO. 2080
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: PM-2
Sample Collected: 11/22/03 15:00
Sample Receipt : 11/24/03
Date of Report : 12/11/03

SVL JOB: 108797
SAMPLE: 366696
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	300	mg CaCO3/L		2320B	11/25/03
T	Spec. Cond.	1090	umhos/cm		120.1	11/25/03
T	Eh (mV)	+193	mV		2580	11/25/03
T	pH	8.23			150.1	11/25/03
T	TDS	642	mg/L		160.1	11/25/03
T	Calcium	70.7	mg/L		200.7	12/09/03
T	Chloride	17.6	mg/L	5	300.0	12/08/03
T	Fluoride	<0.50*	mg/L	5	300.0	12/08/03
T	Potassium	134	mg/L	5	200.7	12/10/03
T	Magnesium	19.0	mg/L		200.7	12/09/03
T	Sodium	25.6	mg/L		200.7	12/09/03
T	Sulfide	<1.0	mg/L		376.1	11/25/03
T	Sulfate, SO4	175	mg/L	10	300.0	12/08/03
T	Arsenic	<0.010	mg/L		200.7	12/09/03
T	Iron	0.923	mg/L		200.7	12/09/03
T	Manganese	0.274	mg/L		200.7	12/09/03
T	Silica	16.4	mg/L		200.7	12/09/03
T	INORGANIC CARBON	72.1	mg/L		415.1	12/02/03
D	Arsenic	<0.010	mg/L		200.7	12/10/03
D	Iron	<0.020	mg/L		200.7	12/10/03
D	Manganese	0.0544	mg/L		200.7	12/10/03
D	Silica	13.8	mg/L		200.7	12/10/03

CalcTDS:	661	TDS/Cond:	CATION SUM:	9.67meq/L	BALANCE
TDS/CalcTDS:	1.0	CalcTDS/Cond:	ANION SUM:	10.13meq/L	-2.32%

Filtered fraction: 366716
*Elevated detection limit due to matrix interference.

Reviewed By: Kirby Gray Date 12/11/03
12/11/03 11:00

SVL ANALYTICAL, INC.
Certificate: CA CERTIFICATE NO. 2080
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: PM-3
Sample Collected: 11/23/03 12:45
Sample Receipt : 11/24/03
Date of Report : 12/11/03

SVL JOB: 108797
SAMPLE: 366698
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	151	mg CaCO3/L		2320B	11/25/03
T	Spec. Cond.	1750	umhos/cm		120.1	12/10/03
T	Eh (mV)	+193	mV		2580	11/25/03
T	pH	8.03			150.1	11/25/03
T	TDS	1160	mg/L		160.1	11/25/03
T	Calcium	167	mg/L		200.7	12/09/03
T	Chloride	108	mg/L	50	300.0	12/08/03
T	Fluoride	<1.0*	mg/L	10	300.0	12/08/03
T	Potassium	143	mg/L	5	200.7	12/10/03
T	Magnesium	43.0	mg/L		200.7	12/09/03
T	Sodium	75.6	mg/L		200.7	12/09/03
T	Sulfide	<1.0	mg/L		376.1	11/25/03
T	Sulfate, SO4	465	mg/L	50	300.0	12/08/03
T	Arsenic	<0.010	mg/L		200.7	12/09/03
T	Iron	0.804	mg/L		200.7	12/09/03
T	Manganese	0.786	mg/L		200.7	12/09/03
T	Silica	15.7	mg/L		200.7	12/09/03
T	INORGANIC CARBON	70.9	mg/L		415.1	12/02/03
D	Arsenic	<0.010	mg/L		200.7	12/10/03
D	Iron	<0.020	mg/L		200.7	12/10/03
D	Manganese	0.717	mg/L		200.7	12/10/03
D	Silica	13.3	mg/L		200.7	12/10/03

CalcTDS:	1130	TDS/Cond:	CATION SUM:	18.91meq/L	BALANCE
TDS/CalcTDS:	1.0	CalcTDS/Cond:	ANION SUM:	15.75meq/L	9.12%

Filtered fraction: 366718
*Elevated detection limit due to matrix interference.

Reviewed By: Kirby Gray Date 12/11/03
12/11/03 11:00

SVL ANALYTICAL, INC.
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891
Certificate: CA CERTIFICATE NO. 2080

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: PM-4
Sample Collected: 11/23/03 13:05
Sample Receipt : 11/24/03
Date of Report : 12/11/03

SVL JOB: 108797
SAMPLE: 366699
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	1510	mg CaCO3/L		2320B	11/25/03
T	Spec. Cond.	7190	umhos/cm		120.1	11/25/03
T	Eh (mV)	-218	mV		2580	11/25/03
T	pH	11.70			150.1	11/25/03
T	TDS	4130	mg/L		160.1	11/25/03
T	Calcium	7.53	mg/L		200.7	12/09/03
T	Chloride	93.5	mg/L	100	300.0	12/08/03
T	Fluoride	1.36	mg/L	10	300.0	12/09/03
T	Potassium	2050	mg/L	100	200.7	12/10/03
T	Magnesium	1.48	mg/L		200.7	12/09/03
T	Sodium	122	mg/L		200.7	12/09/03
T	Sulfide	2.70	mg/L		376.1	11/25/03
T	Sulfate, SO4	1020	mg/L	100	300.0	12/08/03
T	Arsenic	0.118	mg/L		200.7	12/09/03
T	Iron	3.56	mg/L		200.7	12/09/03
T	Manganese	0.0948	mg/L		200.7	12/09/03
T	Silica	55.5	mg/L		200.7	12/09/03
T	INORGANIC CARBON	129	mg/L		415.1	12/02/03
D	Arsenic	0.101	mg/L		200.7	12/10/03
D	Iron	0.480	mg/L		200.7	12/10/03
D	Manganese	0.0122	mg/L		200.7	12/10/03
D	Silica	45.8	mg/L		200.7	12/10/03

CalcTDS: 4330 TDS/Cond:
TDS/CalcTDS: 1.0 CalcTDS/Cond:

CATION SUM: 58.40meq/L
ANION SUM: 54.06meq/L

BALANCE
3.86%

Filtered fraction: 366719

Reviewed By: Kirby Gray Date 12/11/03
12/11/03 11:00

SVL ANALYTICAL, INC.
Certificate: CA CERTIFICATE NO. 2080
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: PM-5
Sample Collected: 11/22/03 15:45
Sample Receipt : 11/24/03
Date of Report : 12/11/03

SVL JOB: 108797
SAMPLE: 366697
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	817	mg CaCO3/L		2320B	11/25/03
T	Spec. Cond.	6390	umhos/cm		120.1	11/25/03
T	Eh (mV)	+121	mV		2580	11/25/03
T	pH	9.69			150.1	11/25/03
T	TDS	3660	mg/L		160.1	11/25/03
T	Calcium	29.5	mg/L		200.7	12/09/03
T	Chloride	1190	mg/L	200	300.0	12/08/03
T	Fluoride	<1.0*	mg/L	10	300.0	12/08/03
T	Potassium	539	mg/L	20	200.7	12/10/03
T	Magnesium	25.2	mg/L		200.7	12/09/03
T	Sodium	983	mg/L	20	200.7	12/10/03
T	Sulfide	<1.0	mg/L		376.1	11/25/03
T	Sulfate, SO4	612	mg/L	50	300.0	12/08/03
T	Arsenic	<0.010	mg/L		200.7	12/09/03
T	Iron	0.211	mg/L		200.7	12/09/03
T	Manganese	0.0690	mg/L		200.7	12/09/03
T	Silica	18.9	mg/L		200.7	12/09/03
T	INORGANIC CARBON	137	mg/L		415.1	12/02/03
D	Arsenic	0.034	mg/L		200.7	12/10/03
D	Iron	0.217	mg/L		200.7	12/10/03
D	Manganese	0.0153	mg/L		200.7	12/10/03
D	Silica	25.7	mg/L		200.7	12/10/03

CalcTDS:	3930	TDS/Cond:	CATION SUM:	60.11meq/L	BALANCE
TDS/CalcTDS:	0.9	CalcTDS/Cond:	ANION SUM:	62.63meq/L	-2.05%

Filtered fraction: 366717
*Elevated detection limit due to matrix interference.

Reviewed By:______________________ Date 12/11/03
12/11/03 11:00

SVL ANALYTICAL, INC. Certificate: CA CERTIFICATE NO. 2080
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: PM-6
Sample Collected: 12/02/03 12:30
Sample Receipt : 12/03/03
Date of Report : 12/18/03

SVL JOB: 108900
SAMPLE: 367593
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	1860	mg CaCO3/L		2320B	12/04/03
T	Spec. Cond.	8200	umhos/cm		120.1	12/04/03
T	Eh (mV)	+45.1	mV		2580	12/08/03
T	pH	11.69			150.1	12/04/03
T	TDS	5390	mg/L		160.1	12/04/03
T	Calcium	24.5	mg/L		200.7	12/17/03
T	Chloride	50.1	mg/L	10	300.0	12/12/03
T	Fluoride	1.13	mg/L	10	300.0	12/12/03
T	Potassium	2790	mg/L	50	200.7	12/17/03
T	Magnesium	0.951	mg/L		200.7	12/17/03
T	Sodium	149	mg/L		200.7	12/17/03
T	Sulfide	<1.0	mg/L		376.1	12/05/03
T	Sulfate, SO4	1380	mg/L	100	300.0	12/12/03
T	Arsenic	0.323	mg/L		200.7	12/17/03
T	Iron	2.01	mg/L		200.7	12/17/03
T	Manganese	0.0510	mg/L		200.7	12/17/03
T	Silica	138	mg/L	50	200.7	12/17/03
T	INORGANIC CARBON	161	mg/L		415.1	12/05/03
D	Arsenic	0.326	mg/L		200.7	12/17/03
D	Iron	0.180	mg/L		200.7	12/17/03
D	Manganese	0.0075	mg/L		200.7	12/17/03
D	Silica	139	mg/L	50	200.7	12/17/03

CalcTDS:	5870	TDS/Cond:	CATION SUM:	79.23meq/L	BALANCE
TDS/CalcTDS:	0.9	CalcTDS/Cond:	ANION SUM:	67.52meq/L	7.98%

Filtered fraction: 367595

Reviewed By: Kirby Gray Date 12/18/03

12/18/03 14:10

SVL ANALYTICAL, INC.
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891
Certificate: CA CERTIFICATE NO. 2080

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: PM-7
Sample Collected: 11/22/03 9:30
Sample Receipt : 11/24/03
Date of Report : 12/11/03

SVL JOB: 108797
SAMPLE: 366690
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	1030	mg CaCO3/L		2320B	11/25/03
T	Spec. Cond.	3550	umhos/cm		120.1	11/25/03
T	Eh (mV)	+156	mV		2580	11/25/03
T	pH	8.28			150.1	11/25/03
T	TDS	2390	mg/L		160.1	11/25/03
T	Calcium	438	mg/L		200.7	12/09/03
T	Chloride	225	mg/L	25	300.0	12/08/03
T	Fluoride	1.34	mg/L	10	300.0	12/08/03
T	Potassium	502	mg/L	20	200.7	12/10/03
T	Magnesium	75.3	mg/L		200.7	12/09/03
T	Sodium	270	mg/L		200.7	12/09/03
T	Sulfide	<1.0	mg/L		376.1	11/25/03
T	Sulfate, SO4	541	mg/L	25	300.0	12/08/03
T	Arsenic	0.476	mg/L		200.7	12/09/03
T	Iron	458	mg/L		200.7	12/09/03
T	Manganese	15.3	mg/L		200.7	12/09/03
T	Silica	117	mg/L		200.7	12/09/03
T	INORGANIC CARBON	204	mg/L		415.1	12/02/03
D	Arsenic	<0.010	mg/L		200.7	12/10/03
D	Iron	7.02	mg/L		200.7	12/10/03
D	Manganese	1.20	mg/L		200.7	12/10/03
D	Silica	17.2	mg/L		200.7	12/10/03

CalcTDS:	3310	TDS/Cond:	CATION SUM:	69.90meq/L	BALANCE
TDS/CalcTDS:	0.7	CalcTDS/Cond:	ANION SUM:	38.32meq/L	29.18%

Filtered fraction: 366710

Reviewed By: Kirby Gray Date 12/11/03

12/11/03 11:00

SVL ANALYTICAL, INC.
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Certificate: CA CERTIFICATE NO. 2080

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: PM-8
Sample Collected: 11/22/03 9:00
Sample Receipt : 11/24/03
Date of Report : 12/11/03

SVL JOB: 108797
SAMPLE: 366689
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	947	mg CaCO3/L		2320B	11/25/03
T	Spec. Cond.	5620	umhos/cm		120.1	11/25/03
T	Eh (mV)	+56.3	mV		2580	11/25/03
T	pH	9.76			150.1	11/25/03
T	TDS	3170	mg/L		160.1	11/25/03
T	Calcium	17.9	mg/L		200.7	12/09/03
T	Chloride	1030	mg/L	200	300.0	12/08/03
T	Fluoride	<1.0*	mg/L	10	300.0	12/08/03
T	Potassium	672	mg/L	20	200.7	12/10/03
T	Magnesium	20.1	mg/L		200.7	12/09/03
T	Sodium	818	mg/L	20	200.7	12/10/03
T	Sulfide	1.40	mg/L		376.1	11/25/03
T	Sulfate, SO4	359	mg/L	50	300.0	12/08/03
T	Arsenic	0.021	mg/L		200.7	12/09/03
T	Iron	0.716	mg/L		200.7	12/09/03
T	Manganese	0.0146	mg/L		200.7	12/09/03
T	Silica	24.7	mg/L		200.7	12/09/03
T	INORGANIC CARBON	145	mg/L		415.1	12/02/03
D	Arsenic	0.029	mg/L		200.7	12/10/03
D	Iron	0.393	mg/L		200.7	12/10/03
D	Manganese	0.0110	mg/L		200.7	12/10/03
D	Silica	22.4	mg/L		200.7	12/10/03

CalcTDS:	3550	TDS/Cond:	CATION SUM:	55.35meq/L	BALANCE
TDS/CalcTDS:	0.9	CalcTDS/Cond:	ANION SUM:	55.45meq/L	-0.09%

Filtered fraction: 366709
*Elevated detection limit due to matrix interference.

Reviewed By: ______________________ Date 12/11/03
12/11/03 11:00

SVL ANALYTICAL, INC.
Certificate: CA CERTIFICATE NO. 2080
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: PM-9
Sample Collected: 12/02/03 12:00
Sample Receipt : 12/03/03
Date of Report : 12/18/03

SVL JOB: 108900
SAMPLE: 367594
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	438	mg CaCO3/L		2320B	12/04/03
T	Spec. Cond.	4600	umhos/cm		120.1	12/04/03
T	Eh (mV)	+150	mV		2580	12/08/03
T	pH	8.40			150.1	12/04/03
T	TDS	2260	mg/L		160.1	12/04/03
T	Calcium	38.2	mg/L		200.7	12/17/03
T	Chloride	997	mg/L	20	300.0	12/12/03
T	Fluoride	<1.0*	mg/L		300.0	12/12/03
T	Potassium	358	mg/L	10	200.7	12/17/03
T	Magnesium	40.4	mg/L		200.7	12/17/03
T	Sodium	636	mg/L	10	200.7	12/17/03
T	Sulfide	<1.0	mg/L		376.1	12/05/03
T	Sulfate, SO4	142	mg/L	10	300.0	12/12/03
T	Arsenic	0.015	mg/L		200.7	12/17/03
T	Iron	1.05	mg/L		200.7	12/17/03
T	Manganese	0.472	mg/L		200.7	12/17/03
T	Silica	9.28	mg/L		200.7	12/17/03
T	INORGANIC CARBON	101	mg/L		415.1	12/05/03
D	Arsenic	0.017	mg/L		200.7	12/17/03
D	Iron	0.420	mg/L		200.7	12/17/03
D	Manganese	0.434	mg/L		200.7	12/17/03
D	Silica	8.48	mg/L		200.7	12/17/03

CalcTDS: 2500	TDS/Cond:	CATION SUM:	42.16meq/L	BALANCE
TDS/CalcTDS: 0.9	CalcTDS/Cond:	ANION SUM:	39.84meq/L	2.83%

Filtered fraction: 367596
*Elevated detection limit due to matrix interference.

Reviewed By: Kirby Gray Date 12/18/03
12/18/03 15:38

SVL ANALYTICAL, INC.
Certificate: CA CERTIFICATE NO. 2080
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: PM10
Sample Collected: 11/21/03 12:00
Sample Receipt : 11/24/03
Date of Report : 12/11/03

SVL JOB: 108797
SAMPLE: 366681
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	766	mg CaCO3/L		2320B	11/25/03
T	Spec. Cond.	2300	umhos/cm		120.1	11/25/03
T	Eh (mV)	+299	mV		2580	11/25/03
T	pH	7.35			150.1	11/25/03
T	TDS	1580	mg/L		160.1	11/25/03
T	Calcium	99.3	mg/L		200.7	12/09/03
T	Chloride	105	mg/L	25	300.0	12/08/03
T	Fluoride	<1.0*	mg/L	10	300.0	12/08/03
T	Potassium	490	mg/L	20	200.7	12/10/03
T	Magnesium	10.2	mg/L		200.7	12/09/03
T	Sodium	79.8	mg/L		200.7	12/09/03
T	Sulfide	<1.0	mg/L		376.1	11/25/03
T	Sulfate, SO4	236	mg/L	10	300.0	12/08/03
T	Arsenic	<0.010	mg/L		200.7	12/09/03
T	Iron	20.6	mg/L		200.7	12/09/03
T	Manganese	2.95	mg/L		200.7	12/09/03
T	Silica	18.3	mg/L		200.7	12/09/03
T	INORGANIC CARBON	201	mg/L		415.1	12/02/03
D	Arsenic	<0.010	mg/L		200.7	12/09/03
D	Iron	9.24	mg/L		200.7	12/09/03
D	Manganese	2.73	mg/L		200.7	12/09/03
D	Silica	16.6	mg/L		200.7	12/09/03

CalcTDS:	1550	TDS/Cond:		CATION SUM:	23.08meq/L	BALANCE
TDS/CalcTDS:	1.0	CalcTDS/Cond:		ANION SUM:	23.17meq/L	-0.19%

Filtered fraction: 366701
*Elevated detection limit due to matrix interference.

Reviewed By: Kirby Gray Date 12/11/03
12/11/03 10:59

SVL ANALYTICAL, INC.
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891
Certificate: CA CERTIFICATE NO. 2080

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: PM11
Sample Collected: 11/21/03 12:30
Sample Receipt : 11/24/03
Date of Report : 12/11/03

SVL JOB: 108797
SAMPLE: 366682
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	783	mg CaCO3/L		2320B	11/25/03
T	Spec. Cond.	1700	umhos/cm		120.1	11/25/03
T	Eh (mV)	+80.7	mV		2580	11/25/03
T	pH	7.09			150.1	11/25/03
T	TDS	1030	mg/L		160.1	11/25/03
T	Calcium	166	mg/L		200.7	12/09/03
T	Chloride	37.4	mg/L	5	300.0	12/08/03
T	Fluoride	<0.20*	mg/L	2	300.0	12/08/03
T	Potassium	228	mg/L	10	200.7	12/10/03
T	Magnesium	14.0	mg/L		200.7	12/09/03
T	Sodium	36.0	mg/L		200.7	12/09/03
T	Sulfide	<1.0	mg/L		376.1	11/25/03
T	Sulfate, SO4	76.1	mg/L	5	300.0	12/08/03
T	Arsenic	<0.010	mg/L		200.7	12/09/03
T	Iron	41.8	mg/L		200.7	12/09/03
T	Manganese	4.50	mg/L		200.7	12/09/03
T	Silica	22.5	mg/L		200.7	12/09/03
T	INORGANIC CARBON	242	mg/L		415.1	12/02/03
D	Arsenic	<0.010	mg/L		200.7	12/09/03
D	Iron	31.8	mg/L		200.7	12/09/03
D	Manganese	4.36	mg/L		200.7	12/09/03
D	Silica	21.3	mg/L		200.7	12/09/03

CalcTDS:	1160	TDS/Cond:	CATION SUM:	19.79meq/L	BALANCE	
TDS/CalcTDS:	0.9	CalcTDS/Cond:	ANION SUM:	18.28meq/L	3.97%	

Filtered fraction: 366702
*Elevated detection limit due to matrix interference.

Reviewed By: ______________________ Date 12/11/03
12/11/03 10:59

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: PM-12
Sample Collected: 11/21/03 13:30
Sample Receipt : 11/24/03
Date of Report : 12/11/03

SVL JOB: 108797
SAMPLE: 366684
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	949	mg CaCO3/L		2320B	11/25/03
T	Spec. Cond.	2970	umhos/cm		120.1	11/25/03
T	Eh (mV)	+236	mV		2580	11/25/03
T	pH	7.61			150.1	11/25/03
T	TDS	1850	mg/L		160.1	11/25/03
T	Calcium	78.7	mg/L		200.7	12/09/03
T	Chloride	109	mg/L	25	300.0	12/08/03
T	Fluoride	<0.50*	mg/L	5	300.0	12/08/03
T	Potassium	728	mg/L	20	200.7	12/10/03
T	Magnesium	10.3	mg/L		200.7	12/09/03
T	Sodium	90.7	mg/L		200.7	12/09/03
T	Sulfide	<1.0	mg/L		376.1	11/25/03
T	Sulfate, SO4	297	mg/L	25	300.0	12/08/03
T	Arsenic	<0.010	mg/L		200.7	12/09/03
T	Iron	26.2	mg/L		200.7	12/09/03
T	Manganese	2.75	mg/L		200.7	12/09/03
T	Silica	24.1	mg/L		200.7	12/09/03
T	INORGANIC CARBON	217	mg/L		415.1	12/02/03
D	Arsenic	<0.010	mg/L		200.7	12/09/03
D	Iron	3.74	mg/L		200.7	12/09/03
D	Manganese	2.58	mg/L		200.7	12/09/03
D	Silica	21.3	mg/L		200.7	12/09/03

CalcTDS: 1970	TDS/Cond:	CATION SUM:	28.61meq/L	BALANCE
TDS/CalcTDS: 0.9	CalcTDS/Cond:	ANION SUM:	28.21meq/L	0.70%

Filtered fraction: 366704
*Elevated detection limit due to matrix interference.

Reviewed By: Kirby Gray Date 12/11/03
12/11/03 11:00

SVL ANALYTICAL, INC.

Certificate: CA CERTIFICATE NO. 2080

One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: PM-13
Sample Collected: 11/21/03 14:00
Sample Receipt : 11/24/03
Date of Report : 12/11/03

SVL JOB: 108797
SAMPLE: 366685
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	707	mg CaCO3/L		2320B	11/25/03
T	Spec. Cond.	2070	umhos/cm		120.1	11/25/03
T	Eh (mV)	+134	mV		2580	11/25/03
T	pH	9.70			150.1	11/25/03
T	TDS	1270	mg/L		160.1	11/25/03
T	Calcium	13.9	mg/L		200.7	12/09/03
T	Chloride	91.2	mg/L	25	300.0	12/08/03
T	Fluoride	<0.50*	mg/L	5	300.0	12/08/03
T	Potassium	572	mg/L	20	200.7	12/10/03
T	Magnesium	3.88	mg/L		200.7	12/09/03
T	Sodium	67.6	mg/L		200.7	12/09/03
T	Sulfide	<1.0	mg/L		376.1	11/25/03
T	Sulfate, SO4	91.5	mg/L	5	300.0	12/08/03
T	Arsenic	<0.010	mg/L		200.7	12/09/03
T	Iron	1.04	mg/L		200.7	12/09/03
T	Manganese	0.235	mg/L		200.7	12/09/03
T	Silica	6.70	mg/L		200.7	12/09/03
T	INORGANIC CARBON	124	mg/L		415.1	12/02/03
D	Arsenic	<0.010	mg/L		200.7	12/09/03
D	Iron	0.730	mg/L		200.7	12/09/03
D	Manganese	0.219	mg/L		200.7	12/09/03
D	Silica	6.13	mg/L		200.7	12/09/03

CalcTDS:	1280	TDS/Cond:	CATION SUM:	18.67meq/L	BALANCE
TDS/CalcTDS:	1.0	CalcTDS/Cond:	ANION SUM:	18.61meq/L	0.16%

Filtered fraction: 366705
*Elevated detection limit due to matrix interference.

Reviewed By:______________ Date 12/11/03
12/11/03 11:00

SVL ANALYTICAL, INC.

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One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: PM-14
Sample Collected: 11/21/03 15:30
Sample Receipt : 11/24/03
Date of Report : 12/11/03

SVL JOB: 108797
SAMPLE: 366687
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	394	mg CaCO3/L		2320B	11/25/03
T	Spec. Cond.	1410	umhos/cm		120.1	11/25/03
T	Eh (mV)	+201	mV		2580	11/25/03
T	pH	9.14			150.1	11/25/03
T	TDS	878	mg/L		160.1	11/25/03
T	Calcium	13.3	mg/L		200.7	12/09/03
T	Chloride	57.5	mg/L	10	300.0	12/08/03
T	Fluoride	1.06	mg/L	10	300.0	12/08/03
T	Potassium	364	mg/L	10	200.7	12/10/03
T	Magnesium	2.10	mg/L		200.7	12/09/03
T	Sodium	43.6	mg/L		200.7	12/09/03
T	Sulfide	<1.0	mg/L		376.1	11/25/03
T	Sulfate, SO4	135	mg/L	10	300.0	12/08/03
T	Arsenic	<0.010	mg/L		200.7	12/09/03
T	Iron	0.948	mg/L		200.7	12/09/03
T	Manganese	0.154	mg/L		200.7	12/09/03
T	Silica	5.13	mg/L		200.7	12/09/03
T	INORGANIC CARBON	82.7	mg/L		415.1	12/02/03
D	Arsenic	<0.010	mg/L		200.7	12/09/03
D	Iron	0.670	mg/L		200.7	12/09/03
D	Manganese	0.154	mg/L		200.7	12/09/03
D	Silica	4.87	mg/L		200.7	12/09/03

CalcTDS: 867 TDS/Cond:
TDS/CalcTDS: 1.0 CalcTDS/Cond:

CATION SUM: 12.11meq/L
ANION SUM: 12.36meq/L

BALANCE -1.02%

Filtered fraction: 366707

Reviewed By: Kirby Gray Date 12/11/03
12/11/03 11:00

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CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: PM-15
Sample Collected: 11/22/03 13:30
Sample Receipt : 11/24/03
Date of Report : 12/11/03

SVL JOB: 108797
SAMPLE: 366693
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	2370	mg CaCO3/L		2320B	11/25/03
T	Spec. Cond.	12000	umhos/cm		120.1	11/25/03
T	Eh (mV)	-211	mV		2580	11/25/03
T	pH	12.20			150.1	11/25/03
T	TDS	6590	mg/L		160.1	11/25/03
T	Calcium	3.31	mg/L		200.7	12/09/03
T	Chloride	50.7	mg/L	10	300.0	12/08/03
T	Fluoride	1.27	mg/L	10	300.0	12/08/03
T	Potassium	3190	mg/L	100	200.7	12/10/03
T	Magnesium	<0.040	mg/L		200.7	12/09/03
T	Sodium	121	mg/L		200.7	12/09/03
T	Sulfide	1.50	mg/L		376.1	11/25/03
T	Sulfate, SO4	1730	mg/L	100	300.0	12/08/03
T	Arsenic	0.133	mg/L		200.7	12/09/03
T	Iron	0.191	mg/L		200.7	12/09/03
T	Manganese	<0.0020	mg/L		200.7	12/09/03
T	Silica	102	mg/L		200.7	12/09/03
T	INORGANIC CARBON	156	mg/L		415.1	12/02/03
D	Arsenic	0.143	mg/L		200.7	12/10/03
D	Iron	0.198	mg/L		200.7	12/10/03
D	Manganese	0.0023	mg/L		200.7	12/10/03
D	Silica	102	mg/L		200.7	12/10/03

CalcTDS:	6770	TDS/Cond:	CATION SUM:	87.05meq/L	BALANCE
TDS/CalcTDS:	1.0	CalcTDS/Cond:	ANION SUM:	84.73meq/L	1.35%

Filtered fraction: 366713

Reviewed By: Kirby Gray

Date 12/11/03
12/11/03 11:00

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Certificate: CA CERTIFICATE NO. 2080
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: PM-17
Sample Collected: 11/21/03 16:00
Sample Receipt : 11/24/03
Date of Report : 12/11/03

SVL JOB: 108797
SAMPLE: 366688
TOT/DIS
Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	1300	mg CaCO3/L		2320B	11/25/03
T	Spec. Cond.	6370	umhos/cm		120.1	11/25/03
T	Eh (mV)	-225	mV		2580	11/25/03
T	pH	12.00			150.1	11/25/03
T	TDS	2800	mg/L		160.1	11/25/03
T	Calcium	4.85	mg/L		200.7	12/09/03
T	Chloride	32.3	mg/L	10	300.0	12/08/03
T	Fluoride	1.34	mg/L	10	300.0	12/08/03
T	Potassium	1590	mg/L	50	200.7	12/10/03
T	Magnesium	<0.040	mg/L		200.7	12/09/03
T	Sodium	61.4	mg/L		200.7	12/09/03
T	Sulfide	2.30	mg/L		376.1	11/25/03
T	Sulfate, SO4	719	mg/L	50	300.0	12/08/03
T	Arsenic	0.079	mg/L		200.7	12/09/03
T	Iron	0.899	mg/L		200.7	12/09/03
T	Manganese	0.0118	mg/L		200.7	12/09/03
T	Silica	47.0	mg/L		200.7	12/09/03
T	INORGANIC CARBON	83.5	mg/L		415.1	12/02/03
D	Arsenic	0.071	mg/L		200.7	12/09/03
D	Iron	0.622	mg/L		200.7	12/09/03
D	Manganese	0.0114	mg/L		200.7	12/09/03
D	Silica	44.6	mg/L		200.7	12/09/03

CalcTDS:	3310	TDS/Cond:	CATION SUM:	43.63meq/L	BALANCE
TDS/CalcTDS:	0.8	CalcTDS/Cond:	ANION SUM:	41.96meq/L	1.95%

Filtered fraction: 366708

Reviewed By: Kirby Gray Date 12/11/03
12/11/03 11:00

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One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: PM-18
Sample Collected: 11/22/03 12:45
Sample Receipt : 11/24/03
Date of Report : 12/11/03

SVL JOB: 108797
SAMPLE: 366691
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	1990	mg CaCO3/L		2320B	11/25/03
T	Spec. Cond.	9170	umhos/cm		120.1	11/25/03
T	Eh (mV)	-22.4	mV		2580	11/25/03
T	pH	11.84			150.1	11/25/03
T	TDS	5510	mg/L		160.1	11/25/03
T	Calcium	4.31	mg/L		200.7	12/09/03
T	Chloride	41.1	mg/L	10	300.0	12/08/03
T	Fluoride	1.12	mg/L	10	300.0	12/08/03
T	Potassium	2740	mg/L	100	200.7	12/10/03
T	Magnesium	<0.040	mg/L		200.7	12/09/03
T	Sodium	120	mg/L		200.7	12/09/03
T	Sulfide	<1.0	mg/L		376.1	11/25/03
T	Sulfate, SO4	1650	mg/L	100	300.0	12/08/03
T	Arsenic	0.198	mg/L		200.7	12/09/03
T	Iron	0.161	mg/L		200.7	12/09/03
T	Manganese	0.0041	mg/L		200.7	12/09/03
T	Silica	73.3	mg/L		200.7	12/09/03
T	INORGANIC CARBON	188	mg/L		415.1	12/02/03
D	Arsenic	0.194	mg/L		200.7	12/10/03
D	Iron	0.119	mg/L		200.7	12/10/03
D	Manganese	0.0033	mg/L		200.7	12/10/03
D	Silica	74.8	mg/L		200.7	12/10/03

CalcTDS:	5940	TDS/Cond:	CATION SUM:	75.54meq/L	BALANCE
TDS/CalcTDS:	0.9	CalcTDS/Cond:	ANION SUM:	75.29meq/L	0.17%

Filtered fraction: 366711

Reviewed By: Kirby Gray Date 12/11/03
12/11/03 11:00

SVL ANALYTICAL, INC.
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891
Certificate: CA CERTIFICATE NO. 2080

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: PM-19
Sample Collected: 11/22/03 13:15
Sample Receipt : 11/24/03
Date of Report : 12/11/03

SVL JOB: 108797
SAMPLE: 366692
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	2170	mg CaCO3/L		2320B	11/25/03
T	Spec. Cond.	10900	umhos/cm		120.1	11/25/03
T	Eh (mV)	-82.2	mV		2580	11/25/03
T	pH	12.20			150.1	11/25/03
T	TDS	5830	mg/L		160.1	11/25/03
T	Calcium	1.98	mg/L		200.7	12/09/03
T	Chloride	43.4	mg/L	10	300.0	12/08/03
T	Fluoride	1.15	mg/L	10	300.0	12/08/03
T	Potassium	2920	mg/L	100	200.7	12/10/03
T	Magnesium	<0.040	mg/L		200.7	12/09/03
T	Sodium	111	mg/L		200.7	12/09/03
T	Sulfide	<1.0	mg/L		376.1	11/25/03
T	Sulfate, SO4	1680	mg/L	100	300.0	12/08/03
T	Arsenic	0.144	mg/L		200.7	12/09/03
T	Iron	0.146	mg/L		200.7	12/09/03
T	Manganese	0.0206	mg/L		200.7	12/09/03
T	Silica	101	mg/L		200.7	12/09/03
T	INORGANIC CARBON	150	mg/L		415.1	12/02/03
D	Arsenic	0.153	mg/L		200.7	12/10/03
D	Iron	0.147	mg/L		200.7	12/10/03
D	Manganese	0.0197	mg/L		200.7	12/10/03
D	Silica	102	mg/L		200.7	12/10/03

CalcTDS:	6320	TDS/Cond:	CATION SUM:	79.64meq/L	BALANCE
TDS/CalcTDS:	0.9	CalcTDS/Cond:	ANION SUM:	79.64meq/L	0.00%

Filtered fraction: 366712

Reviewed By: Kirby Gray Date 12/11/03

12/11/03 11:00

SVL ANALYTICAL, INC.
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Certificate: CA CERTIFICATE NO. 2080

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: PM-20
Sample Collected: 11/22/03 14:00
Sample Receipt : 11/24/03
Date of Report : 12/11/03

SVL JOB: 108797
SAMPLE: 366694
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	997	mg CaCO3/L		2320B	11/25/03
T	Spec. Cond.	4490	umhos/cm		120.1	11/25/03
T	Eh (mV)	+147	mV		2580	11/25/03
T	pH	8.64			150.1	11/25/03
T	TDS	2900	mg/L		160.1	11/25/03
T	Calcium	80.7	mg/L		200.7	12/09/03
T	Chloride	30.4	mg/L	10	300.0	12/08/03
T	Fluoride	1.17	mg/L	10	300.0	12/08/03
T	Potassium	1130	mg/L	50	200.7	12/10/03
T	Magnesium	19.2	mg/L		200.7	12/09/03
T	Sodium	85.5	mg/L		200.7	12/09/03
T	Sulfide	<1.0	mg/L		376.1	11/25/03
T	Sulfate, SO4	1030	mg/L	100	300.0	12/08/03
T	Arsenic	<0.010	mg/L		200.7	12/09/03
T	Iron	0.576	mg/L		200.7	12/09/03
T	Manganese	0.658	mg/L		200.7	12/09/03
T	Silica	8.60	mg/L		200.7	12/09/03
T	INORGANIC CARBON	203	mg/L		415.1	12/02/03
D	Arsenic	<0.010	mg/L		200.7	12/10/03
D	Iron	0.257	mg/L		200.7	12/10/03
D	Manganese	0.544	mg/L		200.7	12/10/03
D	Silica	7.66	mg/L		200.7	12/10/03

CalcTDS:	2990	TDS/Cond:	CATION SUM:	38.31meq/L	BALANCE
TDS/CalcTDS:	1.0	CalcTDS/Cond:	ANION SUM:	42.22meq/L	-4.86%

Filtered fraction: 366714

Reviewed By: Kirby Gray Date 12/11/03
12/11/03 11:00

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Certificate: CA CERTIFICATE NO. 2080
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: PM-21
Sample Collected: 11/22/03 14:45
Sample Receipt : 11/24/03
Date of Report : 12/11/03

SVL JOB: 108797
SAMPLE: 366695
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	343	mg CaCO3/L		2320B	11/25/03
T	Spec. Cond.	2570	umhos/cm		120.1	11/25/03
T	Eh (mV)	+119	mV		2580	11/25/03
T	pH	9.72			150.1	11/25/03
T	TDS	1820	mg/L		160.1	11/25/03
T	Calcium	24.1	mg/L		200.7	12/09/03
T	Chloride	60.0	mg/L	10	300.0	12/08/03
T	Fluoride	1.14	mg/L	10	300.0	12/08/03
T	Potassium	633	mg/L	20	200.7	12/10/03
T	Magnesium	5.10	mg/L		200.7	12/09/03
T	Sodium	115	mg/L		200.7	12/09/03
T	Sulfide	<1.0	mg/L		376.1	11/25/03
T	Sulfate, SO4	673	mg/L	50	300.0	12/08/03
T	Arsenic	0.038	mg/L		200.7	12/09/03
T	Iron	0.628	mg/L		200.7	12/09/03
T	Manganese	0.0152	mg/L		200.7	12/09/03
T	Silica	16.0	mg/L		200.7	12/09/03
T	INORGANIC CARBON	59.2	mg/L		415.1	12/02/03
D	Arsenic	0.043	mg/L		200.7	12/10/03
D	Iron	0.284	mg/L		200.7	12/10/03
D	Manganese	0.0123	mg/L		200.7	12/10/03
D	Silica	14.0	mg/L		200.7	12/10/03

CalcTDS:	1760	TDS/Cond:		CATION SUM:	22.84meq/L	BALANCE
TDS/CalcTDS:	1.0	CalcTDS/Cond:		ANION SUM:	22.61meq/L	0.51%

Filtered fraction: 366715

Reviewed By: Kirby Gray Date 12/11/03
12/11/03 11:00

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CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: AVG-E
Sample Collected: 11/21/03 14:45
Sample Receipt : 11/24/03
Date of Report : 12/11/03

SVL JOB: 108797
SAMPLE: 366686
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	143	mg CaCO3/L		2320B	12/10/03
T	Spec. Cond.	503	umhos/cm		120.1	11/25/03
T	Eh (mV)	+273	mV		2580	11/25/03
T	pH	6.04			150.1	11/25/03
T	TDS	239	mg/L		160.1	11/25/03
T	Calcium	31.7	mg/L		200.7	12/09/03
T	Chloride	52.3	mg/L	10	300.0	12/08/03
T	Fluoride	<0.10	mg/L		300.0	12/08/03
T	Potassium	27.2	mg/L		200.7	12/10/03
T	Magnesium	6.69	mg/L		200.7	12/09/03
T	Sodium	37.5	mg/L		200.7	12/09/03
T	Sulfide	<1.0	mg/L		376.1	11/25/03
T	Sulfate, SO4	17.9	mg/L		300.0	12/08/03
T	Arsenic	<0.010	mg/L		200.7	12/09/03
T	Iron	1.90	mg/L		200.7	12/09/03
T	Manganese	0.490	mg/L		200.7	12/09/03
T	Silica	6.94	mg/L		200.7	12/09/03
T	INORGANIC CARBON	85.6	mg/L		415.1	12/02/03
D	Arsenic	<0.010	mg/L		200.7	12/09/03
D	Iron	0.664	mg/L		200.7	12/09/03
D	Manganese	0.454	mg/L		200.7	12/09/03
D	Silica	4.29	mg/L		200.7	12/09/03

CalcTDS:	276	TDS/Cond:	CATION SUM:	4.59meq/L	BALANCE	
TDS/CalcTDS:	0.9	CalcTDS/Cond:	ANION SUM:	4.71meq/L	-1.29%	

Filtered fraction: 366706

Reviewed By: Kirby Gray

Date 12/11/03
12/11/03 11:00

SVL ANALYTICAL, INC.
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891
Certificate: CA CERTIFICATE NO. 2080

CLIENT : GeoSyntec
PROJECT: LEHIGH
CLIENT SAMPLE ID: AVG-W
Sample Collected: 11/21/03 12:45
Sample Receipt : 11/24/03
Date of Report : 12/11/03

SVL JOB: 108797
SAMPLE: 366683
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	157	mg CaCO3/L		2320B	11/25/03
T	Spec. Cond.	444	umhos/cm		120.1	11/25/03
T	Eh (mV)	+249	mV		2580	11/25/03
T	pH	6.31			150.1	11/25/03
T	TDS	228	mg/L		160.1	11/25/03
T	Calcium	26.7	mg/L		200.7	12/09/03
T	Chloride	24.7	mg/L	5	300.0	12/08/03
T	Fluoride	<0.10	mg/L		300.0	12/08/03
T	Potassium	33.9	mg/L		200.7	12/10/03
T	Magnesium	8.33	mg/L		200.7	12/09/03
T	Sodium	22.6	mg/L		200.7	12/09/03
T	Sulfide	<1.0	mg/L		376.1	11/25/03
T	Sulfate, SO4	6.76	mg/L		300.0	12/08/03
T	Arsenic	<0.010	mg/L		200.7	12/09/03
T	Iron	2.16	mg/L		200.7	12/09/03
T	Manganese	0.573	mg/L		200.7	12/09/03
T	Silica	8.12	mg/L		200.7	12/09/03
T	INORGANIC CARBON	164	mg/L		415.1	12/02/03
D	Arsenic	<0.010	mg/L		200.7	12/09/03
D	Iron	0.382	mg/L		200.7	12/09/03
D	Manganese	0.534	mg/L		200.7	12/09/03
D	Silica	3.99	mg/L		200.7	12/09/03

CalcTDS:	235	TDS/Cond:	CATION SUM:	4.00meq/L	BALANCE
TDS/CalcTDS:	1.0	CalcTDS/Cond:	ANION SUM:	3.98meq/L	0.25%

Filtered fraction: 366703

Reviewed By: Kirby Gray Date 12/11/03
12/11/03 11:00

SVL ANALYTICAL, INC.

Quality Control Report
Part I Prep Blank and Laboratory Control Sample

Client :GeoSyntec

SVL JOB No: 108797

Analyte	Method	Matrix	Units	Prep Blank	True LCS	LCS Found	LCS %R	Analysis Date
Arsenic	200.7	WATER	mg/L	<0.010	1.00	0.970	97.0	12/09/03
Calcium	200.7	WATER	mg/L	<0.040	20.0	18.8	94.0	12/09/03
Iron	200.7	WATER	mg/L	<0.020	10.0	9.68	96.8	12/09/03
Potassium	200.7	WATER	mg/L	<1.0	30.0	30.4	101.3	12/10/03
Magnesium	200.7	WATER	mg/L	<0.040	20.0	18.8	94.0	12/09/03
Manganese	200.7	WATER	mg/L	<0.0020	1.00	0.989	98.9	12/09/03
Sodium	200.7	WATER	mg/L	<0.50	20.0	19.4	97.0	12/09/03
Silica	200.7	WATER	mg/L	<0.171	10.7	10.5	98.1	12/09/03
Chloride	300.0	WATER	mg/L	<0.20	5.00	4.83	96.6	12/08/03
Fluoride	300.0	WATER	mg/L	<0.10	2.50	2.54	101.6	12/08/03
Sulfate, SO4	300.0	WATER	mg/L	<0.30	10.0	9.41	94.1	12/08/03
ALKALINITY	2320B	WATER	mg/L	<1.0	55.0	59.4	108.0	11/25/03
pH	150.1	WATER		5.38	7.42	7.40	99.7	11/25/03
Spec. Cond.	120.1	WATER	umhos/cm	0.700	494	497	100.6	11/25/03
Eh (mV)	2580	WATER	mV	+225	+228	+238	104.4	11/25/03
INORGANIC CARBON	415.1	WATER	mg/L	<1.0	30.0	29.3	97.7	12/02/03
Sulfide	376.1	WATER	mg/L	<1.0	2.00	2.20	110.0	11/25/03
TDS	160.1	WATER	mg/L	<10	525	460	87.6	11/25/03

LEGEND:

LCS = Laboratory Control Sample　　LCS %R = LCS Percent Recovery　　N/A = Not Applicable

12/11/03 10:51

SVL ANALYTICAL, INC.

Quality Control Report
Part II Duplicate and Spike Analysis

Client :GeoSyntec

SVL JOB No: 108797

			QC SAMPLE ID			Duplicate or MSD		Matrix Spike			Analysis
est	Method	Matrix		Units	Result	Found	RPD%	Result	SPK ADD	%R	Date
As	200.7	WATERG	1	mg/L	<0.010	<0.010	UDL	1.03	1.00	103.0	12/09/03
As	200.7	WATERG	2	mg/L	0.198	N/A	N/A	1.22	1.00	102.2	12/09/03
As	200.7	WATERG	3	mg/L	<0.010	<0.010	UDL	0.987	1.00	98.7	12/09/03
As	200.7	WATERG	4	mg/L	0.194	N/A	N/A	1.20	1.00	100.6	12/10/03
Ca	200.7	WATERG	1	mg/L	99.3	99.3	0.0	119	20.0	98.5	12/09/03
Ca	200.7	WATERG	2	mg/L	4.31	N/A	N/A	22.5	20.0	91.0	12/09/03
Fe	200.7	WATERG	1	mg/L	20.6	20.7	0.5	29.8	10.0	92.0	12/09/03
Fe	200.7	WATERG	2	mg/L	0.161	N/A	N/A	9.65	10.0	94.9	12/09/03
Fe	200.7	WATERG	3	mg/L	9.24	9.00	2.6	18.3	10.0	90.6	12/09/03
Fe	200.7	WATERG	4	mg/L	0.119	N/A	N/A	9.40	10.0	92.8	12/10/03
K	200.7	WATERG	1	mg/L	490	489	0.2	524	30.0	113.3	12/10/03
K	200.7	WATERG	2	mg/L	2740	N/A	N/A	2790	30.0	R >4S	12/10/03
Mg	200.7	WATERG	1	mg/L	10.2	10.3	1.0	28.5	20.0	91.5	12/09/03
Mg	200.7	WATERG	2	mg/L	<0.040	N/A	N/A	18.2	20.0	91.0	12/09/03
Mn	200.7	WATERG	1	mg/L	2.95	2.95	0.0	3.89	1.00	94.0	12/09/03
Mn	200.7	WATERG	2	mg/L	0.0041	N/A	N/A	0.968	1.00	96.4	12/09/03
Mn	200.7	WATERG	3	mg/L	2.73	2.69	1.5	3.57	1.00	84.0	12/09/03
Mn	200.7	WATERG	4	mg/L	0.0033	N/A	N/A	0.940	1.00	93.7	12/10/03
Na	200.7	WATERG	1	mg/L	79.8	80.7	1.1	98.7	20.0	94.5	12/09/03
Na	200.7	WATERG	2	mg/L	120	N/A	N/A	141	20.0	105.0	12/09/03
SiO2	200.7	WATERG	1	mg/L	18.3	18.4	0.5	28.5	10.7	95.3	12/09/03
SiO2	200.7	WATERG	2	mg/L	73.3	N/A	N/A	86.8	10.7	R >4S	12/09/03
SiO2	200.7	WATERG	3	mg/L	16.6	16.4	1.2	25.7	10.7	85.0	12/09/03
SiO2	200.7	WATERG	4	mg/L	74.8	N/A	N/A	79.7	10.7	R >4S	12/10/03
Cl	300.0	WATERG	1	mg/L	105	105	0.0	154	50.0	98.0	12/08/03
Cl	300.0	WATERG	2	mg/L	41.1	N/A	N/A	62.2	20.0	105.5	12/08/03
	300.0	WATERG	1	mg/L	<1.0*	<1.0*	UDL	18.4	20.0	92.0	12/08/03
	300.0	WATERG	2	mg/L	1.12	N/A	N/A	18.3	20.0	85.9	12/08/03
SO4	300.0	WATERG	1	mg/L	236	229	3.0	354	125	94.4	12/08/03
SO4	300.0	WATERG	2	mg/L	1650	N/A	N/A	2230	500	116.0	12/08/03
ALK	2320B	WATERG	1	mg/L	766	757	1.2	N/A	N/A	N/A	11/25/03
pH	150.1	WATERG	1		7.35	7.40	0.7	N/A	N/A	N/A	11/25/03
COND	120.1	WATERG	1	umhos/c	2300	2310	0.4	N/A	N/A	N/A	11/25/03
Eh	2580	WATERG	1	mV	+299	+307	2.6	N/A	N/A	N/A	11/25/03
ORG18D	415.1	WATERG	1	mg/L	201	201	0.0	232	50.0	R >4S	12/02/03
ORG18D	415.1	WATERG	2	mg/L	188	N/A	N/A	220	50.0	64.0	12/02/03
TDS	160.1	WATERG	1	mg/L	1580	1360	15.0	N/A	N/A	N/A	11/25/03

LEGEND:

RPD% = (|SAM - DUP|/((SAM + DUP)/2) * 100) UDL = Both SAM & DUP not detected. *Result or *Found: Interference required dilution.

RPD% = (|SPK - MSD|/((SPK + MSD)/2) * 100) M in Duplicate/MSD column indicates MSD.

SPIKE ADD column, A = Post Digest Spike; %R = Percent Recovery N/A = Not Analyzed; R > 4S = Result more than 4X the Spike Added

Control limits for MS recoveries apply only if the spike add is at least 0.25 times the concentration of the analyte in the sample.

Control limits for the RPD apply only if the concentration of the analyte in the sample is at least five times the reporting limit.

QC Sample 1: SVL SAM No.: 366681 Client Sample ID: PM10 ^T

QC Sample 2: SVL SAM No.: 366691 Client Sample ID: PM-18 ^T

QC Sample 3: SVL SAM No.: 366701 Client Sample ID: PM10 ^D

QC Sample 4: SVL SAM No.: 366711 Client Sample ID: PM-18 ^D

12/11/03 10:52

SVL ANALYTICAL, INC.

Quality Control Report
Part I Prep Blank and Laboratory Control Sample

Client :GeoSyntec SVL JOB No: 108900

Analyte	Method	Matrix	Units	Prep Blank	True——LCS	——Found	LCS %R	Analysis Date
Arsenic	200.7	WATER	mg/L	<0.010	1.00	1.03	103.0	12/17/03
Calcium	200.7	WATER	mg/L	<0.040	20.0	19.1	95.5	12/17/03
Iron	200.7	WATER	mg/L	<0.020	10.0	10.3	103.0	12/17/03
Potassium	200.7	WATER	mg/L	<1.0	30.0	31.9	106.3	12/17/03
Magnesium	200.7	WATER	mg/L	<0.040	20.0	20.9	104.5	12/17/03
Manganese	200.7	WATER	mg/L	<0.0020	1.00	1.01	101.0	12/17/03
Sodium	200.7	WATER	mg/L	<0.50	20.0	20.0	100.0	12/17/03
Silica	200.7	WATER	mg/L	<0.171	10.7	11.5	107.5	12/17/03
Chloride	300.0	WATER	mg/L	<0.20	5.00	4.76	95.2	12/12/03
Fluoride	300.0	WATER	mg/L	<0.10	2.50	2.40	96.0	12/12/03
Sulfate, SO4	300.0	WATER	mg/L	<0.30	10.0	9.50	95.0	12/12/03
ALKALINITY	2320B	WATER	mg/L	<1.0	55.0	59.4	108.0	12/04/03
pH	150.1	WATER		5.36	7.42	7.39	99.6	12/04/03
Spec. Cond.	120.1	WATER	umhos/cm	0.200	494	495	100.2	12/04/03
Eh (mV)	2580	WATER	mV	N/A	+228	+228	100.0	12/08/03
INORGANIC CARBON	415.1	WATER	mg/L	<1.0	30.0	30.2	100.7	12/05/03
Sulfide	376.1	WATER	mg/L	<1.0	2.00	1.90	95.0	12/05/03
TDS	160.1	WATER	mg/L	<10	237	268	113.1	12/04/03

LEGEND:

LCS = Laboratory Control Sample LCS %R = LCS Percent Recovery N/A = Not Applicable

12/18/03 14:10

SVL ANALYTICAL, INC.

Quality Control Report
Part II Duplicate and Spike Analysis

Client :GeoSyntec

SVL JOB No: 108900

			QC SAMPLE ID			Duplicate or MSD		Matrix Spike			Analysis
st	Method	Mtx		Units	Result	Found	RPD%	Result	SPK ADD	%R	Date
As	200.7	W	1	mg/L	0.015	0.013	14.3	1.15	1.00	113.5	12/17/03
As	200.7	W	2	mg/L	0.017	0.022	25.6	1.10	1.00	108.3	12/17/03
Ca	200.7	W	1	mg/L	38.2	37.7	1.3	58.2	20.0	100.0	12/17/03
Fe	200.7	W	1	mg/L	1.05	1.03	1.9	11.5	10.0	104.5	12/17/03
Fe	200.7	W	2	mg/L	0.420	0.425	1.2	11.0	10.0	105.8	12/17/03
K	200.7	W	1	mg/L	358	374	4.4	396	30.0	R >4S	12/17/03
Mg	200.7	W	1	mg/L	40.4	39.6	2.0	64.0	20.0	118.0	12/17/03
Mn	200.7	W	1	mg/L	0.472	0.466	1.3	1.51	1.00	103.8	12/17/03
Mn	200.7	W	2	mg/L	0.434	0.433	0.2	1.37	1.00	93.6	12/17/03
Na	200.7	W	1	mg/L	636	667	4.8	677	20.0	R >4S	12/17/03
SiO2	200.7	W	1	mg/L	9.28	8.86	4.6	21.2	10.7	111.4	12/17/03
SiO2	200.7	W	2	mg/L	8.48	8.46	0.2	19.4	10.7	102.1	12/17/03
Cl	300.0	W	3	mg/L	50.1	50.3	0.4	70.8	20.0	103.5	12/12/03
F	300.0	W	3	mg/L	1.13	1.13	0.0	18.2	20.0	85.4	12/12/03
SO4	300.0	W	3	mg/L	1380	1440	4.3	1980	500	120.0	12/12/03
ALK	2320B	W	3	mg/L	1860	1830	1.6	N/A	N/A	N/A	12/04/03
pH	150.1	W	3		11.69	11.50	1.6	N/A	N/A	N/A	12/04/03
COND	120.1	W	3	umhos/c	8200	8670	5.6	N/A	N/A	N/A	12/04/03
Eh	2580	W	3	mV	+45.1	+45.1	0.0	N/A	N/A	N/A	12/08/03
ORG18D	415.1	W	3	mg/L	161	165	2.5	204	50.0	86.0	12/05/03
S-²	376.1	W	3	mg/L	<1.0		N/A		N/A	N/A	12/05/03
TDS	160.1	W	3	mg/L	5390	5230	3.0	N/A	N/A	N/A	12/04/03

LEGEND:

RPD% = (|SAM - DUP|/((SAM + DUP)/2) * 100) UDL = Both SAM & DUP not detected. *Result or *Found: Interference required dilution.

ᴰᴰD% = (|SPK - MSD|/((SPK + MSD)/2) * 100) M in Duplicate/MSD column indicates MSD.

KE ADD column, A = Post Digest Spike; %R = Percent Recovery N/A = Not Analyzed

= Accuracy of spike %R reduced; sample analyte conc. is disproportionate to spike. The LCS %R was acceptable.

QC limits for MS recoveries apply only if the spike is at least 1/4 the concentration of the analyte in the sample.

Control limits for the RPD apply only if the concentration of the analyte in the sample is at least five times the reporting limit.

QC Sample 1:	SVL SAM No.: 367594	Client Sample ID: PM-9	^T
QC Sample 2:	SVL SAM No.: 367596	Client Sample ID: PM-9	^D
QC Sample 3:	SVL SAM No.: 367593	Client Sample ID: PM-6	^T

N : #1/4 [illegible]
#2/4 1 liter - ZnAc
#3/4 500 ml - requires lab filter & HNO3
#4/4 500 ml HNO3

CHAIN OF CUSTODY RECORD

Page 1 of 2

Client: Geo Syntec
Contact: Brian Petty
Address: 2100 Main St, #150
Huntington Beach, CA 92648
Phone Number: 714-969-0800
FAX Number: 714-969-0820

NOTES:

1) Ensure proper container packaging.
2) Ship samples promptly following collection.
* 3) Designate Sample Reject Disposition

PO#:
Project Name: Lehigh

Table 1. -- Matrix Type

1 = Surface Water, [✓ 2] = Ground Water
3 = Soil/Sediment, 4 = Rinsate, 5 = Oil
6 = Waste, 7 = Other (Specify) ________

FOR SVL USE ONLY
SVL JOB # 108797

Samplers Signature: g. Hoy / SP

Lab Name: SVL Analytical, Inc. (208) 784-1258 FAX (208) 783-0891
Address: One Government Gulch, Kellogg, ID 83837-0929

Sample ID	Collection		Miscellaneous				Preservative(s)						Analyses Required									Comments
	Date	Time	Collected by: (Init.)	Matrix Type From Table 1	No. of Containers	Sample Filtered ? Y/N	Unpreserved (Ice Only)	HNO3	HCL	H2SO4	NAOH	Other (Specify) ZnAc	metals + Si (200.7)	inc dis As, mang, Fe	pH (150.1), eH (2580)	Alk (2320) DIC (415.1)	SEC (120.1), TDS	Sulfide (376.1)	major cat/an (200.7, 300)			
1. PM10	11/21/03	1200	gh/sp	2	4	N	2	1					x	x	x	x	x	x	x			
2. PM 11	11/21	1230																				
3. AVG-W	11/21	1245																				
PM-12	11/21	1330																				
5. PM-13	11/21	1400																				
6. AVG-E	11/21	1445																				
7. PM-14	11/21	1530																				
8. PM-17	11/21	1600																				2 vials HNO3
9. PM-8	11/22	0900																				
10. PM-7	11/22	0930																				

Relinquished by: Gretchen E. Hoy	Date:	Time:	Received by: Heidi Baines	Date: 11-24-03	Time: 10:00
Relinquished by:	Date:	Time:	Received by:	Date:	Time:

* Sample Reject: [ ] Return [ ] Dispose [ ] Store (30 Days)

White: LAB COPY Yellow: CUSTOMER COPY SVL-COC 12/95

SVL ANALYTICAL

Note: #1/4 1 liter - NONE
#2/4 1 liter - ZnAC
#3/4 500 ml - requires lab filter + HNO3
#4/4 500 ml - HNO3

CHAIN OF CUSTODY RECORD

Page 2 of 2

Client: Geo Syntec
Contact: Brian Petty
Address: 2100 Main St #150
Huntington Beach, CA 92648
Phone Number: 714-969-0800
FAX Number: 714-969-0820

NOTES:

1) Ensure proper container packaging.
2) Ship samples promptly following collection.
* 3) Designate Sample Reject Disposition

PO#:
Project Name: Lehigh

Table 1. -- Matrix Type
1 = Surface Water, 2 = Ground Water
3 = Soil/Sediment, 4 = Rinsate, 5 = Oil
6 = Waste, 7 = Other (Specify) ______

Samplers Signature: G. Hoy / SP

FOR SVL USE ONLY
SVL JOB # 108797

Lab Name: SVL Analytical, Inc. (208) 784-1258 FAX (208) 783-0891
Address: One Government Gulch, Kellogg, ID 83837-0929

Sample ID	Collection		Miscellaneous				Preservative(s)						Analyses Required									Comments
	Date	Time	Collected by: (Init.)	Matrix Type From Table 1	No. of Containers	Sample Filtered ? Y/N	Unpreserved (Ice Only)	HNO3	HCL	H2SO4	NAOH	Other (Specify) ZnAc	metals+Si (200.7)	Ind dis As, Mang, Fe	pH(150.1), eH(2580)	Alk(2320) DIC(415.1)	SEC(120.1), TDS	Sulfide(376.1)	maj cat an (200.7, 300.0)			
1. PM-18	11/22	12:45	gh/sp	2	4	N	2	1				1	X	X	X	X	X	X	X			2 vials HNO3
2. PM-19	11/22	13:15																				2 vials HNO3
3. PM-15	11/22	13:30																				2 vials HNO3
4. PM-20	11/22	14:00																				
5. PM-21	11/22	14:45																				
6. PM-2	11/22	1500																				well going dry
7. PM-5	11/22	1545																				well went dry
8. PM-3	11/23	12:45																				well going dry
9. PM-4	11/23	13:05																				
10. ~~[illegible]~~ PM-1	~~11/23~~	14:15																				2 vials HNO3

Relinquished by: Gretchen E. Hoy Date: Time: Received by: Nadi Barnes Date: 11-24-03 Time: 10:00
Relinquished by: Date: Time: Received by: Date: Time:

* Sample Reject: [ ] Return [ ] Dispose [ ] Store (30 Days)

White: LAB COPY Yellow: CUSTOMER COPY

SVL ANALYTICAL

CHAIN OF CUSTODY RECORD

Page 1 of 1

Client: GeoSyntec
Contact: Brian Petty
Address: 2100 Main St #150
Huntington Beach CA 92648
Phone Number: 714-969-0800
FAX Number: 714-969-0820

NOTES:
1) Ensure proper container packaging.
2) Ship samples promptly following collection.
* 3) Designate Sample Reject Disposition
PO#:
Project Name: Lehigh

Table 1. -- Matrix Type
1 = Surface Water, 2 = Ground Water
3 = Soil/Sediment, 4 = Rinsate, 5 = Oil
6 = Waste, 7 = Other (Specify) ________

Samplers Signature:

FOR SVL USE ONLY
SVL JOB # 108900

Lab Name: SVL Analytical, Inc. (208) 784-1258 FAX (208) 783-0891
Address: One Government Gulch, Kellogg, ID 83837-0929

	Sample ID	Collection		Miscellaneous				Preservative(s)						Analyses Required	Comments
		Date	Time	Collected by: (Init.)	Matrix Type From Table 1	No. of Containers	Sample Filtered ? Y/N	Unpreserved (Ice Only)	HNO3	HCL	H2SO4	NAOH	Other (Specify) ZnAc	Same list as previously submitted "PM" wells.	SVL to filter for Diss. Metals BM done 12/3/03
1.	PM-6	12/2/03	1230	SP	2	4	N	2	1				1		
2.	PM-9	12/2/03	1200	SP	2	4	N	2	1				1		
3.	~~PM-10 SP~~			~~SP~~	~~2~~	~~4~~	~~N~~	~~2~~	~~1~~				~~1~~		
4.															
5.															
6.															
7.															
8.															
9.															
10.															

Relinquished by: Date: 12/3/03 Time: 11:15 Received by: Gloria Burmeister Date: 12-3-03 Time: 11:15
Relinquished by: Date: Time: Received by: Date: Time:

* Sample Reject: [ ] Return [ ] Dispose [ ] Store (30 Days)

White: LAB COPY Yellow: CUSTOMER COPY SVL-COC 12/95

TRANSMISSION VERIFICATION REPORT

TIME : 12/03/2003 18:33
NAME : SVL ANALYTICAL
FAX : 2087830891
TEL : 2087841258
SER.# : BROF3J496071

DATE,TIME	12/03 18:32
FAX NO./NAME	917149690820
DURATION	00:00:23
PAGE(S)	01
RESULT	OK
MODE	FINE ECM

SVL ANALYTICAL, INC.
;overnment Gulch - Kellogg, ID 83837-0929

SAMPLE RECEIPT CONFIRMATION

SVL JOB No: 108900
Received: 12/03/03
Expected Due date: 12/17/03

e	By	Received	Sample Comments
)	SP	12/03/03	
)	SP	12/03/03	
)		12/03/03	
)	SP	12/03/03	

iss. (^P) and Dissolved (^D) fractions separately. Field samples may appear twice.

temp: 9°C.
& PRESERVE FOR DISSOLVED METALS

after job completion.
, then you will receive a letter requesting disposal options.

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f you have questions regarding the receipt of these samples. 12/03/03 12:29

SVL ANALYTICAL, INC.

Certificate: WA CERTIFICATE NO. C074

One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: HR0196-12
CLIENT SAMPLE ID: MW-7
Sample Collected: 3/31/04
Sample Receipt : 4/01/04
Date of Report : 4/16/04

SVL JOB: 110277
SAMPLE: 378316
TOT/DIS

Matrix: WATER

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	243	mg CaCO3/L		2320B	4/09/04
T	Spec. Cond.	385	umhos/cm		120.1	4/08/04
T	Eh (mV)	+105	mV		2580	4/08/04
T	pH	7.88			150.1	4/01/04
T	TDS	244	mg/L		160.1	4/06/04
T	Turbidity	0.209	NTU'S		180.1	4/02/04
T	Calcium	51.6	mg/L		200.7	4/13/04
T	Chloride	0.54	mg/L		300.0	4/07/04
T	Fluoride	0.15	mg/L		300.0	4/07/04
T	Potassium	3.4	mg/L		200.7	4/13/04
T	Magnesium	21.2	mg/L		200.7	4/13/04
T	Sodium	4.98	mg/L		200.7	4/13/04
T	Sulfide	<1.0	mg/L		376.1	4/06/04
T	Sulfate, SO4	24.5	mg/L		300.0	4/07/04
T	Arsenic	<0.010	mg/L		200.7	4/13/04
T	Chromium	<0.0060	mg/L		200.7	4/13/04
T	Iron	<0.020	mg/L		200.7	4/13/04
T	Manganese	0.0091	mg/L		200.7	4/13/04
T	Lead	<0.0050	mg/L		200.7	4/13/04
T	Silica	10.8	mg/L		200.7	4/13/04
T	DIS. INOR CARBON	54.5	mg/L		415.1	4/14/04
D	Arsenic	<0.010	mg/L		200.7	4/15/04
D	Chromium	<0.0060	mg/L		200.7	4/15/04
D	Iron	<0.020	mg/L		200.7	4/15/04
D	Manganese	0.0026	mg/L		200.7	4/15/04
D	Lead	<0.0050	mg/L		200.7	4/15/04
D	Silica	11.5	mg/L		200.7	4/15/04

CalcTDS:	280	TDS/Cond:	CATION SUM:	4.62meq/L	BALANCE
TDS/CalcTDS:	0.9	CalcTDS/Cond:	ANION SUM:	5.40meq/L	-7.78%

Filtered fraction: 378322

Reviewed By: ______________________ Date 4/16/04

4/16/04 11:56

SVL ANALYTICAL, INC.
Certificate: WA CERTIFICATE NO. C074
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: HR0196-12
CLIENT SAMPLE ID: MW-8
Sample Collected: 3/31/04
Sample Receipt : 4/01/04
Date of Report : 4/16/04

SVL JOB: 110277
SAMPLE: 378317
TOT/DIS

Matrix: WATER

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	296	mg CaCO3/L		2320B	4/09/04
T	Spec. Cond.	716	umhos/cm		120.1	4/08/04
T	Eh (mV)	+130	mV		2580	4/08/04
T	pH	7.84			150.1	4/01/04
T	TDS	371	mg/L		160.1	4/06/04
T	Turbidity	46.4	NTU'S		180.1	4/02/04
T	Calcium	68.3	mg/L		200.7	4/15/04
T	Chloride	31.4	mg/L	5	300.0	4/08/04
T	Fluoride	0.21	mg/L		300.0	4/07/04
T	Potassium	30.6	mg/L		200.7	4/15/04
T	Magnesium	31.8	mg/L		200.7	4/15/04
T	Sodium	14.6	mg/L		200.7	4/15/04
T	Sulfide	<1.0	mg/L		376.1	4/06/04
T	Sulfate, SO4	41.7	mg/L	5	300.0	4/08/04
T	Arsenic	<0.010	mg/L		200.7	4/15/04
T	Chromium	<0.0060	mg/L		200.7	4/15/04
T	Iron	4.74	mg/L		200.7	4/15/04
T	Manganese	1.82	mg/L		200.7	4/15/04
T	Lead	<0.0050	mg/L		200.7	4/15/04
T	Silica	12.6	mg/L		200.7	4/15/04
T	DIS. INOR CARBON	71.4	mg/L		415.1	4/14/04
D	Arsenic	<0.010	mg/L		200.7	4/15/04
D	Chromium	<0.0060	mg/L		200.7	4/15/04
D	Iron	0.167	mg/L		200.7	4/15/04
D	Manganese	1.67	mg/L		200.7	4/15/04
D	Lead	<0.0050	mg/L		200.7	4/15/04
D	Silica	12.1	mg/L		200.7	4/15/04

CalcTDS: 432
TDS/CalcTDS: 0.9
TDS/Cond:
CalcTDS/Cond:

CATION SUM: 7.76meq/L
ANION SUM: 7.68meq/L

BALANCE 0.52%

Filtered fraction: 378323

Reviewed By: ______ Date 4/16/04

4/16/04 11:57

SVL ANALYTICAL, INC.
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891
Certificate: WA CERTIFICATE NO. C074

CLIENT : GeoSyntec
PROJECT: HR0196-12
CLIENT SAMPLE ID: MW-9
Sample Collected: 3/31/04
Sample Receipt : 4/01/04
Date of Report : 4/16/04

SVL JOB: 110277
SAMPLE: 378318
TOT/DIS

Matrix: WATER

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	1070	mg CaCO3/L		2320B	4/09/04
T	Spec. Cond.	5110	umhos/cm		120.1	4/08/04
T	Eh (mV)	-251	mV		2580	4/08/04
T	pH	12.23			150.1	4/01/04
T	TDS	C074	mg/L		160.1	4/06/04
T	Turbidity	2.14	NTU'S		180.1	4/02/04
T	Calcium	3.18	mg/L		200.7	4/15/04
T	Chloride	26.7	mg/L	10	300.0	4/07/04
T	Fluoride	1.51	mg/L	10	300.0	4/07/04
T	Potassium	1260	mg/L	20	200.7	4/15/04
T	Magnesium	<0.040	mg/L		200.7	4/15/04
T	Sodium	51.7	mg/L		200.7	4/15/04
T	Sulfide	2.6	mg/L		376.1	4/06/04
T	Sulfate, SO4	356	mg/L	25	300.0	4/08/04
T	Arsenic	0.084	mg/L		200.7	4/15/04
T	Chromium	<0.0060	mg/L		200.7	4/15/04
T	Iron	0.728	mg/L		200.7	4/15/04
T	Manganese	0.0093	mg/L		200.7	4/15/04
T	Lead	<0.0050	mg/L		200.7	4/15/04
T	Silica	56.6	mg/L		200.7	4/15/04
T	DIS. INOR CARBON	58.6	mg/L		415.1	4/14/04
D	Arsenic	0.065	mg/L		200.7	4/15/04
D	Chromium	<0.0060	mg/L		200.7	4/15/04
D	Iron	0.535	mg/L		200.7	4/15/04
D	Manganese	0.0081	mg/L		200.7	4/15/04
D	Lead	<0.0050	mg/L		200.7	4/15/04
D	Silica	56.0	mg/L		200.7	4/15/04

CalcTDS:	2480	TDS/Cond:	CATION SUM:	34.69meq/L	BALANCE	
TDS/CalcTDS:	0.8	CalcTDS/Cond:	ANION SUM:	29.58meq/L	7.95%	

Filtered fraction: 378324

Reviewed By:______________________ Date 4/16/04
4/16/04 11:57

SVL ANALYTICAL, INC.
Certificate: WA CERTIFICATE NO. C074
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: HR0196-12
CLIENT SAMPLE ID: MW-9D
Sample Collected: 3/31/04
Sample Receipt : 4/01/04
Date of Report : 4/16/04

SVL JOB: 110277
SAMPLE: 378319
TOT/DIS

Matrix: WATER

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	1000	mg CaCO3/L		2320B	4/09/04
T	Spec. Cond.	4730	umhos/cm		120.1	4/08/04
T	Eh (mV)	-242	mV		2580	4/08/04
T	pH	12.17			150.1	4/01/04
T	TDS	1990	mg/L		160.1	4/06/04
T	Turbidity	1.41	NTU'S		180.1	4/02/04
T	Calcium	3.08	mg/L		200.7	4/15/04
T	Chloride	26.0	mg/L	10	300.0	4/07/04
T	Fluoride	1.45	mg/L	10	300.0	4/07/04
T	Potassium	1130	mg/L	20	200.7	4/15/04
T	Magnesium	<0.040	mg/L		200.7	4/15/04
T	Sodium	45.3	mg/L		200.7	4/15/04
T	Sulfide	2.9	mg/L		376.1	4/06/04
T	Sulfate, SO4	310	mg/L	25	300.0	4/08/04
T	Arsenic	0.073	mg/L		200.7	4/15/04
T	Chromium	<0.0060	mg/L		200.7	4/15/04
T	Iron	0.711	mg/L		200.7	4/15/04
T	Manganese	0.0097	mg/L		200.7	4/15/04
T	Lead	<0.0050	mg/L		200.7	4/15/04
T	Silica	53.0	mg/L		200.7	4/15/04
T	DIS. INOR CARBON	55.8	mg/L		415.1	4/14/04
D	Arsenic	0.059	mg/L		200.7	4/15/04
D	Chromium	<0.0060	mg/L		200.7	4/15/04
D	Iron	0.518	mg/L		200.7	4/15/04
D	Manganese	0.0080	mg/L		200.7	4/15/04
D	Lead	<0.0050	mg/L		200.7	4/15/04
D	Silica	54.1	mg/L		200.7	4/15/04

CalcTDS:	2250	TDS/Cond:	CATION SUM:	31.08meq/L	BALANCE
TDS/CalcTDS:	0.9	CalcTDS/Cond:	ANION SUM:	27.30meq/L	6.47%

Filtered fraction: 378325

Reviewed By: ____________________ Date 4/16/04

4/16/04 11:57

SVL ANALYTICAL, INC.
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891
Certificate: WA CERTIFICATE NO. C074

CLIENT : GeoSyntec
PROJECT: HR0196-12
CLIENT SAMPLE ID: MW-11
Sample Collected: 3/31/04
Sample Receipt : 4/01/04
Date of Report : 4/16/04

SVL JOB: 110277
SAMPLE: 378320
TOT/DIS

Matrix: WATER

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	406	mg CaCO3/L		2320B	4/09/04
T	Spec. Cond.	1310	umhos/cm		120.1	4/08/04
T	Eh (mV)	+115	mV		2580	4/08/04
T	pH	7.82			150.1	4/01/04
T	TDS	507	mg/L		160.1	4/06/04
T	Turbidity	0.288	NTU'S		180.1	4/02/04
T	Calcium	132	mg/L		200.7	4/15/04
T	Chloride	8.14	mg/L		300.0	4/08/04
T	Fluoride	0.14	mg/L		300.0	4/08/04
T	Potassium	3.6	mg/L		200.7	4/15/04
T	Magnesium	46.9	mg/L		200.7	4/15/04
T	Sodium	5.57	mg/L		200.7	4/15/04
T	Sulfide	<1.0	mg/L		376.1	4/06/04
T	Sulfate, SO4	110	mg/L	5	300.0	4/08/04
T	Arsenic	<0.010	mg/L		200.7	4/15/04
T	Chromium	<0.0060	mg/L		200.7	4/15/04
T	Iron	1.03	mg/L		200.7	4/15/04
T	Manganese	0.0190	mg/L		200.7	4/15/04
T	Lead	<0.0050	mg/L		200.7	4/15/04
T	Silica	27.1	mg/L		200.7	4/15/04
T	DIS. INOR CARBON	95.2	mg/L		415.1	4/14/04
D	Arsenic	<0.010	mg/L		200.7	4/15/04
D	Chromium	<0.0060	mg/L		200.7	4/15/04
D	Iron	<0.020	mg/L		200.7	4/15/04
D	Manganese	<0.0020	mg/L		200.7	4/15/04
D	Lead	<0.0050	mg/L		200.7	4/15/04
D	Silica	25.9	mg/L		200.7	4/15/04

CalcTDS: 618 TDS/Cond:
TDS/CalcTDS: 0.8 CalcTDS/Cond:

CATION SUM: 10.82meq/L
ANION SUM: 10.64meq/L

BALANCE
0.84%

Filtered fraction: 378326

Reviewed By: ________________ Date 4/16/04

4/16/04 11:57

SVL ANALYTICAL, INC.
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891
Certificate: WA CERTIFICATE NO. C074

CLIENT : GeoSyntec
PROJECT: HR0196-12
CLIENT SAMPLE ID: MW-12
Sample Collected: 3/31/04
Sample Receipt : 4/01/04
Date of Report : 4/16/04

SVL JOB: 110277
SAMPLE: 378321
TOT/DIS

Matrix: WATER

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	689	mg CaCO3/L		2320B	4/09/04
T	Spec. Cond.	901	umhos/cm		120.1	4/08/04
T	Eh (mV)	+110	mV		2580	4/08/04
T	pH	8.18			150.1	4/01/04
T	TDS	680	mg/L		160.1	4/06/04
T	Turbidity	9.40	NTU'S		180.1	4/02/04
T	Calcium	75.8	mg/L		200.7	4/15/04
T	Chloride	188	mg/L	50	300.0	4/08/04
T	Fluoride	0.14	mg/L		300.0	4/08/04
T	Potassium	52.6	mg/L		200.7	4/15/04
T	Magnesium	37.8	mg/L		200.7	4/15/04
T	Sodium	114	mg/L		200.7	4/15/04
T	Sulfide	<1.0	mg/L		376.1	4/06/04
T	Sulfate, SO4	51.3	mg/L	5	300.0	4/08/04
T	Arsenic	<0.010	mg/L		200.7	4/15/04
T	Chromium	<0.0060	mg/L		200.7	4/15/04
T	Iron	2.22	mg/L		200.7	4/15/04
T	Manganese	1.61	mg/L		200.7	4/15/04
T	Lead	<0.0050	mg/L		200.7	4/15/04
T	Silica	11.7	mg/L		200.7	4/15/04
T	DIS. INOR CARBON	78.2	mg/L		415.1	4/14/04
D	Arsenic	<0.010	mg/L		200.7	4/15/04
D	Chromium	<0.0060	mg/L		200.7	4/15/04
D	Iron	0.035	mg/L		200.7	4/15/04
D	Manganese	1.54	mg/L		200.7	4/15/04
D	Lead	<0.0050	mg/L		200.7	4/15/04
D	Silica	11.2	mg/L		200.7	4/15/04

CalcTDS: 964 TDS/Cond:
TDS/CalcTDS: 0.7 CalcTDS/Cond:

CATION SUM: 13.40meq/L
ANION SUM: 20.15meq/L

BALANCE
-20.12%

Filtered fraction: 378327

Reviewed By: ____________________ Date 4/16/04
4/16/04 11:57

SVL ANALYTICAL, INC.

Quality Control Report
Part I Prep Blank and Laboratory Control Sample

Client :GeoSyntec

SVL JOB No: 110277

nalyte	Method	Matrix	Units	Prep Blank	True —LCS	— Found	LCS %R	Analysis Date
Arsenic	200.7	WATER	mg/L	<0.010	1.00	0.881	88.1	4/13/04
Calcium	200.7	WATER	mg/L	<0.040	20.0	18.9	94.5	4/13/04
Chromium	200.7	WATER	mg/L	<0.0060	1.00	0.943	94.3	4/13/04
Iron	200.7	WATER	mg/L	<0.020	10.0	9.13	91.3	4/13/04
Potassium	200.7	WATER	mg/L	<1.0	30.0	28.1	93.7	4/13/04
Magnesium	200.7	WATER	mg/L	<0.040	20.0	18.1	90.5	4/13/04
Manganese	200.7	WATER	mg/L	<0.0020	1.00	0.932	93.2	4/13/04
Sodium	200.7	WATER	mg/L	<0.50	20.0	18.8	94.0	4/13/04
Lead	200.7	WATER	mg/L	<0.0050	1.00	0.923	92.3	4/13/04
Silica	200.7	WATER	mg/L	<0.171	10.7	10.6	99.1	4/13/04
Chloride	300.0	WATER	mg/L	<0.20	5.00	4.84	96.8	4/07/04
Fluoride	300.0	WATER	mg/L	<0.10	2.50	2.39	95.6	4/07/04
Sulfate, SO4	300.0	WATER	mg/L	<0.30	10.0	9.60	96.0	4/07/04
ALKALINITY	2320B	WATER	mg/L	<1.0	20.5	23.4	114.1	4/09/04
pH	150.1	WATER		5.46	7.70	7.69	99.9	4/01/04
Spec. Cond.	120.1	WATER	umhos/cm	0.048	488	498	102.0	4/08/04
Eh (mV)	2580	WATER	mV	N/A	+228	+234	102.6	4/08/04
DIS. INOR CARBON	415.1	WATER	mg/L	<1.0	14.0	13.9	99.3	4/14/04
Sulfide	376.1	WATER	mg/L	<1.0	2.0	2.1	105.0	4/06/04
TDS	160.1	WATER	mg/L	<10	450	488	108.4	4/06/04
Turbidity	180.1	WATER	NTU'S	0.097	13.1	12.2	93.1	4/02/04

LEGEND:

LCS = Laboratory Control Sample

LCS %R = LCS Percent Recovery

N/A = Not Applicable

4/16/04 11:03

SVL ANALYTICAL, INC.

Quality Control Report
Part II Duplicate and Spike Analysis

Client :GeoSyntec

SVL JOB No: 110277

			QC SAMPLE ID			Duplicate or	MSD	Matrix Spike			Analysis
t	Method	Mtx		Units	Result	Found	RPD%	Result	SPK ADD	%R	Date
As	200.7	W	1	mg/L	<0.010	<0.010	UDL	0.984	1.00	98.4	4/13/04
As	200.7	W	2	mg/L	<0.010	<0.010	UDL	1.08	1.00	108.0	4/15/04
Ca	200.7	W	1	mg/L	51.6	51.9	0.6	73.5	20.0	109.5	4/13/04
Cr	200.7	W	1	mg/L	<0.0060	<0.0060	UDL	1.05	1.00	105.0	4/13/04
Cr	200.7	W	2	mg/L	<0.0060	<0.0060	UDL	1.07	1.00	107.0	4/15/04
Fe	200.7	W	1	mg/L	<0.020	<0.020	UDL	10.1	10.0	101.0	4/13/04
Fe	200.7	W	2	mg/L	<0.020	<0.020	UDL	11.0	10.0	110.0	4/15/04
K	200.7	W	1	mg/L	3.4	3.5	2.9	34.2	30.0	102.7	4/13/04
Mg	200.7	W	1	mg/L	21.2	21.5	1.4	44.6	20.0	117.0	4/13/04
Mn	200.7	W	1	mg/L	0.0091	0.0099	8.4	1.00	1.00	99.1	4/13/04
Mn	200.7	W	2	mg/L	0.0026	0.0026	0.0	1.08	1.00	107.7	4/15/04
Na	200.7	W	1	mg/L	4.98	5.03	1.0	25.3	20.0	101.6	4/13/04
Pb	200.7	W	1	mg/L	<0.0050	<0.0050	UDL	1.01	1.00	101.0	4/13/04
Pb	200.7	W	2	mg/L	<0.0050	<0.0050	UDL	1.08	1.00	108.0	4/15/04
SiO2	200.7	W	1	mg/L	10.8	10.9	0.9	21.7	10.7	101.9	4/13/04
SiO2	200.7	W	2	mg/L	11.5	11.4	0.9	23.1	10.7	108.4	4/15/04
Cl	300.0	W	1	mg/L	0.54	0.55	1.8	2.32	2.00	89.0	4/07/04
F	300.0	W	1	mg/L	0.15	0.15	0.0	2.02	2.00	93.5	4/07/04
SO4	300.0	W	1	mg/L	24.5	24.6	0.4	34.3	10.0	98.0	4/07/04
ALK	2320B	W	1	mg/L	243	233	4.2	N/A	N/A	N/A	4/09/04
pH	150.1	W	1		7.88	7.97	1.1	N/A	N/A	N/A	4/01/04
COND	120.1	W	1	umhos/c	385	383	0.5	N/A	N/A	N/A	4/08/04
Eh	2580	W	1	mV	+105	+105	0.0	N/A	N/A	N/A	4/08/04
ORG18D	415.1	W	1	mg/L	54.5	54.7	0.4	97.7	50.0	86.4	4/14/04
TDS	160.1	W	1	mg/L	244	206	16.9	N/A	N/A	N/A	4/06/04
TURB	180.1	W	1	NTU'S	0.209	0.210	0.5	N/A	N/A	N/A	4/02/04

LEGEND:

RPD% = (|SAM - DUP|/((SAM + DUP)/2) * 100) UDL = Both SAM & DUP not detected. *Result or *Found: Interference required dilution.

RPD% = (|SPK - MSD|/((SPK + MSD)/2) * 100) M in Duplicate/MSD column indicates MSD.

SPIKE ADD column, A = Post Digest Spike; %R = Percent Recovery N/A = Not Analyzed; R > 4S = Result more than 4X the Spike Added

QC limits for MS recoveries apply only if the spike is at least 1/4 the concentration of the analyte in the sample.

Control limits for the RPD apply only if the concentration of the analyte in the sample is at least five times the reporting limit.

QC Sample 1: SVL SAM No.: 378316 Client Sample ID: MW-7 ^T

QC Sample 2: SVL SAM No.: 378322 Client Sample ID: MW-7 ^D

4/16/04 11:03

SVL ANALYTICAL

CHAIN OF CUSTODY RECORD

Page 1 of 1

Client: GeoSyntec
Contact: Brian Petty
Address:
Huntington Beach, CA
Phone Number: 714-969-0820
FAX Number:

NOTES:
1) Ensure proper container packaging.
2) Ship samples promptly following collection.
* 3) Designate Sample Reject Disposition
PO#: HR0196-12
Project Name: Lehigh

Table 1. -- Matrix Type
1 = Surface Water [✓ 2] = Ground Water
3 = Soil/Sediment, 4 = Rinsate, 5 = Oil
6 = Waste, 7 = Other (Specify) ________

Samplers Signature: G. Hoy

FOR SVL USE ONLY
SVL JOB # 110277

Lab Name: SVL Analytical, Inc. (208) 784-1258 FAX (208) 783-0891
Address: One Government Gulch, Kellogg, ID 83837-0929

Sample ID	Collection		Miscellaneous				Preservative(s)						Analyses Required									Comments
	Date	Time	Collected by: (Init.)	Matrix Type From Table 1	No. of Containers	Sample Filtered ? Y/N *	Unpreserved (Ice Only)	HNO3	HCL	H2SO4	NAOH	Other (Specify) ZnAc	turbid redox, pH	Dis & Tot Ar, Pb, Cr	metals & silicon (200.7)	sulfide 376.1	TDS	maj cat (Na, Ca, Mg, K)	maj an (Cl, F, SO4)			* bottle #3 of all samples needs to be lab filtered & preserved Call Brian if questions
1. MW-7	3/31/04		gh	2	4	N	2	1				1	X	X	X	X	X	X	X			
2. MW-8																						
3. MW-9																						
4. MW-9D																						
5. MW-11																						
6. MW-12																						
7.																						
8.																						
9.																						
10.																						

Relinquished by: Hoy	Date: 4/1/04	Time: 11:18	Received by:	Date: 4/1/04	Time: 11:17
Relinquished by:	Date:	Time:	Received by:	Date:	Time:

* Sample Reject: [ ] Return [ ] Dispose [ ] Store (30 Days)

White: LAB COPY Yellow: CUSTOMER COPY SVL-COC 12/95

SVL ANALYTICAL, INC.
Certificate: CA CERTIFICATE NO. 2080
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: HR0196-12
CLIENT SAMPLE ID: SEEP-1
Sample Collected: 3/30/04 9:30
Sample Receipt : 4/01/04
Date of Report : 4/15/04

SVL JOB: 110278
SAMPLE: 378330
TOT/DIS

Matrix: WATER

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	283	mg CaCO3/L		2320B	4/02/04
T	Spec. Cond.	527	umhos/cm		120.1	4/02/04
T	Eh (mV)	+295	mV		2580	4/02/04
T	pH	8.34			150.1	4/02/04
T	TDS	298	mg/L		160.1	4/02/04
T	Turbidity	17.1	NTU'S		180.1	4/02/04
T	Calcium	83.9	mg/L		200.7	4/07/04
T	Chloride	0.50	mg/L		300.0	4/07/04
T	Fluoride	0.11	mg/L		300.0	4/07/04
T	Potassium	2.7	mg/L		200.7	4/07/04
T	Magnesium	30.6	mg/L		200.7	4/07/04
T	Sodium	2.30	mg/L		200.7	4/07/04
T	Sulfide	<1.0	mg/L		376.1	4/06/04
T	Sulfate, SO4	23.9	mg/L	2	300.0	4/07/04
T	Arsenic	<0.010	mg/L		200.7	4/07/04
T	Chromium	<0.0060	mg/L		200.7	4/07/04
T	Iron	1.43	mg/L		200.7	4/07/04
T	Manganese	0.0360	mg/L		200.7	4/07/04
T	Lead	<0.0050	mg/L		200.7	4/07/04
T	Silica	17.6	mg/L		200.7	4/07/04
T	DIS. INOR CARBON	59.5	mg/L		415.1	4/05/04
D	Arsenic	<0.010	mg/L		200.7	4/07/04
D	Chromium	<0.0060	mg/L		200.7	4/07/04
D	Iron	<0.020	mg/L		200.7	4/07/04
D	Manganese	0.0049	mg/L		200.7	4/07/04
D	Lead	<0.0050	mg/L		200.7	4/07/04
D	Silica	12.4	mg/L		200.7	4/07/04

CalcTDS:	353	TDS/Cond:	CATION SUM:	6.93meq/L	BALANCE	
TDS/CalcTDS:	0.8	CalcTDS/Cond:	ANION SUM:	6.17meq/L	5.80%	

Filtered fraction: 378331
TURBIDITY(RECEIVED AND ANALYZED PAST HOLDING TIME).

Reviewed By: ______________ Date 4/15/04
4/15/04 10:24

SVL ANALYTICAL, INC.

Quality Control Report
Part I Prep Blank and Laboratory Control Sample

Client :GeoSyntec

SVL JOB No: 110278

Analyte	Method	Matrix	Units	Prep Blank	LCS		LCS %R	Analysis Date
					True	Found		
Arsenic	200.7	WATER	mg/L	<0.010	1.00	0.999	99.9	4/07/04
Calcium	200.7	WATER	mg/L	<0.040	20.0	19.6	98.0	4/07/04
Chromium	200.7	WATER	mg/L	<0.0060	1.00	1.04	104.0	4/07/04
Iron	200.7	WATER	mg/L	<0.020	10.0	9.57	95.7	4/07/04
Potassium	200.7	WATER	mg/L	<1.0	30.0	29.3	97.7	4/07/04
Magnesium	200.7	WATER	mg/L	<0.040	20.0	18.8	94.0	4/07/04
Manganese	200.7	WATER	mg/L	<0.0020	1.00	1.02	102.0	4/07/04
Sodium	200.7	WATER	mg/L	<0.50	20.0	19.0	95.0	4/07/04
Lead	200.7	WATER	mg/L	<0.0050	1.00	1.00	100.0	4/07/04
Silica	200.7	WATER	mg/L	<0.171	10.7	11.3	105.6	4/07/04
Chloride	300.0	WATER	mg/L	<0.20	5.00	4.85	97.0	4/07/04
Fluoride	300.0	WATER	mg/L	<0.10	2.50	2.50	100.0	4/07/04
Sulfate, SO4	300.0	WATER	mg/L	<0.30	10.0	9.84	98.4	4/07/04
ALKALINITY	2320B	WATER	mg/L	<1.0	20.5	23.3	113.7	4/02/04
pH	150.1	WATER		5.41	7.70	7.65	99.4	4/02/04
Spec. Cond.	120.1	WATER	umhos/cm	0.045	488	501	102.7	4/02/04
Eh (mV)	2580	WATER	mV	N/A	+228	+234	102.6	4/02/04
DIS. INOR CARBON	415.1	WATER	mg/L	<1.0	14.0	13.9	99.3	4/05/04
Sulfide	376.1	WATER	mg/L	<1.0	2.0	2.1	105.0	4/06/04
TDS	160.1	WATER	mg/L	<10	450	413	91.8	4/02/04
Turbidity	180.1	WATER	NTU'S	0.087	13.1	12.2	93.1	4/02/04

LEGEND:

LCS = Laboratory Control Sample

LCS %R = LCS Percent Recovery

N/A = Not Applicable

4/15/04 10:45

SVL ANALYTICAL, INC.

Quality Control Report
Part II Duplicate and Spike Analysis

Client :GeoSyntec SVL JOB No: 110278

				QC SAMPLE ID		Duplicate or MSD		Matrix Spike			Analysis
st	Method	Mtx		Units	Result	Found	RPD%	Result	SPK ADD	%R	Date
As	200.7	W	1	mg/L	<0.010	<0.010	UDL	1.02	1.00	102.0	4/07/04
As	200.7	W	2	mg/L	<0.010	<0.010	UDL	1.07	1.00	107.0	4/07/04
Ca	200.7	W	1	mg/L	83.9	81.4	3.0	108	20.0	120.5	4/07/04
Cr	200.7	W	1	mg/L	<0.0060	<0.0060	UDL	1.02	1.00	102.0	4/07/04
Cr	200.7	W	2	mg/L	<0.0060	<0.0060	UDL	1.01	1.00	101.0	4/07/04
Fe	200.7	W	1	mg/L	1.43	1.13	23.4	11.1	10.0	96.7	4/07/04
Fe	200.7	W	2	mg/L	<0.020	<0.020	UDL	9.49	10.0	94.9	4/07/04
K	200.7	W	1	mg/L	2.7	2.6	3.8	33.8	30.0	103.7	4/07/04
Mg	200.7	W	1	mg/L	30.6	29.7	3.0	49.1	20.0	92.5	4/07/04
Mn	200.7	W	1	mg/L	0.0360	0.0325	10.2	1.08	1.00	104.4	4/07/04
Mn	200.7	W	2	mg/L	0.0049	0.0044	10.8	1.00	1.00	99.5	4/07/04
Na	200.7	W	1	mg/L	2.30	2.21	4.0	22.4	20.0	100.5	4/07/04
Pb	200.7	W	1	mg/L	<0.0050	<0.0050	UDL	0.983	1.00	98.3	4/07/04
Pb	200.7	W	2	mg/L	<0.0050	<0.0050	UDL	1.01	1.00	101.0	4/07/04
SiO2	200.7	W	1	mg/L	17.6	15.7	11.4	30.2	10.7	117.8	4/07/04
SiO2	200.7	W	2	mg/L	12.4	12.6	1.6	22.3	10.7	92.5	4/07/04
Cl	300.0	W	1	mg/L	0.50	0.50	0.0	2.34	2.00	92.0	4/07/04
F	300.0	W	1	mg/L	0.11	0.11	0.0	2.00	2.00	94.5	4/07/04
SO4	300.0	W	1	mg/L	23.9	23.9	0.0	33.8	10.0	99.0	4/07/04
ALK	2320B	W	1	mg/L	283	284	0.4	N/A	N/A	N/A	4/02/04
pH	150.1	W	1		8.34	8.37	0.4	N/A	N/A	N/A	4/02/04
COND	120.1	W	1	umhos/c	527	529	0.4	N/A	N/A	N/A	4/02/04
Eh	2580	W	1	mV	+295	+295	0.0	N/A	N/A	N/A	4/02/04
ORG18D	415.1	W	1	mg/L	59.5	62.1	4.3	101	50.0	83.0	4/05/04
TDS	160.1	W	1	mg/L	298	304	2.0	N/A	N/A	N/A	4/02/04
TURB	180.1	W	1	NTU'S	17.1	17.0	0.6	N/A	N/A	N/A	4/02/04

LEGEND:

RPD% = (|SAM - DUP|/((SAM + DUP)/2) * 100) UDL = Both SAM & DUP not detected. *Result or *Found: Interference required dilution.

RPD% = (|SPK - MSD|/((SPK + MSD)/2) * 100) M in Duplicate/MSD column indicates MSD.

SPIKE ADD column, A = Post Digest Spike; %R = Percent Recovery N/A = Not Analyzed; R > 4S = Result more than 4X the Spike Added

QC limits for MS recoveries apply only if the spike is at least 1/4 the concentration of the analyte in the sample.

Control limits for the RPD apply only if the concentration of the analyte in the sample is at least five times the reporting limit.

QC Sample 1: SVL SAM No.: 378330 Client Sample ID: SEEP-1 ^T

QC Sample 2: SVL SAM No.: 378331 Client Sample ID: SEEP-1 ^D

4/15/04 10:46

SVL ANALYTICAL

CHAIN OF CUSTODY RECORD

Page 1 of 1

Client: GeoSyntec
Contact: Brian Petty
Address:
Huntington Beach, CA
Phone Number: 714-969-0820
FAX Number:

NOTES:

1) Ensure proper container packaging.

2) Ship samples promptly following collection.

* 3) Designate Sample Reject Disposition

PO#: 4R0196-12
Project Name: Lehigh

Table 1. -- Matrix Type

1 = Surface Water, 2 = Ground Water
3 = Soil/Sediment, 4 = Rinsate, 5 = Oil
6 = Waste [✓ 7 = Other] (Specify) Seep

Samplers Signature: G. Hoy

FOR SVL USE ONLY
SVL JOB # 110278

Lab Name: SVL Analytical, Inc. (208) 784-1258 FAX (208) 783-0891
Address: One Government Gulch, Kellogg, ID 83837-0929

	Collection		Miscellaneous				Preservative(s)						Analyses Required									
Sample ID	Date	Time	Collected by: (Init.)	Matrix Type From Table 1	No. of Containers	Sample Filtered ? Y/N*	Unpreserved (Ice Only)	HNO3	HCL	H2SO4	NAOH	Other (Specify) Zn Ac	Turbid, redox, pH	As, Pb, Cr, Fe, Mn (T+D)	silicon, alkalinity	DIC, TDS	maj cations (Na, Ca, Mg, K)	maj anions (Cl, F, SO4)	sulfide	Conductivity		*bottle #3 needs to be lab filtered & preserved Comments call Brian if questions
1. SEEP-1	3/30/04	9:30	gh	7	4	N	2	1				1	X	X	X	X	X	X	X	X		
2.																						
3.																						
4.																						
5.																						
6.																						
7.																						
8.																						
9.																						
10.																						

Relinquished by: Gretchen E. Hoy Date: 4/1/04 Time: 11:17 Received by: Date: 4/1/04 Time: 11:17
Relinquished by: Date: Time: Received by: Date: Time:

* Sam ject: [ ] Return [ ] Dispose [ ] Store (30 Days)

White: LAB COPY Yellow: CUSTOMER COPY SVL C 12/95

SVL ANALYTICAL, INC. REPORT OF ANALYTICAL RESULTS

One Government Gulch ▪ PO Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

Client: **GeoSyntec**

Job No: 110422
Report Date: 4/23/04

Sample ID: **AVE E**
Collected: 4/07/04 16:00 By: GH
Matrix: **WATERG**

SVL Sample: 379635|379646
Received: 4/09/04

PHYSICAL PROPERTIES	TOTAL	DISSOLVED
pH	6.04	
TDS, mg/L	581	
TSS, mg/L		
Conductivity		

NONMETALS (mg/L)	TOTAL	DISSOLVED
Alkalinity as CaCO3	399	
Bicarbonate		
Carbonate		
Hydroxide		
Chloride	108	
Fluoride	<0.10	
Nitrate-N		
Orthophosphate		
Sulfate	45.1	

METALS (mg/L)	TOTAL	DISSOLVED
Aluminum		
Antimony		
Arsenic	<0.010	<0.010
Barium		
Beryllium		
Bismuth		
Boron		
Cadmium		
Calcium	99.1	

METALS (cont'd)	TOTAL	DISSOLVED
Chromium		
Cobalt		
Copper		
Gallium		
Iron	4.11	0.030
Lanthanum		
Lead		
Lithium		
Magnesium	26.1	
Manganese	1.41	1.35
Mercury		
Molybdenum		
Nickel		
Phosphorus		
Potassium	70.2	
Scandium		
Selenium		
Silica	18.7	11.4
Silver		
Sodium	67.0	
Strontium		
Thallium		
Tin		
Titanium		
Vanadium		
Zinc		

ADDITIONAL TESTS	TOTAL	DISSOLVED		TOTAL	DISSOLVED
Eh (mV)	+194		Turbidity	54.2	
Sulfide	<1.0		DIS. INOR CARBON	271	

QUALITY CONTROL

Calculated TDS: 697.1
Meas/Calc TDS ratio: 0.83
TDS/Cond Ratio:
CalcTDS/Cond Ratio:

Cation-Anion Balance 0.21%
Cation Sum, meq/L 12.01 0.05
Anion Sum, meq/L 11.96

Certificate: WA CERTIFICATE NO. C074

This report has been checked and is certified to be accurate.

Signed: Date: 4/23/04

4/23/04 15:33

SVL ANALYTICAL, INC.
One Government Gulch ▪ PO Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

REPORT OF ANALYTICAL RESULTS

Client: GeoSyntec
Job No: 110422
Report Date: 4/23/04

Sample ID: AVG W
Collected: 4/07/04 14:16 By: GH
Matrix: WATERG
SVL Sample: 379634|379645
Received: 4/09/04

PHYSICAL PROPERTIES	TOTAL	DISSOLVED
pH	5.82	
TDS, mg/L	585	
TSS, mg/L		
Conductivity		

NONMETALS (mg/L)	TOTAL	DISSOLVED
Alkalinity as CaCO3	386	
Bicarbonate		
Carbonate		
Hydroxide		
Chloride	69.1	
Fluoride	<0.10	
Nitrate-N		
Orthophosphate		
Sulfate	46.9	

METALS (mg/L)	TOTAL	DISSOLVED
Aluminum		
Antimony		
Arsenic	<0.010	<0.010
Barium		
Beryllium		
Bismuth		
Boron		
Cadmium		
Calcium	102	

METALS (cont'd)	TOTAL	DISSOLVED
Chromium		
Cobalt		
Copper		
Gallium		
Iron	0.640	0.185
Lanthanum		
Lead		
Lithium		
Magnesium	20.1	
Manganese	1.28	1.23
Mercury		
Molybdenum		
Nickel		
Phosphorus		
Potassium	72.4	
Scandium		
Selenium		
Silica	11.2	10.9
Silver		
Sodium	56.8	
Strontium		
Thallium		
Tin		
Titanium		
Vanadium		
Zinc		

ADDITIONAL TESTS	TOTAL	DISSOLVED		TOTAL	DISSOLVED
Eh (mV)	+179		Turbidity	4.25	
Sulfide	<1.0		DIS. INOR CARBON	276	

QUALITY CONTROL

Calculated TDS:	627.7			
Meas/Calc TDS ratio:	0.93	Cation-Anion Balance	2.25%	
TDS/Cond Ratio:		Cation Sum, meq/L	11.13	0.05
CalcTDS/Cond Ratio:		Anion Sum, meq/L	10.64	

Certificate: WA CERTIFICATE NO. C074
This report has been checked and is certified to be accurate.

Signed: ____________ Date: 4/23/04 4/23/04 15:33

SVL ANALYTICAL, INC.

Certificate: WA CERTIFICATE NO. C074

One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: HR0196-12
CLIENT SAMPLE ID: PM-1
Sample Collected: 4/05/04 13:30
Sample Receipt : 4/07/04
Date of Report : 4/22/04

SVL JOB: 110352
SAMPLE: 379022
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	1200	mg CaCO3/L		2320B	4/08/04
T	Eh (mV)	+17.2	mV		2580	4/08/04
T	pH	10.40			150.1	4/08/04
T	TDS	2890	mg/L		160.1	4/12/04
T	Turbidity	1.57	NTU'S		180.1	4/07/04
T	Calcium	9.88	mg/L		200.7	4/20/04
T	Chloride	99.7	mg/L	10	300.0	4/14/04
T	Fluoride	<1.0*	mg/L	10	300.0	4/14/04
T	Potassium	1310	mg/L	10	200.7	4/21/04
T	Magnesium	1.66	mg/L		200.7	4/20/04
T	Sodium	125	mg/L		200.7	4/20/04
T	Sulfide	<1.0	mg/L		376.1	4/12/04
T	Sulfate, SO4	694	mg/L	50	300.0	4/14/04
T	Arsenic	0.050	mg/L		200.7	4/21/04
T	Iron	0.505	mg/L		200.7	4/20/04
T	Manganese	0.0115	mg/L		200.7	4/21/04
T	Silica	25.4	mg/L		200.7	4/20/04
T	DIS. INOR CARBON	170	mg/L		415.1	4/15/04
D	Arsenic	0.047	mg/L		200.7	4/21/04
D	Iron	0.381	mg/L		200.7	4/20/04
D	Manganese	0.0111	mg/L		200.7	4/21/04
D	Silica	24.1	mg/L		200.7	4/20/04

CalcTDS:	3020	TDS/Cond:	CATION SUM:	39.61meq/L	BALANCE
TDS/CalcTDS:	1.0	CalcTDS/Cond:	ANION SUM:	41.20meq/L	-1.97%

Filtered fraction: 379034
*Elevated detection limit due to matrix interference.

Reviewed By: ____________ Date 4/22/04

4/22/04 10:18

SVL ANALYTICAL, INC.

Certificate: WA CERTIFICATE NO. C074

One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: HR0196-12
CLIENT SAMPLE ID: PM-2
Sample Collected: 4/05/04 15:40
Sample Receipt : 4/07/04
Date of Report : 4/22/04

SVL JOB: 110352
SAMPLE: 379025
TOT/DIS
Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	330	mg CaCO3/L		2320B	4/08/04
T	Eh (mV)	+50.0	mV		2580	4/08/04
T	pH	8.47			150.1	4/08/04
T	TDS	658	mg/L		160.1	4/12/04
T	Turbidity	2.01	NTU'S		180.1	4/07/04
T	Calcium	59.2	mg/L		200.7	4/20/04
T	Chloride	14.6	mg/L	2	300.0	4/14/04
T	Fluoride	0.19	mg/L		300.0	4/14/04
T	Potassium	144	mg/L		200.7	4/21/04
T	Magnesium	15.9	mg/L		200.7	4/20/04
T	Sodium	51.6	mg/L		200.7	4/20/04
T	Sulfide	<1.0	mg/L		376.1	4/12/04
T	Sulfate, SO4	172	mg/L	10	300.0	4/14/04
T	Arsenic	<0.010	mg/L		200.7	4/21/04
T	Iron	0.507	mg/L		200.7	4/20/04
T	Manganese	0.324	mg/L		200.7	4/21/04
T	Silica	11.7	mg/L		200.7	4/20/04
T	DIS. INOR CARBON	73.8	mg/L		415.1	4/15/04
D	Arsenic	<0.010	mg/L		200.7	4/21/04
D	Iron	<0.020	mg/L		200.7	4/20/04
D	Manganese	0.0526	mg/L		200.7	4/21/04
D	Silica	8.91	mg/L		200.7	4/20/04

CalcTDS:	682	TDS/Cond:	CATION SUM:	10.21meq/L	BALANCE
TDS/CalcTDS:	1.0	CalcTDS/Cond:	ANION SUM:	10.59meq/L	-1.83%

Filtered fraction: 379037

Reviewed By: ____________ Date 4/22/04

4/22/04 10:19

SVL ANALYTICAL, INC. **REPORT OF ANALYTICAL RESULTS**

One Government Gulch ▪ PO Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

Client: **GeoSyntec**

Job No: 110422
Report Date: 4/23/04

Sample ID: PM-3
Collected: 4/07/04 11:00 By: GH
Matrix: WATERG

SVL Sample: 379625|379636
Received: 4/09/04

PHYSICAL PROPERTIES	TOTAL	DISSOLVED
pH	7.67	
TDS, mg/L	1190	
TSS, mg/L		
Conductivity		

NONMETALS (mg/L)	TOTAL	DISSOLVED
Alkalinity as CaCO3	332	
Bicarbonate		
Carbonate		
Hydroxide		
Chloride	122	
Fluoride	<0.20*	
Nitrate-N		
Orthophosphate		
Sulfate	501	

METALS (mg/L)	TOTAL	DISSOLVED
Aluminum		
Antimony		
Arsenic	<0.010	<0.010
Barium		
Beryllium		
Bismuth		
Boron		
Cadmium		
Calcium	186	

METALS (cont'd)	TOTAL	DISSOLVED
Chromium		
Cobalt		
Copper		
Gallium		
Iron	0.150	<0.020
Lanthanum		
Lead		
Lithium		
Magnesium	46.8	
Manganese	0.522	0.500
Mercury		
Molybdenum		
Nickel		
Phosphorus		
Potassium	156	
Scandium		
Selenium		
Silica	13.4	12.9
Silver		
Sodium	82.9	
Strontium		
Thallium		
Tin		
Titanium		
Vanadium		
Zinc		

ADDITIONAL TESTS	TOTAL	DISSOLVED
Eh (mV)	+251	
Sulfide	<1.0	

	TOTAL	DISSOLVED
Turbidity	1.20	
DIS. INOR CARBON	78.4	

QUALITY CONTROL

Calculated TDS: 1327.4
Meas/Calc TDS ratio: 0.90
TDS/Cond Ratio:
CalcTDS/Cond Ratio:

Cation-Anion Balance 0.63%
Cation Sum, meq/L 20.76 0.02
Anion Sum, meq/L 20.50

*Elevated detection limit due to matrix interference.
SAMPLE FOR TURB RECEIVED & ANALYZED PAST HOLDING TIME
Certificate: WA CERTIFICATE NO. C074
This report has been checked and is certified to be accurate.

Signed: ______________ Date: 4/23/04

4/23/04 15:33

SVL ANALYTICAL, INC.

REPORT OF ANALYTICAL RESULTS

One Government Gulch ▪ PO Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

Client: **GeoSyntec**
Job No: 110422
Report Date: 4/23/04

Sample ID: **PM-4**
Collected: 4/07/04 11:45 By: GH
Matrix: **WATERG**
SVL Sample:379626|379637
Received: 4/09/04

PHYSICAL PROPERTIES	TOTAL	DISSOLVED
pH	10.91	
TDS, mg/L	2440	
TSS, mg/L		
Conductivity		

NONMETALS (mg/L)	TOTAL	DISSOLVED
Alkalinity as CaCO3	1190	
Bicarbonate		
Carbonate		
Hydroxide		
Chloride	165	
Fluoride	<1.0*	
Nitrate-N		
Orthophosphate		
Sulfate	496	

METALS (mg/L)	TOTAL	DISSOLVED
Aluminum		
Antimony		
Arsenic	0.037	0.033
Barium		
Beryllium		
Bismuth		
Boron		
Cadmium		
Calcium	4.40	

METALS (cont'd)	TOTAL	DISSOLVED
Chromium		
Cobalt		
Copper		
Gallium		
Iron	0.715	0.353
Lanthanum		
Lead		
Lithium		
Magnesium	0.468	
Manganese	0.0116	0.0056
Mercury		
Molybdenum		
Nickel		
Phosphorus		
Potassium	1230	
Scandium		
Selenium		
Silica	22.5	21.3
Silver		
Sodium	153	
Strontium		
Thallium		
Tin		
Titanium		
Vanadium		
Zinc		

ADDITIONAL TESTS	TOTAL	DISSOLVED		TOTAL	DISSOLVED
Eh (mV)	+91.5		Turbidity	1.89	
Sulfide	1.6		DIS. INOR CARBON	142	

QUALITY CONTROL

Calculated TDS: 2819.5
Meas/Calc TDS ratio: 0.87
TDS/Cond Ratio:
CalcTDS/Cond Ratio:

Cation-Anion Balance -0.53%
Cation Sum, meq/L 38.41 0.01
Anion Sum, meq/L 38.82

*Elevated detection limit due to matrix interference.
SAMPLE FOR TURB RECEIVED & ANALYZED PAST HOLDING TIME
Certificate: WA CERTIFICATE NO. C074
This report has been checked and is certified to be accurate.

Signed:______________________ Date: 4/23/04

4/23/04 15:33

SVL ANALYTICAL, INC.

Certificate: WA CERTIFICATE NO. C074

One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: HR0196-12
CLIENT SAMPLE ID: PM-5
Sample Collected: 4/05/04 18:00
Sample Receipt : 4/07/04
Date of Report : 4/22/04

SVL JOB: 110352
SAMPLE: 379029
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	621	mg CaCO3/L		2320B	4/08/04
T	Eh (mV)	+7.3	mV		2580	4/08/04
T	pH	9.60			150.1	4/08/04
T	TDS	3100	mg/L		160.1	4/12/04
T	Turbidity	1.70	NTU'S		180.1	4/07/04
T	Calcium	16.5	mg/L		200.7	4/20/04
T	Chloride	1470	mg/L	500	300.0	4/14/04
T	Fluoride	1.17	mg/L	10	300.0	4/14/04
T	Potassium	515	mg/L	10	200.7	4/21/04
T	Magnesium	16.6	mg/L		200.7	4/20/04
T	Sodium	913	mg/L		200.7	4/20/04
T	Sulfide	1.2	mg/L		376.1	4/12/04
T	Sulfate, SO4	293	mg/L	25	300.0	4/14/04
T	Arsenic	<0.010	mg/L		200.7	4/21/04
T	Iron	0.130	mg/L		200.7	4/20/04
T	Manganese	0.0239	mg/L		200.7	4/21/04
T	Silica	14.9	mg/L		200.7	4/20/04
T	DIS. INOR CARBON	119	mg/L		415.1	4/16/04
D	Arsenic	<0.010	mg/L		200.7	4/21/04
D	Iron	0.066	mg/L		200.7	4/21/04
D	Manganese	0.0169	mg/L		200.7	4/21/04
D	Silica	13.9	mg/L		200.7	4/21/04

CalcTDS:	3630	TDS/Cond:	CATION SUM:	55.08meq/L	BALANCE
TDS/CalcTDS:	0.9	CalcTDS/Cond:	ANION SUM:	59.93meq/L	-4.22%

Filtered fraction: 379041

Reviewed By:______________________ Date 4/22/04

4/22/04 10:19

SVL ANALYTICAL, INC.

Certificate: WA CERTIFICATE NO. C074

One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: HR0196-12
CLIENT SAMPLE ID: PM-6
Sample Collected: 4/05/04 15:10
Sample Receipt : 4/07/04
Date of Report : 4/22/04

SVL JOB: 110352
SAMPLE: 379028
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	1950	mg CaCO3/L		2320B	4/08/04
T	Eh (mV)	-92.5	mV		2580	4/08/04
T	pH	11.90			150.1	4/08/04
T	TDS	5840	mg/L		160.1	4/12/04
T	Turbidity	2.84	NTU'S		180.1	4/07/04
T	Calcium	4.81	mg/L		200.7	4/20/04
T	Chloride	57.0	mg/L	10	300.0	4/14/04
T	Fluoride	1.16	mg/L	10	300.0	4/14/04
T	Potassium	2540	mg/L	50	200.7	4/21/04
T	Magnesium	0.117	mg/L		200.7	4/20/04
T	Sodium	153	mg/L		200.7	4/20/04
T	Sulfide	<1.0	mg/L		376.1	4/12/04
T	Sulfate, SO4	1570	mg/L	100	300.0	4/14/04
T	Arsenic	0.308	mg/L		200.7	4/21/04
T	Iron	0.405	mg/L		200.7	4/20/04
T	Manganese	0.0155	mg/L		200.7	4/21/04
T	Silica	120	mg/L		200.7	4/20/04
T	DIS. INOR CARBON	198	mg/L		415.1	4/16/04
D	Arsenic	0.325	mg/L		200.7	4/21/04
D	Iron	0.117	mg/L		200.7	4/21/04
D	Manganese	0.0100	mg/L		200.7	4/21/04
D	Silica	120	mg/L		200.7	4/21/04

CalcTDS:	5800	TDS/Cond:	CATION SUM:	71.89meq/L	BALANCE
TDS/CalcTDS:	1.0	CalcTDS/Cond:	ANION SUM:	73.30meq/L	-0.97%

Filtered fraction: 379040

Reviewed By:________________ Date 4/22/04

4/22/04 10:19

SVL ANALYTICAL, INC.
Certificate: WA CERTIFICATE NO. C074
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: HR0196-12
CLIENT SAMPLE ID: PM-7
Sample Collected: 4/05/04 17:00
Sample Receipt : 4/07/04
Date of Report : 4/22/04

SVL JOB: 110352
SAMPLE: 379027
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	1050	mg CaCO3/L		2320B	4/22/04
T	Eh (mV)	-39.1	mV		2580	4/08/04
T	pH	6.87			150.1	4/08/04
T	TDS	1410	mg/L		160.1	4/12/04
T	Turbidity	2.95	NTU'S		180.1	4/07/04
T	Calcium	203	mg/L		200.7	4/20/04
T	Chloride	114	mg/L	25	300.0	4/14/04
T	Fluoride	<0.20*	mg/L	2	300.0	4/14/04
T	Potassium	199	mg/L		200.7	4/21/04
T	Magnesium	29.4	mg/L		200.7	4/20/04
T	Sodium	180	mg/L		200.7	4/20/04
T	Sulfide	<1.0	mg/L		376.1	4/12/04
T	Sulfate, SO4	121	mg/L	10	300.0	4/14/04
T	Arsenic	0.014	mg/L		200.7	4/21/04
T	Iron	69.1	mg/L		200.7	4/20/04
T	Manganese	7.18	mg/L		200.7	4/21/04
T	Silica	42.5	mg/L		200.7	4/20/04
T	DIS. INOR CARBON	257	mg/L		415.1	4/15/04
D	Arsenic	<0.010	mg/L		200.7	4/21/04
D	Iron	7.41	mg/L		200.7	4/21/04
D	Manganese	6.48	mg/L		200.7	4/21/04
D	Silica	33.7	mg/L		200.7	4/21/04

CalcTDS:	1650	TDS/Cond:	CATION SUM:	28.71meq/L	BALANCE
TDS/CalcTDS:	0.9	CalcTDS/Cond:	ANION SUM:	26.78meq/L	3.48%

Filtered fraction: 379039
*Elevated detection limit due to matrix interference.

Reviewed By: ______________________ Date 4/22/04

4/22/04 14:10

SVL ANALYTICAL, INC.

Certificate: WA CERTIFICATE NO. C074

One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: HR0196-12
CLIENT SAMPLE ID: PM-8
Sample Collected: 4/05/04 16:15
Sample Receipt : 4/07/04
Date of Report : 4/22/04

SVL JOB: 110352
SAMPLE: 379026
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	1020	mg CaCO3/L		2320B	4/08/04
T	Eh (mV)	+8.4	mV		2580	4/08/04
T	pH	9.81			150.1	4/08/04
T	TDS	2330	mg/L		160.1	4/12/04
T	Turbidity	2.81	NTU'S		180.1	4/07/04
T	Calcium	10.2	mg/L		200.7	4/20/04
T	Chloride	480	mg/L	100	300.0	4/14/04
T	Fluoride	<1.0*	mg/L	10	300.0	4/14/04
T	Potassium	648	mg/L	10	200.7	4/21/04
T	Magnesium	15.6	mg/L		200.7	4/20/04
T	Sodium	407	mg/L		200.7	4/20/04
T	Sulfide	<1.0	mg/L		376.1	4/12/04
T	Sulfate, SO4	250	mg/L	10	300.0	4/14/04
T	Arsenic	<0.010	mg/L		200.7	4/21/04
T	Iron	1.66	mg/L		200.7	4/20/04
T	Manganese	0.0411	mg/L		200.7	4/21/04
T	Silica	9.64	mg/L		200.7	4/20/04
T	DIS. INOR CARBON	184	mg/L		415.1	4/15/04
D	Arsenic	<0.010	mg/L		200.7	4/21/04
D	Iron	0.709	mg/L		200.7	4/20/04
D	Manganese	0.0323	mg/L		200.7	4/21/04
D	Silica	7.90	mg/L		200.7	4/20/04

CalcTDS: 2450 TDS/Cond:
TDS/CalcTDS: 1.0 CalcTDS/Cond:

CATION SUM: 36.16meq/L
ANION SUM: 39.17meq/L

BALANCE
-4.00%

Filtered fraction: 379038
*Elevated detection limit due to matrix interference.

Reviewed By: ______ Date 4/22/04
4/22/04 10:19

SVL ANALYTICAL, INC. **REPORT OF ANALYTICAL RESULTS**

One Government Gulch ▪ PO Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

Client: GeoSyntec
Job No: 110422
Report Date: 4/23/04

Sample ID: PM-9
Collected: 4/07/04 12:20 By: GH
Matrix: WATERG
SVL Sample: 379627|379638
Received: 4/09/04

PHYSICAL PROPERTIES	TOTAL	DISSOLVED
pH	7.39	
TDS, mg/L	1810	
TSS, mg/L		
Conductivity		

NONMETALS (mg/L)	TOTAL	DISSOLVED
Alkalinity as CaCO3	458	
Bicarbonate		
Carbonate		
Hydroxide		
Chloride	876	
Fluoride	<0.20*	
Nitrate-N		
Orthophosphate		
Sulfate	86.2	

METALS (mg/L)	TOTAL	DISSOLVED
Aluminum		
Antimony		
Arsenic	0.011	<0.010
Barium		
Beryllium		
Bismuth		
Boron		
Cadmium		
Calcium	54.4	

METALS (cont'd)	TOTAL	DISSOLVED
Chromium		
Cobalt		
Copper		
Gallium		
Iron	18.3	6.41
Lanthanum		
Lead		
Lithium		
Magnesium	37.3	
Manganese	1.78	1.63
Mercury		
Molybdenum		
Nickel		
Phosphorus		
Potassium	225	
Scandium		
Selenium		
Silica	13.5	12.1
Silver		
Sodium	519	
Strontium		
Thallium		
Tin		
Titanium		
Vanadium		
Zinc		

ADDITIONAL TESTS	TOTAL	DISSOLVED		TOTAL	DISSOLVED
Eh (mV)	+171		Turbidity	127	
Sulfide	<1.0		DIS. INOR CARBON	109	

QUALITY CONTROL

Calculated TDS: 2129.8
Meas/Calc TDS ratio: 0.85
TDS/Cond Ratio:
CalcTDS/Cond Ratio:
Cation-Anion Balance -1.15%
Cation Sum, meq/L 34.84 0.29
Anion Sum, meq/L 35.65

SAMPLE FOR TURB RECEIVED & ANALYZED PAST HOLDING TIME
*Elevated detection limit due to matrix interference.
Certificate: WA CERTIFICATE NO. C074
This report has been checked and is certified to be accurate.

Signed:__________ Date: 4/23/04 4/23/04 15:33

SVL ANALYTICAL, INC.
One Government Gulch ▪ PO Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

REPORT OF ANALYTICAL RESULTS

Client: **GeoSyntec**
Job No: 110422
Report Date: 4/23/04

Sample ID: **PM-10**
Collected: 4/07/04 15:00 By: GH
Matrix: WATERG
SVL Sample: 379628 | 379639
Received: 4/09/04

PHYSICAL PROPERTIES	TOTAL	DISSOLVED
pH	7.22	
TDS, mg/L	2450	
TSS, mg/L		
Conductivity		

NONMETALS (mg/L)	TOTAL	DISSOLVED
Alkalinity as CaCO3	860	
Bicarbonate		
Carbonate		
Hydroxide		
Chloride	98.0	
Fluoride	<1.0*	
Nitrate-N		
Orthophosphate		
Sulfate	745	

METALS (mg/L)	TOTAL	DISSOLVED
Aluminum		
Antimony		
Arsenic	0.026	0.018
Barium		
Beryllium		
Bismuth		
Boron		
Cadmium		
Calcium	71.6	

METALS (cont'd)	TOTAL	DISSOLVED
Chromium		
Cobalt		
Copper		
Gallium		
Iron	20.2	16.5
Lanthanum		
Lead		
Lithium		
Magnesium	17.3	
Manganese	2.42	2.23
Mercury		
Molybdenum		
Nickel		
Phosphorus		
Potassium	920	
Scandium		
Selenium		
Silica	19.7	17.9
Silver		
Sodium	95.8	
Strontium		
Thallium		
Tin		
Titanium		
Vanadium		
Zinc		

ADDITIONAL TESTS	TOTAL	DISSOLVED		TOTAL	DISSOLVED
Eh (mV)	+183		Turbidity	16.2	
Sulfide	<1.0		DIS. INOR CARBON	243	

QUALITY CONTROL

Calculated TDS:	2548.1			
Meas/Calc TDS ratio:	0.96	Cation-Anion Balance	-2.83%	
TDS/Cond Ratio:		Cation Sum, meq/L	33.50	0.67
CalcTDS/Cond Ratio:		Anion Sum, meq/L	35.45	

Certificate: WA CERTIFICATE NO. C074
This report has been checked and is certified to be accurate.

Signed:________________ Date: 4/23/04 4/23/04 15:33

SVL ANALYTICAL, INC.

One Government Gulch ▪ PO Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

REPORT OF ANALYTICAL RESULTS

Client: GeoSyntec

Job No: 110422

Report Date: 4/23/04

Sample ID: PM-11

Collected: 4/07/04 13:55 By: GH

Matrix: WATERG

SVL Sample:379629|379640

Received: 4/09/04

PHYSICAL PROPERTIES	TOTAL	DISSOLVED
pH	6.27	
TDS, mg/L	1110	
TSS, mg/L		
Conductivity		

NONMETALS (mg/L)	TOTAL	DISSOLVED
Alkalinity as CaCO3	820	
Bicarbonate		
Carbonate		
Hydroxide		
Chloride	88.0	
Fluoride	<0.20*	
Nitrate-N		
Orthophosphate		
Sulfate	120	

METALS (mg/L)	TOTAL	DISSOLVED
Aluminum		
Antimony		
Arsenic	<0.010	<0.010
Barium		
Beryllium		
Bismuth		
Boron		
Cadmium		
Calcium	236	

METALS (cont'd)	TOTAL	DISSOLVED
Chromium		
Cobalt		
Copper		
Gallium		
Iron	46.1	27.3
Lanthanum		
Lead		
Lithium		
Magnesium	26.3	
Manganese	3.91	3.65
Mercury		
Molybdenum		
Nickel		
Phosphorus		
Potassium	185	
Scandium		
Selenium		
Silica	33.1	25.1
Silver		
Sodium	67.2	
Strontium		
Thallium		
Tin		
Titanium		
Vanadium		
Zinc		

ADDITIONAL TESTS	TOTAL	DISSOLVED		TOTAL	DISSOLVED
Eh (mV)	+91.0		Turbidity	398	
Sulfide	<1.0		DIS. INOR CARBON	316	

QUALITY CONTROL

Calculated TDS:	1361.6	Cation-Anion Balance	4.51%	
Meas/Calc TDS ratio:	0.82	Cation Sum, meq/L	23.38	1.11
TDS/Cond Ratio:		Anion Sum, meq/L	21.36	
CalcTDS/Cond Ratio:				

*Elevated detection limit due to matrix interference.

Certificate: WA CERTIFICATE NO. C074

This report has been checked and is certified to be accurate.

Signed:______________________ Date: 4/23/04 4/23/04 15:33

SVL ANALYTICAL, INC.
One Government Gulch ▪ PO Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

REPORT OF ANALYTICAL RESULTS

Client: GeoSyntec
Job No: 110422
Report Date: 4/23/04

Sample ID: PM-12
Collected: 4/07/04 13:30 By: GH
Matrix: WATERG
SVL Sample: 379630|379641
Received: 4/09/04

PHYSICAL PROPERTIES	TOTAL	DISSOLVED
pH	6.24	
TDS, mg/L	1200	
TSS, mg/L		
Conductivity		

NONMETALS (mg/L)	TOTAL	DISSOLVED
Alkalinity as CaCO3	960	
Bicarbonate		
Carbonate		
Hydroxide		
Chloride	95.2	
Fluoride	<0.20*	
Nitrate-N		
Orthophosphate		
Sulfate	122	

METALS (mg/L)	TOTAL	DISSOLVED
Aluminum		
Antimony		
Arsenic	0.024	0.011
Barium		
Beryllium		
Bismuth		
Boron		
Cadmium		
Calcium	275	

METALS (cont'd)	TOTAL	DISSOLVED
Chromium		
Cobalt		
Copper		
Gallium		
Iron	80.0	56.3
Lanthanum		
Lead		
Lithium		
Magnesium	30.1	
Manganese	5.45	5.14
Mercury		
Molybdenum		
Nickel		
Phosphorus		
Potassium	178	
Scandium		
Selenium		
Silica	43.2	31.5
Silver		
Sodium	77.3	
Strontium		
Thallium		
Tin		
Titanium		
Vanadium		
Zinc		

ADDITIONAL TESTS	TOTAL	DISSOLVED		TOTAL	DISSOLVED
Eh (mV)	+15.7		Turbidity	284	
Sulfide	<1.0		DIS. INOR CARBON	336	

QUALITY CONTROL

Calculated TDS:	1584.5			
Meas/Calc TDS ratio:	0.76	Cation-Anion Balance	5.35%	
TDS/Cond Ratio:		Cation Sum, meq/L	27.17	2.21
CalcTDS/Cond Ratio:		Anion Sum, meq/L	24.41	

*Elevated detection limit due to matrix interference.
Certificate: WA CERTIFICATE NO. C074
This report has been checked and is certified to be accurate.

Signed: ____________ Date: 4/23/04

4/23/04 15:33

SVL ANALYTICAL, INC. **REPORT OF ANALYTICAL RESULTS**

One Government Gulch ▪ PO Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

Client: GeoSyntec
Job No: 110422
Report Date: 4/23/04

Sample ID: PM-13
Collected: 4/07/04 15:30 By: GH
Matrix: WATERG
SVL Sample:379631|379642
Received: 4/09/04

PHYSICAL PROPERTIES	TOTAL	DISSOLVED
pH	9.38	
TDS, mg/L	607	
TSS, mg/L		
Conductivity		

NONMETALS (mg/L)	TOTAL	DISSOLVED
Alkalinity as CaCO3	328	
Bicarbonate		
Carbonate		
Hydroxide		
Chloride	55.5	
Fluoride	0.50	
Nitrate-N		
Orthophosphate		
Sulfate	75.4	

METALS (mg/L)	TOTAL	DISSOLVED
Aluminum		
Antimony		
Arsenic	<0.010	<0.010
Barium		
Beryllium		
Bismuth		
Boron		
Cadmium		
Calcium	12.4	

METALS (cont'd)	TOTAL	DISSOLVED
Chromium		
Cobalt		
Copper		
Gallium		
Iron	2.70	1.54
Lanthanum		
Lead		
Lithium		
Magnesium	2.92	
Manganese	0.378	0.327
Mercury		
Molybdenum		
Nickel		
Phosphorus		
Potassium	241	
Scandium		
Selenium		
Silica	7.80	6.77
Silver		
Sodium	43.1	
Strontium		
Thallium		
Tin		
Titanium		
Vanadium		
Zinc		

ADDITIONAL TESTS	TOTAL	DISSOLVED		TOTAL	DISSOLVED
Eh (mV)	+9.3		Turbidity	4.81	
Sulfide	<1.0		DIS. INOR CARBON	75.3	

QUALITY CONTROL

Calculated TDS:	650.3			
Meas/Calc TDS ratio:	0.93	Cation-Anion Balance	-3.85%	
TDS/Cond Ratio:		Cation Sum, meq/L	9.00	0.07
CalcTDS/Cond Ratio:		Anion Sum, meq/L	9.72	

Certificate: WA CERTIFICATE NO. C074

This report has been checked and is certified to be accurate.

Signed:______________________ Date: 4/23/04 4/23/04 15:33

SVL ANALYTICAL, INC.
One Government Gulch ▪ PO Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

F ORT OF ANALYTICAL RESULTS

Client: GeoSyntec

Job No: 110422
Report Date: 4/23/04

Sample ID: PM-14
Collected: 4/07/04 17:45 By: GH
Matrix: WATERG

SVL Sample:379632|379643
Received: 4/09/04

PHYSICAL PROPERTIES	TOTAL	DISSOLVED
pH	9.56	
TDS, mg/L	779	
TSS, mg/L		
Conductivity		

NONMETALS (mg/L)	TOTAL	DISSOLVED
Alkalinity as CaCO3	396	
Bicarbonate		
Carbonate		
Hydroxide		
Chloride	114	
Fluoride	<1.0*	
Nitrate-N		
Orthophosphate		
Sulfate	89.7	

METALS (mg/L)	TOTAL	DISSOLVED
Aluminum		
Antimony		
Arsenic	<0.010	<0.010
Barium		
Beryllium		
Bismuth		
Boron		
Cadmium		
Calcium	11.8	

METALS (cont'd)	TOTAL	DISSOLVED
Chromium		
Cobalt		
Copper		
Gallium		
Iron	5.31	4.36
Lanthanum		
Lead		
Lithium		
Magnesium	1.81	
Manganese	0.316	0.299
Mercury		
Molybdenum		
Nickel		
Phosphorus		
Potassium	314	
Scandium		
Selenium		
Silica	4.36	3.98
Silver		
Sodium	76.6	
Strontium		
Thallium		
Tin		
Titanium		
Vanadium		
Zinc		

ADDITIONAL TESTS	TOTAL	DISSOLVED		TOTAL	DISSOLVED
Eh (mV)	+27.7		Turbidity	2.88	
Sulfide	<1.0		DIS. INOR CARBON	78.0	

QUALITY CONTROL

Calculated TDS:	865.7			
Meas/Calc TDS ratio:	0.90	Cation-Anion Balance	-2.77%	
TDS/Cond Ratio:		Cation Sum, meq/L	12.30	0.17
CalcTDS/Cond Ratio:		Anion Sum, meq/L	13.00	

*Elevated detection limit due to matrix interference.

Certificate: WA CERTIFICATE NO. C074

This report has been checked and is certified to be accurate.

Signed: ______________________ Date: 4/23/04

4/23/04 15:33

SVL ANALYTICAL, INC.

Certificate: WA CERTIFICATE NO. C074

One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: HR0196-12
CLIENT SAMPLE ID: PM-15
Sample Collected: 4/05/04 12:15
Sample Receipt : 4/07/04
Date of Report : 4/22/04

SVL JOB: 110352
SAMPLE: 379020
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	1900	mg CaCO3/L		2320B	4/08/04
T	Eh (mV)	-166	mV		2580	4/08/04
T	pH	12.30			150.1	4/08/04
T	TDS	4770	mg/L		160.1	4/12/04
T	Turbidity	0.414	NTU'S		180.1	4/07/04
T	Calcium	2.35	mg/L		200.7	4/20/04
T	Chloride	44.5	mg/L	10	300.0	4/14/04
T	Fluoride	1.33	mg/L	10	300.0	4/14/04
T	Potassium	2360	mg/L	50	200.7	4/21/04
T	Magnesium	<0.040	mg/L		200.7	4/20/04
T	Sodium	91.0	mg/L		200.7	4/20/04
T	Sulfide	1.1	mg/L		376.1	4/12/04
T	Sulfate, SO4	1130	mg/L	100	300.0	4/14/04
T	Arsenic	0.118	mg/L		200.7	4/21/04
T	Iron	0.290	mg/L		200.7	4/20/04
T	Manganese	0.0033	mg/L		200.7	4/21/04
T	Silica	101	mg/L		200.7	4/20/04
T	DIS. INOR CARBON	109	mg/L		415.1	4/15/04
D	Arsenic	0.121	mg/L		200.7	4/21/04
D	Iron	0.255	mg/L		200.7	4/20/04
D	Manganese	0.0027	mg/L		200.7	4/21/04
D	Silica	94.5	mg/L		200.7	4/20/04

CalcTDS: 5020 TDS/Cond:
TDS/CalcTDS: 1.0 CalcTDS/Cond:

CATION SUM: 64.47meq/L
ANION SUM: 62.82meq/L

BALANCE
1.30%

Filtered fraction: 379032

Reviewed By:______________ Date 4/22/04

4/22/04 10:18

SVL ANALYTICAL, INC.

Certificate: WA CERTIFICATE NO. C074

One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: HR0196-12
CLIENT SAMPLE ID: PM-16
Sample Collected: 4/05/04 14:35
Sample Receipt : 4/07/04
Date of Report : 4/22/04

SVL JOB: 110352
SAMPLE: 379024
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	2020	mg CaCO3/L		2320B	4/08/04
T	Eh (mV)	-349	mV		2580	4/08/04
T	pH	12.40			150.1	4/08/04
T	TDS	5010	mg/L		160.1	4/12/04
T	Turbidity	1.19	NTU'S		180.1	4/07/04
T	Calcium	3.22	mg/L		200.7	4/20/04
T	Chloride	44.4	mg/L	10	300.0	4/14/04
T	Fluoride	1.30	mg/L	10	300.0	4/14/04
T	Potassium	2540	mg/L	50	200.7	4/21/04
T	Magnesium	0.114	mg/L		200.7	4/20/04
T	Sodium	98.0	mg/L		200.7	4/20/04
T	Sulfide	2.8	mg/L		376.1	4/12/04
T	Sulfate, SO4	1190	mg/L	100	300.0	4/14/04
T	Arsenic	0.115	mg/L		200.7	4/21/04
T	Iron	0.767	mg/L		200.7	4/20/04
T	Manganese	0.0104	mg/L		200.7	4/21/04
T	Silica	95.9	mg/L		200.7	4/20/04
T	DIS. INOR CARBON	104	mg/L		415.1	4/15/04
D	Arsenic	0.086	mg/L		200.7	4/21/04
D	Iron	0.434	mg/L		200.7	4/20/04
D	Manganese	0.0045	mg/L		200.7	4/21/04
D	Silica	97.0	mg/L		200.7	4/20/04

CalcTDS: 5330 TDS/Cond:
TDS/CalcTDS: 0.9 CalcTDS/Cond:

CATION SUM: 69.45meq/L
ANION SUM: 66.33meq/L

BALANCE
2.30%

Filtered fraction: 379036

Reviewed By: Date 4/22/04

4/22/04 10:19

SVL ANALYTICAL, INC. **REPORT OF ANALYTICAL RESULTS**

One Government Gulch ▪ PO Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

Client: **GeoSyntec**
Job No: **110422**
Report Date: **4/23/04**

Sample ID: **PM-17**
Collected: **4/07/04 17:00** By: **GH**
Matrix: **WATERG**
SVL Sample: **379633|379644**
Received: **4/09/04**

PHYSICAL PROPERTIES	TOTAL	DISSOLVED
pH	11.58	
TDS, mg/L	1430	
TSS, mg/L		
Conductivity		

NONMETALS (mg/L)	TOTAL	DISSOLVED
Alkalinity as CaCO3	698	
Bicarbonate		
Carbonate		
Hydroxide		
Chloride	35.4	
Fluoride	1.16	
Nitrate-N		
Orthophosphate		
Sulfate	185	

METALS (mg/L)	TOTAL	DISSOLVED
Aluminum		
Antimony		
Arsenic	0.033	0.038
Barium		
Beryllium		
Bismuth		
Boron		
Cadmium		
Calcium	3.47	

METALS (cont'd)	TOTAL	DISSOLVED
Chromium		
Cobalt		
Copper		
Gallium		
Iron	0.675	0.456
Lanthanum		
Lead		
Lithium		
Magnesium	<0.040	
Manganese	0.0113	0.0103
Mercury		
Molybdenum		
Nickel		
Phosphorus		
Potassium	648	
Scandium		
Selenium		
Silica	28.4	27.9
Silver		
Sodium	38.9	
Strontium		
Thallium		
Tin		
Titanium		
Vanadium		
Zinc		

ADDITIONAL TESTS	TOTAL	DISSOLVED
Eh (mV)	-164	
Sulfide	1.7	

	TOTAL	DISSOLVED
Turbidity	0.573	
DIS. INOR CARBON	59.1	

QUALITY CONTROL

Calculated TDS:	1403.3			
Meas/Calc TDS ratio:	1.02	Cation-Anion Balance	-1.07%	
TDS/Cond Ratio:		Cation Sum, meq/L	18.46	0.02
CalcTDS/Cond Ratio:		Anion Sum, meq/L	18.86	

Certificate: WA CERTIFICATE NO. C074

This report has been checked and is certified to be accurate.

Signed:_______________ Date: 4/23/04

4/23/04 15:33

SVL ANALYTICAL, INC.
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891
Certificate: WA CERTIFICATE NO. C074

CLIENT : GeoSyntec
PROJECT: HR0196-12
CLIENT SAMPLE ID: PM-18
Sample Collected: 4/05/04 11:15
Sample Receipt : 4/07/04
Date of Report : 4/22/04

SVL JOB: 110352
SAMPLE: 379018
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	1180	mg CaCO3/L		2320B	4/08/04
T	Eh (mV)	+103	mV		2580	4/08/04
T	pH	11.70			150.1	4/08/04
T	TDS	3560	mg/L		160.1	4/12/04
T	Turbidity	0.597	NTU'S		180.1	4/07/04
T	Calcium	2.98	mg/L		200.7	4/20/04
T	Chloride	68.3	mg/L	10	300.0	4/14/04
T	Fluoride	<1.0*	mg/L	10	300.0	4/14/04
T	Potassium	1610	mg/L	10	200.7	4/21/04
T	Magnesium	<0.040	mg/L		200.7	4/20/04
T	Sodium	95.7	mg/L		200.7	4/20/04
T	Sulfide	<1.0	mg/L		376.1	4/12/04
T	Sulfate, SO4	1060	mg/L	100	300.0	4/14/04
T	Arsenic	0.094	mg/L		200.7	4/21/04
T	Iron	0.121	mg/L		200.7	4/20/04
T	Manganese	0.0021	mg/L		200.7	4/21/04
T	Silica	63.7	mg/L		200.7	4/20/04
T	DIS. INOR CARBON	106	mg/L		415.1	4/14/04
D	Arsenic	0.106	mg/L		200.7	4/21/04
D	Iron	0.064	mg/L		200.7	4/20/04
D	Manganese	<0.0020	mg/L		200.7	4/21/04
D	Silica	64.7	mg/L		200.7	4/20/04

CalcTDS:	3710	TDS/Cond:	CATION SUM:	45.49meq/L	BALANCE
TDS/CalcTDS:	1.0	CalcTDS/Cond:	ANION SUM:	47.60meq/L	-2.27%

Filtered fraction: 379030
*Elevated detection limit due to matrix interference.

Reviewed By: ______________________ Date 4/22/04
4/22/04 14:10

SVL ANALYTICAL, INC.

Certificate: WA CERTIFICATE NO. C074

One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: HR0196-12
CLIENT SAMPLE ID: PM-20
Sample Collected: 4/05/04 13:00
Sample Receipt : 4/07/04
Date of Report : 4/22/04

SVL JOB: 110352
SAMPLE: 379021
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	580	mg CaCO3/L		2320B	4/08/04
T	Eh (mV)	+102	mV		2580	4/08/04
T	pH	8.92			150.1	4/08/04
T	TDS	1520	mg/L		160.1	4/12/04
T	Turbidity	1.97	NTU'S		180.1	4/07/04
T	Calcium	21.5	mg/L		200.7	4/20/04
T	Chloride	14.0	mg/L	5	300.0	4/14/04
T	Fluoride	0.62	mg/L	5	300.0	4/14/04
T	Potassium	522	mg/L	10	200.7	4/21/04
T	Magnesium	6.57	mg/L		200.7	4/20/04
T	Sodium	163	mg/L		200.7	4/20/04
T	Sulfide	<1.0	mg/L		376.1	4/12/04
T	Sulfate, SO4	466	mg/L	50	300.0	4/14/04
T	Arsenic	<0.010	mg/L		200.7	4/21/04
T	Iron	0.437	mg/L		200.7	4/20/04
T	Manganese	0.108	mg/L		200.7	4/21/04
T	Silica	10.6	mg/L		200.7	4/20/04
T	DIS. INOR CARBON	135	mg/L		415.1	4/15/04
D	Arsenic	<0.010	mg/L		200.7	4/21/04
D	Iron	0.073	mg/L		200.7	4/20/04
D	Manganese	0.0868	mg/L		200.7	4/21/04
D	Silica	9.53	mg/L		200.7	4/20/04

CalcTDS: 1570 TDS/Cond:
TDS/CalcTDS: 1.0 CalcTDS/Cond:

CATION SUM: 22.07meq/L
ANION SUM: 21.71meq/L

BALANCE
0.82%

Filtered fraction: 379033

Reviewed By: ______________ Date 4/22/04
4/22/04 10:18

SVL ANALYTICAL, INC.

Certificate: WA CERTIFICATE NO. C074

One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: HR0196-12
CLIENT SAMPLE ID: PM-21
Sample Collected: 4/05/04 14:00
Sample Receipt : 4/07/04
Date of Report : 4/22/04

SVL JOB: 110352
SAMPLE: 379023
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	922	mg CaCO3/L		2320B	4/08/04
T	Eh (mV)	-3.9	mV		2580	4/08/04
T	pH	10.70			150.1	4/08/04
T	TDS	2920	mg/L		160.1	4/12/04
T	Turbidity	0.955	NTU'S		180.1	4/07/04
T	Calcium	10.9	mg/L		200.7	4/20/04
T	Chloride	64.7	mg/L	10	300.0	4/14/04
T	Fluoride	1.05	mg/L	10	300.0	4/14/04
T	Potassium	1340	mg/L	10	200.7	4/21/04
T	Magnesium	0.473	mg/L		200.7	4/20/04
T	Sodium	116	mg/L		200.7	4/20/04
T	Sulfide	<1.0	mg/L		376.1	4/12/04
T	Sulfate, SO4	948	mg/L	50	300.0	4/14/04
T	Arsenic	0.054	mg/L		200.7	4/21/04
T	Iron	0.542	mg/L		200.7	4/20/04
T	Manganese	0.0089	mg/L		200.7	4/21/04
T	Silica	23.1	mg/L		200.7	4/20/04
T	DIS. INOR CARBON	123	mg/L		415.1	4/15/04
D	Arsenic	0.065	mg/L		200.7	4/21/04
D	Iron	0.342	mg/L		200.7	4/20/04
D	Manganese	0.0072	mg/L		200.7	4/21/04
D	Silica	22.1	mg/L		200.7	4/20/04

CalcTDS:	3090	TDS/Cond:	CATION SUM:	39.94meq/L	BALANCE
TDS/CalcTDS:	0.9	CalcTDS/Cond:	ANION SUM:	40.05meq/L	-0.14%

Filtered fraction: 379035

Reviewed By: Date 4/22/04

4/22/04 10:18

SVL ANALYTICAL, INC.

Quality Control Report
Part I Prep Blank and Laboratory Control Sample

Client :GeoSyntec

SVL JOB No: 110352

nalyte	Method	Matrix	Units	Prep Blank	True——LCS——Found		LCS %R	Analysis Date
Arsenic	200.7	WATER	mg/L	<0.010	1.00	0.982	98.2	4/21/04
Calcium	200.7	WATER	mg/L	<0.040	20.0	20.5	102.5	4/20/04
Iron	200.7	WATER	mg/L	<0.020	10.0	10.2	102.0	4/20/04
Potassium	200.7	WATER	mg/L	<1.0	30.0	29.6	98.7	4/21/04
Magnesium	200.7	WATER	mg/L	<0.040	20.0	20.0	100.0	4/20/04
Manganese	200.7	WATER	mg/L	<0.0020	1.00	0.984	98.4	4/21/04
Sodium	200.7	WATER	mg/L	<0.50	20.0	20.4	102.0	4/20/04
Silica	200.7	WATER	mg/L	<0.171	10.7	11.7	109.3	4/20/04
Chloride	300.0	WATER	mg/L	<0.20	5.00	4.79	95.8	4/14/04
Fluoride	300.0	WATER	mg/L	<0.10	2.50	2.41	96.4	4/14/04
Sulfate, SO4	300.0	WATER	mg/L	<0.30	10.0	9.69	96.9	4/14/04
ALKALINITY	2320B	WATER	mg/L	<1.0	20.5	23.4	114.1	4/08/04
pH	150.1	WATER		5.46	7.70	7.68	99.7	4/08/04
Eh (mV)	2580	WATER	mV	N/A	+228	+233	102.2	4/08/04
DIS. INOR CARBON	415.1	WATER	mg/L	<1.0	14.0	13.9	99.3	4/14/04
Sulfide	376.1	WATER	mg/L	<1.0	2.0	1.9	95.0	4/12/04
TDS	160.1	WATER	mg/L	<10	233	250	107.3	4/12/04
Turbidity	180.1	WATER	NTU'S	0.074	1.77	1.75	98.9	4/07/04

LEGEND:

LCS = Laboratory Control Sample

LCS %R = LCS Percent Recovery

N/A = Not Applicable

4/22/04 14:05

SVL ANALYTICAL, INC.

Quality Control Report
Part II Duplicate and Spike Analysis

Client :GeoSyntec

SVL JOB No: 110352

			QC SAMPLE ID		Duplicate or	MSD	Matrix Spike			Analysis
st	Method	Mtx	Units		Result	Found	RPD%	Result	SPK ADD	%R	Date

st	Method	Mtx		Units	Result	Found	RPD%	Result	SPK ADD	%R	Date
As	200.7	W	1	mg/L	0.094	0.096	2.1	1.15	1.00	105.6	4/21/04
As	200.7	W	2	mg/L	0.308	N/A	N/A	1.37	1.00	106.2	4/21/04
As	200.7	W	3	mg/L	0.106	0.098	7.8	1.24	1.00	113.4	4/21/04
As	200.7	W	4	mg/L	0.325	N/A	N/A	1.45	1.00	112.5	4/21/04
Ca	200.7	W	1	mg/L	2.98	3.07	3.0	23.9	20.0	104.6	4/20/04
Ca	200.7	W	2	mg/L	4.81	N/A	N/A	26.0	20.0	106.0	4/20/04
Fe	200.7	W	1	mg/L	0.121	0.121	0.0	10.3	10.0	101.8	4/20/04
Fe	200.7	W	2	mg/L	0.405	N/A	N/A	10.7	10.0	103.0	4/20/04
Fe	200.7	W	3	mg/L	0.064	0.120	60.9	9.97	10.0	99.1	4/20/04
Fe	200.7	W	4	mg/L	0.117	N/A	N/A	10.2	10.0	100.8	4/21/04
K	200.7	W	1	mg/L	1610	1690	4.8	1720	30.0	R >4S	4/21/04
K	200.7	W	2	mg/L	2540	N/A	N/A	2500	30.0	R >4S	4/21/04
Mg	200.7	W	1	mg/L	<0.040	<0.040	UDL	19.9	20.0	99.5	4/20/04
Mg	200.7	W	2	mg/L	0.117	N/A	N/A	20.2	20.0	100.4	4/20/04
Mn	200.7	W	1	mg/L	0.0021	0.0022	4.7	0.996	1.00	99.4	4/21/04
Mn	200.7	W	2	mg/L	0.0155	N/A	N/A	0.996	1.00	98.1	4/21/04
Mn	200.7	W	3	mg/L	<0.0020	0.0021	200.0	1.02	1.00	102.0	4/21/04
Mn	200.7	W	4	mg/L	0.0100	N/A	N/A	1.00	1.00	99.0	4/21/04
Na	200.7	W	1	mg/L	95.7	98.6	3.0	119	20.0	116.5	4/20/04
Na	200.7	W	2	mg/L	153	N/A	N/A	178	20.0	125.0	4/20/04
SiO2	200.7	W	1	mg/L	63.7	65.7	3.1	75.6	10.7	111.2	4/20/04
SiO2	200.7	W	2	mg/L	120	N/A	N/A	130	10.7	93.5	4/20/04
SiO2	200.7	W	3	mg/L	64.7	63.1	2.5	71.5	10.7	R >4S	4/20/04
SiO2	200.7	W	4	mg/L	120	N/A	N/A	128	10.7	R >4S	4/21/04
Cl	300.0	W	1	mg/L	68.3	68.0	0.4	107	50.0	77.4	4/14/04
Cl	300.0	W	2	mg/L	57.0	N/A	N/A	98.9	50.0	83.8	4/14/04
r	300.0	W	1	mg/L	<1.0*	<1.0*	UDL	19.1	20.0	95.5	4/14/04
ι	300.0	W	2	mg/L	1.16	N/A	N/A	47.3	50.0	92.3	4/14/04
SO4	300.0	W	1	mg/L	1060	1060	0.0	1610	500	110.0	4/14/04
SO4	300.0	W	2	mg/L	1570	N/A	N/A	2140	500	114.0	4/14/04
ALK	2320B	W	1	mg/L	1180	1200	1.7	N/A	N/A	N/A	4/08/04
ALK	2320B	W	5	mg/L	1050	1080	2.8	N/A	N/A	N/A	4/22/04
pH	150.1	W	1		11.70	11.70	0.0	N/A	N/A	N/A	4/08/04
Eh	2580	W	1	mV	+103	+104	1.0	N/A	N/A	N/A	4/08/04
ORG18D	415.1	W	1	mg/L	106	110	3.7	395	250	115.6	4/14/04
TDS	160.1	W	1	mg/L	3560	3590	0.8	N/A	N/A	N/A	4/12/04
TURB	180.1	W	1	NTU'S	0.597	0.592	0.8	N/A	N/A	N/A	4/07/04

LEGEND:

RPD% = (|SAM - DUP|/((SAM + DUP)/2) * 100) UDL = Both SAM & DUP not detected. *Result or *Found: Interference required dilution.

RPD% = (|SPK - MSD|/((SPK + MSD)/2) * 100) M in Duplicate/MSD column indicates MSD.

SPIKE ADD column, A = Post Digest Spike; %R = Percent Recovery N/A = Not Analyzed; R > 4S = Result more than 4X the Spike Added

QC limits for MS recoveries apply only if the spike is at least 1/4 the concentration of the analyte in the sample.

Control limits for the RPD apply only if the concentration of the analyte in the sample is at least five times the reporting limit.

QC Sample 1: SVL SAM No.: 379018 Client Sample ID: PM-18 ^T
QC Sample 2: SVL SAM No.: 379028 Client Sample ID: PM-6 ^T
QC Sample 3: SVL SAM No.: 379030 Client Sample ID: PM-18 ^D
QC Sample 4: SVL SAM No.: 379040 Client Sample ID: PM-6 ^D
QC Sample 5: SVL SAM No.: 379027 Client Sample ID: PM-7 ^T

4/22/04 14:05

SVL ANALYTICAL

CHAIN OF CUSTODY RECORD

Page 1 of 2

Client: GeoSyntec
Contact: Brian Betty
Address: 2100 Main St #150
Huntington Beach, CA 92648
Phone Number: 714-969-0800
FAX Number: 714-969-0820

NOTES:

1) Ensure proper container packaging.
2) Ship samples promptly following collection.
* 3) Designate Sample Reject Disposition

PO#: HR0196-12
Project Name: Lehigh

Table 1. -- Matrix Type

1 = Surface Water, [✓ 2 = Ground Water]
3 = Soil/Sediment, 4 = Rinsate, 5 = Oil
6 = Waste, 7 = Other (Specify) ________

Samplers Signature: G. Hoy

FOR SVL USE ONLY
SVL JOB # 110352

Lab Name: SVL Analytical, Inc. (208) 784-1258 FAX (208) 783-0891
Address: One Government Gulch, Kellogg, ID 83837-0929

Sample ID	Collection		Miscellaneous				Preservative(s)						Analyses Required									Call Brian if questions *bottle #3 requires lab filter + HNO3 Comments
	Date	Time	Collected by: (Init.)	Matrix Type From Table 1	No. of Containers	Sample Filtered ? Y/N*	Unpreserved (Ice Only)	HNO3	HCL	H2SO4	NAOH	Other (Specify) ZnAc	turb, pH, redox, TDS	Diss Tot Ar, Pb, Cr	Metals + Si (200.7)	Alk (2320), Dk (415.1)	Sulfide (376.1)	Major cat Na, Ca, Mg, K	Major an Cl, F, SO4		incl'd As, Mn, Fe	
1. PM-18	4/5/04	11:15	gh	2	4	N	2	1				1	X	X	X	X	X	X	X			
* 2. PM-19		11:45																				* Sample
3. PM-15		12:15																				label read
4. PM-20		13:00																				MW-19
5. PM-1		13:30																				CRS
6. PM-21		14:00																				4/17/04
7. PM-16		14:35																				
8. PM-2		15:40																				
9. PM-8		16:15																				
10. PM-7		1700																				

Relinquished by:	Date:	Time:	Received by:	Date:	Time:
Gretchen E. Hoy	4/6/04			4-7-04	8:00a

* Sample Reject: [ ] Return [ ] Dispose [ ] Store (30 Days)

White: LAB COPY Yellow: CUSTOMER COPY SVL-COC 12/95

SVL ANALYTICAL

CHAIN OF CUSTODY RECORD

Page 2 of 2

Client: GeoSyntec
Contact: Brian Petty
Address: 2100 Main St, #150
Huntington Beach, CA 92648
Phone Number: 714-969-0800
FAX Number: 714-969-0820

NOTES:
1) Ensure proper container packaging.
2) Ship samples promptly following collection.
3) Designate Sample Reject Disposition
PO#: HR0196-12
Project Name: Lehigh

Table 1. -- Matrix Type
1 = Surface Water, [✓ 2 = Ground Water]
3 = Soil/Sediment, 4 = Rinsate, 5 = Oil
6 = Waste, 7 = Other (Specify) ________
Samplers Signature: G. Hoy

FOR SVL USE ONLY
SVL JOB # 110352

Lab Name: SVL Analytical, Inc. (208) 784-1258 FAX (208) 783-0891
Address: One Government Gulch, Kellogg, ID 83837-0929

Sample ID	Collection		Miscellaneous				Preservative(s)						Analyses Required									Comments
	Date	Time	Collected by: (Init.)	Matrix Type From Table 1	No. of Containers	Sample Filtered ? Y/N*	Unpreserved (Ice Only)	HNO3	HCL	H2SO4	NAOH	Other (Specify) Zn Ac	Turb, pH, redox, TDS	Dist+Tol As, Pb, Cd	Metals+Si (200.7)	Alk (2320) DIC (415.1)	Sulfide (376.1)	Maj Cat Na, Ca, Mg, K	Maj An Cl, F, SO4		incld As, Mn, Fe	*bottle #3 requires lab filter & HNO3 Call Brian if questions
1. PM-6	4/5/04	15:10	gh	2	4	N	2	1				1	X	X	X	x	x	x	x			
2. PM-5	4/5/04	18:00	gh	2	4	N	2	1				1	x	x	x	x	x	x	x			
3.																						
4.																						
5.																						
6.																						
7.																						
8.																						
9.																						
10.																						

Relinquished by:	Date:	Time:	Received by:	Date:	Time:
Gretchen E. Hoy	4/6/04			4-7-04	8:00a
Relinquished by:	Date:	Time:	Received by:	Date:	Time:

* Sample Reject: [ ] Return [ ] Dispose [ ] Store (30 Days)

White: LAB COPY Yellow: CUSTOMER COPY

SVL-COC 12/95

Quality Control Report
Part I Prep Blank and Laboratory Control Sample

Client :GeoSyntec

SVL JOB No: 110422

nalyte	Method	Matrix	Units	Prep Blank	LCS		LCS %R	Analysis Date
					True	Found		
Arsenic	200.7	WATER	mg/L	<0.010	1.00	0.976	97.6	4/22/04
Calcium	200.7	WATER	mg/L	<0.040	20.0	21.4	107.0	4/22/04
Iron	200.7	WATER	mg/L	<0.020	10.0	10.5	105.0	4/22/04
Potassium	200.7	WATER	mg/L	<1.0	30.0	30.9	103.0	4/22/04
Magnesium	200.7	WATER	mg/L	<0.040	20.0	20.5	102.5	4/22/04
Manganese	200.7	WATER	mg/L	<0.0020	1.00	1.01	101.0	4/22/04
Sodium	200.7	WATER	mg/L	<0.50	20.0	21.3	106.5	4/22/04
Silica	200.7	WATER	mg/L	<0.171	10.7	11.4	106.5	4/22/04
Chloride	300.0	WATER	mg/L	<0.20	5.00	4.92	98.4	4/15/04
Fluoride	300.0	WATER	mg/L	<0.10	2.50	2.55	102.0	4/15/04
Sulfate, SO4	300.0	WATER	mg/L	<0.30	10.0	9.82	98.2	4/15/04
ALKALINITY	2320B	WATER	mg/L	<1.0	20.5	23.5	114.6	4/13/04
pH	150.1	WATER		5.68	7.70	7.68	99.7	4/12/04
Eh (mV)	2580	WATER	mV	N/A	+228	+232	101.8	4/12/04
DIS. INOR CARBON	415.1	WATER	mg/L	<1.0	14.0	14.5	103.6	4/16/04
Sulfide	376.1	WATER	mg/L	<1.0	2.0	1.9	95.0	4/12/04
TDS	160.1	WATER	mg/L	<10	450	419	93.1	4/14/04
Turbidity	180.1	WATER	NTU'S	0.087	13.1	12.1	92.4	4/09/04

LEGEND:

LCS = Laboratory Control Sample

LCS %R = LCS Percent Recovery

N/A = Not Applicable

VL ANALYTICAL, INC.

Quality Control Report
Part II Duplicate and Spike Analysis

Client :GeoSyntec

SVL JOB No: 110422

	Method	Mtx	QC SAMPLE ID	Units	Result	Duplicate or Found	MSD RPD%	Matrix Spike Result	SPK ADD	%R	Analysis Date
s	200.7	W	1	mg/L	<0.010	<0.010	UDL	1.03	1.00	103.0	4/22/04
s	200.7	W	2	mg/L	<0.010	N/A	N/A	0.995	1.00	99.5	4/22/04
s	200.7	W	3	mg/L	<0.010	<0.010	UDL	1.09	1.00	109.0	4/22/04
s	200.7	W	4	mg/L	<0.010	N/A	N/A	1.02	1.00	102.0	4/23/04
a	200.7	W	1	mg/L	186	189	1.6	208	20.0	110.0	4/22/04
a	200.7	W	2	mg/L	99.1	N/A	N/A	125	20.0	R >4S	4/22/04
e	200.7	W	1	mg/L	0.150	0.179	17.6	10.6	10.0	104.5	4/22/04
e	200.7	W	2	mg/L	4.11	N/A	N/A	14.7	10.0	105.9	4/22/04
e	200.7	W	3	mg/L	<0.020	<0.020	UDL	10.2	10.0	102.0	4/22/04
e	200.7	W	4	mg/L	0.030	N/A	N/A	10.1	10.0	100.7	4/23/04
	200.7	W	1	mg/L	156	158	1.3	189	30.0	110.0	4/22/04
	200.7	W	2	mg/L	70.2	N/A	N/A	105	30.0	116.0	4/22/04
g	200.7	W	1	mg/L	46.8	47.0	0.4	67.4	20.0	103.0	4/22/04
g	200.7	W	2	mg/L	26.1	N/A	N/A	46.6	20.0	102.5	4/22/04
n	200.7	W	1	mg/L	0.522	0.534	2.3	1.54	1.00	101.8	4/22/04
n	200.7	W	2	mg/L	1.41	N/A	N/A	2.42	1.00	101.0	4/22/04
n	200.7	W	3	mg/L	0.500	0.500	0.0	1.45	1.00	95.0	4/22/04
n	200.7	W	4	mg/L	1.35	N/A	N/A	2.24	1.00	89.0	4/23/04
a	200.7	W	1	mg/L	82.9	83.6	0.8	105	20.0	110.5	4/22/04
a	200.7	W	2	mg/L	67.0	N/A	N/A	91.9	20.0	124.5	4/22/04
iO2	200.7	W	1	mg/L	13.4	13.5	0.7	25.4	10.7	112.1	4/22/04
iO2	200.7	W	2	mg/L	18.7	N/A	N/A	34.7	10.7	149.5	4/22/04
iO2	200.7	W	2	mg/L	18.7	N/A	N/A	28.5	10.7 A	91.6	4/22/04
iO2	200.7	W	3	mg/L	12.9	12.9	0.0	23.9	10.7	102.8	4/22/04
iO2	200.7	W	4	mg/L	11.4	N/A	N/A	22.3	10.7	101.9	4/23/04
l	300.0	W	1	mg/L	122	122	0.0	211	100	89.0	4/15/04
	300.0	W	2	mg/L	108	N/A	N/A	152	50.0	88.0	4/15/04
	300.0	W	1	mg/L	<0.20*	<0.20*	UDL	3.77	4.00	94.3	4/15/04
	300.0	W	2	mg/L	<0.10	N/A	N/A	1.86	2.00	93.0	4/15/04
O4	300.0	W	1	mg/L	501	505	0.8	766	250	106.0	4/15/04
O4	300.0	W	2	mg/L	45.1	N/A	N/A	71.1	25.0	104.0	4/15/04
LK	2320B	W	1	mg/L	332	331	0.3	N/A	N/A	N/A	4/13/04
H	150.1	W	1		7.67	7.68	0.1	N/A	N/A	N/A	4/12/04
h	2580	W	1	mV	+251	+249	0.8	N/A	N/A	N/A	4/12/04
RG18D	415.1	W	1	mg/L	78.4	78.0	0.5	110	50.0	63.2	4/16/04
DS	160.1	W	1	mg/L	1190	1210	1.7	I/S	I/S	N/A	4/14/04
URB	180.1	W	1	NTU'S	1.20	1.16	3.4	N/A	N/A	N/A	4/09/04

LEGEND:

RPD% = (|SAM - DUP|/((SAM + DUP)/2) * 100) UDL = Both SAM & DUP not detected. *Result or *Found: Interference required dilution.

RPD% = (|SPK - MSD|/((SPK + MSD)/2) * 100) M in Duplicate/MSD column indicates MSD.

SPIKE ADD column, A = Post Digest Spike; %R = Percent Recovery N/A = Not Analyzed; R > 4S = Result more than 4X the Spike Added

QC limits for MS recoveries apply only if the spike is at least 1/4 the concentration of the analyte in the sample.

Control limits for the RPD apply only if the concentration of the analyte in the sample is at least five times the reporting limit.

I/S: Insufficient sample for QC test.

QC Sample 1: SVL SAM No.: 379625 Client Sample ID: PM-3 ^T
QC Sample 2: SVL SAM No.: 379635 Client Sample ID: AVE E ^T
QC Sample 3: SVL SAM No.: 379636 Client Sample ID: PM-3 ^D
QC Sample 4: SVL SAM No.: 379646 Client Sample ID: AVE E ^D

4/23/04 15:37

SVL ANALYTICAL

CHAIN OF CUSTODY RECORD

Page 2 of 2

Client: Geo Syntec
Contact: Brian Petty
Address: 2100 Main St #150
Huntington Beach, CA 92648
Phone Number: 714-969-0800
FAX Number: 714-969-0820

NOTES:
1) Ensure proper container packaging.
2) Ship samples promptly following collection.
3) Designate Sample Reject Disposition
PO#: HR0196-12
Project Name: Lehigh

Table 1. -- Matrix Type
1 = Surface Water, [✓ 2] = Ground Water
3 = Soil/Sediment, 4 = Rinsate, 5 = Oil
6 = Waste, 7 = Other (Specify) ______

FOR SVL USE ONLY
SVL JOB #
110422

Samplers Signature: G. Hoy

Lab Name: SVL Analytical, Inc. (208) 784-1258 FAX (208) 783-0891
Address: One Government Gulch, Kellogg, ID 83837-0929

Sample ID	Collection		Miscellaneous				Preservative(s)						Analyses Required									Comments
	Date	Time	Collected by: (Init.)	Matrix Type From Table 1	No. of Containers	Sample Filtered ? Y/N	Unpreserved (Ice Only)	HNO3	HCL	H2SO4	NAOH	Other (Specify) Zn Ac	Turbid, pH, redox, TDS	Diss & Tot As, Pb, Cr	Metals & Si (200.7)	Alk (2320), DIC (415.1)	Sulfide (376.1)	Maj Cat (Na, Ca, Mg, K)	Maj An Cl, F, SO4		incl'd As, Mn, Fe	bottle #3 requires lab filtered HNO3 Call Brian if question
1. PM - [illegible]13	4/7/04	15:30	gh	2	4	N	2	1				1	X	X	X	X	X	X	X		X	
2. PM -14		17:45																				
3. PM-17		17:00																				
4. Avg W		14:16																				
5. Avg E		16:00																				
6.																						
7.																						
8.																						
9.																						
10.																						

Relinquished by: [illegible] E. Hoy Date: 4/8/04 Time: 13:37 Received by: CR Sewy Date: 4/9/04 Time: 9:25
Relinquished by: Date: Time: Received by: Date: Time:

* Sampl ect: ☐ Return ☐ Dispose ☐ Store (30 Days)

White: LAB COPY Yellow: CUSTOMER COPY SVL- 12/95

SVL ANALYTICAL

CHAIN OF CUSTODY RECORD

Page 1 of 2

Client: GeoSyntec
Contact: Brian Petty
Address: 2100 Main St. #150
Huntington Beach, CA 92648
Phone Number: 714-969-0800
FAX Number: 714-969-0820

NOTES:
1) Ensure proper container packaging.
2) Ship samples promptly following collection.
* 3) Designate Sample Reject Disposition
PO#: H120196-12
Project Name: Lehigh

Table 1. -- Matrix Type
1 = Surface Water, [✓ 2 = Ground Water]
3 = Soil/Sediment, 4 = Rinsate, 5 = Oil
6 = Waste, 7 = Other (Specify) ____

FOR SVL USE ONLY
SVL JOB # 110422

Samplers Signature: G. Hoy

Lab Name: SVL Analytical, Inc. (208) 784-1258 FAX (208) 783-0891
Address: One Government Gulch, Kellogg, ID 83837-0929

Sample ID	Collection		Miscellaneous				Preservative(s)						Analyses Required									Comments
	Date	Time	Collected by: (Init.)	Matrix Type From Table 1	No. of Containers	Sample Filtered ? Y/N	Unpreserved (Ice Only)	HNO3	HCL	H2SO4	NAOH	Other (Specify) ZnAc	turb, pH, redox, TDS	Diss & Tot As, Pb, Cr	Metals & Si (200.7)	Alk (2320), DIC (415.1)	Sulfide (376.1)	Maj Cat Na, Ca, Mg, K	Maj An Cl, F, SO4		include As, Mn, Fe	bottle #3 requires lab filter & HNO3 Call Brian if questions
1. PM-3	4/7/04	11:00	gh	2	4	N	2	1				1	x	x	x	x	x	x	x	x	x	
2. PM-4		11:45																				per Brian 4/7/04
3. PM-9		12:20																				PM wells sample
4. PM-10		15:00																				to be analyzed
5. PM-11		13:55																				for same list
6. PM-12		13:30																				as Job 110352
7.																						ybm 4/9/04
8.																						no Cr or Pb
9.																						
10.																						

Relinquished by: Cynthia E. Hoy Date: 4/8/04 Time: 13:37 Received by: ClSevy Date: 4/9/04 Time: 9:25
Relinquished by: Date: Time: Received by: Date: Time:

* Samp ject: [ ] Return [ ] Dispose [ ] Store (30 Days)

White: LAB COPY Yellow: CUSTOMER COPY

SVL ANALYTICAL, INC.
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: HR0196-12
CLIENT SAMPLE ID: MW-7
Sample Collected: 6/01/04 11:15
Sample Receipt : 6/02/04
Date of Report : 6/17/04

SVL JOB: 111266
SAMPLE: 388788
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	289	mg CaCO3/L		2320B	6/04/04
T	Eh (mV)	+245	mV		2580	6/02/04
T	pH	8.02			150.1	6/04/04
T	TDS	267	mg/L		160.1	6/03/04
T	Turbidity	0.331	NTU'S		180.1	6/03/04
T	Calcium	64.6	mg/L		200.7	6/15/04
T	Chloride	0.28	mg/L		300.0	6/15/04
T	Fluoride	0.15	mg/L		300.0	6/15/04
T	Potassium	5.0	mg/L		200.7	6/15/04
T	Magnesium	26.2	mg/L		200.7	6/15/04
T	Sodium	2.34	mg/L		200.7	6/15/04
T	Sulfide	<1.0	mg/L		376.1	6/04/04
T	Sulfate, SO4	20.6	mg/L		300.0	6/15/04
T	Arsenic	<0.010	mg/L		200.7	6/15/04
T	Chromium	<0.0060	mg/L		200.7	6/15/04
T	Iron	<0.020	mg/L		200.7	6/15/04
T	Manganese	0.0032	mg/L		200.7	6/15/04
T	Lead	<0.0050	mg/L		200.7	6/15/04
T	Silica	13.6	mg/L		200.7	6/15/04
T	DIS. INOR CARBON	66.3	mg/L		415.1	6/04/04
D	Arsenic	<0.010	mg/L		200.7	6/15/04
D	Chromium	<0.0060	mg/L		200.7	6/15/04
D	Iron	<0.020	mg/L		200.7	6/15/04
D	Manganese	0.0023	mg/L		200.7	6/15/04
D	Lead	<0.0050	mg/L		200.7	6/15/04
D	Silica	12.8	mg/L		200.7	6/15/04

CalcTDS:	326	TDS/Cond:		CATION SUM:	5.61meq/L	BALANCE
TDS/CalcTDS:	0.8	CalcTDS/Cond:		ANION SUM:	6.22meq/L	-5.16%

Filtered fraction: 388794

Reviewed By:______________________ Date 6/17/04
6/17/04 14:33

AZ: AZ0538 CA: NO. 2080 CO: 08/13/03 ID: ID00019 NV: ID-19-2004-19 TX: TX241-2002A WA: DOE NO. C074; DOH NO. 050

SVL ANALYTICAL, INC.

One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: HR0196-12
CLIENT SAMPLE ID: MW-8
Sample Collected: 6/01/04 10:45
Sample Receipt : 6/02/04
Date of Report : 6/17/04

SVL JOB: 111266
SAMPLE: 388789
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	284	mg CaCO3/L		2320B	6/04/04
T	Eh (mV)	+220	mV		2580	6/02/04
T	pH	7.91			150.1	6/04/04
T	TDS	292	mg/L		160.1	6/03/04
T	Turbidity	53.2	NTU'S		180.1	6/03/04
T	Calcium	61.4	mg/L		200.7	6/15/04
T	Chloride	7.48	mg/L		300.0	6/15/04
T	Fluoride	0.18	mg/L		300.0	6/15/04
T	Potassium	9.6	mg/L		200.7	6/15/04
T	Magnesium	26.0	mg/L		200.7	6/15/04
T	Sodium	5.15	mg/L		200.7	6/15/04
T	Sulfide	<1.0	mg/L		376.1	6/04/04
T	Sulfate, SO4	29.8	mg/L	2	300.0	6/15/04
T	Arsenic	<0.010	mg/L		200.7	6/15/04
T	Chromium	<0.0060	mg/L		200.7	6/15/04
T	Iron	5.50	mg/L		200.7	6/15/04
T	Manganese	2.07	mg/L		200.7	6/15/04
T	Lead	<0.0050	mg/L		200.7	6/15/04
T	Silica	13.2	mg/L		200.7	6/15/04
T	DIS. INOR CARBON	64.9	mg/L		415.1	6/04/04
D	Arsenic	<0.010	mg/L		200.7	6/15/04
D	Chromium	<0.0060	mg/L		200.7	6/15/04
D	Iron	0.185	mg/L		200.7	6/15/04
D	Manganese	2.00	mg/L		200.7	6/15/04
D	Lead	<0.0050	mg/L		200.7	6/15/04
D	Silica	12.4	mg/L		200.7	6/15/04

CalcTDS:	348	TDS/Cond:		CATION SUM:	6.03meq/L	BALANCE
TDS/CalcTDS:	0.8	CalcTDS/Cond:		ANION SUM:	6.51meq/L	-3.83%

Filtered fraction: 388795

Reviewed By:________________ Date 6/17/04

6/17/04 14:33

AZ: AZ0538 CA: NO. 2080 CO: 08/13/03 ID: ID00019 NV: ID-19-2004-19 TX: TX241-2002A WA: DOE NO. C074; DOH NO. 050

SVL ANALYTICAL, INC.
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: HR0196-12
CLIENT SAMPLE ID: MW-9
Sample Collected: 6/01/04
Sample Receipt : 6/02/04
Date of Report : 6/17/04

SVL JOB: 111266
SAMPLE: 388790
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	1410	mg CaCO3/L		2320B	6/04/04
T	Eh (mV)	-386	mV		2580	6/02/04
T	pH	11.87			150.1	6/04/04
T	TDS	2890	mg/L		160.1	6/03/04
T	Turbidity	4.65	NTU'S		180.1	6/03/04
T	Calcium	3.99	mg/L		200.7	6/15/04
T	Chloride	35.3	mg/L	10	300.0	6/15/04
T	Fluoride	1.30	mg/L	10	300.0	6/15/04
T	Potassium	1380	mg/L	10	200.7	6/15/04
T	Magnesium	0.116	mg/L		200.7	6/15/04
T	Sodium	63.6	mg/L		200.7	6/15/04
T	Sulfide	9.8	mg/L		376.1	6/04/04
T	Sulfate, SO4	655	mg/L	100	300.0	6/15/04
T	Arsenic	0.074	mg/L		200.7	6/15/04
T	Chromium	<0.0060	mg/L		200.7	6/15/04
T	Iron	1.12	mg/L		200.7	6/15/04
T	Manganese	0.0169	mg/L		200.7	6/15/04
T	Lead	0.0056	mg/L		200.7	6/15/04
T	Silica	45.9	mg/L		200.7	6/15/04
T	DIS. INOR CARBON	100	mg/L		415.1	6/04/04
D	Arsenic	0.074	mg/L		200.7	6/15/04
D	Chromium	<0.0060	mg/L		200.7	6/15/04
D	Iron	0.823	mg/L		200.7	6/15/04
D	Manganese	0.0130	mg/L		200.7	6/15/04
D	Lead	<0.0050	mg/L		200.7	6/15/04
D	Silica	45.3	mg/L		200.7	6/15/04

CalcTDS:	3100	TDS/Cond:		CATION SUM:	38.35meq/L	BALANCE
TDS/CalcTDS:	0.9	CalcTDS/Cond:		ANION SUM:	42.92meq/L	-5.62%

Filtered fraction: 388796

Reviewed By:________________ Date 6/17/04
6/17/04 14:33

AZ: AZ0538 CA: NO. 2080 CO: 08/13/03 ID: ID00019 NV: ID-19-2004-19 TX: TX241-2002A WA: DOE NO. C074; DOH NO. 050

SVL ANALYTICAL, INC.
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: HR0196-12
CLIENT SAMPLE ID: MW-9(D)
Sample Collected: 6/01/04
Sample Receipt : 6/02/04
Date of Report : 6/17/04

SVL JOB: 111266
SAMPLE: 388791
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	1420	mg CaCO3/L		2320B	6/04/04
T	Eh (mV)	-376	mV		2580	6/02/04
T	pH	11.86			150.1	6/04/04
T	TDS	2790	mg/L		160.1	6/03/04
T	Turbidity	2.53	NTU'S		180.1	6/03/04
T	Calcium	4.00	mg/L		200.7	6/15/04
T	Chloride	36.9	mg/L	10	300.0	6/15/04
T	Fluoride	1.30	mg/L	10	300.0	6/15/04
T	Potassium	1420	mg/L	10	200.7	6/15/04
T	Magnesium	0.115	mg/L		200.7	6/15/04
T	Sodium	62.8	mg/L		200.7	6/15/04
T	Sulfide	9.7	mg/L		376.1	6/04/04
T	Sulfate, SO4	647	mg/L	100	300.0	6/15/04
T	Arsenic	0.076	mg/L		200.7	6/15/04
T	Chromium	<0.0060	mg/L		200.7	6/15/04
T	Iron	1.10	mg/L		200.7	6/15/04
T	Manganese	0.0164	mg/L		200.7	6/15/04
T	Lead	<0.0050	mg/L		200.7	6/15/04
T	Silica	45.5	mg/L		200.7	6/15/04
T	DIS. INOR CARBON	99.0	mg/L		415.1	6/04/04
D	Arsenic	0.065	mg/L		200.7	6/15/04
D	Chromium	<0.0060	mg/L		200.7	6/15/04
D	Iron	0.799	mg/L		200.7	6/15/04
D	Manganese	0.0125	mg/L		200.7	6/15/04
D	Lead	<0.0050	mg/L		200.7	6/15/04
D	Silica	44.0	mg/L		200.7	6/15/04

CalcTDS: 3140 TDS/Cond:
TDS/CalcTDS: 0.9 CalcTDS/Cond:

CATION SUM: 39.33meq/L
ANION SUM: 42.91meq/L

BALANCE
-4.35%

Filtered fraction: 388797

Reviewed By:__________ Date 6/17/04

6/17/04 14:33

AZ: AZ0538 CA: NO. 2080 CO: 08/13/03 ID: ID00019 NV: ID-19-2004-19 TX: TX241-2002A WA: DOE NO. C074; DOH NO. 050

SVL ANALYTICAL, INC.
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: HR0196-12
CLIENT SAMPLE ID: MW-11
Sample Collected: 6/01/04 11:35
Sample Receipt : 6/02/04
Date of Report : 6/17/04

SVL JOB: 111266
SAMPLE: 388792
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	417	mg CaCO3/L		2320B	6/04/04
T	Eh (mV)	+55.2	mV		2580	6/02/04
T	pH	7.86			150.1	6/04/04
T	TDS	502	mg/L		160.1	6/03/04
T	Turbidity	1.97	NTU'S		180.1	6/03/04
T	Calcium	122	mg/L		200.7	6/15/04
T	Chloride	8.39	mg/L		300.0	6/15/04
T	Fluoride	0.10	mg/L		300.0	6/15/04
T	Potassium	3.1	mg/L		200.7	6/15/04
T	Magnesium	38.6	mg/L		200.7	6/15/04
T	Sodium	5.51	mg/L		200.7	6/15/04
T	Sulfide	<1.0	mg/L		376.1	6/04/04
T	Sulfate, SO4	93.2	mg/L	5	300.0	6/15/04
T	Arsenic	<0.010	mg/L		200.7	6/15/04
T	Chromium	<0.0060	mg/L		200.7	6/15/04
T	Iron	0.630	mg/L		200.7	6/15/04
T	Manganese	0.0136	mg/L		200.7	6/15/04
T	Lead	<0.0050	mg/L		200.7	6/15/04
T	Silica	24.8	mg/L		200.7	6/15/04
T	DIS. INOR CARBON	96.7	mg/L		415.1	6/04/04
D	Arsenic	<0.010	mg/L		200.7	6/15/04
D	Chromium	<0.0060	mg/L		200.7	6/15/04
D	Iron	<0.020	mg/L		200.7	6/15/04
D	Manganese	0.0040	mg/L		200.7	6/15/04
D	Lead	<0.0050	mg/L		200.7	6/15/04
D	Silica	23.0	mg/L		200.7	6/15/04

CalcTDS:	582	TDS/Cond:		CATION SUM:	9.61meq/L	BALANCE
TDS/CalcTDS:	0.9	CalcTDS/Cond:		ANION SUM:	10.52meq/L	-4.52%

Filtered fraction: 388798

Reviewed By:______________________ Date 6/17/04

6/17/04 14:33

AZ: AZ0538 CA: NO. 2080 CO: 08/13/03 ID: ID00019 NV: ID-19-2004-19 TX: TX241-2002A WA: DOE NO. C074; DOH NO. 050

SVL ANALYTICAL, INC.

One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: HR0196-12
CLIENT SAMPLE ID: MW-12
Sample Collected: 6/01/04 9:55
Sample Receipt : 6/02/04
Date of Report : 6/17/04

SVL JOB: 111266
SAMPLE: 388793
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	323	mg CaCO3/L		2320B	6/04/04
T	Eh (mV)	+95.3	mV		2580	6/02/04
T	pH	8.09			150.1	6/04/04
T	TDS	661	mg/L		160.1	6/03/04
T	Turbidity	14.5	NTU'S		180.1	6/03/04
T	Calcium	71.8	mg/L		200.7	6/15/04
T	Chloride	228	mg/L	25	300.0	6/15/04
T	Fluoride	0.16	mg/L		300.0	6/15/04
T	Potassium	40.3	mg/L		200.7	6/15/04
T	Magnesium	27.5	mg/L		200.7	6/15/04
T	Sodium	120	mg/L		200.7	6/15/04
T	Sulfide	<1.0	mg/L		376.1	6/04/04
T	Sulfate, SO4	40.5	mg/L	2	300.0	6/15/04
T	Arsenic	<0.010	mg/L		200.7	6/15/04
T	Chromium	<0.0060	mg/L		200.7	6/15/04
T	Iron	2.41	mg/L		200.7	6/15/04
T	Manganese	1.99	mg/L		200.7	6/15/04
T	Lead	<0.0050	mg/L		200.7	6/15/04
T	Silica	11.0	mg/L		200.7	6/15/04
T	DIS. INOR CARBON	69.7	mg/L		415.1	6/04/04
D	Arsenic	<0.010	mg/L		200.7	6/15/04
D	Chromium	<0.0060	mg/L		200.7	6/15/04
D	Iron	0.054	mg/L		200.7	6/15/04
D	Manganese	1.92	mg/L		200.7	6/15/04
D	Lead	<0.0050	mg/L		200.7	6/15/04
D	Silica	10.5	mg/L		200.7	6/15/04

CalcTDS:	752	TDS/Cond:		CATION SUM:	12.32meq/L	BALANCE
TDS/CalcTDS:	0.9	CalcTDS/Cond:		ANION SUM:	13.73meq/L	-5.41%

Filtered fraction: 388799

Reviewed By: ______________________ Date 6/17/04

6/17/04 14:33

AZ: AZ0538 CA: NO. 2080 CO: 08/13/03 ID: ID00019 NV: ID-19-2004-19 TX: TX241-2002A WA: DOE NO. C074; DOH NO. 050

SVL ANALYTICAL, INC.

Quality Control Report
Part I Prep Blank and Laboratory Control Sample

Client :GeoSyntec SVL JOB No: 111266

Analyte	Method	Matrix	Units	Prep Blank	LCS		LCS %R	Analysis Date
					True	Found		
Arsenic	200.7	WATER	mg/L	<0.010	1.00	0.976	97.6	6/15/04
Calcium	200.7	WATER	mg/L	<0.040	20.0	20.1	100.5	6/15/04
Chromium	200.7	WATER	mg/L	<0.0060	1.00	0.992	99.2	6/15/04
Iron	200.7	WATER	mg/L	<0.020	10.0	9.64	96.4	6/15/04
Potassium	200.7	WATER	mg/L	<1.0	30.0	30.3	101.0	6/15/04
Magnesium	200.7	WATER	mg/L	<0.040	20.0	19.3	96.5	6/15/04
Manganese	200.7	WATER	mg/L	<0.0020	1.00	0.979	97.9	6/15/04
Sodium	200.7	WATER	mg/L	<0.50	20.0	19.8	99.0	6/15/04
Lead	200.7	WATER	mg/L	<0.0050	1.00	0.969	96.9	6/15/04
Silica	200.7	WATER	mg/L	<0.171	10.7	10.6	99.1	6/15/04
Chloride	300.0	WATER	mg/L	<0.20	5.00	5.00	100.0	6/15/04
Fluoride	300.0	WATER	mg/L	<0.10	2.50	2.55	102.0	6/15/04
Sulfate, SO4	300.0	WATER	mg/L	<0.30	10.0	9.89	98.9	6/15/04
ALKALINITY	2320B	WATER	mg/L	<1.0	20.5	23.8	116.1	6/04/04
pH	150.1	WATER		5.61	7.70	7.69	99.9	6/04/04
Eh (mV)	2580	WATER	mV	N/A	+228	+228	100.0	6/02/04
DIS. INOR CARBON	415.1	WATER	mg/L	<1.0	8.00	7.96	99.5	6/04/04
Sulfide	376.1	WATER	mg/L	<1.0	1.2	1.3	108.3	6/04/04
TDS	160.1	WATER	mg/L	<10	450	432	96.0	6/03/04
Turbidity	180.1	WATER	NTU'S	0.072	13.1	12.8	97.7	6/03/04

LEGEND:

LCS = Laboratory Control Sample LCS %R = LCS Percent Recovery N/A = Not Applicable

6/17/04 14:34

SVL ANALYTICAL, INC.

Quality Control Report
Part II Duplicate and Spike Analysis

Client :GeoSyntec SVL JOB No: 111266

t	Method	Mtx	QC SAMPLE ID	Units	Result	Duplicate or MSD Found	RPD%	Matrix Spike Result	SPK ADD	%R	Analysis Date
As	200.7	W	1	mg/L	<0.010	<0.010	UDL	0.924	1.00	92.4	6/15/04
As	200.7	W	2	mg/L	<0.010	<0.010	UDL	0.898	1.00	89.8	6/15/04
Ca	200.7	W	1	mg/L	64.6	63.8	1.2	80.8	20.0	81.0	6/15/04
Cr	200.7	W	1	mg/L	<0.0060	<0.0060	UDL	0.948	1.00	94.8	6/15/04
Cr	200.7	W	2	mg/L	<0.0060	<0.0060	UDL	0.907	1.00	90.7	6/15/04
Fe	200.7	W	1	mg/L	<0.020	<0.020	UDL	9.11	10.0	91.1	6/15/04
Fe	200.7	W	2	mg/L	<0.020	<0.020	UDL	8.93	10.0	89.3	6/15/04
K	200.7	W	1	mg/L	5.0	4.9	2.0	34.1	30.0	97.0	6/15/04
Mg	200.7	W	1	mg/L	26.2	26.0	0.8	43.7	20.0	87.5	6/15/04
Mn	200.7	W	1	mg/L	0.0032	0.0033	3.1	0.929	1.00	92.6	6/15/04
Mn	200.7	W	2	mg/L	0.0023	0.0021	9.1	0.910	1.00	90.8	6/15/04
Na	200.7	W	1	mg/L	2.34	2.30	1.7	21.3	20.0	94.8	6/15/04
Pb	200.7	W	1	mg/L	<0.0050	<0.0050	UDL	0.911	1.00	91.1	6/15/04
Pb	200.7	W	2	mg/L	<0.0050	<0.0050	UDL	0.909	1.00	90.9	6/15/04
SiO2	200.7	W	1	mg/L	13.6	13.3	2.2	23.0	10.7	87.9	6/15/04
SiO2	200.7	W	2	mg/L	12.8	13.1	2.3	22.2	10.7	87.9	6/15/04
Cl	300.0	W	1	mg/L	0.28	0.29	3.5	2.13	2.00	92.5	6/15/04
F	300.0	W	1	mg/L	0.15	0.15	0.0	2.10	2.00	97.5	6/15/04
SO4	300.0	W	1	mg/L	20.6	20.5	0.5	45.6	25.0	100.0	6/15/04
ALK	2320B	W	1	mg/L	289	289	0.0	N/A	N/A	N/A	6/04/04
pH	150.1	W	1		8.02	8.03	0.1	N/A	N/A	N/A	6/04/04
Eh	2580	W	1	mV	+245	+245	0.0	N/A	N/A	N/A	6/02/04
ORG18D	415.1	W	1	mg/L	66.3	65.5	1.2	104	50.0	75.4	6/04/04
TDS	160.1	W	1	mg/L	267	282	5.5	N/A	N/A	N/A	6/03/04
TURB	180.1	W	1	NTU'S	0.331	0.368	10.6	N/A	N/A	N/A	6/03/04

END:

RPD% = (|SAM - DUP|/((SAM + DUP)/2) * 100) UDL = Both SAM & DUP not detected. *Result or *Found: Interference required dilution.

RPD% = (|SPK - MSD|/((SPK + MSD)/2) * 100) M in Duplicate/MSD column indicates MSD.

SPIKE ADD column, A = Post Digest Spike; %R = Percent Recovery N/A = Not Analyzed; R > 4S = Result more than 4X the Spike Added

QC limits for MS recoveries apply only if the spike is at least 1/4 the concentration of the analyte in the sample.

Control limits for the RPD apply only if the concentration of the analyte in the sample is at least five times the reporting limit.

QC Sample 1: SVL SAM No.: 388788 Client Sample ID: MW-7 ^T
QC Sample 2: SVL SAM No.: 388794 Client Sample ID: MW-7 ^D

INSUFFICIENT SAMPLE FOR SULFIDE*

6/17/04 14:34

208-185-0871

SVL ANALYTICAL

CHAIN OF CUSTODY RECORD

Page 1 of 1

Client: GeoSyntec Consultants
Contact: Brian Petty
Address: 2100 Main St, Suite 150
Huntington Beach, CA 92648
Phone Number: 714-969-0800
FAX Number: 714-969-0820

NOTES:

1) Ensure proper container packaging.
2) Ship samples promptly following collection.
* 3) Designate Sample Reject Disposition

PO#: HR0196-12
Project Name: Metaline Falls

Table 1. -- Matrix Type
1 = Surface Water, 2 = Ground Water
3 = Soil/Sediment, 4 = Rinsate, 5 = Oil
6 = Waste, 7 = Other (Specify) ______

FOR SVL USE ONLY
SVL JOB # 1112660

Samplers Signature:

Lab Name: SVL Analytical, Inc. (208) 784-1258 FAX (208) 783-0891
Address: One Government Gulch, Kellogg, ID 83837-0929

SVL to filter for Diss. metals on 6/2/04

Sample ID	Collection		Miscellaneous				Preservative(s)						Analyses Required									Comments
	Date	Time	Collected by: (Init.)	Matrix Type From Table 1	No. of Containers	Sample Filtered ? Y/N	Unpreserved (Ice Only)	HNO3	HCL	H2SO4	NAOH	Other (Specify)	Turbidity, redox	pH, alkalinity	DIC, TDS	Sulfide	major cations (Na, Ca, Mg)	major anions (Cl, F, SO4)	(total+dissolved) As, Pb	(total+dissolved) Fe, Mn	(total+dissolved) silicon	
1. MW-7	6/1/04	11:15	GH	2									X	X	X	X	X	X	X	X	X	* Sample Times
2. MW-8	6/1/04	10:45	GH	2									|	|	|	|	|	|	|	|	|	are on Bottles not on C.O.C.
3. MW-9	6/1/04		GH	2									|	|	|	|	|	|	|	|	|	KLS 6-2-04
4. MW-9 (D)	6/1/04		GH	2									|	|	|	|	|	|	|	|	|	
5. MW-11	6/1/04	11:35	GH	2									|	|	|	|	|	|	|	|	|	
6. MW-12	6/1/04	9:55	GH	2									X	X	X	X	X	X	X	X	X	
7.																						
8.																						
9.																						
10.																						

Relinquished by:	Date:	Time:	Received by:	Date:	Time:
Gretchen Hoy			Kelli Seery	6-2-04	12:34

* Sample Reject: [ ] Return [ ] Dispose [ ] Store (30 Days)

White: LAB COPY Yellow: CUSTOMER COPY SVL-COC 12/95

TRANSMISSION VERIFICATION REPORT

TIME : 06/02/2004 14:00
NAME : SVL ANALYTICAL
FAX : 2087830891
TEL : 2087841258
SER.# : BROF3J496071

DATE,TIME	06/02 13:59
FAX NO./NAME	917149690820
DURATION	00:00:25
PAGE(S)	01
RESULT	OK
MODE	FINE ECM

SVL LYTICAL, INC.
overnment Gulch - Kellogg, ID 83837-0929

Page 1 of 1

SAMPLE RECEIPT CONFIRMATION

SVL JOB No: 111266
Received: 6/02/04
Expected Due date: 6/16/04

By	Received	Sample Comments
GH	6/02/04	
GH	6/02/04	
GH	6/02/04	
GH	6/02/04	
GH	6/02/04	
GH	6/02/04	
GH	6/02/04	
GH	6/02/04	
GH	6/02/04	
GH	6/02/04	
GH	6/02/04	
GH	6/02/04	

ss. (^P) and Dissolved (^D) fractions separately. Field samples may appear twice.

emp: 19°C.

after job completion.
, then you will receive a letter requesting disposal options.

you have questions regarding the receipt of these samples. 6/02/04 13:13

SVL ANALYTICAL, INC.

Certificate: CA NO. 2080

One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: HR0196-12
CLIENT SAMPLE ID: MW-7
Sample Collected: 7/30/04 10:45
Sample Receipt : 8/02/04
Date of Report : 8/16/04

SVL JOB: 112402
SAMPLE: 402213
TOT/DIS

Matrix: WATER

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	317	mg CaCO3/L		2320B	8/09/04
T	Eh (mV)	+194	mV		2580	8/10/04
T	pH	8.07			150.1	8/09/04
T	TDS	295	mg/L		160.1	8/06/04
T	Turbidity	0.167	NTU'S		180.1	8/04/04
T	Calcium	68.9	mg/L		200.7	8/13/04
T	Chloride	0.47	mg/L		300.0	8/11/04
T	Fluoride	0.10	mg/L		300.0	8/11/04
T	Potassium	5.5	mg/L		200.7	8/13/04
T	Magnesium	27.6	mg/L		200.7	8/13/04
T	Sodium	2.43	mg/L		200.7	8/13/04
T	Sulfide	<1.0	mg/L		376.1	8/05/04
T	Sulfate, SO4	16.6	mg/L		300.0	8/11/04
T	Arsenic	<0.010	mg/L		200.7	8/13/04
T	Chromium	<0.0060	mg/L		200.7	8/13/04
T	Iron	0.030	mg/L		200.7	8/13/04
T	Manganese	0.0034	mg/L		200.7	8/13/04
T	Lead	<0.0050	mg/L		200.7	8/13/04
T	Silica	17.3	mg/L		200.7	8/13/04
T	DIS. INOR CARBON	72.6	mg/L		415.1	8/13/04
D	Arsenic	<0.010	mg/L		200.7	8/13/04
D	Chromium	<0.0060	mg/L		200.7	8/13/04
D	Iron	<0.020	mg/L		200.7	8/13/04
D	Manganese	0.0045	mg/L		200.7	8/13/04
D	Lead	<0.0050	mg/L		200.7	8/13/04
D	Silica	17.1	mg/L		200.7	8/13/04

CalcTDS:	355	TDS/Cond:		CATION SUM:	5.96meq/L	BALANCE
TDS/CalcTDS:	0.8	CalcTDS/Cond:		ANION SUM:	6.70meq/L	-5.85%

Filtered fraction: 402219

Reviewed By: ______________________ Date 8/16/04

8/16/04 13:54

AZ: AZ0538 CA: NO. 2080 CO: 08/13/03 ID: ID00019 NV: ID-19-2004-19 TX: TX241-2002A WA: DOE NO. C074; DOH NO. 050

SVL ANALYTICAL, INC.

Certificate: CA NO. 2080

One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: HR0196-12
CLIENT SAMPLE ID: MW-8
Sample Collected: 7/30/04 10:15
Sample Receipt : 8/02/04
Date of Report : 8/16/04

SVL JOB: 112402
SAMPLE: 402214
TOT/DIS

Matrix: WATER

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	311	mg CaCO3/L		2320B	8/09/04
T	Eh (mV)	+200	mV		2580	8/10/04
T	pH	8.11			150.1	8/09/04
T	TDS	321	mg/L		160.1	8/06/04
T	Turbidity	3.82	NTU'S		180.1	8/04/04
T	Calcium	66.1	mg/L		200.7	8/13/04
T	Chloride	10.4	mg/L		300.0	8/12/04
T	Fluoride	0.16	mg/L		300.0	8/11/04
T	Potassium	10.6	mg/L		200.7	8/13/04
T	Magnesium	27.8	mg/L		200.7	8/13/04
T	Sodium	4.25	mg/L		200.7	8/13/04
T	Sulfide	<1.0	mg/L		376.1	8/05/04
T	Sulfate, SO4	26.1	mg/L	2	300.0	8/12/04
T	Arsenic	<0.010	mg/L		200.7	8/13/04
T	Chromium	<0.0060	mg/L		200.7	8/13/04
T	Iron	6.02	mg/L		200.7	8/13/04
T	Manganese	2.30	mg/L		200.7	8/13/04
T	Lead	<0.0050	mg/L		200.7	8/13/04
T	Silica	15.5	mg/L		200.7	8/13/04
T	DIS. INOR CARBON	70.8	mg/L		415.1	8/13/04
D	Arsenic	<0.010	mg/L		200.7	8/13/04
D	Chromium	<0.0060	mg/L		200.7	8/13/04
D	Iron	0.176	mg/L		200.7	8/13/04
D	Manganese	2.29	mg/L		200.7	8/13/04
D	Lead	<0.0050	mg/L		200.7	8/13/04
D	Silica	14.4	mg/L		200.7	8/13/04

CalcTDS:	376	TDS/Cond:	CATION SUM:	6.43meq/L	BALANCE
TDS/CalcTDS:	0.9	CalcTDS/Cond:	ANION SUM:	7.05meq/L	-4.60%

Filtered fraction: 402220

Reviewed By: ______________________ Date 8/16/04

8/16/04 13:54

AZ: AZ0538 CA: NO. 2080 CO: 08/13/03 ID: ID00019 NV: ID-19-2004-19 TX: TX241-2002A WA: DOE NO. C074; DOH NO. 050

SVL ANALYTICAL, INC.
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891
Certificate: CA NO. 2080

CLIENT : GeoSyntec
PROJECT: HR0196-12
CLIENT SAMPLE ID: MW-9
Sample Collected: 7/30/04 9:35
Sample Receipt : 8/02/04
Date of Report : 8/16/04

SVL JOB: 112402
SAMPLE: 402215
TOT/DIS

Matrix: WATER

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	1480	mg CaCO3/L		2320B	8/09/04
T	Eh (mV)	-277	mV		2580	8/10/04
T	pH	11.10			150.1	8/09/04
T	TDS	3590	mg/L		160.1	8/06/04
T	Turbidity	1.08	NTU'S		180.1	8/04/04
T	Calcium	4.35	mg/L		200.7	8/13/04
T	Chloride	34.2	mg/L		300.0	8/12/04
T	Fluoride	<1.00*	mg/L	10	300.0	8/12/04
T	Potassium	1830	mg/L	10	200.7	8/13/04
T	Magnesium	0.430	mg/L		200.7	8/13/04
T	Sodium	73.0	mg/L		200.7	8/13/04
T	Sulfide	3.1	mg/L		376.1	8/05/04
T	Sulfate, SO4	639	mg/L	50	300.0	8/12/04
T	Arsenic	0.141	mg/L		200.7	8/13/04
T	Chromium	<0.0060	mg/L		200.7	8/13/04
T	Iron	1.59	mg/L		200.7	8/13/04
T	Manganese	0.0292	mg/L		200.7	8/13/04
T	Lead	0.0100	mg/L		200.7	8/13/04
T	Silica	66.7	mg/L		200.7	8/13/04
T	DIS. INOR CARBON	76.9	mg/L		415.1	8/13/04
D	Arsenic	0.082	mg/L		200.7	8/13/04
D	Chromium	<0.0060	mg/L		200.7	8/13/04
D	Iron	0.597	mg/L		200.7	8/13/04
D	Manganese	0.0093	mg/L		200.7	8/13/04
D	Lead	<0.0050	mg/L		200.7	8/13/04
D	Silica	62.1	mg/L		200.7	8/13/04

CalcTDS:	3630	TDS/Cond:		CATION SUM:	50.33meq/L	BALANCE
TDS/CalcTDS:	1.0	CalcTDS/Cond:		ANION SUM:	43.81meq/L	6.93%

Filtered fraction: 402221
*Elevated detection limit due to matrix interference.

Reviewed By:________________ Date 8/16/04
8/16/04 13:54

AZ: AZ0538 CA: NO. 2080 CO: 08/13/03 ID: ID00019 NV: ID-19-2004-19 TX: TX241-2002A WA: DOE NO. C074; DOH NO. 050

SVL ANALYTICAL, INC.
Certificate: CA NO. 2080
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: HR0196-12
CLIENT SAMPLE ID: MW-9D
Sample Collected: 7/30/04
Sample Receipt : 8/02/04
Date of Report : 8/16/04

SVL JOB: 112402
SAMPLE: 402216
TOT/DIS

Matrix: WATER

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	1580	mg CaCO3/L		2320B	8/09/04
T	Eh (mV)	-278	mV		2580	8/10/04
T	pH	11.10			150.1	8/09/04
T	TDS	3320	mg/L		160.1	8/06/04
T	Turbidity	0.987	NTU'S		180.1	8/04/04
T	Calcium	4.31	mg/L		200.7	8/13/04
T	Chloride	38.6	mg/L		300.0	8/12/04
T	Fluoride	<1.00*	mg/L	10	300.0	8/12/04
T	Potassium	1680	mg/L	10	200.7	8/13/04
T	Magnesium	0.049	mg/L		200.7	8/13/04
T	Sodium	66.2	mg/L		200.7	8/13/04
T	Sulfide	3.1	mg/L		376.1	8/05/04
T	Sulfate, SO4	718	mg/L	50	300.0	8/12/04
T	Arsenic	0.119	mg/L		200.7	8/13/04
T	Chromium	<0.0060	mg/L		200.7	8/13/04
T	Iron	0.824	mg/L		200.7	8/13/04
T	Manganese	0.0105	mg/L		200.7	8/13/04
T	Lead	<0.0050	mg/L		200.7	8/13/04
T	Silica	62.5	mg/L		200.7	8/13/04
T	DIS. INOR CARBON	78.9	mg/L		415.1	8/13/04
D	Arsenic	0.072	mg/L		200.7	8/13/04
D	Chromium	<0.0060	mg/L		200.7	8/13/04
D	Iron	0.620	mg/L		200.7	8/13/04
D	Manganese	0.0089	mg/L		200.7	8/13/04
D	Lead	<0.0050	mg/L		200.7	8/13/04
D	Silica	60.6	mg/L		200.7	8/13/04

CalcTDS: 3610 TDS/Cond:
TDS/CalcTDS: 0.9 CalcTDS/Cond:

CATION SUM: 46.12meq/L
ANION SUM: 47.59meq/L

BALANCE
-1.57%

Filtered fraction: 402222
*Elevated detection limit due to matrix interference.

Reviewed By:__________ Date 8/16/04
8/16/04 13:54

AZ: AZ0538 CA: NO. 2080 CO: 08/13/03 ID: ID00019 NV: ID-19-2004-19 TX: TX241-2002A WA: DOE NO. C074; DOH NO. 050

SVL ANALYTICAL, INC.
Certificate: CA NO. 2080

One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: HR0196-12
CLIENT SAMPLE ID: MW-11
Sample Collected: 7/30/04 9:00
Sample Receipt : 8/02/04
Date of Report : 8/16/04

SVL JOB: 112402
SAMPLE: 402211
TOT/DIS

Matrix: WATER

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	435	mg CaCO3/L		2320B	8/09/04
T	Eh (mV)	+192	mV		2580	8/10/04
T	pH	7.93			150.1	8/09/04
T	TDS	517	mg/L		160.1	8/06/04
T	Turbidity	0.791	NTU'S		180.1	8/04/04
T	Calcium	128	mg/L		200.7	8/13/04
T	Chloride	9.68	mg/L	5	300.0	8/11/04
T	Fluoride	<0.10	mg/L		300.0	8/11/04
T	Potassium	2.6	mg/L		200.7	8/13/04
T	Magnesium	40.6	mg/L		200.7	8/13/04
T	Sodium	4.53	mg/L		200.7	8/13/04
T	Sulfide	<1.0	mg/L		376.1	8/05/04
T	Sulfate, SO4	91.7	mg/L	5	300.0	8/11/04
T	Arsenic	<0.010	mg/L		200.7	8/13/04
T	Chromium	<0.0060	mg/L		200.7	8/13/04
T	Iron	0.325	mg/L		200.7	8/13/04
T	Manganese	0.0076	mg/L		200.7	8/13/04
T	Lead	<0.0050	mg/L		200.7	8/13/04
T	Silica	25.5	mg/L		200.7	8/13/04
T	DIS. INOR CARBON	98.3	mg/L		415.1	8/13/04
D	Arsenic	<0.010	mg/L		200.7	8/13/04
D	Chromium	<0.0060	mg/L		200.7	8/13/04
D	Iron	0.023	mg/L		200.7	8/13/04
D	Manganese	0.0047	mg/L		200.7	8/13/04
D	Lead	<0.0050	mg/L		200.7	8/13/04
D	Silica	24.1	mg/L		200.7	8/13/04

CalcTDS:	601	TDS/Cond:		CATION SUM:	10.01meq/L	BALANCE
TDS/CalcTDS:	0.9	CalcTDS/Cond:		ANION SUM:	10.87meq/L	-4.12%

Filtered fraction: 402217

Reviewed By:______________________ Date 8/16/04

8/16/04 13:53

AZ: AZ0538 CA: NO. 2080 CO: 08/13/03 ID: ID00019 NV: ID-19-2004-19 TX: TX241-2002A WA: DOE NO. C074; DOH NO. 050

SVL ANALYTICAL, INC.

Certificate: CA NO. 2080

One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: HR0196-12
CLIENT SAMPLE ID: MW-12
Sample Collected: 7/30/04 11:15
Sample Receipt : 8/02/04
Date of Report : 8/16/04

SVL JOB: 112402
SAMPLE: 402212
TOT/DIS

Matrix: WATER

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	324	mg CaCO3/L		2320B	8/09/04
T	Eh (mV)	+176	mV		2580	8/10/04
T	pH	8.20			150.1	8/09/04
T	TDS	466	mg/L		160.1	8/06/04
T	Turbidity	2.02	NTU'S		180.1	8/04/04
T	Calcium	56.4	mg/L		200.7	8/13/04
T	Chloride	93.8	mg/L	50	300.0	8/12/04
T	Fluoride	0.15	mg/L		300.0	8/11/04
T	Potassium	46.2	mg/L		200.7	8/13/04
T	Magnesium	24.6	mg/L		200.7	8/13/04
T	Sodium	55.3	mg/L		200.7	8/13/04
T	Sulfide	<1.0	mg/L		376.1	8/05/04
T	Sulfate, SO4	28.0	mg/L	2	300.0	8/12/04
T	Arsenic	<0.010	mg/L		200.7	8/13/04
T	Chromium	<0.0060	mg/L		200.7	8/13/04
T	Iron	1.49	mg/L		200.7	8/13/04
T	Manganese	1.34	mg/L		200.7	8/13/04
T	Lead	<0.0050	mg/L		200.7	8/13/04
T	Silica	11.1	mg/L		200.7	8/13/04
T	DIS. INOR CARBON	72.8	mg/L		415.1	8/13/04
D	Arsenic	0.011	mg/L		200.7	8/13/04
D	Chromium	<0.0060	mg/L		200.7	8/13/04
D	Iron	0.141	mg/L		200.7	8/13/04
D	Manganese	1.30	mg/L		200.7	8/13/04
D	Lead	<0.0050	mg/L		200.7	8/13/04
D	Silica	10.8	mg/L		200.7	8/13/04

CalcTDS:	528	TDS/Cond:	CATION SUM:	8.58meq/L	BALANCE
TDS/CalcTDS:	0.9	CalcTDS/Cond:	ANION SUM:	9.71meq/L	-6.18%

Filtered fraction: 402218

Reviewed By: ______________________ Date 8/16/04

8/16/04 13:54

AZ: AZ0538 CA: NO. 2080 CO: 08/13/03 ID: ID00019 NV: ID-19-2004-19 TX: TX241-2002A WA: DOE NO. C074; DOH NO. 050

SVL ANALYTICAL, INC.

Quality Control Report
Part I Prep Blank and Laboratory Control Sample

Client :GeoSyntec

SVL JOB No: 112402

nalyte	Method	Matrix	Units	Prep Blank	LCS		LCS %R	Analysis Date
					True	Found		
Arsenic	200.7	WATER	mg/L	<0.010	1.00	1.01	101.0	8/13/04
Calcium	200.7	WATER	mg/L	<0.040	20.0	19.9	99.5	8/13/04
Chromium	200.7	WATER	mg/L	<0.0060	1.00	0.9998	100.0	8/13/04
Iron	200.7	WATER	mg/L	<0.020	10.0	9.87	98.7	8/13/04
Potassium	200.7	WATER	mg/L	<1.0	30.0	29.8	99.3	8/13/04
Magnesium	200.7	WATER	mg/L	<0.040	20.0	19.6	98.0	8/13/04
Manganese	200.7	WATER	mg/L	<0.0020	1.00	1.02	102.0	8/13/04
Sodium	200.7	WATER	mg/L	<0.50	20.0	18.7	93.5	8/13/04
Lead	200.7	WATER	mg/L	<0.0050	1.00	0.992	99.2	8/13/04
Silica	200.7	WATER	mg/L	<0.171	10.7	10.7	100.0	8/13/04
Chloride	300.0	WATER	mg/L	<0.20	5.00	4.92	98.4	8/11/04
Fluoride	300.0	WATER	mg/L	<0.10	2.50	2.43	97.2	8/11/04
Sulfate, SO4	300.0	WATER	mg/L	<0.30	10.0	9.85	98.5	8/11/04
ALKALINITY	2320B	WATER	mg/L	<1.0	14.8	18.5	125.0	8/09/04
pH	150.1	WATER		5.13	8.50	8.56	100.7	8/09/04
Eh (mV)	2580	WATER	mV	N/A	+228	+232	101.8	8/10/04
DIS. INOR CARBON	415.1	WATER	mg/L	<1.0	14.0	14.2	101.4	8/13/04
Sulfide	376.1	WATER	mg/L	<1.0	4.0	3.9	97.5	8/05/04
TDS	160.1	WATER	mg/L	<10	45	27	60.0	8/06/04
Turbidity	180.1	WATER	NTU'S	0.079	13.1	12.1	92.4	8/04/04

LEGEND:

LCS = Laboratory Control Sample

LCS %R = LCS Percent Recovery

N/A = Not Applicable

8/16/04 13:53

SVL ANALYTICAL, INC.

Quality Control Report
Part II Duplicate and Spike Analysis

Client :GeoSyntec

SVL JOB No: 112402

			QC SAMPLE ID			Duplicate or	MSD	Matrix Spike			Analysis
t	Method	Mtx		Units	Result	Found	RPD%	Result	SPK ADD	%R	Date
As	200.7	W	1	mg/L	<0.010	<0.010	UDL	1.06	1.00	106.0	8/13/04
As	200.7	W	2	mg/L	<0.010	<0.010	UDL	1.05	1.00	105.0	8/13/04
Ca	200.7	W	1	mg/L	128	126	1.6	149	20.0	105.0	8/13/04
Cr	200.7	W	1	mg/L	<0.0060	<0.0060	UDL	1.02	1.00	102.0	8/13/04
Cr	200.7	W	2	mg/L	<0.0060	<0.0060	UDL	0.984	1.00	98.4	8/13/04
Fe	200.7	W	1	mg/L	0.325	0.313	3.8	10.1	10.0	97.8	8/13/04
Fe	200.7	W	2	mg/L	0.023	0.021	9.1	9.65	10.0	96.3	8/13/04
K	200.7	W	1	mg/L	2.6	2.5	3.9	33.1	30.0	101.7	8/13/04
Mg	200.7	W	1	mg/L	40.6	40.1	1.2	60.3	20.0	98.5	8/13/04
Mn	200.7	W	1	mg/L	0.0076	0.0075	1.3	1.02	1.00	101.2	8/13/04
Mn	200.7	W	2	mg/L	0.0047	0.0045	4.3	0.962	1.00	95.7	8/13/04
Na	200.7	W	1	mg/L	4.53	4.48	1.1	23.6	20.0	95.4	8/13/04
Pb	200.7	W	1	mg/L	<0.0050	<0.0050	UDL	0.999	1.00	99.9	8/13/04
Pb	200.7	W	2	mg/L	<0.0050	<0.0050	UDL	0.994	1.00	99.4	8/13/04
SiO2	200.7	W	1	mg/L	25.5	25.2	1.2	36.1	10.7	99.1	8/13/04
SiO2	200.7	W	2	mg/L	24.1	23.9	0.8	34.0	10.7	92.5	8/13/04
Cl	300.0	W	1	mg/L	9.68	10.3	6.2	20.6	10.0	109.2	8/11/04
F	300.0	W	1	mg/L	<0.10	<0.10	UDL	2.06	2.00	103.0	8/11/04
SO4	300.0	W	1	mg/L	91.7	91.0	0.8	117	25.0	101.2	8/11/04
ALK	2320B	W	1	mg/L	435	440	1.1	N/A	N/A	N/A	8/09/04
pH	150.1	W	1		7.93	8.01	1.0	N/A	N/A	N/A	8/09/04
Eh	2580	W	1	mV	+192	+191	0.5	N/A	N/A	N/A	8/10/04
ORG18D	415.1	W	1	mg/L	98.3	100	1.7	138	50.0	79.4	8/13/04
TDS	160.1	W	1	mg/L	517	557	7.4	I/S	I/S	N/A	8/06/04
TURB	180.1	W	1	NTU'S	0.791	0.761	3.9	N/A	N/A	N/A	8/04/04

END:

RPD% = (|SAM - DUP|/((SAM + DUP)/2) * 100) UDL = Both SAM & DUP not detected. *Result or *Found: Interference required dilution.

RPD% = (|SPK - MSD|/((SPK + MSD)/2) * 100) M in Duplicate/MSD column indicates MSD.

SPIKE ADD column, A = Post Digest Spike; %R = Percent Recovery N/A = Not Analyzed; R > 4S = Result more than 4X the Spike Added

QC limits for MS recoveries apply only if the spike is at least 1/4 the concentration of the analyte in the sample.

Control limits for the RPD apply only if the concentration of the analyte in the sample is at least five times the reporting limit.

I/S: Insufficient sample for QC test.

QC Sample 1: SVL SAM No.: 402211 Client Sample ID: MW-11 ^T

QC Sample 2: SVL SAM No.: 402217 Client Sample ID: MW-11 ^D

8/16/04 13:53

SVL ANALYTICAL

CHAIN OF CUSTODY RECORD

Page 1 of 1

Client: GeoSyntec
Contact: Brian Petty
Address: 2100 Main St., #150
Huntington Beach, CA 92648
Phone Number: 714-969-0800
FAX Number: 714.969-0820

NOTES:

1) Ensure proper container packaging.
2) Ship samples promptly following collection.
3) Designate Sample Reject Disposition*

PO#: HR0196-12
Project Name: Metaline Falls

Table 1. -- Matrix Type
1 = Surface Water, [✓ 2 = Ground Water]
3 = Soil/Sediment, 4 = Rinsate, 5 = Oil
6 = Waste, 7 = Other (Specify) ______

Samplers Signature: gh

FOR SVL USE ONLY
SVL JOB # 112402

Lab Name: SVL Analytical, Inc. (208) 784-1258 FAX (208) 783-0891
Address: One Government Gulch, Kellogg, ID 83837-0929

Sample ID	Collection		Miscellaneous				Preservative(s)						Analyses Required									Comments
	Date	Time	Collected by: (Init.)	Matrix Type From Table 1	No. of Containers	Sample Filtered ? Y/N	Unpreserved (Ice Only)	HNO3	HCL	H2SO4	NAOH	Other (Specify)	turbid, redox, pH	As, Pb, Cr, Fe, Mn (T+D)	alk, DIC, TDS	maj cat + an	sulfide	conductivity				Bottle #3 requires lab filter & HNO3
1. MW-11	7/30	9:00	gh	2	4								X	X	X	X	X	X				
2. MW-12		11:15																				
3. MW-7		10:45																				
4. MW-8		10:15																				
5. MW-9		9:35																				
6. MW-9D																						
7.																						
8.																						
9.																						
10.																						

Relinquished by:	Date:	Time:	Received by:	Date:	Time:
Gretchen E. Hoy	8/2/04	12:15		8/2/04	1215

* Sample Reject: [ ] Return [ ] Dispose [ ] Store (30 Days)

White: LAB COPY Yellow: CUSTOMER COPY

SVL-COC 12/95

Chris Meyer

From: Dr. Gretchen Hoy [hoyinc@mindspring.com]
Sent: Tuesday, August 03, 2004 10:13 AM
To: Chris Meyer
Cc: BPetty@GeoSyntec.com
Subject: conductivity...

Hi Chris-

Say... rec'd a definitive answer from Brian.

He said asked me to contact you, to say conductivity should be taken OFF the COC for the MW wells.

My fault, sorry about the confusion,

gh

TRANSMISSION VERIFICATION REPORT

TIME : 08/03/2004 08:37
NAME : SVL ANALYTICAL
FAX : 2087830891
TEL : 2087841258
SER.# : BROF3J496071

DATE,TIME	08/03 08:37
FAX NO./NAME	917149690820
DURATION	00:00:19
PAGE(S)	01
RESULT	OK
MODE	FINE ECM

SVL LYTICAL, INC.
overnment Gulch - Kellogg, ID 83837-0929

Page 1 of 1

SAMPLE RECEIPT CONFIRMATION

SVL JOB No: 112402
Received: 8/02/04
Expected Due date: 8/16/04

By	Received	Sample Comments
GH	8/02/04	
GH	8/02/04	
GH	8/02/04	
GH	8/02/04	
GH	8/02/04	
GH	8/02/04	
GH	8/02/04	
GH	8/02/04	
GH	8/02/04	
GH	8/02/04	
GH	8/02/04	
GH	8/02/04	

ss. (^P) and Dissolved (^D) fractions separately. Field samples may appear twice.

ontainer temp not measured upon receipt.
PRESERVE FOR DISS. METALS

after job completion.
, then you will receive a letter requesting disposal options.

you have questions regarding the receipt of these samples. 8/03/04 6:31

SVL ANALYTICAL, INC.

One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83827-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

PORT OF ANALYTICAL RESULTS

CLIENT : GeoSyntec
PROJECT: HR0196-12
Sample Receipt: 8/02/04
Report Date: 8/18/04
SVL JOB: 112403

SVL ID	CLIENT SAMPLE ID		As 200.7	ALK 2320B	pH 150.1	Eh 2580	ORG18D 415.1
W402225	AVG-E	ˆT 7/30/04	0.016mg/L	544mg/L	6.45	+73.6mV	214mg/L
W402226	AVG-W	ˆT 7/30/04	0.016mg/L	586mg/L	6.57	+97.8mV	188mg/L
W402227	PM-1	ˆT 7/29/04	0.107mg/L	1720mg/L	10.67	-76.0mV	117mg/L
W402228	PM-2	ˆT 7/29/04	0.010mg/L	339mg/L	8.25	+80.8mV	56.5mg/L
W402229	PM-6	ˆT 7/30/04	0.307mg/L	2110mg/L	10.75	-55.5mV	175mg/L
W402230	PM-7	ˆT 7/30/04	0.031mg/L	1090mg/L	7.98	+86.4mV	224mg/L
W402231	PM-8	ˆT 7/29/04	0.017mg/L	889mg/L	9.55	+21.1mV	139mg/L
W402232	PM-10	ˆT 7/30/04	0.109mg/L	756mg/L	9.46	-3.6mV	113mg/L
W402233	PM-11	ˆT 7/30/04	0.022mg/L	769mg/L	7.40	+118mV	259mg/L
W402234	PM-12	ˆT 7/30/04	0.026mg/L	845mg/L	7.24	+20.0mV	306mg/L
W402235	PM-13	ˆT 7/30/04	0.011mg/L	361mg/L	9.04	+40.1mV	58.3mg/L
W402236	PM-14	ˆT 7/29/04	0.014mg/L	383mg/L	9.52	+23.3mV	54.0mg/L
W402237	PM-15	ˆT 7/29/04	0.147mg/L	***	12.23	***	105mg/L
W402238	PM-16	ˆT 7/30/04	0.151mg/L	***	12.40	***	81.5mg/L
W402239	PM-17	ˆT 7/29/04	0.042mg/L	916mg/L	10.40	-132mV	60.1mg/L
W402240	PM-18	ˆT 7/29/04	0.157mg/L	***	11.70	***	87.0mg/L
W402241	PM-19	ˆT 7/29/04	0.121mg/L	***	12.00	***	91.0mg/L
W402242	PM-20	ˆT 7/29/04	0.016mg/L	***	8.80	***	67.1mg/L
W402243	PM-21	ˆT 7/30/04	0.061mg/L	884mg/L	10.00	-45.1mV	70.6mg/L
W402244	AVG-E	ˆD 7/30/04	0.016mg/L	***	***	***	***
W402245	AVG-W	ˆD 7/30/04	0.016mg/L	***	***	***	***
W402246	PM-1	ˆD 7/29/04	0.124mg/L	***	***	***	***
W402247	PM-2	ˆD 7/29/04	0.018mg/L	***	***	***	***
W402248	PM-6	ˆD 7/30/04	0.333mg/L	***	***	***	***
W402249	PM-7	ˆD 7/30/04	0.016mg/L	***	***	***	***
W402250	PM-8	ˆD 7/29/04	0.017mg/L	***	***	***	***
W402251	PM-10	ˆD 7/30/04	0.117mg/L	***	***	***	***
W402252	PM-11	ˆD 7/30/04	0.015mg/L	***	***	***	***
W402253	PM-12	ˆD 7/30/04	<0.010mg/L	***	***	***	***
W402254	PM-13	ˆD 7/30/04	0.014mg/L	***	***	***	***
W402255	PM-14	ˆD 7/29/04	0.017mg/L	***	***	***	***
W402256	PM-15	ˆD 7/29/04	0.152mg/L	***	***	***	***
W402257	PM-16	ˆD 7/30/04	0.113mg/L	***	***	***	***
W402258	PM-17	ˆD 7/29/04	0.042mg/L	***	***	***	***
W402259	PM-18	ˆD 7/29/04	0.170mg/L	***	***	***	***
W402260	PM-19	ˆD 7/29/04	0.130mg/L	***	***	***	***
W402261	PM-20	ˆD 7/29/04	0.024mg/L	***	***	***	***
W402262	PM-21	ˆD 7/30/04	0.071mg/L	***	***	***	***

*** Not Requested

Certificate: WA NO. C074

Reviewed By: ____________ Date: 8/18/04

SVL ANALYTICAL, INC.

Quality Control Report
Part I Prep Blank and Laboratory Control Sample

Client :GeoSyntec

SVL JOB No: 112403

Analyte	Method	Matrix	Units	Prep Blank	True —LCS	— Found	LCS %R	Analysis Date
Arsenic	200.7	WATER	mg/L	<0.010	1.00	1.07	107.0	8/12/04
ALKALINITY	2320B	WATER	mg/L	<1.0	14.8	18.5	125.0	8/09/04
pH	150.1	WATER		5.13	8.50	8.56	100.7	8/09/04
Eh (mV)	2580	WATER	mV	N/A	+228	+232	101.8	8/09/04
DIS. INOR CARBON	415.1	WATER	mg/L	<1.0	14.0	13.0	92.9	8/16/04

LEGEND:

LCS = Laboratory Control Sample

LCS %R = LCS Percent Recovery

N/A = Not Applicable

8/18/04 8:42

SVL ANALYTICAL, INC.

Quality Control Report
Part II Duplicate and Spike Analysis

Client :GeoSyntec

SVL JOB No: 112403

			QC SAMPLE ID			Duplicate or MSD		Matrix Spike			Analysis
Test	Method	Mtx		Units	Result	Found	RPD%	Result	SPK ADD	%R	Date
As	200.7	W	1	mg/L	0.016	<0.010	200.0	1.07	1.00	105.4	8/12/04
As	200.7	W	2	mg/L	0.011	N/A	N/A	1.03	1.00	101.9	8/14/04
As	200.7	W	3	mg/L	0.016	0.018	11.8	1.13	1.00	111.4	8/14/04
As	200.7	W	4	mg/L	0.014	N/A	N/A	1.12	1.00	110.6	8/14/04
ALK	2320B	W	1	mg/L	544	551	1.3	N/A	N/A	N/A	8/09/04
pH	150.1	W	1		6.45	6.48	0.5	N/A	N/A	N/A	8/09/04
Eh	2580	W	1	mV	+73.6	+74.5	1.2	N/A	N/A	N/A	8/09/04
ORG18D	415.1	W	1	mg/L	214	231	7.6	274	50.0	120.0	8/16/04

LEGEND:

RPD% = (|SAM - DUP|/((SAM + DUP)/2) * 100) UDL = Both SAM & DUP not detected. *Result or *Found: Interference required dilution.
RPD% = (|SPK - MSD|/((SPK + MSD)/2) * 100) M in Duplicate/MSD column indicates MSD.
SPIKE ADD column, A = Post Digest Spike; %R = Percent Recovery N/A = Not Analyzed; R > 4S = Result more than 4X the Spike Added
QC limits for MS recoveries apply only if the spike is at least 1/4 the concentration of the analyte in the sample.
Control limits for the RPD apply only if the concentration of the analyte in the sample is at least five times the reporting limit.

QC Sample 1: SVL SAM No.: 402225 Client Sample ID: AVG-E ^T
QC Sample 2: SVL SAM No.: 402235 Client Sample ID: PM-13 ^T
QC Sample 3: SVL SAM No.: 402244 Client Sample ID: AVG-E ^D
QC Sample 4: SVL SAM No.: 402254 Client Sample ID: PM-13 ^D

8/18/04 8:42

CHAIN OF CUSTODY RECORD

Page 1 of 2

Client: GeoSyntec
Contact: Brian Petty
Address: 2100 Main St, Suite 150
Huntington Beach, CA 92648
Phone Number: 714-969-0800
FAX Number: 714-969-0820

NOTES:
1) Ensure proper container packaging.
2) Ship samples promptly following collection.
* 3) Designate Sample Reject Disposition
PO#: HR0196-12
Project Name: Metaline Falls

Table 1. -- Matrix Type
1 = Surface Water, [✓ 2 = Ground Water]
3 = Soil/Sediment, 4 = Rinsate, 5 = Oil
6 = Waste, 7 = Other (Specify) ________

Samplers Signature: gh

FOR SVL USE ONLY
SVL JOB # 112403

Lab Name: SVL Analytical, Inc. (208) 784-1258 FAX (208) 783-0891
Address: One Government Gulch, Kellogg, ID 83837-0929

	Collection		Miscellaneous				Preservative(s)						Analyses Required									Comments
Sample ID	Date	Time	Collected by: (Init.)	Matrix Type From Table I	No. of Containers	Sample Filtered ? Y/N	Unpreserved (Ice Only)	HNO3	HCL	H2SO4	NAOH	Other (Specify)	As (total and dissolved)	pH	alkalinity	ORP	DIC					Bottle #3 requires lab filtered HNO3
1. AVG-E	7/30	12:15	gh	2	3								X	X	X	X	X					
2. AVG-W	7/30	12:45											X	X	X	X	X					
3. PM-1	7/29	1700											X	X	X	X	X					
4. PM-2	7/29	1725											X	X	X	X	X					
5. PM-6	7/30	1450											X	X	X	X	X					
6. PM-7	7/30	1630											X	X	X	X	X					
7. PM-8	7/29	1940											X	X	X	X	X					
8. PM-10	7/30	1415											X	X	X	X	X					
9. PM-11	7/30	1345											X	X	X	X	X					
10. PM-12	7/30	1420											X	X	X	X	X					

Relinquished by: Gretchen E Hoy Date: 8/2/04 Time: 12:05 Received by: Date: 8/2/04 Time: 12:05
Relinquished by: Date: Time: Received by: Date: Time:

* Sam ject: [ ] Return [ ] Dispose [ ] Store (30 Days)

White: LAB COPY Yellow: CUSTOMER COPY

SVL C 12/95

SVL ANALYTICAL

CHAIN OF CUSTODY RECORD

Page 2 of 2

Client: GeoSyntec
Contact: Brian Petty
Address: 2100 Main St, Suite 150
~~Suite~~ 3D Huntington Beach, CA 92648*
Phone Number: 714-969-0800
FAX Number: 714-969-0820

NOTES:
1) Ensure proper container packaging.
2) Ship samples promptly following collection.
3) Designate Sample Reject Disposition

PO#: H120196-12
Project Name: Metaline Falls

Table 1. -- Matrix Type
1 = Surface Water, [✓ 2 = Ground Water]
3 = Soil/Sediment, 4 = Rinsate, 5 = Oil
6 = Waste, 7 = Other (Specify) ______

Samplers Signature:

FOR SVL USE ONLY
SVL JOB # ______

Lab Name: SVL Analytical, Inc. (208) 784-1258 FAX (208) 783-0891
Address: One Government Gulch, Kellogg, ID 83837-0929

Sample ID	Collection		Miscellaneous				Preservative(s)						Analyses Required					Comments
	Date	Time	Collected by: (Init.)	Matrix Type From Table 1	No. of Containers	Sample Filtered ? Y/N	Unpreserved (Ice Only)	HNO3	HCL	H2SO4	NAOH	Other (Specify)	As (total and dissolved)	pH	alkalinity	ORP	DIC	Bottle #3 requires lab filter & HNO3
1. PM-13	7/30	13:15		2	3								X	X	X	X	X	
2. PM-14	7/29	18:45											X	X	X	X	X	
3. PM-15	7/29	14:20											X	X			X	Time on bottle is 16:20 pm 8/2/04
4. PM-16	7/30	18:10											X	X			X	
5. PM-17	7/29	19:15											X	X	X	X	X	
6. PM-18	7/29	15:30											X	X			X	
7. PM-19	7/29	16:00											X	X			X	
8. PM-20	7/29	16:45											X	X			X	
9. PM-21	7/30	17:15											X	X	X	X	X	
10.																		

Relinquished by:	Date:	Time:	Received by:	Date:	Time:
Gretchen E. Hoy	8/2/04	12:05		8/2/04	12:05

* Sample Reject: ☐ Return ☐ Dispose ☐ Store (30 Days)

White: LAB COPY Yellow: CUSTOMER COPY SVL 12/95

TRANSMISSION VERIFICATION REPORT

TIME : 08/03/2004 08:34
NAME : SVL ANALYTICAL
FAX : 2087830891
TEL : 2087841258
SER.# : BROF3J496071

DATE,TIME	08/03 08:34
FAX NO./NAME	917149690820
DURATION	00:00:30
PAGE(S)	02
RESULT	OK
MODE	FINE ECM

SVI ALYTICAL, INC.
Government Gulch - Kellogg, ID 83837-0929

Page 1 of 2

SAMPLE RECEIPT CONFIRMATION

SVL JOB No: 112403
Received: 8/02/04
Expected Due date: 8/16/04

e	By	Received	Sample Comments
5	GH	8/02/04	
5	GH	8/02/04	
0	GH	8/02/04	
5	GH	8/02/04	
0	GH	8/02/04	
0	GH	8/02/04	
0	GH	8/02/04	
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0	GH	8/02/04	
5	GH	8/02/04	
5	GH	8/02/04	
0	GH	8/02/04	

after job completion.
, then you will receive a letter requesting disposal options.

you have questions regarding the receipt of these samples. 8/03/04 7:05

SVL ANALYTICAL, INC.
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-089

CLIENT : GeoSyntec
PROJECT: HR0196-12
CLIENT SAMPLE ID: MW-7
Sample Collected: 11/04/04 11:00
Sample Receipt : 11/09/04
Date of Report : 11/23/04

SVL JOB: 114447
SAMPLE: 426294
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	432	mg CaCO3/L		2320B	11/10/04
T	Eh (mV)	+194	mV		2580	11/23/04
T	pH	7.26			150.1	11/10/04
T	TDS	540	mg/L		160.1	11/11/04
T	Turbidity	0.326	NTU'S		180.1	11/10/04
T	Calcium	130	mg/L		200.7	11/19/04
T	Chloride	9.01	mg/L	2	300.0	11/10/04
T	Potassium	2.6	mg/L		200.7	11/19/04
T	Magnesium	41.1	mg/L		200.7	11/19/04
T	Sodium	4.59	mg/L		200.7	11/19/04
T	Nitrate-N	0.189	mg/L		300.0	11/10/04
T	Sulfide	<1.0	mg/L		376.1	11/10/04
T	Sulfate, SO4	115	mg/L	10	300.0	11/10/04
T	Arsenic	<0.010	mg/L		200.7	11/19/04
T	Chromium	<0.0060	mg/L		200.7	11/19/04
T	Iron	0.408	mg/L		200.7	11/19/04
T	Manganese	0.0086	mg/L		200.7	11/19/04
T	Lead	<0.0050	mg/L		200.7	11/19/04
T	DIS. INOR CARBON	100	mg/L		415.1	11/16/04
D	Arsenic	<0.010	mg/L		200.7	11/19/04
D	Chromium	<0.0060	mg/L		200.7	11/19/04
D	Iron	<0.020	mg/L		200.7	11/19/04
D	Manganese	<0.0020	mg/L		200.7	11/19/04
D	Lead	<0.0050	mg/L		200.7	11/19/04

CalcTDS:	562	TDS/Cond:		CATION SUM:	10.15meq/L	BALANCE
TDS/CalcTDS:	1.0	CalcTDS/Cond:		ANION SUM:	11.28meq/L	-5.27%

Filtered fraction: 426300
TURBIDITY & NITRATE-N RECEIVED AND ANALYZED PAST HOLDING TIME

Reviewed By: Date 11/23/04
11/23/04 11:52

AZ: AZ0538 CA: NO. 2080 CO: 08/13/03 ID: ID00019 NV: ID-19-2004-19 TX: TX241-2002A WA: DOE NO. C074; DOH NO. 050

SVL ANALYTICAL, INC.
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-089

CLIENT : GeoSyntec
PROJECT: HR0196-12
CLIENT SAMPLE ID: MW-8
Sample Collected: 11/04/04 8:30
Sample Receipt : 11/09/04
Date of Report : 11/23/04

SVL JOB: 114447
SAMPLE: 426295
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	316	mg CaCO3/L		2320B	11/10/04
T	Eh (mV)	+191	mV		2580	11/23/04
T	pH	7.63			150.1	11/10/04
T	TDS	308	mg/L		160.1	11/11/04
T	Turbidity	33.8	NTU'S		180.1	11/10/04
T	Calcium	62.6	mg/L		200.7	11/19/04
T	Chloride	6.85	mg/L	2	300.0	11/10/04
T	Potassium	17.3	mg/L		200.7	11/19/04
T	Magnesium	27.0	mg/L		200.7	11/19/04
T	Sodium	5.13	mg/L		200.7	11/19/04
T	Nitrate-N	0.086	mg/L		300.0	11/10/04
T	Sulfide	<1.0	mg/L		376.1	11/10/04
T	Sulfate, SO4	23.3	mg/L	2	300.0	11/10/04
T	Arsenic	<0.010	mg/L		200.7	11/19/04
T	Chromium	<0.0060	mg/L		200.7	11/19/04
T	Iron	3.39	mg/L		200.7	11/19/04
T	Manganese	0.927	mg/L		200.7	11/19/04
T	Lead	<0.0050	mg/L		200.7	11/19/04
T	DIS. INOR CARBON	73.0	mg/L		415.1	11/16/04
D	Arsenic	0.010	mg/L		200.7	11/19/04
D	Chromium	<0.0060	mg/L		200.7	11/19/04
D	Iron	0.286	mg/L		200.7	11/19/04
D	Manganese	0.788	mg/L		200.7	11/19/04
D	Lead	<0.0050	mg/L		200.7	11/19/04

CalcTDS:	336	TDS/Cond:	CATION SUM:	6.19meq/L	BALANCE
TDS/CalcTDS:	0.9	CalcTDS/Cond:	ANION SUM:	7.00meq/L	-6.14%

Filtered fraction: 426301
TURBIDITY & NITRATE-N RECEIVED AND ANALYZED PAST HOLDING TIME

Reviewed By: ______________________ Date 11/23/04

11/23/04 11:52

AZ: AZ0538 CA: NO. 2080 CO: 08/13/03 ID: ID00019 NV: ID-19-2004-19 TX: TX241-2002A WA: DOE NO. C074; DOH NO. 050

SVL ANALYTICAL, INC.
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: HR0196-12
CLIENT SAMPLE ID: MW-9
Sample Collected: 11/04/04 9:45
Sample Receipt : 11/09/04
Date of Report : 11/23/04

SVL JOB: 114447
SAMPLE: 426296
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	903	mg CaCO3/L		2320B	11/10/04
T	Eh (mV)	+83.0	mV		2580	11/23/04
T	pH	10.95			150.1	11/10/04
T	TDS	1690	mg/L		160.1	11/11/04
T	Turbidity	2.00	NTU'S		180.1	11/10/04
T	Calcium	5.71	mg/L		200.7	11/19/04
T	Chloride	28.1	mg/L	5	300.0	11/10/04
T	Potassium	958	mg/L	10	200.7	11/19/04
T	Magnesium	0.116	mg/L		200.7	11/19/04
T	Sodium	44.8	mg/L		200.7	11/19/04
T	Nitrate-N	<0.050	mg/L		300.0	11/10/04
T	Sulfide	9.5	mg/L		376.1	11/10/04
T	Sulfate, SO4	312	mg/L	25	300.0	11/10/04
T	Arsenic	0.045	mg/L		200.7	11/19/04
T	Chromium	<0.0060	mg/L		200.7	11/19/04
T	Iron	1.47	mg/L		200.7	11/19/04
T	Manganese	0.0205	mg/L		200.7	11/19/04
T	Lead	0.0128	mg/L		200.7	11/19/04
T	DIS. INOR CARBON	89.8	mg/L		415.1	11/16/04
D	Arsenic	0.043	mg/L		200.7	11/19/04
D	Chromium	<0.0060	mg/L		200.7	11/19/04
D	Iron	0.552	mg/L		200.7	11/19/04
D	Manganese	0.0146	mg/L		200.7	11/19/04
D	Lead	0.0133	mg/L		200.7	11/19/04

CalcTDS:	1890	TDS/Cond:	CATION SUM:	26.82meq/L	BALANCE
TDS/CalcTDS:	0.9	CalcTDS/Cond:	ANION SUM:	25.33meq/L	2.86%

Filtered fraction: 426302
TURBIDITY & NITRATE-N RECEIVED AND ANALYZED PAST HOLDING TIME

Reviewed By:______________________ Date 11/23/04
11/23/04 11:52

AZ: AZ0538 CA: NO. 2080 CO: 08/13/03 ID: ID00019 NV: ID-19-2004-19 TX: TX241-2002A WA: DOE NO. C074; DOH NO. 050

SVL ANALYTICAL, INC.
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: HR0196-12
CLIENT SAMPLE ID: MW-9(D)
Sample Collected: 11/04/04 9:46
Sample Receipt : 11/09/04
Date of Report : 11/23/04

SVL JOB: 114447
SAMPLE: 426297
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	886	mg CaCO3/L		2320B	11/10/04
T	Eh (mV)	+68.0	mV		2580	11/23/04
T	pH	10.88			150.1	11/10/04
T	TDS	1730	mg/L		160.1	11/11/04
T	Turbidity	2.03	NTU'S		180.1	11/10/04
T	Calcium	5.95	mg/L		200.7	11/19/04
T	Chloride	28.1	mg/L	5	300.0	11/10/04
T	Potassium	1010	mg/L	10	200.7	11/19/04
T	Magnesium	0.107	mg/L		200.7	11/19/04
T	Sodium	49.0	mg/L		200.7	11/19/04
T	Nitrate-N	<0.050	mg/L		300.0	11/10/04
T	Sulfide	9.4	mg/L		376.1	11/10/04
T	Sulfate, SO4	300	mg/L	25	300.0	11/10/04
T	Arsenic	0.048	mg/L		200.7	11/19/04
T	Chromium	<0.0060	mg/L		200.7	11/19/04
T	Iron	1.51	mg/L		200.7	11/19/04
T	Manganese	0.0206	mg/L		200.7	11/19/04
T	Lead	0.0115	mg/L		200.7	11/19/04
T	DIS. INOR CARBON	90.2	mg/L		415.1	11/16/04
D	Arsenic	0.047	mg/L		200.7	11/19/04
D	Chromium	<0.0060	mg/L		200.7	11/19/04
D	Iron	0.524	mg/L		200.7	11/19/04
D	Manganese	0.0138	mg/L		200.7	11/19/04
D	Lead	0.0102	mg/L		200.7	11/19/04

CalcTDS:	1930	TDS/Cond:		CATION SUM:	28.35meq/L	BALANCE
TDS/CalcTDS:	0.9	CalcTDS/Cond:		ANION SUM:	24.74meq/L	6.80%

Filtered fraction: 426303
TURBIDITY & NITRATE-N RECEIVED AND ANALYZED PAST HOLDING TIME

Reviewed By: Date 11/23/04
11/23/04 11:52

AZ: AZ0538 CA: NO. 2080 CO: 08/13/03 ID: ID00019 NV: ID-19-2004-19 TX: TX241-2002A WA: DOE NO. C074; DOH NO. 050

SVL ANALYTICAL, INC.
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-089

CLIENT : GeoSyntec
PROJECT: HR0196-12
CLIENT SAMPLE ID: MW-11
Sample Collected: 11/04/04 9:15
Sample Receipt : 11/09/04
Date of Report : 11/23/04

SVL JOB: 114447
SAMPLE: 426298
TOT/DIS
Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	261	mg CaCO3/L		2320B	11/10/04
T	Eh (mV)	+152	mV		2580	11/23/04
T	pH	6.84			150.1	11/10/04
T	TDS	262	mg/L		160.1	11/11/04
T	Turbidity	0.361	NTU'S		180.1	11/10/04
T	Calcium	58.0	mg/L		200.7	11/19/04
T	Chloride	0.61	mg/L		300.0	11/10/04
T	Potassium	4.2	mg/L		200.7	11/19/04
T	Magnesium	23.6	mg/L		200.7	11/19/04
T	Sodium	3.72	mg/L		200.7	11/19/04
T	Nitrate-N	0.110	mg/L		300.0	11/10/04
T	Sulfide	<1.0	mg/L		376.1	11/10/04
T	Sulfate, SO4	25.2	mg/L	2	300.0	11/10/04
T	Arsenic	<0.010	mg/L		200.7	11/19/04
T	Chromium	<0.0060	mg/L		200.7	11/19/04
T	Iron	<0.020	mg/L		200.7	11/19/04
T	Manganese	0.0034	mg/L		200.7	11/19/04
T	Lead	<0.0050	mg/L		200.7	11/19/04
T	DIS. INOR CARBON	55.0	mg/L		415.1	11/16/04
D	Arsenic	0.011	mg/L		200.7	11/19/04
D	Chromium	<0.0060	mg/L		200.7	11/19/04
D	Iron	<0.020	mg/L		200.7	11/19/04
D	Manganese	0.0081	mg/L		200.7	11/19/04
D	Lead	<0.0050	mg/L		200.7	11/19/04

CalcTDS:	272	TDS/Cond:	CATION SUM:	5.10meq/L	BALANCE
TDS/CalcTDS:	1.0	CalcTDS/Cond:	ANION SUM:	5.76meq/L	-6.08%

Filtered fraction: 426304
TURBIDITY & NITRATE-N RECEIVED AND ANALYZED PAST HOLDING TIME

Reviewed By: ______________________ Date 11/23/04
11/23/04 11:52

AZ: AZ0538 CA: NO. 2080 CO: 08/13/03 ID: ID00019 NV: ID-19-2004-19 TX: TX241-2002A WA: DOE NO. C074; DOH NO. 050

SVL ANALYTICAL, INC.
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83837-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

CLIENT : GeoSyntec
PROJECT: HR0196-12
CLIENT SAMPLE ID: MW-12
Sample Collected: 11/04/04 10:45
Sample Receipt : 11/09/04
Date of Report : 11/23/04

SVL JOB: 114447
SAMPLE: 426299
TOT/DIS

Matrix: WATERG

	Determination	Result	Units	Dilution	Method	Analyzed
T	ALKALINITY	371	mg CaCO3/L		2320B	11/10/04
T	Eh (mV)	+166	mV		2580	11/23/04
T	pH	7.49			150.1	11/10/04
T	TDS	538	mg/L		160.1	11/11/04
T	Turbidity	3.34	NTU'S		180.1	11/10/04
T	Calcium	65.2	mg/L		200.7	11/19/04
T	Chloride	108	mg/L	25	300.0	11/10/04
T	Potassium	47.8	mg/L		200.7	11/19/04
T	Magnesium	28.3	mg/L		200.7	11/19/04
T	Sodium	67.7	mg/L		200.7	11/19/04
T	Nitrate-N	<0.050	mg/L		300.0	11/10/04
T	Sulfide	<1.0	mg/L		376.1	11/10/04
T	Sulfate, SO4	27.4	mg/L	2	300.0	11/10/04
T	Arsenic	0.015	mg/L		200.7	11/19/04
T	Chromium	<0.0060	mg/L		200.7	11/19/04
T	Iron	1.92	mg/L		200.7	11/19/04
T	Manganese	1.65	mg/L		200.7	11/19/04
T	Lead	<0.0050	mg/L		200.7	11/19/04
T	DIS. INOR CARBON	73.0	mg/L		415.1	11/16/04
D	Arsenic	<0.010	mg/L		200.7	11/19/04
D	Chromium	<0.0060	mg/L		200.7	11/19/04
D	Iron	0.040	mg/L		200.7	11/19/04
D	Manganese	1.59	mg/L		200.7	11/19/04
D	Lead	<0.0050	mg/L		200.7	11/19/04

CalcTDS:	569	TDS/Cond:	CATION SUM:	9.93meq/L	BALANCE
TDS/CalcTDS:	0.9	CalcTDS/Cond:	ANION SUM:	11.03meq/L	-5.25%

Filtered fraction: 426305
TURBIDITY & NITRATE-N RECEIVED AND ANALYZED PAST HOLDING TIME

Reviewed By:______________________ Date 11/23/04
11/23/04 11:52

AZ: AZ0538 CA: NO. 2080 CO: 08/13/03 ID: ID00019 NV: ID-19-2004-19 TX: TX241-2002A WA: DOE NO. C074; DOH NO. 050

SVL ANALYTICAL, INC.

Quality Control Report
Part I Prep Blank and Laboratory Control Sample

Client :GeoSyntec

SVL JOB No: 114447

					LCS			Analysis
nalyte	Method	Matrix	Units	Prep Blank	True	Found	LCS %R	Date
Arsenic	200.7	WATER	mg/L	<0.010	1.00	1.02	102.0	11/19/04
Calcium	200.7	WATER	mg/L	<0.040	20.0	19.4	97.0	11/19/04
Chromium	200.7	WATER	mg/L	<0.0060	1.00	1.02	102.0	11/19/04
Iron	200.7	WATER	mg/L	<0.020	10.0	9.81	98.1	11/19/04
Potassium	200.7	WATER	mg/L	<1.0	20.0	19.6	98.0	11/19/04
Magnesium	200.7	WATER	mg/L	<0.040	20.0	19.4	97.0	11/19/04
Manganese	200.7	WATER	mg/L	<0.0020	1.00	0.990	99.0	11/19/04
Sodium	200.7	WATER	mg/L	<0.50	19.0	18.8	98.9	11/19/04
Lead	200.7	WATER	mg/L	<0.0050	1.00	0.997	99.7	11/19/04
Chloride	300.0	WATER	mg/L	<0.20	5.00	4.77	95.4	11/10/04
Nitrate-N	300.0	WATER	mg/L	<0.050	2.50	2.45	98.0	11/10/04
Sulfate, SO4	300.0	WATER	mg/L	<0.30	10.0	9.75	97.5	11/10/04
ALKALINITY	2320B	WATER	mg/L	<1.0	47.0	48.9	104.0	11/10/04
pH	150.1	WATER		5.75	5.40	5.39	99.8	11/10/04
Eh (mV)	2580	WATER	mV	N/A	+228	+232	101.8	11/23/04
DIS. INOR CARBON	415.1	WATER	mg/L	<1.0	14.0	14.0	100.0	11/16/04
Sulfide	376.1	WATER	mg/L	<1.0	4.0	3.9	97.5	11/10/04
TDS	160.1	WATER	mg/L	<10	428	406	94.9	11/11/04
Turbidity	180.1	WATER	NTU'S	0.071	12.3	12.1	98.4	11/10/04

LEGEND:

LCS = Laboratory Control Sample

LCS %R = LCS Percent Recovery

N/A = Not Applicable

11/23/04 14:57

SVL ANALYTICAL, INC.

Quality Control Report
Part II Duplicate and Spike Analysis

Client :GeoSyntec

SVL JOB No: 114447

				QC SAMPLE ID		Duplicate or MSD		Matrix Spike			Analysis
st	Method	Mtx		Units	Result	Found	RPD%	Result	SPK ADD	%R	Date
As	200.7	W	1	mg/L	<0.010	0.010	200.0	1.04	1.00	104.0	11/19/04
As	200.7	W	2	mg/L	<0.010	0.015	200.0	1.10	1.00	110.0	11/19/04
Ca	200.7	W	1	mg/L	130	129	0.8	150	20.0	100.0	11/19/04
Cr	200.7	W	1	mg/L	<0.0060	<0.0060	UDL	1.01	1.00	101.0	11/19/04
Cr	200.7	W	2	mg/L	<0.0060	<0.0060	UDL	0.997	1.00	99.7	11/19/04
Fe	200.7	W	1	mg/L	0.408	0.368	10.3	10.1	10.0	96.9	11/19/04
Fe	200.7	W	2	mg/L	<0.020	<0.020	UDL	9.76	10.0	97.6	11/19/04
K	200.7	W	1	mg/L	2.6	2.6	0.0	22.9	20.0	101.5	11/19/04
Mg	200.7	W	1	mg/L	41.1	41.1	0.0	60.4	20.0	96.5	11/19/04
Mn	200.7	W	1	mg/L	0.0086	0.0075	13.7	0.994	1.00	98.5	11/19/04
Mn	200.7	W	2	mg/L	<0.0020	<0.0020	UDL	0.986	1.00	98.6	11/19/04
Na	200.7	W	1	mg/L	4.59	4.61	0.4	23.8	19.0	101.1	11/19/04
Pb	200.7	W	1	mg/L	<0.0050	<0.0050	UDL	0.986	1.00	98.6	11/19/04
Pb	200.7	W	2	mg/L	<0.0050	<0.0050	UDL	1.01	1.00	101.0	11/19/04
Cl	300.0	W	1	mg/L	9.01	8.99	0.2	26.5	20.0	87.5	11/10/04
NO3-N	300.0	W	1	mg/L	0.189	0.189	0.0	2.15	2.00	98.1	11/10/04
SO4	300.0	W	1	mg/L	115	115	0.0	164	50.0	98.0	11/10/04
ALK	2320B	W	1	mg/L	432	438	1.4	N/A	N/A	N/A	11/10/04
pH	150.1	W	1		7.26	7.10	2.2	N/A	N/A	N/A	11/10/04
Eh	2580	W	1	mV	+194	+192	1.0	N/A	N/A	N/A	11/23/04
ORG18D	415.1	W	1	mg/L	100	99.3	0.7	139	50.0	78.0	11/16/04
TDS	160.1	W	1	mg/L	540	577	6.6	I/S	I/S	N/A	11/11/04
TURB	180.1	W	1	NTU'S	0.326	0.320	1.9	N/A	N/A	N/A	11/10/04

LEGEND:

RPD% = (|SAM - DUP|/((SAM + DUP)/2) * 100)   UDL = Both SAM & DUP not detected.   *Result or *Found: Interference required dilution.
= (|SPK - MSD|/((SPK + MSD)/2) * 100)   M in Duplicate/MSD column indicates MSD.
E ADD column, A = Post Digest Spike;   %R = Percent Recovery N/A = Not Analyzed; R > 4S = Result more than 4X the Spike Added
QC limits for MS recoveries apply only if the spike is at least 1/4 the concentration of the analyte in the sample.
Control limits for the RPD apply only if the concentration of the analyte in the sample is at least five times the reporting limit.
I/S: Insufficient sample for QC test.
QC Sample 1:   SVL SAM No.: 426294   Client Sample ID: MW-7   ^T
QC Sample 2:   SVL SAM No.: 426300   Client Sample ID: MW-7   ^D

SVL ANALYTICAL

CHAIN OF CUSTODY RECORD

Page 1 of 3

Client: GeoSyntec Consultants
Contact: Brian Petty
Address: 2100 Main St., Suit 150
Huntington Beach, CA 92648
Phone Number: (714) 969-0800
FAX Number: (714) 969-0820

NOTES:

1) Ensure proper container packaging.
2) Ship samples promptly following collection.
* 3) Designate Sample Reject Disposition

PO#: HR0196-12
Project Name: Metaline Falls

Table 1. -- Matrix Type
1 = Surface Water, [✓ 2 = Ground Water]
3 = Soil/Sediment, 4 = Rinsate, 5 = Oil
6 = Waste, 7 = Other (Specify) ______

FOR SVL USE ONLY
SVL JOB # 14447

Samplers Signature: G. Hay

Lab Name: SVL Analytical, Inc. (208) 784-1258 FAX (208) 783-0891
Address: One Government Gulch, Kellogg, ID 83837-0929

Sample ID	Collection		Miscellaneous				Preservative(s)						Analyses Required									Comments
	Date	Time	Collected by: (Init.)	Matrix Type From Table 1	No. of Containers	Sample Filtered ? Y/N	Unpreserved (Ice Only)	HNO3	HCL	H2SO4	NAOH	Other (Specify) ZnAc	Turbidity	Redox	pH	As, Pb, Cd, Fe, Mn (total/dissolved)	Alkalinity	DIC, TDS	Sulfide	Major cats (Na, Ca, Mg, K)	Major anions (Cl, NO3, SO4)	
1. MW-7	11/4/04	11^{00}	gh	2	4	*	*	*				4	X	X	X	X	X	X	X	X	X	
2. MW-8		8:30																				
3. MW-9		9:45																				
4. MW-9(D)		9:46																				
5. MW-11		9:15																				
6. MW-12		10:45																				
7.																						SVL filtered for
8.																						metals HNO3
9.																						Lot # 1104060
10.																						11/9/04 BM

Relinquished by: G. E. Hay	Date: 11/9/04	Time: 12:20	Received by:	Date: 11/9/04	Time: 12:20
Relinquished by:	Date:	Time:	Received by:	Date:	Time:

* Sample Reject: [ ] Return [ ] Dispose [ ] Store (30 Days)

White: LAB COPY Yellow: CUSTOMER COPY SVL-COC 12/95

*Pl lab filter & preserve bottle 3

TRANSMISSION VERIFICATION REPORT

TIME : 11/09/2004 15:28
NAME : SVL ANALYTICAL
FAX : 2087830891
TEL : 2087841258
SER.# : BROF3J496071

DATE,TIME	11/09 16:27
FAX NO./NAME	917149690820
DURATION	00:00:21
PAGE(S)	01
RESULT	OK
MODE	FINE ECM

SVL ALYTICAL, INC.
Government Gulch - Kellogg, ID 83837-0929

Page 1 of 1

SAMPLE RECEIPT CONFIRMATION

SVL JOB No: 114447
Received: 11/09/04
Expected Due date: 11/23/04

me	By	Received	Sample Comments
0	GH	11/09/04	
30	GH	11/09/04	
15	GH	11/09/04	
16	GH	11/09/04	
5	GH	11/09/04	
5	GH	11/09/04	
0	GH	11/09/04	
0	GH	11/09/04	
5	GH	11/09/04	
6	GH	11/09/04	
5	GH	11/09/04	
5	GH	11/09/04	

iss. (^P) and Dissolved (^D) fractions separately. Field samples may appear twice.

Container temp not measured upon receipt.
FOR METALS
ED OUT OF HOLDING TIME FOR NO3 & TURB

after job completion.
, then you will receive a letter requesting disposal options.

---

you have questions regarding the receipt of these samples. 11/09/04 15:49

SVL ANALYTICAL, INC. **PORT OF ANALYTICAL RESULT**

One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83827-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-089

CLIENT : GeoSyntec Sample Receipt: 11/09/04 Page 1 of 1
PROJECT: HR0196-12 Report Date: 11/23/04 SVL JOB: 114448

SVL ID	CLIENT SAMPLE ID	As 200.7	ALK 2320B	pH 150.1	Eh 2580	ORG18D 415.1
W426308	AVG-W ˆT11/05/04	<0.010mg/L	140mg/L	5.63	+225mV	138mg/L
W426309	AVG-E ˆT11/05/04	<0.010mg/L	133mg/L	6.27	+230mV	123mg/L
W426310	PM-1 ˆT11/04/04	0.031mg/L	1240mg/L	10.20	+118mV	200mg/L
W426311	PM-2 ˆT11/03/04	<0.010mg/L	343mg/L	8.01	+162mV	77.1mg/L
W426312	PM-6 ˆT11/04/04	0.239mg/L	1810mg/L	11.60	+34.0mV	170mg/L
W426313	PM-7 ˆT11/03/04	0.026mg/L	899mg/L	7.74	+141mV	226mg/L
W426314	PM-8 ˆT11/04/04	0.058mg/L	733mg/L	8.26	+124mV	176mg/L
W426315	PM-10 ˆT11/03/04	0.021mg/L	368mg/L	7.02	+177mV	112mg/L
W426316	PM-11 ˆT11/03/04	<0.010mg/L	408mg/L	6.94	+183mV	124mg/L
W426317	PM-12 ˆT11/03/04	0.023mg/L	970mg/L	6.64	+193mV	329mg/L
W426318	PM-13 ˆT11/03/04	<0.010mg/L	647mg/L	8.37	+144mV	161mg/L
W426319	PM-14 ˆT11/03/04	<0.010mg/L	390mg/L	9.65	+115mV	72.1mg/L
W426320	PM-15 ˆT11/04/04	0.116mg/L	***	12.00	-206mV	183mg/L
W426321	PM-16 ˆT11/04/04	0.038mg/L	***	12.10	-187mV	113mg/L
W426322	PM-17 ˆT11/03/04	0.029mg/L	1150mg/L	11.30	-76.0mV	104mg/L
W426323	PM-18 ˆT11/03/04	0.076mg/L	***	11.20	-56.0mV	184mg/L
W426324	PM-19 ˆT11/04/04	0.122mg/L	***	11.70	-68.0mV	172mg/L
W426325	PM-20 ˆT11/04/04	<0.010mg/L	***	8.50	+85.0mV	191mg/L
W426326	PM-21 ˆT11/05/04	0.010mg/L	358mg/L	9.92	+31.0mV	46.4mg/L
W426327	AVG-W ˆD11/05/04	<0.010mg/L	***	***	***	***
W426328	AVG-E ˆD11/05/04	<0.010mg/L	***	***	***	***
W426329	PM-1 ˆD11/04/04	0.033mg/L	***	***	***	***
W426330	PM-2 ˆD11/03/04	<0.010mg/L	***	***	***	***
W426331	PM-6 ˆD11/04/04	0.228mg/L	***	***	***	***
W426332	PM-7 ˆD11/03/04	0.020mg/L	***	***	***	***
W426333	PM-8 ˆD11/04/04	0.024mg/L	***	***	***	***
W426334	PM-10 ˆD11/03/04	<0.010mg/L	***	***	***	***
W426335	PM-11 ˆD11/03/04	<0.010mg/L	***	***	***	***
W426336	PM-12 ˆD11/03/04	<0.010mg/L	***	***	***	***
W426337	PM-13 ˆD11/03/04	<0.010mg/L	***	***	***	***
W426338	PM-14 ˆD11/03/04	<0.010mg/L	***	***	***	***
W426339	PM-15 ˆD11/04/04	0.115mg/L	***	***	***	***
W426340	PM-16 ˆD11/04/04	0.099mg/L	***	***	***	***
W426341	PM-17 ˆD11/03/04	0.035mg/L	***	***	***	***
W426342	PM-18 ˆD11/03/04	0.074mg/L	***	***	***	***
W426343	PM-19 ˆD11/04/04	0.126mg/L	***	***	***	***
W426344	PM-20 ˆD11/04/04	<0.010mg/L	***	***	***	***
W426345	PM-21 ˆD11/05/04	<0.010mg/L	***	***	***	***

*** Not Requested

WA NO. C074

Reviewed By: __________ Date: 11/23/04

SVL ANALYTICAL, INC.

Quality Control Report
Part I Prep Blank and Laboratory Control Sample

Client :GeoSyntec

SVL JOB No: 114448

Analyte	Method	Matrix	Units	Prep Blank	True——LCS	——Found	LCS %R	Analysis Date
Arsenic	200.7	WATER	mg/L	<0.010	1.00	1.11	111.0	11/19/04
ALKALINITY	2320B	WATER	mg/L	<1.0	90.0	91.0	101.1	11/15/04
pH	150.1	WATER		5.72	5.40	5.39	99.8	11/15/04
Eh (mV)	2580	WATER	mV	N/A	+228	+232	101.8	11/23/04
DIS. INOR CARBON	415.1	WATER	mg/L	<1.0	14.0	13.4	95.7	11/18/04

LEGEND:

LCS = Laboratory Control Sample

LCS %R = LCS Percent Recovery

N/A = Not Applicable

11/23/04 15:00

SVL ANALYTICAL, INC.

Quality Control Report
Part II Duplicate and Spike Analysis

Client :GeoSyntec

SVL JOB No: 114448

			QC SAMPLE ID			Duplicate or	MSD	Matrix Spike			Analysis
est	Method	Mtx		Units	Result	Found	RPD%	Result	SPK ADD	%R	Date
As	200.7	W	1	mg/L	<0.010	<0.010	UDL	1.13	1.00	113.0	11/18/04
As	200.7	W	2	mg/L	<0.010	N/A	N/A	1.18	1.00	118.0	11/19/04
As	200.7	W	3	mg/L	<0.010	<0.010	UDL	1.13	1.00	113.0	11/19/04
As	200.7	W	4	mg/L	<0.010	N/A	N/A	1.17	1.00	117.0	11/19/04
ALK	2320B	W	1	mg/L	140	132	5.9	N/A	N/A	N/A	11/15/04
pH	150.1	W	1		5.63	5.64	0.2	N/A	N/A	N/A	11/15/04
Eh	2580	W	1	mV	+225	+226	0.4	N/A	N/A	N/A	11/23/04
ORG18D	415.1	W	1	mg/L	138	140	1.4	366	250	91.2	11/18/04

LEGEND:

RPD% = (|SAM - DUP|/((SAM + DUP)/2) * 100) UDL = Both SAM & DUP not detected. *Result or *Found: Interference required dilution.

RPD% = (|SPK - MSD|/((SPK + MSD)/2) * 100) M in Duplicate/MSD column indicates MSD.

SPIKE ADD column, A = Post Digest Spike; %R = Percent Recovery N/A = Not Analyzed; R > 4S = Result more than 4X the Spike Added

QC limits for MS recoveries apply only if the spike is at least 1/4 the concentration of the analyte in the sample.

Control limits for the RPD apply only if the concentration of the analyte in the sample is at least five times the reporting limit.

QC Sample 1: SVL SAM No.: 426308 Client Sample ID: AVG-W ^T
QC Sample 2: SVL SAM No.: 426318 Client Sample ID: PM-13 ^T
QC Sample 3: SVL SAM No.: 426327 Client Sample ID: AVG-W ^D
QC Sample 4: SVL SAM No.: 426337 Client Sample ID: PM-13 ^D

11/23/04 15:00

SVL ANALYTICAL

CHAIN OF CUSTODY RECORD

Pres HNO3
LOT# 1104060
11/10/04
CRS

Page 2 of 3

Client: GeoSyntec Consultants
Contact: Brian Petty
Address: 2100 Main St, Suite 150
Huntington Beach, CA 92648
Phone Number: 714 969-0800
FAX Number: 714 969-0820

NOTES:

1) Ensure proper container packaging.
2) Ship samples promptly following collection.
* 3) Designate Sample Reject Disposition

PO#: HR0196-12
Project Name: MET FALLS

Table 1. -- Matrix Type

1 = Surface Water, [✓ 2 = Ground Water]
3 = Soil/Sediment, 4 = Rinsate, 5 = Oil
6 = Waste, 7 = Other (Specify) ______

Samplers Signature: g. hwy

FOR SVL USE ONLY
SVL JOB # 114448

*pls lab filter & preserve bottle #2

Lab Name: SVL Analytical, Inc. (208) 784-1258 FAX (208) 783-0891
Address: One Government Gulch, Kellogg, ID 83837-0929

Sample ID	Collection		Miscellaneous				Preservative(s)						Analyses Required									Comments
	Date	Time	Collected by: (Init.)	Matrix Type From Table 1	No. of Containers	Sample Filtered ? Y/N	Unpreserved (Ice Only)	HNO3	HCL	H2SO4	NAOH	Other (Specify)	pH	Arsenic (total+dissolved)	DIC	Redox						
1. AVG-W	11/5	9	gh	2	3	*	*	*					X									bailed
2. AVG-E	11/5	920																				bailed
3. PM-1	11/4	1315																				
4. PM-2	11/3	1630																				
5. PM-6	11/4	1330																				
6. PM-7	11/3	1640																				
7. PM-8	11/4	1045																				bailed
8. PM-10	11/3	1400																				
9. PM-11	11/3	1425																				
10. PM-12	11/3	1345																				

Relinquished by: g. E. Hwy Date: 11/8/04 Time: 12:20 Received by: Date: 11/9/04 Time: 12:20
Relinquished by: Date: Time: Received by: Date: Time:

* Sample Reject: [ ] Return [ ] Dispose [ ] Store (30 Days)

White: LAB COPY Yellow: CUSTOMER COPY SVL-COC 12/95

SVL ANALYTICAL

CHAIN OF CUSTODY RECORD

Pres HNO3
Lot # 1604060
11/10/04
ers

Page 3 of 3

Client: GeoSyntec Consultants
Contact: Brian Petty
Address: 2100 Main St., Suite 150
Huntington Beach, CA 92648
Phone Number: (714) 969-0800
FAX Number: (714) 969-0820

NOTES:

1) Ensure proper container packaging.
2) Ship samples promptly following collection.
* 3) Designate Sample Reject Disposition

PO#: HR0196-12
Project Name: Met FALLS

Table 1. -- ~~Matrix Type~~
1 = Surface Water, [✓ 2 = Ground Water]
3 = Soil/Sediment, 4 = Rinsate, ~~5 = Oil~~
6 = Waste, 7 = Other (Specify) ______

Samplers Signature: g. Hy

FOR SVL USE ONLY
SVL JOB # 114448

– :Pls lab filter+preserv bottle #2

Lab Name: SVL Analytical, Inc. (208) 784-1258 FAX (208) 783-0891
Address: One Government Gulch, Kellogg, ID 83837-0929

	Sample ID	Collection		Miscellaneous				Preservative(s)						Analyses Required									Comments
		Date	Time	Collected by: (Init.)	Matrix Type From Table 1	No. of Containers	Sample Filtered ? Y/N	Unpreserved (Ice Only)	HNO3	HCL	H2SO4	NAOH	Other (Specify)	PH	Arsenic (total+dissolved)	DIC	Redox						
1.	PM-13	11/3	14³⁰	gh	2	3	*	*	*					X	X	X	X						
2.	PM-14	11/3	1455																				
3.	PM-15	11/4	1230																				
4.	PM-16	11/4	1445																				bailed
5.	PM-17	11/3	1510																				
6.	PM-18	11/4	1115																				
7.	PM-19	11/4	1135																				* ID By Time
8.	PM-20	11/4	1200																				label reads PM-18 ers 11/10/04
9.	PM-21		1000		X									X	X	X	X						bailed
10.																							

Relinquished by: g. E. Hy	Date: 11/8/04	Time: 12:20	Received by:	Date: 11/9/04	Time: 12:20
Relinquished by:	Date:	Time:	Received by:	Date:	Time:

* Sample Reject: [ ] Return [ ] Dispose [ ] Store (30 Days)

White: LAB COPY Yellow: CUSTOMER COPY SVL-COC 12/95

TRANSMISSION VERIFICATION REPORT

TIME : 11/11/2004 08:37
NAME : SVL ANALYTICAL
FAX : 2087830891
TEL : 2087841258
SER.# : BROF3J496071

DATE,TIME	11/11 08:35
FAX NO./NAME	917149690820
DURATION	00:00:41
PAGE(S)	02
RESULT	OK
MODE	FINE ECM

SV NALYTICAL, INC.
Government Gulch - Kellogg, ID 83837-0929

SAMPLE RECEIPT CONFIRMATION

SVL JOB No: 114448
Received: 11/09/04
Expected Due date: 11/23/04

e	By	Received	Sample Comments
0	GH	11/09/04	
0	GH	11/09/04	
5	GH	11/09/04	
0	GH	11/09/04	
0	GH	11/09/04	
0	GH	11/09/04	
5	GH	11/09/04	
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0	GH	11/09/04	
5	GH	11/09/04	
0	GH	11/09/04	
5	GH	11/09/04	
5	GH	11/09/04	

after job completion.
, then you will receive a letter requesting disposal options.

you have questions regarding the receipt of these samples. 11/10/04 15:50

SOIL LABORATORY DATA
ATTACHMENT 1 FOR APPENDIX A

PILOT TREATMENT WALL STUDY
2003 WORK PROGRAM DESCRIPTION AND SUMMARY OF FINDINGS

DRAFT FEASIBILITY STUDY TECHNICAL REPORT
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

SVL ANALYTICAL, INC.
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83827-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-08

REPORT OF ANALYTICAL RESULT

CLIENT : GEOSYNTEC CONSULTANTS
PROJECT:

Sample Receipt: 7/21/03
Report Date: 8/06/03

Page 1 of 1
SVL JOB: 106756

SVL ID	CLIENT SAMPLE ID		Fe 6010B	Mn 6010B	As 7060	S^{-2} LECO
S343343	FSP-06-5	7/15/03	18900mg/kg	470mg/kg	4.46mg/kg	<0.010%
S343344	FSP-18-12	7/17/03	17800mg/kg	353mg/kg	3.00mg/kg	<0.010%
S343345	FSP-26-4	7/17/03	***	***	***	***
S343346	PM-16-9	7/17/03	***	***	***	***
S343347	PM-16-5	7/17/03	***	***	***	***
S343348	FSP-21-10	7/17/03	***	***	***	***
S343349	FSP-26-8	7/17/03	***	***	***	***
S343350	FSP-19-8	7/17/03	20100mg/kg	419mg/kg	4.36mg/kg	<0.010%

*** Not Requested Soil Samples: As Received Basis

Certificate: CA CERTIFICATE NO. 2080

Reviewed By:

Date: 8/6/03

Part I Prep Blank and Laboratory Control Sample

Client :GEOSYNTEC CONSULTANTS

SVL JOB No: 106756

nalyte	Method	Matrix	Units	Prep Blank	True——LCS	——Found	LCS %R	Analysis Date
Iron	6010B	SOIL	mg/kg	<2.0	11400	9960	87.4	8/04/03
Manganese	6010B	SOIL	mg/kg	0.24	534	481	90.1	8/04/03
Arsenic	7060	SOIL	mg/kg	<0.30	110	115	104.5	8/05/03

LEGEND:

LCS = Laboratory Control Sample

LCS %R = LCS Percent Recovery

N/A = Not Applicable

8/06/03 10:49

SVL ANALYTICAL, INC.

Quality Control Report
Part II Duplicate and Spike Analysis

ient :GEOSYNTEC CONSULTANTS

SVL JOB No: 106756

			QC SAMPLE ID			Duplicate or MSD			Matrix Spike			Analysis
Test	Method	Matrix		Units	Result	Found		RPD%	Result	SPK ADD	%R	Date
Fe	6010B	SOIL	1	mg/kg	18900	19300	M	4.6	20200	1000	R >4S	8/04/03
Mn	6010B	SOIL	1	mg/kg	470	551	M	4.8	525	100	R >4S	8/04/03
As	7060	SOIL	1	mg/kg	4.46	7.55	M	4.9	7.93	5.00	69.4	8/05/03
S^{-2}	LECO	SOIL	1	%	<0.010	<0.010		UDL	N/A	N/A	N/A	8/01/03

LEGEND:

RPD% = (|SAM - DUP|/((SAM + DUP)/2) * 100) UDL = Both SAM & DUP not detected. *Result or *Found: Interference required dilution.

RPD% = (|SPK - MSD|/((SPK + MSD)/2) * 100) M in Duplicate/MSD column indicates MSD.

SPIKE ADD column, A = Post Digest Spike; %R = Percent Recovery N/A = Not Analyzed; R > 4S = Result more than 4X the Spike Added

QC Sample 1: SVL SAM No.: 343343 Client Sample ID: FSP-06-5

CHAIN OF CUSTODY RECORD

Page 2 of 3

Client:
Contact: Lee R.
Address:
Phone Number:
FAX Number:

NOTES:
1) Ensure proper container packaging.
2) Ship samples promptly following collection.
* 3) Designate Sample Reject Disposition

PO#:
Project Name:

Table 1. -- Matrix Type
1 = Surface Water, [✓ 2] = Ground Water
[✓ 3] = Soil/Sediment, 4 = Rinsate, 5 = Oil
6 = Waste, 7 = Other (Specify) ______

Samplers Signature:

FOR SVL USE ONLY
SVL JOB # 1016755

Lab Name: SVL Analytical, Inc. (208) 784-1258 FAX (208) 783-0891
Address: One Government Gulch, Kellogg, ID 83837-0929

Sample ID	Collection		Miscellaneous				Preservative(s)						Analyses Required									Comments
	Date	Time	Collected by: (Init.)	Matrix Type From Table 1	No. of Containers	Sample Filtered ? Y/N	Unpreserved (Ice Only)	HNO3	HCL	H2SO4	NAOH	Other (Specify)										
1. FBP-23	7/16/03	1540	BP	2	2	N	|	|														NO time on 2nd bot.
2. FBP-15	7/16/03	1600	|	2	2	N	|	|														(assumed)
3. FBP-16	7/17/03	0930	|	2	2	N	|															
4. FSP-18	|	1000	|	2	2	|	|	|													
5. FBP-20	|	1100	|	2	2	|	|	|													NO time on 2nd bot.
6. FBP-18-12	|	1100	|	3	1	|	|															(assumed)
7. FSP-23	|	1140	|	2	2	|	|	|													no time on 2nd bot.
8. FBP-25	|	1300	|	2	2	|	|	|													(assumed)
9. FBP-20	|	1400	|	2	2	|	|	|													NO time on 2nd bot.
10. FSP-26-4	|	1500	X	3	1	X	|															(assumed)

Relinquished by: J.E. Fry Date: 7/21/03 Time: 2:00 Received by: Date: 7-21-03 Time: 2:00p
Relinquished by: Date: Time: Received by: Date: Time:

* Sample Reject: [ ] Return [ ] Dispose [ ] Store (30 Days)

Copy

White: LAB COPY Yellow: CUSTOMER COPY SVL-COC 12/95

See other copy of COC.

CHAIN OF CUSTODY RECORD

Page 1 of 3

Client: GeoSyntec Consultants
Contact: Eric Smalstig
Address: 200 Main St, Suite 150
Huntington Beach, CA 92648
Phone Number: 714-969-0800
FAX Number: 714-969-0820

NOTES:

1) Ensure proper container packaging.
2) Ship samples promptly following collection.
* 3) Designate Sample Reject Disposition

PO#: 4R0196-12
Project Name: Metaline Falls

Table 1. -- Matrix Type
1 = Surface Water, [✓ 2 = Ground Water]
[✓ 3 = Soil/Sediment], 4 = Rinsate, 5 = Oil
6 = Waste, 7 = Other (Specify) ______

Samplers Signature:

FOR SVL USE ONLY
SVL JOB # 106755

Lab Name: SVL Analytical, Inc. (208) 784-1258 FAX (208) 783-0891
Address: One Government Gulch, Kellogg, ID 83837-0929

Sample ID	Collection		Miscellaneous				Preservative(s)						Analyses Required									Comments
	Date	Time	Collected by: (Init.)	Matrix Type From Table 1	No. of Containers	Sample Filtered ? Y/N	Unpreserved (Ice Only)	HNO3	HCL	H2SO4	NAOH	Other (Specify)										
1. FSP-06-5	7/15/03	1400	SP	3	|	N	|	|														
2. FSP-02	|	1710	|	2	2	N	|	|														
3. FSP-03		1730	|	2	|	N	|	|														
4. FSP-05		1800		2		N	|	|														
5. FSP-06		1900		2		N	|	|														
6. FSP-07		1910		2		N	|	|														
7. FSP-08	X	1930		2		N	|	|														
8. FSP-17	7/16/03	1400		2		N	|	(														
9. FSP-19	|	1430		2		N	|	(														
10. FSP-26	X	1500	X	2		N	|	(														

Relinquished by: G. E. Hoy Date: 7/21/03 Time: 2:00 Received by: Dave Waes Date: 7-21-03 Time: 2:00
Relinquished by: Date: Time: Received by: Date: Time:

* Sample Reject: [ ] Return [ ] Dispose [ ] Store (30 Days)

COPY

White: LAB COPY Yellow: CUSTOMER COPY SVL-COC 12/95

SVL ANALYTICAL

CHAIN OF CUSTODY RECORD

Page 3 of 3

Client:
Contact:
Address: Gee P
Phone Number:
FAX Number:

NOTES:
1) Ensure proper container packaging.
2) Ship samples promptly following collection.
* 3) Designate Sample Reject Disposition
PO#:
Project Name:

Table 1. -- Matrix Type
1 = Surface Water, [✓ 2] = Ground Water
[✓ 3] = Soil/Sediment, 4 = Rinsate, 5 = Oil
6 = Waste, 7 = Other (Specify) ________
Samplers Signature:

FOR SVL USE ONLY
SVL JOB# 106755

Lab Name: SVL Analytical, Inc. (208) 784-1258 FAX (208) 783-0891
Address: One Government Gulch, Kellogg, ID 83837-0929

Sample ID	Collection		Miscellaneous				Preservative(s)						Analyses Required									Comments
	Date	Time	Collected by: (Init.)	Matrix Type From Table 1	No. of Containers	Sample Filtered ? Y/N	Unpreserved (Ice Only)	HNO3	HCL	H2SO4	NAOH	Other (Specify)										
1. ~~FSP~~ PM-16-9	7/17/03		BD	3	1	N	1															
2. PM-16-5				3	1	N	1															
3. FSP-21-10				3	1	N	1															
4. FSP-26-8				3	1	N	1															
5. FSP-19-8				3	1	N	1															
6. PM-16	7/[illegible]/03	0030		2	2	N	1	1														
7.																						
8.																						
9.																						
10.																						

Relinquished by:	Date: 7/21/03	Time: 2:00	Received by:	Date: 7-21-03	Time: 2:00p
Relinquished by:	Date:	Time:	Received by:	Date:	Time:

* Sample Reject: [ ] Return [ ] Dispose [ ] Store (30 Days)

Copy

White: LAB COPY Yellow: CUSTOMER COPY

SVL-COC 12/95

SVL ANALYTICAL

208-783-0891

CHAIN OF CUSTODY RECORD

Page 1 of 3

Client: GeoSyntec Consultants
Contact: Eric Smalstis
Address: 200 Main St. Suite 150
Huntington Beach CA 92648
Phone Number: 714-969-0800
FAX Number: 714-969-0820

NOTES:

1) Ensure proper container packaging.
2) Ship samples promptly following collection.
* 3) Designate Sample Reject Disposition

PO#: +120196.12
Project Name: Metaline Falls

Table 1. -- Matrix Type
1 = Surface Water, 2 = Ground Water
3 = Soil/Sediment, 4 = Rinsate, 5 = Oil
6 = Waste, 7 = Other (Specify) ______

FOR SVL USE ONLY
SVL JOB # 106756

Samplers Signature:

Lab Name: SVL Analytical, Inc. (208) 784-1258 FAX (208) 783-0891
Address: One Government Gulch, Kellogg, ID 83837-0929

Sample ID	Collection		Miscellaneous				Preservative(s)						Analyses Required									Comments
	Date	Time	Collected by: (Init.)	Matrix Type From Table 1	No. of Containers	Sample Filtered ? Y/N	Unpreserved (Ice Only)	HNO3	HCL	H2SO4	NAOH	Other (Specify)	SEC, ORP, pH	As	DIC, S^{2-}	Total alkalinity, Alk, Bicarb Carb	Major cations (incl. K)	Major anions (Cl F SO4)	Fe ~~[illegible]~~ Total	Mn (Dissolved + Total)	NH3, NO2, NO3, F	* Samples being run other soils on HOLD 7/24/03 CRS
1. FSP-06-5	7/15/03	1400	SP	3	|	N	|	|						X	S^{2-}				X	X		
2. FSP-02	|	710	|	2	2	N	|	|														HOLD
3. FSP-03		1730		2	|	N	|	|														HOLD
4. FSP-05		1800		2	|	N	|	|														HOLD
5. FSP-06		1900		2		N	|	|					X	X	X	X	X	X	X	X	X	
6. FSP-07		1910		2		N	|	|					X	X	X	X	X	X	X	X	X	
7. FSP-08	X	1930		2		N	|	|														HOLD
8. FSP-17	7/16/03	1400		2		N	|	(						X	X	X	X	X	X	X	X	X	
9. FSP-14	|	1430		2		N	|	(						X	X	X	X	X	X				
10. FSP-26	X	1500	X	2		N	|	(						X	X	X	X	X	X	X	X	X	

Relinquished by: Date: Time: Received by: Date: Time:
Relinquished by: Date: Time: Received by: Date: Time:

* Sample Reject: [ ] Return [ ] Dispose [ ] Store (30 Days)

White: LAB COPY Yellow: CUSTOMER COPY SVL-COC 12/95

See "Original Copy"

SVL ANALYTICAL

CHAIN OF CUSTODY RECORD

Page 2 of 3

Client:
Contact:
Address:
Phone Number:
FAX Number:

NOTES:
1) Ensure proper container packaging.
2) Ship samples promptly following collection.
* 3) Designate Sample Reject Disposition
PO#:
Project Name:

Table 1. -- Matrix Type
1 = Surface Water, 2 = Ground Water
3 = Soil/Sediment, 4 = Rinsate, 5 = Oil
6 = Waste, 7 = Other (Specify) ______

Samplers Signature:

FOR SVL USE ONLY
SVL JOB #
106756 7/24/03 7/21/03

Lab Name: SVL Analytical, Inc. (208) 784-1258 FAX (208) 783-0891
Address: One Government Gulch, Kellogg, ID 83837-0929

	Collection		Miscellaneous				Preservative(s)						Analyses Required									
Sample ID	Date	Time	Collected by: (Init.)	Matrix Type From Table 1	No. of Containers	Sample Filtered ? Y/N	Unpreserved (Ice Only)	HNO3	HCL	H2SO4	NAOH	Other (Specify)	SC ORP, pH	As	DIC S^{2-}	Total alkalinity, Alk Alk Brab Co	Major cations (incl. K)	Major anions (Cl, F, SO4)	Fe (Total)	Mn (Dissolved + Total)	NH_3, NO_2^-, NO_3^-, F^-	Comments
1. FSP-23	7/16/03	1540	BB	2	2	N	/	/					X	X	X	X	X	X	X	X	X	
2. FSP-15	7/16/03	1600		2	2	N	/	/					X	X	X	X	X	X				
3. FSP-16	7/17/03	0930		2	2	N	/						X	X	X	X	X	X				
4. FSP-18		1000		2	2		/	/					X	X	X	X	X	X				
5. FSP-20		1100		2	2		/	/					X	X	X	X	X	X				
6. FSP-18-12		1100		3	1		/							X	Vol				X	X		
7. FSP-23		1140		2	2		/	/					X	X	X	X	X	X	X	X	X	
8. FSP-25		1300		2	2		/	/														HOLD
9. FSP-20		1400		2	2		/	/					X	X	X	X	X	X				
10. FSP-26-4		1500	X	3	1	X	/															HOLD

Relinquished by: Date: Time: Received by: Date: Time:
Relinquished by: Date: Time: Received by: Date: Time:

* Sample Reject: [ ] Return [ ] Dispose [ ] Store (30 Days)

White: LAB COPY Yellow: CUSTOMER COPY SVL-COC 12/95

SVL ANALYTICAL

CHAIN OF CUSTODY RECORD

Page 3 of 3

TOTAL P.04

Client:
Contact:
Address: GEP

Phone Number:
FAX Number:

NOTES:
1) Ensure proper container packaging.
2) Ship samples promptly following collection.
* 3) Designate Sample Reject Disposition

PO#:
Project Name:

Table 1. -- Matrix Type
1 = Surface Water, 2 = Ground Water
3 = Soil/Sediment, 4 = Rinsate, 5 = Oil
6 = Waste, 7 = Other (Specify) ______

Samplers Signature:

FOR SVL USE ONLY
SVL JOB # 106756
7/24/03

Lab Name: SVL Analytical, Inc. (208) 784-1258 FAX (208) 783-0891
Address: One Government Gulch, Kellogg, ID 83837-0929

Sample ID	Collection Date	Collection Time	Collected by: (Init.)	Matrix Type From Table 1	No. of Containers	Sample Filtered ? Y/N	Unpreserved (Ice Only)	HNO3	HCL	H2SO4	NAOH	Other (Specify)	SEC, ORP, pH	As	DIC, S2-	Total alkalinity, Bicarb/Alk	Major cations (incl K)	Major anions (Cl, F, SO4)	Fe (total)	Mn (Dissolved + Total)	NH3, NO2+NO3, F	Comments
1. PM-16-9	7/7/03		BP	3	1	N	1															HOLD
2. PM-16-5				3	1	N	1															HOLD
3. FSP-21-10				3	1	N	1															HOLD
4. FSP-26-8				3	1	N	1															HOLD
5. FSP-19-8				3	1	N	1							X	S				X	X		
6. PM-16	7/[illegible]/03	0930		2	2	N	1	1					X	X	X	X	X	X				
7.																						
8.																						
9.																						
10.																						

gc

Per Brian Petty
Major cations: Ca, Mg, Na, K
Major ions: Cl, F, SO4
As by GFAA on soil only – water by ICP
gc 7/24/03

Relinquished by:		Date:	Time:	Received by:		Date:	Time:
Relinquished by:		Date:	Time:	Received by:		Date:	Time:

* Sample Reject: [ ] Return [ ] Dispose [ ] Store (30 Days)

White: LAB COPY Yellow: CUSTOMER COPY SVL-COC 12/95

GAS LABORATORY DATA
ATTACHMENT 1 FOR APPENDIX A

PILOT TREATMENT WALL STUDY
2003 WORK PROGRAM DESCRIPTION AND SUMMARY OF FINDINGS

DRAFT FEASIBILITY STUDY TECHNICAL REPORT
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

Calscience
Environmental
Laboratories, Inc.

August 08, 2003

Brian Petty
GeoSyntec Consultants
2100 Main Street, Suite 150
Huntington Beach, CA 92648-2460

Subject: **Calscience Work Order No.: 03-08-0177**
Client Reference: Lehigh

Dear Client:

Enclosed is an analytical report for the above-referenced project. The samples included in this report were received 8/5/2003 and analyzed in accordance with the attached chain-of-custody.

Unless otherwise noted, all analytical testing was accomplished in accordance with the guidelines established in our Quality Assurance Program Manual, applicable standard operating procedures, and other related documentation. The original report of any subcontracted analysis is provided herein, and follows the standard Calscience data package. The results in this analytical report are limited to the samples tested and any reproduction thereof must be made in its entirety.

If you have any questions regarding this report, please do not hesitate to contact the undersigned.

Sincerely,

Calscience Environmental
Laboratories, Inc.
Stephen Nowak
Project Manager

Michael J. Crisostomo
Quality Assurance Manager

Calscience
Environmental
Laboratories, Inc.

ANALYTICAL REPORT

GeoSyntec Consultants
2100 Main Street, Suite 150
Huntington Beach, CA 92648-2460

Attn: Brian Petty
RE: Lehigh

Date Sampled: 08/01/03
Date Received: 08/05/03
Date Analyzed: 08/05/03

Work Order No.: 03-08-0177
Method: GC/FPD
Page 1 of 1

All concentrations are reported in ppm (v/v).

Sample Number	Hydrogen Sulfide Concentration	Reporting Limit
PIPE AT203-10	3	1
PIPE AT204-12	ND	1
PIPE AT205-14	ND	1
PIPE AT206-16	ND	1
~~PIPE AT201-8~~ PIPE AT202-8	2	1
Method Blank	ND	1

QA/QC

Sample Number	Sample Conc.	Duplicate Conc.	%RPD	Control Limits (%)
PIPE AT203-10 (Duplicate)	3.39	3.20	6	0 - 15

GC/FPD
flame photo-
ionization

ND denotes not detected at indicated reportable limit.

Each sample was received by CEL intact and with chain

Calscience
Environmental
Laboratories, Inc.

ANALYTICAL REPORT

GeoSyntec Consultants
2100 Main Street, Suite 150
Huntington Beach, CA 92648-2460

Date Sampled: 08/01/03
Date Received: 08/05/03
Date Analyzed: 08/05/03

Work Order No.: 03-08-0177
Method: ASTM D-1946
Page 1 of 2

Attn: Brian Petty
RE: Lehigh

All concentrations are reported in percent (%) by volume.

Analyte	Concentration	Reporting Limit
Sample Number: PIPE AT203-10		
Oxygen (O_2) + Argon (Ar)	0.7	0.1
Nitrogen (N_2)	2.0	0.1
Methane (CH_4)	ND	0.1
Carbon Dioxide (CO_2)	97.3	0.1
Sample Number: PIPE AT204-12		
Oxygen (O_2) + Argon (Ar)	0.8	0.1
Nitrogen (N_2)	2.6	0.1
Methane (CH_4)	ND	0.1
Carbon Dioxide (CO_2)	96.6	0.1
Sample Number: PIPE AT205-14		
Oxygen (O_2) + Argon (Ar)	0.7	0.1
Nitrogen (N_2)	2.1	0.1
Methane (CH_4)	ND	0.1
Carbon Dioxide (CO_2)	97.2	0.1
Sample Number: PIPE AT206-16		
Oxygen (O_2) + Argon (Ar)	0.7	0.1
Nitrogen (N_2)	1.9	0.1
Methane (CH_4)	ND	0.1
Carbon Dioxide (CO_2)	97.5	0.1

ANALYTICAL REPORT

GeoSyntec Consultants
2100 Main Street, Suite 150
Huntington Beach, CA 92648-2460

Attn: Brian Petty
RE: Lehigh

Date Sampled: 08/01/03
Date Received: 08/05/03
Date Analyzed: 08/05/03

Work Order No.: 03-08-0177
Method: ASTM D-1946
Page 2 of 2

All concentrations are reported in percent (%) by volume.

Analyte	Concentration	Reporting Limit
Sample Number: PIPE AT201-8		
Oxygen (O_2) + Argon (Ar)	0.7	0.1
Nitrogen (N_2)	2.0	0.1
Methane (CH_4)	ND	0.1
Carbon Dioxide (CO_2)	97.3	0.1
Sample Number: Method Blank		
Oxygen (O_2) + Argon (Ar)	ND	0.1
Nitrogen (N_2)	ND	0.1
Methane (CH_4)	ND	0.1
Carbon Dioxide (CO_2)	ND	0.1

QA/QC

Sample Number: Laboratory Control Sample

Analyte	Sample Conc.	Duplicate Conc.	%RPD	Control Limits (%)
Oxygen (O_2) + Argon (Ar)	18.5	18.5	0	0 - 30
Nitrogen (N_2)	70.5	70.9	1	0 - 30
Carbon Dioxide (CO_2)	5.50	5.51	0	0 - 30

ND denotes not detected at indicated reportable limit.

Each sample was received by CEL intact and with chain-of-custody attached.

Calscience Environmental Laboratories, Inc.

WORK ORDER #: **03 - 0 8 - 0 1 7 7**

Cooler 0 of 0

SAMPLE RECEIPT FORM

CLIENT: GEOSYNTEC

DATE: 8/5/03

TEMPERATURE – SAMPLES RECEIVED BY:

CALSCIENCE COURIER:

_______ Chilled, cooler with temperature blank provided.
_______ Chilled, cooler without temperature blank.
_______ Chilled and placed in cooler with wet ice.
_______ Ambient and placed in cooler with wet ice.
_______ Ambient temperature.

_______ °C Temperature blank.

LABORATORY (Other than Calscience Courier):

_______ °C Temperature blank.
_______ °C IR thermometer.
✓ Ambient temperature.

Initial: _______

CUSTODY SEAL INTACT:

Sample(s): _______ Cooler: _______ No (Not Intact) : _______ Not Applicable (N/A): —

Initial: _______

SAMPLE CONDITION:

	Yes	No	N/A
Chain-Of-Custody document(s) received with samples	—		
Sample container label(s) consistent with custody papers	—		
Sample container(s) intact and good condition	—		
Correct containers for analyses requested	—		
Proper preservation noted on sample label(s)			—
VOA vial(s) free of headspace			—
Tedlar bag(s) free of condensation	✓		—

Initial: _______

COMMENTS:

SVL ANALYTICAL

0127

CHAIN OF CUSTODY RECORD

Page 1 of 1

Client: GeoSyntec
Contact: Brian Petty
Address: 2100 Main St.
Suite #150
Phone Number: 714 969-0800
FAX Number: 714 969-0820

NOTES:

1) Ensure proper container packaging.

2) Ship samples promptly following collection.

* 3) Designate Sample Reject Disposition

PO#: HR0196-12

Project Name: Lehigh

Table 1. -- Matrix Type

1 = Surface Water, 2 = Ground Water

3 = Soil/Sediment, 4 = Rinsate, 5 = Oil

6 = Waste, [✓ 7 = Other] (Specify) gas

Samplers Signature:

FOR SVL USE ONLY

SVL JOB #

Lab Name: SVL Analytical, Inc. (208) 784-1258 FAX (208) 783-0891

Address: One Government Gulch, Kellogg, ID 83837-0929

	Collection		Miscellaneous				Preservative(s)						Analyses Required									
Sample ID	Date	Time	Collected by: (Init.)	Matrix Type From Table 1	No. of Containers	Sample Filtered ? Y/N	Unpreserved (Ice Only)	HNO3	HCL	H2SO4	NAOH	Other (Specify)	Oxygen	Nitrogen	Carbon dioxide	hyd. sulfide	methane					Comments
1. PIPE AT203-	10 8/1	0833	BP	7			X						X	X	X	X	X					
2. PIPE AT204-	12 8/1	0835	BP	7																		
3. PIPE AT205-	14 8/1	0830	BP	7																		
4. PIPE AT206-	16 8/1	0827	BP	7																		
5. PIPE AT201-	8 8/1	0820	BP	7			X						X	X	X	X	X					
6.																						
7.																						
8.																						
9.																						
10.																						

Relinquished by: Arthur E. Huy	Date: 8/4/03	Time: 4pm	Received by: FEDEX	Date:	Time:
Relinquished by: FEDEX	Date: 8/5/03	Time: 1300	Received by:	Date: 8/5/03	Time: 1300

* Sample Reject: [ ] Return [ ] Dispose [ ] Store (30 Days)

White: LAB COPY Yellow: CUSTOMER COPY

SVL-COC 12/95

SOIL LABORATORY DATA
ATTACHMENT 1 FOR APPENDIX A

PILOT TREATMENT WALL STUDY
2003 WORK PROGRAM DESCRIPTION AND SUMMARY OF FINDINGS

DRAFT FEASIBILITY STUDY TECHNICAL REPORT
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

SVL ANALYTICAL, INC. **PORT OF ANALYTICAL RESULT**

One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83827-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-089

CLIENT : GeoSyntec
PROJECT: HR0196-12
Sample Receipt: 11/09/04
Report Date: 11/23/04
Page 1 of 1
SVL JOB: 114448

SVL ID	CLIENT SAMPLE ID	As 200.7	ALK 2320B	pH 150.1	Eh 2580	ORG18D 415.1
W426308	AVG-W ˆT11/05/04	<0.010mg/L	140mg/L	5.63	+225mV	138mg/L
W426309	AVG-E ˆT11/05/04	<0.010mg/L	133mg/L	6.27	+230mV	123mg/L
W426310	PM-1 ˆT11/04/04	0.031mg/L	1240mg/L	10.20	+118mV	200mg/L
W426311	PM-2 ˆT11/03/04	<0.010mg/L	343mg/L	8.01	+162mV	77.1mg/L
W426312	PM-6 ˆT11/04/04	0.239mg/L	1810mg/L	11.60	+34.0mV	170mg/L
W426313	PM-7 ˆT11/03/04	0.026mg/L	899mg/L	7.74	+141mV	226mg/L
W426314	PM-8 ˆT11/04/04	0.058mg/L	733mg/L	8.26	+124mV	176mg/L
W426315	PM-10 ˆT11/03/04	0.021mg/L	368mg/L	7.02	+177mV	112mg/L
W426316	PM-11 ˆT11/03/04	<0.010mg/L	408mg/L	6.94	+183mV	124mg/L
W426317	PM-12 ˆT11/03/04	0.023mg/L	970mg/L	6.64	+193mV	329mg/L
W426318	PM-13 ˆT11/03/04	<0.010mg/L	647mg/L	8.37	+144mV	161mg/L
W426319	PM-14 ˆT11/03/04	<0.010mg/L	390mg/L	9.65	+115mV	72.1mg/L
W426320	PM-15 ˆT11/04/04	0.116mg/L	***	12.00	-206mV	183mg/L
W426321	PM-16 ˆT11/04/04	0.038mg/L	***	12.10	-187mV	113mg/L
W426322	PM-17 ˆT11/03/04	0.029mg/L	1150mg/L	11.30	-76.0mV	104mg/L
W426323	PM-18 ˆT11/03/04	0.076mg/L	***	11.20	-56.0mV	184mg/L
W426324	PM-19 ˆT11/04/04	0.122mg/L	***	11.70	-68.0mV	172mg/L
W426325	PM-20 ˆT11/04/04	<0.010mg/L	***	8.50	+85.0mV	191mg/L
W426326	PM-21 ˆT11/05/04	0.010mg/L	358mg/L	9.92	+31.0mV	46.4mg/L
W426327	AVG-W ˆD11/05/04	<0.010mg/L	***	***	***	***
W426328	AVG-E ˆD11/05/04	<0.010mg/L	***	***	***	***
W426329	PM-1 ˆD11/04/04	0.033mg/L	***	***	***	***
W426330	PM-2 ˆD11/03/04	<0.010mg/L	***	***	***	***
W426331	PM-6 ˆD11/04/04	0.228mg/L	***	***	***	***
W426332	PM-7 ˆD11/03/04	0.020mg/L	***	***	***	***
W426333	PM-8 ˆD11/04/04	0.024mg/L	***	***	***	***
W426334	PM-10 ˆD11/03/04	<0.010mg/L	***	***	***	***
W426335	PM-11 ˆD11/03/04	<0.010mg/L	***	***	***	***
W426336	PM-12 ˆD11/03/04	<0.010mg/L	***	***	***	***
W426337	PM-13 ˆD11/03/04	<0.010mg/L	***	***	***	***
W426338	PM-14 ˆD11/03/04	<0.010mg/L	***	***	***	***
W426339	PM-15 ˆD11/04/04	0.115mg/L	***	***	***	***
W426340	PM-16 ˆD11/04/04	0.099mg/L	***	***	***	***
W426341	PM-17 ˆD11/03/04	0.035mg/L	***	***	***	***
W426342	PM-18 ˆD11/03/04	0.074mg/L	***	***	***	***
W426343	PM-19 ˆD11/04/04	0.126mg/L	***	***	***	***
W426344	PM-20 ˆD11/04/04	<0.010mg/L	***	***	***	***
W426345	PM-21 ˆD11/05/04	<0.010mg/L	***	***	***	***

*** Not Requested

WA NO. C074

Reviewed By: Date: 11/23/04

SVL ANALYTICAL, INC.

Quality Control Report
Part I Prep Blank and Laboratory Control Sample

Client :GeoSyntec

SVL JOB No: 114448

Analyte	Method	Matrix	Units	Prep Blank	True—LCS	—Found	LCS %R	Analysis Date
Arsenic	200.7	WATER	mg/L	<0.010	1.00	1.11	111.0	11/19/04
ALKALINITY	2320B	WATER	mg/L	<1.0	90.0	91.0	101.1	11/15/04
pH	150.1	WATER		5.72	5.40	5.39	99.8	11/15/04
Eh (mV)	2580	WATER	mV	N/A	+228	+232	101.8	11/23/04
DIS. INOR CARBON	415.1	WATER	mg/L	<1.0	14.0	13.4	95.7	11/18/04

LEGEND:

LCS = Laboratory Control Sample

LCS %R = LCS Percent Recovery

N/A = Not Applicable

11/23/04 15:00

SVL ANALYTICAL, INC.

Quality Control Report
Part II Duplicate and Spike Analysis

Client :GeoSyntec

SVL JOB No: 114448

			QC SAMPLE ID			Duplicate or MSD		Matrix Spike			Analysis
est	Method	Mtx		Units	Result	Found	RPD%	Result	SPK ADD	%R	Date
As	200.7	W	1	mg/L	<0.010	<0.010	UDL	1.13	1.00	113.0	11/18/04
As	200.7	W	2	mg/L	<0.010	N/A	N/A	1.18	1.00	118.0	11/19/04
As	200.7	W	3	mg/L	<0.010	<0.010	UDL	1.13	1.00	113.0	11/19/04
As	200.7	W	4	mg/L	<0.010	N/A	N/A	1.17	1.00	117.0	11/19/04
ALK	2320B	W	1	mg/L	140	132	5.9	N/A	N/A	N/A	11/15/04
pH	150.1	W	1		5.63	5.64	0.2	N/A	N/A	N/A	11/15/04
Eh	2580	W	1	mV	+225	+226	0.4	N/A	N/A	N/A	11/23/04
ORG18D	415.1	W	1	mg/L	138	140	1.4	366	250	91.2	11/18/04

LEGEND:

RPD% = (|SAM - DUP|/((SAM + DUP)/2) * 100) UDL = Both SAM & DUP not detected. *Result or *Found: Interference required dilution.

RPD% = (|SPK - MSD|/((SPK + MSD)/2) * 100) M in Duplicate/MSD column indicates MSD.

SPIKE ADD column, A = Post Digest Spike; %R = Percent Recovery N/A = Not Analyzed; R > 4S = Result more than 4X the Spike Added

QC limits for MS recoveries apply only if the spike is at least 1/4 the concentration of the analyte in the sample.

Control limits for the RPD apply only if the concentration of the analyte in the sample is at least five times the reporting limit.

QC Sample 1: SVL SAM No.: 426308 Client Sample ID: AVG-W ^T
QC Sample 2: SVL SAM No.: 426318 Client Sample ID: PM-13 ^T
QC Sample 3: SVL SAM No.: 426327 Client Sample ID: AVG-W ^D
QC Sample 4: SVL SAM No.: 426337 Client Sample ID: PM-13 ^D

11/23/04 15:00

SVL ANALYTICAL

CHAIN OF CUSTODY RECORD

Pres HNO3
LOT# 1104060
11/10/04
CRS

Page 2 of 3

Client: GeoSyntec Consultants
Contact: Brian Petty
Address: 2100 Main St, Suite 150
Huntington Beach, CA 92648
Phone Number: 714 969-0800
FAX Number: 714 969-0820

NOTES:

1) Ensure proper container packaging.
2) Ship samples promptly following collection.
* 3) Designate Sample Reject Disposition

PO#: HR0196-12
Project Name: MET FALLS

Table 1. -- Matrix Type
1 = Surface Water, [✓ 2 = Ground Water]
3 = Soil/Sediment, 4 = Rinsate, 5 = Oil
6 = Waste, 7 = Other (Specify)

FOR SVL USE ONLY
SVL JOB # 114448

Samplers Signature: g. Huy

*pls lab filter & preserve bottl. #2

Lab Name: SVL Analytical, Inc. (208) 784-1258 FAX (208) 783-0891
Address: One Government Gulch, Kellogg, ID 83837-0929

Sample ID	Collection		Miscellaneous				Preservative(s)						Analyses Required									Comments
	Date	Time	Collected by: (Init.)	Matrix Type From Table 1	No. of Containers	Sample Filtered ? Y/N	Unpreserved (Ice Only)	HNO3	HCL	H2SO4	NAOH	Other (Specify)	pH	Arsenic (total+dissolved)	DIC	Redox						
1. AVG-W	11/5	9	gh	2	3	*	*	*					X									bailed
2. AVG-E	11/5	920																				bailed
3. PM-1	11/4	1315																				
4. PM-2	11/3	1630																				
5. PM-6	11/4	1330																				
6. PM-7	11/3	1640																				
7. PM-8	11/4	1045																				bailed
8. PM-10	11/3	1400																				
9. PM-11	11/3	1425																				
10. PM-12	11/3	1345																				

Relinquished by: g. E. Huy	Date: 11/8/04	Time: 12:20	Received by:	Date: 11/9/04	Time: 12:20
Relinquished by:	Date:	Time:	Received by:	Date:	Time:

* Sample Reject: [ ] Return [ ] Dispose [ ] Store (30 Days)

White: LAB COPY Yellow: CUSTOMER COPY SVL-COC 12/95

SVL ANALYTICAL

CHAIN OF CUSTODY RECORD

Pres HNO3
Lot # 1604060
11/10/04
CRS

Page 3 of 3

Client: GeoSyntec Consultants
Contact: Brian Petty
Address: 2100 Main St., Suite 150
Huntington Beach, CA 92648
Phone Number: (714) 969-0800
FAX Number: (714) 969-0820

NOTES:

1) Ensure proper container packaging.
2) Ship samples promptly following collection.
* 3) Designate Sample Reject Disposition

PO#: HR0196-12
Project Name: Met FALLS

Table 1. -- ~~Matrix Type~~
1 = Surface Water, [✓ 2 = Ground Water]
3 = Soil/Sediment, 4 = Rinsate, 5 = Oil
6 = Waste, 7 = Other (Specify) ______

Samplers Signature: g. Hry

FOR SVL USE ONLY
SVL JOB # 114448

– =Pls lab filt+preser bottle #2

Lab Name: SVL Analytical, Inc. (208) 784-1258 FAX (208) 783-0891
Address: One Government Gulch, Kellogg, ID 83837-0929

Sample ID	Collection		Miscellaneous				Preservative(s)						Analyses Required									Comments
	Date	Time	Collected by: (Init.)	Matrix Type From Table 1	No. of Containers	Sample Filtered ? Y/N	Unpreserved (Ice Only)	HNO3	HCL	H2SO4	NAOH	Other (Specify)	PH	Arsenic (total+dissolved)	DIC	Redox						
1. PM-13	11/3	1430	gh	2	3	*	*	*					X	X	X	X						
2. PM-14	11/3	1455																				
3. PM-15	11/4	1230																				
4. PM-16	11/4	1445																				baild
5. PM-17	11/3	1510																				
6. PM-18	11/4	1115																				
7. PM-19	11/4	1135																				* ID By Time
8. PM-20	11/4	1200																				label Reads PM-18 CRS 11/9/04
9. PM-21		1000		X									X	X	X	X						bailed
10.																						

Relinquished by: g. E. Hry	Date: 11/8/04	Time: 12:20	Received by:	Date: 11/9/04	Time: 12:20
Relinquished by:	Date:	Time:	Received by:	Date:	Time:

* Sample Reject: [ ] Return [ ] Dispose [ ] Store (30 Days)

White: LAB COPY Yellow: CUSTOMER COPY

SVL-COC 12/95

SV NALYTICAL, INC.
Government Gulch - Kellogg, ID 83837-0929

SAMPLE RECEIPT CONFIRMATION

SVL JOB No: 114448
Received: 11/09/04
Expected Due date: 11/23/04

e	By	Received	Sample Comments
0	GH	11/09/04	
0	GH	11/09/04	
5	GH	11/09/04	
0	GH	11/09/04	
0	GH	11/09/04	
0	GH	11/09/04	
5	GH	11/09/04	
0	GH	11/09/04	
5	GH	11/09/04	
5	GH	11/09/04	
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0	GH	11/09/04	
5	GH	11/09/04	
0	GH	11/09/04	
5	GH	11/09/04	
5	GH	11/09/04	

after job completion.
, then you will receive a letter requesting disposal options.

you have questions regarding the receipt of these samples. 11/10/04 15:50

TRANSMISSION VERIFICATION REPORT

TIME : 11/11/2004 08:37
NAME : SVL ANALYTICAL
FAX : 2087830891
TEL : 2087841258
SER.# : BROF3J496071

DATE,TIME	11/11 08:36
FAX NO./NAME	917149690820
DURATION	00:00:41
PAGE(S)	02
RESULT	OK
MODE	FINE ECM

SOIL LABORATORY DATA
ATTACHMENT 1 FOR APPENDIX A

PILOT TREATMENT WALL STUDY
2003 WORK PROGRAM DESCRIPTION AND SUMMARY OF FINDINGS

DRAFT FEASIBILITY STUDY TECHNICAL REPORT
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

SVL ANALYTICAL, INC.
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83827-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-08

REPORT OF ANALYTICAL RESULT

CLIENT : GEOSYNTEC CONSULTANTS
PROJECT:

Sample Receipt: 7/21/03
Report Date: 8/06/03

Page 1 of 1
SVL JOB: 106756

SVL ID	CLIENT SAMPLE ID		Fe 6010B	Mn 6010B	As 7060	S-^{2} LECO
S343343	FSP-06-5	7/15/03	18900mg/kg	470mg/kg	4.46mg/kg	<0.010%
S343344	FSP-18-12	7/17/03	17800mg/kg	353mg/kg	3.00mg/kg	<0.010%
S343345	FSP-26-4	7/17/03	***	***	***	***
S343346	PM-16-9	7/17/03	***	***	***	***
S343347	PM-16-5	7/17/03	***	***	***	***
S343348	FSP-21-10	7/17/03	***	***	***	***
S343349	FSP-26-8	7/17/03	***	***	***	***
S343350	FSP-19-8	7/17/03	20100mg/kg	419mg/kg	4.36mg/kg	<0.010%

*** Not Requested   Soil Samples: As Received Basis

Certificate: CA CERTIFICATE NO. 2080

Reviewed By:

Date: 8/6/03

Part I Prep Blank and Laboratory Control Sample

Client :GEOSYNTEC CONSULTANTS SVL JOB No: 106756

nalyte	Method	Matrix	Units	Prep Blank	True—LCS	—Found	LCS %R	Analysis Date
Iron	6010B	SOIL	mg/kg	<2.0	11400	9960	87.4	8/04/03
Manganese	6010B	SOIL	mg/kg	0.24	534	481	90.1	8/04/03
Arsenic	7060	SOIL	mg/kg	<0.30	110	115	104.5	8/05/03

LEGEND:

LCS = Laboratory Control Sample LCS %R = LCS Percent Recovery N/A = Not Applicable

8/06/03 10:49

SVL ANALYTICAL, INC.

Quality Control Report
Part II Duplicate and Spike Analysis

ient :GEOSYNTEC CONSULTANTS

SVL JOB No: 106756

			QC SAMPLE ID			Duplicate or MSD			Matrix Spike			Analysis
Test	Method	Matrix		Units	Result	Found		RPD%	Result	SPK ADD	%R	Date
Fe	6010B	SOIL	1	mg/kg	18900	19300	M	4.6	20200	1000	R >4S	8/04/03
Mn	6010B	SOIL	1	mg/kg	470	551	M	4.8	525	100	R >4S	8/04/03
As	7060	SOIL	1	mg/kg	4.46	7.55	M	4.9	7.93	5.00	69.4	8/05/03
S^{-2}	LECO	SOIL	1	%	<0.010	<0.010		UDL	N/A	N/A	N/A	8/01/03

LEGEND:

RPD% = (|SAM - DUP|/((SAM + DUP)/2) * 100) UDL = Both SAM & DUP not detected. *Result or *Found: Interference required dilution.

RPD% = (|SPK - MSD|/((SPK + MSD)/2) * 100) M in Duplicate/MSD column indicates MSD.

SPIKE ADD column, A = Post Digest Spike; %R = Percent Recovery N/A = Not Analyzed; R > 4S = Result more than 4X the Spike Added

QC Sample 1: SVL SAM No.: 343343 Client Sample ID: FSP-06-5

SVL ANALYTICAL

CHAIN OF CUSTODY RECORD

Page 2 of 3

Client:
Contact: Gee P.
Address:
Phone Number:
FAX Number:

NOTES:

1) Ensure proper container packaging.
2) Ship samples promptly following collection.
* 3) Designate Sample Reject Disposition

PO#:
Project Name:

Table 1. -- Matrix Type

1 = Surface Water, [✓ 2] = Ground Water
[✓ 3] = Soil/Sediment, 4 = Rinsate, 5 = Oil
6 = Waste, 7 = Other (Specify) ________

Samplers Signature:

FOR SVL USE ONLY
SVL JOB # 101755

Lab Name: SVL Analytical, Inc. (208) 784-1258 FAX (208) 783-0891
Address: One Government Gulch, Kellogg, ID 83837-0929

Sample ID	Collection		Miscellaneous				Preservative(s)						Analyses Required									Comments
	Date	Time	Collected by: (Init.)	Matrix Type From Table 1	No. of Containers	Sample Filtered ? Y/N	Unpreserved (Ice Only)	HNO3	HCL	H2SO4	NAOH	Other (Specify)										
✓ 1. FBP-23	7/16/03	1540	BP	2	2	N	|	|													← NO time on 2nd bot.
✓ 2. FBP-15	7/16/03	1600	|	2	2	N	(	(														(assumed)
✓ 3. FBP-16	7/17/03	0930	|	2	2	N	|															
✓ 4. FSP-18	|	1000	|	2	2	|	|	|														
✓ 5. FBP-20	|	1100	|	2	2	|	|	|													← NO time ON 2nd bot.
✓ 6. FBP-B-12	|	1100	|	3	1	|	|														(assumed)
✓ 7. FSP-23	|	1140	|	2	2	|	|	|													← NO time on 2nd bot.
✓ 8. FSP-25	|	1300	|	2	2	|	|	(													(assumed)
✓ 9. FSP-20	|	1400	|	2	2	|	|	(													← NO time ON 2nd bot.
✓ 10. FSP-26-4	|	1500	X	3	1	X	|														(assumed)

Relinquished by: J. E. Fry	Date: 7/21/03	Time: 2:00	Received by: Dave Haas	Date: 7-21-03	Time: 2:00p
Relinquished by:	Date:	Time:	Received by:	Date:	Time:

* Sample Reject: [ ] Return [ ] Dispose [ ] Store (30 Days)

Copy

White: LAB COPY Yellow: CUSTOMER COPY SVL-COC 12/95

SVL ANALYTICAL

See other copy of COC.

CHAIN OF CUSTODY RECORD

Page 1 of 3

Client: GeoSyntec Consultants
Contact: Eric Smalstig
Address: 2100 Main St, Suite 150
Huntington Beach, CA 92648
Phone Number: 714-969-0800
FAX Number: 714-969-0820

NOTES:

1) Ensure proper container packaging.

2) Ship samples promptly following collection.

* 3) Designate Sample Reject Disposition

PO#: HR0196-12
Project Name: Metaline Falls

Table 1. -- Matrix Type
1 = Surface Water, [✓ 2] = Ground Water
[✓ 3] = Soil/Sediment, 4 = Rinsate, 5 = Oil
6 = Waste, 7 = Other (Specify) ______

Samplers Signature:

FOR SVL USE ONLY
SVL JOB # 106755

Lab Name: SVL Analytical, Inc. (208) 784-1258 FAX (208) 783-0891
Address: One Government Gulch, Kellogg, ID 83837-0929

	Collection		Miscellaneous				Preservative(s)						Analyses Required									
Sample ID	Date	Time	Collected by: (Init.)	Matrix Type From Table 1	No. of Containers	Sample Filtered ? Y/N	Unpreserved (Ice Only)	HNO3	HCL	H2SO4	NAOH	Other (Specify)										Comments
1. FSP-06-5	7/15/03	1400	SP	3	|	N	|	|													
2. FSP-02	|	1710	|	2	2	N	|	|													
3. FSP-03		1730	|	2	|	N	|	|													
4. FSP-05		1800		2		N	|	|													
5. FSP-06		1900		2		N	|	|													
6. FSP-07		1910		2		N	|	|													
7. FSP-08	X	1930		2		N	|	|													
8. FSP-17	7/16/03	1400		2		N	|	|													
9. FSP-19	|	1430		2		N	|	|													
10. FSP-26	X	1500	X	2		N	|	|													

Relinquished by: G. E. Hoy Date: 7/21/03 Time: 2:00 Received by: Date: 7-21-03 Time: 2:00
Relinquished by: Date: Time: Received by: Date: Time:

* Sample Reject: [ ] Return [ ] Dispose [ ] Store (30 Days)

Copy

White: LAB COPY Yellow: CUSTOMER COPY

SVL-COC 12/95

SVL ANALYTICAL

CHAIN OF CUSTODY RECORD

Page 3 of 3

Client:
Contact:
Address:

Phone Number:
FAX Number:

NOTES:
1) Ensure proper container packaging.
2) Ship samples promptly following collection.
* 3) Designate Sample Reject Disposition

PO#:
Project Name:

Table 1. -- Matrix Type
1 = Surface Water, [✓ 2 = Ground Water]
[✓ 3 = Soil/Sediment], 4 = Rinsate, 5 = Oil
6 = Waste, 7 = Other (Specify) ________

Samplers Signature:

FOR SVL USE ONLY
SVL JOB# 106755

Lab Name: SVL Analytical, Inc. (208) 784-1258 FAX (208) 783-0891
Address: One Government Gulch, Kellogg, ID 83837-0929

Sample ID	Collection		Miscellaneous				Preservative(s)						Analyses Required									Comments
	Date	Time	Collected by: (Init.)	Matrix Type From Table 1	No. of Containers	Sample Filtered ? Y/N	Unpreserved (Ice Only)	HNO3	HCL	H2SO4	NAOH	Other (Specify)										
1. PM-16-9	7/17/03		BD	3	1	N	1															
2. PM-16-5				3	1	N	1															
3. FSP-21-10				3	1	N	1															
4. FSP-26-8				3	1	N	1															
5. FSP-19-8				3	1	N	1															
6. PM-16	7/[illegible]/03	0030		2	2	N	1	1														
7.																						
8.																						
9.																						
10.																						

Relinquished by: Date: 7/21/03 Time: 2:00 Received by: Date: 7-21-03 Time: 2:00p
Relinquished by: Date: Time: Received by: Date: Time:

* Sample Reject: [ ] Return [ ] Dispose [ ] Store (30 Days)

Copy

White: LAB COPY Yellow: CUSTOMER COPY

SVL-COC 12/95

SVL ANALYTICAL

208-783-0891

CHAIN OF CUSTODY RECORD

Page 1 of 3

Client: GeoSyntec Consultants
Contact: Eric Smalstig
Address: 2100 Main St. Suite 150
Huntington Beach CA 92648
Phone Number: 714-969-0800
FAX Number: 714-969-0820

NOTES:

1) Ensure proper container packaging.
2) Ship samples promptly following collection.
* 3) Designate Sample Reject Disposition

PO#: ~~+~~ 120196.12
Project Name: Metaline Falls

Table 1. -- Matrix Type
1 = Surface Water, 2 = Ground Water
3 = Soil/Sediment, 4 = Rinsate, 5 = Oil
6 = Waste, 7 = Other (Specify) ______

FOR SVL USE ONLY
SVL JOB # 106756

Samplers Signature:

Lab Name: SVL Analytical, Inc. (208) 784-1258 FAX (208) 783-0891
Address: One Government Gulch, Kellogg, ID 83837-0929

Sample ID	Collection		Miscellaneous				Preservative(s)						Analyses Required									Comments
	Date	Time	Collected by: (Init.)	Matrix Type From Table 1	No. of Containers	Sample Filtered ? Y/N	Unpreserved (Ice Only)	HNO3	HCL	H2SO4	NAOH	Other (Specify)	SEC, ORP, pH	As	DIC, S^{2-}	Total alkalinity, Alk, Bicarb Carb Alk	Major cations (incl. K)	Major anions (Cl F SO4)	Fe ~~[illegible]~~ Total	Mn Dissolved + Total	NH_3, NO_2^-, NO_3^-, F	* Samples being run & R other soils on HOLD 7/24/03 CRS
1. FSP-06-5	7/15/03	1400	SP	3	|	N	|	|						X	S^{2-}				X	X		
2. FSP-02	|	1710	|	2	2	N	|	|														HOLD
3. FSP-03	|	1730	|	2	|	N	|	|														HOLD
4. FSP-05	|	1800	|	2	|	N	|	|														HOLD
5. FSP-06	|	1900	|	2	|	N	|	|					X	X	X	X	X	X	X	X	X	
6. FSP-07	|	1910	|	2	|	N	|	|					X	X	X	X	X	X	X	X	X	
7. FSP-08	X	1930	|	2	|	N	|	|														HOLD
8. FSP-17	7/16/03	1400	|	2	|	N	|	(						X	X	X	X	X	X	X	X	X	
9. FSP-14	|	1430	|	2	|	N	|	(						X	X	X	X	X	X				
10. FSP-26	X	1500	X	2	|	N	|	(						X	X	X	X	X	X	X	X	X	

Relinquished by: Date: Time: Received by: Date: Time:
Relinquished by: Date: Time: Received by: Date: Time:

* Sample Reject: [ ] Return [ ] Dispose [ ] Store (30 Days)

White: LAB COPY Yellow: CUSTOMER COPY

See "Original Copy"

SVL ANALYTICAL

CHAIN OF CUSTODY RECORD

Page 2 of 3

Client:
Contact:
Address:
Phone Number:
FAX Number:

NOTES:
1) Ensure proper container packaging.
2) Ship samples promptly following collection.
* 3) Designate Sample Reject Disposition
PO#:
Project Name:

Table 1. -- Matrix Type
1 = Surface Water, 2 = Ground Water
3 = Soil/Sediment, 4 = Rinsate, 5 = Oil
6 = Waste, 7 = Other (Specify) ______

Samplers Signature:

FOR SVL USE ONLY
SVL JOB #
106756 7/24/03

Lab Name: SVL Analytical, Inc. (208) 784-1258 FAX (208) 783-0891
Address: One Government Gulch, Kellogg, ID 83837-0929

Sample ID	Collection		Miscellaneous				Preservative(s)						Analyses Required									Comments
	Date	Time	Collected by: (Init.)	Matrix Type From Table 1	No. of Containers	Sample Filtered ? Y/N	Unpreserved (Ice Only)	HNO3	HCL	H2SO4	NAOH	Other (Specify)	SEC, ORP, pH	As	DIC, S²⁻	Total alkalinity, Alk, Alb	Major cations (incl. K)	Major anions (Cl, F, S)	Fe (Total)	Mn Dissolved + Total	NH3, NO2⁻, NO3⁻, F⁻	
1. FSP-23	7/16/03	1540	BP	2	2	N	|	|					X	X	X	X	X	X	X	X	X	
2. FSP-15	7/16/03	1600		2	2	N	|	|					X	X	X	X	X	X				
3. FSP-16	7/17/03	0930		2	2	N	|	|					X	X	X	X	X	X				
4. FSP-18		1000		2	2		|	|					X	X	X	X	X	X				
5. FSP-20		1100		2	2		|	|					X	X	X	X	X	X				
6. FSP-18-12		1100		3	1		|							X	Sal				X	X		
7. FSP-23		1140		2	2		|	|					X	X	X	X	X	X	X	X	X	
8. FSP-25		1300		2	2		|	|														HOLD
9. FSP-20		1400		2	2		|	|					X	X	X	X	X	X				
10. FSP-26-4		1500	X	3	1	X	|																HOLD

Relinquished by:	Date:	Time:	Received by:	Date:	Time:
Relinquished by:	Date:	Time:	Received by:	Date:	Time:

* Sample Reject: [ ] Return [ ] Dispose [ ] Store (30 Days)

White: LAB COPY Yellow: CUSTOMER COPY SVL-COC 12/95

SVL ANALYTICAL

CHAIN OF CUSTODY RECORD

Page 3 of 3

Client:
Contact:
Address: GLE P
Phone Number:
FAX Number:

NOTES:
1) Ensure proper container packaging.
2) Ship samples promptly following collection.
* 3) Designate Sample Reject Disposition
PO#:
Project Name:

Table 1. -- Matrix Type
1 = Surface Water, 2 = Ground Water
3 = Soil/Sediment, 4 = Rinsate, 5 = Oil
6 = Waste, 7 = Other (Specify) ____

Samplers Signature:

FOR SVL USE ONLY
SVL JOB # 106756
7/24/03

Lab Name: SVL Analytical, Inc. (208) 784-1258 FAX (208) 783-0891
Address: One Government Gulch, Kellogg, ID 83837-0929

Sample ID	Collection		Miscellaneous				Preservative(s)						Analyses Required									Comments
	Date	Time	Collected by: (Init.)	Matrix Type From Table 1	No. of Containers	Sample Filtered ? Y/N	Unpreserved (Ice Only)	HNO3	HCL	H2SO4	NAOH	Other (Specify)	SEC, ORP, pH	As	DIC, S=	Total alkalinity, Bicarb, Alk	Major cations (incl. K)	Major anions (Cl, F, SO4)	Fe (total)	Mn (Dissolved + Total)	NH3, NO3+NO2, F	
PM-16-9	7/7/03		BP	3	1	N	1															HOLD
2. PM-16-5				3	1	N	1															HOLD
3. FSP-21-10				3	1	N	1															HOLD
4. FSP-26-8				3	1	N	1															HOLD
5. FSP-19-8	X			3	1	N	1							X	S				X	X		
6. PM-16	7/[illegible]/03	0830		2	2	N	1	1					X	X	X	X	X	X				
7.																						
8.																						
9.																						
10.																						

Per Brian Petty
Major cations: Ca, Mg, Na, K
Major ions: Cl, F, SO4
As by GFAA on soil only, water by ICP
gc 7/24/03

Relinquished by:	Date:	Time:	Received by:	Date:	Time:
Relinquished by:	Date:	Time:	Received by:	Date:	Time:

* Sample Reject: [ ] Return [ ] Dispose [ ] Store (30 Days)

White: LAB COPY Yellow: CUSTOMER COPY SVL-COC 12/95

GAS LABORATORY DATA
ATTACHMENT 1 FOR APPENDIX A

PILOT TREATMENT WALL STUDY
2003 WORK PROGRAM DESCRIPTION AND SUMMARY OF FINDINGS

DRAFT FEASIBILITY STUDY TECHNICAL REPORT
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

Calscience
Environmental
Laboratories, Inc.

August 08, 2003

Brian Petty
GeoSyntec Consultants
2100 Main Street, Suite 150
Huntington Beach, CA 92648-2460

Subject: **Calscience Work Order No.:** **03-08-0177**
Client Reference: **Lehigh**

Dear Client:

Enclosed is an analytical report for the above-referenced project. The samples included in this report were received 8/5/2003 and analyzed in accordance with the attached chain-of-custody.

Unless otherwise noted, all analytical testing was accomplished in accordance with the guidelines established in our Quality Assurance Program Manual, applicable standard operating procedures, and other related documentation. The original report of any subcontracted analysis is provided herein, and follows the standard Calscience data package. The results in this analytical report are limited to the samples tested and any reproduction thereof must be made in its entirety.

If you have any questions regarding this report, please do not hesitate to contact the undersigned.

Sincerely,

Calscience Environmental
Laboratories, Inc.
Stephen Nowak
Project Manager

Michael J. Crisostomo
Quality Assurance Manager

Calscience
Environmental
Laboratories, Inc.

ANALYTICAL REPORT

GeoSyntec Consultants
2100 Main Street, Suite 150
Huntington Beach, CA 92648-2460

Attn: Brian Petty
RE: Lehigh

Date Sampled: 08/01/03
Date Received: 08/05/03
Date Analyzed: 08/05/03

Work Order No.: 03-08-0177
Method: GC/FPD
Page 1 of 1

All concentrations are reported in ppm (v/v).

Sample Number	Hydrogen Sulfide Concentration	Reporting Limit
PIPE AT203-10	3	1
PIPE AT204-12	ND	1
PIPE AT205-14	ND	1
PIPE AT206-16	ND	1
~~PIPE AT201-8~~ PIPE AT202-8	2	1
Method Blank	ND	1

QA/QC

Sample Number	Sample Conc.	Duplicate Conc.	%RPD	Control Limits (%)
PIPE AT203-10 (Duplicate)	3.39	3.20	6	0 - 15

GC/FPD
flame photo-
ionization

ND denotes not detected at indicated reportable limit.

Each sample was received by CEL intact and with chain

Calscience
Environmental
Laboratories, Inc.

ANALYTICAL REPORT

GeoSyntec Consultants
2100 Main Street, Suite 150
Huntington Beach, CA 92648-2460

Attn: Brian Petty
RE: Lehigh

Date Sampled: 08/01/03
Date Received: 08/05/03
Date Analyzed: 08/05/03

Work Order No.: 03-08-0177
Method: ASTM D-1946
Page 1 of 2

All concentrations are reported in percent (%) by volume.

Analyte	Concentration	Reporting Limit
Sample Number: PIPE AT203-10		
Oxygen (O_2) + Argon (Ar)	0.7	0.1
Nitrogen (N_2)	2.0	0.1
Methane (CH_4)	ND	0.1
Carbon Dioxide (CO_2)	97.3	0.1
Sample Number: PIPE AT204-12		
Oxygen (O_2) + Argon (Ar)	0.8	0.1
Nitrogen (N_2)	2.6	0.1
Methane (CH_4)	ND	0.1
Carbon Dioxide (CO_2)	96.6	0.1
Sample Number: PIPE AT205-14		
Oxygen (O_2) + Argon (Ar)	0.7	0.1
Nitrogen (N_2)	2.1	0.1
Methane (CH_4)	ND	0.1
Carbon Dioxide (CO_2)	97.2	0.1
Sample Number: PIPE AT206-16		
Oxygen (O_2) + Argon (Ar)	0.7	0.1
Nitrogen (N_2)	1.9	0.1
Methane (CH_4)	ND	0.1
Carbon Dioxide (CO_2)	97.5	0.1

GeoSyntec Consultants
2100 Main Street, Suite 150
Huntington Beach, CA 92648-2460

Attn: Brian Petty
RE: Lehigh

Date Sampled: 08/01/03
Date Received: 08/05/03
Date Analyzed: 08/05/03

Work Order No.: 03-08-0177
Method: ASTM D-1946
Page 2 of 2

All concentrations are reported in percent (%) by volume.

Analyte	Concentration	Reporting Limit
Sample Number: PIPE AT201-8		
Oxygen (O_2) + Argon (Ar)	0.7	0.1
Nitrogen (N_2)	2.0	0.1
Methane (CH_4)	ND	0.1
Carbon Dioxide (CO_2)	97.3	0.1
Sample Number: Method Blank		
Oxygen (O_2) + Argon (Ar)	ND	0.1
Nitrogen (N_2)	ND	0.1
Methane (CH_4)	ND	0.1
Carbon Dioxide (CO_2)	ND	0.1

QA/QC

Sample Number: Laboratory Control Sample

Analyte	Sample Conc.	Duplicate Conc.	%RPD	Control Limits (%)
Oxygen (O_2) + Argon (Ar)	18.5	18.5	0	0 - 30
Nitrogen (N_2)	70.5	70.9	1	0 - 30
Carbon Dioxide (CO_2)	5.50	5.51	0	0 - 30

ND denotes not detected at indicated reportable limit.

Each sample was received by CEL intact and with chain-of-custody attached.

Calscience Environmental Laboratories, Inc.

WORK ORDER #: **03 - 0 8 - 0 1 7 7**

Cooler 0 of 0

SAMPLE RECEIPT FORM

CLIENT: Geosyntec

DATE: 8/5/03

TEMPERATURE – SAMPLES RECEIVED BY:

CALSCIENCE COURIER:

____ Chilled, cooler with temperature blank provided.
____ Chilled, cooler without temperature blank.
____ Chilled and placed in cooler with wet ice.
____ Ambient and placed in cooler with wet ice.
____ Ambient temperature.

____ °C Temperature blank.

LABORATORY (Other than Calscience Courier):

____ °C Temperature blank.
____ °C IR thermometer.
✓ Ambient temperature.

Initial:

CUSTODY SEAL INTACT:

Sample(s): ____ Cooler: ____ No (Not Intact) : ____ Not Applicable (N/A): —

Initial:

SAMPLE CONDITION:

	Yes	No	N/A
Chain-Of-Custody document(s) received with samples	—		
Sample container label(s) consistent with custody papers	—		
Sample container(s) intact and good condition	—		
Correct containers for analyses requested	—		
Proper preservation noted on sample label(s)			—
VOA vial(s) free of headspace			—
Tedlar bag(s) free of condensation	✓		—

Initial:

COMMENTS:

SVL ANALYTICAL

0177

CHAIN OF CUSTODY RECORD

Page 1 of 1

Client: GeoSyntec
Contact: Brian Petty
Address: 2100 Main St.
Suite #150
Phone Number: 714 969-0800
FAX Number: 714 969-0820

NOTES:

1) Ensure proper container packaging.
2) Ship samples promptly following collection.
* 3) Designate Sample Reject Disposition

PO#: HR0196-12
Project Name: Lehigh

Table 1. -- Matrix Type
1 = Surface Water, 2 = Ground Water
3 = Soil/Sediment, 4 = Rinsate, 5 = Oil
6 = Waste, [✓ 7] = Other (Specify) gas

Samplers Signature:

FOR SVL USE ONLY
SVL JOB #

Lab Name: SVL Analytical, Inc. (208) 784-1258 FAX (208) 783-0891
Address: One Government Gulch, Kellogg, ID 83837-0929

Sample ID	Collection		Miscellaneous				Preservative(s)						Analyses Required									Comments
	Date	Time	Collected by: (Init.)	Matrix Type From Table 1	No. of Containers	Sample Filtered ? Y/N	Unpreserved (Ice Only)	HNO3	HCL	H2SO4	NAOH	Other (Specify)	Oxygen	Nitrogen	Carbon dioxide	hyd. sulfide	methane					
1. PIPE AT203-10	8/1	0833	BP	7			X						X	X	X	X	X					
2. PIPE AT204-12	8/1	0835	BP	7																		
3. PIPE AT205-14	8/1	0830	BP	7																		
4. PIPE AT206-16	8/1	0827	BP	7																		
5. PIPE AT201-8	8/1	0820	BP	7			X						X	X	X	X	X					
6.																						
7.																						
8.																						
9.																						
10.																						

Relinquished by:	Date:	Time:	Received by:	Date:	Time:
Arthur E. Huy	8/4/03	4pm	FEDEX		
FEDEX	8/5/03	1300		8/5/03	1300

* Sample Reject: [ ] Return [ ] Dispose [ ] Store (30 Days)

White: LAB COPY Yellow: CUSTOMER COPY SVL-COC 12/95

APPENDIX B

SUMMER 2004 INVESTIGATION
WASHINGTON DEPARTMENT OF ECOLOGY

DRAFT FEASIBILITY STUDY TECHNICAL REPORT
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

1889

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
4601 N. Monroe Street • Spokane, Washington 99205-1295 • (509) 456-2926

October 25, 2004

Mr. Eric Smalstig, P.E.
GeoSyntec Consultants, Inc.
2100 Main Street, Suite 150
Huntington Beach, CA 92648

Dear Mr. Smalstig:

The Washington Department of Ecology (Ecology) has completed the seep and pile toe investigation at the Closed CKD Kiln Dust Pile located in Metaline Falls, Washington. Drilling was performed by Cascade Drilling, Inc. on July 20 and 21, 2004, with seven borings completed at the pile toe and three borings in the south rill area. Temporary well screens were placed in six of the borings in the toe area. Groundwater was withdrawn from the wells with a peristaltic pump. Groundwater was collected into a laboratory jar from each temporary well. A calibrated Orion pH meter was used to measure the pH and the measurement was recorded. The wells were allowed to equilibrate to the end of the day at which time water levels were measured. The groundwater levels were measured with an electronic water meter to the ground surface on the north side of each temporary well. The temporary wells were abandoned with hydrated bentonite chips to ground surface in accordance with WAC 173-160. Table 1 presents the pH measurements from the temporary wells.

The three borings completed in the south rill area were used to assess the presence of seeps. Soil samples were continuously retrieved from the borings with a four-foot core sampler lined with a clear plastic insert. A visual assessment of soil moisture was made prior to slicing open the plastic insert. Areas of the samples that appeared to be moist to wet were cut from the sampler prior to slicing the sample tube open. The cut samples, typically six inches in length, were covered with Teflon sheets and capped with rubber ends. The sample interval was measured and recorded on the sample. The samples were submitted to the laboratory for physical testing, which included moisture density, moisture content and percent passing the number 200 sieve. Given the field observation of the soil, a full sieve analysis was not requested since a majority of the soil appeared to be silt with fine sand. The laboratory results are presented in Appendix A.

The soil moisture results show that the soil samples were wet, but not saturated. Based on the investigation results in the south rill, Ecology does not believe the "seeps" area as described in the draft feasibility study technical report is a significant source of groundwater. Soil moisture contents ranged from 19.6 percent in boring EB-8 at 11 feet below ground surface (bgs) to 25 percent in boring EB-10 at 19 bgs.

During the drilling of boring EB-10 located in the south rill, an apparent cement kiln dust (CKD) interval was encountered at 18 feet below ground surface. A paste pH was performed on the material by adding a minimal amount of distilled water to the material inside a jar. A pH strip was used to measure the pH and the resulting pH was shown to be 11.5-12 standard units (SU). Based on visual observation, the pH measurement, and physical characteristics of the material, the sample was determined to be CKD and was submitted to the analytical laboratory for analysis. The analytical parameters included calcium, potassium, magnesium, and manganese. Sample results indicated the material was mostly calcium, which is similar to the CKD information provided by Lehigh.

Additional analytical laboratory testing was performed on the CKD sample. A series of 40 milliliter (ml) vials were prepared with measured amounts of CKD in increments ranging from 0.5 grams to 15 grams. Twenty milliliters of groundwater collected from background monitoring well MW-11 were added to each vial. The vials were tumbled in a TCLP tumbler overnight. A calibrated pH meter was used to measure pH in the water after the sample was allowed to settle. The water was filtered in order to remove any suspended solids that may have affected the pH measurement. Following filtration, an additional pH measurement was performed and recorded. The two separate pH measurements were very similar. The pH values ranged from 9.8 standard units (SU) for the 0.5 gram filtered sample to 11.79 SU for the 12 and 15 gram filtered samples.

The resulting filtrate of the 0.5 gram, 1 gram, and 2 gram samples were tested again with the same procedure discussed above. A reduction in pH was observed in the three samples. The procedure was repeated a 3rd time and additional reduction in pH was observed. The pH values went from 9.8 SU to 7.49 SU in the 0.5 gram sample and 11.08 SU to 9.38 SU in the 2 gram sample. Based on the observed reduction in pH, dilution ratios were developed for the material. The first ratio suggests 10:1 water versus soil mixture is necessary to observe an appreciable reduction in water pH. The second ratio demonstrates that 80:1 water versus soil mixture is required to reduce the pH near neutral. The test results are presented as Appendix B.

James A. Sewell and Associates completed a civil survey of the boring locations. The boring were surveyed for horizontal and vertical location and placed on GeoSyntec's site map. Groundwater elevations were tabulated from the data for the temporary wells and existing monitoring points. Based on the elevations, the groundwater flow direction is to the northeast with a strong northerly flow component. This flow direction is oblique to parallel with the pilot treatment wall and may account for the limited treatment observed near MW-9 and the perceived downgradient direction of the wall.

Based on the investigation results, Ecology concludes that the inundated area is the major source of groundwater contamination observed at the Site. The CKD is mostly calcium and not potassium as modeled using the Geochemist's Workbench. The pH values observed at the toe area in the temporary wells suggest that pH increases toward the central portion of the pile and decreases near the edges. While the pilot treatment wall appears to be effectively treating high pH groundwater, the wall orientation does not provide the best opportunity to observe downgradient treatment.

If you have any questions, please contact me at (509) 329-3589.

Sincerely,

William J Fees

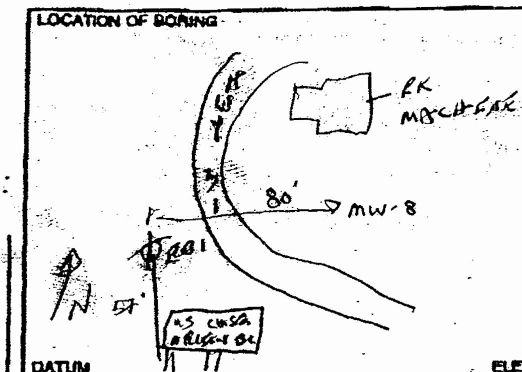
William J. Fees, P.E.
Environmental Engineer
Toxics Cleanup Program

CC: Elizabeth Mikols – Lehigh Portland Cement Company
Jay Manning – Brown Reavis & Manning
Andy Fitz - AAG

TABLE 1
LEHIGH PORTLAND CEMENT COMPANY
METALINE FALLS, WASHINGTON
PH MEASUREMENTS

EB-1	10.14
EB-2	N/A
EB-3	8.87
EB-4	12.86
EB-5	9.99
EB-6	11.48
EB-7	12.86

LOCATION OF BORING



DATUM

ELEVATION

JOB NUMBER J1A71

CLIENT ECOLOGY

LOCATION MET-FALLS,

DRILLING METHOD: FORD F350 GEOPROBE

BORING NUMBER GB-1

SHEET 1 **OF**

SAMPLING METHOD:

DRILLING

	START	**FI**
TIME		93
DATE	7/28/04	7/2

SURFACE CONDITIONS:

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	TIME	SAMPLE NUMBER / SAMPLE DEPTH	BLOWS/FT. SAMPLER	OVA AUGER	OVA SAMPLE	OVA CUTTINGS	DEPTH IN FEET	SOIL GRAPH
								0	
								1	
								2	
								3	
								4	
								5	
								6	
								7	
								8	
								9	
								10	
								1	
								2	
								3	
								4	
								5	
								6	TD 16'
								7	
								8	
								9	
								20	
								1	

0-6"
BROWN, GRAVELLY SILT W/ FINE SAND
6-4'
BROWN, SILT WITH FINE SAND, DRY-MOIST ~
3½' - MED DENSE

4-4.3 AA
4.3-5.0 - GREY, SILTY GRAVEL, DRY, DENSE

5.0-6.2 BROWN, MOIST-WET, SILT
6.2-6.3 DK. GREY GRAVEL, MOIST
6.2-8.0 - DK BROWN, WET, SILT
POOR RECOVERY - 8-12 ~ 2' RECOVERED
SATURATED, DK GREY GRAVEL, SUBANG - SUBROUND
FINE-COARSE IN SILTY MATRIX
GRAVEL ~ 75%, 20% SILT, 5% FINE SAND

12-16 - DK GREY, subrounded - subangular gravel
mostly fine w/ coarse in brown silt matrix and
trace fine sand
Place temp well - 10' of screen & 5' casing
Boring to sloughed in to ~ 12' -

DRILLING CONTRACTOR

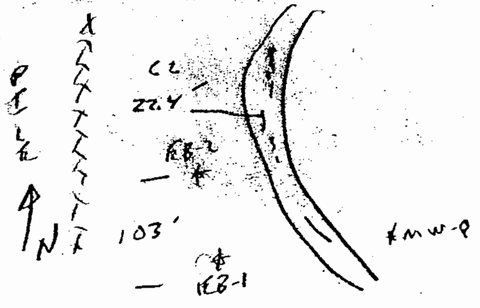
52156

BY WJF

DATE 7/20/04

CHECKED BY

LOCATION OF BORING



DATUM **ELEVATION**

JOB NUMBER

CLIENT

LOCATION MET FALLS, WA

BORING NUMBE EB-2

SHEET **OF**

DRILLING METHOD:

SAMPLING METHOD:

SURFACE CONDITIONS:

DRILLING

START	FI
TIME	T
1000	
DATE	D
7/21/04	7/2

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	TIME	SAMPLE NUMBER / SAMPLE DEPTH	BLOWS/FT. SAMPLER	OVA AUGER	OVA SAMPLE	OVA CUTTINGS	DEPTH IN FEET	SOIL GRAPH	
								0		0-1' Road Fill Brown, Dry, Silt w/ F. Sand
								1		1-2.2 . Brown, moist silt w/ sand
								2		2.2-3' Fine, subang Gravel w/ Brown silt matr
								3		4-8
								4		4-4.5 Slough w/
								5		4.5-8 - Dk grey, brown wet silt w/ fine sand
								6		8-8.25 Grey silty fine sand w/ sl plastic clay
								7		8.5-12
								8		1.4' Grey sandy fine subang - mostly subround gravel in med-coarse sand matrix
								9		.6' Grey coarse sub ang gravel w/ sandy matrix
								10		
								1		
								2		
								3	TD 12'	
								4		
								5		
								6		
								7		
								8		
								9		
								0		
								1		

DRILLING CONTRACTOR

52156

BY

DATE

CHECKED BY

JOB NUMBER	CLIENT	LOCATION
	ECOLOGY	MIET, FALLS

BORING NUMBE EB-3

SHEET 1 OF 1

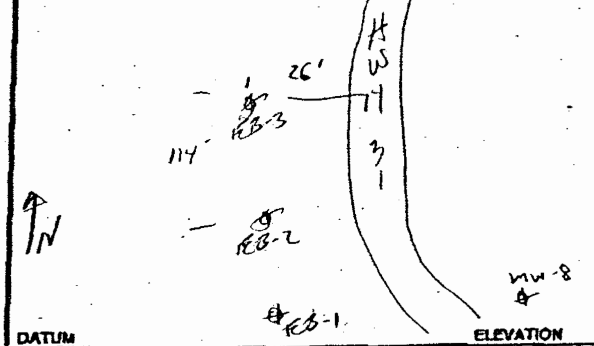
DRILLING METHOD:

SAMPLING METHOD:

SURFACE CONDITIONS:

DRILLING	
START	FI
TIME	TI
DATE	DA
7/20/04	

LOCATION OF BORING



DATUM

ELEVATION

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	TIME	SAMPLE NUMBER / SAMPLE DEPTH	BLOWS/FT. SAMPLER	OVA AUGER	OVA SAMPLE	OVA CUTTINGS	DEPTH IN FEET	SOIL GRAPH
								0	
								1	
								2	
								3	
								4	
								5	
								6	
								7	
								8	
								9	
								10	
								1	
								2	
								3	
								4	
								5	
								6	
								7	
								8	
								9	
								0	
								1	

0-4 - 3' recovery

1.2' Brown silt w/ fine sand dry

1.2-2' Dk Brown silt w/ subangular gravel, dry

2-3 - Moist dk brown subangular to subrounded mostly coarse gravel in silty sand matrix, oxidizing on sand grains - sand mostly fine-med, moist-wet

4-8 - No recovery

8-10 - Good recovery
Sat. Dk grey, subangular mostly coarse gravel in silty sand matrix

Temp screen to 9'
10' screen

DRILLING CONTRACTOR

52156

CHECKED BY

BY

DATE

LOCATION OF BORING

33' - ℄

JOB NUMBER

CLIENT: Ecology

LOCATION: Mtl Falls, W

DRILLING METHOD:

BORING NUMBE

EB-4

SHEET

OF

SAMPLING METHOD:

DRILLING

START

FI

TIME

T

SURFACE CONDITIONS:

DATE

D/

7/20/84

DATUM

ELEVATION

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	TIME	SAMPLE NUMBER / SAMPLE DEPTH	BLOWS/FT. SAMPLER	OVA AUGER	OVA SAMPLE	OVA CUTTINGS	DEPTH IN FEET	SOIL GRAPH
								0	
								1	Sm
								2	
								3	
								4	
								5	
								6	
								7	
								8	
								9	
								1 0	
								1	
								2	
								3	TD 12
								4	
								5	
								6	
								7	
								8	
								9	
								0	
								1	

0-4

1.1 Recovery

0-.6' - Brown road fill silty sand

.6-1.1

Brown, silty gravel w/ silt

4-8-

2.3' recovery

1.3' Brown grey, silty gravel - subround - mostly subangular

1' Brown, grey silty fine sand

increase silt in lower 4"

8-12

3' Recovery

8-10

Brown, grey silt w/ gravel sat

10-11 Grey wet mostly coarse subangular gravel - silt matrix sl. plastic

Paste pH @ 10-5-11

Temp well @ 11.5

DRILLING CONTRACTOR

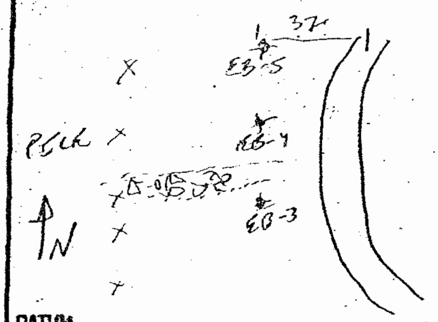
52156

BY

CHECKED BY

DATE

LOCATION OF BORING



DATUM

ELEVATION

JOB NUMBER

CLIENT

LOCATION: MEJ FALLS

BORING NUMBE
EB-5

SHEET

OF

DRILLING METHOD:

SAMPLING METHOD:

SURFACE CONDITIONS:

DRILLING

START	FI
TIME	TI
DATE	DA
7/20/01	

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	TIME	SAMPLE NUMBER / SAMPLE DEPTH	BLOWS/FT. SAMPLER	OVA AUGER	OVA SAMPLE	OVA CUTTINGS	DEPTH IN FEET	SOIL GRAPH
								0	
								1	
								2	
								3	
								4	
								5	
								6	
								7	
								8	
								9	
								10	
								1	
								2	
								3	
								4	
								5	
								6	
								7	
								8	
								9	
								20	
								1	

0-4
3.5 RECOVERY
0-.7' Brown silt root zone

.7-3.6' Brown fine sandy silt - damp
w/ occ gravel - fine gravel subangular

4-8 - 2.5' RECOVERY
1' PULVERIZED ROCK 1-2' moist.
1.5 Brown, sandy silt w/ some Ox
Ash inclusions in 1-2 mm size
8-12 - 2.5 Recovery
1' Brown, sl plastic silt w/ sand w/ roots and wood
pieces - FeOx
1.5 - Grey mostly coarse subangular gravel w/ silt
and clay matrix

12-16 . 2.5 Recovery
1' Coarse gravel as above
1-2.2' coarsening down, sandy gravel subang - abraded
mostly coarse sand - fine - mostly fine at bottom

2.2-2.6 Brown plastic clayey silt w/ occ
sub ang coarse gravel w/ trace sand

16-20' 2' RECOVERY
Brown, clayey silt mixture w/ coarse subangl
gravel w/ coarse sand

.4' Brown silty fine sand

20-24 - 4' RECOVERY some sloughed
Brown gravel

22-24 grey fine sand WL - 20.1

Purge ~ 1/2 gallon

Take sample of pH probe
thermo [illegible]

pH - 8.5

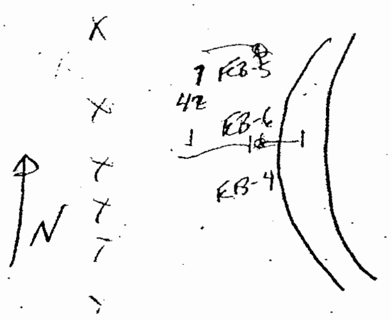
DRILLING CONTRACTOR ______

CHECKED BY ______

BY ______ DATE ______

52156

LOCATION OF BORING



DATUM

ELEVATION

JOB NUMBER

CLIENT

LOCATION

DRILLING METHOD:

BORING NUMBE EB-6

SHEET 1 **OF** 1

SAMPLING METHOD:

DRILLING

START

TIME 1580

DATE 7/26/04

SURFACE CONDITIONS:

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	TIME	SAMPLE NUMBER / SAMPLE DEPTH	BLOWS/FT. SAMPLER	OVA			DEPTH IN FEET	SOIL GRAPH	
					AUGER	SAMPLE	CUTTINGS			
								0		0-4 - 4' RECOVERY .3 Topsoil grass
								1		.3-4 Brown sandy silt w/ fine gravel subangular coarse from 1.8-3'; dry
								2		
								3		4-8 2.8' Recovery. 1' AA
								4		1.-1.7' Brown sandy silt w/ grey biege clay moist 1.7-2.8 Brown silty coarse subangle gravel w/
								5		fine sand
								6		8-12 - 3 Recovery 1' AA
								7		1-2.7 Brown, sandy silt, damp-moist 2.7-3 - Brown fine-mostly medium sand moist
								8		12-16 -3' Recovery
								9		1' Brown grey silty gravel - sub angl fine-coarse
								0		1-3' Brown sandy gravel w/ silt subangle-subround mostly coarse
								1		16-20' 3.8 Recovery
								2		.8' Brown moist silty gravel - coarse sub angl .8-1.2 Brown silty fine-mostly med sand
								3		1.2-3.8 Brown silty gravel w/ sand
								4		Gravel - subangle coarse; sand mostly fine-coarse
								5		
								6		
								7		
								8		
								9		
								0		
								1		

DRILLING CONTRACTOR

CHECKED BY

DATE

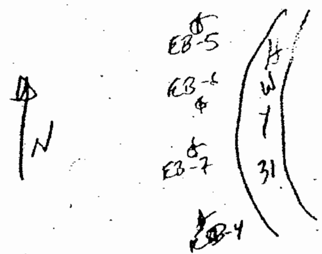
BY

5'

DRILLING CONTRACTOR

52156

LOCATION OF BORING



DATUM

ELEVATION

JOB NUMBER

CLIENT

LOCATION MET. FALLS

BORING NUMBER EB-7

SHEET OF

DRILLING METHOD:

SAMPLING METHOD:

SURFACE CONDITIONS:

DRILLING

START	FIN
TIME	TI
1530	
DATE	DA
7/20/04	

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	TIME	SAMPLE NUMBER / SAMPLE DEPTH	BLOWS/FT. SAMPLER	OVA AUGER	OVA SAMPLE	OVA CUTTINGS	DEPTH IN FEET	SOIL GRAPH
								0	
								1	
								2	
								3	
								4	
								5	
								6	
								7	
								8	
								9	
								10	
								1	
								2	
								3	
								4	
								5	
								6	
								7	
								8	
								9	
								20	
								1	

0-4' - 3' RECOVERY
.8' GRAVEL SUBBASE clay
.8-3' Brown sandy silt, damp

4-8 - 3' Recovery
.8' Silty gravel
.8-1.8' Brown moist silt
1.8-3 - Gray silty gravel

8-12 - 2.8 - Recovery
An

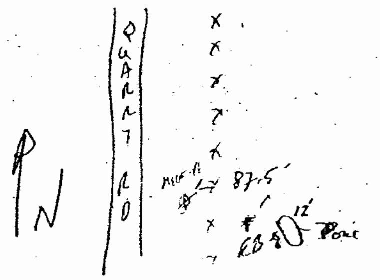
12-16 -
12-14 - AR
14-16 Gray sandy silt wet

CHECKED BY

BY

DATE

LOCATION OF BORING



DATUM

ELEVATION

JOB NUMBER

CLIENT

LOCATION MKT FALLS

BORING NUMBER EB-8

SHEET 1 OF 1

DRILLING METHOD:

SAMPLING METHOD:

SURFACE CONDITIONS:

DRILLING

	START	FI
TIME		
DATE	7/21/04	

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	TIME	SAMPLE NUMBER / SAMPLE DEPTH	BLOWS/FT. SAMPLER	OVA AUGER	OVA SAMPLE	OVA CUTTINGS	DEPTH IN FEET	SOIL GRAPH	
								0		0-4 2.7' RECOVERY FILL MATERIAL - Brown silty gravel w/ fine sand
								1		Gravel mostly coarse, subangular - [illegible] at 4'
								2		4-8' 2.4 .6' slough of silty gravel
								3		.6-2.4' Brown, damp-moist sandy silt w/ root pieces sand to very fine grained ~ 10%
								4		8-12 3.6 RECOVERY
								5		As above Wood inclusions @ 9' and 10'
								6		12-16 3.8' RECOVERY
								7		1.5 brown ~~silty~~ silt damp 2.5 Brown silty sandy silt, moist - Collect
								8		sample @ 15.5'-16'
								9		16-20 4' recovery Upper .5' slough from above
								10		Brown sandy silt, damp - moist in lower 1.3'
								1		20-24 4' RECOVERY Brown, silt w/ trace fine sand ↑ moisture to
								2		moist-wet in lower 2.5'
								3		24-28 3.4 RECOVERY
								4		1.6 Brown moist-wet silt w/ trace fine sand grades to fine grained sand for .8' - fine to
								5		Mostly med w/ coarse sand for .3' - Mostly coarse-fine w/ fine gravel subangular
								6		to subrounded w/ [illegible] coarse
								7		28-32 3' Recovery Brown-gravelly sand w/ trace silt
								8		Sand mostly coarse to fine Gravel most coarse subangular to subround
								9		32-36 3.3' RECOVERY
								20		.5' Sandy gravel, damp-moist; .3 Brown silt w/ Ox staining; .4' Brown, moist fine grained sand
								1		2.2' Brown silt, moist w/ FeOx banding Sample @ 35-35.5

DRILLING CONTRACTOR

52156

CHECKED BY

BY

DATE

DRILLING CONTRACTOR ____

52156

BY ____ DATE ____ CHECKED BY ____

LOCATION OF BORING

JOB NUMBER | CLIENT | LOCATION

DRILLING METHOD:

SAMPLING METHOD:

SURFACE CONDITIONS:

BORING NUMBE

EB-9

SHEET

OF

DRILLING

START | FI

TIME | TI

DATE | DA

7/21/04 | 7/21/

DATUM

ELEVATION

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	TIME	SAMPLE NUMBER / SAMPLE DEPTH	BLOWS/FT. SAMPLER	OVA AUGER	OVA SAMPLE	OVA CUTTINGS	DEPTH IN FEET	SOIL GRAPH
								0	
								1	
								2	
								3	
								4	
								5	
								6	
								7	
								8	
								9	
								10	
								1	
								2	
								3	
								4	
								5	
								6	
								7	
								8	
								9	
								0	
								1	

0-4 2' recovery

Brown silty gravel w/ ~~coarse sand~~

Gravel mostly coarse, subangular

sand mostly fine - coarse

4-8 3.8' Recovery

.4' slough silty gravel

1.2' Brown, silt w/ trace fine sand, damp, roots down to bottom end

1.4 Brown silty ~~fine~~ fine grained sand damp, some roots in upper 1'

.2 Brown, oxidized silt w/ trace fine sand moist

.6 Brown silty sand damp

8-12' 4' Recovery

Upper .8' slough from hole

Brown silty fine sand w/ roots to 11' and FeOx staining, damp

12-16 3.2 Recovery

.8 FeOx overcoat on Brown silt, moist

1.8 Brown-grey silt moist

.6 FeOx coated Brown, grey clayey silt, sl. plastic

16-20' 3.4 Recovery

.6- Brown, grey silt Heavy FeOx and MnOx

2.8 Brown, silt w/ trace sand

20-24 - 3.8 recovery

3.8' Brown, sandy silt, damp

24-28 - 2.3' recovery

Brown grey, silty fine sand, damp

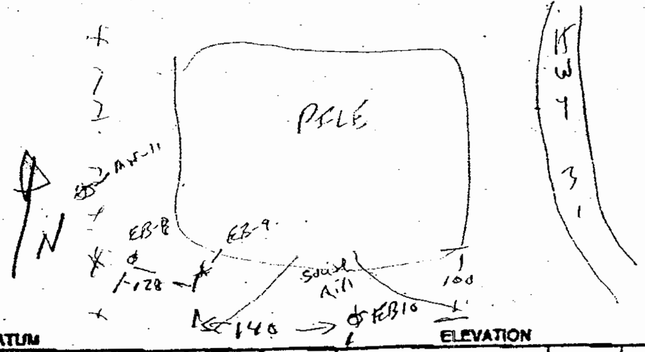
28-32 - 3.8 Recovery

Brown, grey silty fine sand damp some FeOx stain @ 29.7' ~ .1' stain

32-36 - 3.6 Recovery

AA

LOCATION OF BORING



DATUM

ELEVATION

JOB NUMBER

CLIENT

LOCATION

BORING NUMBE EB-10

SHEET 1 **OF** 1

DRILLING METHOD:

SAMPLING METHOD:

SURFACE CONDITIONS:

DRILLING

START	
TIME	
DATE	
7/21/84	

DRILLING CONTRACTOR

BY

DATE

CHECKED BY

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	TIME	SAMPLE NUMBER / SAMPLE DEPTH	BLOWS/FT. SAMPLER	OVA AUGER	OVA SAMPLE	OVA CUTTINGS	DEPTH IN FEET	SOIL GRAPH
								0	
								1	
								2	
								3	
								4	
								5	
								6	
								7	
								8	
								9	
								10	
								1	
								2	
								3	
								4	
								5	
								6	
								7	
								8	
								9	
								0	
								1	

0-4' 1.5 RECOVERY
Brown grey silty gravel w/ trace sand, moist-wet
Fill on bottom ~~shoe~~
Gravel mostly coarse, subangle
.5 ft silt & sand
4-8 1-6 Recovery
Silty gravel moist-wet w/ trace sand

8-12 ~~A~~ 1.4 Recovery

12-16 - Wet - Just pushing rods down in boring
V. little recovery ~~AB~~ ? Note driller says rods are wet from 9'

16-20 3.4 Recovery
Cut sample @ 19-19.5'
Brown grey silty gravel for 2.2' w/ sand
1.2 Brown grey silt w/ root material ~18' - .2' of CKD encountered - Take paste pH - 11.5-12 S.U. on pH paper

20-24 - 2.4' Recovery
.2 gravelly silt
Grey silt w/ occ. subang. coarse gravel, moist sl. plastic from 23.5-24'

24-28 - 1.8 recovery
Grey silt to 1.0', moist-wet
1.4 Grey, white gravel then .3' of grey lt brown/tan sand.

28-32 3.4 Recovery
Brown grey silty fine sand moist

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Portland 9405 SW Nimbus Avenue, Beaverton, OR 97008-7132
503.906.9200 fax 503.906.9210
Bend 20332 Empire Avenue, Suite F-1, Bend, OR 97701-5711
[illegible]
Anchorage 2000 W. International Airport Road, Suite A10, Anchorage, AK 99502-1119
907.563.9200 fax 907.563.9210

Effect of Dilution upon pH -Lehigh Site

OCT - 1 2004

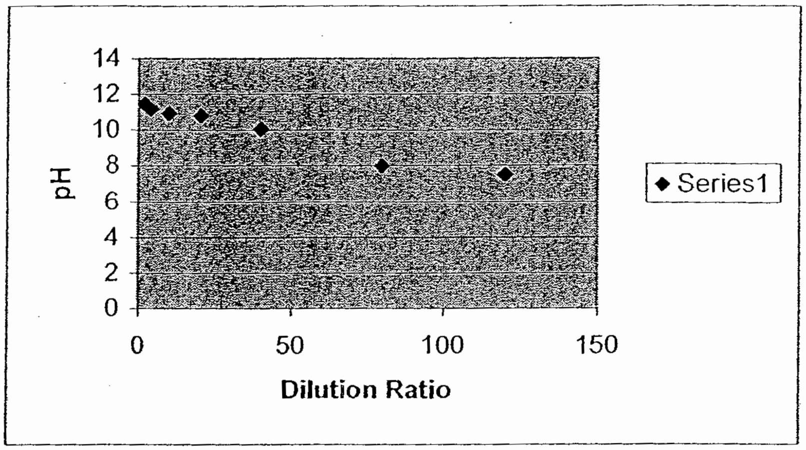
Stock pHs

S4H0082-01	Water	MW-1	pH 7.03
S4H0082-02	Water	PM-16	pH 11.6
S4G0136-01	Soil	EB- 10-18'	pH 11.65

S4G0136-01 (EB-10/18') + S4H0082-01 (MW-1)

WT+VOL	pH	Filtered pH	Used Soil + 20ml (MW-1)	2nd Filtered pH	2nd Used Soil + 20ml (MW-1)
0.5g + 20ml	10.04	9.8	7.97	7.49	7.49
1.0g + 20ml	10.81	11.02	9.72	9.23	8.06
2.0g + 20ml	10.93	11.08	10.39	9.97	9.38
5.0g + 20ml	11.17	11.33	10.99		
10g + 20ml	11.46	11.57			
12g + 20ml	11.78	11.79			
15g + 20ml	11.65	11.79			

2	11.46
4	11.17
10	10.93
20	10.81
40	10.04
80	7.97
120	7.49



A sample of soil supplied by Bill Fees of WADOE was diluted with water from a monitoring well (MW-1) to determine the effect of water washing upon pH.
A series of 40 milliliter vials were prepared by adding small amounts of soil to each one in incremental amounts from 0.5 grams to 15 grams. Twenty milliliters of water were added to each vial and the vials were tumbled end-over-end in a TCLP tumbler overnight. A calibrated pH meter and electrode were used to measure pH in the water after the sample was allowed to settle. Additionally, pH was meadured on the water after filtration to eliminate any affect from soil fines that may have remained suspended in the water.
In addition, the first three soil samples were tumbled again with new 20 milliliter portions of water and pH was measured in the water after settling. This procedure was repeated twice for the first three samples.
Measurements have been summarized in the table above. Also, we made a plot of pH versus dilution ratio.

Two observations seem to be pertinent:
A ratio of 80:1 water versus soil is necessary to reduce the pH to near neutral.
A ratio of 10:1 water versus coil is necessary to see any appreciable reduction in pH in the water.

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Portland 9405 SW Nimbus Avenue, Beaverton, OR 97008-7132
503.906.9200 fax 503.906.9210
Bend 20332 Empire Avenue, Suite F-1, Bend, OR 97701-5711
541.383.9310 fax 541.382.7588
Anchorage 2000 W International Airport Road, Suite A-10, Anchorage, AK 99502-1119
907.563.9200 fax 907.563.9210

Department of Ecology
4601 Monroe St.
Spokane WA, 99205-1295

Project: Leiteck
Project Number: J1A71
Project Manager: Bill Fees

Reported:
08/09/04 17:18

Total Metals by EPA 6010/7000 Series Methods

North Creek Analytical - Spokane

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
EB-10/18' (S4G0136-01) Soil Sampled: 07/21/04 00:00 Received: 07/23/04 12:47									
Calcium	**246000**	250	mg/kg dry	25	4080035	08/04/04	08/05/04	EPA 6010B	
Potassium	573	0.500	"	1	"	"	"	"	
Magnesium	**10100**	0.400	"	"	"	"	"	"	
Manganese	226	0.400	"	"	"	"	"	"	

Moisture and Density Determinations for Ring Sample with I.D of 2.416" Obtained per ASTM D 3550-01

Project:	LEHIGH (JIA71)				
Owner:		File No.:	8000-001-45	Date Submitted:	07/23/04
Client	Department of Ecology Eastern Regional Office	Location:	4601 N. Monroe St., Spokane, WA	Date Due:	ASAP
				Date Completed:	07/27/04

Reported To:	MB / BF(Ecology)
Tested By:	GT
Checked By:	

Date	07/26/04 →					
Tested by	GT					
Boring No.						
Sample No.	EB-8	EB-8	EB-8	EB-8	EB-9	EB-10
Depth (ft.)	11.2-11.7	15.5-16.0	22.5-23.0	35-35.5	18.0-18.5	19.0-19.5
Tube+ Wet soil (g)	409.67	449.75	476.58	501.81	457.27	454.19
Ave. tube height (in)	5.58	6.09	6.34	6.50	6.03	5.91
Tube Weight (g)	25.43	27.08	28.51	28.92	28.62	27.93
Wet Soil Weight (g)	384.2	422.7	448.1	472.9	428.7	426.3
Conversion Factor	0.2625	0.2625	0.2625	0.2625	0.2625	0.2625
Wet Density (pcf)	100.9	111.0	117.6	124.1	112.5	111.9
Pan Number	BB	EE	AA	A	DD	FF
Pan + Wet Soil (g)	246.18	274.3	302.1	272.73	331.52	246.72
Pan + Dry Soil (g)	220.17	240.45	260.57	238.14	289.42	214.31
Moisture loss(g)	26.0	33.9	41.5	34.6	42.1	32.4
Pan Wt. (g)	87.25	85.31	84.68	81.7	85.74	84.59
Dry Soil Wt. (g)	132.9	155.1	175.9	156.4	203.7	129.7
Moisture Content (%)	19.6	21.8	23.6	22.1	20.7	25.0
Dry Density (pcf)	84.4	91.1	95.2	101.7	93.2	89.5
Soil Description:	Gray NP SILT with fine sand, moist, ML	Gray NP SILT with fine sand, moist, ML	Gray NP SILT with fine sand, moist-wet, ML	Gray NP SILT with fine sand, moist, ML	Gray NP SILT with fine sand, moist-wet, ML	Dark gray SILT, moist, ML
Notes:	An average value of 1.655 inch is used for tube diameter.					

No. Rings	Wt. of Rings, g	Factor	No. Rings	Wt. of Rings, g	Factor
1	45.3	0.8313	4	181.2	0.2078
2	90.6	0.4156	5	226.5	0.1663
3	135.9	0.2771	6	271.8	0.1385

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Percent Passing N0. 200 (ASTM D1140)

Job Name: LEHIGH (JIA71)
Job No: 8000-001-45
Client: Department of Ecology
Report Date: 07/28/04
Technician: GT
Reviewed By:

Date Tested	07/26/04				
Boring / Test Pit No.	na	na	na	na	na
Sample No.	EB-8	EB-8	EB-8	EB-8	EB-9
Sample Depth, ft	11.1-11.3	15.5-16.0	22.5-23.0	35.0-35.5	18.0-18.5
MOISTURE CONTENT					
Pan	BB	EE	AA	A	DD
Pan + Wet Soil	246.18	274.3	302.1	272.73	331.52
Pan + Dry Soil	220.17	240.45	260.57	238.14	289.42
Moisture Loss	26.01	33.85	41.53	34.59	42.1
Pan Tare	87.25	85.31	84.68	81.7	85.74
Dry Soil	132.92	155.14	175.89	156.44	203.68
Moisture Content	**19.6%**	**21.8%**	**23.6%**	**22.1%**	**20.7%**
PERCENT PASSING #200 SIEVE					
Pan	BB	EE	AA	A	DD
Pan + Dry Soil(before)	220.17	240.45	260.57	238.14	289.42
Pan + Dry Soil(after)	121.74	124.01	131.37	115.28	167.16
Minus 200 From Wash	98.43	116.44	129.2	122.86	122.26
Pan Tare	87.25	85.31	84.68	81.7	85.74
Dry Soil	132.92	155.14	175.89	156.44	203.68
Percent passing	**74.1%**	**75.1%**	**73.5%**	**78.5%**	**60.0%**
Visual Soil Description	Gray NP SILT with fine sand, moist, ML	Gray NP SILT with fine sand, moist, ML	Gray NP SILT with fine sand, moist-wet, ML	Gray NP SILT with fine sand, moist, ML	Gray NP SILT with fine sand, moist-wet, ML
Description based on -200	SILT with fine sand.	SILT with fine sand.	SILT with fine sand.	SILT with fine sand.	Sandy (fine) SILT .
Classification based on -200	ML	ML	ML	ML	ML

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Percent Passing N0. 200 (ASTM D1140)

Job Name: LEHIGH (JIA71) **Client:** Department of Ecology **Technician:** GT

Job No: 8000-001-45 **Report Date:** 07/28/04 **Reviewed By:**

Date Tested	07/26/04				
Boring / Test Pit No.	na				
Sample No.	EB-10				
Sample Depth, ft	19.0-19.5				
MOISTURE CONTENT					
Pan	FF				
Pan + Wet Soil	246.72				
Pan + Dry Soil	214.31				
Moisture Loss	32.41				
Pan Tare	84.59				
Dry Soil	129.72				
Moisture Content	**25.0%**				
PERCENT PASSING #200 SIEVE					
Pan	FF				
Pan + Dry Soil(before)	214.31				
Pan + Dry Soil(after)	115.34				
Minus 200 From Wash	98.97				
Pan Tare	84.59				
Dry Soil	129.72				
Percent passing	**76.3%**				
Visual Soil Description	Dark gray SILT, moist, ML	Note:	NP (none plastic) Maximum particle size is approximately 0.25mm for all samples except that sample EB-10 @19.5' contained sand particle size of approximately 6.35mm.		
Description based on -200	SILT with fine sand.				
Classification based on -200	ML				

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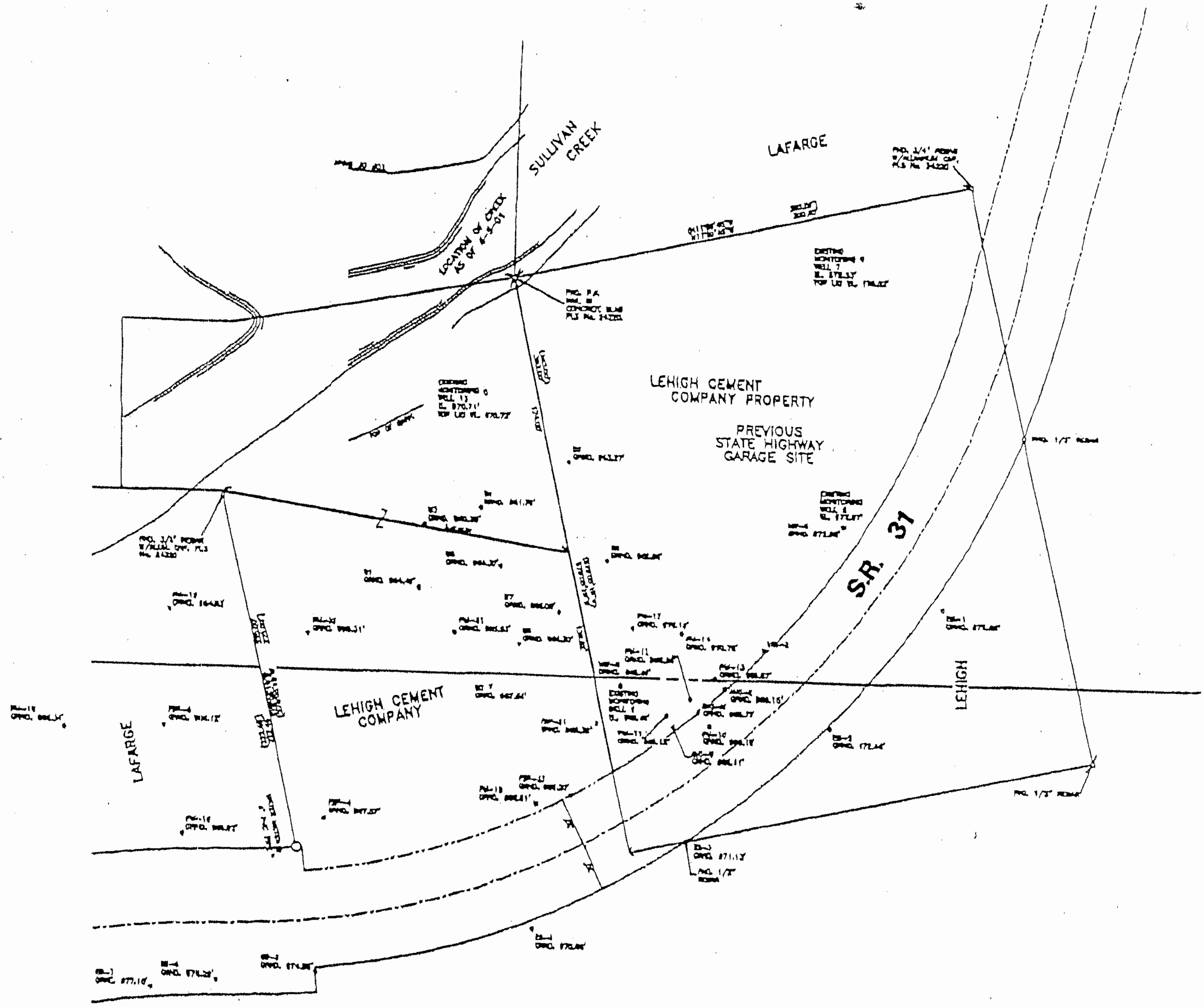
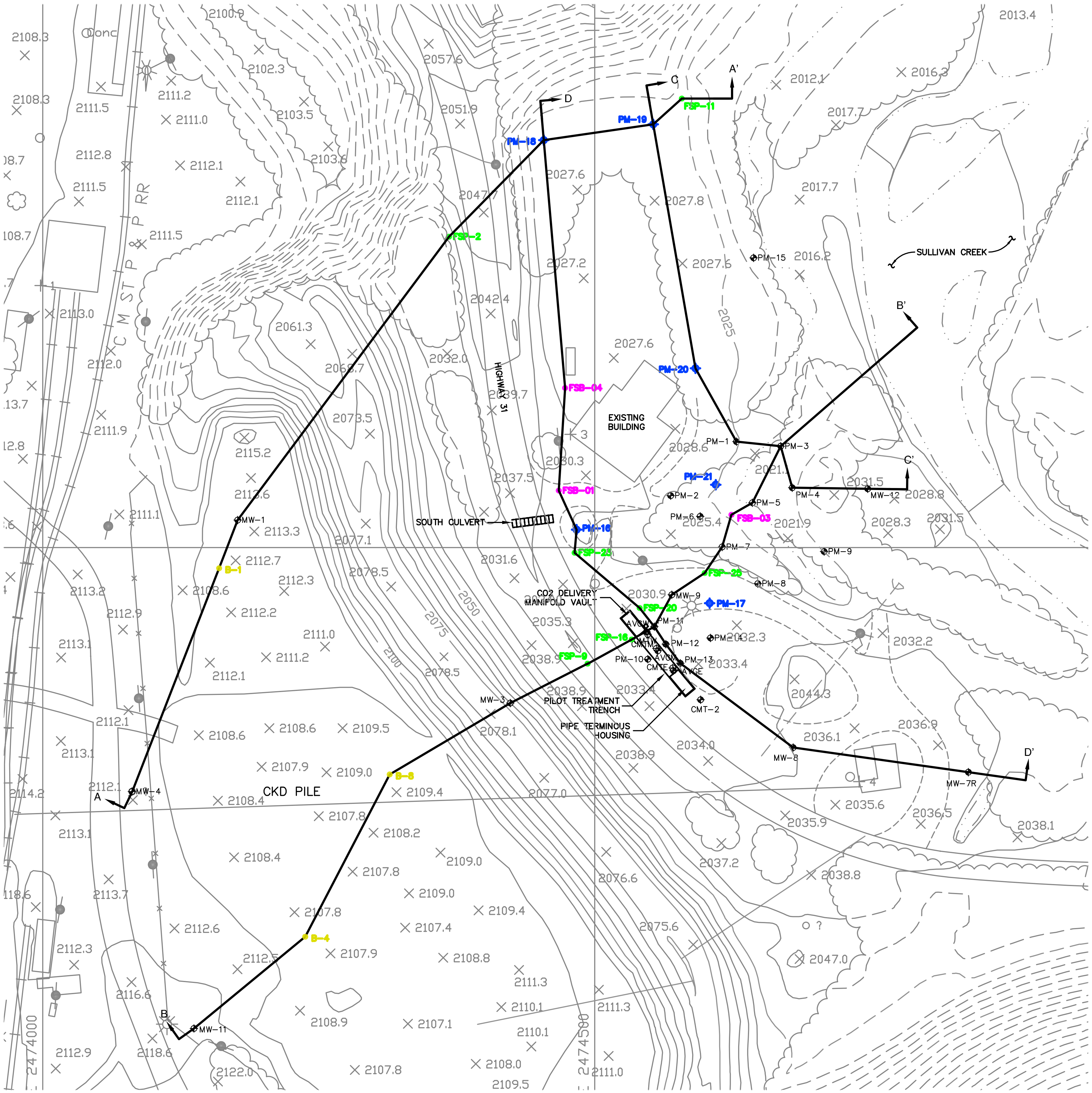

SULLIVAN CREEK
LOCATION OF CREEK AS OF 6-5-01
LAFARGE
LEHIGH CEMENT COMPANY PROPERTY
PREVIOUS STATE HIGHWAY GARAGE SITE
EXISTING MONITORING WELL 7
EXISTING MONITORING WELL 13
EXISTING MONITORING WELL 6
EXISTING MONITORING WELL 1
174.00'
S.R. 31
LEHIGH
LEHIGH CEMENT COMPANY
LAFARGE
Z

APPENDIX C

BORING LOGS AND CROSS SECTIONS

REVISED DRAFT FEASIBILITY STUDY TECHNICAL REPORT CLOSED CEMENT KILN DUST PILE METALINE FALLS, WASHINGTON



1760	EXISTING TOPOGRAPHY (FEET ABOVE M.S.L.)
⊕	GROUNDWATER MONITORING LOCATIONS
◆	PERFORMANCE MONITORING LOCATION
●	APPROXIMATE DIRECT PUSH BORING LOCATIONS (JULY 2003)
●	APPROXIMATE ROTASONIC BORING LOCATIONS (JULY 2003)
●	BORING LOCATION (DAMES AND MOORE, 1992)

N

50 25 0 50 100
SCALE IN FEET

DRAFT

LEHIGH
HEIDELBERGCEMENTGroup

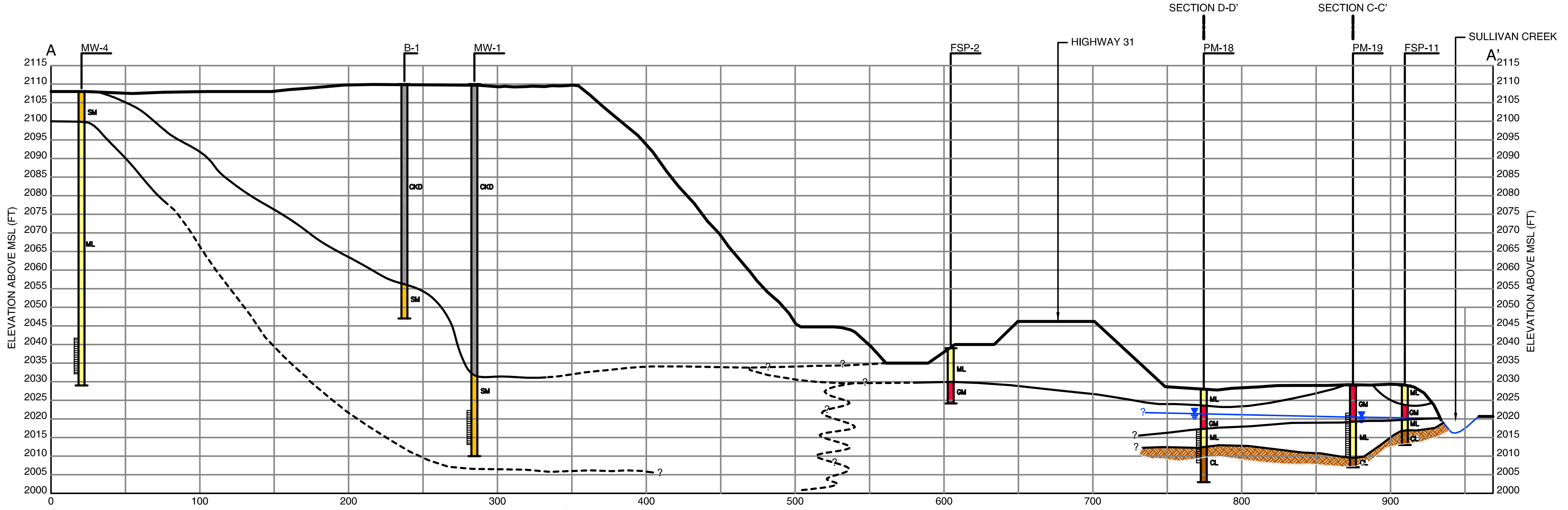
GEOSYNTEC CONSULTANTS
2100 MAIN STREET, SUITE 150
HUNTINGTON BEACH, CALIFORNIA 92648
TELEPHONE: (714) 969-0800

PROJECT:
LEHIGH CEMENT COMPANY CLOSED CKD PILE
METALINE FALLS, WASHINGTON
REVISED DRAFT FEASIBILITY STUDY TECHNICAL REPORT

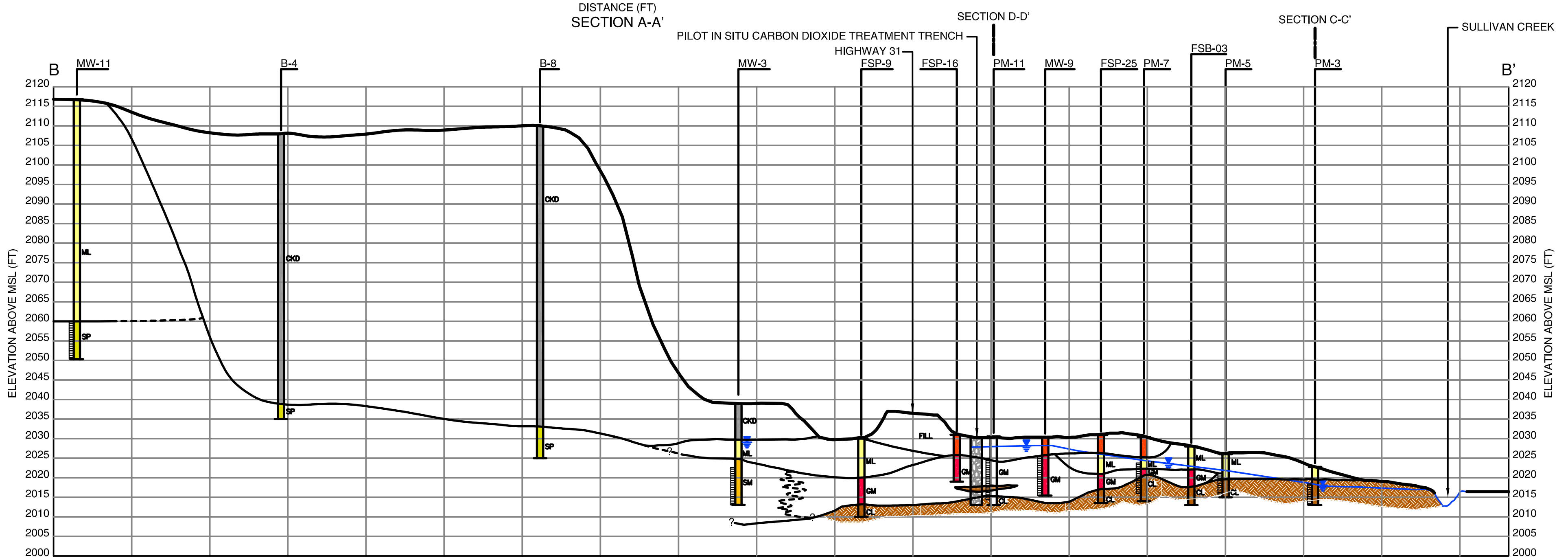
TITLE:
CROSS SECTION LOCATIONS

DATE:	MARCH 2005	CHECKED BY:	EDS	SCALE:	AS SHOWN	EXHIBIT NO:
DESIGN BY:	BLP	REVIEWED BY: (PROJ. MGR.)	AJB	JOB NO.:	HR0196-12	C-1
DRAWN BY:	SLB	DOCUMENT NO:		FILE NO:	0196F090	

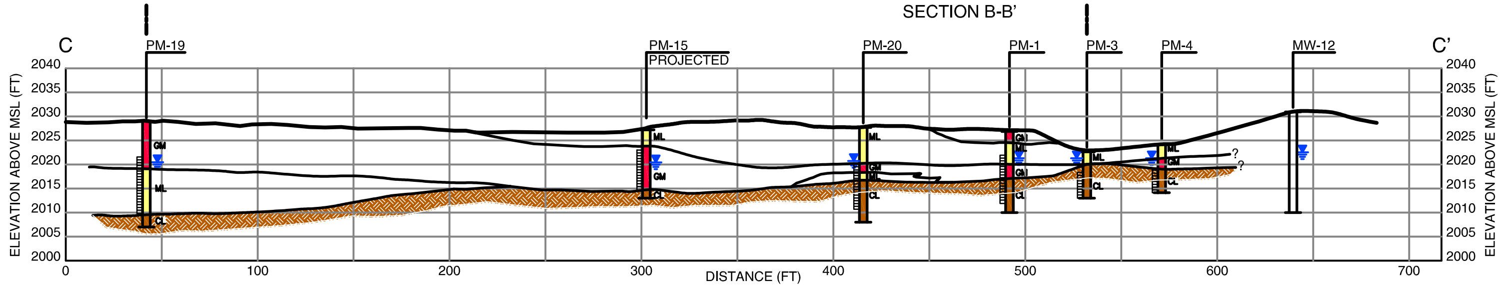
N:\CACAD\0196\figures\0196F090.dwg 5/23/05 07:47 SBerdy



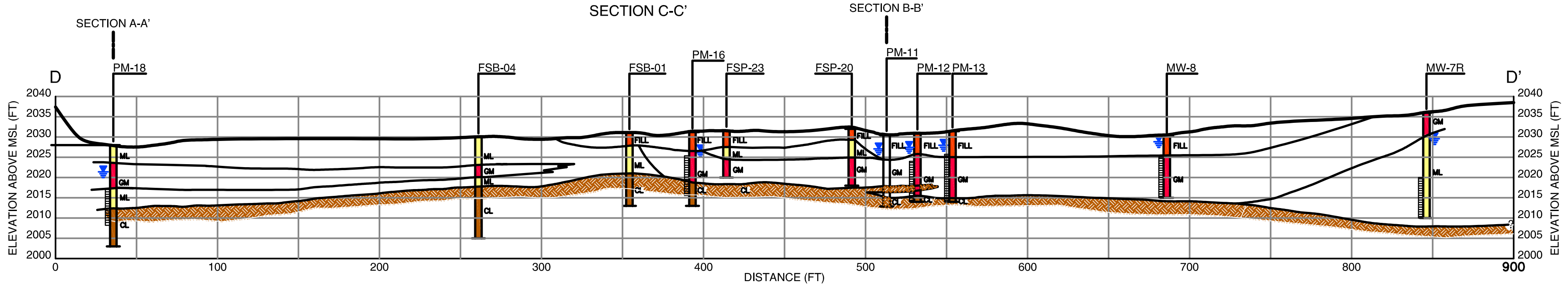
SECTION A-A'



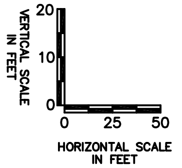
SECTION B-B'



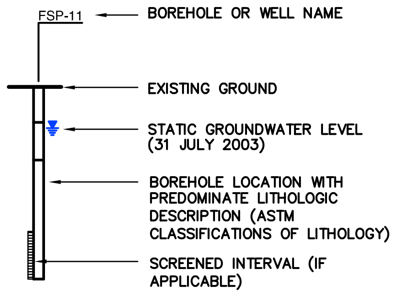
SECTION C-C'



SECTION D-D'



EXPLANATION



ASTM CLASSIFICATIONS OF LITHOLOGY

🟨	ML – GRAVELLY SILT
🟥	GM – WELL-GRADED SILTY GRAVEL
🟫	CL – SILTY CLAY
🟧	FILL – ARTIFICIAL FILL
🟨	SP – SANDY GRAVEL
⬜	CKD – CEMENT KILN DUST
🟧	SM – SANDY SILT
▨	CONFINING SILTY CLAY LAYER

DRAFT

LEHIGH
HEIDELBERGCEMENT Group

GEOSYNTEC CONSULTANTS
2100 MAIN STREET, SUITE 150
HUNTINGTON BEACH, CALIFORNIA 92648
TELEPHONE: (714) 969-0800

PROJECT:
LEHIGH CEMENT COMPANY CLOSED CKD PILE
METALINE FALLS, WASHINGTON
REVISED DRAFT FEASIBILITY STUDY TECHNICAL REPORT

TITLE:
CROSS SECTIONS

DATE:	MARCH 2005	CHECKED BY:	EDS	SCALE:	AS SHOWN	EXHIBIT NO:
DESIGN BY:	BLP	REVIEWED BY: (PROJ. MGR.)	AJB	JOB NO.:	HR0196-12	C-2
DRAWN BY:	SLB	DOCUMENT NO:		FILE NO:	0196F091	

N:\CACAD\0196\figures\0196F091.dwg 5/23/05 07:48 SBerdy

GEOSYNTEC CONSULTANTS

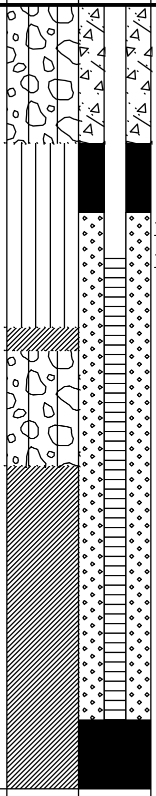
2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING PM-1 **SHEET** 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT NUMBER

ELEVATION DATA:
GROUND SURF. 2026.87
TOP OF CASING
DATUM



DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES						COMMENTS
						NUMBER	TYPE	BLOWS PER 6"	RECOVERY (%)	PID READING (ppm)	TIME	
	Silty GRAVEL (GM): brown; well graded											Began drilling at 0945 on 28 August 2002
	@ 1' - gravel becomes fine				2025							
	Silt (ML): gravel (25,0,75)											
5				Static groundwater level at 5 ft-bgs measured on 28 August 2002 Encountered 1st groundwater at 5.7 ft-bgs on 28 August 2002								
					2020							
	Clay (CL): gray; wet; with organics											
	Silty GRAVEL (GM): gray; wet											pH level at ~10.5
10	Clay (CL): gray; wet											
					2015							
15												
					2010							Completed borehole at 1005 on 28 August 2002
20												
25												
30												

CONTRACTOR Boart Longyear
EQUIPMENT
DRILL MTHD Rotasonic
DIAMETER 6-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697595.990
EASTING 2474628.400
ANGLE Vertical

REMARKS: Surface completion monument extends approximately 3 feet above ground.

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

GEOSYNTEC CONSULTANTS

2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

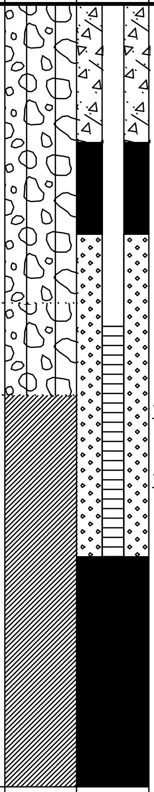
BOREHOLE LOG

BORING PM-2 **SHEET** 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT NUMBER

ELEVATION DATA:
GROUND SURF. 2030.02
TOP OF CASING
DATUM

DEPTH (ft)	MATERIAL DESCRIPTION	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	COMMENTS
0	Silty GRAVEL (GM): brown; (50,0,50)			Began drilling at 1135 on 28 August 2002
5			2025	
~6.5	Silty GRAVEL (GM): moist; (70,0,30)			
~8.5	Clay (CL): gray; wet	Static groundwater level at 9 ft-bgs measured on 28 August 2002 Encountered 1st groundwater at 10.5 ft-bgs on 28 August 2002		
10			2020	pH level at ~7.0
15			2015	
~16				pH level at ~7.0
~17				Completed borehole at 1240 on 28 August 2002
20				
25				
30				

SAMPLES: NUMBER, TYPE, BLOWS PER 6", RECOVERY (%), PID READING (ppm), TIME



CONTRACTOR Boart Longyear
EQUIPMENT
DRILL MTHD Rotasonic
DIAMETER 6-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697547.070
EASTING 2474568.810
ANGLE Vertical

REMARKS: Surface completion monument extends approximately 3 feet above ground.

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

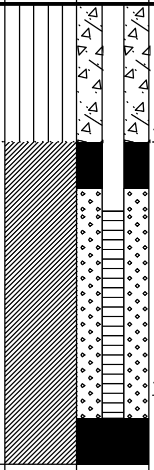
GEOSYNTEC CONSULTANTS
2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING PM-3 **SHEET** 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT NUMBER

ELEVATION DATA:
GROUND SURF. 2022.66
TOP OF CASING
DATUM



DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS PER 6"	SAMPLES RECOVERY (%)	SAMPLES PID READING (ppm)	SAMPLES TIME	COMMENTS
	Silt (ML): gray; wet; gravel (25,0,75)											Began drilling at 1615 on 28 August 2002
					2020							
	Clay (CL): gray; silt			▼ Static groundwater level at 3 ft-bgs measured on 28 August 2002								pH level at ~10.0
5												
					2015							
				▽ Encountered 1st groundwater at 8.5 ft-bgs on 28 August 2002								
10												pH level at ~9.0 Completed borehole at 1640 on 28 August 2002
15												
20												
25												
30												

CONTRACTOR Boart Longyear
EQUIPMENT
DRILL MTHD Rotasonic
DIAMETER 6-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697591.880
EASTING 2474668.510
ANGLE Vertical

REMARKS: Surface completion monument extends approximately 3 feet above ground.

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

GEOSYNTEC CONSULTANTS

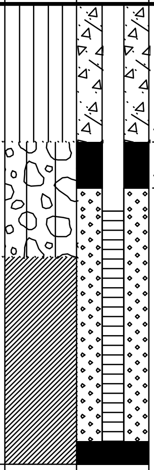
2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING PM-4 **SHEET** 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT
NUMBER

ELEVATION DATA:
GROUND SURF. 2024.17
TOP OF CASING
DATUM



DEPTH (ft)	MATERIAL DESCRIPTION	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES NUMBER	TYPE	BLOWS PER 6"	RECOVERY (%)	PID READING (ppm)	TIME	COMMENTS
	Silt (ML): brown; gravel (10,0,90)									Began drilling at 1700 on 28 August 2002
	@ 2' - becomes moist									
	Silty GRAVEL (GM): gray; wet	Static groundwater level at 3 ft-bgs measured on 28 August 2002 Encountered 1st groundwater at 4 ft-bgs on 28 August 2002	2020							
5										
	Silty CLAY (CL)									
			2015							
10										pH level at ~7.5 Completed borehole at 1730 on 28 August 2002
15										
20										
25										
30										

CONTRACTOR Boart Longyear
EQUIPMENT
DRILL MTHD Rotasonic
DIAMETER 6-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697554.260
EASTING 2474678.910
ANGLE Vertical

REMARKS: Surface completion monument extends approximately 3 feet above ground.

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

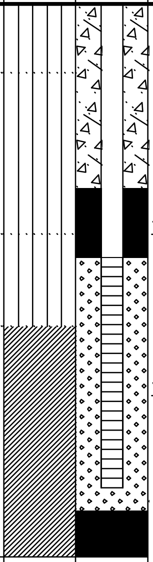
WELL_BORE METFALHR0196_03.GPJ GEOSNTEC.GDT 19/5/05

GEOSYNTEC CONSULTANTS
2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING PM-5 **SHEET** 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT NUMBER
ELEVATION DATA:
GROUND SURF. 2026.68
TOP OF CASING
DATUM



DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES NUMBER	TYPE	BLOWS PER 6"	RECOVERY (%)	PID READING (ppm)	TIME	COMMENTS
	Silt (ML): brown; dry											Began drilling at 0725 on 29 August 2002
	Silt (ML): brown, dry; gravel (25,0,75)				2025							
5	Silt (ML): gray; wet; gravel (10,0,90)			Static groundwater level at 5 ft-bgs measured on 29 August 2002								
					2020							
	Clay(CL): gray; wet											pH level at ~9.5
				Encountered 1st groundwater at 8.5 ft-bgs on 29 August 2002								
10												
					2015							
												pH level at ~10.5 Completed borehole at 0745 on 29 August 2002
15												
20												
25												
30												

CONTRACTOR Boart Longyear
EQUIPMENT
DRILL MTHD Rotasonic
DIAMETER 6-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697540.610
EASTING 2474642.850
ANGLE Vertical

REMARKS: Surface completion monument extends approximately 3 feet above ground.

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

GEOSYNTEC CONSULTANTS

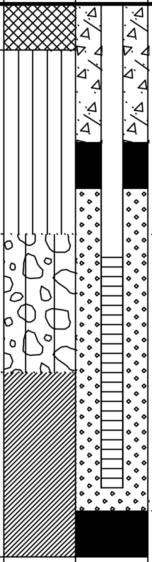
2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING PM-6 **SHEET** 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT NUMBER

ELEVATION DATA:
GROUND SURF. 2028.68
TOP OF CASING
DATUM



DEPTH (ft)	MATERIAL DESCRIPTION	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES NUMBER	TYPE	BLOWS PER 6"	RECOVERY (%)	PID READING (ppm)	TIME	COMMENTS
	ARTIFICAL FILL: Gravel fill with silt									Began drilling at 0830 on 29 August 2002
	Silt (ML): brown; dry; gravel (5,0,95)									
	@ 3' - becomes moist; increase in gravel (25,0,75)		2025							
5	Silty GRAVEL (GM): gray; wet	▼ Static groundwater level at 5 ft-bgs measured on 29 August 2002								pH level at ~11.0
	Clay (CL): gray; wet		2020							
10										
		▽ Encountered 1st groundwater at 11 ft-bgs on 29 August 2002								pH level at ~9.0 Completed borehole at 0855 on 29 August 2002
15										
20										
25										
30										

CONTRACTOR Boart Longyear
EQUIPMENT
DRILL MTHD Rotasonic
DIAMETER 6-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697528.310
EASTING 2474595.530
ANGLE Vertical

REMARKS: Surface completion monument extends approximately 3 feet above ground.

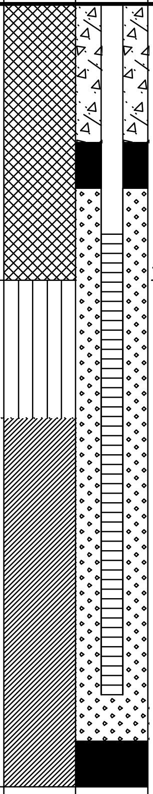
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

GEOSYNTEC CONSULTANTS
2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING PM-7 **SHEET** 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT NUMBER
ELEVATION DATA:
GROUND SURF. 2030.44
TOP OF CASING
DATUM



DEPTH (ft)	MATERIAL DESCRIPTION	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES NUMBER	TYPE	BLOWS PER 6"	RECOVERY (%)	PID READING (ppm)	TIME	COMMENTS
	ARTIFICAL FILL: Gravel fill with silt; gray		2030							Began drilling at 1005 on 29 August 2002
5			2025							
	Gravelly SILT (ML): gray; wet (40,0,60)	▼ Static groundwater level at 6 ft-bgs measured on 29 August 2002 Encountered 1st groundwater at 6 ft-bgs on 29 August 2002								pH level at ~10.0
	Clay (CL): gray; wet									
10			2020							
15			2015							
										pH level at ~8.5 Completed borehole at 1030 on 29 August 2002
20										
25										
30										

CONTRACTOR Boart Longyear
EQUIPMENT
DRILL MTHD Rotasonic
DIAMETER 6-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697500.590
EASTING 2474615.450
ANGLE Vertical

REMARKS: Surface completion monument extends approximately 3 feet above ground.

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

GEOSYNTEC CONSULTANTS

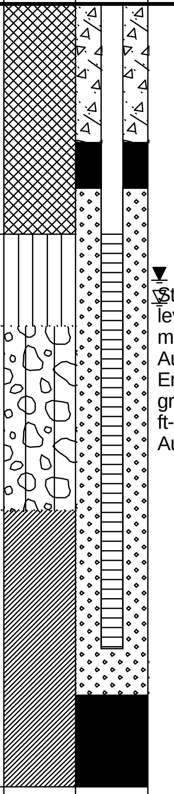
2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING PM-8 **SHEET** 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT NUMBER

ELEVATION DATA:
GROUND SURF. 2031.34
TOP OF CASING
DATUM



DEPTH (ft)	MATERIAL DESCRIPTION	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS PER 6"	SAMPLES RECOVERY (%)	SAMPLES PID READING (ppm)	SAMPLES TIME	COMMENTS
	ARTIFICAL FILL: Gravel fill with silt; gray; dry @ 1' - becomes moist and color change to brown		2030							Began drilling at 1150 on 29 August 2002
5	Gravelly SILT (ML): (25,0,75)	Static groundwater level at 6 ft-bgs measured on 29 August 2002 Encountered 1st groundwater at 6.5 ft-bgs measured on 29 August 2002	2025							pH level at ~10.5
	Silty GRAVEL (GM): poorly graded									
10			2020							
	Clay (CL): gray; wet									
15			2015							
										pH level at ~7.0 Completed borehole at 1205 on 29 August 2002
20										
25										
30										

CONTRACTOR Boart Longyear
EQUIPMENT
DRILL MTHD Rotasonic
DIAMETER 6-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697467.350
EASTING 2474647.750
ANGLE Vertical

REMARKS: Surface completion monument extends approximately 3 feet above ground.

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

GEOSYNTEC CONSULTANTS

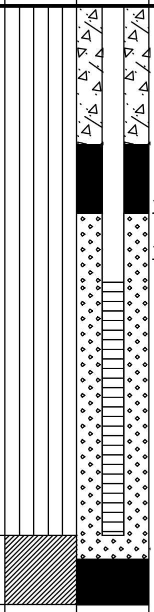
2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM: WELL BORE

BOREHOLE LOG

BORING PM-9 **SHEET** 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT NUMBER

ELEVATION DATA:
GROUND SURF. 2025.65
TOP OF CASING
DATUM



DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES						COMMENTS
						NUMBER	TYPE	BLOWS PER 6"	RECOVERY (%)	PID READING (ppm)	TIME	
	Silt (ML): brown; dry; gravel (10,0,90)				2025							Began drilling at 1440 on 29 August 2002
	@ 3' - increase in gravel (40,0,60); color change to gray; and becomes moist											
5	@ 5' - becomes wet			Static groundwater level at 4.5 ft-bgs measured on 29 August 2002 Encountered 1st groundwater at 5.5 ft-bgs measured on 29 August 2002	2020							
10					2015							
	Clay (CL): gray; wet											
												pH level at ~7.0 Completed borehole at 1520 on 29 August 2002
15												
20												
25												
30												

CONTRACTOR Boart Longyear
EQUIPMENT
DRILL MTHD Rotasonic
DIAMETER 6-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697493.420
EASTING 2474707.810
ANGLE Vertical

REMARKS: Surface completion monument extends approximately 3 feet above ground.

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

GEOSYNTEC CONSULTANTS

2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING PM-10 **SHEET** 1 **OF** 1

START DRILL DATE

FINISH DRILL DATE

LOCATION Metaline Falls, Washington

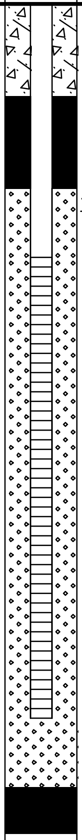
PROJECT NUMBER

ELEVATION DATA:

GROUND SURF. 2031.53

TOP OF CASING

DATUM

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES						COMMENTS
						NUMBER	TYPE	BLOWS PER 6"	RECOVERY (%)	PID READING (ppm)	TIME	
	No lithologic logging of PM-10. See PM-13 for similar description. PM-13 located approximately 30 feet to the east.											Began drilling at 1430 on 12 November 2002
					2030							
5				▽ Encountered 1st groundwater during drilling at 4.5 ft-bgs measured on 12 November 2002								
					2025							
10												
					2020							
15												
					2015							
												Completed borehole at 1540 on 12 November 2002
20												
25												
30												

CONTRACTOR Boart Longyear
EQUIPMENT
DRILL MTHD Rotasonic
DIAMETER 6-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697398.880
EASTING 2474548.080
ANGLE Vertical

REMARKS: Surface completion monument extends approximately 3 feet above ground.

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

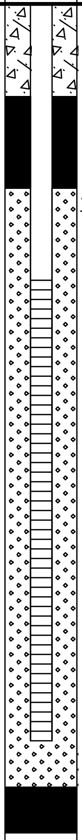
GEOSYNTEC CONSULTANTS
2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING PM-11 **SHEET** 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT NUMBER

ELEVATION DATA:
GROUND SURF. 2030.56
TOP OF CASING
DATUM

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES						COMMENTS
						NUMBER	TYPE	BLOWS PER 6"	RECOVERY (%)	PID READING (ppm)	TIME	
	No lithologic logging of PM-11. See PM-13 for similar description. PM-13 located approximately 40 feet to the southeast.				2030							Began drilling at 1155 on 12 November 2002
				▽ Encountered 1st groundwater during drilling at 4.5 ft-bgs measured on 12 November 2002								
5					2025							
10					2020							
15					2015							
												Completed borehole at 1300 on 12 November 2002
20												
25												
30												

CONTRACTOR Boart Longyear
EQUIPMENT
DRILL MTHD Rotasonic
DIAMETER 6-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697428.350
EASTING 2474554.010
ANGLE Vertical

REMARKS: Surface completion monument extends approximately 3 feet above ground.

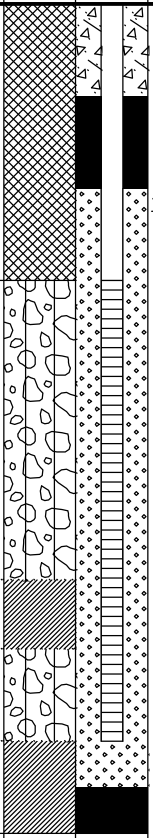
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

GEOSYNTEC CONSULTANTS
2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING PM-12 **SHEET** 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT NUMBER
ELEVATION DATA:
GROUND SURF. 2030.94
TOP OF CASING
DATUM



DEPTH (ft)	MATERIAL DESCRIPTION	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS PER 6"	SAMPLES RECOVERY (%)	SAMPLES PID READING (ppm)	SAMPLES TIME	COMMENTS
	ARTIFICAL FILL: Sand, silt, and clay; brown to gray; wet									Began drilling at 0820 on 12 November 2002
			2030							
		∇ Encountered 1st groundwater during drilling at 4.5 ft-bgs measured on 12 November 2002								
5										
			2025							
	Silty GRAVEL (GM): gray; wet; (75,0,25)									
10										
			2020							
	Clay (CL): gray									
	Gravel; gray; silt; some organics									
15										
			2015							
	Clay (CL): gray									
										Completed borehole at 0855 on 12 November 2002
20										
25										
30										

CONTRACTOR Boart Longyear
EQUIPMENT
DRILL MTHD Rotasonic
DIAMETER 6-inch
LOGGER B. Petty **REVIEWER**
NORTHING 697412.500
EASTING 2474564.400
ANGLE Vertical

REMARKS: Surface completion monument extends approximately 3 feet above ground.

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

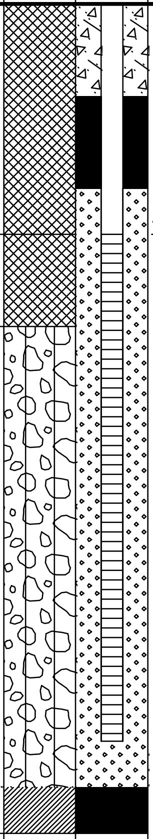
GEOSYNTEC CONSULTANTS

2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING PM-13 **SHEET** 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT NUMBER
ELEVATION DATA:
GROUND SURF. 2031.45
TOP OF CASING
DATUM

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES						COMMENTS
						NUMBER	TYPE	BLOWS PER 6"	RECOVERY (%)	PID READING (ppm)	TIME	
	ARTIFICAL FILL: brown to gray; wet											Began drilling at 1030 on 12 November 2002
					2030							
5	**ARTIFICAL FILL:** Wood: appears to be plywood; slow drilling			▽ Encountered 1st groundwater during drilling at 5 ft-bgs measured on 12 November 2002								
					2025							
	Silty GRAVEL (GM): gray; wet (80,0,20)											
10												
					2020							
	@ 14' - increase in silt (50,0,50)											
15												
					2015							
	Clay (CL): gray; wet											
												Completed borehole at 1105 on 12 November 2002
20												
25												
30												

CONTRACTOR Boart Longyear
EQUIPMENT
DRILL MTHD Rotasonic
DIAMETER 6-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697395.220
EASTING 2474577.530
ANGLE Vertical

REMARKS: Surface completion monument extends approximately 3 feet above ground.

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

GEOSYNTEC CONSULTANTS

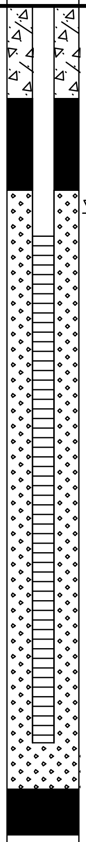
2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING PM-14 **SHEET** 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT NUMBER

ELEVATION DATA:
GROUND SURF. 2033.14
TOP OF CASING
DATUM

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES NUMBER	TYPE	BLOWS PER 6"	RECOVERY (%)	PID READING (ppm)	TIME	COMMENTS
	No lithologic logging of PM-14. See PM-13 for similar description. PM-13 located approximately 35 feet to the southwest.											Began drilling at 0730 on 12 November 2002
					2030							
				∇ Encountered 1st groundwater during drilling at 4.5 ft-bgs measured on 12 November 2002								
5												
					2025							
10												
					2020							
15												
												Completed borehole at 0800 on 12 November 2002
20												
25												
30												

CONTRACTOR Boart Longyear
EQUIPMENT
DRILL MTHD Rotasonic
DIAMETER 6-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697418.130
EASTING 2474604.830
ANGLE Vertical

REMARKS: Surface completion monument extends approximately 3 feet above ground.

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

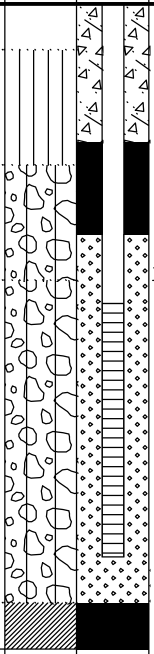
GEOSYNTEC CONSULTANTS
2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING **PM-15** **SHEET 1 OF 1**
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT NUMBER

ELEVATION DATA:
GROUND SURF. 2027.21
TOP OF CASING
DATUM



DEPTH (ft)	MATERIAL DESCRIPTION	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS PER 6"	SAMPLES RECOVERY (%)	SAMPLES PID READING (ppm)	SAMPLES TIME	COMMENTS
	Organics and Silt (OM): grassy layer									Began drilling at 0935 on 12 November 2002
	Silt (ML): light brown; sand (0,25,75); some organics		2025							
	Gravel and Silt (GM): light brown; dry (50,0,50)									
5										
	Silty GRAVEL (GM): gray; moist; sand @ 7' - becomes wet; decrease in silt and sand	Encountered 1st groundwater during drilling at 6 ft-bgs measured on 12 November 2002	2020							pH level at ~9.5
10										
			2015							pH level at ~10.0
	Clay (CL): gray; wet									
										pH level at ~7.5 Completed borehole at 0955 on 12 November 2002
15										
20										
25										
30										

CONTRACTOR Boart Longyear
EQUIPMENT
DRILL MTHD Rotasonic
DIAMETER 6-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697763.990
EASTING 2474611.750
ANGLE Vertical

REMARKS: Surface completion monument extends approximately 3 feet above ground.

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

GEOSYNTEC CONSULTANTS

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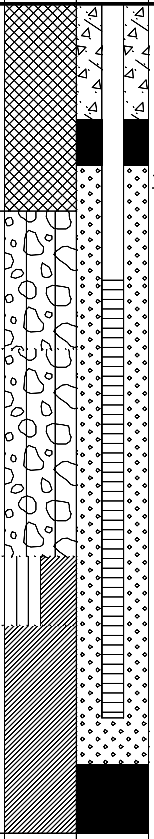
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING PM-16 **SHEET** 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT
NUMBER

ELEVATION DATA:
GROUND SURF. 2031.2
TOP OF CASING
DATUM



DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES						COMMENTS
						NUMBER	TYPE	BLOWS PER 6"	RECOVERY (%)	PID READING (ppm)	TIME	
	ARTIFICAL FILL: brown; silt; sand; gravel (20,20,60)											Began drilling at 0705 on 15 July 2003
					2030							
				∇ Encountered 1st groundwater at 4 ft-bgs on 15 July 2003								
5	GRAVEL (GM): brown-gray; moist; sand; silt											
					2025							
	GRAVEL (GM): gray; wet; silt (25,0,75)											
10												pH level at 12.0
					2020							
	SILT and CLAY (ML-CL): gray; wet											
	CLAY (CL): gray; wet											
15												
					2015							pH level at 10.5
												Completed borehole at 0915 on 15 July 2003
20												
25												
30												

CONTRACTOR Boart Longyear
EQUIPMENT
DRILL MTHD Rotasonic
DIAMETER 8-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697508.005
EASTING 2474494.645
ANGLE Vertical

REMARKS: Well is completed in a flush-mounted vault

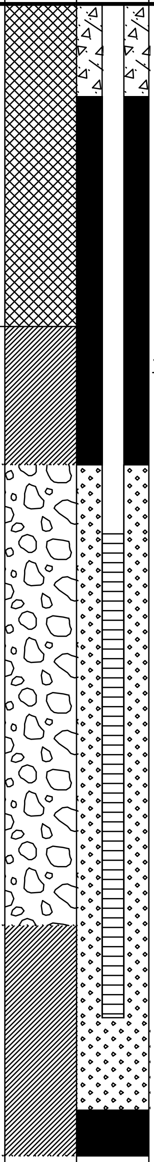
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

GEOSYNTEC CONSULTANTS
2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING PM-17
SHEET 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT NUMBER
ELEVATION DATA:
GROUND SURF. 2032.54
TOP OF CASING
DATUM



DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES NUMBER	TYPE	BLOWS PER 6"	RECOVERY (%)	PID READING (ppm)	TIME	COMMENTS
	ARTIFICAL FILL: light brown											Began drilling at 1145 on 15 July 2003
					2030							
5												
	Silty CLAY (CL): gray; wet				2025							
				▽ Encountered 1st groundwater at 8 ft-bgs on 15 July 2003								
10	GRAVEL (GP): gray; wet; poorly sorted; well graded											pH level at 10.5
					2020							
15												
												pH level at 11.0
					2015							
20	CLAY (CL): dark gray; wet; some gravel											
	@ 22' - color change to gray; no gravel				2010							pH level 9.0
25												Completed borehole at 1350 on 15 July 2003
30												

CONTRACTOR Boart Longyear
EQUIPMENT
DRILL MTHD Rotasonic
DIAMETER 6-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697444.067
EASTING 2474604.743
ANGLE Vertical

REMARKS: Surface completion monument extends approximately 3 feet above ground.

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

GEOSYNTEC CONSULTANTS

2100 Main Street, Suite 150
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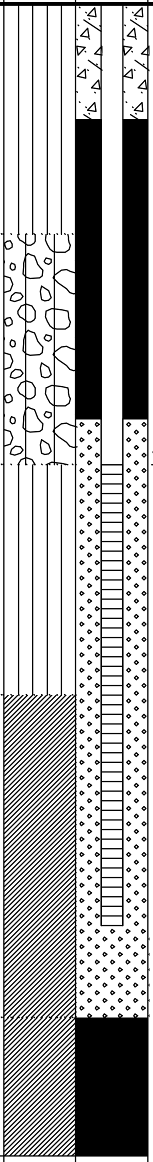
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING PM-18 **SHEET** 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT NUMBER

ELEVATION DATA:
GROUND SURF. 2028.31
TOP OF CASING
DATUM



						SAMPLES						
DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	NUMBER	TYPE	BLOWS PER 6"	RECOVERY (%)	PID READING (ppm)	TIME	COMMENTS
	SILT (ML): brown; dry; gravel (75,0,25)											Began drilling at 0700 on 16 July 2003
					2025							
5	GRAVEL (GM): brown; moist; silt (25,0,75)											
					2020							
10	SILT (ML): brown-gray; wet; fine-grained sand (80,20,0)			∇ Encountered 1st groundwater at 10 ft-bgs on 16 July 2003								
												pH level at 11.5
					2015							
15	Silty CLAY (CL): gray; wet											
												pH level at 11.5
					2010							
20												
												pH level at 11.0
	CLAY (CL): gray; wet											
					2005							
25												Completed borehole at 0920 on 16 July 2003
30												

CONTRACTOR Boart Longyear
EQUIPMENT
DRILL MTHD Rotasonic
DIAMETER 6-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697735.167
EASTING 2474470.164
ANGLE Vertical

REMARKS: Surface completion monument extends approximately 3 feet above ground.

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

GEOSYNTEC CONSULTANTS

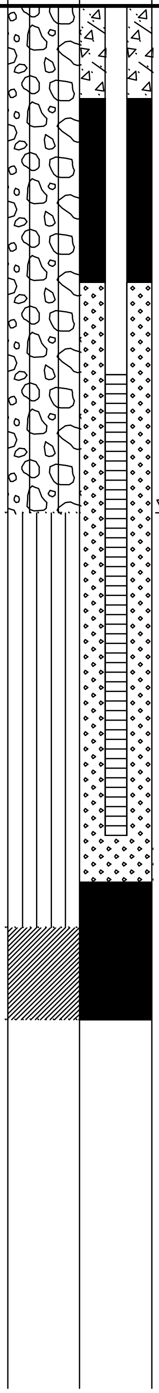
2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING PM-19
SHEET 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT NUMBER

ELEVATION DATA:
GROUND SURF. 2028.73
TOP OF CASING
DATUM



DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES						COMMENTS
						NUMBER	TYPE	BLOWS PER 6"	RECOVERY (%)	PID READING (ppm)	TIME	
	SILT-SAND-GRAVEL (GM): brown; dry; organics											Began drilling at 1140 on 16 July 2003
					2025							
5												
					2020							
10												
	SILT (ML): gray; wet			▽ Encountered 1st groundwater at 11 ft-bgs on 16 July 2003								
					2015							
15												pH level at 11.5
	@ 16' - increase in gravel (80,0,20)											
					2010							
20	CLAY (CL): gray; wet											pH level at 9.0
												Completed borehole at 1210 on 16 July 2003
25												
30												

CONTRACTOR Boart Longyear
EQUIPMENT
DRILL MTHD Rotasonic
DIAMETER 6-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697811.123
EASTING 2474533.552
ANGLE Vertical

REMARKS: Surface completion monument extends approximately 3 feet above ground.

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

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Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

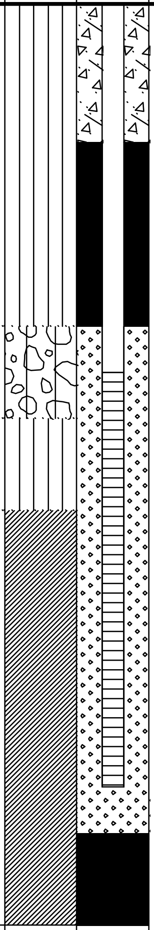
BOREHOLE LOG

BORING PM-20 **SHEET** 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT NUMBER

ELEVATION DATA:
GROUND SURF. 2027.7
TOP OF CASING
DATUM

DEPTH (ft)	MATERIAL DESCRIPTION	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	COMMENTS
0	SILT (ML): brown; dry; organics			Began drilling at 1045 on 17 July 2003
2.5	@ 2.5' - becomes moist; increase in fine to large gravel and cobbles		2025	
5				
7	GRAVEL (GM): gray-brown; wet; silt (20,0,80)		2020	
9	SILT (ML): brown; moist; large gravel			
10				
11	CLAY (CL): gray; moist			pH level at 8.0
			2015	
15				
			2010	
20				Completed borehole at 1330 on 17 July 2003
25				
30				

SAMPLES: NUMBER | TYPE | BLOWS PER 6" | RECOVERY (%) | PID READING (ppm) | TIME



CONTRACTOR Boart Longyear
EQUIPMENT
DRILL MTHD Rotasonic
DIAMETER 8-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697655.301
EASTING 2474596.773
ANGLE Vertical

REMARKS: Surface completion monument extends approximately 3 feet above ground.

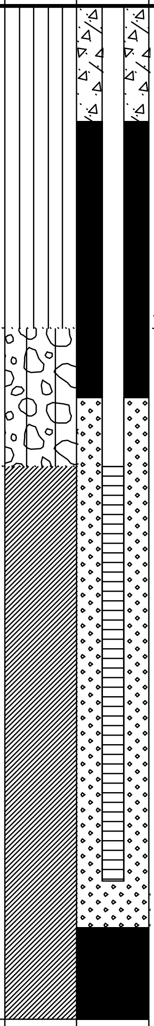
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

GEOSYNTEC CONSULTANTS
2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING PM-21 **SHEET** 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT NUMBER
ELEVATION DATA:
GROUND SURF. 2027.92
TOP OF CASING
DATUM



DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS PER 6"	SAMPLES RECOVERY (%)	SAMPLES PID READING (ppm)	SAMPLES TIME	COMMENTS
	SILT (ML): brown; dry; gravel (80,0,20)											Began drilling at 1400 on 17 July 2003
	@ 1' - increase in organics; no gravel											
					2025							
	@ 4' - increase in sand; decrease in organics											
5												
	GRAVEL (GM): gray-brown; wet; silt (25,0,75)			∇ Encountered 1st groundwater at 7 ft-bgs on 17 July 2003	2020							
10	CLAY (CL): gray; wet											
					2015							
15												
					2010							
20												
												Completed borehole at 1700 on 17 July 2003
25												
30												

CONTRACTOR Boart Longyear
EQUIPMENT
DRILL MTHD Rotasonic
DIAMETER 8-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697560.358
EASTING 2474599.205
ANGLE Vertical

REMARKS: Well is completed in a flush-mounted vault

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

GEOSYNTEC CONSULTANTS

2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

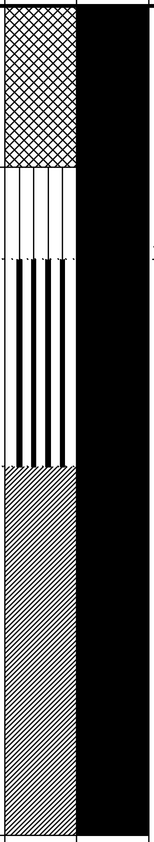
GS FORM:
WELL BORE

BOREHOLE LOG

BORING FSB-01 **SHEET** 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT NUMBER

ELEVATION DATA:
GROUND SURF. 2031
TOP OF CASING
DATUM

DEPTH (ft)	MATERIAL DESCRIPTION	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS PER 6"	SAMPLES RECOVERY (%)	SAMPLES PID READING (ppm)	SAMPLES TIME	COMMENTS
	ARTIFICAL FILL: brown; dry		2030							Began drilling at 0920 on 15 July 2003
	SILT (ML): brown; moist									
5	Sandy SILT (MH): brown; moist; sand; large gravel (well graded); some cobbles	∇ Encountered 1st groundwater at 5.5 ft-bgs on 15 July 2003	2025							pH level at 12
10	CLAY (CL): gray; wet		2020							pH level at 10.5
15			2015							
										Completed borehole at 1010 on 15 July 2003
20										
25										
30										



CONTRACTOR Boart Longyear
EQUIPMENT
DRILL MTHD Rotasonic
DIAMETER 6-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697539.090
EASTING 2474495.310
ANGLE Vertical

REMARKS: Investigative soil boring.

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

WELL_BORE METFALHR0196_03.GPJ GEOSNTEC.GDT 19/5/05

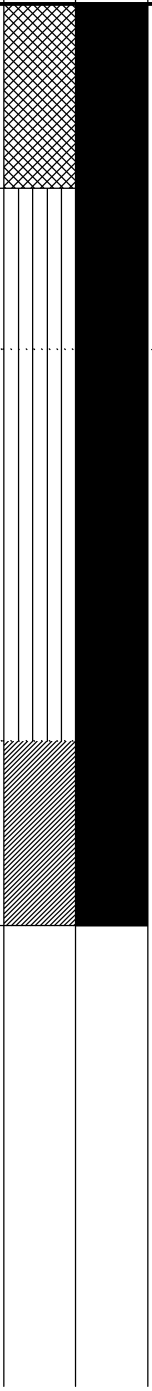
GEOSYNTEC CONSULTANTS

2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING	FSB-02	**SHEET**	1 **OF** 1
START DRILL DATE		**ELEVATION DATA:**	
FINISH DRILL DATE		**GROUND SURF.**	2035.5
LOCATION	Metaline Falls, Washington	**TOP OF CASING**	
PROJECT NUMBER		**DATUM**	



DEPTH (ft)	MATERIAL DESCRIPTION	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS PER 6"	SAMPLES RECOVERY (%)	SAMPLES PID READING (ppm)	SAMPLES TIME	COMMENTS
	ARTIFICAL FILL: brown; dry		2035							Began drilling at 1435 on 15 July 2003
	SILT (ML): gray; moist; large gravel									
5			2030							
	SILT (ML): wet; gravel (75,0,25)	▽ Encountered 1st groundwater at 7.5 ft-bgs on 15 July 2003								
10			2025							
										pH level at 8.0
15			2020							
	CLAY (CL): gray; wet									
20										Completed borehole at 1510 on 15 July 2003
25										
30										

CONTRACTOR	Boart Longyear	**NORTHING**	697378.740
EQUIPMENT		**EASTING**	2474656.280
DRILL MTHD	Rotasonic	**ANGLE**	Vertical
DIAMETER	6-inch		
LOGGER	B. Petty	**REVIEWER**	

REMARKS: Investigative soil boring.

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

WELL_BORE METFALHR0196_03.GPJ GEOSNTEC.GDT 19/5/05

GEOSYNTEC CONSULTANTS

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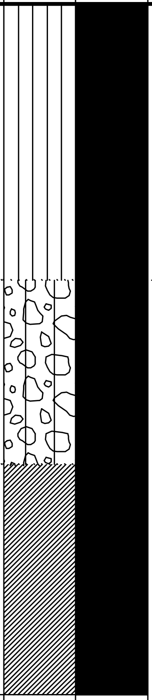
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING FSB-03 **SHEET** 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT NUMBER

ELEVATION DATA:
GROUND SURF. 2028
TOP OF CASING
DATUM



DEPTH (ft)	MATERIAL DESCRIPTION	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS PER 6"	SAMPLES RECOVERY (%)	SAMPLES PID READING (ppm)	SAMPLES TIME	COMMENTS
	SILT (ML): brown; dry									Began drilling at 1600 on 15 July 2003
			2025							
	@ 4' - becomes moist									
5										
	GRAVEL (GM): gray; wet; silt (25,0,75)	∇ Encountered 1st groundwater at 6 ft-bgs on 15 July 2003								
										pH level at 11.0
			2020							
10	CLAY (CL): gray; wet									
										pH level at 10.0
			2015							
15										Completed borehole at 1630 on 15 July 2003
20										
25										
30										

CONTRACTOR Boart Longyear
EQUIPMENT
DRILL MTHD Rotasonic
DIAMETER 6-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697526.350
EASTING 2474623.410
ANGLE Vertical

REMARKS: Investigative soil boring.

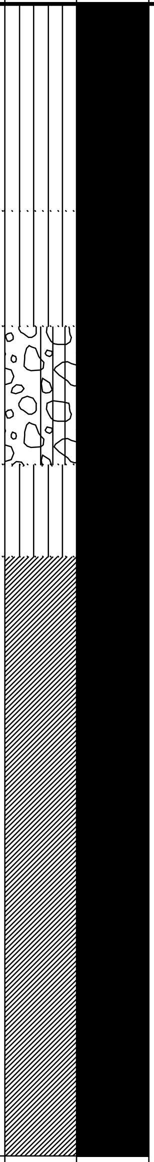
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

GEOSYNTEC CONSULTANTS
2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING	FSB-04	**SHEET**	1 **OF** 1
START DRILL DATE		**ELEVATION DATA:**	
FINISH DRILL DATE		**GROUND SURF.**	2029.96
LOCATION	Metaline Falls, Washington	**TOP OF CASING**	
PROJECT NUMBER		**DATUM**	



DEPTH (ft)	MATERIAL DESCRIPTION	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES NUMBER	TYPE	BLOWS PER 6"	RECOVERY (%)	PID READING (ppm)	TIME	COMMENTS
	SILT (ML): brown; dry; organics; large gravel	Temporary well: 3/4-inch PVC to 13 ft-bgs pH level at 8.03								Began drilling at 1220 on 16 July 2003
										Retry at 1235 due to refusal @ 3'
5	SILT (ML): brown; moist		2025							Retry at 1300 due to refusal @ 5.5'
	SILT and GRAVEL (GP-GM): gray-brown; moist; cobbles (50,0,50)									
10	SILT (ML): gray; moist		2020							
	CLAY (CL): gray; moist									
15			2015							
20			2010							
25			2005							Completed borehole at 1510 on 16 July 2003
30										

CONTRACTOR	Boart Longyear	**NORTHING**	697645.080
EQUIPMENT		**EASTING**	2474482.010
DRILL MTHD	Rotasonic	**ANGLE**	Vertical
DIAMETER	8-inch		
LOGGER	B. Petty	**REVIEWER**	

REMARKS: Investigative soil boring.

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

GEOSYNTEC CONSULTANTS

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Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING FSB-05 **SHEET** 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT NUMBER

ELEVATION DATA:
GROUND SURF. 2029.5
TOP OF CASING
DATUM

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES NUMBER	TYPE	BLOWS PER 6"	RECOVERY (%)	PID READING (ppm)	TIME	COMMENTS
	SILT (ML): brown; dry; organics											Began drilling at 1530 on 16 July 2003
	SILT (ML): brown; dry; fine to large gravel				2025							
5												
	Silty GRAVEL (GM): brown; moist; small cobbles				2020							
10	CLAY (CL): gray; wet			∇ Encountered 1st groundwater at 10 ft-bgs on 16 July 2003								
					2015							
15	SILT (ML): brown; wet; small cobbles (50,0,50)											pH level at 10.5
												pH level at 9.0
	@ 17.5' - decrease in cobbles											
	CLAY (CL): gray; wet				2010							
20												
					2005							
25												Completed borehole at 1655 on 16 July 2003
30												

CONTRACTOR Boart Longyear
EQUIPMENT
DRILL MTHD Rotasonic
DIAMETER 8-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697656.080
EASTING 2474540.640
ANGLE Vertical

REMARKS: Investigative soil boring.

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

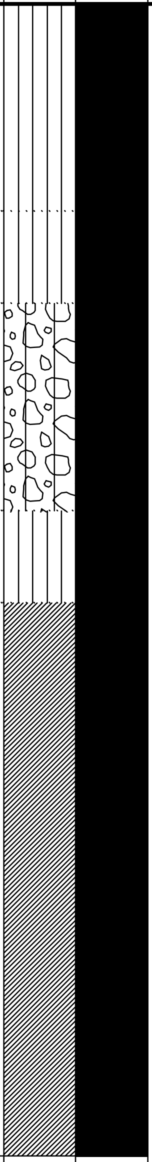
GEOSYNTEC CONSULTANTS

2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING	FSB-06	**SHEET** 1 **OF** 1	
START DRILL DATE		**ELEVATION DATA:**	
FINISH DRILL DATE		**GROUND SURF.**	2028.51
LOCATION	Metaline Falls, Washington	**TOP OF CASING**	
PROJECT NUMBER		**DATUM**	



DEPTH (ft)	MATERIAL DESCRIPTION	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES NUMBER	TYPE	BLOWS PER 6"	RECOVERY (%)	PID READING (ppm)	TIME	COMMENTS
	SILT (ML): brown; dry; organics; trace gravel	Temporary well: 3/4-inch PVC to 11 ft-bgs pH level at 9.78								Began drilling at 1700 on 16 July 2003
			2025							
5	SILT (ML): brown; moist									
	Silty GRAVEL (GM): brown; dry; cobbles (40,0,70)									
			2020							
10										
	SILT (ML): gray; moist									
	CLAY (CL): gray; moist		2015							
15										
			2010							
20										
			2005							
25										Completed borehole at 0930 on 17 July 2003
30										

CONTRACTOR	Boart Longyear	**NORTHING**	697747.520
EQUIPMENT		**EASTING**	2474536.300
DRILL MTHD	Rotasonic	**ANGLE**	Vertical
DIAMETER	8-inch		
LOGGER	B. Petty	**REVIEWER**	

REMARKS: Investigative soil boring.

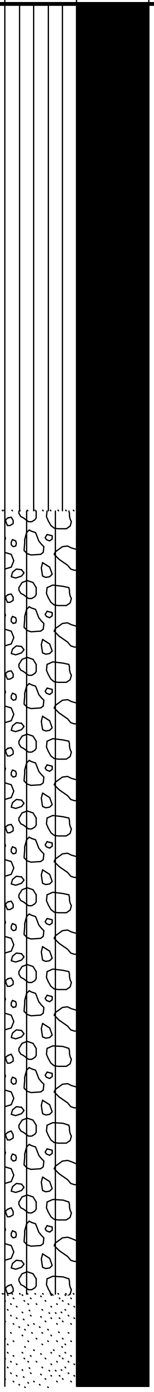
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

GEOSYNTEC CONSULTANTS
2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING FSP-01 **SHEET** 1 **OF** 2
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT NUMBER
ELEVATION DATA:
GROUND SURF. 2037
TOP OF CASING
DATUM



DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES						COMMENTS
						NUMBER	TYPE	BLOWS PER 6"	RECOVERY (%)	PID READING (ppm)	TIME	
	SILT (ML): brown; dry; organics			Temporary well: 3/4-inch PVC to 17 ft-bgs Groundwater not encountered								Began drilling at 0715 on 15 July 2003
					2035							
5												
	@ 7' - becomes moist; increase in gravel; decrease in organics				2030							
10												
	Silty GRAVEL (GM): brown; moist; (50,0,50)				2025							
												pH level at 8.5
15												
					2020							
20												
					2015							
												pH level at 9.5
25												
					2010							
	SAND (SP): brown-gray; moist; fine-grained sand											pH level at 9.5
30												

CONTRACTOR Cascade
EQUIPMENT Geoprobe
DRILL MTHD Direct Push
DIAMETER 1.5-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697739.210
EASTING 2474393.990
ANGLE Vertical

REMARKS: Backfilled with bentonite

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

GEOSYNTEC CONSULTANTS

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GS FORM:
WELL BORE

BOREHOLE LOG

BORING FSP-01 **SHEET** 2 **OF** 2
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT NUMBER

ELEVATION DATA:
GROUND SURF. 2037
TOP OF CASING
DATUM

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES NUMBER	TYPE	BLOWS PER 6"	RECOVERY (%)	PID READING (ppm)	TIME	COMMENTS
		▨	■		2005							Completed borehole at 0935 on 15 July 2003
35												
40												
45												
50												
55												
60												

CONTRACTOR Cascade
EQUIPMENT Geoprobe
DRILL MTHD Direct Push
DIAMETER 1.5-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697739.210
EASTING 2474393.990
ANGLE Vertical

REMARKS: Backfilled with bentonite

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

GEOSYNTEC CONSULTANTS

2100 Main Street, Suite 150
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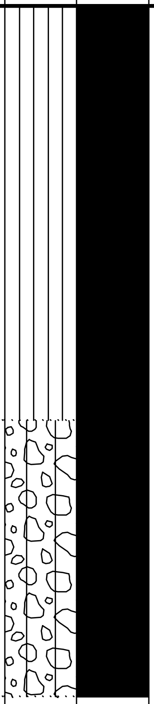
GS FORM:
WELL BORE

BOREHOLE LOG

BORING FSP-02 **SHEET** 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT NUMBER

ELEVATION DATA:
GROUND SURF. 2037
TOP OF CASING
DATUM



DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES NUMBER	TYPE	BLOWS PER 6"	RECOVERY (%)	PID READING (ppm)	TIME	COMMENTS
	SILT (ML): brown; dry; organics											Began drilling at 0915 on 15 July 2003
	@ 1' - decrease in organics											
					2035							
5												
					2030							pH level at 8.0
	Silty GRAVEL (GM): brown-gray; moist											
10												
				Temporary screen from 12 to 16 ft-bgs pH level at 11.5	2025							
15												pH level at 7.5 Completed borehole at 0950 on 15 July 2003
20												
25												
30												

CONTRACTOR Cascade
EQUIPMENT Geoprobe
DRILL MTHD Direct Push
DIAMETER 1.5-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697681.460
EASTING 2474394.750
ANGLE Vertical

REMARKS: Backfilled with bentonite

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

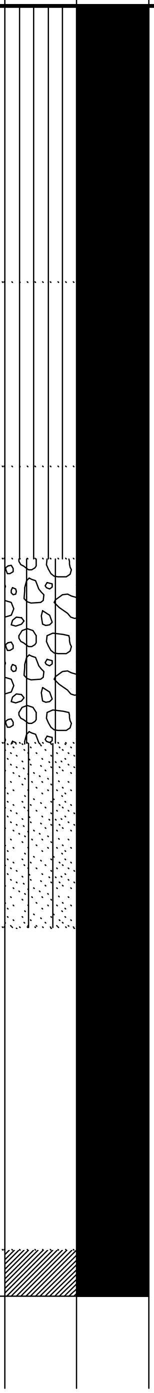
GEOSYNTEC CONSULTANTS
2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING FSP-03 **SHEET** 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT NUMBER

ELEVATION DATA:
GROUND SURF. 2036
TOP OF CASING
DATUM



DEPTH (ft)	MATERIAL DESCRIPTION	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS PER 6"	SAMPLES RECOVERY (%)	SAMPLES PID READING (ppm)	SAMPLES TIME	COMMENTS
	SILT (ML): brown; dry; organics @ 1' - decrease in organics		2035							Began drilling at 1000 on 15 July 2003
5										
	SILT (ML): gray-brown; dry; gravel		2030							
10	SILT (ML): brown; moist @ 11' - color change to light gray; becomes dry; increase in gravel		2025							
	Silty GRAVEL (GM): brown; moist; (50,0,50)									
15										
	SAND (SM): brown; wet; fine-grained sand; silt (25,75,0)	Temporary screen from 16 to 20 ft-bgs pH level at 12.0	2020							
20	SILT and SAND (ML-SP): gray; wet (50,50,0)		2015							pH level at 12.0
										pH level at 12.0
25			2010							
	CLAY (CL): gray; wet; silt									
										pH level at 9.5 Completed borehole at 1105 on 15 July 2003
30										

CONTRACTOR Cascade
EQUIPMENT Geoprobe
DRILL MTHD Direct Push
DIAMETER 1.5-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697636.550
EASTING 2474400.770
ANGLE Vertical

REMARKS: Backfilled with bentonite

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

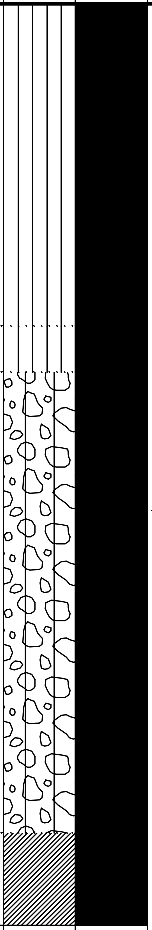
GEOSYNTEC CONSULTANTS

2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING	FSP-04	**SHEET** 1 **OF** 1	
START DRILL DATE		**ELEVATION DATA:**	
FINISH DRILL DATE		**GROUND SURF.**	2036
LOCATION	Metaline Falls, Washington	**TOP OF CASING**	
PROJECT NUMBER		**DATUM**	



DEPTH (ft)	MATERIAL DESCRIPTION	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES NUMBER	TYPE	BLOWS PER 6"	RECOVERY (%)	PID READING (ppm)	TIME	COMMENTS
	SILT (ML): brown; dry; organics	No groundwater due to hole collapse	2035							Began drilling at 1115 on 15 July 2003
	@ 1' - becomes moist; decrease in organics									
5			2030							
	SILT (ML): dark gray; dry; gravel									
	Silty GRAVEL (GM): brown; dry; (50,0,50)									pH level at 7.0
10		∇ Encountered 1st groundwater at 11 ft-bgs on 15 July 2003	2025							
	@ 11' - becomes wet									
15			2020							pH level at 13.0
	CLAY (CL): gray; wet									
20										pH level at 13.0 Completed borehole at 1140 on 15 July 2003
25										
30										

CONTRACTOR	Cascade	**NORTHING**	697582.860
EQUIPMENT	Geoprobe	**EASTING**	2474411.960
DRILL MTHD	Direct Push	**ANGLE**	Vertical
DIAMETER	1.5-inch		
LOGGER	B. Petty	**REVIEWER**	

REMARKS: Backfilled with bentonite

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

GEOSYNTEC CONSULTANTS

2100 Main Street, Suite 150
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Phone: (714) 969-0800

GS FORM:
WELL BORE

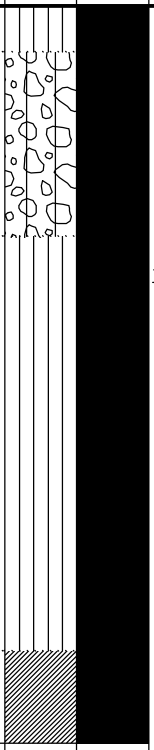
BOREHOLE LOG

BORING FSP-05 **SHEET** 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT
NUMBER

ELEVATION DATA:
GROUND SURF. 2036
TOP OF CASING
DATUM

DEPTH (ft)	MATERIAL DESCRIPTION	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES						COMMENTS
				NUMBER	TYPE	BLOWS PER 6"	RECOVERY (%)	PID READING (ppm)	TIME	
	SILT (ML): brown; dry; organics									Began drilling at 1200 on 15 July 2003
	Silty GRAVEL (GM): brown; moist; (40,0,60)		2035							
5	SILT (ML): brown-gray; wet; gravel (75,0,25)									
		∇ Encountered 1st groundwater at 6 ft-bgs on 15 July 2003	2030							
10		Temporary screen from 10 to 14 ft-bgs pH level at 12.5	2025							pH level at 10.0
										pH level at 12.5
	CLAY (CL): gray; wet									
15			2020							Completed borehole at 1255 on 15 July 2003
20										
25										
30										

SYMBOLIC LOG / WELL LOG



CONTRACTOR Cascade
EQUIPMENT Geoprobe
DRILL MTHD Direct Push
DIAMETER 1.5-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697552.140
EASTING 2474417.780
ANGLE Vertical

REMARKS: Backfilled with bentonite

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

GEOSYNTEC CONSULTANTS

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Phone: (714) 969-0800

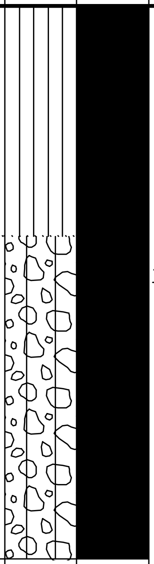
GS FORM:
WELL BORE

BOREHOLE LOG

BORING FSP-06 **SHEET** 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT NUMBER

ELEVATION DATA:
GROUND SURF. 2036
TOP OF CASING
DATUM

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES						COMMENTS
						NUMBER	TYPE	BLOWS PER 6"	RECOVERY (%)	PID READING (ppm)	TIME	
	SILT (ML): brown; dry; organics											Began drilling at 1215 on 15 July 2003
	@ 1' - becomes moist				2035							
5	GRAVEL (GM): gray; wet; silt (25,0,75)											
				∇ Encountered 1st groundwater at 6 ft-bgs on 15 July 2003	2030							
				Temporary screen from 8 to 12 ft-bgs pH level at 13.0								pH level at 11.0
10												pH level at 11.0
					2025							
												Completed borehole at 1305 on 15 July 2003
15												
20												
25												
30												



CONTRACTOR	Cascade	**NORTHING**	697527.640
EQUIPMENT	Geoprobe	**EASTING**	2474424.870
DRILL MTHD	Direct Push	**ANGLE**	Vertical
DIAMETER	1.5-inch		
LOGGER	B. Petty	**REVIEWER**	

REMARKS: Backfilled with bentonite

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

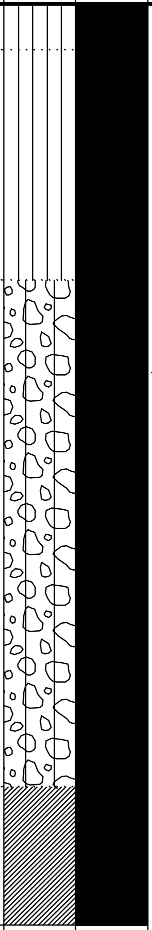
GEOSYNTEC CONSULTANTS
2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING FSP-07 **SHEET** 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT
NUMBER

ELEVATION DATA:
GROUND SURF. 2036
TOP OF CASING
DATUM



DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES						COMMENTS
						NUMBER	TYPE	BLOWS PER 6"	RECOVERY (%)	PID READING (ppm)	TIME	
	SILT (ML): brown; dry				2035							Began drilling at 1315 on 15 July 2003
	SILT (ML): brown-gray; moist; gravel (75,0,25)											
5												
	GRAVEL (GM): gray; wet; silt (25,0,75)				2030							
				∇ Encountered 1st groundwater at 8 ft-bgs on 15 July 2003								
10												pH level at 8.5
					2025							
												pH level at 12.0
15				Temporary screen from 15 to 19 ft-bgs pH level at 13.0	2020							
	CLAY (CL): gray; wet											
20												pH level at 9.5 Completed borehole at 1340 on 15 July 2003
25												
30												

CONTRACTOR Cascade
EQUIPMENT Geoprobe
DRILL MTHD Direct Push
DIAMETER 1.5-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697503.790
EASTING 2474433.250
ANGLE Vertical

REMARKS: Backfilled with bentonite

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

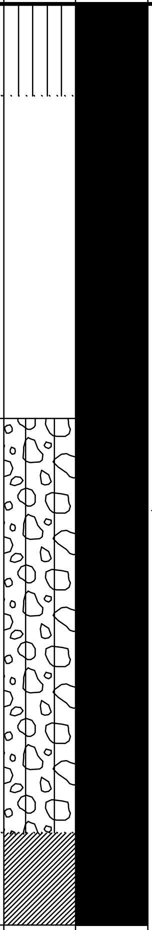
GEOSYNTEC CONSULTANTS
2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING FSP-08 **SHEET** 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT NUMBER

ELEVATION DATA:
GROUND SURF. 2035.5
TOP OF CASING
DATUM



DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES						COMMENTS
						NUMBER	TYPE	BLOWS PER 6"	RECOVERY (%)	PID READING (ppm)	TIME	
	SILT (ML): grown; dry; organics			Temporary well: 3/4-inch PVC to 7 ft-bgs Dry	2035							Began drilling at 1400 on 15 July 2003
5					2030							
	GRAVEL (GM): gray-brown; wet; silt (10,0,90)											
10				▽ Encountered 1st groundwater at 11 ft-bgs on 15 July 2003	2025							pH level at 8.5
15					2020							pH level at 12.5
	CLAY (CL): gray; wet											
20												pH level at 12.5 Completed borehole on 15 July 2003
25												
30												

CONTRACTOR	Cascade	**NORTHING**	697468.990
EQUIPMENT	Geoprobe	**EASTING**	2474449.370
DRILL MTHD	Direct Push	**ANGLE**	Vertical
DIAMETER	1.5-inch		
LOGGER	B. Petty	**REVIEWER**	

REMARKS: Backfilled with bentonite

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

WELL_BORE METFALHR0196_03.GPJ GEOSNTEC.GDT 19/5/05

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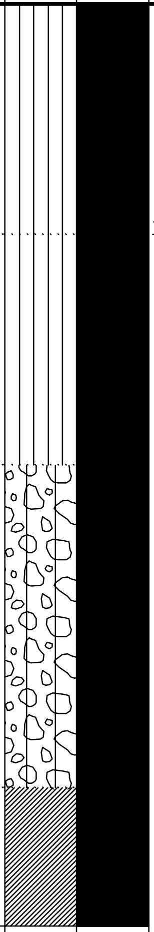
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING	FSP-09	**SHEET**	1 **OF** 1
START DRILL DATE		**ELEVATION DATA:**	
FINISH DRILL DATE		**GROUND SURF.**	2030
LOCATION	Metaline Falls, Washington	**TOP OF CASING**	
PROJECT NUMBER		**DATUM**	



DEPTH (ft)	MATERIAL DESCRIPTION	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES NUMBER	TYPE	BLOWS PER 6"	RECOVERY (%)	PID READING (ppm)	TIME	COMMENTS
	SILT (ML): brown; dry; organics @ 1' - becomes moist; decrease in organics	No groundwater sampled due to small volume								Began drilling at 1430 on 15 July 2003
5	SILT (ML): gray-brown; wet; gravel (80,0,20)	∇ Encountered 1st groundwater at 5 ft-bgs on 15 July 2003	2025							
										pH level at 8.5
10	GRAVEL (GM): gray-brown; wet; silt (10,0,90)		2020							
										pH level at 9.5
15			2015							
										pH level at 11.0
	CLAY (CL): gray; wet									
20			2010							Completed borehole at 1515 on 15 July 2003
25										
30										

CONTRACTOR	Cascade	**NORTHING**	697404.530
EQUIPMENT	Geoprobe	**EASTING**	2474483.530
DRILL MTHD	Direct Push	**ANGLE**	Vertical
DIAMETER	1.5-inch		
LOGGER	B. Petty	**REVIEWER**	

REMARKS: Backfilled with bentonite

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

GEOSYNTEC CONSULTANTS

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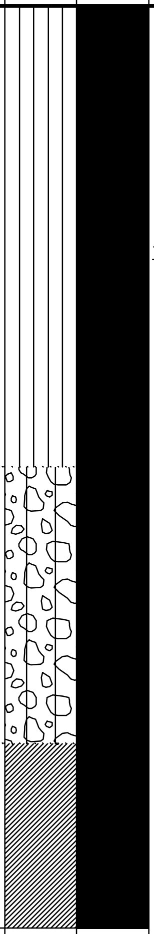
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING FSP-10 **SHEET** 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT NUMBER
ELEVATION DATA:
GROUND SURF. 2030
TOP OF CASING
DATUM



DEPTH (ft)	MATERIAL DESCRIPTION	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS PER 6"	SAMPLES RECOVERY (%)	SAMPLES PID READING (ppm)	SAMPLES TIME	COMMENTS
	SILT (ML): brown; dry									Began drilling at 1530 on 15 July 2003
	@ 1' - becomes moist									
5	@ 5' - color change to gray; becomes wet	∇ Encountered 1st groundwater at 5.5 ft-bgs on 15 July 2003	2025							
										pH level at 9.0
10	Silty GRAVEL (GM): gray-brown; wet		2020							
		Temporary screen from 12 to 16 ft-bgs pH level at 8.75								
15			2015							pH level at 9.0
	CLAY (CL): gray; wet									
20			2010							Completed borehole at 1600 on 15 July 2003
25										
30										

CONTRACTOR Cascade
EQUIPMENT Geoprobe
DRILL MTHD Direct Push
DIAMETER 1.5-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697335.560
EASTING 2474542.830
ANGLE Vertical

REMARKS: Backfilled with bentonite

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

GEOSYNTEC CONSULTANTS

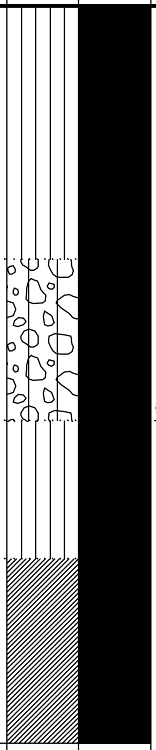
2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING FSP-11 **SHEET** 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT NUMBER

ELEVATION DATA:
GROUND SURF. 2029
TOP OF CASING
DATUM



DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES						COMMENTS
						NUMBER	TYPE	BLOWS PER 6"	RECOVERY (%)	PID READING (ppm)	TIME	
	SILT (ML): brown; dry; gravel (75,0,25)			No groundwater sampled due to hole collapse								Began drilling at 1615 on 15 July 2003
					2025							
5												
	Silty GRAVEL (GM): gray; dry; (50,0,50)											
					2020							
	Sandy SILT (ML): gray-brown; wet; gravel (50,40,10)			∇ Encountered 1st groundwater at 9 ft-bgs on 15 July 2003								
10												
												pH level at 12.0
	CLAY (CL): gray; wet											
					2015							
15												
												Completed borehole at 1700 on 15 July 2003
20												
25												
30												

CONTRACTOR Cascade
EQUIPMENT Geoprobe
DRILL MTHD Direct Push
DIAMETER 1.5-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697824.020
EASTING 2474552.920
ANGLE Vertical

REMARKS: Backfilled with bentonite

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

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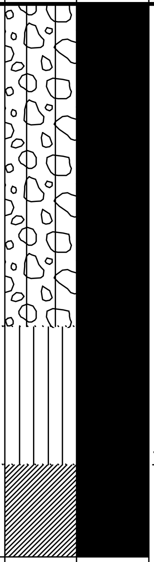
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING FSP-12
SHEET 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT NUMBER
ELEVATION DATA:
GROUND SURF. 2028
TOP OF CASING
DATUM



DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES NUMBER	TYPE	BLOWS PER 6"	RECOVERY (%)	PID READING (ppm)	TIME	COMMENTS
	SILT-SAND-GRAVEL (GM): brown; dry; organics											Began drilling at 0700 on 16 July 2003
					2025							
5												
	Gravelly SILT (ML): brown; moist; (60,0,40)											
				Temporary screen from 8 to 12 ft-bgs pH level at 11.0	2020							
10	CLAY (CL): gray; wet			▽Encountered 1st groundwater at 6 ft-bgs on 16 July 2003								pH level at 10.5
												Completed borehole at 0800 on 16 July 2003
15												
20												
25												
30												

CONTRACTOR Cascade
EQUIPMENT Geoprobe
DRILL MTHD Direct Push
DIAMETER 1.5-inch
LOGGER B. Petty **REVIEWER**
NORTHING 697792.220
EASTING 2474586.800
ANGLE Vertical

REMARKS: Backfilled with bentonite

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

GEOSYNTEC CONSULTANTS
2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING FSP-13
SHEET 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT
NUMBER
ELEVATION DATA:
GROUND SURF. 2028
TOP OF CASING
DATUM

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES						COMMENTS
						NUMBER	TYPE	BLOWS PER 6"	RECOVERY (%)	PID READING (ppm)	TIME	
	SILT (ML): brown; dry; organics											Began drilling at 0810 on 16 July 2003
					2025							Two samplers bent
5	SILT (ML): brown; moist; gravel (75,0,25)											
					2020							Completed borehole at 0830 on 16 July 2003
10												
15												
20												
25												
30												

CONTRACTOR Cascade
EQUIPMENT Geoprobe
DRILL MTHD Direct Push
DIAMETER 1.5-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697727.470
EASTING 2474591.010
ANGLE Vertical

REMARKS: Backfilled with bentonite

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

GEOSYNTEC CONSULTANTS

2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING FSP-14 **SHEET** 1 **OF** 1

START DRILL DATE

FINISH DRILL DATE

LOCATION Metaline Falls, Washington

PROJECT NUMBER

ELEVATION DATA:

GROUND SURF. 2028

TOP OF CASING

DATUM

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES NUMBER	TYPE	BLOWS PER 6"	RECOVERY (%)	PID READING (ppm)	TIME	COMMENTS
	SILT (ML): brown; dry; organics											Began drilling at 0835 on 16 July 2003
					2025							
												Refusal: no sample
5												
												Terminated borehole at 0900 on 16 July 2003 Bent two samplers Angled rods Damaged two sample tips
10												
15												
20												
25												
30												

CONTRACTOR Cascade

EQUIPMENT Geoprobe

DRILL MTHD Direct Push

DIAMETER 1.5-inch

LOGGER B. Petty **REVIEWER**

NORTHING 697693.950

EASTING 2474569.260

ANGLE Vertical

REMARKS: Backfilled with bentonite

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

GEOSYNTEC CONSULTANTS

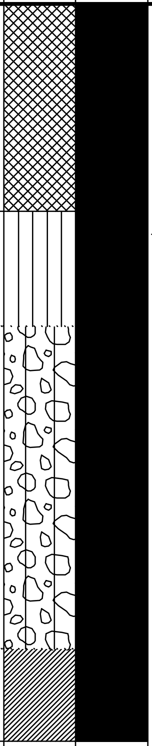
2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING FSP-15 **SHEET** 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT NUMBER

ELEVATION DATA:
GROUND SURF. 2031
TOP OF CASING
DATUM



DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES						COMMENTS
						NUMBER	TYPE	BLOWS PER 6"	RECOVERY (%)	PID READING (ppm)	TIME	
	ARTIFICAL FILL: Silt; gray and brown; dry; sand				2030							Began drilling at 0955 on 16 July 2003
5	SILT (ML): brown; wet; fine gravel (75,0,25)			∇ Encountered 1st groundwater at 5 ft-bgs on 16 July 2003	2025							
	GRAVEL (GM): gray; wet; silt; sand											pH level at 8.0
10					2020							
				Temporary screen from 12 to 16 ft-bgs pH level at 9.5								pH level at 8.5
	CLAY (CL): gray; wet											
15					2015							Completed borehole at 1040 on 16 July 2003
20												
25												
30												

CONTRACTOR Cascade
EQUIPMENT Geoprobe
DRILL MTHD Direct Push
DIAMETER 1.5-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697375.720
EASTING 2474564.440
ANGLE Vertical

REMARKS: Backfilled with bentonite

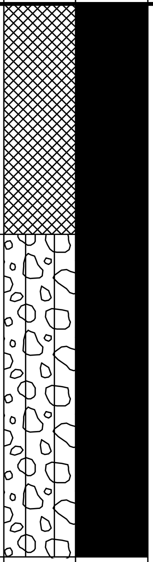
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

GEOSYNTEC CONSULTANTS
2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING	FSP-16	**SHEET**	1 **OF** 1
START DRILL DATE		**ELEVATION DATA:**	
FINISH DRILL DATE		**GROUND SURF.**	2031
LOCATION	Metaline Falls, Washington	**TOP OF CASING**	
PROJECT NUMBER		**DATUM**	



DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES						COMMENTS
						NUMBER	TYPE	BLOWS PER 6"	RECOVERY (%)	PID READING (ppm)	TIME	
	ARTIFICAL FILL: brown; dry; gravel; silt; sand				2030							Began drilling at 1050 on 16 July 2003
5	GRAVEL (GM): brown; wet; fine gravel; silt (20,0,80)				2025							
	@ 8' - becomes dry			Temporary screen from 8 to 12 ft-bgs pH level at 11.5								pH level at 8.5
10					2020							pH level at 11.0
												Completed borehole at 1120 on 16 July 2003
15												
20												
25												
30												

CONTRACTOR	Cascade	**NORTHING**	697418.690
EQUIPMENT	Geoprobe	**EASTING**	2474531.450
DRILL MTHD	Direct Push	**ANGLE**	Vertical
DIAMETER	1.5-inch		
LOGGER	B. Petty	**REVIEWER**	

REMARKS: Backfilled with bentonite

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

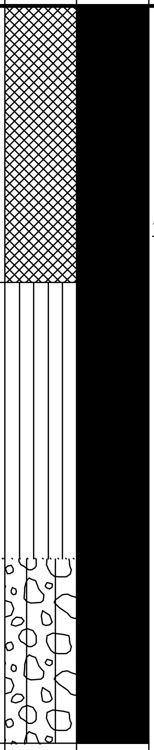
GEOSYNTEC CONSULTANTS
2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING FSP-17 **SHEET** 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT NUMBER

ELEVATION DATA:
GROUND SURF. 2034
TOP OF CASING
DATUM



DEPTH (ft)	MATERIAL DESCRIPTION	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES: NUMBER	TYPE	BLOWS PER 6"	RECOVERY (%)	PID READING (ppm)	TIME	COMMENTS
	ARTIFICAL FILL: brown; dry									Began drilling at 1130 on 16 July 2003
			2030							
5		∇ Encountered 1st groundwater at 5 ft-bgs on 16 July 2003								
	SILT (ML): dark brown; wet; very little gravel									
			2025							
10										pH level at 7.5
	Silty Sandy GRAVEL (GM): gray; wet	Temporary screen from 12 to 16 ft-bgs pH level at 7.0								
			2020							pH level at 8.5
15										
										Completed borehole at 1200 on 16 July 2003
20										
25										
30										

CONTRACTOR Cascade
EQUIPMENT Geoprobe
DRILL MTHD Direct Push
DIAMETER 1.5-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697382.610
EASTING 2474616.320
ANGLE Vertical

REMARKS: Backfilled with bentonite

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

GEOSYNTEC CONSULTANTS

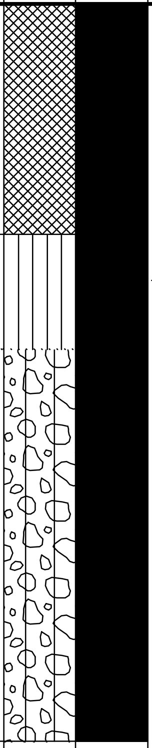
2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING FSP-18 **SHEET** 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT NUMBER

ELEVATION DATA:
GROUND SURF. 2032.5
TOP OF CASING
DATUM



DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES						COMMENTS
						NUMBER	TYPE	BLOWS PER 6"	RECOVERY (%)	PID READING (ppm)	TIME	
	ARTIFICAL FILL: brown; dry; silt; sand											Began drilling at 1220 on 16 July 2003
					2030							
5	SILT (ML): brown-gray; wet											
				∇ Encountered 1st groundwater at 6 ft-bgs on 16 July 2003								
					2025							
	GRAVEL (GM): gray; wet; silt											
10												pH level at 7.5
				Temporary screen from 12 to 16 ft-bgs pH level at 7.5	2020							
												pH level at 8.5
15												
												Completed borehole at 1300 on 16 July 2003
20												
25												
30												

CONTRACTOR Cascade
EQUIPMENT Geoprobe
DRILL MTHD Direct Push
DIAMETER 1.5-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697409.680
EASTING 2474589.890
ANGLE Vertical

REMARKS: Backfilled with bentonite

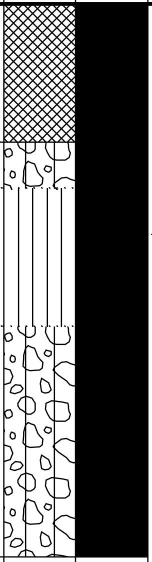
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

GEOSYNTEC CONSULTANTS
2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING FSP-19 **SHEET** 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT NUMBER
ELEVATION DATA:
GROUND SURF. 2032.5
TOP OF CASING
DATUM



DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES						COMMENTS
						NUMBER	TYPE	BLOWS PER 6"	RECOVERY (%)	PID READING (ppm)	TIME	
	ARTIFICAL FILL: brown; dry											Began drilling at 1310 on 16 July 2003
					2030							
	Silty GRAVEL (GM): light gray											
	Clayey SILT (ML): brown; wet											
5				∇ Encountered 1st groundwater at 5 ft-bgs on 16 July 2003								
	Silty GRAVEL (GM): gray; wet (50,0,50)				2025							
												pH level at 7.5
10												
				Temporary screen from 12 to 16 ft-bgs pH level at 7.5								Completed borehole at 1340 on 16 July 2003
15												
20												
25												
30												

CONTRACTOR Cascade
EQUIPMENT Geoprobe
DRILL MTHD Direct Push
DIAMETER 1.5-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697426.440
EASTING 2474573.770
ANGLE Vertical

REMARKS: Backfilled with bentonite

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

GEOSYNTEC CONSULTANTS

2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING FSP-20 **SHEET** 1 **OF** 1

START DRILL DATE

FINISH DRILL DATE

LOCATION Metaline Falls, Washington

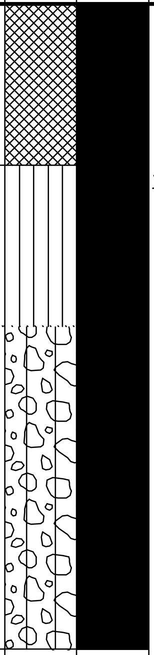
PROJECT NUMBER

ELEVATION DATA:

GROUND SURF. 2032

TOP OF CASING

DATUM



DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES NUMBER	TYPE	BLOWS PER 6"	RECOVERY (%)	PID READING (ppm)	TIME	COMMENTS
	ARTIFICAL FILL: brown; dry				2030							Began drilling at 1350 on 16 July 2003
5	SILT (ML): gray; wet			▽ Encountered 1st groundwater at 4 ft-bgs on 16 July 2003								
	Silty GRAVEL (GM): gray; wet; (30,0,70)				2025							pH level at 10.0
10				Temporary screen from 10 to 14 ft-bgs pH level at 9.60	2020							pH level at 11.5
15												Completed borehole at 1420 on 16 July 2003
20												
25												
30												

CONTRACTOR Cascade

EQUIPMENT Geoprobe

DRILL MTHD Direct Push

DIAMETER 1.5-inch

LOGGER B. Petty **REVIEWER**

NORTHING 697436.950

EASTING 2474564.050

ANGLE Vertical

REMARKS: Backfilled with bentonite

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

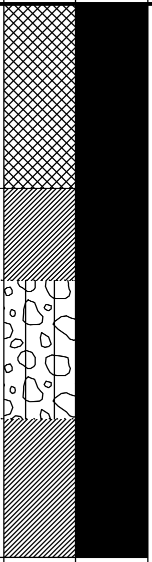
GEOSYNTEC CONSULTANTS

2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING FSP-21 **SHEET** 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT NUMBER
ELEVATION DATA:
GROUND SURF. 2030.78
TOP OF CASING
DATUM



DEPTH (ft)	MATERIAL DESCRIPTION	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS PER 6"	SAMPLES RECOVERY (%)	SAMPLES PID READING (ppm)	SAMPLES TIME	COMMENTS
	ARTIFICAL FILL: brown; dry		2030							Began drilling at 1500 on 16 July 2003
	@ 3' - becomes moist									
	Silty CLAY (CL): brown; wet									
5			2025							
	SANDY-SILTY-GRAVEL (GM)									
		Temporary screen from 8 to 12 ft-bgs pH level at 10.05								
	CLAY (CL): gray; wet									
10			2020							
										Completed borehole at 1600 on 16 July 2003
15										
20										
25										
30										

CONTRACTOR Cascade
EQUIPMENT Geoprobe
DRILL MTHD Direct Push
DIAMETER 1.5-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697467.300
EASTING 2474544.660
ANGLE Vertical

REMARKS: Backfilled with bentonite

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

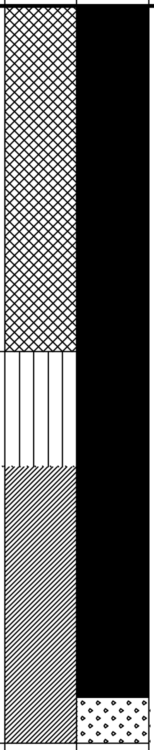
GEOSYNTEC CONSULTANTS

2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING	FSP-22	**SHEET** 1 **OF** 1	
START DRILL DATE		**ELEVATION DATA:**	
FINISH DRILL DATE		**GROUND SURF.**	2030
LOCATION	Metaline Falls, Washington	**TOP OF CASING**	
PROJECT NUMBER		**DATUM**	



DEPTH (ft)	MATERIAL DESCRIPTION	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES NUMBER	TYPE	BLOWS PER 6"	RECOVERY (%)	PID READING (ppm)	TIME	COMMENTS
	ARTIFICAL FILL: brown; dry									Began drilling at 0710 on 17 July 2003
5	@ 4.5' - becomes wet; some silt	Encountered 1st groundwater at 4 ft-bgs on 17 July 2003	2025							
	SILT (ML): gray									
10	CLAY (CL): gray; wet	Temporary screen from 10 to 14 ft-bgs pH level at 11.8	2020							
15		Native - hole collapse	2015							
										Completed borehole at 0735 on 17 July 2003
20										
25										
30										

CONTRACTOR	Cascade	**NORTHING**	697531.100
EQUIPMENT	Geoprobe	**EASTING**	2474519.880
DRILL MTHD	Direct Push	**ANGLE**	Vertical
DIAMETER	1.5-inch		
LOGGER	B. Petty	**REVIEWER**	

REMARKS: Backfilled with bentonite

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

WELL_BORE METFALHR0196_03.GPJ GEOSNTEC.GDT 19/5/05

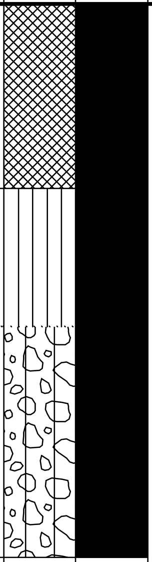
GEOSYNTEC CONSULTANTS

2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING	FSP-23	**SHEET**	1 **OF** 1
START DRILL DATE		**ELEVATION DATA:**	
FINISH DRILL DATE		**GROUND SURF.**	2031.59
LOCATION	Metaline Falls, Washington	**TOP OF CASING**	
PROJECT NUMBER		**DATUM**	



DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES						COMMENTS
						NUMBER	TYPE	BLOWS PER 6"	RECOVERY (%)	PID READING (ppm)	TIME	
	ARTIFICAL FILL: brown; dry			Temporary well: 3/4-inch PVC to 9 ft-bgs	2030							Began drilling at 0740 on 17 July 2003
5	SILT (ML): brown; wet			Encountered 1st groundwater at 4 ft-bgs on 17 July 2003	2025							
10	GRAVEL (GM): gray; wet; silt (25,0,75)				2020							
												Completed borehole at 0815 on 17 July 2003
15												
20												
25												
30												

CONTRACTOR	Cascade	**NORTHING**	697484.410
EQUIPMENT	Geoprobe	**EASTING**	2474500.040
DRILL MTHD	Direct Push	**ANGLE**	Vertical
DIAMETER	1.5-inch		
LOGGER	B. Petty	**REVIEWER**	

REMARKS: Backfilled with bentonite

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

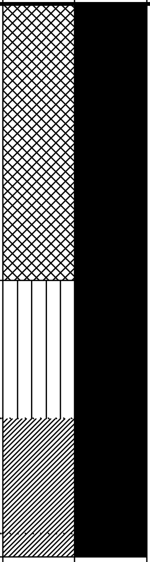
GEOSYNTEC CONSULTANTS

2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING	FSP-24	**SHEET**	1 **OF** 1
START DRILL DATE		**ELEVATION DATA:**	
FINISH DRILL DATE		**GROUND SURF.**	2033.5
LOCATION	Metaline Falls, Washington	**TOP OF CASING**	
PROJECT NUMBER		**DATUM**	



DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS PER 6"	SAMPLES RECOVERY (%)	SAMPLES PID READING (ppm)	SAMPLES TIME	COMMENTS
	ARTIFICAL FILL: brown; dry			Temporary well: 3/4-inch PVC to 12 ft-bgs								Began drilling at 0900 on 17 July 2003
					2030							
5												
	SILT (ML): gray; wet			∇ Encountered 1st groundwater at 7 ft-bgs on 17 July 2003 pH level at 7.41								
					2025							
	Silty CLAY (CL): gray-brown; wet											
10												
	CLAY (CL): gray; wet											
												Completed borehole at 0935 on 17 July 2003
15												
20												
25												
30												

CONTRACTOR	Cascade	**NORTHING**	697418.060
EQUIPMENT	Geoprobe	**EASTING**	2474637.590
DRILL MTHD	Direct Push	**ANGLE**	Vertical
DIAMETER	1.5-inch		
LOGGER	B. Petty	**REVIEWER**	

REMARKS: Backfilled with bentonite

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

GEOSYNTEC CONSULTANTS

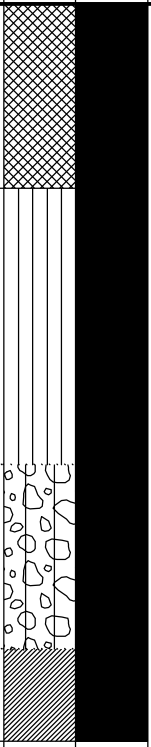
2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING FSP-25 **SHEET** 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT NUMBER

ELEVATION DATA:
GROUND SURF. 2033.5
TOP OF CASING
DATUM



DEPTH (ft)	MATERIAL DESCRIPTION	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS PER 6"	SAMPLES RECOVERY (%)	SAMPLES PID READING (ppm)	SAMPLES TIME	COMMENTS
	ARTIFICAL FILL: brown; dry									Began drilling at 1000 on 17 July 2003
			2030							
	SILT (ML): dark gray; wet									
5		Encountered 1st groundwater at 4.5 ft-bgs on 17 July 2003								
			2025							
10										pH level at 11.5
	GRAVEL (GM): gray; wet; silt	Temporary screen from 10 to 14 ft-bgs pH level at 12.0								
			2020							
	CLAY (CL): gray; wet									
15										
										Completed borehole at 1020 on 17 July 2003
20										
25										
30										

CONTRACTOR Cascade
EQUIPMENT Geoprobe
DRILL MTHD Direct Push
DIAMETER 1.5-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697478.010
EASTING 2474593.760
ANGLE Vertical

REMARKS: Backfilled with bentonite

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

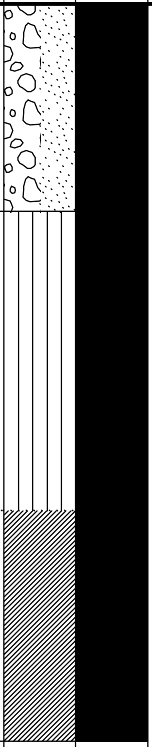
GEOSYNTEC CONSULTANTS
2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING FSP-26 **SHEET** 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT NUMBER

ELEVATION DATA:
GROUND SURF. 2031
TOP OF CASING
DATUM



DEPTH (ft)	MATERIAL DESCRIPTION	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES NUMBER	TYPE	BLOWS PER 6"	RECOVERY (%)	PID READING (ppm)	TIME	COMMENTS
	ARTIFICAL FILL: brown; dry		2030							Began drilling at 1130 on 17 July 2003
5	SILT (ML): gray-brown; wet	Encountered 1st groundwater at 5 ft-bgs on 17 July 2003	2025							
		Temporary screen from 8 to 12 ft-bgs pH level at 11.53								
10										pH level at 11.5
	CLAY (CL): gray; wet		2020							
15			2015							Completed borehole at 1200 on 17 July 2003
20										
25										
30										

CONTRACTOR Cascade
EQUIPMENT Geoprobe
DRILL MTHD Direct Push
DIAMETER 1.5-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697505.730
EASTING 2474575.710
ANGLE Vertical

REMARKS: Backfilled with bentonite

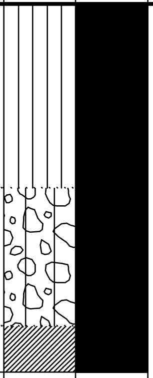
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

GEOSYNTEC CONSULTANTS
2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING FSP-27 **SHEET** 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT NUMBER
ELEVATION DATA:
GROUND SURF. 2027
TOP OF CASING
DATUM



DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES						COMMENTS
						NUMBER	TYPE	BLOWS PER 6"	RECOVERY (%)	PID READING (ppm)	TIME	
	SILT (ML): brown; dry; organics											Began drilling at 1220 on 17 July 2003
					2025							
	GRAVEL (GM): dark gray; silt (10,0,90)			Temporary screen from 4 to 8 ft-bgs pH level at 10.20								
5												
					2020							
	CLAY (CL): gray; wet											
				Encountered 1st groundwater at 7.5 ft-bgs on 17 July 2003								Completed borehole at 1252 on 17 July 2003
10												
15												
20												
25												
30												

CONTRACTOR Cascade
EQUIPMENT Geoprobe
DRILL MTHD Direct Push
DIAMETER 1.5-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697542.470
EASTING 2474626.630
ANGLE Vertical

REMARKS: Backfilled with bentonite

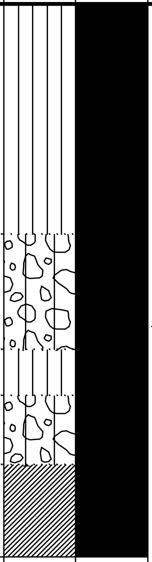
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

GEOSYNTEC CONSULTANTS
2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING FSP-28 **SHEET** 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT NUMBER
ELEVATION DATA:
GROUND SURF. 2027
TOP OF CASING
DATUM



DEPTH (ft)	MATERIAL DESCRIPTION	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	COMMENTS
	SILT (ML): brown; dry; organics			Began drilling at 1320 on 17 July 2003
			2025	
5	GRAVEL (GM): gray; wet; fine gravel; some silt			
		∇ Encountered 1st groundwater at 7 ft-bgs on 17 July 2003 Temporary screen from 8 to 12 ft-bgs pH level at 10.48	2020	
	SILT (ML): light gray; wet			
	GRAVEL (GM): gray; wet; fine gravel; some silt			
10	CLAY (CL): gray; wet			
			2015	Completed borehole at 1400 on 17 July 2003
15				
20				
25				
30				

SAMPLES: NUMBER | TYPE | BLOWS PER 6" | RECOVERY (%) | PID READING (ppm) | TIME

CONTRACTOR Cascade
EQUIPMENT Geoprobe
DRILL MTHD Direct Push
DIAMETER 1.5-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697513.460
EASTING 2474664.660
ANGLE Vertical

REMARKS: Backfilled with bentonite

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

GEOSYNTEC CONSULTANTS

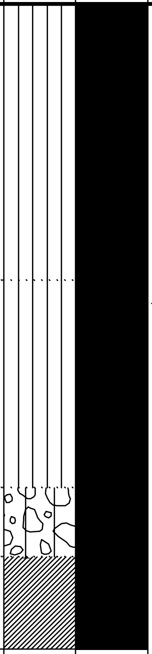
2100 Main Street, Suite 150
Huntington Beach, CA 92648
Phone: (714) 969-0800

GS FORM:
WELL BORE

BOREHOLE LOG

BORING FSP-29 **SHEET** 1 **OF** 1
START DRILL DATE
FINISH DRILL DATE
LOCATION Metaline Falls, Washington
PROJECT NUMBER

ELEVATION DATA:
GROUND SURF. 2027
TOP OF CASING
DATUM



DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	STRUCTURE/ GROUNDWATER	ELEVATION (ft)	SAMPLES NUMBER	TYPE	BLOWS PER 6"	RECOVERY (%)	PID READING (ppm)	TIME	COMMENTS
	SILT (ML): brown; dry; gravel (75,0,25)											Began drilling at 1400 on 17 July 2003
					2025							
5												
	Clayey SILT (ML): brown-gray; wet			▽ Encountered 1st groundwater at 6.5 ft-bgs on 17 July 2003	2020							
10	GRAVEL (GM): gray; wet; silt (20,0,80)			Temporary screen from 10 to 14 ft-bgs pH level at 8.36								
	CLAY (CL): gray; wet				2015							
												Completed borehole at 1435 on 17 July 2003
15												
20												
25												
30												

CONTRACTOR Cascade
EQUIPMENT Geoprobe
DRILL MTHD Direct Push
DIAMETER 1.5-inch
LOGGER B. Petty **REVIEWER**

NORTHING 697479.940
EASTING 2474687.220
ANGLE Vertical

REMARKS: Backfilled with bentonite

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

APPENDIX D

RESPONSE TO ECOLOGY COMMENTS ON THE FEASIBILITY STUDY TECHNICAL MEMORANDUM

REVISED DRAFT FEASIBILITY STUDY TECHNICAL REPORT
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

APPENDIX D
RESPONSE TO ECOLOGY COMMENTS ON THE FEASIBILITY STUDY TECHNICAL MEMORANDUM
LEHIGH CEMENT COMPANY
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

GENERAL COMMENTS

ECOLOGY COMMENT	RESPONSE
Comment 1: *A permanent remedy must be included in the alternatives that are evaluated for cleanup. The dismissal of CKD pile removal or partial removal as being disproportionate is premature. A disproportionate conclusion has to be demonstrated through a more thorough analysis following the process described in WAC 173-340-360(3) (e) (ii). All remedial alternatives that meet the minimum requirements must be compared in terms of costs and benefits to show a disproportionate argument. A table showing the comparisons would be very helpful.*	Based on the remoteness of this site and the logistics involved in operating systems at an unmanned site, Lehigh would also prefer a permanent remedy. The Feasibility Study Technical Report (FSTR) reviews each alternative for both the concept of permanent remedy and degree of permanence. The Lehigh rationale for screening out complete CKD pile removal in the FS Technical Memorandum included: - Feasibility agreements between Ecology and Lehigh referenced in the 11 April 1994 letter from Ecology to Lehigh; and - No permanent remedy was identified during the screening process. As documented in the 11 April 1994 letter, "Ecology believes that excavation and/or treatment of the CKD waste pile to meet MTCA cleanup levels is not economically feasible. It is our opinion that the CKD waste pile should be closed in place…" According to the WAC definition of permanent, no alternative for the Site meets the definition. Even complete CKD pile removal does not meet the definition of a permanent remedy for the site, because it would be removed to another Site. Such a remedy would still require a system to treat the residual CKD affected groundwater downgradient of the pile to meet the site cleanup standard for some time period after CKD removal. It should also be noted that, because the placement of CKD buttresses the hillside above the pile, complete CKD pile removal would need to be augmented by inert fill buttressing of the current slopes. These systems would require long term monitoring and maintenance. In addition, WAC regulations indicate that simply moving the source of contamination from one facility to another does not meet the definition of permanent. Residual risks posed by the new CKD facility would need to be managed.

	No partial source removal meets the definition of permanent. However, the FSTR does evaluate the alternative for its degree of permanence in Section 4.6.6. Please see the following components of the Feasibility Study Technical Report (FSTR): ● Sections 4 and 5 ● As requested, for a summary comparison, Exhibit 5.5-1 provides a summary of each alternative's ability to meet WAC and AO criteria, including cost. Also refer to Exhibits 4.1-1, 4.1-2, 4.1-3, 4.1-4, 4.1-5, 4.1-6 for individual evaluation of alternative and cost.
Comment 2: *The costs of all alternatives that meet the minimum requirements must be consistently presented for comparative purposes. Monitoring costs and expected duration of the monitoring requirements should be included in the analysis.*	As requested, the cost components of each alternative, including monitoring, are included in this FSTR. Please see the following components of the FSTR: ● Exhibits 4.3-2, 4.4-2, 4.5-2, 4.6-2, 4.7-2, 4.8-2 contain the unit prices and calculations for each alternative. ● Appendix C provides cost assumptions for each alternative.
Comment 3: *The following suggestions are made to make the forthcoming draft FS report easier to review for the public:* • *The draft FS Report should include removal and disposal of all CKD and/or partial removal and disposal of CKD in the draft FS Report.* • *Include a combination of partial removal of CKD and containment wall (i.e. CO2 wall and/or pump and treat) as an alternative.* • *Perform a rigorous disproportionate cost analysis in the FS Report.*	Pursuant to discussions with Ecology, a partial removal option, as well as a combination of source control and CKD affected groundwater containment, are included in the analysis. These alternatives are included in the discussion of Alternative #4 – Partial Source Removal and Alternative #5 –Groundwater Control, respectively. As requested, cost disproportionality is addressed in the FSTR (Section 5.14). Please see the following components of the FSTR: ● Sections 4.6 and 4.7 ● Exhibits 4.1-4, 4.1-6, 4.6-1, 4.6-2, 4.7-1, 4.7-2

SPECIFIC COMMENTS

ECOLOGY COMMENT	RESPONSE
Comment 1: *Page 5, Section 2.4.2, Cleanup Levels, Is surface water a media of concern? If there were no exceedances of regulatory levels in surface water, cleanup levels for this media, as well as points of compliance are not necessary. Because groundwater discharges to surface water, cleanup levels of groundwater must be protective of both the groundwater and surface water.*	Surface water is not a media of concern for this evaluation. The final groundwater remedy will address CKD-affects to groundwater, thereby precluding affects to surface water. Method A cleanup levels for both groundwater and surface water have been proposed [GeoSyntec, 2001], resulting in a site cleanup standard that is protective of both groundwater and surface water. Please see the following components of the FSTR: • Sections 3.2.2 and 3.3.4 • Exhibit 4.2-1
Comment 2: *Page 7, Section 3.1, Introduction, The remedial actions listed in Table 3-1 are considered as having met the definition of an interim action. The pilot study is not considered an interim action. Other remedial actions may not have been conducted under the MTCA administrative options required for an interim action. It is recommended that the term interim action not be used.*	As requested, the pilot study will not be referenced as an interim action.
Comment 3: *Page 8, Section 3.2, Source Control, The CKD removal discusses only full removal of the pile and not partial removal of materials in contact with groundwater. Please add partial removal to the discussion.*	As requested, a partial source removal option, Alternative #4, is included in the FSTR. Please see the following components of the FSTR: • Section 4.6 • Exhibits 4.1-4, 4.6-1, 4.6-2,

Comment 4: *Page 11, Section 3.4, Contaminant Migration Management, As with the CKD removal, the slurry wall discussion includes a slurry wall around the entire pile. Please include a discussion on a partial slurry wall.*	As requested, a partial slurry wall has been included in the alternatives analysis in Alternative #3 – Additional Source Control, and Alternative #6 – Source and Seepage Control. Please see the following components of the FSTR: • Section 4.5.1.3 (ASC) and 4.8.1.3 (SSC) • Exhibits 4.1-3, 4.1-6, 4.5-1, 4.5-2, 4.8-1, 4.8-2
Comment 5: *Page 11, Section 3.5, Institutional Controls, Institutional controls shall include restrictive covenants in accordance with WAC 173-340-440.*	As requested, Lehigh will implement restrictive covenants for the selected alternative, in accordance with WAC 173-340-440(1). Please see the following sections of the FSTR: • 5.2, 6.2
Comment 6: *Page 15, Section 4.3.2.2, CKD Removal and Remote Disposal, While Ecology approved in concept the CKD Pile closure plan, Ecology also cautioned Lehigh about proceeding with closure while portions of the pile were in continuous contact with groundwater. Ecology did not acknowledge by pile closure approval that CKD pile removal is disproportionate. A determination of disproportionate costs is only arrived at using the procedure described in MTCA. Any further discussion regarding the disproportionate cost without an analysis is premature at this point. The benefits and costs must be compared with those of the other alternatives that are being evaluated.* *What is the expected time frame for compliance monitoring and what would be the projected monitoring costs? Please include slope stability costs in the analysis.*	Ecology identified CKD pile removal as "not economically feasible" and further recommended that the CKD material be capped in place [Ecology, 1994]: "Ecology believes that excavation and/or treatment of the CKD waste pile to meet MTCA cleanup levels is not economically feasible. It is our opinion that the CKD waste pile should be closed in place…" A brief summary of the expected timeframes for compliance monitoring are included in the evaluation of each of the alternatives. As requested, where appropriate, slope stability considerations have been included in the cost analysis. Please see the following sections of the FSTR: • Section 4.5, 4.8 • Exhibits 4.1-3, 4.1-6, 4.5-1, 4.5-2, 4.8-1, 4.8-2

Comment 7: *Page 17, Section 4.3.2.3, Vertical CKD Pile Soil Mixing/Cement Grouting, Ecology is unaware of features and boulders that may be present in the subsurface below the CKD pile that may complicate grouting.*	There is a potential that objects other than CKD, including boulders, may be present based on Site surroundings and anecdotal information from former Site employees. As requested, subsurface pile grouting is included in the alternatives analysis in Alternative #3 – Additional Source Control, and Alternative #6 – Source and Seepage Control. Please see the following sections of the FSTR: ● Section 4.5, 4.8 ● Exhibits 4.1-3, 4.1-6, 4.5-1, 4.5-2, 4.8-1, 4.8-2
Comment 8: *Page 18, Section 4.3.2.4, Vertical CKD Pile Chemical Grouting, The cover system has been disturbed by GeoSyntec in the past for the slope drain installation. The idea that an additional penetration cannot be performed to perform cleanup activities is not valid.* *How long is the compliance monitoring going to be conducted and what are the associated costs?*	Lehigh acknowledges and agrees with the comment. The discussion on cover disturbances was intended to cite them as one negative factor, but not necessarily a prohibitory one. While compromising the integrity of an installed cover is not preferred, alternatives requiring the disturbance of the cover systems have been considered for detailed analysis in the FSTR. As requested, monitoring time frames and cost are included in the FSTR. Please see the following sections of the FSTR: ● Sections 4 and 5 ● Exhibits 4.3-2, 4.4-2, 4.5-2, 4.6-2, 4.7-2, 4.8-2
Comment 9: *Page 23, Section 4.3.3.2, Metallic Iron In-Situ Permeable Reactive Wall, Part of the success of permeable reactive walls is that they provide viable treatment and allow for continued use of a facility. Also, settlement in the wall area is typically addressed with the design if it appears problematic. Ecology does not believe these issues to be a hindrance for wall installation.*	Lehigh agrees that the appropriate design must be used when settlement is an issue. The FSTM discussion was intended to be mentioned settlement as one negative factor, but not necessarily a prohibitory one. However, the metallic iron option was screened from the alternatives list based on its potential to mobilize metals.

Comment 10: *Page 29, Section 4.3.3.5, In-Situ Permeable Treatment Wall – Acid Formation, How long will the system require operation? What is the life estimate for the tubes and what are replacement costs? Please include anticipated monitoring costs.*	The treatment system would require continuous operation for an indefinite period of time (likely several decades). Based on preliminary evaluations, the tubing will remain effective for decades, as well. Replacement of system components are included in the cost analysis. Please see the following components of the FSTR: • Sections 4.3, 4.7 • Exhibits 4.3-2, 4.7-2
Comment 11: *Page 29, Section 4.3.3.6, Gaseous Carbon Dioxide In-Situ Sparging Points, Have the air sparging points been activated? If so, when will test data be available for review?*	The gas sparge points were activated for a brief period of time. The observations and evaluations conducted on this option indicate that the sulfur content of the groundwater is high enough to result in the formation of hydrogen sulfide gas, a toxic gas. The gas sparging operation, while involving microbubble formation, is sufficient to form and strip hydrogen sulfide gas from the saturated zone. This alternative is not considered for further evaluation in this FSTR. Please see the following components of the FSTR: • Appendix A
Comment 12: *Page 31, Section 4.3.3.7, Pyrite In-Situ Permeable Treatment Wall, Where were lab samples collected?*	Samples of commercially available pyrite were submitted for laboratory analysis.
Comment 13: *Page 41, Section 4.4, Results of Alternative Screening, Ecology believes source control measures are appropriate for the Site. A limited investigation of the area previously identified as having CKD in direct contact with groundwater would yield a quantifiable source area. Once the source is identified a removal methodology can be assessed and a cost can be determined.*	As requested, source control measures were included in 3 of the alternatives evaluated, Alternative #3 – Additional Source Control, Alternative #4 – Partial Source Removal, and Alternative #6 – Source and Seepage Control. This FSTR documents the evaluation of various source control alternatives. Please see the following components of the FSTR: • Sections: 4.5, 4.6, 4.8 • Exhibits 4.1-3, 4.1-4, 4.1-6, 4.5-1, 4.5-2, 4.6-1, 4.6-2, 4.6-3, 4.8-1, 4.8-2, 4.8-3
Comment 14: *Page 44, Section 6.1, General, The pilot test is not considered an interim action as defined by WAC 173-340-430. Please remove the reference.*	As requested, the pilot study will not be referenced as an interim action.

Comment 15: *Page 46, Section 6.3.2, Progress in Decreasing pH, Are there groundwater elevation data that can explain the advective, diffusive, and dispersive mixing with untreated groundwater?*	A discussion of data collected from the PTW is presented in Appendix A. Groundwater elevation data show that flow is approximately perpendicular to treatment in the pilot PTW location. However, based on the stratified geology encountered in the floodplain alluvial materials, channeling of untreated water within high permeability zones is likely occurring in the area of the permeable treatment wall. Please see the following components of the FSTR: ● Appendix A
Comment 16: *Page 46, Section 6.3.3, Progress in Increasing Eh, What steps have been taken to obtain more accurate and precise Eh data? Ecology notes for example that two groundwater samples collected on 3/03/03 from MW-9 had Eh readings of -203 and +179 mV. The other analytes for these samples were similar.*	Redox potential was introduced to understand the geochemistry and predict the behavior of arsenic. Redox potential was evaluated as a remedy selection factor, but it is not considered an indicator of remedy performance due to the many factors that can influence it. However, redox potential data is also supplied via field monitoring devices that are used when groundwater samples are collected.
Comment 17: *Page 48, Section 6.3.5, Future Data Needs, How will the dissolved inorganic carbon useful and what will it tell us? Please expand.* *Ecology is unclear about the concept of short-circuiting of groundwater from the culvert to MW-9. The culvert elevation on the pile side is reportedly 10 feet higher than the groundwater elevation in MW-9. Please explain.*	The permeable treatment wall consists of a carbon dioxide distribution system. The carbon dioxide reacts with water molecules to form carbonic acid, and therefore inorganic carbon. Dissolved inorganic carbon (DIC) is a linearly-related indicator of pilot treatment wall performance. DIC is also a conservative tracer which provides useful performance evaluation data downgradient of the treatment zone. The culvert, and more importantly the bedding material into which the culvert was placed, was one potential preferential pathway for ground water migration downgradient of the closed CKD pile. Prior to the investigation, the exact depth of the culvert invert and bedding materials was unknown. The culvert investigation performed to evaluate the bedding materials Showed that the culvert and bedding materials were not acting as preferential conduits to groundwater flow. Please see the following sections of the FSTR: ● Appendix A.

Comment 18: *Table 3.2, Acid Injection, What regulated daughter products may be generated?*	Depending on the acid selected, its conjugate base will be formed upon dissolution in water. Examples include: • Phosphate from phosphoric acid; • Nitrate from nitric acid; • Sulfate from sulfuric acid; and • Chloride from hydrochloric acid.
Comment 19: *Table 6.2, Oxidation Reduction Potential Data in Vicinity of the Treatment Trench, Is the "<" symbol being used as the same as a negative sign "-"? If so please use standard notation for the negative sign*	As requested, standard notation will be used.
Comment 20: *Attachment A, Analytical Data, See comment 19 for data presentation. Some of the data for monitoring well MW-9 is referred to as mid or shallow. What are these depths and how were they achieved? What depth were the rest of the samples taken.*	To evaluate the potential for the CKD affected groundwater to be stratified (i.e., not homogeneous throughout the saturated zone), GeoSyntec collected groundwater samples from monitoring well MW-9 using low flow sampling techniques. The MW-9 sample results provided in the database were collected as follows: • -SHALLOW samples were collected from 1 foot below the groundwater surface (approximately 2029 feet above mean sea level (ft msl)) • -MID were collected from the midpoint of the MW-9 saturated interval (approximately 2023 ft msl)

APPENDIX E

COST ESTIMATE DESCRIPTIONS

REVISED DRAFT FEASIBILITY STUDY TECHNICAL REPORT CLOSED CEMENT KILN DUST PILE METALINE FALLS, WASHINGTON

TABLE OF CONTENTS

APPENDIX E

COST ESTIMATE DESCRIPTIONS

DRAFT FEASIBILITY STUDY TECHNICAL REPORT
CLOSED CEMENT KILN DUST PILE
METALINE FALLS, WASHINGTON

E.1. INTRODUCTION

E.1.1 Basis for Cost Estimates

As part of the Feasibility Study (FS) conducted for the Lehigh Cement Company (Lehigh) Closed Cement Kiln Dust (CKD) Pile (Site) located in Metaline Falls, Washington, GeoSyntec prepared cost estimates for six remedial alternatives. Washington Administrative Code (WAC 173-340-360) and the Agreed Order No. DE99HS-E941 include cost as an evaluation criterion. The FS is documented in the Revised Draft Feasibility Study Technical Report (Revised dFSTR), of which this document is Appendix E.

Cost estimates were prepared for the following alternatives:

1. Permeable Treatment Wall (PTW)
2. Groundwater Control (GWC)
3. Additional Source Control (ASC)
4. Partial Source Removal (PSR)
5. Funnel and Gate Treatment (FGT)
6. Partial Additional Source Control (PASC)

E.1.2 Organization of this Appendix

The remainder of this appendix is organized into the following sections:

- Section 2, *Alternative Descriptions and Assumptions*, which describes the components included in the cost estimates; and

- Section 3, *Estimating Procedures*, which presents the general methods used to estimate costs of the alternatives.

E.2. ALTERNATIVE DESCRIPTIONS AND ASSUMPTIONS

E.2.1 Introduction

This section includes assumptions regarding the conceptual layouts and operating scenarios of the remedial alternatives.

E.2.2 Permeable Treatment Wall (PTW)

For the purposes of the calculations in the Revised dFSTR, components of PTW include:

- The pilot PTW operating in its current mode;
- Boreholes at 50 feet (ft) intervals to provide lithologic information to align additional panels of the PTW;
- Approximately 400 ft of additional PTW installed to approximately 20 ft below ground surface (bgs);
- Approximately 1,500 cubic yards (cy) of coarse gravel backfill in the PTW trench;
- PTW includes approximately 60,000 lineal ft of silicon tubing encased in approximately 3,000 lineal ft of buried perforated plastic pipe;
- Structures to house PTW manifolds;

- 3 groundwater barrier walls with a total length of approximately 140 ft to conduct groundwater to the treatment panels;

- 5 additional PTW performance monitoring wells installed up to 20 ft bgs, a subset of these wells or existing wells may be converted to extraction wells to capture water that passes the PTW alignment untreated;

- 4 compliance monitoring groundwater wells installed up to 20 ft bgs;

- one additional 14-ton capacity carbon dioxide storage tank (28-ton capacity total); and

- Additional structures to house the tank and additional controls.

For the purposes of the calculations in the Revised dFSTR, components of yearly PTW operation include:

- Approximately 160 hours operation and maintenance (O&M) labor on the PTW;

- Approximately 200,000 lbs of carbon dioxide consumption;

- Water from extraction wells will be routed back to the treatment zone;

- Approximately 15 kilowatts operating power; and

- Quarterly groundwater monitoring and reporting.

E.2.3 Groundwater Control (GWC)

For the purposes of the calculations in the Revised dFSTR, components of GWC include:

- The pilot PTW operating in its current mode;
- 16 groundwater extraction wells installed up to 20 ft bgs;
- 18 (includes 2 spares) submersible pumps capable of pumping a maximum of 15 gallons per minute each;
- Approximately 300 ft of buried 1.25-inch (in.) polyvinyl chloride (PVC) piping to conduct groundwater from the extraction wells to the header;
- Approximately 800 ft of buried 6-in. PVC header leading to the treatment system;
- Approximately 1,700 ft of electrical wiring and conduit to energize the pumps;
- Heating capability for winter operation;
- 4 compliance monitoring groundwater wells installed up to 20 ft bgs;
- one additional 14-ton capacity carbon dioxide storage tank (28-ton capacity total);
- An aboveground groundwater treatment system that uses carbon dioxide neutralization followed by ferric chloride precipitation/flocculation of metals, filtration, and treated water discharge to surface water;

- Structure to house the treatment system, additional carbon dioxide tank, and controls;

- Solid waste storage area; and

- Approximately 200 ft of 6-in. PVC pipe to discharge treated groundwater to Sullivan Creek.

For the purposes of the calculations in the FSTR, components of yearly GWC operation include:

- Approximately 260 hours O&M labor on the GWC;

- Approximately 180,000 lbs of carbon dioxide consumption, which is less than in situ treatment due to enhanced carbon dioxide diffusion efficiencies in the above ground system, and the slight neutralizing effects of ferric chloride;

- Approximately 30 to 50 mg/L of ferric chloride addition;

- Approximately 35 kilowatts operating power;

- Approximate total extraction rate of 55 gpm;

- Maintenance and redevelopment of extraction pumps and wells, as needed;

- Approximately 140 lbs treatment residuals that are not expected to be State dangerous waste generated per day. GWC includes the in situ Pilot System so its treatment residuals generation rate is lower than a pure pump and treat alternative;

- Monthly NPDES testing and reporting; and

- Quarterly groundwater monitoring and reporting.

E.2.4 Additional Source Control (ASC)

For the purposes of the calculations in the Revised dFSTR, components of ASC include:

- Remedy design investigation including lithologic borings and landslide investigations;
- Approximately 1,600 lineal ft of slurry cut-off wall installed hydraulically upgradient of the Closed CKD Pile to depths ranging from 40 to 120 ft deep;
- Groundwater extraction (dewatering) wells every 100 ft upgradient of the slurry cut-off wall (14 total) to approximately the same depth as the adjacent slurry wall;
- Approximately 1,800 lineal ft of conveyance piping for the water from upgradient dewatering;
- 16 (includes 2 spares) submersible pumps capable of pumping a maximum of 15 gpm each in upgradient dewatering wells; and
- 13 downgradient groundwater extraction wells installed up to 20 ft bgs for the pump-and-treat (P&T) system;
- 15 (includes 2 spares) submersible pumps capable of pumping a maximum of 15 gallons per minute each in downgradient extraction wells;
- Approximately 250 ft of buried 1.25-inch (in.) polyvinyl chloride (PVC) piping to conduct groundwater from the extraction wells to the P&T header;

- Approximately 650 ft of buried 6-in. PVC header leading to the P&T treatment system;
- Approximately 1,500 ft of electrical wiring and conduit to energize the downgradient pumps;
- Heating capability for winter operation;
- An aboveground groundwater treatment system that uses carbon dioxide neutralization followed by ferric chloride precipitation/flocculation of metals, filtration, and treated water discharge to surface water;
- one additional 14-ton capacity carbon dioxide storage tank (28-ton capacity total);
- Structure to house treatment system and controls;
- Solid waste storage area for P&T treatment residuals; and
- Approximately 200 ft of 6-in. PVC pipe to discharge treated groundwater to Sullivan Creek.

The source control components of ASC will decrease the amount of CKD-affected groundwater that requires treatment. The degree of reduction is dependent on the success of the slurry wall and dewatering walls, and is not quantifiable at this time. For the purposes of the calculations in the Revised dFSTR, components of yearly ASC operation include:

- Approximately 45 kilowatts of dewatering operating power;
- Approximate downgradient total extraction rate of 55 gallons per minute (gpm);
- Approximately 260 hours O&M labor of the P&T;

- Maintenance and redevelopment of extraction pumps and wells, as needed;
- Approximately 200,000 lbs of carbon dioxide consumption;
- Approximately 50 milligrams/liter (mg/L) of ferric chloride addition to extracted groundwater;
- Approximately 150 lbs of non-dangerous waste treatment residuals generated per day;
- On-site storage of treatment residuals for periodic off-Site transport and disposal;
- Monthly NPDES testing and reporting; and
- Quarterly groundwater monitoring and reporting.

E.2.5 Partial Source Removal (PSR)

PSR includes two major construction tasks: (1) excavating, storing and replacing the CKD and (2) installing a treatment system for residual groundwater. For the purposes of the calculations in the Revised dFSTR, components of PSR related to the first task, excavating and replacing the CKD, include:

- Construction of a lined pad (approximately 24,000 square yards (sy) or 5 acres) equipped with drainage features to receive the excavated CKD as it is removed for interim storage;
- Clearing an area adjacent to the Closed CKD Pile to stockpile the re-usable cover components (i.e., approximately 35,000 cy of clay and surface water systems);
- 4 boreholes through the CKD pile to locate inundated areas;

- Dewatering wells installed prior to and operated during excavation activities;

- Treatment of the water from dewatering wells and discharge to Sullivan Creek;

- Approximately 500 ft sheet piles installed upgradient of the toe to isolate the toe of the Closed CKD Pile;

- Removal of CKD at the toe of the Closed CKD Pile (approximately 5,500 cy);

- Replacement of the CKD from the toe with a layer of inert backfill (approximately 2,800 cy) wrapped in geotextile, followed by approximately 2,700 cy of the previously removed CKD;

- Removal of the lower CKD saturated zone within the body of the Closed CKD Pile and replacement with inert material via a sloped-back excavation using 2H:1V (Horizontal:Vertical) slopes (approximately 260,000 cy);

- Replacement of the CKD from the lower saturated zone with a layer of inert backfill (approximately 7,000 cy) wrapped in geotextile, followed by previously removed approximately 253,000 cy of CKD;

- Cover repair following removal and replacement of the CKD (approximately 34,000 sy);

- Transportation and off-Site disposal of a portion of the CKD (9,800 cy); and

- GWC (described in Section E.2.3) installed to capture downgradient CKD-affected water.

PSR includes two groundwater treatment scenarios. The first scenario assumes that downgradient groundwater treatment with GWC will be required for approximately five years following PSR implementation. The second scenario assumes that downgradient groundwater treatment with GWC will continue for an indefinite time period. For the purposes of the calculations in the Revised dFSTR, components of yearly PSR operation include:

- GWC operation (described in Section E.2.3) for 5 years under PSR scenario #1; and
- GWC operation (described in Section E.2.3) for an indefinite time period under PSR scenario #2.

E.2.6 Funnel and Gate Treatment (FGT)

For the purposes of the calculations in the Revised dFSTR, components of FGT include:

- Construct an earthen platform approximately 3 ft thick that straddles the slurry wall alignment, approximately 1,200 lineal ft in length;
- Approximately 550 to 750 lineal ft of a subsurface gravel drainage wall installed approximately 15 to 25 ft bgs;
- Approximately 600 to 800 lineal ft of slurry walls installed approximately 15 to 25 ft bgs;
- Approximately 200 to 400 lineal ft of structural subsurface walls (such as slurry diaphragm walls) installed approximately 15 to 25 ft bgs;
- Excavation of the approximately 9,000 to 11,000 cy treatment zone;
- Dewatering and treatment of excavated corridor;

- Approximately 5 to 7 separate treatment zone panels similar to the Pilot System installed in series in the treatment zone;
- Approximately 9,000 to 11,000 cy gravel backfill placed in the treatment zone;
- Installation of erosion protection at the banks of Sullivan Creek where the discharge emerges;
- 4 compliance monitoring groundwater wells installed up to 20 ft bgs;
- one additional 14-ton capacity carbon dioxide storage tank (28-ton capacity total); and
- Additional structures to house the tank and additional controls.

For the purposes of the calculations in the Revised dFSTR, components of yearly FGT operation include:

- Approximately 160 hours operation and maintenance (O&M) labor on the PTW;
- Approximately 200,000 lbs of carbon dioxide consumption;
- Approximately 15 kilowatts operating power;
- Monthly NPDES testing and reporting; and
- Quarterly groundwater monitoring and reporting.

E.2.7 Partial Additional Source Control (PASC)

For the purposes of the calculations in the Revised dFSTR, components of PASC include:

- FGT described in Section E.2.6;
- Installation of a directionally-drilled borehole under the southern end of the Closed CKD Pile that will accommodate a perforated drain pipe (approximately 4 to 6 in. in diameter);
- Subsurface vault at the borehole insertion point to house the drain outlet and direct it to the FGT for treatment if needed;
- Drain pipe (approximately 500 to 600 ft in length) installed into the borehole; and
- Drain pipe integration into the FGT system.

For the purposes of the calculations in the Revised dFSTR, components of yearly PASC operation include:

- FGT operation described in Section E.2.6.

E.3. ESTIMATION PROCEDURES

E.3.1 Introduction

MTCA includes cost as a criterion for conducting feasibility studies, and cost is a factor in engineering design. GeoSyntec prepared cost estimates for the six alternatives to evaluate and compare the costs of the alternatives. The cost estimates also allow for comparing the cash flows for each of the alternative. For example, the estimates show whether the construction or long-term operations are the major cost components, or if they are similar. At this stage, each of the cost estimates are preliminary and include some degree of uncertainty.

E.3.2 Approach

This Revised dFSTR presents alternative costs in 2005 U.S. dollars. The cost calculations provide three project duration and discounting scenarios. The three scenarios are based on Ecology comments and EPA guidance [EPA, 2000]. The three costing scenarios are:

1. Thirty-year project duration using a seven percent discount rate;
2. One-hundred-year project duration using a seven percent discount rate; and
3. One-hundred-year non-discounted project. EPA guidance suggests that a non-discounting scenario be presented only for comparison purposes[1].

Future cash flows were discounted back to 2005 using seven percent for the thirty-year and one hundred-year discounted scenarios discussed above. GeoSyntec assumed that the capital costs associated with implementation would occur in the first year. The capital costs are described in the Revised dFSTR. GeoSyntec also assumed that yearly O&M costs would be incurred following implementation for the project duration. These yearly costs include operation and maintenance of the remedy, monitoring, and nominal remedy component replacements (i.e., pump replacements, pipe repairs, etc.). Large periodic charges are also included to cover major items (i.e., new GWC aboveground treatment system, replacement of a PTW panel, etc.) every fifteen years.

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[1] United States Environmental Protection Agency, 2000. *A Guide for Developing and Documenting Cost Estimates During the Feasibility Study*, Washington, D.C., August 2000.

E.3.3 Cost Estimate Accuracy

The remedial alternatives at this stage are at a conceptual design level and may be modified as new data is collected or if actual Site conditions are different than expected. GeoSyntec used the conceptual layouts of the remedial alternatives to estimate the alternative components that are listed in Section E.2. GeoSyntec estimated preliminary operating scenarios based on site-specific information, professional judgment, and input from contractors and vendors. GeoSyntec then used the preliminary conceptual layouts and component list, and the preliminary operating scenarios to estimate costs. GeoSyntec used existing subcontractor quotes and rates, known unit prices, known labor rates, and engineering judgment to prepare the cost estimates for the conceptual designs.

A significant level of uncertainty is implicit in a cost estimate for this level of design. Based on the level of design, actual costs may differ from those presented in the estimates in the approximate range of –20 percent to +50 percent. Contingencies ranging between 10 percent and 20 percent for capital costs and O&M costs were considered to be appropriate and were added to the estimates.

While there may be uncertainties in the estimates, they allow the six remedy costs to be compared on the same basis. The costs are included in the Revised dFSTR and used as a tool for evaluating the remedies.