E File

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

We Protect Hoosiers and Our Environment.

Mitchell E. Daniels, Jr.
Governor

Thomas W. Easterly
Commissioner

100 North Senate Avenue
Indianapolis, Indiana 46204
(317) 232-8603
Toll Free (800) 451-6027
www.idem.IN.gov

April 22, 2008

VIA CERTIFIED MAIL 7000 0600 0027 2038 2056

Tony Sullivan, Esquire
Barnes & Thornburg LLP
11 South Meridian Street
Indianapolis, IN 46204-3535

Re: Adoption of Agreed Order
Commissioner, Indiana Department of Environmental Management
v.
IPL Eagle Valley Station
Case Nos. 2007-16780-W and 2008-17693-W

Dear Mr. Sullivan

This is to inform you that the Agreed Order in the above-referenced case has been approved and adopted by the Indiana Department of Environmental Management. A copy of the Agreed Order is enclosed.

Please note the terms of compliance contained in the Agreed Order. The time frames for compliance are effective upon your receipt of this correspondence. Please note that the civil penalty is due within thirty (30) days after the effective date of the Agreed Order. Payment should be made payable to the Environmental Management Special Fund and sent to Cashier - Mail Code 50-10C, IDEM, 100 N. Senate Avenue, Indianapolis, Indiana 46204-2251. Please include the Case Number on the front of the check. If you have any questions, please contact Mark Stanifer at 317/232-8431.

Sincerely,

Lori Kyle Endris

Lori Kyle Endris
Chief
Office of Enforcement

Enclosure

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
We make Indiana a cleaner, healthier place to live.

Mitchell E. Daniels, Jr.
Governor

Thomas W. Easterly
Commissioner

100 North Senate Avenue
Mail Code 60-02
Indianapolis, Indiana 46204
(317) 232-8603
(800) 451-6027
www.idem.in.gov

STATE OF INDIANA) SS:		BEFORE THE INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
COUNTY OF MARION)		
COMMISSIONER OF THE DEPARTMENT OF ENVIRONMENTAL MANAGEMENT	)	
Complainant,	)	
v.	)	Case Nos. 2007-16780-W 2008-17693-W
INDIANAPOLIS POWER & LIGHT CO.	)	
Respondent.	)	

AGREED ORDER

Complainant and Respondent desire to settle and compromise this action without hearing or adjudication of any issue of fact or law, and consent to the entry of the following Findings of Fact and Order. Pursuant to IC 13-30-3-3, entry into the terms of this Agreed Order does not constitute an admission of any violation contained herein. Respondent's entry into this Agreed Order shall not constitute a waiver of any defense, legal or equitable, which Respondent may have in any future administrative or judicial proceeding, except a proceeding to enforce this order.

I. FINDINGS OF FACT

1. Complainant is the Commissioner ("Complainant") of the Indiana Department of Environmental Management ("IDEM"), a department of the State of Indiana created by Indiana Code ("IC") 13-13-1-1.

2. Respondent is Indianapolis Power & Light Co. ("Respondent"), which owns and operates the Eagle Valley Generating Station, which discharges to the West Fork of White River under National Pollutant Discharge Elimination System ("NPDES") Permit No. IN0004693, located at 4040 Blue Bluff Road, in Martinsville, Morgan County, Indiana ("Site").

3. IDEM has jurisdiction over the parties and the subject matter of this action.

4. Pursuant to IC 13-30-3-3, IDEM issued a Notice of Violation via Certified Mail to Ann D. Murtlow, President, and S. Michael Woodard, Registered Agent, Indianapolis Power & Light Co., One Monument Circle, Indianapolis, IN 46204.

5. Respondent owns and operates a 344 megawatt steam electric power plant.

6. During an investigation in response to a spill report conducted by a representative of IDEM on February 14, 2007, the following violations were found:

   A. Pursuant to 327 IAC 5-2-2, any discharge of pollutants into waters of the state as a point source discharge, except for exclusions made in 327 IAC 5-2-4, is prohibited unless in conformity with a valid NPDES permit obtained prior to the discharge. Respondent discharged ash pond water into the West Fork of White River on February 14, 2007, of a nature and from a location not authorized by the Permit, in violation of 327 IAC 5-2-2.

   B. Pursuant to 327 IAC 2-1-6(a) and Part I. B. of the Permit, all waters at all times and at all places, including the mixing zone, shall meet the minimum conditions of being free from substances, materials, floating debris, oil, or scum attributable to municipal, industrial, agricultural, and other land use practices, or other discharges:
      (A) that will settle to form putrescent or otherwise objectionable deposits;
      (B) that are in amounts sufficient to be unsightly or deleterious;
      (C) that produce color, visible oil sheen, odor, or other conditions in such degree as to create a nuisance;
      (D) which are in amounts sufficient to be acutely toxic to, or to otherwise severely injure or kill aquatic life, other animals, plants, or humans; and
      (E) which are in concentrations or combinations that will cause or contribute to the growth of aquatic plants or algae to such degree as to create a nuisance, be unsightly, or otherwise impair the designated uses.

      Respondent caused or contributed to the contamination of waters of the state by allowing the release of substances and materials from the ash pond on February 14, 2007, into the West Fork of White River that were unsightly and deleterious, in violation of 327 IAC 2-1-6(a) and Part I. B. of the Permit.

   C. Pursuant to IC 13-18-4-5, it is unlawful for any person to throw, run, drain, or otherwise dispose into any of the streams or waters of Indiana; or cause, permit, or suffer to be thrown, run, drained, allowed to seep, or otherwise disposed into any waters; any organic or inorganic matter that causes or contributes to a polluted condition of any waters, as determined by a rule of the board adopted under sections 1 and 3 of this chapter.

      Respondent caused or contributed to a polluted condition of waters of the state by the release from the ash pond on February 14, 2007, into the West Fork of White

River, in violation of 327 IAC 5-2-2 and 327 IAC 2-1-6(a), rules of the water pollution control board, in violation of IC 13-18-4-5.

D. Pursuant to IC 13-30-2-1, a person may not discharge, emit, cause, allow, or threaten to discharge, emit, cause, or allow any contaminant or waste, including any noxious odor either alone or in combination with contaminants from other sources, into the environment in any form that causes or would cause pollution that violates or would violate rules, standards, or discharge or emission requirements adopted by the appropriate board under the environmental management laws.

Respondent released a pollutant into the environment by the discharge from its ash pond on February 14, 2007, into the West Fork of White River, in violation of 327 IAC 327 IAC 5-2-2 and 327 IAC 2-1-6(a), rules of the water pollution control board, in violation of IC 13-30-2-1.

E. Pursuant to Part II. B. 4 of NPDES permit, removed substances are to be managed in such a manner as to prevent any pollutants from such from entering waters of the state.

The events of February 14, 2007, allowed amounts of ash (a removed substance) to enter waters of the state, in violation of Part II. B. 4 of the NPDES permit.

7. Respondent immediately notified regulatory authorities of the levee failure, took the leaking ash pond out of service and utilized the back-up ash pond after the levee failed. Respondent stopped the leak roughly 30 hours after the levee failed. Respondent is in the process of implementing permanent repairs to the failed levee.

8. On January 30, 2008, the levee in the main ash pond (D) failed in the same location as it had on February 14, 2007, and again caused the levee of ash pond E to fail, releasing approximately 30,000,000 gallons of ash pond water into Respondent's discharge canal and then the West Fork of White River. The circumstances were very similar to those of the February 14, 2007, event. Respondent reported the release to IDEM Emergency Response. As with the 2007 event, this discharge violated 327 IAC 5-2-2, 327 IAC 2-1-6(a) and Part I.B. of the permit, IC 13-18-4-5, and IC 13-30-2-1. Respondent waives issuance of a Notice of Violation and to the settlement period of sixty (60) days as provided for by IC 13-30-3-3 for the violations that occurred on January 30, 2008. This second event has been assigned case number 2008-17693-W.

9. In recognition of the settlement reached, Respondent waives any right to administrative and judicial review of this Agreed Order.

II. ORDER

1. This Agreed Order shall be effective (Effective Date) when it is approved by Complainant or Complainant's delegate, and has been received by Respondent. This Agreed Order shall have no force or effect until the Effective Date.

2. Respondent shall comply with the statutes, rules, and permit conditions listed in the findings above at issue.

3. Respondent shall perform a detailed study of the ash pond levees at Eagle Valley in the areas of the breach. The objective of the study will be to determine whether these areas are constructed adequately to prevent future breaches. The study shall identify recommended improvements if any are necessary to achieve this objective:
   - The detailed study will be performed by a professional with expertise evaluating ash pond levees.
   - The detailed study will be completed within 180 days after the Effective Date.
   - The results and any recommendations of the detailed study will be submitted to IDEM within 60 days after the completion of the study.
   - The Respondent will implement any recommendations that are necessary to achieve the study's objective, are consistent with the design and purpose of Respondent's business operations at Eagle Valley Generating Station, and are reasonable and cost-effective. Such implementation will be initiated within 60 days after submitting the results and recommendations to IDEM.
   - A more detailed description of the study was submitted by Respondent to Complainant dated March 21, 2008, and is included with this Agreed Order as Attachment A.

4. Respondent will implement system-wide inspections for all ash ponds under its control, as set forth in Attachment A. The first inspection of each ash pond is to be completed within 270 days after the Effective Date.

5. Beginning on the Effective Date and continuing until the completion of the activities identified in Paragraphs 3 and 4 above, Respondent shall, at all times, operate its existing wastewater treatment facilities as efficiently and effectively as possible, and consistent with the terms of Respondent's NPDES permit.

6. All submittals required by this Agreed Order, unless Respondent is notified otherwise in writing by IDEM, shall be sent to:

   Mark Stanifer, Section Chief
   Indiana Department of Environmental Management
   Office of Enforcement – Mail Code 60-02
   100 North Senate Avenue
   Indianapolis, IN 46204-2251

7. Respondent is assessed a civil penalty of Twenty Three Thousand Eight Hundred dollars ($23,800). Said penalty amount shall be due and payable to the Environmental Management Special Fund within thirty (30) days of the Effective Date. In the event that the civil penalty is not paid within thirty (30) days of the Effective Date, Respondent shall pay interest on the unpaid balance at the rate established by IC 24-4.6-1-101. The interest shall continue to accrue until the civil penalty is paid in full.

8. In the event the terms and conditions of the following paragraphs are violated, Complainant may assess and Respondent shall pay a stipulated penalty in the following amount:

Paragraph	Violation	Stipulated Penalty
3	Failure to complete the study within 180 days after the Effective Date	$500 per week late, or part thereof.
3	Failure to submit the findings and recommendations of the study within 60 days after the completion of the study.	$500 per week late, or part thereof.
3	Failure to initiate implementation of the study recommendations, as described under Paragraph 3, within 60 days after submitting study results and recommendations to IDEM.	$500 per week late, or part thereof.
4	Failure to complete initial inspections within 270 days of the Effective Date, or failure to conduct inspections thereafter at the frequency set forth in Attachment A.	$500 per week late, or part thereof.

9. Stipulated penalties shall be due and payable within thirty (30) days after Respondent receives written notice that Complainant has determined a stipulated penalty is due. Assessment and payment of stipulated penalties shall not preclude Complainant from seeking any additional relief against Respondent for violation of this Agreed Order. In lieu of any of the stipulated penalties set out above, Complainant may seek any other remedies or sanctions available by virtue of Respondent's violation of this Agreed Order or Indiana law, including, but not limited to, civil penalties pursuant to IC 13-30-4.

10. Civil and stipulated penalties are payable by check to the "Environmental Management Special Fund." Checks shall include the Case Number of this action and shall be mailed to:

Indiana Department of Environmental Management
Cashier – Mail Code 50-10C
100 North Senate Avenue
Indianapolis, IN 46204-2251

11. This Agreed Order shall apply to and be binding upon Respondent and its successors and assigns. Respondent's signatories to this Agreed Order certify that they are fully authorized to execute this Agreed Order and legally bind the party they represent. No change in ownership,

corporate, or partnership status of Respondent shall in any way alter its status or responsibilities under this Agreed Order.

12. In the event that any terms of this Agreed Order are found to be invalid, the remaining terms shall remain in full force and effect and shall be construed and enforced as if this Agreed Order did not contain the invalid terms.

13. Respondent shall provide a copy of this Agreed Order, if in force, to any subsequent owners or successors before ownership rights are transferred. Respondent shall ensure that all contractors, firms and other persons performing work under this Agreed Order comply with the terms of this Agreed Order.

14. This Agreed Order is not and shall not be interpreted to be a permit or a modification of an existing permit. This Agreed Order, and IDEM's review or approval of any submittal made by Respondent pursuant to this Agreed Order, shall not in any way relieve Respondent of its obligation to comply with the requirements of its applicable permit or any applicable Federal or State law or regulation.

15. Complainant does not, by its approval of this Agreed Order, warrant or aver in any manner that Respondent's compliance with any aspect of this Agreed Order will result in compliance with the provisions of any permit, order, or any applicable Federal or State law or regulation. Additionally, IDEM or anyone acting on its behalf shall not be held liable for any costs or penalties Respondent may incur as a result of Respondent's efforts to comply with this Agreed Order.

16. Nothing in this Agreed Order shall prevent or limit IDEM's rights to obtain penalties or injunctive relief under any applicable Federal or State law or regulation, except that IDEM may not, and hereby waives its right to, seek additional civil penalties for the same violations specified in the NOV.

17. Nothing in this Agreed Order shall prevent IDEM or anyone acting on its behalf from communicating with the EPA or any other agency or entity about any matters relating to this enforcement action. IDEM or anyone acting on its behalf shall not be held liable for any costs or penalties Respondent may incur as a result of such communications with the EPA or any other agency or entity.

18. This Agreed Order shall remain in effect until Respondent has complied with all terms and conditions of Order Paragraph Nos. 3 through 10 (regarding Paragraph No. 4, and the related stipulated penalties under Paragraph 8, through the first set of inspections) and IDEM issues a Resolution of Case letter.

Remainder of page intentionally left blank.

TECHNICAL RECOMMENDATION:
Department of Environmental Management

By: Mark W. Stanifer
Mark W. Stanifer, Chief
Water Enforcement Section
Office of Enforcement

Date: 3-24-2008

RESPONDENT:
Indianapolis Power & Light Co.

By:

Printed: RONALD E. TALBOT

Title: SVP, Power Supply

Date: 4/8/8

COUNSEL FOR COMPLAINANT:
For the Department of Environmental Management

By:
Justin D. Barrett
Deputy Attorney General

Date: 3-24-08

COUNSEL FOR RESPONDENT:

By: Tony Sullivan

Date: 4/9/08

APPROVED AND ADOPTED BY THE INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT THIS 18th DAY OF April, 2008.

For the Commissioner:

Robert B. Keene
Robert B. Keene
Assistant Commissioner
Office of Legal Counsel and Enforcement

M/S METS E-file

ENCOMPASS

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Detail 1 | Detail 2 | Detail 3 | Item Activity | Item Accounting Entries | Item Audit History

Unit: 00495 **Customer:** CST100010861 INDIANAPOLIS POWER & LIGHT CO

Item ID: 2007-16780-W 032008 **Line:** **Days Late:** -30 **Status:** Closed

Accounting Date: 05/12/2008 **Entry Type:** IN **Billing Unit:**

Balance: 0.000 USD **Entry Reason:** ENFSP **Original Amount:** 11,900.000 USD

AR Distribution Code: ACCTS REC

Discount Options

Due Date: 06/11/2008 **Due Days:**

Terms: NET30 **Discount Days:**

Discount Amount: Date:

Discount Amount 1: Date 1:

☐ **Always Allow Discount**

As Of Date: 05/12/2008 **Posted:** 05/12/2008

Payment/Draft Options

Payment Method Check

Draft Type: ☐ Preapproved?

Direct Debit Profile ID: ☐ Create Document?

☐ One Item per Draft?

Customer Relations

☐ **Dispute** **Reason:** **Date:**

Dispute Amount:

☐ **Deduction** **Reason:** **Date:**

☐ **Doubtful**

☐ **Collection** **Code:** **Date:**

Analyst: IDEM INDIANA DEPARTMENT OF ENVIRONMENTAL MGMT

Collector: IDEM ACCOUNTS RECEIVABLE

Sales Person: IDEM IDEM

AR Specialist:

Other Options

☑ **Revaluation Flag** ☑ **Available for Netting**

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Detail 1 | Detail 2 | Detail 3 | Item Activity | Item Accounting Entries | Item Audit History

Unit: 00495 **Customer:** CST100010861 INDIANAPOLIS POWER & LIGHT CO

Item ID: 2007-16780-W 032008 **Line:** **Days Late:** -30 **Status:** Closed

Balance: 0.000 USD

Item Activities

Sequence: 1 **Accounting Date:** 05/12/2008 **Posted Date:** 05/12/2008

Entry Type IN **Reason:** ENFSP **Voucher ID:**

Document: **Amount:** 11,900.000 USD

Group Unit: 00495 **Group ID:** 162757 BILLING

Sequence: 2 **Accounting Date:** 05/12/2008 **Posted Date:** 05/12/2008

Entry Type PY **Reason:** **Worksheet Reason:** **Voucher ID:**

Document: **Amount:** -11,900.000 USD

Group Unit: 00495 **Group ID:** 162833 PAYMENTS

Deposit Unit: 00495 **Deposit ID:** 0000016102 **Payment ID:** 1500067578

Split Add A Conversation

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Unit: 00495 Customer: CST100010861 INDIANAPOLIS POWER & LIGHT CO

Item ID: 2008-17693-W 032008 Line: Days Late: -30 Status: Closed

Accounting Date: 05/12/2008 Entry Type: IN Billing Unit:

Balance: 0.000 USD Entry Reason: ENFSP Original Amount: 11,900.000 USD

AR Distribution Code: ACCTS REC

Discount Options

Due Date: 06/11/2008 Due Days:

Terms: NET30 Discount Days:

Discount Amount: Date:

Discount Amount 1: Date 1:

☐ Always Allow Discount

As Of Date: 05/12/2008 Posted: 05/12/2008

Payment/Draft Options

Payment Method Check

Draft Type: ☐ Preapproved?

Direct Debit Profile ID: ☐ Create Document?

☐ One Item per Draft?

Customer Relations

☑ Dispute Reason: Date:

Dispute Amount:

☑ Deduction Reason: Date:

☐ Doubtful

☐ Collection Code: Date:

Analyst: IDEM INDIANA DEPARTMENT OF ENVIRONMENTAL MGMT

Collector: IDEM ACCOUNTS RECEIVABLE

Sales Person: IDEM IDEM

AR Specialist:

Other Options

☑ Revaluation Flag ☑ Available for Netting

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Detail 1 | Detail 2 | Detail 3 | Item Activity | Item Accounting Entries | Item Audit History

Unit: 00495 Customer: CST100010861 INDIANAPOLIS POWER & LIGHT CO

Item ID: 2008-17693-W 032008 Line: Days Late: -30 Status: Closed

Balance: 0.000 USD

Item Activities

Sequence: 1 Accounting Date: 05/12/2008 Posted Date: 05/12/2008

Entry Type IN Reason: ENFSP Voucher ID:

Document: Amount: 11,900.000 USD

Group Unit: 00495 Group ID: 162757 BILLING

Sequence: 2 Accounting Date: 05/12/2008 Posted Date: 05/12/2008

Entry Type PY Reason: Worksheet Reason: Voucher ID:

Document: Amount: -11,900.000 USD

Group Unit: 00495 Group ID: 162833 PAYMENTS

Deposit Unit: 00495 Deposit ID: 0000016102 Payment ID: 1500067578

Split Add A Conversation

OK | Cancel | Apply | Refresh

Detail 1 | Detail 2 | Detail 3 | Item Activity | Item Accounting Entries | Item Audit History

BARNES & THORNBURG LLP

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Anthony C. Sullivan
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tony.sullivan@btlaw.com

IDEM
OFFICE OF
WATER QUALITY

2009 JAN 26 A 8:55

January 21, 2009

Mark W. Stanifer, Section Chief
Indiana Department of Environmental Management
Water Enforcement Section
Office of Enforcement, Mail Code 60-02
100 North Senate Avenue, IGCN 1315
Indianapolis, Indiana 46204-2251

Re: ***IDEM v. Indianapolis Power & Light Company***
Case Nos. 2007-16780-W and 2008-17693-W

Dear Mark:

Regarding the approved Agreed Order for the above-referenced matter dated April 22, 2008, please note that IPL has initiated system wide inspections at all three (3) generating IPL facilities within 270 days of the Effective Date of the Agreed Order as required by Section II.4. (and referenced in Attachment A thereto), as follows:

- Informal bi-weekly inspections were implemented prior to the January 19, 2009 deadline.
- Bi-annual inspections were implemented prior to the January 19, 2009 deadline.
- Semi-Annual inspections will be implemented this Spring which is prior to deadline of June 19, 2009.

If you have any questions, please call. Thank you.

Sincerely,

Tony Sullivan

Anthony C. Sullivan

ACS:naw

INDS01 TCS 1096278v1

BARNES & THORNBURG LLP

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Indianapolis, IN 46204-3535 U.S.A.
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DEC 19 2008
IDEM-ENFORCEMENT

Anthony C. Sullivan
(317) 231-7472
tony.sullivan@btlaw.com

December 19, 2008

Mark W. Stanifer, Section Chief
Indiana Department of Environmental Management
Water Enforcement Section
Office of Enforcement, Mail Code 60-02
100 North Senate Avenue, IGCN 1315
Indianapolis, Indiana 46204-2251

Re: ***IDEM v. Indianapolis Power & Light Company***
Case Nos. 2007-16780-W and 2008-17693-W

Dear Mark:

In accordance with the approved Agreed Order for the above-referenced matter dated April 22, 2008, enclosed please find the detailed study performed by BT^2 Inc., and completed prior to October 21, 2008. Regarding the results and recommendations of the study, I have also enclosed a Feasibility Analysis for Use of D-Pond for Future Processing of Ash Slurry, dated December 18, 2008.

Regarding the Agreed Order requirement that IPL "implement any recommendations that are necessary to achieve the study's objective," note that IPL has not placed the D and E ponds in service and currently has Pond D available strictly for emergency uses only. To implement the goals of the Agreed Order, IPL is considering the possibility of filling the present Pond E to the elevation of the exterior E-Pond dike with ash to buttress the existing D-E levee that previously failed. This approach is supported by the December 18, 2008 feasibility analysis from BT^2 and would provide operational capability to the company. We would like to convene a meeting with you and any other necessary IDEM staff to discuss this plan, perhaps in the second or third week of January. Along those lines, please email to me your dates and availability during that time period. In the meantime, IPL will continue to not place Ponds D or E in service unless required to do so by absolute emergency.

IPL considers the enclosures to this letter to be business confidential and requests that your agency maintain these documents as business confidential.

If you have any questions, please call. Thank you.

Sincerely,

Anthony C. Sullivan

ACS:naw
Via Hand Delivery

BT² inc.
Engineering & Science

Madison, WI | Lake Delton, WI | Chicago, IL

December 18, 2008

Mr. Rick Jacobs
Indianapolis Power & Light Company
4040 Blue Bluff Road
Martinsville, IN 46151

SUBJECT: Feasibility Analysis for Use of D-Pond for Future Processing of Ash Slurry
Indianapolis Power & Light - Eagle Valley Plant
Martinsville, Indiana

Dear Mr. Jacobs:

At your request, Mr. David M. Hendron, P.E. of BT^2, Inc., made an analysis of the feasibility of the use of D-Pond at the Indianapolis Power & Light (IPL) Eagle Valley Plant (EVP) for future use in processing of ash slurry from the plant operations. This letter presents results of the feasibility analysis. We understand that IPL intends to fill the present E-Pond to the elevation of the exterior E-Pond dike with ash to buttress the existing D/E levee that previously failed. IPL will maintain the continuity of the conduit that exists between the E-Pond and the C-Pond so that it can be used to convey the overflow fluids from D Pond to maintain that the fluid levels in D-Pond will not exceed elevation (elev.) 620 as discussed in Section 2 of this letter report.

Our feasibility analysis included the following:

1. **Stage/Storage Volume Calculations for D-Pond**
2. **Stability Analyses of D-Pond for Various Storage Scenarios**
3. **Summary Conclusion of Feasibility**

A discussion of each follows.

1. Stage/Storage Volume Calculations for D-Pond

We understand that IPL wants to have the ability to use D-Pond for future processing of ash slurry. IPL requested BT^2 make a feasibility study of this option.

The first step in the feasibility analysis was to calculate the available storage volume in the D-Pond for the range of water elevations in the D-Pond. We were provided a topographic map of the D-Pond and the adjacent E-Pond by IPL. This topographic map, dated January 15, 2008, is given on **Figure 1**. We assume that the present contours of the configuration of D-Pond are reasonably consistent with the contours shown in this topographic map.

We used the topographic map to prepare a Stage/Storage (S/S) curve for D-Pond. This curve is shown on **Figure 2**. In effect, the S/S curve shows the available storage volume in D-Pond below each elevation that fluid could be stored in the pond. In order to prepare this curve, we assumed that there was no fluid in the pond. To determine the stage that the additional ash slurry volume will result in when it is used for plant operation, the fluid stage in the pond at the beginning of surge storage operation, defined as the antecedent water elevation, must be determined.

2. Stability Analyses of D-Pond for Various Storage Scenarios

The second step in the feasibility analysis was to perform stability analyses for the exterior dikes that form D-Pond. We first back-calculated the Frictional Shear Strength (FSS) parameter for the ash based on previous performance of the exterior dikes. The exterior dikes for D-Pond were shown to be stable when the fluid level in the pond was at elev. 639.5. We assumed that the exterior dike had a Factor of Safety (FS) of 1.0 when the water level was elev. 639.5. Our back calculations show that the FSS for the ash was 26 degrees. Based on this result, we assumed a FSS value for the ash material forming the perimeter dikes of 26 degrees.

Using a FSS value of 26 degrees for the ash material in the perimeter dikes, we performed calculations to determine the water level (also referred to as stage) in D-Pond corresponding to a FS of 1.4. We used a value of 1.4 to be consistent with minimum short-term design factor of safety for this type of geotechnical structure that considers short-term effects such as the effects of waves and other transient loads on the perimiter dikes during normal operation of the pond. In summary, a FS of 1.4 is obtained in D-Pond at a stage of elev. 622. This will be defined as the short-term, Maximum Allowable Water Elevation (MAWE) for the use of D-Pond for future ash slurry processing purposes.

We recommend that the Maximum Operating Water Elevation (MOWE) for use of D-Pond for surge storage be 2 feet below the MAWE to provide for steady state operation of the pond for future ash processing. Consequently, our stability calculations indicate that the MOWE for use of D-Pond for surge storage of ash slurry is elev. 620. At this elevation, based on the topographic information available for this study, the pond will provide at least 3,000,000 gallons of capacity for surge storage for all antecedent fluid level conditions below elev. 617. At a water level elev. 620, the FS for the D-Pond dikes is 1.5. This FS is consistent with the Standard Practice for FS for this type of water retention structure.

Given the results of our stability analyses, we recommend that a spillway overflow be provided at some point in the D-Pond with an invert elevation of 620. The spillway should be sized to handle a flow equal to the plant flow rate plus rainfall equivalent to at least a 100-year return frequency. We understand that the flow from this spillway can and will be connected via a closed conduit to the existing conduit between E-Pond and C-Pond.

3. Summary Conclusion of Feasibility of Use of D-Pond for Future Processing of Ash Slurry

In summary, our analyses indicate that use of D-Pond for future processing of ash slurry is feasible given that IPL implements the recommendations outlined in this letter report. Specifically, the recommendations include the following items:

a) The breach in the existing D/E levee will be repaired by placement and compaction of ash to the lines and grades of the original D/E levee to the elevation of the MAWL (elev. 622).

b) The E-Pond will be filled with ash obtained from site ash ponds. The exterior of the original E-Pond levees will be dressed up to repair past damage to these levees.

c) The D-Pond will be provided with a spillway connected to the C-Pond with an invert elevation of elev. 620 and a capacity of conveying maximum fluid output from the plant plus the flow resulting from a 100-year return frequency (1% chance of a return in any year) rainfall event.

d) IPL will prepare a set of engineering documents for the design of modification of D-Pond for the intended usage for future ash slurry processing.

Sincerely,
BT^2, Inc.

David M. Hendron, P.E.
Senior Manager

Enclosures: Figure 1 - January 15, 2008 Topographic Map
Figure 2 - Stage / Storage Curve

DH/lmh
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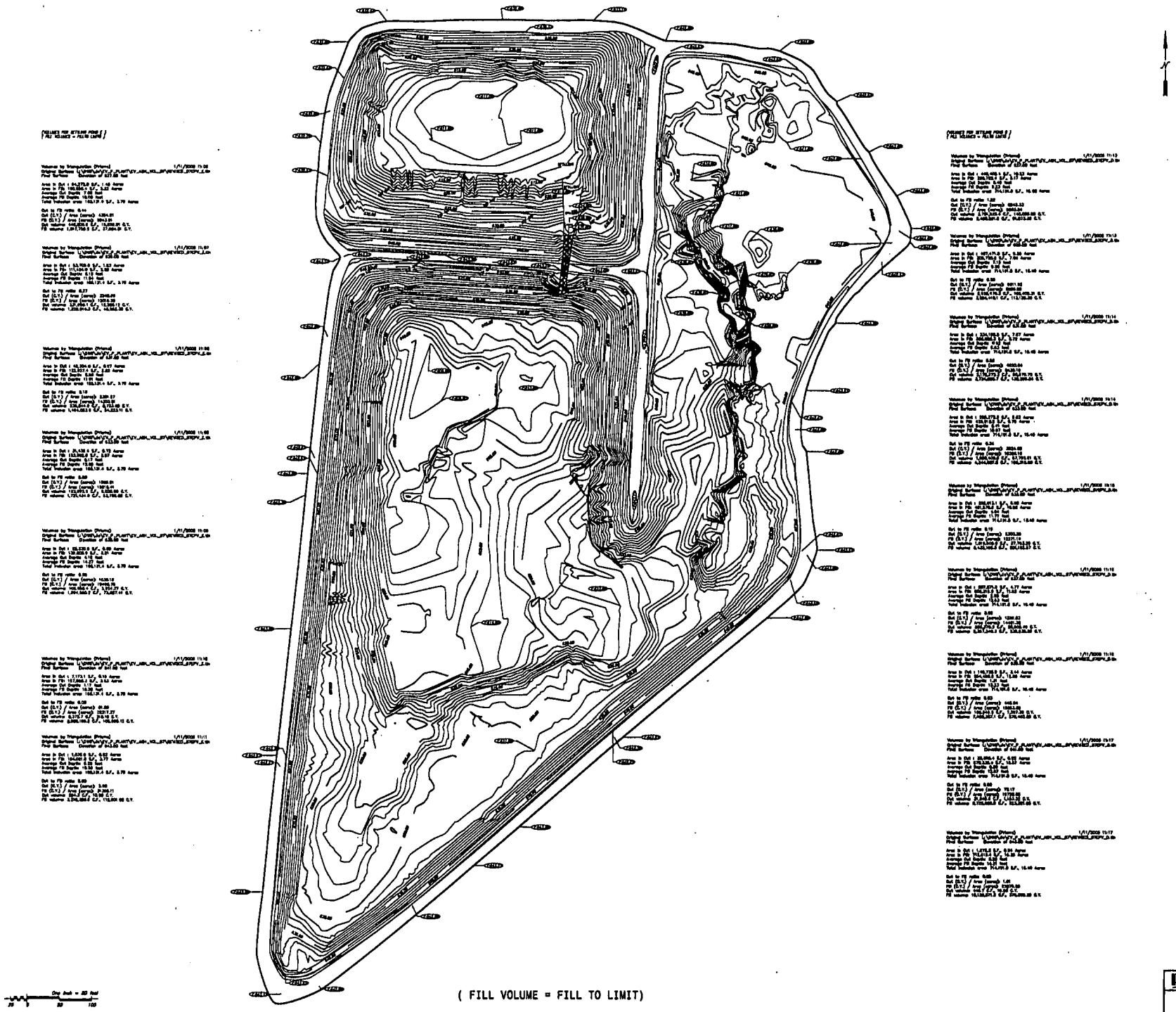


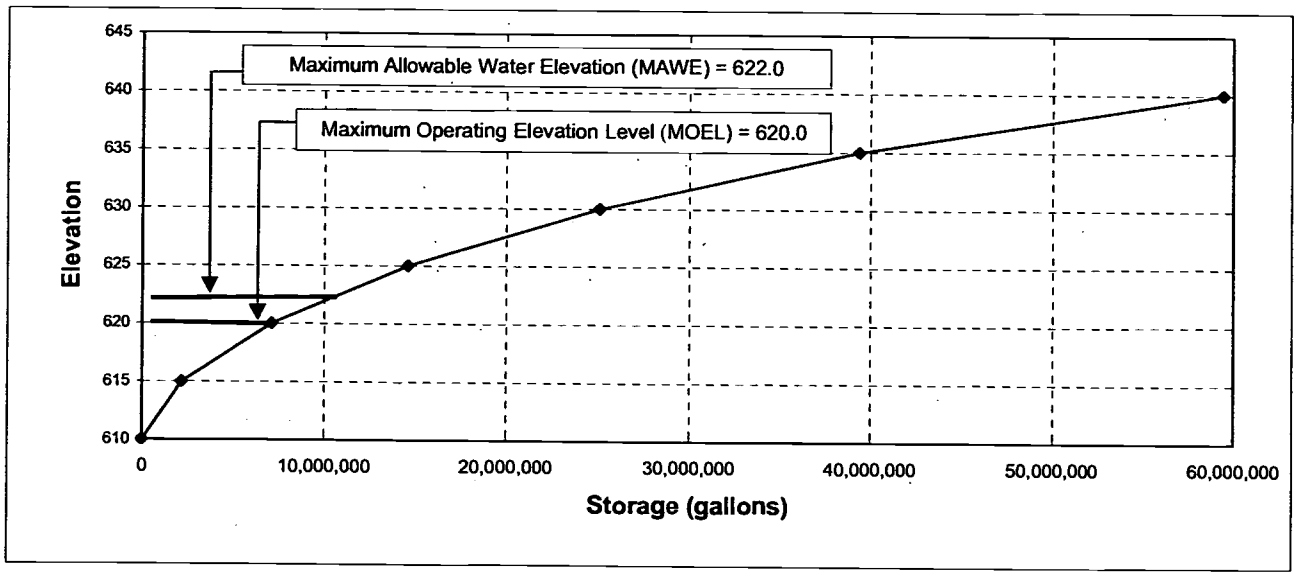
(FILL VOLUME = FILL TO LIMIT)

INDIANAPOLIS POWER & LIGHT COMPANY

EAGLE VALLEY POWER PLANT
ASH PONDS D & E

Figure 2
Pond D Stage/Storage Calculation
Indianapolis Power & Light Company
Eagle Valley Power Plant

Elevation	Area (ft^2)	Average Area (ft^2)	Volume (ft^3)	Cumulative Volume (ft^3)	Cumulative Volume (gal)
610	16,476			0	0
		57,916	289,580		
615	99,356			289,580	2,166,058
		132,558	662,790		
620	165,760			952,370	7,123,728
		200,585	1,002,925		
625	235,410			1,955,295	14,625,607
		280,221	1,401,103		
630	325,031			3,356,398	25,105,853
		383,073	1,915,363		
635	441,114			5,271,760	39,432,765
		535,104	2,675,518		
640	629,093			7,947,278	59,445,636



Note: Volumes calculated using areas obtained from drawing titled: Eagle Valley Power Plant, Ash Ponds D & E, Volume Survey, dated January 15, 2008.

KRG/krg/DH
I:\3573\Tables-General\[Pond D volume.xls]Sheet1

Engineering & Science

Causal Analysis Report
Indianapolis Power & Light Company
Eagle Valley Generating Plant
Martinsville, Indiana

October 2008

RECEIVED

DEC 30 2008

DEPARTMENT OF
ENVIRONMENTAL MANAGEMENT
OFFICE OF LAND QUALITY

Prepared For:

Indianapolis Power & Light Company
1230 W. Morris Street
Indianapolis, IN 46221-1744

RECEIVED BY

JAN 07 2009

IDEM-ENFORCEMENT

Prepared By:

BT^2, Inc.
2830 Dairy Drive
Madison, Wisconsin 53718

BT^2 Project #3573

October 15, 2008

Mr. Rick Jacobs
Indianapolis Power & Light Company
1230 W. Morris St.
Indianapolis, IN 46221-1744

SUBJECT: Causal Analysis Report
Eagle Valley Generating Plant
Martinsville, Indiana
BT² Project #3573

Dear Mr. Jacobs:

Enclosed are three copies of the report summarizing our evaluation of the Ashponds D and E dike failures.

Please call if you have any questions or concerns.

Sincerely,
BT², Inc.

for

David M. Hendron, P.E.
Senior Professional Manager

Enclosure: Causal Analysis Report (3)

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1.0 INTRODUCTION

In accordance with Purchase Order # 864768, BT^2, Inc., of Northfield, Illinois, performed an investigation of the cause of two failures of the dike separating Ashpond D and Ashpond E at the Indianapolis Power and Light (IPL) company Eagle Valley Generating plant (EVP) in Martinsville, Indiana. This separation dike will hereinafter be referred to as D/E dike. The location of the EVP and the ashponds are shown on **Figure 1**. The configuration of Ashponds D and E, and the location of the D/E dike are shown on **Figure 2**.

The ashponds at the EVP and system wide for IPL are typically constructed using flyash generated from coal combustion at the plant. The failures of the D/E dike raise two questions regarding the present IPL method for disposal of flyash at their facilities. First, the failures raise a question about the continued possibility of using Ashponds D and E for slurry ash disposal, and second the failures raise a question about the stability and safety of other flyash disposal retention dikes at EVP and the other generating plants. This report is intended to present the results of BT^2 work to identify the cause of the failures, and to provide the overall answers to the two general questions raised by the failures. The report is organized into the following sections:

Section 1.0 – Introduction
Section 2.0 – Chronology of the Construction of Ashponds D and E
Section 3.0 – Description of D/E Dike Failure #1 – 14 February 2007
Section 4.0 – Description of Redesign of D/E Dike
Section 5.0 – Description of D/E Dike Failure #2 – 30 January 2008
Section 6.0 – Site Investigation by BT^2 – April Through June 2008
Section 7.0 – Identification and Analyses of Potential Failure Mechanisms
Section 8.0 – Identification of the Cause of the Failures
Section 9.0 – Conceptual Design Changes to Correct Cause of Failures
Section 10.0 – Consequence to System Wide Design and Operation of Ashponds for IPL

2.0 CHRONOLOGY OF CONSTRUCTION OF ASHPONDS D AND E

Disposal of flyash at the EVP has involved using slurry methods to convey the flyash material to sedimentation ponds located at various distances from the main plant. The slurry is injected in the pond,

sedimentation of the ash occurs, and the fluid used in the slurry process is discharged to the river after meeting regulatory requirements for its discharge. The evolution of Ashponds D and E has occurred over a period of time. A brief summary of this process up to the time of the first failure of dike D/E on 14 February 2007 is described in the following paragraphs of this report. During our investigation, we reviewed files at the IPL plant; we interviewed Mr. Rick Jacobs and Mr. Roy Holmes, and we found a wealth of aerial photograph information from the time period 1998 to March 2007. Copies of the relevant aerial photos are shown in **Appendix A** for the following dates:

- 1998
- 2000
- 2003
- 2004
- March 2005
- July 2005
- 2006
- March 2007
- July 2007

Original Ash Disposal to about 1990 – We do not know exactly when the EVP began operation or when the plant began disposing of its flyash using slurry methods. However, it is thought that the plant began operation prior to 1960 and began to convey the ash to a disposal pond located in an area west of the main plant at some reasonably short time after that date. The disposal area was constructed over an area that encompassed the entire area now included as Pond D and Pond E. We understand that the flyash slurry was injected in the northeast corner of the ashpond and the sedimentation occurred as the slurry flowed around a "splitter" dike in the center of the pond. Discharge to the adjacent channel north of the ashpond occurred in the northwest corner of the ashpond.

During this period of time, the maximum top elevation of the ashpond, including the splitter dike, was about elevation 624. We understand that the original "starter" dike for the perimeter of the pond was lower than this maximum elevation and may have been constructed of clay borrowed from a nearby source. The ashpond was eventually raised to elevation 624 using flyash. None of the borings drilled during the BT^2 investigation appeared to have penetrated the clay reported to have been used for the starter dike. Consequently, it is assumed that the entire dike cross-section for the perimeter dike system

for what is now Ashpond D and E is constructed of flyash material borrowed from inside the disposal area.

In or about 1990, we understand that IPL ceased using this ashpond for disposal of flyash because of the low volume of flyash being produced by the plant. The ashpond was closed with placement of a soil cover over the flyash. The aerial photograph on Figure A1 in **Appendix A** shows the condition of the closed ashpond complex in 1998.

Construction of Ashponds A, B, and C – After closure of the original ashponds at the plant, IPL constructed a new flyash pond system consisting of three new ponds identified as ashponds A, B, and C. The new system was constructed in an area immediately west of the original pond location. Unlike the original ashpond, the new system contained a primary sediment basin (Basin A) connected to a secondary sediment basin (Basin B) which was connected to a tertiary sediment basin (Basin C). Water from Basin C was discharged to the channel connected to the channel to the White River. These ponds continue to be in operation at the present time.

The dikes that form the three ashpond basins are constructed of flyash, and the dikes have a similar design to the rest of the ashpond dikes at the plant. The top elevation of the dikes is not known but these are lower than the dikes at the present Basins D and E. The side slopes for the interior and exterior slopes of the basins are at about 3 horizontal to 1 vertical (3H:1V). The aerial photograph on Figure A1 in **Appendix A** shows the configuration of the three ashpond basins.

Reopen and Raise the Elevation of the top of the Original Ashponds – about 1999 – In or about 1999, IPL reopened the original ashponds for the EVP. The top of the ashponds was raised from the former top elevation of elevation 624 to approximately elevation 633 using flyash borrowed from an area inside of the original ashpond. It is unknown what design documents were prepared for this construction. It appears that the original reconstruction design may have incorporated some minor cross-dike in the present location of dike D/E but photographs are not clear that this was a part of the construction. It appears that operation of the reopened ashpond resulted in primary and secondary sedimentation in the reopened facilities. After secondary sedimentation, fluids were conveyed to the tertiary sedimentation Basin C in the system west of the reopened ponds and then discharged to the channel to the White River.

It is important to note that there were no stability issues reported for the reopened original ashponds after the beginning of operation in 1999. At this time the top elevation for the ashpond dikes was elevation

624. These ponds were operated along with the ashpond Basins A, B, and C until about the summer of 2004 when they again became full. By the summer of 2004, it appears that the reopened ashponds clearly showed two basins clearly separated by a cross-dike. Basin D was the primary sedimentation basin, and Basin E was the secondary sedimentation basin. Aerial photographs from 2003 and 2004 (Figures A3 and A4 in **Appendix A**) seem to show that fluid levels in Basins D and E during operation of the ponds may have been substantially lower than fluid levels that were used when dike D/E was raised to elevation 642. These lower fluid levels, if they were used, could have been a part of the reason that dike D/E was stable during this period of operation.

Raise the elevation of Basin D to elevation 642 – Fall 2004 – In early 2004, a decision was made to raise the top elevation of Basin D and the splitter dike in Basin D to elevation 642. The design of the new basin configuration was completed by IPL engineering and was bid in the early summer of 2004. Construction was scheduled to be completed by December 2004. The aerial photograph in July 2004 shown on Figure A4 in **Appendix A** shows the beginning of construction of the raising of the ashpond dike for Basin D. Because of delays, construction was not completed until July 2005. The water level in Basin D was controlled by the placement of two horizontal pipes with an invert elevation of 639.5 feet through the dike D/E. We understand that these pipes were placed near the eastern edge of dike D/E. We have no design documents for this construction.

An aerial photograph taken in March 2005 is shown on Figure A5 in **Appendix A** shows that extensive and deep borrow areas were developed inside of Basin D as the source of the flyash. This aerial photograph also shows that some of the clay soils for the soil layer on the exterior slopes was also obtained from the borrow area inside the Basin D area. The natural soils in this area under the flyash are typically relatively thin clay soils overlying a very permeable granular alluvium of the White River. It appears that the excavation of the clay was completed to within a few feet of the upstream toe of dike D/E near the area of the failures. This excavation exposed the relatively permeable granular alluvial soils under the clay. We understand that IPL staff observed this construction activity, and required the contractor to cease this activity and cover the relatively permeable alluvial soils with compacted soils and flyash. We did not find any documentation of the placement of this material over the entire area in which the clay was removed.

After completion of construction in July 2005, it took until late 2006 or early 2007 for Basin D to become filled. The original schedule was that Basin D was to be filled with water by December 2005. The large difference in time for the filling to occur is evidence that there was most likely substantial leakage of ash

slurry fluids through the bottom of Basin D. The leakage most likely occurred through the bottom of the borrow area through the exposed granular alluvial soils exposed when the clay borrow was developed. By the end of 2006 or early 2007, water level in Basin D had reached elevation 639.5 and was filling the Basin E. The water level in Basin E was not measured, but photographic evidence shows that it eventually reached about one-third to one-half the way up the Basin E slopes before the first dike D/E failure on 14 February 2007. This is shown in the aerial photograph on Figure A8 shown in **Appendix A**.

3.0 DESCRIPTION OF FAILURE #1 – 14 FEBRUARY 2007

As indicated in the previous paragraph, dike D/E failed suddenly and without warning on 14 February 2007. We did not find any photographs or other evidence in the IPL files contemporaneous with this failure. We did, however, find an aerial photograph of the site taken on 30 March 2007, that clearly shows the appearance and condition of Basins D and E, and of dike D/E about six weeks after the failure occurred. This photograph is shown on **Figure 3**.

Our review of the visual evidence shown on **Figure 3** indicates several important things about the conditions in Basin D and E at the time of the failure. These are as follows:

- The fluid level in Basin D was near the top of the dikes and was probably at the level of the invert of the spillway pipes that were constructed through dike D/E. This would have resulted in a level of elevation 639.5. The strongest area where this evidence is shown is in the form of an ash slurry mark on the west side of the splitter dike and is shown on **Figure 3**.
- The fluid level as shown by the ash slurry mark on the sides of Basin E was near the mid-slope elevation of the basin. The strongest evidence of this is shown on all four of the interior slopes of Basin E. These are shown as marked on **Figure 3**.
- It appears that the failure occurred at the eastern extremity of dike D/E and that the failure resulted in a semi-circular bowl shaped feature formed at the downstream toe of dike D/E at the intersection of dike D/E with the eastern slope of Basin E. The location and extent of this feature is shown on **Figure 3**. The appearance of this feature is consistent with a slope stability failure associated with piping erosion of the flyash at the downstream toe of dike D/E. We were not able to find any photographic evidence of the failure that occurred on 14 February 2007, and we understand that the photo on **Figure 3** may have been taken after the breaches in dike D/E and the north dike section for Basin E were backfilled with ash.

- There is no visual evidence of the condition of the spillway pipes reported to have been incorporated into the design of dike D/E after the failure.

Based on our review of the available data, discussions with the IPL personnel, and the aerial photograph, it is our conclusion that the failure occurred as a result of slope stability failure of the downstream slope under the loads imposed by the seepage through the dike, by instability of the toe of the slope as a result of loads imposed by seepage under the dike, or by erosion of the dike when leakage occurred from the spillway pipes when overflow occurred after Basin D reached full volume at elevation 639.5. The discussion of each of these three mechanisms will be given after we present the slope stability analyses performed.

4.0 DESCRIPTION OF REDESIGN OF FAILED DIKE BETWEEN ASHPONDS D AND E

We understand that IPL retained the firm of Fuller, Mossbarger, Scott & May (FMSM) to investigate the failure and redesign dike D/E. We reviewed a limited amount of information in the IPL file connected with this work. **Appendix B** contains copies of the information reviewed. The information included the following:

- Executive Summary of the work performed by FMSM including a drawing showing the cross-section that FMSM analyzed to determine the stability of the slope that failed and the redesign of the slope to correct conditions that caused the failure.
- Boring logs for five borings drilled by FMSM during the investigation.
- A series of six drawings prepared by FMSM showing the redesign of the slope and bid package material.
- After a meeting with IPL on 15 July 2008, we were provided information on laboratory testing completed by FMSM.

Of particular interest to the causal study performed by BT^2 is the drawing showing the slope stability analyses performed by FMSM during their redesign of dike D/E. This drawing is shown on **Figure 4**. The drawing shows the two cases considered by FMSM; first a cross-section of the dike D/E before the failure that occurred on 14 February 2007, and second a cross-section of the redesigned dike D/E. As shown, the primary difference between the two cross-sections is the placement of a granular berm on the downstream toe of the dike D/E. The FMSM information did not have specific discussion of the intent of

this berm; it would presumably be to provide a combination of counterweight and filter capability on the lower portion of the downstream toe of the original cross-section that failed. A second design change was also made by FMSM. This design change included the placement of slurry concrete around the two high-density polyethylene (HDPE) spillway pipes constructed through dike D/E in a similar manner as in the original design. This detail is shown on the drawings prepared by FMSM.

The Executive Summary prepared by FMSM discusses the performance of laboratory tests and other activities. We have recently been provided summary information from the testing performed. We understand that there is not a formal report available for the work done by FMSM. We have not been able to review detailed results of the laboratory testing performed for the project by FMSM.

Overall, the most important part of the information we were able to review for our Root Cause Analysis (RCA) was the fact that the FMSM investigation and redesign used a shear strength value for the flyash of 33 degrees. It appears that FMSM may have selected this value based on results of laboratory testing they performed. Our review suggests that the unit weight of the laboratory samples used for the shear strength testing was much greater than the very low unit weights that have to be expected for a bulk of the ash materials used in the construction of the ashpond dikes. This expectation is based on the very low Standard Penetration Test (SPT) results shown in the logs of borings drilled by FMSM, particularly in the lower portion of the borings they drilled. Given the very low SPT values, a value of 33 degrees for the frictional shear strength of the flyash is very high for this type of material. Additionally, the Executive Summary prepared by FMSM cites the very low SPT values in the lower portion of the ash materials in the dikes.

As will be discussed in **Section 7.0** of this report, the back calculations of shear strength made as part of our stability analyses indicate that the friction angle for the flyash is only 21 degrees. This represents a 70% reduction in the shear strength of the flyash material. Stated in another way, using a shear strength of 33 degrees results in a factor of safety of 1.7 times more than the factor of safety using a shear strength of 21 degrees.

Based on our review of the available FMSM information in the IPL files, it is our conclusion that FMSM used a shear strength for the flyash that was significantly higher than the actual shear strength of the loose to very loose flyash indicated in the borings they drilled for their investigation. Based on our review of the boring information and available literature, a more appropriate value would have been about 1.4 (friction angle of 25 degrees) to 1.7 (friction angle of 21 degrees) times less than the value used. Use of

these lower shear strengths would have shown that the redesigned cross-section would, at best, have been only marginally stable. Further discussion of the stability analyses performed by BT^2 is presented in **Section 7.0** of this report.

In summary, it is our conclusion that the use of the very high value of shear strength in the redesign of the failed D/E dike was the principal cause of the second failure that occurred on 30 January 2008.

5.0 DESCRIPTION OF FAILURE #2 – 30 JANUARY 2008

IPL began reconstruction of dike D/E in the summer of 2007, and completed construction and re-operation of the system in November 2007. Unlike the first filling of Basin D, the second filling of Basin D to elevation 639.5 was accomplished by the end of December 2007, and flow of water through the spillway pipes into Basin E began to occur. This relatively rapid filling compared to the first filling suggests strongly that seepage through the bottom of the ashpond in Basin D was minimized by the accumulation of ash sediment.

The aerial photograph of dike D/E taken on 7 July 2007, is shown on Figure A9 in **Appendix A**. At that time, it appeared that there was fluid collecting in Basin D at an elevation substantially below elevation 639.5. There was no fluid in Basin E. The location of the spillway pipes is not shown, and the construction of the granular toe berm is incomplete.

On or about 30 January 2008, dike D/E failed suddenly for a second time. As will be shown in **Section 7.0** of this report, back calculation of the shear strength of the flyash using this failure and appropriate fluid levels in Basins D and E, the value for the shear strength of the flyash is 21 degrees rather than 33 degrees. Based on this work, it is concluded that the redesigned cross-section by FMSM was too weak to support the loads resulting from hydraulic operation of dike D/E with a full pool of elevation 639.5 in Basin D and a partial pool in Basin E, even with the addition of the toe berm constructed on the downstream slope of dike D/E

6.0 SITE INVESTIGATION BY BT^2

In May and June 2008, BT^2 made a site investigation at the EVP site to determine the physical characteristics of the flyash and soils comprising the ashpond retention dikes for Basins D and E including dike D/E. The following sections provide a discussion of the content of the field investigations conducted.

6.1 Field Investigations

BT^2 installed seven soil borings in June 2008 using a hollow stem auger drilling rig. Soil Borings B1 - B7 were completed, and the soil boring logs are included in **Appendix C**. Piezometers were installed in five of the soil borings, and the well installation details are included in **Appendix C**. The location of the borings and piezometers are shown on **Figure 2**. Water levels were measured in the piezometers on two dates, and the water level measurements are summarized in **Table 1**.

A hand auger boring (HA1) of the toe berm material was performed on 30 June 2008, by ATC Associates, Inc. The hand auger boring log is included in **Appendix C**. The location of the hand auger boring is shown on **Figure 2**.

6.2 Laboratory Investigations

Laboratory testing was performed on samples obtained from the borings to determine the physical characteristics of the flyash and the native soils below the dikes. One sample of the granular toe drain material was also tested for grain size distribution. Testing of the flyash and native soils consisted of natural moisture content determinations, Atterberg limits (for cohesive native soil), grain size analyses, and permeability. The test results are contained in **Appendix D** and summarized in **Tables 2** and **3**.

6.3 Summary of Investigations

6.3.1 Nature and Extent of Materials

The results of the borings and laboratory testing done by BT^2 are consistent with and confirm the general conditions shown in the borings performed by FMSM. In general, the borings encountered flyash from the top of the dike at elevation 642 to approximately elevation 600. From elevation 600 to about elevation 595, the borings encountered a relatively thin layer of low to moderate plasticity cohesive soils. Below elevation 595, the borings typically encountered medium dense to dense granular soils. Of particular interest to the evaluation of cause of the failure were the nature, extent, and physical properties

of the flyash material that forms the principal element of the cross-section of the dikes in Basins D and E. These are discussed in the following section.

6.3.2 Physical Properties of Flyash materials

Gradation – **Figure 5** shows the average gradation of flyash materials found in the borings. This gradation curve shows that the flyash is a non-plastic, fine-grained material. The data show that, on average more than 75% of the flyash materials pass the #200 standard sieve, and less than 5% pass the 0.002 micron size that defines clay particle size. It results that the flyash is predominantly a silt-sized material with some medium to fine sand-sized particles.

Water Content – **Table 3** shows the results of water content tests on the flyash materials, and **Figure 6** shows the results of water content plotted vs depth in the boring. It is clear that the water content of the flyash above a depth of 20 to 30 feet is typically much lower than the water content below this depth. Specifically, the water content above a depth of 20 to 30 feet is typically 10 to 40% compared to a water content of typically 40 to 80% below this depth. The importance of the increase in water content is that it occurs in conjunction with lower SPT values in the borings, and it is associated with a lower in-place density of the flyash. These two trends are completely consistent with each other. Given the results of the borings and laboratory tests, the consistency of the flyash must be classified as very loose to loose, and the shear strength must be considered accordingly.

Shear Strength – BT^2 evaluated the shear strength of flyash using available literature and the results of back calculations made during the slope stability studies performed for the project. Typical literature citing the range of typical shear strengths for flyash is given in **Appendix E**. In summary, the range of shear strength values for flyash ranges from 20 degrees to 40 degrees. To understand what shear strength to assign to this material for the project, the density of the material has to be considered. For low density flyash, the lower end of the range typically is used; for high density, the higher end of the range is used. At any rate, the value used should never exceed 30 degrees unless a very complete program of laboratory testing is undertaken and the design that is constructed insure that the density of all of the flyash meets the high density associated with this high value of shear strength for the flyash.

BT^2 did not perform shear strength testing on the flyash as part of this investigation. The purpose of the investigation was to determine the effective shear strength parameters of the in-situ flyash. Because of its very loose nature, the Shelby tube samples taken were not judged to be representative. Additionally, given the silty, non-plastic nature of the flyash material, it was judged to be not possible to reconstitute

samples in the laboratory that would be representative of the very loose condition of much of the flyash found in the borings made in the D/E dike.

We recently obtained some information on the shear strength testing performed by FMSM. The information is given in **Appendix B**. As might be expected, the value of shear strength used in the FMSM redesign is consistent with the values of shear strength FMSM reported to have measured in their laboratory triaxial tests. However, the dry density shown in the laboratory summary sheet for most of the test samples used in this testing was at or above the maximum dry density of the flyash they determined in their Proctor Density Tests. The maximum dry density of the flyash ranged from 81.2 lbs/ft^3 to 90.6 lbs/ft^3. The values of dry density of samples used for the shear strength testing ranged from 77.8 lbs/ft^3 to 99.1 lbs/ft^3. The friction shear strength value determined by FMSM was 36.2 degrees for the range of dry densities tested. Based on our review of the information available from the laboratory testing performed by FMSM, we conclude that the testing did not result in representative values of frictional shear strength of the flyash material for use in the redesign of dike D/E. We conclude that the densities of the triaxial shear strength tests made in the shear strength testing program were too high and resulted in shear strength values that were much higher than the in-place flyash at the site. Consequently, we conclude that the specimens of flyash tested by FMSM were not representative of the very loose condition of the flyash in dike D/E.

7.0 IDENTIFICATION AND ANALYSES OF POTENTIAL FAILURE MECHANISMS

7.1 General

BT^2 identified and evaluated three different failure mechanisms of dike D/E. The failure mechanisms included the following:

- Slope stability
- Piping and erosion along the length of the spillway tubes through dike D/E
- Uplift and piping of materials at the downstream toe of dike D/E

A discussion of each of the analyses follows.

7.2 Slope Stability

BT^2 performed slope stability analyses of dike D/E assuming seven different scenarios representative of conditions during the two failures that have occurred. BT^2 used WINSTABL software version 3.00 to

perform these analyses. **Table 4** presents the summarized results of the stability analyses. **Appendix F** contains the results of all of the stability analyses performed. A discussion of each scenario and the conclusions reached follows.

7.2.1 Scenarios 1 and 2

Reproduction of Stability Analyses Performed by FMSM – BT^2 attempted to reproduce the results of the FMSM stability analyses in these two scenarios. The purpose of this effort was to confirm that results we obtained using WINSTABL were comparable to those obtained by FMSM in their stability analyses. Based on the stability analyses performed by BT^2 in these two scenarios, BT^2 concludes that the results obtained by BT^2 are comparable to those done by FMSM.

Of special interest and note is that BT^2 used the very high value for the shear strength of the flyash assumed by FMSM in their stability analyses and obtained similar factors of safety for each of the two cross-sections of dike D/E analyzed. As will be seen in the following scenarios, our stability analyses show that the actual value of shear strength for the in-situ flyash, determined using back calculation methods, was much less than the shear strength values used in the FMSM stability analyses.

7.2.2 Scenarios 3, 4, and 5

Calculation of a Factor of Safety Using a Minimum Value for Shear Strength of Flyash – BT^2 used the redesigned cross-section proposed by FMSM and the minimum expected shear strength for flyash of 20 degrees to calculate a factor of safety for the redesigned dike D/E. As shown in **Table 4**, the factor of safety for these assumptions is reduced from 1.41 to 0.91. These calculations clearly show that the lower values of shear strength for flyash explain the cause of the failure of dike D/E.

7.2.3 Scenarios 6 and 7

Back Calculation of Flyash Shear Strength for a Factor of Safety of 1.0 for Redesigned Dike D/E Cross-section – BT^2 back calculated the value of flyash shear strength that would explain a factor of safety of 1.0 at the time of the failure of the redesigned cross-section for dike D/E. This type of engineering analysis is typically performed in the event of slope stability failures to obtain full scale or mass shear strength values for in-situ materials involved in the failure. This eliminates laboratory scale problems and provides a reasonably effective way to obtain shear strength values of in-situ materials that can be used in design of repairs for slopes that have failed.

Table 4 shows that a factor of safety of 1.0 can be shown for the redesigned cross-section for dike D/E if the shear strength for the flyash is assumed to be 21 degrees. As indicated previously in this report, this value of shear strength is 1.7 times less than the shear strength used in the FMSM analyses. This amount of variation provides a clear explanation of a principal cause of the second failure of dike D/E.

7.3 Piping and Erosion Along the Sides of the Spillway Tubes through Dike D/E

7.3.1 General

There is not any visual or other evidence that either of the failures were initiated or caused by piping and erosion along the sides of the spillway tubes through dike D/E when the fluid level in Basin D reached elevation 639.5. It appears that there has been some anecdotal association between the timing of the failure with the time that the water level in Basin D reached elevation 639.5 and began spilling into Basin E, but we have no measurements to show this to be the case. The best evidence we have with respect to how much flow had occurred though the spillway pipes at the time of the first failure is shown on the aerial photograph taken in March 2007. This aerial photograph was taken about six weeks after the first failure. In addition to this aerial photograph, we have been able to review digital photographs taken immediately after the second failure. In both cases, the photographs show that the fluid level in Basin E was at some intermediate level above the bottom of the basin when the failure occurred. This would suggest that flow had occurred through the spillway tubes for some reasonably substantial period of time before the failure occurred. While this does not eliminate the possibility that some piping and erosion could have occurred along the spillway tubes and that it may have been contributory, we have concluded that it is not the primary cause of the failures that occurred.

In performing the stability analyses discussed in the previous section, BT^2 was able to show that the most critical slope stability situation is when the water level in Basin E is at an intermediate level about one-third to one-half of the slope height. The fluid levels in the photographs are consistent with these analyses.

In conclusion, BT^2 cannot eliminate the possibility that seepage and erosion along the spillway tubes played a role in the failure but it does not appear to be a principal part. We are of the opinion that a new spillway design should be used if IPL elects to continue to use Basins D and E for sedimentation and disposal of flyash at the plant. We provide our conceptual design approach to accomplish this goal in **Section 9.0** of this report.

7.3.2 Uplift and Piping of Flyash Materials at the Downstream Toe of Dike D/E

Uplift - The toe berm provided by FMSM in the redesign cross-section for dike D/E was not extended into Basin E. In effect, the redesign provided little protection for the possibility of uplift and/or piping of flyash materials at the downstream toe of dike D/E in Basin E. The need for this protection should have been investigated but, given the high shear strength values assumed for the flyash materials in the FMSM design, it was not shown to be needed and the available information we reviewed did not show that it was done.

BT^2 investigated the effect of providing protection for uplift and piping at the toe of dike D/E by extending the toe berm by a length of 20 feet and 50 feet into Basin E. Additionally, BT^2 increased the thickness of the berm from 5 feet to 10 feet. We used a shear strength of 21 degrees for the calculations and found that the factor of safety for dike D/E was increased from 1.0 to about 1.5. These results are shown in Scenarios 8, 9, and 10 in **Table 4.** Without the provision of this extension, the cross-section is not shown to be stable. Consequently, we conclude that the failure to provide this feature in the redesign of dike D/E was a part of the cause of the second failure that occurred.

Piping - **Figure 5** shows the gradation of the granular berm material and the flyash. Also shown on **Figure 5** is the range of the gradation for a filter material to prevent piping of the flyash that could lead to internal erosion and piping failure of the flyash.

Based on the information shown in **Figure 5,** it appears that the gradation of the filter material used by FMSM is acceptable but is near the coarse limit of the range of filter material gradation for the flyash. We conclude that the gradation of the material is marginally acceptable for use as a filter for the flyash and will recommend some trend towards providing a finer graded material for at least the lower 3 to 5 feet of material used in any redesign of dike D/E.

8.0 IDENTIFICATION OF THE CAUSE OF THE FAILURES

Based on our RCA, we conclude that the primary cause for the failure was a slope stability failure of the redesigned dike D/E. This was a result of the use of a shear strength for the flyash material that was too high considering the very loose to loose consistency of the flyash found in the borings made during the FMSM and the BT^2 investigations.

As a secondary potential cause for failure of dike D/E, we conclude that the possibility of seepage along the concrete plug constructed to surround the spillway tubes cannot be ruled out. The general reason for this conclusion is that there were no seepage collars provided on the spillway tubes to prevent lateral seepage at the contact between the concrete and the flyash.

A tertiary potential cause for the failure that cannot be ruled out is the possibility of uplift and piping and erosion of the flyash at the downstream toe of dike D/E. While the gradation of the berm material appeared to be acceptable, the testing we performed showed that the gradation was at the coarsest end of the range of acceptable filter materials for the flyash.

9.0 CONCEPTUAL DESIGN CHANGES TO CORRECT CAUSE OF FAILURES

9.1 Opinion and Recommended Conceptual Design Changes for Dike D/E

In general, it is our opinion that design changes can be made to dike D/E that reflect remediation to all of the causes identified for the failures that have occurred. The recommended conceptual design for dike D/E is shown on **Figures 7** and **8**. The elements of the new design are as follows

- Excavate all of the flyash to an average elevation 615 and all of the existing granular berm material from dike D/E, and segregate materials on site for future reuse. This activity will require dewatering and additional excavation of flyash.
- Construct a new spillway structure between Basin D and Basin E that provides for maintaining a variable water level in Basin D that is maintained in reasonably close proximity to the water level in Basin E. Such a structure is now in place in Basin E at the discharge point to Basin C for tertiary sedimentation. The horizontal spillway tube should be constructed near the base of the flyash dike for D/E and be provided with a vertical drop inlet structure with provision for insertion of "stop logs" to provide the variable water level in Basin D.
- Recompact the flyash for dike D/E above the level of excavation and within a cross-section with 3.5H:1V downstream and 3.0H:1V upstream slopes. Compaction should be accomplished to provide 95% maximum dry density determined using a Modified Proctor compaction test. If this specification is used and the density documented, a value of shear strength for the flyash of 25 degrees can be used. We recommend that the designed cross-section have a minimum factor of safety of 1.5.

- Construct a downstream weighted filter toe berm for dike D/E that is 10 feet thick. The berm should be constructed with its top at elevation 630. The berm should extend a minimum of 50 feet into Basin E as measured from the south downstream toe of the dike. The berm should be wrapped around and extended 50 feet on the east and west slopes of Basin E.
- The upstream compacted slope of dike D/E should be flattened to provide a 4H:1V slope using flyash. This zone of the slope can be constructed without a compaction specification.
- The gradation of the inverted filter material for the bottom 5 feet of the berm should be in the middle of the gradation range for suitable filter material for the flyash material used in the construction of the compacted flyash zone of dike D/E.
- The gradation of the inverted filter material for the upper 5 feet of the berm can be on the coarsest end of the range of suitable filter material for flyash used in the construction of the compacted flyash zone of dike D/E.

9.2 Corrections to Dike D and Dike E

As part of our investigation of the RCA for failure of dike D/E, we made stability analyses of the current configuration of the dikes making up the balance of Basins D and E. The stability analyses are shown as scenarios 11 through 16 and are shown in **Table 4**. The locations of the critical cross-sections chosen for these analyses are shown on **Figures 9** and **10**. The stability analyses were made using a shear strength value for the flyash of 21 degrees. Based on our inspection of the dikes and our experience, we assumed a water level on the downstream dike toe for each cross-section that was at the contact between the flyash and the natural clay soil foundation. This assumption is based on the observation of no zones of seepage or previous piping at the toe of any of the dikes for either of the basins.

As might be expected, the calculated factor of safety for the slopes for these ash ponds is much lower than a normal factor of safety for these types of structures. Our recommended conceptual change to correct for this situation and provide a factor of safety of 1.5 for the dikes for Basins D and E would be to flatten the downstream slope by providing a zone of material that would weight and filter these toes in the same fashion that the weighted filter on the downstream toe of dike D/E provides weight and filter capacity. The recommended conceptual designs for dikes D and E are shown on **Figures 11** and **12**.

9.3 Conceptual Cost Estimate for Recommended Changes to the Design of Dikes for Basins D and E

Table 5 provides a breakdown of the cost estimate for the conceptual changes to the design and construction of dikes D and E to correct the causes for the two previous failures of dike D/E. This cost estimate is based on a rough estimate of the quantities of materials that will be used to make the changes

and on an estimate of the engineering and design costs involved with the activities to complete this work. As shown, we estimate that the recommended changes to dike D/E will cost $3.3 million, and the recommended changes to the remaining dikes for Basins D and E will cost $3.3 million.

10.0 CONSEQUENCE TO SYSTEM WIDE DESIGN AND OPERATION OF IPL ASHPONDS

10.1 General

In our investigation, we did not find the type of documents and information that are normally associated with dams and dikes of the type used in the IPL ashponds. The standard of practice for this type of structure provides that the following information be readily available for use in making engineering judgments:

- Engineering drawings showing relevant dimensional and other plan and cross-section details of all of the facilities.
- Design basis report showing how the design was prepared and the results of important engineering calculations like stability evaluations of the dikes for the various operating levels of ash and fluids.
- Geotechnical engineering report providing backup and basis for soil and fluid elements of the design.
- Operation and maintenance plan and manual.
- Inspection reports for periodic inspection of the facilities.
- Corrective action plan and reports of corrective actions taken.

We found that some of these documents have been prepared at some of the facilities. However, most of the facilities in the IPL system do not have many of these in place. We recommend that IPL make an inventory of the documents at each of the facilities and identify the specific work at each of the three facilities necessary to prepare each of these documents for the ashponds in the system.

TABLES

1 Dike Water Levels
2 Laboratory Test Results
3 Natural Moisture Test Results
4 Stability Analysis Summary
5 Preliminary Estimate of Construction Cost

Table 1
Dike Water Levels
Ashponds D and E
Eagle Valley Generating Station - Martinsville, Indiana

Date	Approximate Groundwater Elevation (feet above mean sea level)				
	Well Number				
	PZ1	PZ2	PZ3	PZ4	PZ5
6/18/2008	600.8	605.4	600.2	609.0	606.1
7/21/2008	603.7	605.8	597.0	607.0	605.9

Date	Depth to Water (feet below top of casing)				
	Well Number				
	PZ1	PZ2	PZ3	PZ4	PZ5
6/18/2008	42.2	37.6	42.8	34.0	36.9
7/21/2008	39.33	37.17	46.01	36.02	37.06

Notes:

(1) Groundwater elevations are estimated based on an assumed top of well casing elevation of 643 feet above mean sea level.

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Sample Number	Sample Depth (feet)	Grain Size Anal							Atterberg its (%)			P
		% Coarse Gravel 3 to 3/4 inch	% Fine Gravel 3/4 inch to #4	% Coarse Sand #4 to #10	% Medium Sand #10 to #40	% Fine Sand #40 to #200	% Fines <#200	% Clay <0.005 mm	Liquid Limit	Plastic Limit	Plasticity Index	
S6	10-12	0.0	0.3	1.0	2.3	5.6	90.8	NA	NA	NA	NA	
S21	40-42	0.0	0.0	0.2	0.8	2.4	96.6	12.5	NA	NA	NA	
S7	12-14	14.3	20.6	4.9	4.9	5.4	49.9	15.6	NA	NA	NA	
S10	18-20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
S21	40-42	0.0	0.0	0.0	0.2	8.2	91.6	10.0	NA	NA	NA	
S5	8-10	0.0	0.1	1.1	2.4	9.9	86.5	21.2	NA	NA	NA	
S23	44-46	0.0	0.0	1.6	2.0	6.3	90.1	NA	NA	NA	NA	
S13	24-26	0.0	0.0	0.0	0.3	7.9	91.8	12.3	NA	NA	NA	
S19	36-38	0.0	0.0	0.0	0.1	10.3	89.6	NA	NA	NA	NA	
S3	4-6	20.9	4.4	1.9	4.2	8.3	60.3	NA	NA	NA	NA	
S21	40-42	0.0	0.0	1.2	4.9	13.0	80.9	9.0	NA	NA	NA	
S14	26-28	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
S15	28-30	0.0	0.0	0.4	1.4	12.4	85.8	11.7	NA	NA	NA	
S19	36-38	0.0	0.0	0.0	0.3	4.3	95.4	NA	NA	NA	NA	
S8	24-26	0.0	4.8	19.5	27.3	12.7	35.7	NA	NA	NA	NA	
S14	36-38	0.0	4.4	18.1	34.9	14.9	27.7	3.6	NA	NA	NA	
--	--	*2.5*	*2.5*	*3.6*	*6.1*	*8.7*	*76.6*	*12.0*	*NA*	*NA*	*NA*	
--	--	*6.5*	*5.6*	*6.6*	*10.8*	*3.7*	*23.2*	*5.1*	*NA*	*NA*	*NA*	
--	--	*20.9*	*20.6*	*19.5*	*34.9*	*14.9*	*96.6*	*21.2*	*NA*	*NA*	*NA*	
--	--	*0.0*	*0.0*	*0.0*	*0.1*	*2.4*	*27.7*	*3.6*	*NA*	*NA*	*NA*	
S24	46-48	0.0	2.9	3.0	5.1	27.8	61.2	NA	25	17	8	
S25	48-50	0.0	7.1	1.7	3.7	14.9	72.6	NA	34	19	15	
S23	44-46	0.0	0.0	0.0	0.6	3.3	96.1	NA	39	23	16	
S25	48-50	0.0	8.0	17.2	63.0	7.5	4.3	2.7	NA	NA	NA	
S25	48-50	4.9	33.6	13.1	19.5	10.9	18.0	4.7	NA	NA	NA	
S25	48-50	0.0	0.0	0.0	0.1	23.5	76.4	NA	26	20	6	
S22	42-44	0.0	0.0	0.0	0.6	33.7	65.7	NA	23	18	5	
S23	44-46	0.0	0.0	0.0	0.2	22.9	76.9	NA	NA	NA	NA	
S16	40-42	0.0	23.7	10.8	19.7	18.6	27.2	9.8	NA	NA	NA	
Material												
S3	3-4	0.0	7.5	20.0	50.0	20.8	1.7	NA	NA	NA	NA	

Table 3
Natural Moisture Test Results
Indianapolis Power & Light - Martinsville, IN
BT^2 Project #3573

Sample Source	Sample Number	Sample Depth (feet)	Natural Moisture (%)
FLYASH			
B1	S2	2-4	21.0
B1	S6	10-12	23.9
B1	S9	16-18	26.3
B1	S13	24-26	27.3
B1	S17	32-34	53.7
B1	S21	40-42	43.8
B2	S3	4-6	29.4
B2	S7	12-14	15.4
B2	S14	26-28	32.7
B2	S17	32-34	62.6
B2	S20	38-40	79.0
B2	S21	40-42	63.8
B3	S3	4-6	24.5
B3	S5	8-10	29.1
B3	S9	16-18	37.5
B3	S12	22-24	33.9
B3	S16	30-32	34.4
B3	S20	38-40	43.8
B3	S23	44-46	52.6
B4	S3	4-6	22.2
B4	S6	10-12	33.4
B4	S9	16-18	26.0
B4	S13	24-26	33.9
B4	S16	30-32	33.5
B4	S19	36-38	37.8
B4	S22	42-44	43.0
B5	S3	4-6	19.1
B5	S7	12-14	26.3
B5	S10	18-20	26.2
B5	S13	24-26	38.3
B5	S18	34-36	61.7
B5	S21	40-42	46.7
B6	S1	0-2	22.9
B6	S5	8-10	29.3
B6	S8	14-16	24.1
B6	S12	22-24	15.6
B6	S15	28-30	69.7

Table 3
Natural Moisture Test Results
Indianapolis Power & Light - Martinsville, IN
BT² Project #3573

Sample Source	Sample Number	Sample Depth (feet)	Natural Moisture (%)
FLYASH			
B6	S19	36-38	49.1
B7	S2	2-4	26.1
B7	S5	8-10	38.2
B7	S7	18-20	11.6
B7	S8	24-26	24.4
B7	S10	28-30	33.9
B7	S12	32-34	12.2
B7	S14	36-38	21.8
Average			34.7
Standard Deviation			15.4
High			79.0
Low			11.6
NATIVE MATERIAL			
B1	S24	46-48	21.3
B1	S25	48-50	23.0
B3	S25	48-50	16.9
B4	S25	48-50	9.2
B5	S25	48-50	25.7
B6	S22	42-44	23.8
B7	S16	40-42	10.1
Average			18.1
Standard Deviation			7.2
High			25.7
Low			9.2

By: TLR 7/10/2008
Checked: RRJ 7/10/2008

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Table 4
Stability Analysis Summary

Ash Pond Dike
Eagle Valley Generating Station
Martinsville, Indiana
BT^2 Project # 3573

Scenario	Top Elevation	Top Width	Fly Ash Friction Angle	Toe Drain	Pond E Water Elevation	Seepage Face	Safety Factor
1 - FMSM Profile	642	20	33	No	611	Yes	0.92
2 - FMSM Profile with toe drain	642	20	33	Yes	611	Yes	1.41
3 - FMSM Profile with toe drain	642	20	20	Yes	611	Yes	0.91
4 - FMSM Profile with toe drain	642	20	20	Yes	611	No	0.96
5 - FMSM Profile with toe drain	642	20	20	Yes	600	No	0.98
6 - FMSM Profile with toe drain	642	20	22	Yes	611	Yes	1.01
7 - FMSM Profile with toe drain	642	20	21	Yes	611	No	0.99
8 - Toe Drain Extended 20 ft	642	20	21	Yes -extended 20 ft and thickened on slope	611	Yes	1.54
9 - 50 ft berm and extended Toe Drain	642	50	21	Yes -extended 20 ft	611	Yes	1.54
10 - Toe Drain Extended 50 ft	642	20	21	Yes -extended 50 ft and thickened on slope	611	Yes	1.95
11 - Dike D	642	20	21	No	639.5 (Pond D)	No	0.79
12 - Dike D - with Toe Drain	642	20	21	Yes	639.5 (Pond D)	No	1.14
13 - Dike D - with Toe Drain and Lower Water	642	20	21	Yes	630 (Pond D)	No	1.37
14 - Dike E	633	20	21	No	629 (Pond E)	No	0.87
15 - Dike E - with Toe Drain	633	20	21	Yes	629 (Pond E)	No	1.38
16 - Dike E - with Toe Drain and Lower Water	633	20	21	Yes	620 (Pond E)	No	1.57

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08/04/08
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Table 5
Preliminary Estimate of Construction Cost
Flyash Dike D/E Conceptual Remediation
Eagle Valley Generating Station - Martinsville, Indiana

Item	Unit	Approximate Quantity	Unit Cost	Estimated Cost
DIKE D/E				
Dewatering	Lump Sum	1	$50,000	$50,000
Structural Flyash Excavation and Stockpile	Cubic Yard	39,290	$10.00	$392,900
Install Spillway Structure	Lump Sum	1	$100,000	$100,000
Nonstructural Flyash Excavation and Stockpile	Cubic Yard	24,450	$10.00	$244,500
Place and Compact Flyash	Cubic Yard	36,270	$5.00	$181,350
Toe Berm Geotextile Separator	Square Foot	177,600	$2.00	$355,200
Toe Berm Filter Sand	Cubic Yard	27,740	$30.00	$832,200
Toe Berm Riprap	Cubic Yard	4,980	$100.00	$498,000
Nonstructural Ash Fill	Cubic Yard	2,140	$5.00	$10,700
Subtotal				$2,700,000
DIKE E				
Toe Berm Geotextile Separator	Square Foot	142,500	$2.00	$285,000
Toe Berm Filter Sand	Cubic Yard	11,120	$30.00	$333,600
Toe Berm Riprap	Cubic Yard	4,170	$100.00	$417,000
Subtotal				$1,000,000
DIKE D				
Toe Berm Geotextile Separator	Square Foot	225,000	$2.00	$450,000
Toe Berm Filter Sand	Cubic Yard	17,600	$30.00	$528,000
Toe Berm Riprap	Cubic Yard	6,490	$100.00	$649,000
Subtotal				$1,600,000
Construction Total				$5,300,000
Engineering, Operation & Contingency (25%)				$1,300,000
TOTAL				$6,600,000

Notes:
1) Dike D/E structural flyash excavation quantitiy is based on an average flyash excavation depth to approximate elevation 615.
2) Dike D quantities are based on toe berm construction along 1,000 lineal feet of dike closest to the river.

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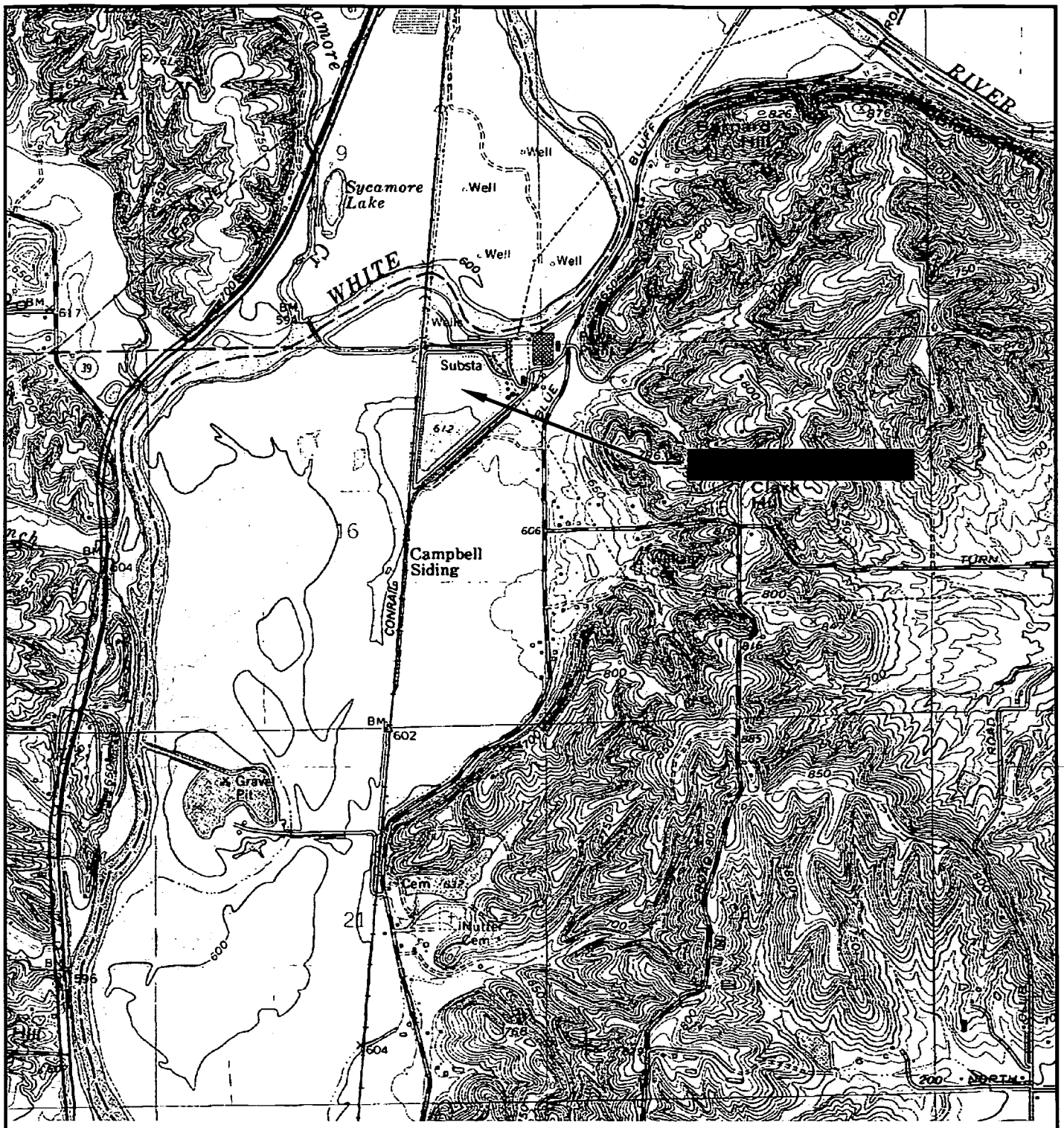
FIGURES

1	Site Location Map
2	Site Features
3	March 2007 Aerial Photograph
4	FMSM Stability Cross-Section
5	Filter Analysis
6	Flyash Water Content with Depth
7	Dike D/E Reconstruction Plan
8	Dike D/E Reconstruction Profile
9	Dike D Critical Cross-Section
10	Dike E Critical Cross-Section
11	Dike D Reconstruction Profile
12	Dike E Reconstruction Profile



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MARTINSVILLE QUADRANLGE
INDIANA – MORGAN CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
1983
SCALE: 1" = 2,000'

QUADRANGLE LOCATION

CLIENT	IPL An AES Company — INDIANAPOLIS POWER & LIGHT COMPANY	SITE	EAGLE VALLEY PLANT 4040 BLUE BLUFF ROAD MARTINSVILLE, INDIANA
			SITE LOCATION MAP

PROJECT NO.	3573	DRAWN BY:	KP
DRAWN:	02/26/08	CHECKED BY:	DH
REVISED:	02/26/08	APPROVED BY:	

ENGINEER: BT² inc.
2830 DAIRY DRIVE
MADISON, WI 53718-6751
PHONE: (608) 224-2830
FAX: (608) 224-2839

FIGURE 1

I:\3573\Drawings-General\SITE LOCATION.dwg, 8/6/2008 8:34:11 AM

NOTES:

1. AERIAL PHOTOGRAPH TAKEN MARCH 2005.
2. BORINGS B1 THROUGH B7 WERE INSTALLED BY ATC IN JUNE 2008 UNDER THE SUPERVISION OF BT², INC.
3. MONITORING WELLS PZ1 THROUGH PZ5 WERE INSTALLED BY ATC IN JUNE 2008 UNDER THE SUPERVISION OF BT², INC.
4. ALL LOCATIONS ARE APPROXIMATE.

LEGEND

B3	SOIL BORING
HA1	HAND AUGER
B1/PZ1	SOIL BORING AND MONITORING WELL

300 0 300

SCALE: 1" = 300'

N

CLIENT	IPL An AES Company	INDIANAPOLIS POWER & LIGHT COMPANY	
SITE	EAGLE VALLEY PLANT 4040 BLUE BLUFF ROAD MARTINSVILLE, INDIANA	SITE FEATURES	

PROJECT NO.	3573	DRAWN BY:	KP
DRAWN:	02/26/08	CHECKED BY:	RJ
REVISED:	07/10/08	APPROVED BY:	RRJ

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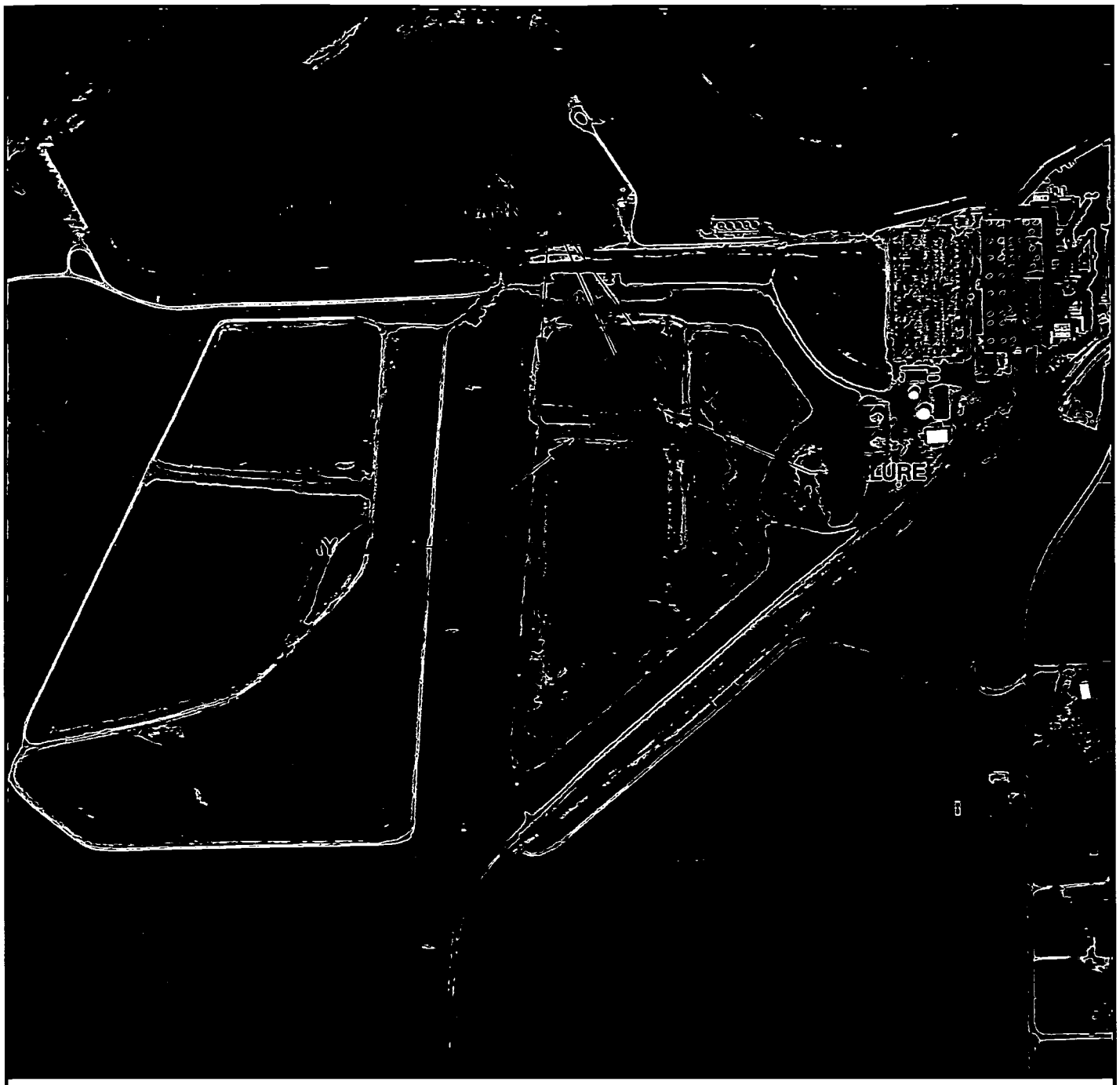
FAX: (608) 224-2839

FIGURE 2



NOTES:

1. AERIAL PHOTOGRAPH FROM GLOBAL EXPLORER, DATED MARCH 30, 2007.

500 0 500

SCALE: 1" = 500'

N

CLIENT: IPL An AES Company — INDIANAPOLIS POWER & LIGHT COMPANY	SITE: EAGLE VALLEY PLANT 4040 BLUE BLUFF ROAD MARTINSVILLE, INDIANA	MARCH 2007 AERIAL PHOTOGRAPH	
PROJECT NO. 3573	DRAWN BY: KP	ENGINEER: BT² inc. 2830 DAIRY DRIVE MADISON, WI 53718-6751 PHONE: (608) 224-2830 FAX: (608) 224-2839	FIGURE
DRAWN: 02/26/08	CHECKED BY: RJ		3
REVISED: 07/10/08	APPROVED BY:		

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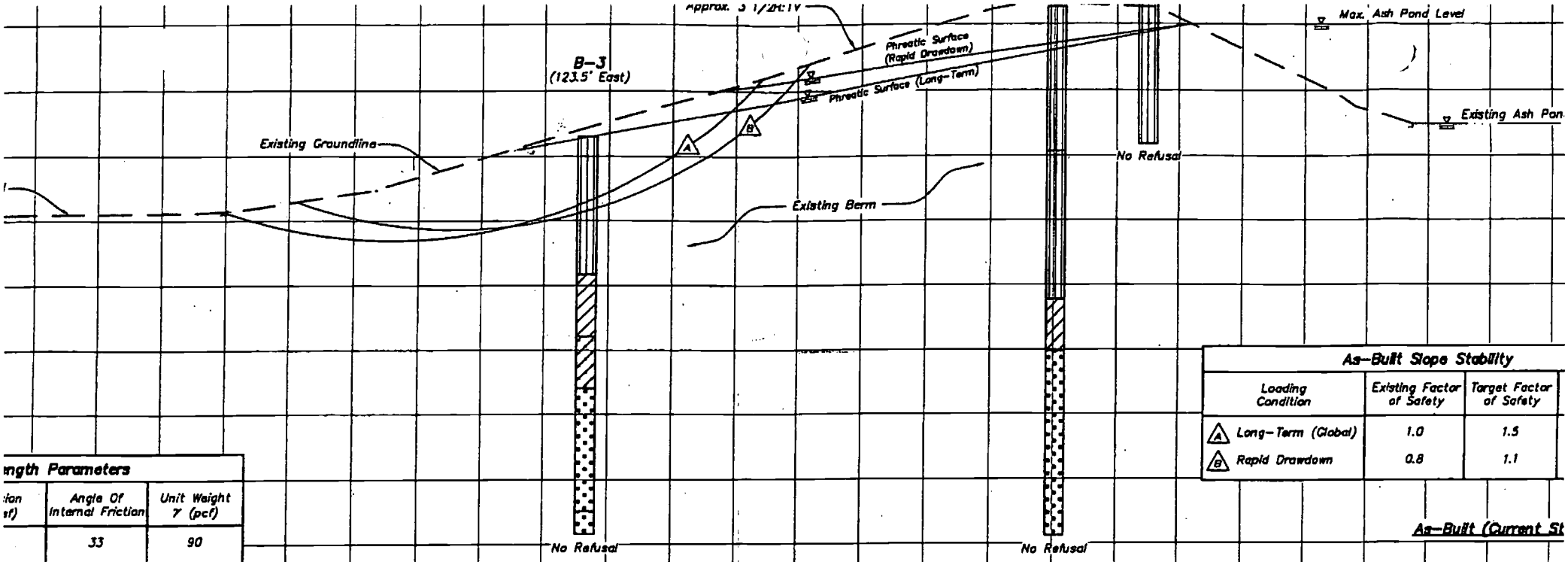
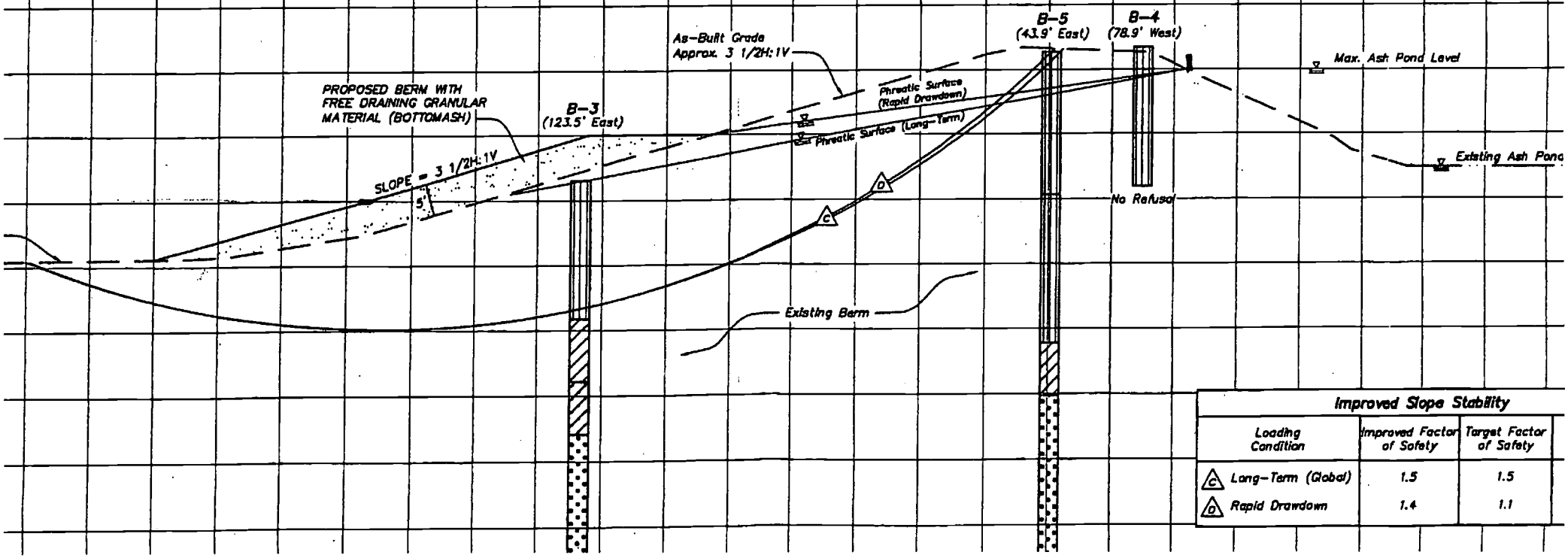


As-Built Slope Stability		
Loading Condition	Existing Factor of Safety	Target Factor of Safety
A Long-Term (Global)	1.0	1.5
B Rapid Drawdown	0.8	1.1

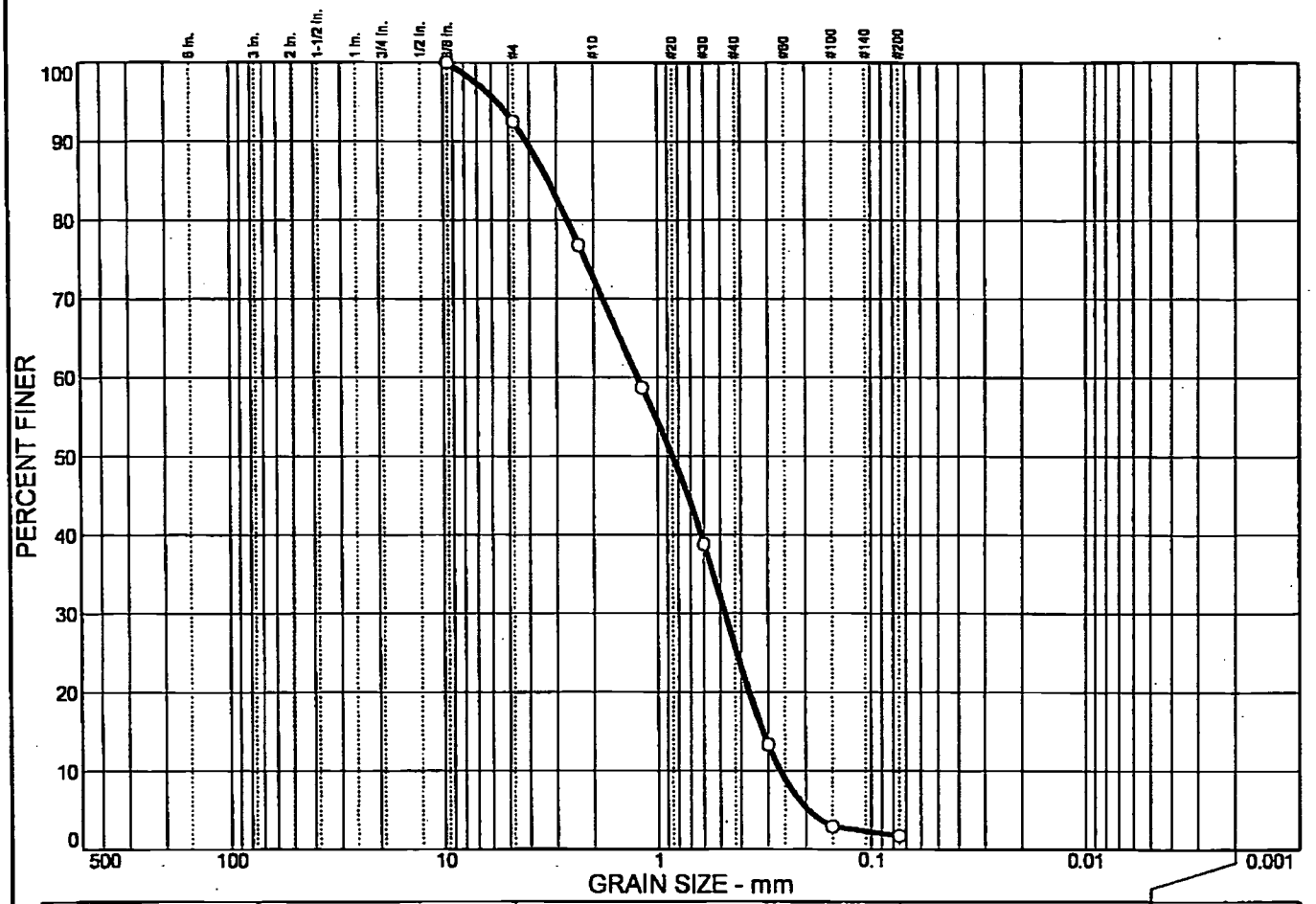
ngth Parameters		
ion sf)	Angle Of Internal Friction	Unit Weight γ (pcf)
	33	90
	25	125
	31	120

As-Built (Current St



Improved Slope Stability		
Loading Condition	Improved Factor of Safety	Target Factor of Safety
C Long-Term (Global)	1.5	1.5
D Rapid Drawdown	1.4	1.1

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	7.5	90.8	1.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8 in.	100.0		
#4	92.5		
#8	76.8		
#16	58.7		
#30	38.8		
#50	13.3		
#100	2.9		
#200	1.7		

* (no specification provided)

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 3.28 D_{60}= 1.24 D_{50}= 0.854
D_{30}= 0.477 D_{15}= 0.318 D_{10}= 0.263
C_u= 4.71 C_c= 0.70

Classification

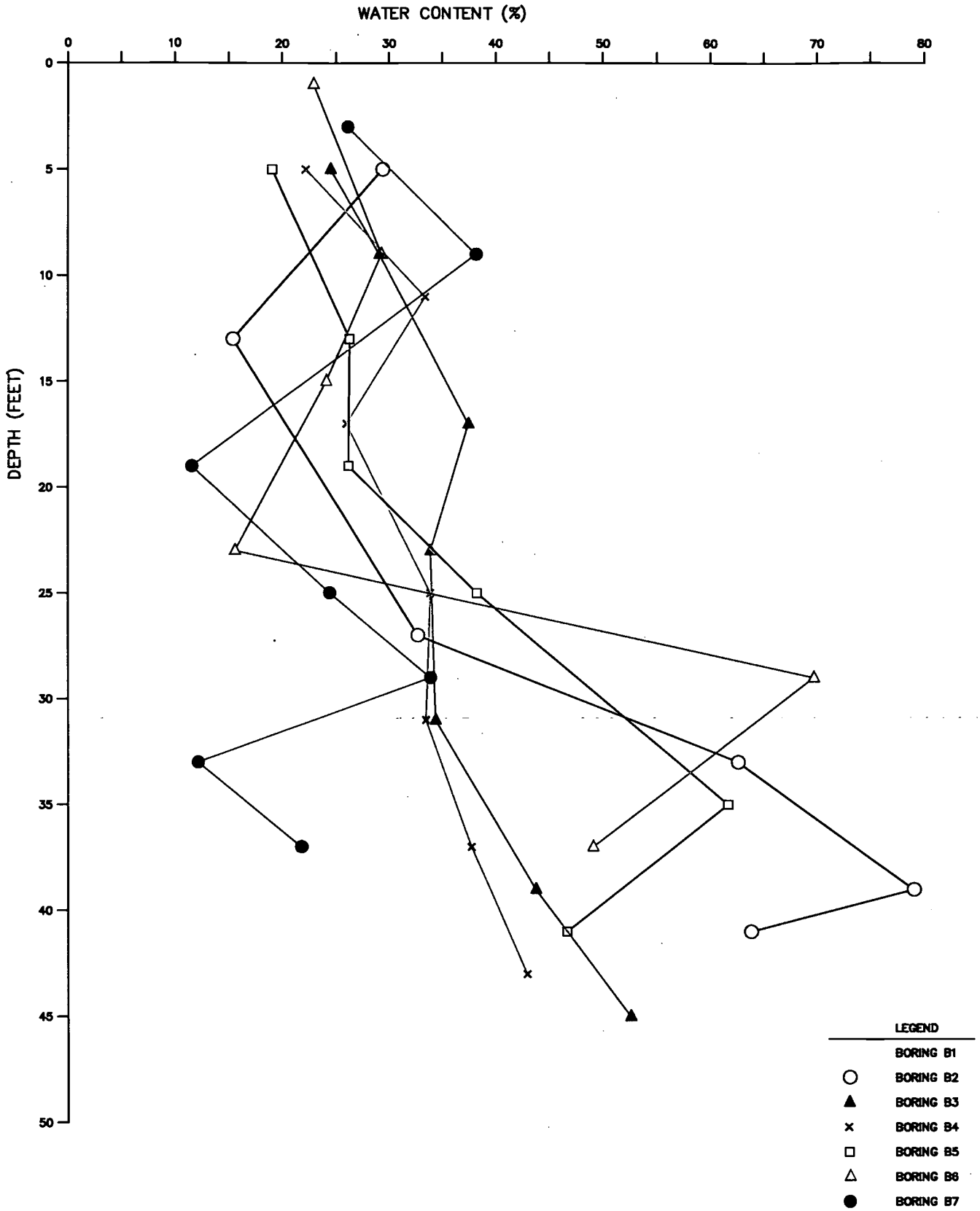
USCS= AASHTO=

Remarks

Sample No.: HA; S-3 **Source of Sample:** 1055 **Date:** 07/03/08
Location: **Elev./Depth:** 3.0'-4.0'

ATC ASSOCIATES, INC.

Client: BT2, Inc.
Project: Eagle Valley IPL
Project No: 37640.0001



CLIENT: IPL An AES Company — INDIANAPOLIS POWER & LIGHT COMPANY	SITE: EAGLE VALLEY PLANT, 4040 BLUE BLUFF ROAD, MARTINSVILLE, INDIANA	FLYASH WATER CONTENT WITH DEPTH	
PROJECT NO. 3573	DRAWN BY: KP	ENGINEER: BT² inc. 2830 DAIRY DRIVE, MADISON, WI 53718-6751, PHONE: (608) 224-2830, FAX: (608) 224-2839	FIGURE 6
DRAWN: 08/04/08	CHECKED BY: DN		
REVISED: 08/04/08	APPROVED BY:		

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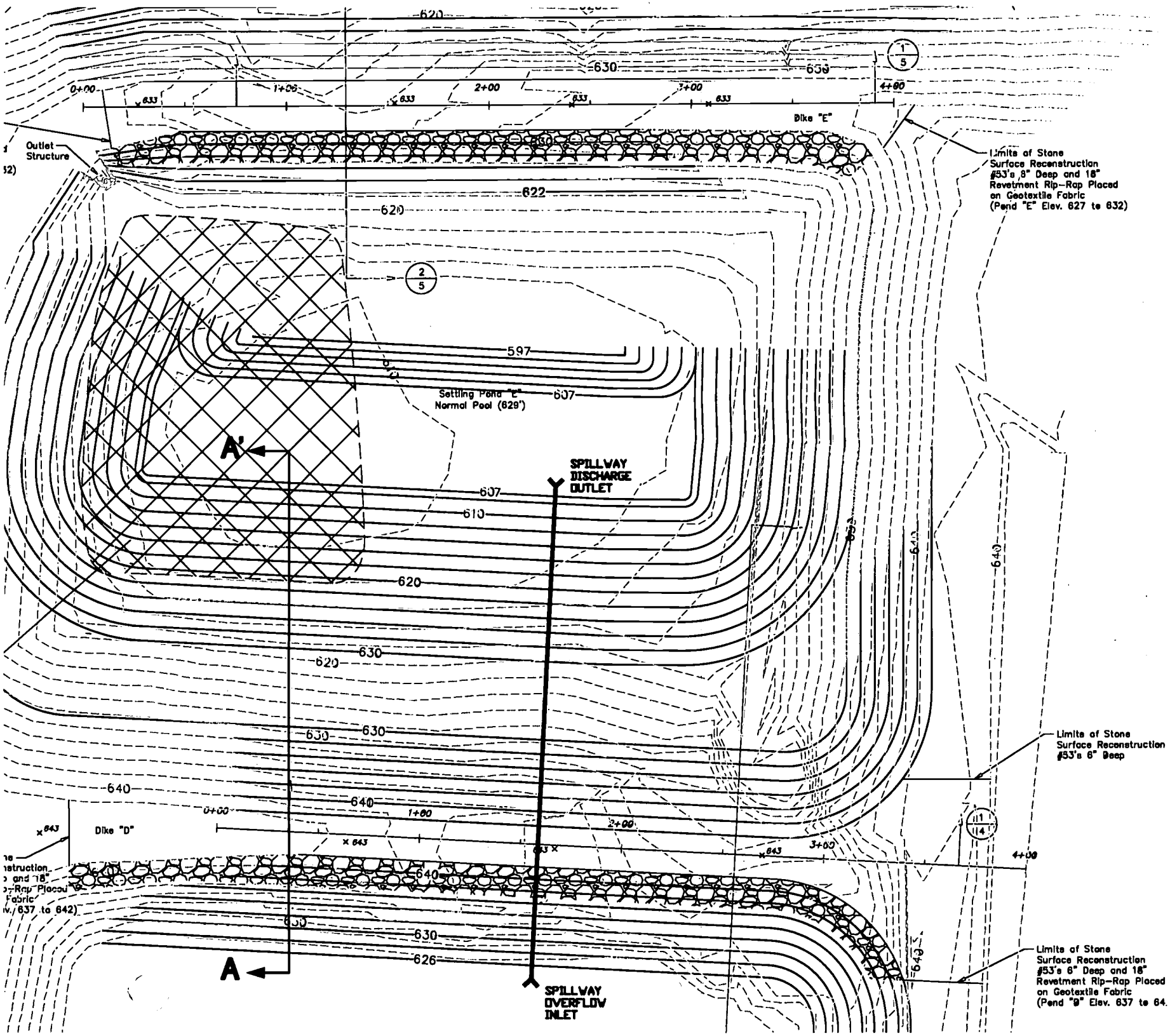
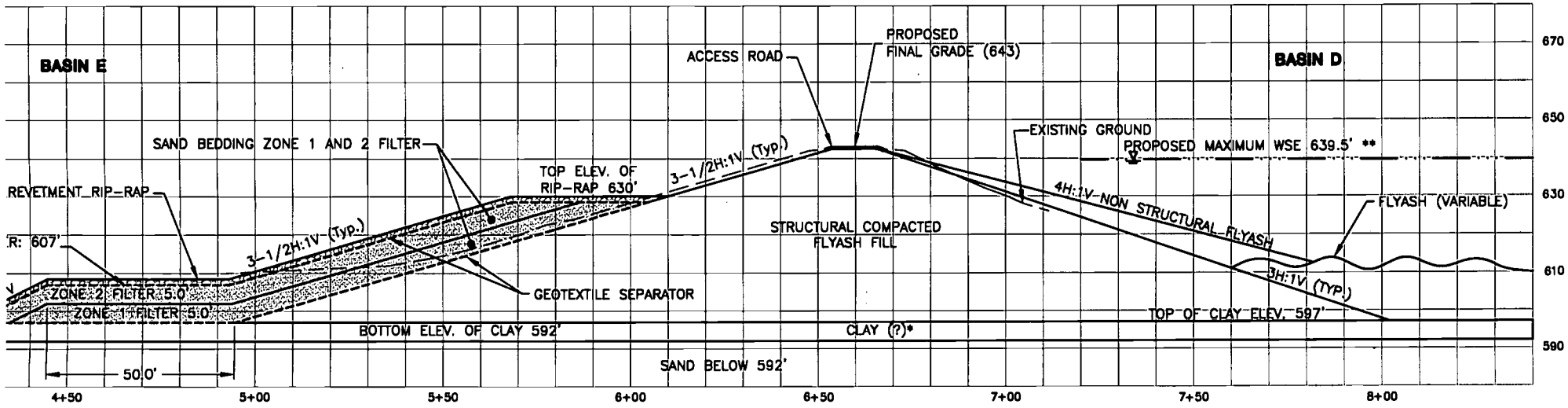

Dike "E"
Outlet Structure
Limits of Stone Surface Reconstruction #53's 8" Deep and 18" Revetment Rip-Rap Placed on Geotextile Fabric (Pond "E" Elev. 627 to 632)
Settling Pond "E" Normal Pool (629')
SPILLWAY DISCHARGE OUTLET
SPILLWAY OVERFLOW INLET
Limits of Stone Surface Reconstruction #53's 6" Deep
Limits of Stone Surface Reconstruction #53's 6" Deep and 18" Revetment Rip-Rap Placed on Geotextile Fabric (Pond "9" Elev. 637 to 64.
Dike "D"
A
A'
0+00
1+00
2+00
3+00
4+00
620
622
626
630
633
640
643
597
607
610

60

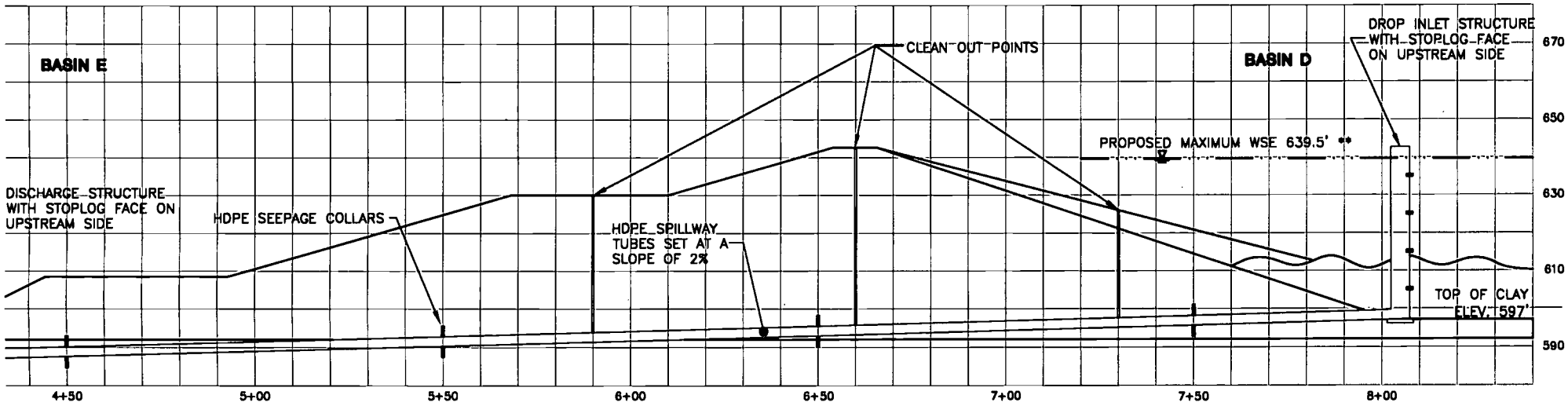
A. TYPICAL STRUCTURAL CROSS SECTION FOR REMEDIATION

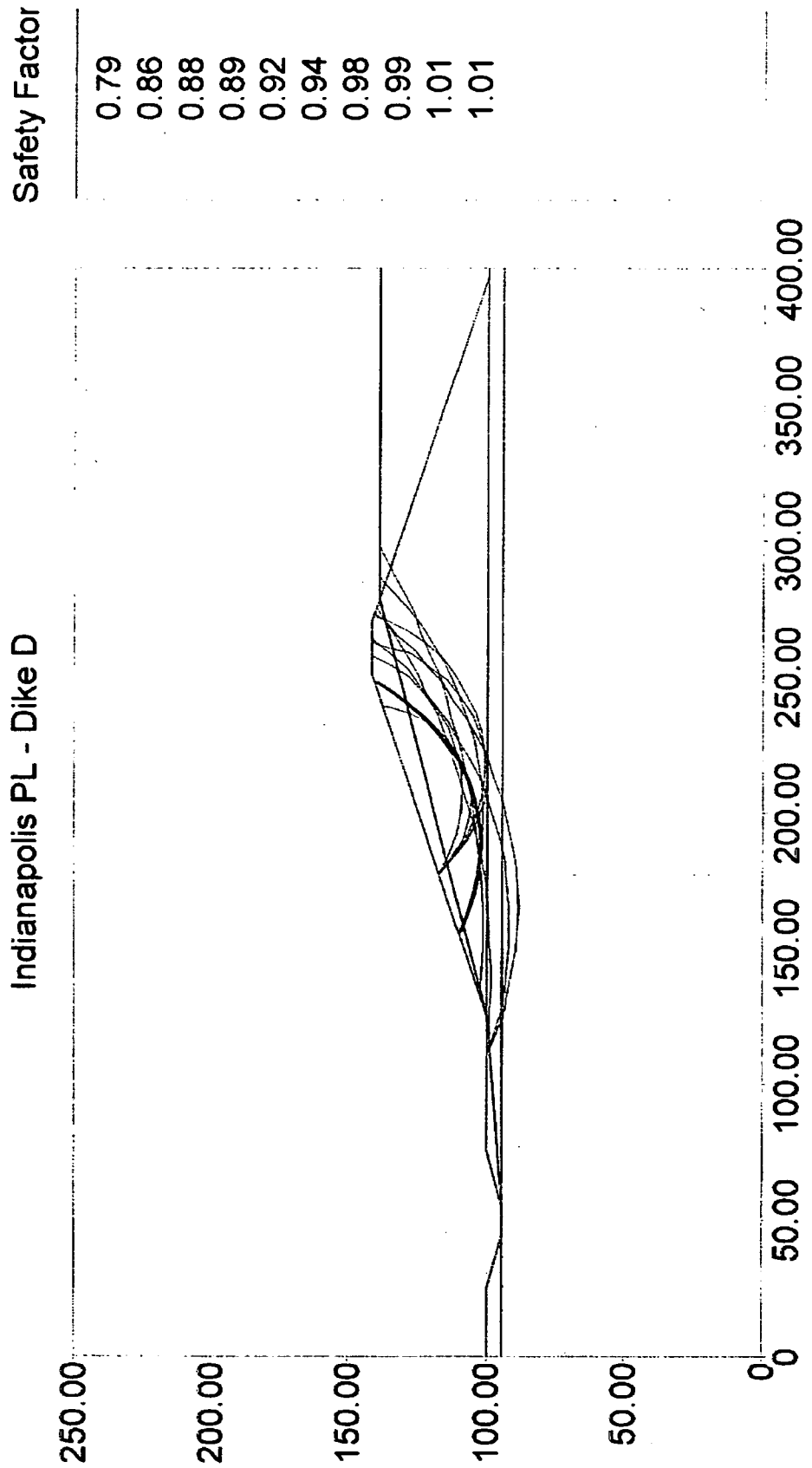


* ELEVATION OF CLAY IS BASED ON RESULTS OF BORINGS B1 AND B5. CONTINUITY OF CLAY LAYER AND CONSISTENCY OF ELEVATION NOT DETERMINED.

** OPERATIONAL WATER SURFACE ELEVATION WILL BE VARIABLE TO PROVIDE MINIMUM DIFFERENTIAL WATER LEVELS IN BASINS D AND E FOR REQUIRED SEDIMENTATION OF ASH IN THE BASINS.

B. OVERLAY SHOWING CONCEPTUAL OVERFLOW SPILLWAY BETWEEN BASINS D AND E





CLIENT: IPL An AES Company — INDIANAPOLIS POWER & LIGHT COMPANY	SITE: EAGLE VALLEY PLANT, 4040 BLUE BLUFF ROAD, MARTINSVILLE, INDIANA	DIKE D CRITICAL CROSS-SECTION	
PROJECT NO. 3573	DRAWN BY: KP	ENGINEER: BT² inc. 2830 DAIRY DRIVE, MADISON, WI 53718-6751, PHONE: (608) 224-2830, FAX: (608) 224-2839	FIGURE
DRAWN: 08/04/08	CHECKED BY: DN		9
REVISED: 08/04/08	APPROVED BY:		

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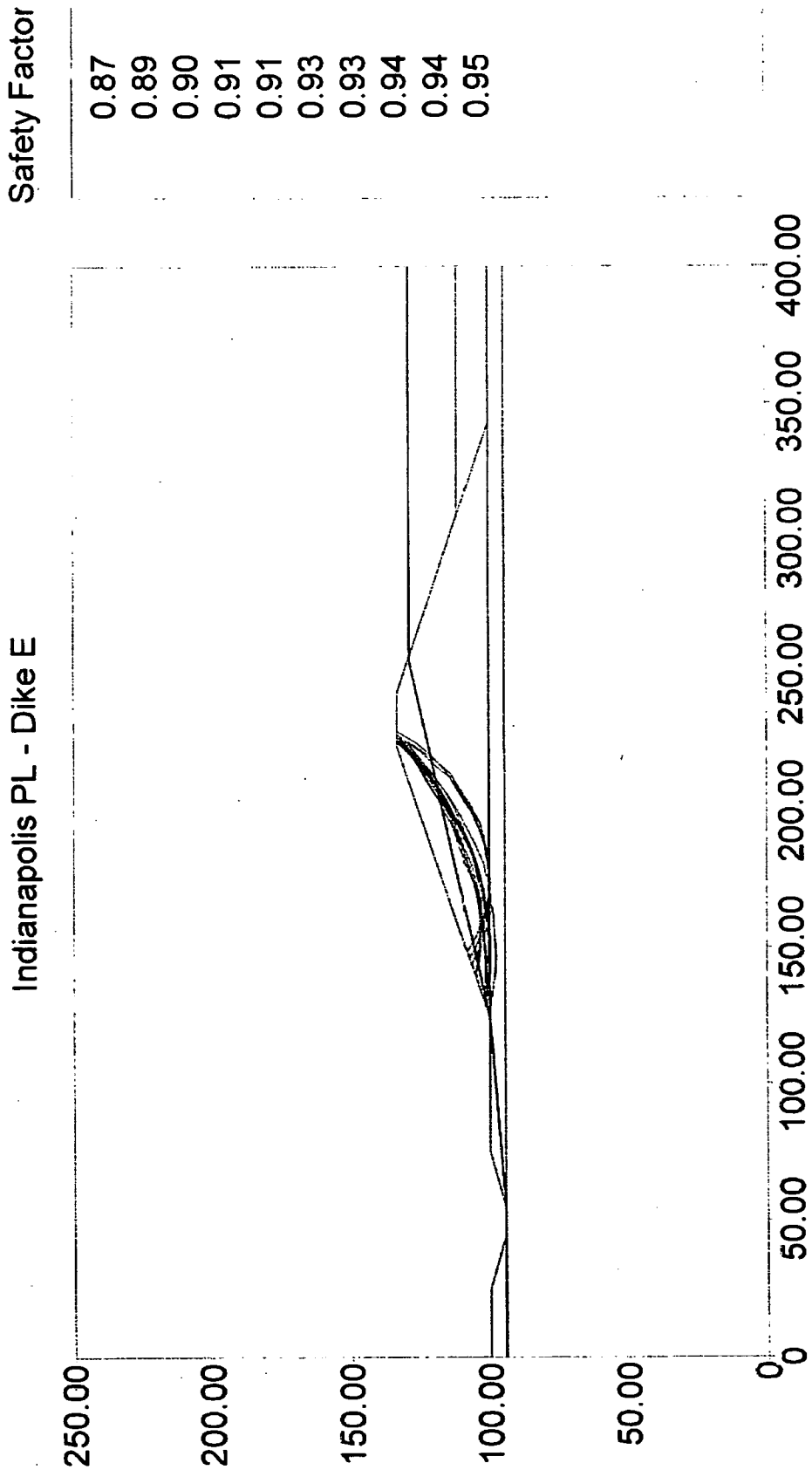

CLIENT	IPL An AES Company — INDIANAPOLIS POWER & LIGHT COMPANY	SITE	EAGLE VALLEY PLANT 4040 BLUE BLUFF ROAD MARTINSVILLE, INDIANA		DIKE E CRITICAL CROSS-SECTION
PROJECT NO.	3573	DRAWN BY:	KP	ENGINEER	BT² inc. 2830 DAIRY DRIVE MADISON, WI 53718-6751 PHONE: (608) 224-2830 FAX: (608) 224-2839
DRAWN:	08/04/08	CHECKED BY:	DN		FIGURE
REVISED:	08/04/08	APPROVED BY:			10

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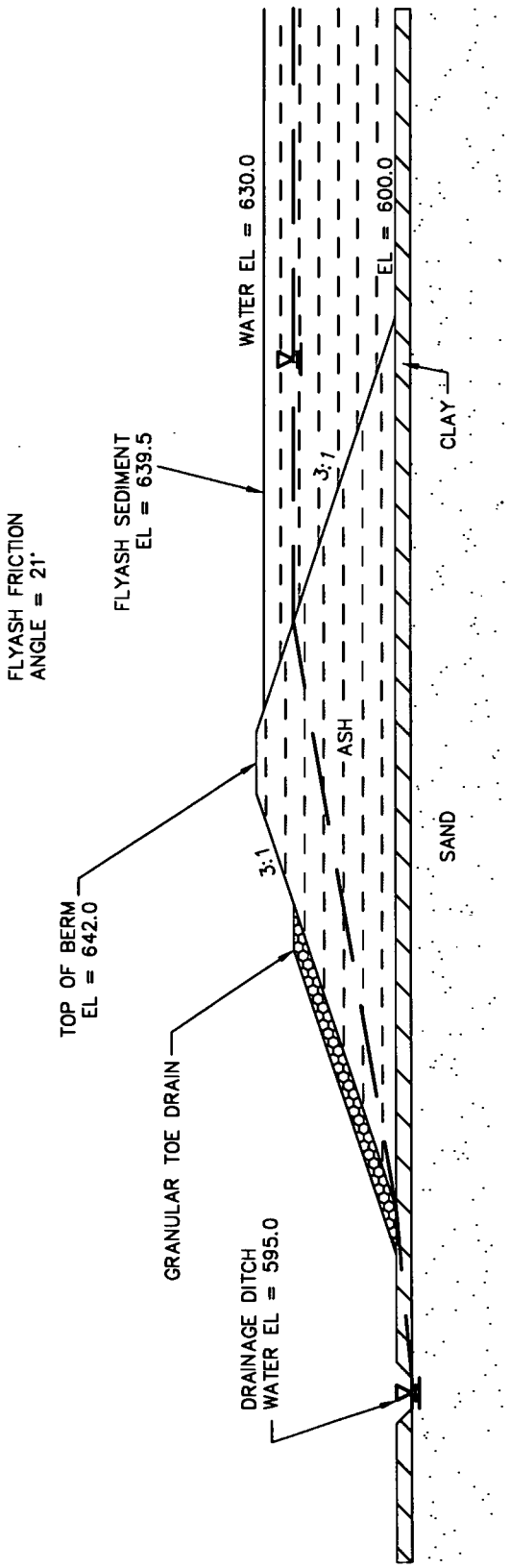

DIKE D

CONCEPTUAL DESIGN APPROACH
NOT FOR CONSTRUCTION

CLIENT: IPL An AES Company	INDIANAPOLIS POWER & LIGHT COMPANY	SITE	EAGLE VALLEY PLANT 4040 BLUE BLUFF ROAD MARTINSVILLE, INDIANA
			DIKE D RECONSTRUCTION PROFILE

PROJECT NO.	3573	DRAWN BY:	KP
DRAWN:	08/04/08	CHECKED BY:	DN
REVISED:	08/04/08	APPROVED BY:	

ENGINEER: BT² inc.
2830 DAIRY DRIVE
MADISON, WI 53718-6751
PHONE: (608) 224-2830
FAX: (608) 224-2839

FIGURE 11

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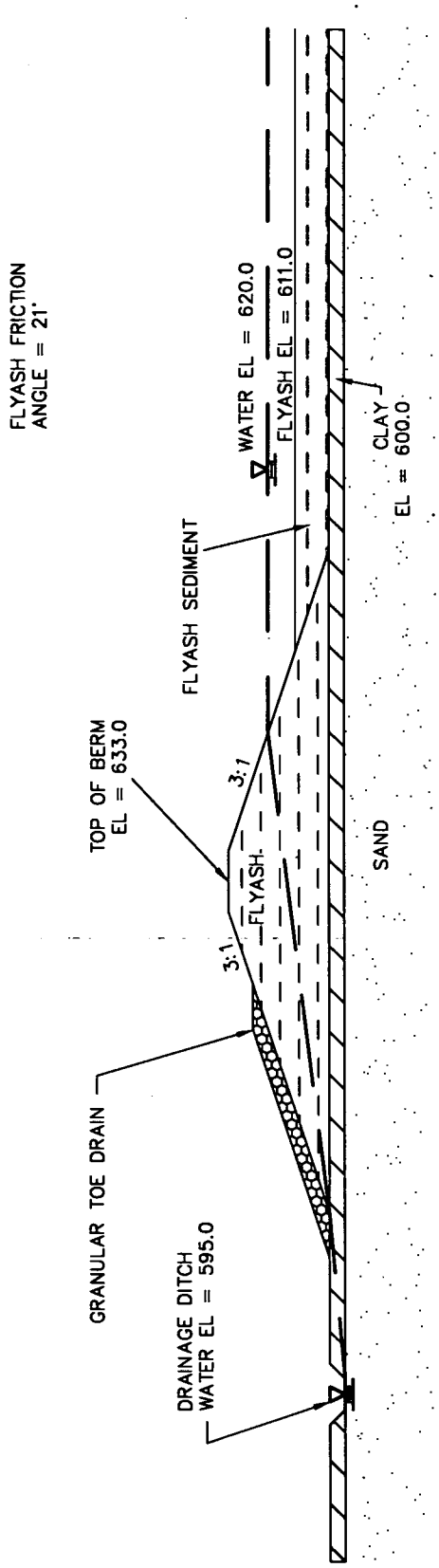

DIKE E

CONCEPTUAL DESIGN APPROACH
NOT FOR CONSTRUCTION

CLIENT: IPL An AES Company	INDIANAPOLIS POWER & LIGHT COMPANY	SITE	EAGLE VALLEY PLANT 4040 BLUE BLUFF ROAD MARTINSVILLE, INDIANA
DIKE E RECONSTRUCTION PROFILE			

PROJECT NO.	3573	DRAWN BY:	KP
DRAWN:	08/04/08	CHECKED BY:	DN
REVISED:	08/04/08	APPROVED BY:	

ENGINEER: BT² inc.
2830 DAIRY DRIVE
MADISON, WI 53718-6751
PHONE: (608) 224-2830
FAX: (608) 224-2839

FIGURE 12

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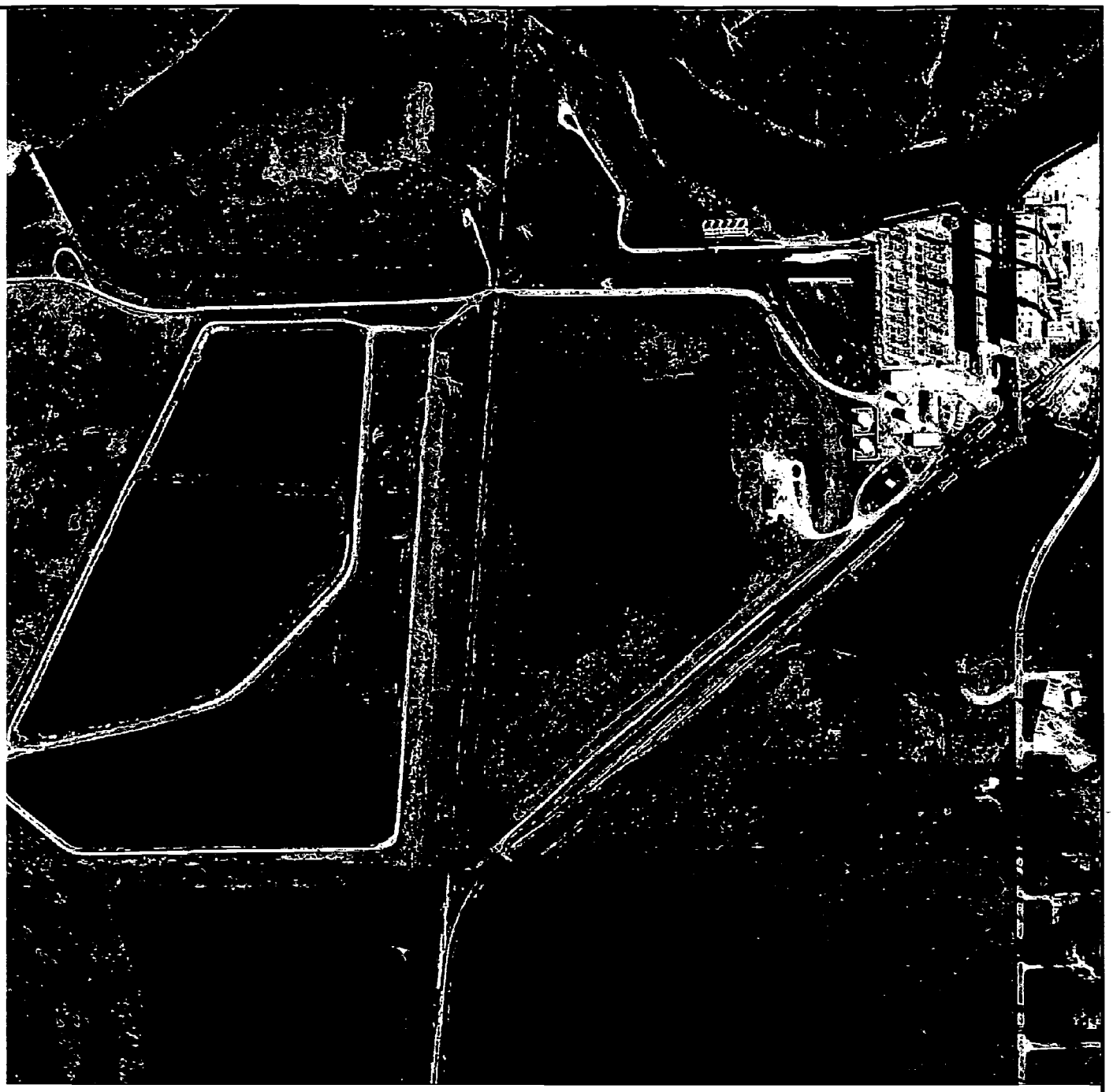
APPENDIX A

Aerial Photographs

A1	1998
A2	2000
A3	2003
A4	2004
A5	March 2005
A6	July 2005
A7	2006
A8	March 2007
A9	July 2007



NOTES:

1. AERIAL PHOTOGRAPH FROM TERRA SERVER, DATED APRIL 5, 1998.

500 0 500

SCALE: 1" = 500'

N

CLIENT	INDIANAPOLIS POWER & LIGHT COMPANY	SITE	EAGLE VALLEY PLANT 4040 BLUE BLUFF ROAD MARTINSVILLE, INDIANA	1998 AERIAL PHOTOGRAPH

PROJECT NO.	3573	DRAWN BY:	KP	ENGINEER BT² inc	2830 DAIRY DRIVE MADISON, WI 53718-6751 PHONE: (608) 224-2830 FAX: (608) 224-2839
DRAWN:	02/26/08	CHECKED BY:	RJ		FIGURE
REVISED:	07/10/08	APPROVED BY:			A1

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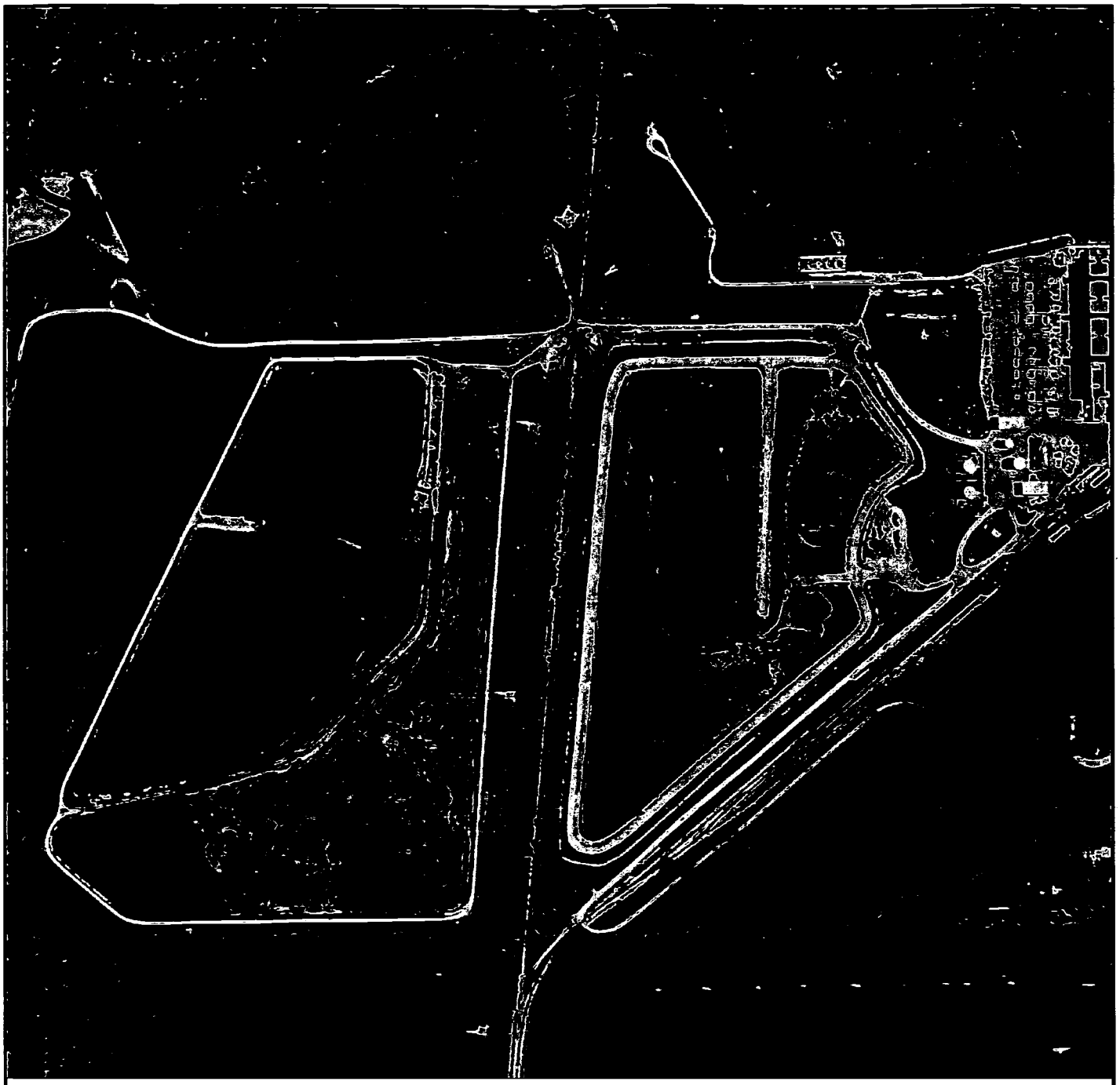

N

NOTES:

1. AERIAL PHOTOGRAPH FROM INDIANA SPATIAL DATA PORTAL, DATED JULY 7, 2000.

NOT TO SCALE

CLIENT	IPL An AES Company — INDIANAPOLIS POWER & LIGHT COMPANY	SITE	EAGLE VALLEY PLANT 4040 BLUE BLUFF ROAD MARTINSVILLE, INDIANA
			2000 AERIAL PHOTOGRAPH

PROJECT NO.	3573	DRAWN BY:	KP
DRAWN:	02/26/08	CHECKED BY:	RJ
REVISED:	07/10/08	APPROVED BY:	

ENGINEER: BT² inc.
2830 DAIRY DRIVE
MADISON, WI 53718-6751
PHONE: (608) 224-2830
FAX: (608) 224-2839

FIGURE A2

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NOTES:

1. AERIAL PHOTOGRAPH FROM INDIANA SPATIAL DATA PORTAL, DATED JULY 14, 2003.

500 0 500

SCALE: 1" = 500'

N

CLIENT	INDIANAPOLIS POWER & LIGHT COMPANY	SITE	EAGLE VALLEY PLANT 4040 BLUE BLUFF ROAD MARTINSVILLE, INDIANA	2003 AERIAL PHOTOGRAPH

PROJECT NO.	3573	DRAWN BY:	KP	ENGINEER BT² inc.	2830 DAIRY DRIVE MADISON, WI 53718-6751 PHONE: (608) 224-2830 FAX: (608) 224-2839
DRAWN:	02/26/08	CHECKED BY:	RJ		FIGURE
REVISED:	07/10/08	APPROVED BY:			A3

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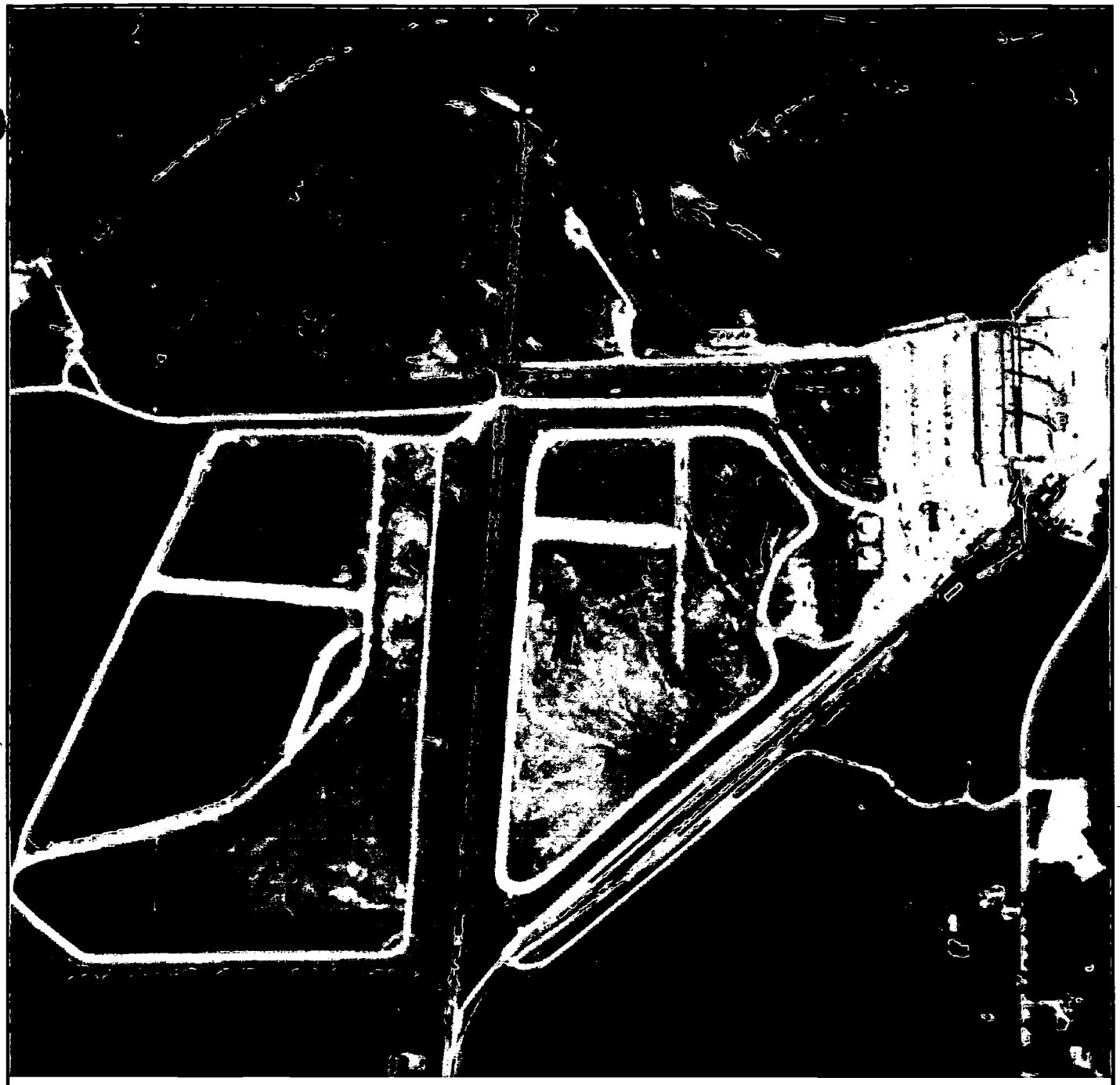

NOTES:

1. AERIAL PHOTOGRAPH FROM INDIANA SPATIAL DATA PORTAL, DATED JULY 16, 2004.

500 0 500

SCALE: 1" = 500'

N

CLIENT	INDIANAPOLIS POWER & LIGHT COMPANY	SITE	EAGLE VALLEY PLANT 4040 BLUE BLUFF ROAD MARTINSVILLE, INDIANA	2004 AERIAL PHOTOGRAPH

PROJECT NO.	3573	DRAWN BY:	KP	ENGINEER BT² inc.	2830 DAIRY DRIVE MADISON, WI 53718-6751 PHONE: (608) 224-2830 FAX: (608) 224-2839
DRAWN:	02/26/08	CHECKED BY:	RJ		FIGURE
REVISED:	07/10/08	APPROVED BY:			A4

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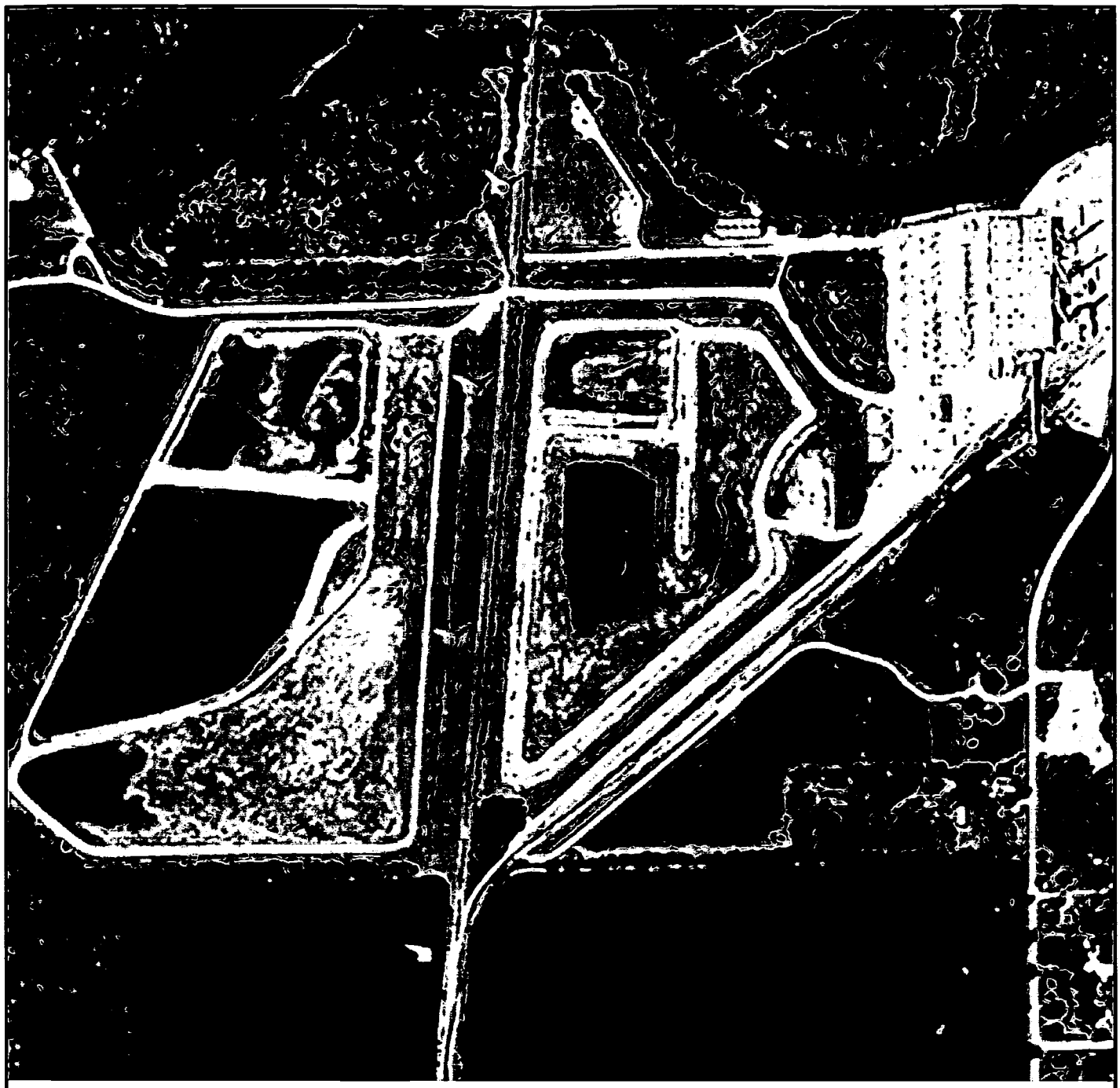

NOTES:

1. AERIAL PHOTOGRAPH FROM INDIANA SPATIAL DATA PORTAL, DATED JULY 25, 2005.

500 0 500

SCALE: 1" = 500'

N

CLIENT: IPL An AES Company	INDIANAPOLIS POWER & LIGHT COMPANY	SITE: EAGLE VALLEY PLANT 4040 BLUE BLUFF ROAD MARTINSVILLE, INDIANA	JULY 2005 AERIAL PHOTOGRAPH

PROJECT NO.	3573	DRAWN BY:	KP	ENGINEER: BT² inc.	2830 DAIRY DRIVE MADISON, WI 53718-6751 PHONE: (608) 224-2830 FAX: (608) 224-2839
DRAWN:	02/26/08	CHECKED BY:	RJ		FIGURE
REVISED:	07/10/08	APPROVED BY:			A6

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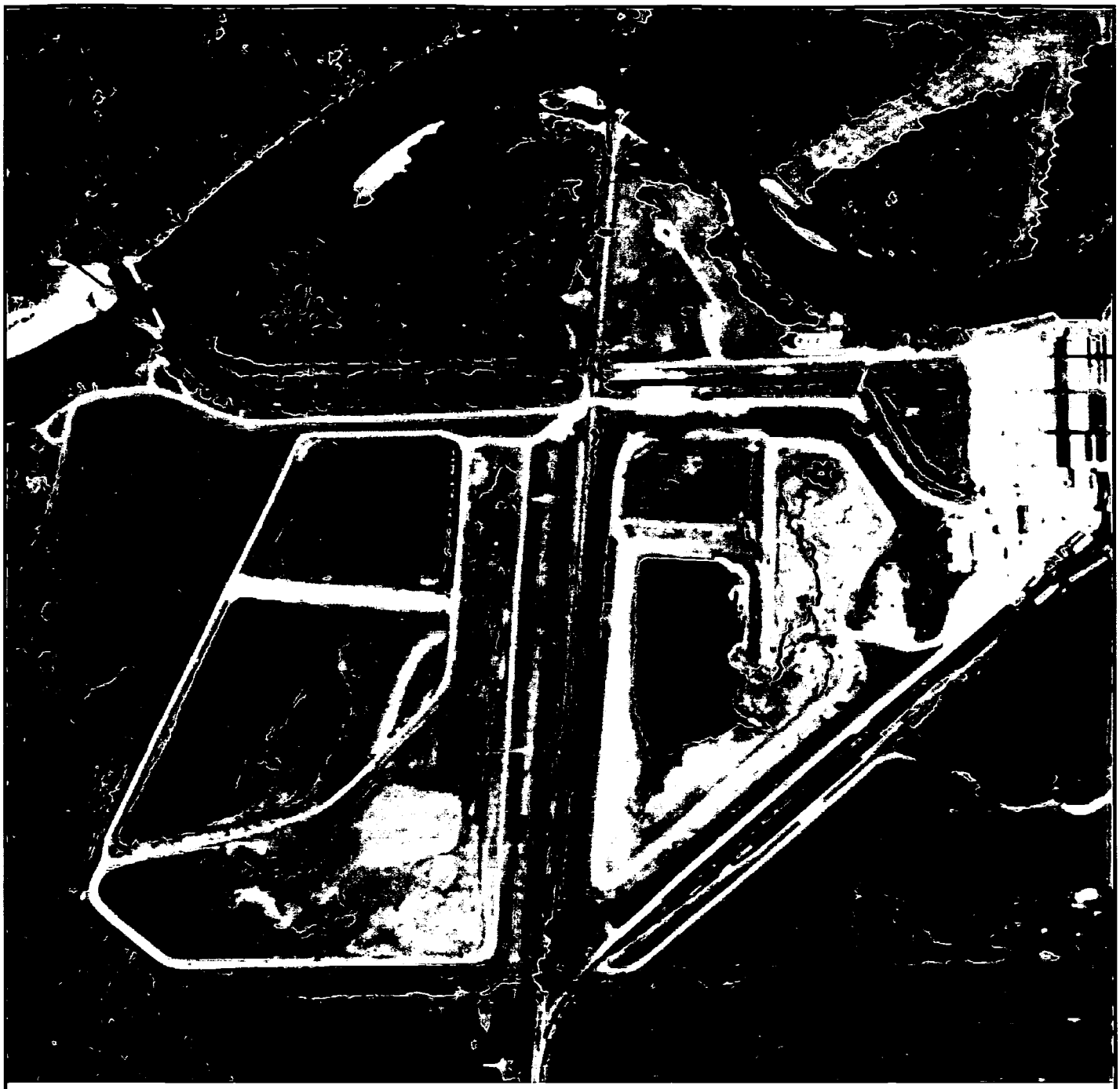

NOTES:

1. AERIAL PHOTOGRAPH FROM INDIANA SPATIAL DATA PORTAL, DATED JULY 07, 2007.

500 0 500

SCALE: 1" = 500'

N

CLIENT	INDIANAPOLIS POWER & LIGHT COMPANY	SITE	EAGLE VALLEY PLANT 4040 BLUE BLUFF ROAD MARTINSVILLE, INDIANA	JULY 2007 AERIAL PHOTOGRAPH

PROJECT NO.	3573	DRAWN BY:	KP	ENGINEER BT² inc. 2830 DAIRY DRIVE MADISON, WI 53718-6751 PHONE: (608) 224-2830 FAX: (608) 224-2839	FIGURE
DRAWN:	02/26/08	CHECKED BY:	RJ		A9
REVISED:	07/10/08	APPROVED BY:			

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APPENDIX B

FMSM Information

Executive Summary

Ash Pond Dikes D and E
Eagle Valley Generating Station
Martinsville, Indiana
FMSM Project No. LV2007041
July 16, 2007

1. Scope

Eagle Valley Generating Station is located along the White River north of Martinsville, Indiana. The facility has a series of on-site ash ponds for byproduct disposal that are in various stages of use. On February 14, 2007 a progressive failure of ash pond D and E dikes resulted in a significant loss of the respective impoundments as well as damage to the sluice line infrastructure and the adjacent canal.

Fuller, Mossbarger, Scott and May Engineers, Inc. (FMSM) was retained to analyze the existing slopes near the failure areas of Dikes D and E and formulate a dike stability evaluation consisting of a drilling exploration, laboratory testing, slope stability analysis and a final report.

In conjunction with borings previously drilled at the site by BBCM Engineers (BBCM) in February 2007 and to provide subsurface data for the dike evaluation, five borings (B-1 through B-5) were advanced through the flyash dikes D and E. The ground surface elevation at each boring location, including the BBCM borings, was recorded. Additionally, FMSM's surveyors collected survey data sufficient to plot cross sections through the existing dikes.

Following the field work, samples were returned to the laboratory for testing and evaluation. Representative portions of the recovered samples were subjected to natural moisture content tests, Atterberg limits testing, sieve and hydrometer analyses, a standard Proctor moisture-density test, unconfined compressive strength tests and consolidated undrained triaxial shear strength tests with pore pressure measurements. BBCM conducted a triaxial shear strength test on a sample of flyash collected during their field exploration, and the results were provided to FMSM. The laboratory testing was performed in general accordance with ASTM standards.

2. Findings

In general, below existing ground surface elevations ranging from about EL. 643 to EL. 615, the borings encountered fly ash within the existing dikes to depths ranging from approximately 5 to 43 feet (approximately EL. 600 to EL. 610). Underlying the flyash, a layer of lean, silty clay soil was encountered. The silty clay layer ranged in thickness from about 8 feet to 14 feet and extended to depths ranging from EL. 590 to EL. 595. Underlying the silty clay, the borings encountered clayey sand and sand to the boring termination depths ranging from about 61 feet to 81 feet (approximately EL. 534 to EL. 593).

Based on measurements taken from groundwater observation wells installed during the drilling operations, the dikes do not appear to be saturated. The groundwater elevations in the FMSM and BBCM borings ranged from approximately EL. 575 to EL. 600, which is approximately at the interface between the silty clay layer and the underlying sand. Results of the surveying indicate the as-built slope of the dikes is approximately 3½ to 1.

3. Analysis and Conclusions

- The FMSM exploration of Dike D and E indicated variable strengths of the flyash materials. The upper 10 feet appeared to be relatively competent, and this was likely the result of the compactive effort used in constructing the documented by density testing performed during the recent vertical expansion. However, at depths below 10 or 15 feet, the flyash consistency was generally loose and variable. This leads us to believe that previous dike construction occurred with limited compactive effort. It also appears likely that the dikes were placed over loose flyash material that was sluiced into place.

- The recent failure appears to have been caused by piping around the discharge pipe, erosion and subsequent blowout of the pipe in Dike D. The flyash material is highly erodible, and erosion can progress quickly after concentrated slurry begins to flow. The initial failure likely resulted in a wave of slurry overtopping the perimeter of Dike E, which was 10 feet lower in elevation, and a breach of Dike E. The Dike D failure may have been initiated from the upstream end by piping around the discharge pipe, or from the downstream side by failure of the halfpipes and subsequent erosion back into the dike.

- FMSM conducted analyses of dikes D and E with the REAME slope stability program.

- Based on laboratory testing results, the following soil strength parameters were used for the analysis:

Soil Strength Parameters (Effective Stress Parameters)

Soil Type	Cohesion c (psf)	Angle of Internal Friction Φ (Degrees)	Unit Weight ɣ (pcf)
Fly Ash (Bottom Ash)	0	33	90
Silty Clay	50	25	125
Sand	0	31	120

- Slope stability analysis for long-term stability and rapid drawdown conditions in dikes D and E was conducted.
- The slope was modeled using reported operating conditions with a pool elevation upstream of dike D of EL. 640 feet and a downstream pool elevation of EL. 630 feet.
- Analysis was based on a saturated embankment assumed to occur during service.
- Initial results indicated that dike D with a height of approximately 33 feet would be the controlling dike.
- The selected target factors of safety, based on our past experience with the Indiana Department of Natural Resources, were 1.5 for long-term (global) stability and 1.1 for rapid drawdown conditions.
- Results from the slope stability analyses indicated insufficient factors of safety for the dikes in their current state using the modeling conditions.
- The current state of the dikes indicated approximate factors of safety of 1.0 for long-term stability and 0.8 for rapid drawdown conditions.

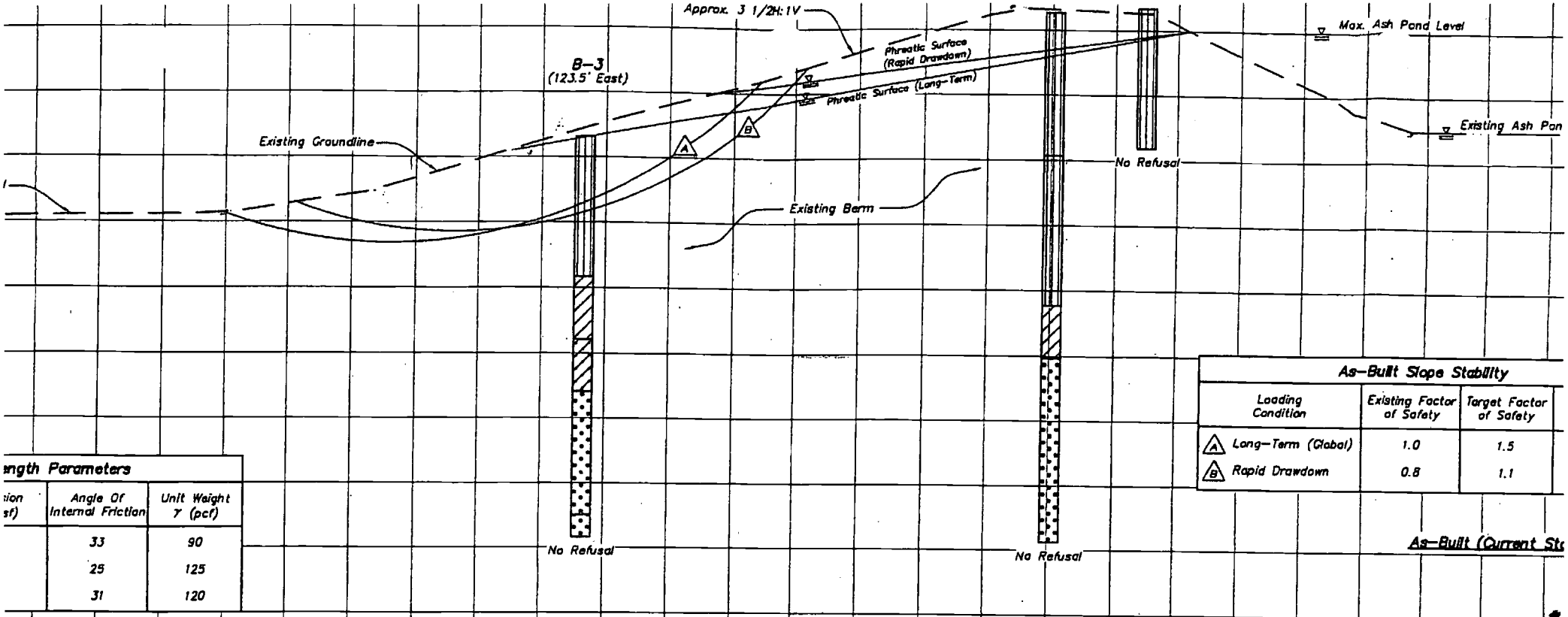
4. Recommendations

- FMSM recommends adding a five foot thick drainage berm, composed of a combination of bottom ash and rip rap, extending down the downstream face of dike D from an elevation of about EL. 630 to the pond bottom EL. 611. (Similar treatment may be required for the upstream face of dike E).
- The recalculated factors of safety for slope stability using the recommended drainage berm was analyzed to be about 1.5 for long-term stability and about 1.4 for rapid drawdown conditions.
- Repair breached areas with properly compacted flyash fill.
- Remove all sloughed and failed materials from breached area prior to placement of fill.
- Place fill in thin lifts while benching into face of undisturbed slope.
- During re-installation of pipe it will be imperative to create a water tight seal using anti-seep measures.
- FMSM recommends adding pipe backfill trenches, flowable fill and seep collars to mitigate seepage.

- The downstream slope of dike D should be protected from erosion at the pipe disscharge.

5. General Comments

- The flyash material within the embankments is highly erodible.
- Inspect the dikes on a daily basis to look for shallow failures, tension cracks or other signs of distress.
- The stability analysis and the recommendations presented herein assume that all the dikes were constructed in a similar manner and meet the marginal factor of safety.
- FMSM recommends that all dikes be raised to same elevation to mitigate potential progressive failure.
- The stability analyses indicate lower factors of safety for sloughing or shallow failures. Circular surface failures of less than a 10 foot radius are considered a maintenance issue.
- Liquefaction of the dike materials was not considered in our conclusions. The fly ash in a saturated state is considered highly liquefiable during a seismic event.
- Depending on the longevity of plant operations, a master plan for converting to a solid waste landfill should be considered.



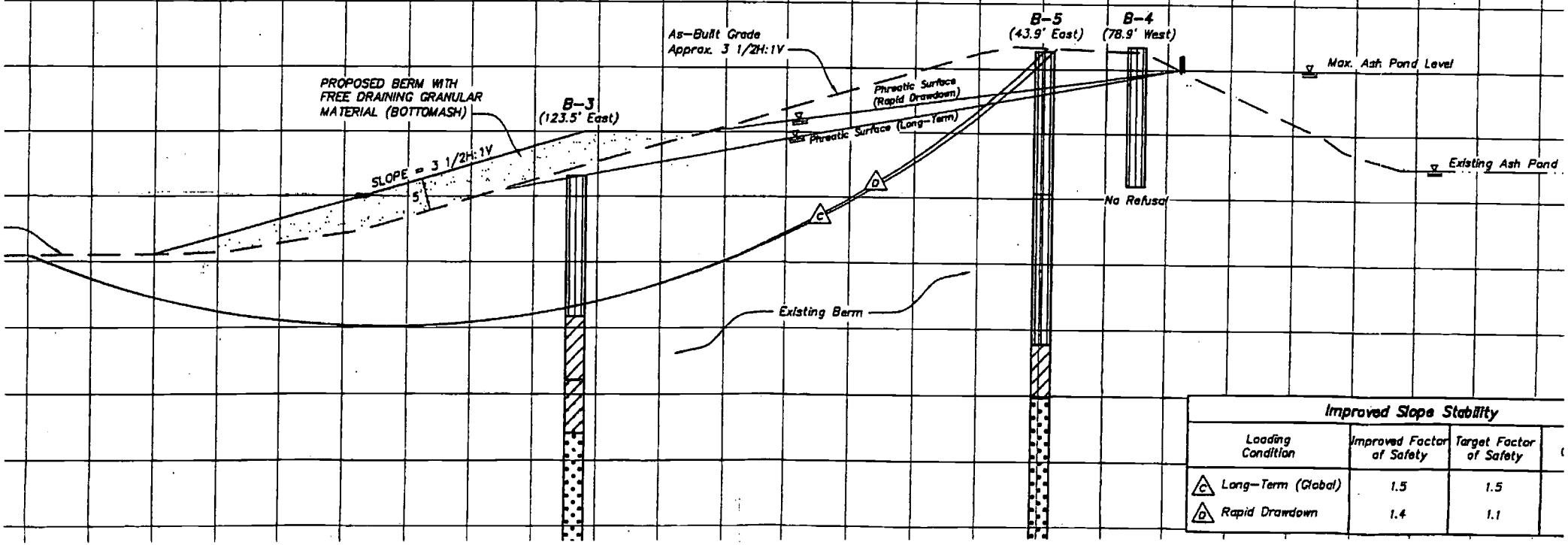
As-Built Slope Stability

Loading Condition	Existing Factor of Safety	Target Factor of Safety
A Long-Term (Global)	1.0	1.5
B Rapid Drawdown	0.8	1.1

ength Parameters

ion sf)	Angle Of Internal Friction	Unit Weight γ (pcf)
	33	90
	25	125
	31	120

As-Built (Current Sta



Improved Slope Stability

Loading Condition	Improved Factor of Safety	Target Factor of Safety
C Long-Term (Global)	1.5	1.5
D Rapid Drawdown	1.4	1.1

FMSM ENGINEERS

SUBSURFACE LOG

Project Number	LV2007041	Location	See Boring Layout
Project Name	IP&L Eagle Valley	Boring No.	B-1
		Total Depth	61.5 ft
County	Morgan	Surface Elevation	615.3 ft
Project Type	Geotechnical Exploration	Date Started	5/8/07
		Completed	5/8/07
Supervisor	M. Vaughan	Driller	D. Jesse
Depth to Water	20.7 ft	Date/Time	5/10/07
Logged By	M. Vaughan	Depth to Water	N/A
		Date/Time	N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
615.3	0.0	Top of Hole							
		Silt With Sand (ML), black and gray, moist, medium stiff, (flyash)							
				SPT-1	2.5 - 4.0	1.2	5-3-2	7	
				SPT-2	5.0 - 6.5	1.2	2-2-4	10	
606.1	9.2			ST-1	7.5 - 9.5	2.0		--	
		Lean Clay (CL), dark brown, moist, very stiff to medium stiff							
				SPT-3	10.0 - 11.5	1.1	4-6-10	27	
				SPT-4	12.5 - 14.0	1.5	3-2-4	20	
598.3	17.0			ST-2	15.0 - 17.0			--	
		Lean Clay (CL) To Sand (sw), brown with gravel, moist, dense							
				SPT-5	17.5 - 19.0	1.5	14-21-16	--	
595.3	20.0								
		Well Graded Sand (SW), with varying amounts of clay, brown, moist to wet, medium dense to very dense							
				SPT-6	20.0 - 21.5	0.8	4-11-18	--	
				SPT-7	25.0 - 26.5	1.5	6-9-9	--	
				SPT-8	30.0 - 31.5	1.5	8-10-14	--	
				SPT-9	35.0 - 36.5	1.5	12-14-13	--	

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SUBSURFACE LOG

Project Number LV2007041 | Location See Boring Layout

Project Name IP&L Eagle Valley | Boring No. **B-1** | Total Depth 61.5 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Well Graded Sand (SW), with varying amounts of clay, brown, moist to wet, medium dense to very dense *(Continued)*		SPT-10	40.0 - 41.5	1.5	24-32-28	–	
				SPT-11	45.0 - 46.5	1.5	13-13-23	–	
567.3	48.0								
		Poorly Graded Sand (SP), brown, moist, medium dense		SPT-12	50.0 - 51.5	1.5	11-14-15	–	
				SPT-13	55.0 - 56.5		12-10-6	–	
553.8	61.5			SPT-14	60.0 - 61.5	1.5	12-13-10	–	
		No Refusal / Bottom of Hole							

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SUBSURFACE LOG

Project Number	LV2007041	Location	See Boring Layout
Project Name	IP&L Eagle Valley	Boring No.	B-2
		Total Depth	81.5 ft
County	Morgan	Surface Elevation	615.6 ft
Project Type	Geotechnical Exploration	Date Started	5/9/07
		Completed	5/9/07
Supervisor	M. Vaughan	Driller	D. Jesse
Depth to Water	22.3 ft	Date/Time	5/10/07
Logged By	M. Vaughan	Depth to Water	N/A
		Date/Time	N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
615.6	0.0	Top of Hole							
		Silt With Sand (ML), black and gray, dry to moist, soft to stiff, (flyash)		SPT-1	2.5 - 4.0	1.5	4-2-2	48	
609.8	5.8			SPT-2	5.0 - 6.5	1.5	9-4-5	29	
		Lean Clay (CL), brown, moist, soft		ST-1	7.5 - 9.5	1.4		--	
				SPT-3	10.0 - 11.5	1.5	2-1-1	43	
602.6	13.0			SPT-4	12.5 - 14.0	1.5	5-8-10	21	
		Lean Clay (CL), brown, moist, stiff and very stiff		SPT-5	15.0 - 16.5	1.3	3-4-5	20	
				SPT-6	17.5 - 19.0	1.5	4-3-15	27	
595.6	20.0								
		Well Graded Sand And Gravel (SW), variable amounts of clay, brown, moist to wet, medium dense		SPT-7	20.0 - 21.5	1.3	15-11-10	--	
				SPT-8	25.0 - 26.5	0.9	20-23-26	--	
587.6	28.0								
		Poorly Graded Sand (SP), with gravel, brown, moist, medium dense		SPT-9	30.0 - 31.5	1.0	20-14-15	--	
580.6	35.0								
		Well Graded Sand (SW), with gravel, variable amounts of clay, brown, wet, medium dense to very dense		SPT-10	35.0 - 36.5	0.8	18-14-14	--	

SUBSURFACE LOG

Project Number	LV2007041	Location	See Boring Layout
Project Name	IP&L Eagle Valley	Boring No.	B-2
Total Depth	81.5 ft		

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Well Graded Sand (SW), with gravel, variable amounts of clay, brown, wet, medium dense to very dense *(Continued)*		SPT-11	40.0 - 41.5	1.1	23-34-27	--	
				SPT-12	45.0 - 46.5	0.9	22-27-31	--	
				SPT-13	50.0 - 51.5	1.2	43-18-17	--	
				SPT-14	55.0 - 56.0	1.0	36-21-24	--	
				SPT-15	60.0 - 61.5	1.5	43-34-32	--	
				SPT-16	65.0 - 66.5	1.5	26-36-40	--	
				SPT-17	70.0 - 71.5	0.3	34-37-22	--	
542.6	73.0								
		Poorly Graded Sand (SP), brown, wet, some clay, medium dense		SPT-18	75.0 - 76.5	1.3	6-8-13	--	
537.6	78.0								
		Well Graded Sand (SW), brown, moist							
534.1	81.5			SPT-19	80.0 - 81.5	1.5		--	
		No Refusal / Bottom of Hole Installed Well							

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SUBSURFACE LOG

Project Number	LV2007041	Location	See Boring Layout
Project Name	IP&L Eagle Valley	Boring No.	B-3 — Total Depth 61.5 ft
County	Morgan	Surface Elevation	623.1 ft
Project Type	Geotechnical Exploration	Date Started	5/9/07 — Completed 5/9/07
Supervisor	M. Vaughan — Driller D. Jesse	Depth to Water	47.7 ft — Date/Time 5/10/07
Logged By	M. Vaughan	Depth to Water	N/A — Date/Time N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
623.1	0.0	Top of Hole							
		Silt With Sand (ML), black and gray, moist to wet, soft to medium stiff, (flyash)							
				SPT-1	2.5 - 4.0	1.5	3-2-2	36	
				SPT-2	5.0 - 6.5	1.5	2-1-2	36	
				SPT-3	7.5 - 9.0	1.5	2-2-3	41	Wood/tree root found
				ST-1	10.0 - 12.0	2.0		--	Wood fragments at 15.0' to 16.5'
				SPT-4	12.5 - 14.0	1.5	2-1-3	43	
				SPT-5	15.0 - 16.5	1.4	3-1-1	42	
				SPT-6	17.5 - 19.0	1.5	0-0-2	35	
601.7	21.4			SPT-7	20.0 - 21.5	1.3	3-4-3	28	
		Lean Clay (CL), brown and gray, moist, soft to stiff							
				ST-2	22.5 - 24.5	2.0		--	
				SPT-8	25.0 - 26.5	1.5	3-2-2	29	
592.1	31.0			SPT-9	30.0 - 31.5	1.5	6-7-10	--	
		Clayey Sand (SC), brown, moist, medium dense							
				SPT-10	35.0 - 36.5	1.5	9-12-12	--	

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SUBSURFACE LOG

Project Number	LV2007041	Location	See Boring Layout
Project Name	IP&L Eagle Valley	Boring No.	B-3
Total Depth	61.5 ft		

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
584.1	39.0	Clayey Sand (SC), brown, moist, medium dense *(Continued)*							
		Well Graded Sand (SW), with gravel, brown, moist to wet, medium dense to dense		SPT-11	40.0 - 41.5	1.5	15-21-26	13	
				SPT-12	45.0 - 46.5	1.5	12-12-15	--	
				SPT-13	50.0 - 51.5	1.4	15-24-23	--	
				SPT-14	55.0 - 56.5	1.5	10-10-13	--	
565.1	58.0								
561.6	61.5	Poorly Graded Sand (SP), occassional gravel, brown, moist, dense		SPT-15	60.0 - 61.5		19-13-17	--	
		No Refusal / Bottom of Hole Installed Well							

SUBSURFACE LOG

Project Number	LV2007041	Location	See Boring Layout
Project Name	IP&L Eagle Valley	Boring No.	B-4
		Total Depth	21.5 ft
County	Morgan	Surface Elevation	643.4 ft
Project Type	Geotechnical Exploration	Date Started	5/9/07
		Completed	5/9/07
Supervisor	M. Vaughan	Driller	D. Jesse
		Depth to Water	Dry
		Date/Time	5/9/07
Logged By	M. Vaughan	Depth to Water	N/A
		Date/Time	N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
643.4	0.0	Top of Hole							
		Silt With Sand (ML), black and gray, moist, soft to very stiff, (flyash)							
				SPT-1	2.5 - 4.0	1.5	3-2-2	23	
				SPT-2	5.0 - 6.5	1.3	6-9-10	17	
				ST-1	7.5 - 9.5	2.0		–	
				SPT-3	10.0 - 11.5	1.4	3-9-11	25	
				SPT-4	12.5 - 14.0	1.4	3-1-4	27	
				ST-2	15.0 - 17.0	2.0		–	
				SPT-5	17.5 - 19.0	1.5	6-4-4	30	
621.9	21.5			SPT-6	20.0 - 21.5	1.5	3-2-2	55	
		No Refusal / Bottom of Hole							

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SUBSURFACE LOG

Project Number	LV2007041	Location	See Boring Layout
Project Name	IP&L Eagle Valley	Boring No.	B-5
		Total Depth	81.5 ft
County	Morgan	Surface Elevation	642.7 ft
Project Type	Geotechnical Exploration	Date Started	5/9/07
		Completed	5/9/07
Supervisor	M. Vaughan	Driller	D. Jesse
		Depth to Water	49.6 ft
		Date/Time	5/10/07
Logged By	M. Vaughan	Depth to Water	N/A
		Date/Time	N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois. Cont. % / Run Depth	Remarks
642.7	0.0	Top of Hole							
		Silt With Sand (ML), black and gray, dry to moist, medium stiff to very stiff, (flyash)		SPT-1	2.5 - 4.0		5-4-4	29	
				SPT-2	5.0 - 6.5		11-3-2	10	
				SPT-3	7.5 - 9.0		9-9-7	23	
				ST-1	10.0 - 12.0			–	
				SPT-4	12.5 - 14.0		8-7-10	29	
				SPT-5	15.0 - 16.5		2-2-3	48	
				SPT-6	17.5 - 19.0		6-8-8	22	
620.7	22.0			SPT-7	20.0 - 21.5		4-2-3	28	
		Silt With Sand (ML), black and gray, dry to moist, very soft to medium stiff, (flyash)		SPT-8	22.5 - 24.0		2-1-1	32	
				SPT-9	25.0 - 26.5		1-1-1	35	
				SPT-10	27.5 - 29.0		4-2-2	38	
				SPT-11	30.0 - 31.5		1-1-2	47	
				SPT-12	32.5 - 34.0		3-2-2	37	
				SPT-13	35.0 - 36.5		1-2-1	56	
				SPT-14	37.5 - 39.0		W.O.R.	38	

SUBSURFACE LOG

Project Number LV2007041 | Location See Boring Layout

Project Name IP&L Eagle Valley | Boring No. **B-5** | Total Depth 81.5 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft / Rec. Ft	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Silt With Sand (ML), black and gray, dry to moist, very soft to medium stiff, (flyash) *(Continued)*		SPT-15	40.0 - 41.5		3-3-3	41	
597.7	45.0								
		Lean Clay (CL), brown and gray, moist, medium stiff to soft		SPT-16	45.0 - 46.5		4-3-3	24	
				ST-2	47.5 - 49.5			--	
				SPT-17	50.0 - 51.5		3-2-2	21	
589.7	53.0								
		Well Graded Sand (SW), and gravel, brown, moist, medium dense to dense (variable clay content decreasing with depth)		SPT-18	55.0 - 56.5		14-13-16	28	
				SPT-19	60.0 - 61.5		15-20-16	--	
				SPT-20	65.0 - 66.5		33-27-23	--	
				SPT-21	70.0 - 71.5		25-18-27	--	
				SPT-22	75.0 - 76.5		14-21-20	--	
561.2	81.5			SPT-23	80.0 - 81.5		14-16-19	--	
		No Refusal / Bottom of Hole Installed Well							

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Summary of Test Results

Ashpond Dikes D & E - Martinsville, Indiana

FMSM Project No. LV2007041

Boring	Depth (feet)	Sample Type	Particle Size (% passing 200 Sieve)	In-Situ Dry Density	Max Dry Density	In-Situ Moisture	Optimum Moisture	Unconfined Compression (psf)	Triaxial Shear Test		Atterberg Limits		
				pcf	pcf	%	%		c'	Φ'	LL	PL	PI
B-1	2.5-4.0	SPT				7.4							
B-1	5.0-6.5	SPT				9.7							
B-1	7.5-9.5	ST		92.5		32.8			0	36.2			
B-1	7.5-9.5	ST		99.1		24.1							
B-1	10.0-11.5	SPT				27.3							
B-1	12.5-14.0	SPT				20.3							
B-1	15.0-17.0	ST		102.0		22.0		1,200					
B-2	2.5-4.0	SPT				47.5							
B-2	5.0-6.5	SPT				28.5							
B-2	10.0-11.5	SPT				43.2							
B-2	12.5-14.0	SPT				20.9							
B-2	15.0-16.5	SPT				19.6							
B-2	17.5-19.0	SPT				26.5							
B-3	2.5-4.0	SPT				36.4							
B-3	5.0-6.5	SPT				35.5							
B-3	7.5-9.0	SPT				40.9							
B-3	10.0-12.0	ST				51.7							
B-3	12.5-14.0	SPT				42.5							
B-3	15.0-16.5	SPT				42.3							
B-3	17.5-19.0	SPT				34.8							
B-3	20.0-21.5	SPT				27.7							
B-3	22.5-24.5	ST		87.0		31.3		3,400					
B-3	22.5-24.5	ST		98.1		25.5			50	33			
B-3	25.0-26.5	SPT	82.0			28.7					38	18	20
B-3	40.0-41.5	SPT	0.4			12.7							
B-4	2.5-4.0	SPT				23.2							
B-4	5.0-6.5	SPT				16.8							
B-4	7.5-9.5	ST				18.6							
B-4	10.0-11.5	SPT				24.8							
B-4	12.5-14.0	SPT				26.9							
B-4	15.0-17.0	ST		77.8		32.9			0	36.2			
B-4	17.5-19.0	SPT				29.8							
B-4	20.0-21.5	SPT				54.8							
B-5	2.5-4.0	SPT				29.4							
B-5	5.0-6.5	SPT				9.8							
B-5	7.5-9.0	SPT	91.3			23.3							
B-5	10.0-12.0	ST				29.7							
B-5	12.5-14.0	SPT				28.8							
B-5	15.0-16.5	SPT				48.4							
B-5	17.5-19.0	SPT				21.5							
B-5	20.0-21.5	SPT				28.4							
B-5	22.5-24.0	SPT				32.2							
B-5	25.0-26.5	SPT				35.1							
B-5	27.5-29.0	SPT	87.5			38.4							
B-5	30.0-31.5	SPT				47.3							
B-5	32.5-34.0	SPT				36.7							
B-5	35.0-36.5	SPT				55.5							

Boring	Depth (feet)	Sample Type	Particle Size (% passing 200 Sieve)	In-Situ Dry Density	Max Dry Density	In-Situ Moisture	Optimum Moisture	Unconfined Compression (psf)	Triaxial Shear Test		Atterberg Limits		
				pcf	pcf	%	%		c'	Φ'	LL	PL	PI
B-5	37.5-39.0	SPT				37.6							
B-5	40.0-41.5	SPT				41.2							
B-5	45.0-46.5	SPT				24.4							
B-5	47.5-49.5	ST		91.9		31.5			50	33			
B-5	47.5-49.5	ST		91.7		31.7							
B-5	50.0-51.5	SPT				21.4							
B-5	55.0-56.5	SPT	0.2			27.6							
Pond A	Surface	BAG	94.2		81.2	37.6	25.7						
BBCM-3	4.0-6.0	ST		74.9		38.2			0	29.8			
BBCM-3	4.0-6.0	ST		75.2		38.4							
BBCM-3	4.0-6.0	ST		75.2		37.8							

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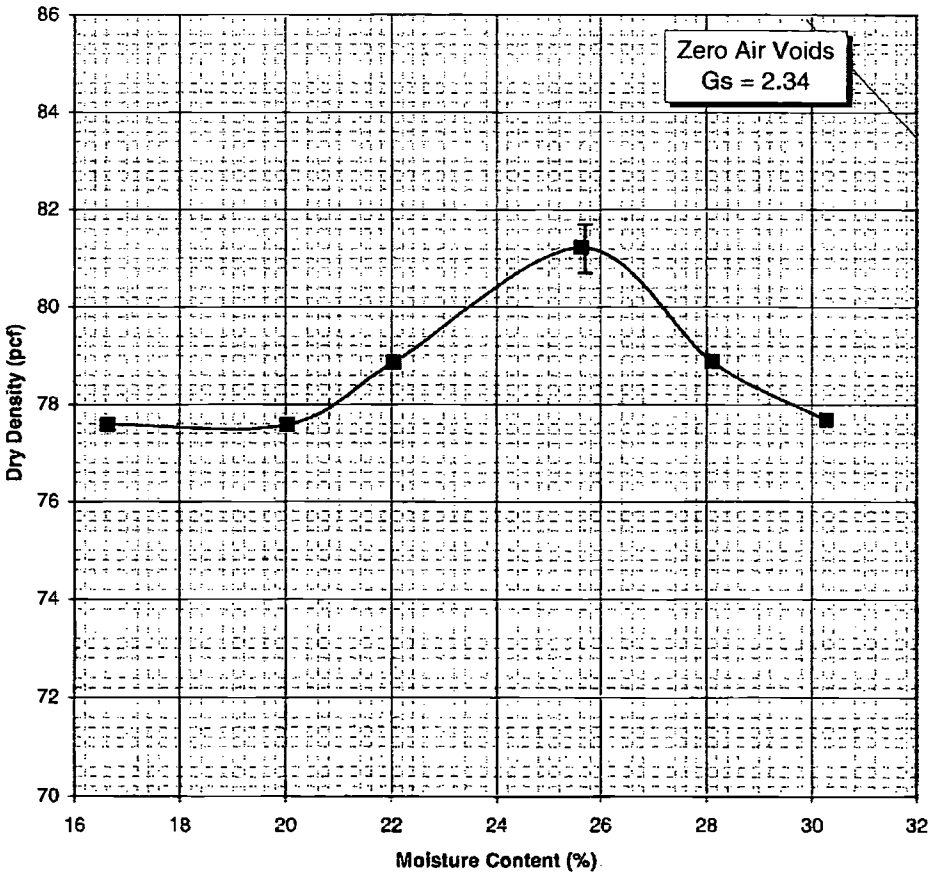
Moisture-Density Data Sheet

Project: IP&L Eagle Valley
Source: Pond A
Sample Description: FSS
Visual Notes: silty
Prepared: Dry Oversized Fraction: < 5 % Rammer: Manual

Project No.: LV2007041
Sample No.: 44
Nmc: 37.6 %
Test Method: ASTM D 698 - Method A
Gs - Fines: AASHTO T 100

Reviewed By _____

Mold Weight 2039 grams		Moisture Determination				
Wet Weight plus Mold (grams)	Wet Weight minus Mold (grams)	Wet Soil and Can Weight (grams)	Dry Soil and Can Weight (grams)	Can Weight (grams)	Water Content (%)	Dry Density (pcf)
3410	1371	228.25	199.80	28.85	16.6	77.6
3450	1411	244.03	208.11	28.88	20.0	77.6
3497	1458	238.48	200.48	28.07	22.0	78.9
3585	1546	289.65	236.52	29.25	25.6	81.2
3570	1531	230.99	186.48	28.15	28.1	78.9
3572	1533	282.00	224.11	32.86	30.3	77.7



Maximum Dry Density 81.2 PCF
Optimum Moisture Content 25.7 %

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Moisture-Density Data Sheet

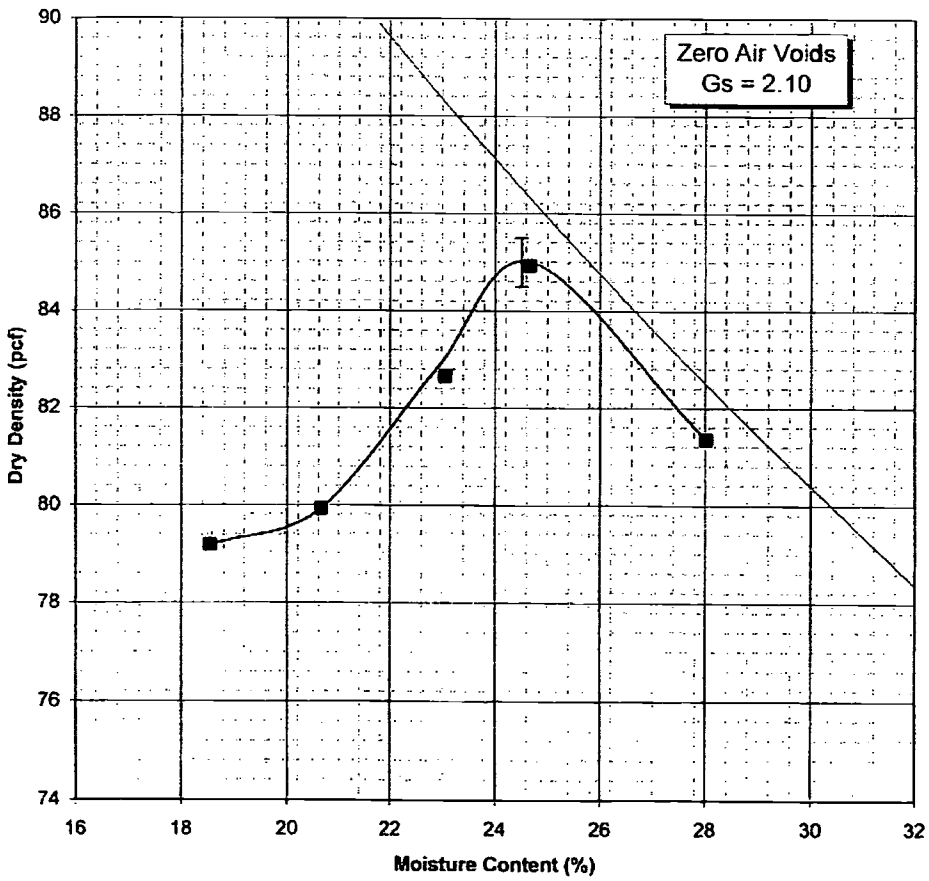
Project: IP&L Eagle Valley
Source: Onsite Borrow
Sample Description: Fly ash
Visual Notes:
Prepared: Dry Oversized Fraction: < 5 % Rammer: Manual

Project No.: LV2007041
Sample No.: OSB1

Test Method: ASTM D 698 - Method A
Gs - Fines: Assumed

Reviewed By _____

Mold Weight 4234 grams		Moisture Determination				
Wet Weight plus Mold (grams)	Wet Weight minus Mold (grams)	Wet Soil and Can Weight (grams)	Dry Soil and Can Weight (grams)	Can Weight (grams)	Water Content (%)	Dry Density (pcf)
5656	1422	216.20	186.90	28.90	18.5	79.2
5695	1461	250.90	212.80	28.40	20.7	79.9
5775	1541	206.20	173.10	29.60	23.1	82.7
5838	1604	188.80	157.20	29.10	24.7	84.9
5812	1578	168.00	137.50	28.70	28.0	81.4



Maximum Dry Density 84.9 PCF
Optimum Moisture Content 24.4 %

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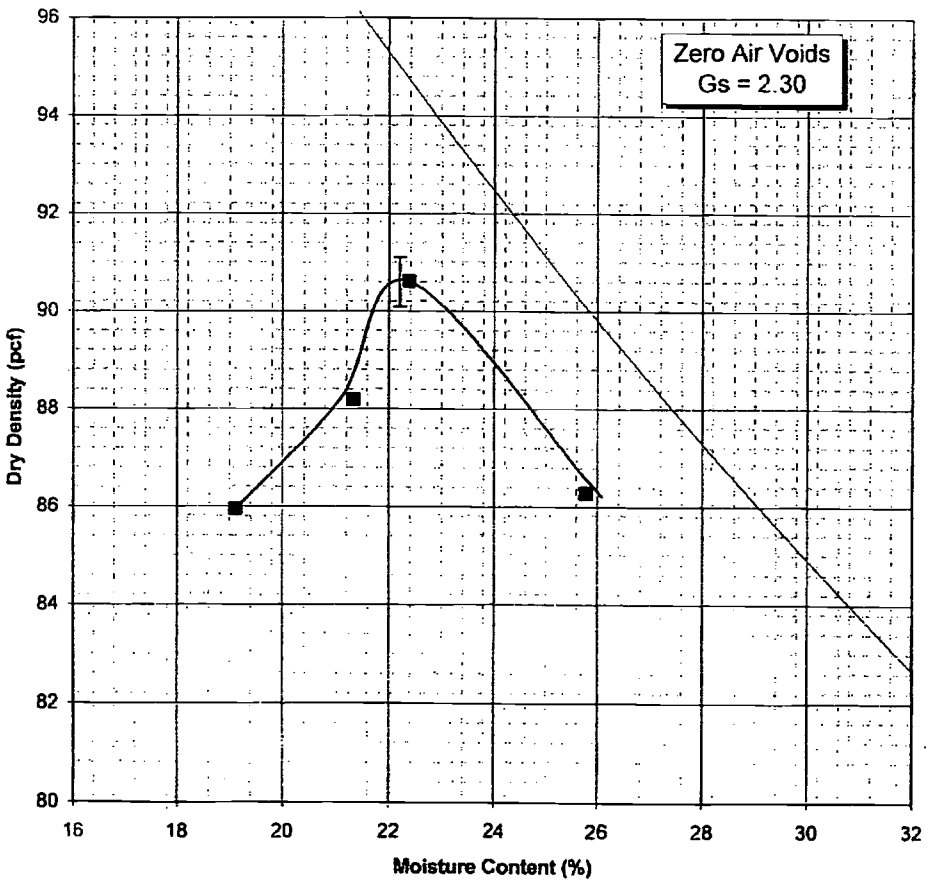
Moisture-Density Data Sheet

Project: IP&L Eagle Valley
Source: Stockpile
Sample Description: Fly ash
Visual Notes:
Prepared: Dry Oversized Fraction: < 5 % Rammer: Manual

Project No.: LV2007041
Sample No.: Stockpile 1
Test Method: ASTM D 698 - Method A
Gs - Fines: Assumed

Reviewed By _____

Mold Weight 4234 grams		Moisture Determination				
Wet Weight plus Mold (grams)	Wet Weight minus Mold (grams)	Wet Soil and Can Weight (grams)	Dry Soil and Can Weight (grams)	Can Weight (grams)	Water Content (%)	Dry Density (pcf)
5785	1551	173.00	149.90	29.10	19.1	85.9
5855	1621	208.90	177.90	32.60	21.3	88.2
5914	1680	204.90	172.70	28.80	22.4	90.6
5878	1644	193.10	159.40	28.70	25.8	86.3



Maximum Dry Density 90.6 PCF
Optimum Moisture Content 22.2 %

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Summary of Soil Tests

Project Name	Indiana Power and Light: Eagle Valley	Project Number	LV2007041
Source	Dike Breach, West Side of Breach, Downstream, 4' Above Base	Lab ID	1
County	Morgan, IN	Date Received	2-1-08
Sample Type	Bag	Date Reported	2-13-08

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 20.0

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	100.0
3/8"	9.5	99.5
No. 4	4.75	97.1
No. 10	2	93.2
No. 40	0.425	87.4
No. 200	0.075	75.8
	0.02	42.6
	0.005	13.5
	0.002	2.7
estimated	0.001	1.5

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	2.9	6.8
Coarse Sand	3.9	5.8
Medium Sand	5.8	---
Fine Sand	11.6	11.6
Silt	62.3	73.1
Clay	13.5	2.7

Atterberg Limits

Test Method: ASTM D 4318 Method B
Prepared: Dry

Liquid Limit: ---
Plastic Limit: Non Plastic
Plasticity Index: ---
Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854
Prepared: Dry

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.45

Classification

Unified Group Symbol: ML
Group Name: Silt with sand

AASHTO Classification: A-4 (0)

Comments:

Reviewed by: RHB

ENGINEERS

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Indiana Power and Light: Eagle Valley
Source: Dike Breach, West Side of Breach, Downstream, 4' Above Base

Project Number: LV2007041
Lab ID: 1

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: AR
Test Date: 02-04-2008
Date Received: 02-01-2008

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	99.5
No. 4	97.1
No. 10	93.2

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

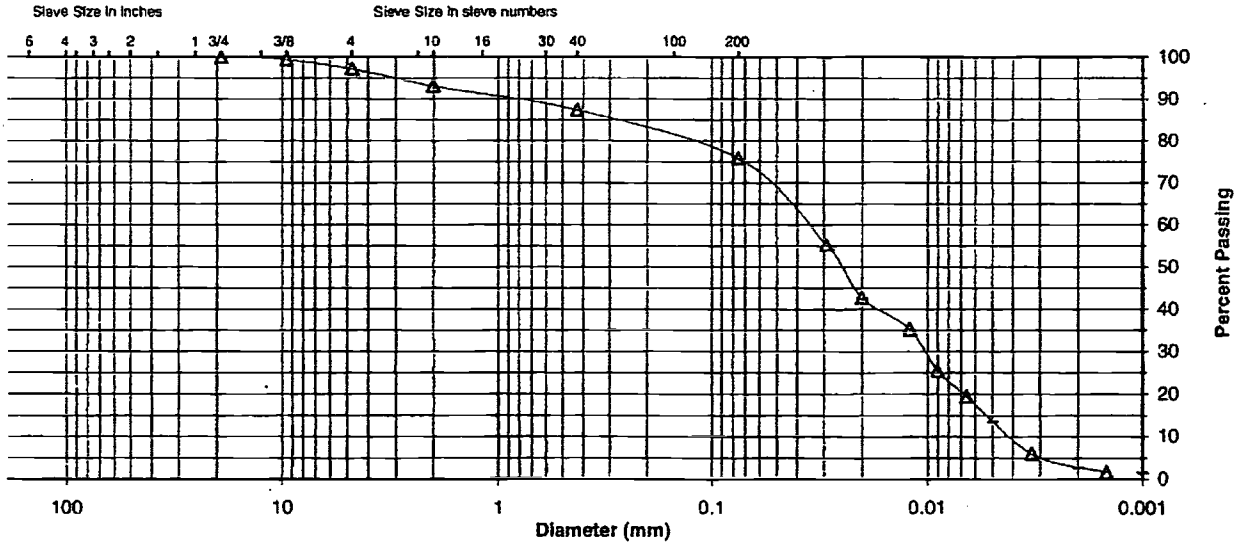
Specific Gravity: 2.45

Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	87.4
No. 200	75.8
0.02 mm	42.6
0.005 mm	13.5
0.002 mm	2.7
0.001 mm	1.5

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	2.9	3.9	5.8	11.6	62.3	13.5
AASHTO	Gravel			Coarse Sand	Fine Sand	Silt	Clay
	6.8			5.8	11.6	73.1	2.7



Comments

Reviewed By RHB

File: LV2007041_Sum-1.xls Sheet: Hydro-Report
Preparation Date: 1998
Revision Date: 05-2003

Fuller, Mossbarger, Scott and May Engineers, Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

ENGINEERS

Gradation Analysis
ASTM D 422

Project Name: Indiana Power and Light: Eagle Valley
Source: Dike Breach, West Side of Breach, Downstream, 4' Above Base

Project Number: LV2007041
Lab ID: 1

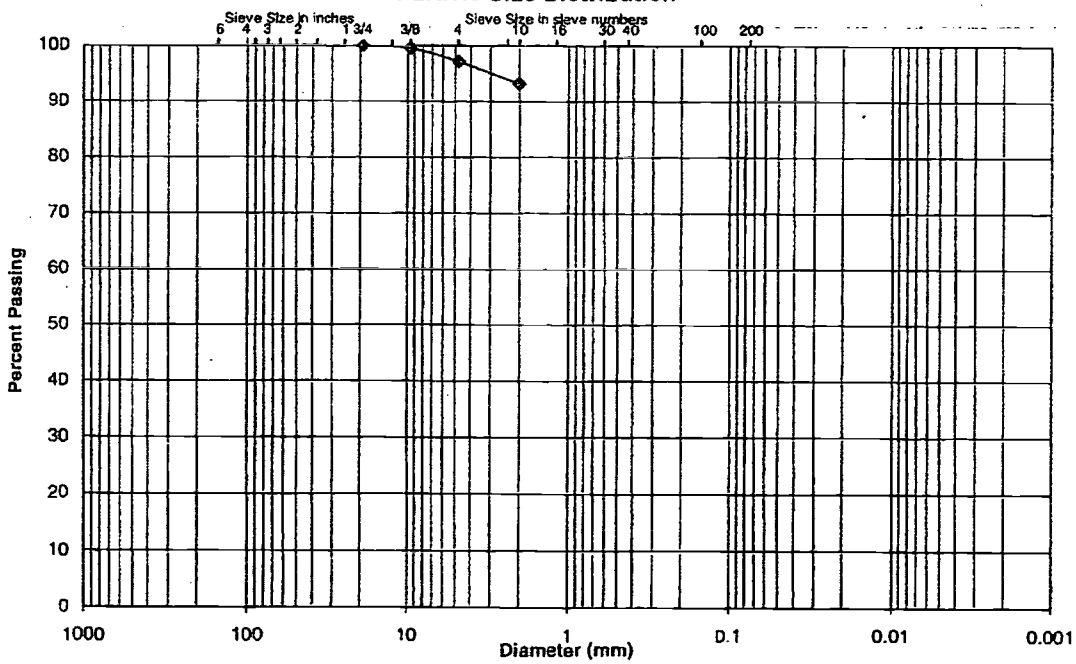
Particle Shape: Angular
Particle Hardness: Hard and Durable
Prepared: ASTM D 421

Tested by: AR
Test Date: 2-4-08
Date Received: 02-01-2008

Sample Dry Weight (g): 259.31
Analysis based on: Total Sample

Sieve Size	Grams Retained	% Retained	% Passing
3"			
2"			
1 1/2"			
1"			
3/4"	0.00	0.0	100.0
3/8"	1.40	0.5	99.5
No. 4	6.00	2.4	97.1
No. 10	10.21	3.9	93.2
Pan	241.22	93.0	---

Particle Size Distribution



Comments

Reviewed By RHB

File: LV2007041_Sum-1.xls Sheet: Sieve-Report
Preparation Date: 1998
Revision Date: 05-2002

Fuller, Mossbarger, Scott and May Engineers, Inc.

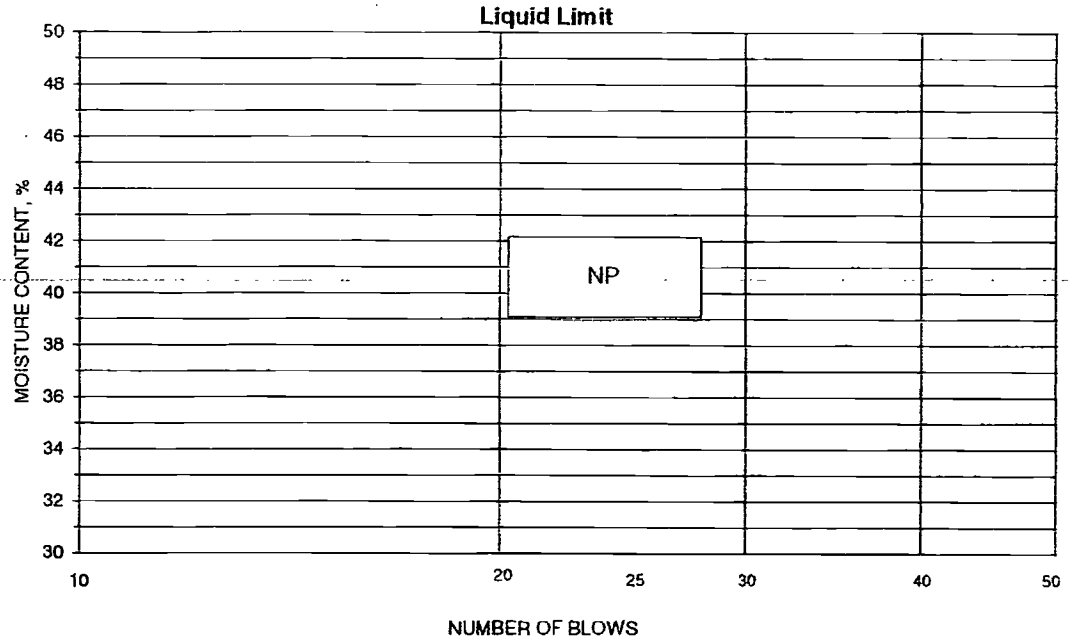
Laboratory Document
Prepared By: MW
Approved BY: TLK

ENGINEERS

ATTERBERG LIMITS

Project	Indiana Power and Light: Eagle Valley	Project No.	LV2007041
Source	Dike Breach, West Side of Breach, Downstream, 4' Above Base	Lab ID	1
		% + No. 40	13
Tested By	RHB	Test Method	ASTM D 4318 Method B
Test Date	02-06-2008	Prepared	Dry
		Date Received	02-01-2008

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
					0



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index

Remarks:

Reviewed By RHB

File: LV2007041_Sum-1.xls
Sheet: Limit-Report
Preparation Date: 1998
Revision Date: 05-2002

Fuller, Mossbarger, Scott and May Engineers, Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

FMSM ENGINEERS

Summary of Soil Tests

Project Name	Indiana Power and Light: Eagle Valley	Project Number	LV2007041
Source	Dike Breach, East Side of Breach, Upstream, 10' Below Crest	Lab ID	2
County	Morgan, IN	Date Received	2-1-08
Sample Type	Bag	Date Reported	2-13-08

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 29.5

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	
3/8"	9.5	100.0
No. 4	4.75	99.3
No. 10	2	96.6
No. 40	0.425	92.7
No. 200	0.075	83.6
	0.02	54.0
	0.005	13.4
	0.002	2.4
estimated	0.001	1.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.7	3.4
Coarse Sand	2.7	3.9
Medium Sand	3.9	---
Fine Sand	9.1	9.1
Silt	70.2	81.2
Clay	13.4	2.4

Atterberg Limits

Test Method: ASTM D 4318 Method B

Prepared: Dry

Liquid Limit: ---

Plastic Limit: Non Plastic

Plasticity Index: ---

Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.45

Classification

Unified Group Symbol: ML

Group Name: Silt with sand

AASHTO Classification: A-4 (0)

Comments:

Reviewed by: RHB

ENGINEERS

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Indiana Power and Light: Eagle Valley
Source: Dike Breach, East Side of Breach, Upstream, 10' Below Crest

Project Number: LV2007041
Lab ID: 2

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: AR
Test Date: 02-04-2008
Date Received: 02-01-2008

Maximum Particle size: 3/8" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	100.0
No. 4	99.3
No. 10	96.6

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

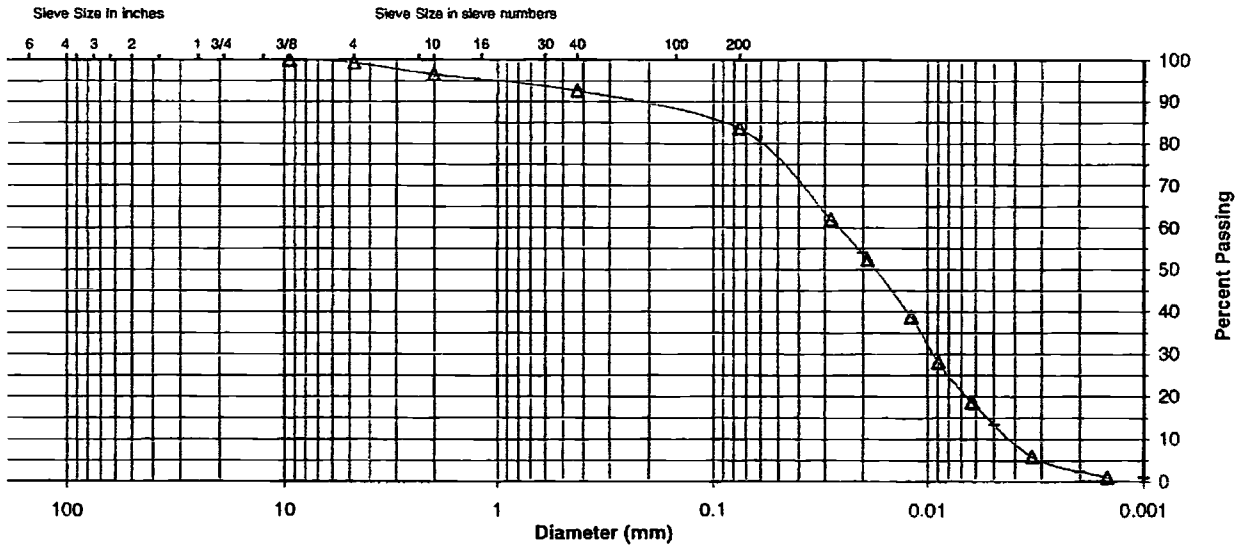
Specific Gravity: 2.45

Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	92.7
No. 200	83.6
0.02 mm	54.0
0.005 mm	13.4
0.002 mm	2.4
0.001 mm	1.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.7	2.7	3.9	9.1	70.2	13.4
AASHTO	Gravel			Coarse Sand	Fine Sand	Silt	Clay
	3.4			3.9	9.1	81.2	2.4



Comments

Reviewed By RHB

File: LV2007041_Sum-2.xls Sheet: Hydro-Report
Preparation Date: 1998
Revision Date: 05-2003

Fuller, Mossbarger, Scott and May Engineers, Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

ENGINEERS

Gradation Analysis
ASTM D 422

Project Name: Indiana Power and Light: Eagle Valley
Source: Dike Breach, East Side of Breach, Upstream, 10' Below Crest

Project Number: LV2007041
Lab ID: 2

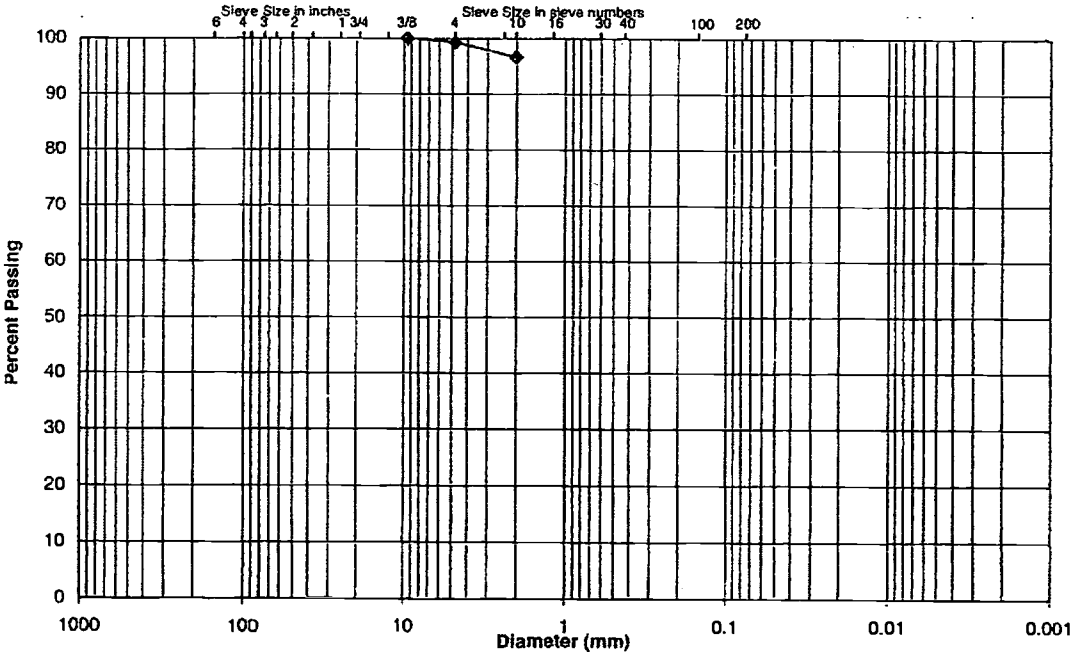
Particle Shape: Angular
Particle Hardness: Hard and Durable
Prepared: ASTM D 421

Tested by: AR
Test Date: 2-4-08
Date Received: 02-01-2008

Sample Dry Weight (g): 261.4
Analysis based on: Total Sample

Sieve Size	Grams Retained	% Retained	% Passing
3"			
2"			
1 1/2"			
1"			
3/4"			
3/8"	0.00	0.0	100.0
No. 4	1.92	0.7	99.3
No. 10	6.87	2.7	96.6
Pan	251.78	96.3	---

Particle Size Distribution



Comments

Reviewed By: RHB

File: LV2007041_Sum-2.xls Sheet: Sieve-Report
Preparation Date: 1998
Revision Date: 05-2002

Fuller, Mossbarger, Scott and May Engineers, Inc.

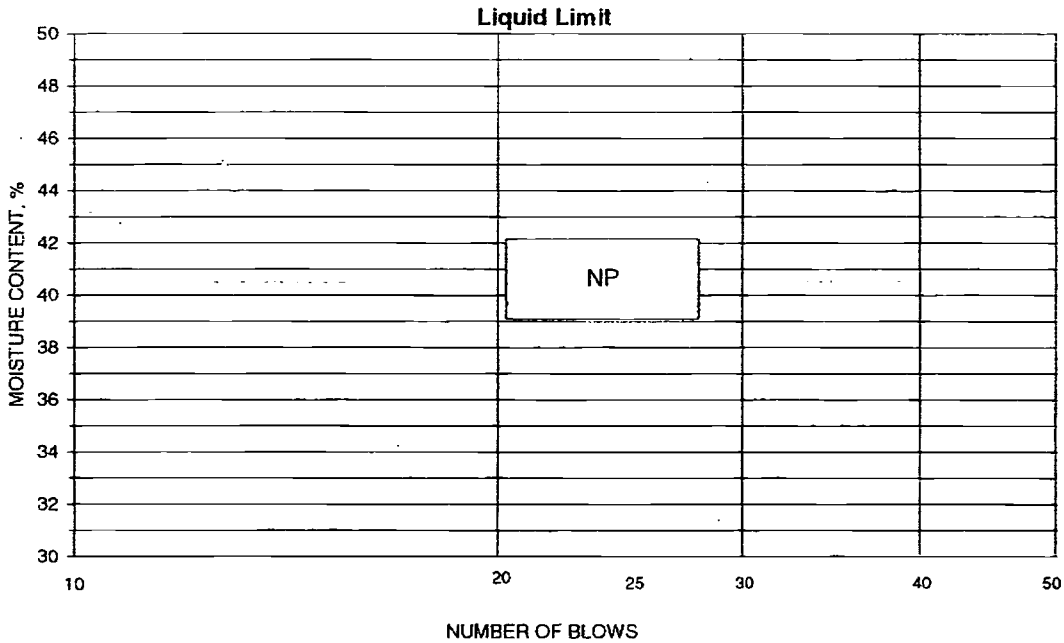
Laboratory Document
Prepared By: MW
Approved BY: TLK

ENGINEERS

ATTERBERG LIMITS

Project	Indiana Power and Light: Eagle Valley	Project No.	LV2007041
Source	Dike Breach, East Side of Breach, Upstream, 10' Below Crest	Lab ID	2
		% + No. 40	7
Tested By	RHB	Test Method	ASTM D 4318 Method B
Test Date	02-06-2008	Prepared	Dry
		Date Received	02-01-2008

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
					0



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index

Remarks:

Reviewed By RHB

File: LV2007041_Sum-2.xls
Sheet: Limit-Report
Preparation Date: 1998
Revision Date: 05-2002

Fuller, Mossbarger, Scott and May Engineers, Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

SECTION I

INSTRUCTIONS TO BIDDERS

SCOPE

The Contractor is furnish all labor, supervision, equipment, and material except as noted to reconstruct the "D" and "E" levees as described in Section II, Technical Specifications.

SCHEDULE

The contractor is to begin work within one week of receipt of a purchase order for this work, and shall complete all work no later than six weeks after commencing said work. The target for completion of the project is by the end of October 2007.

PERMITS

The Owner will obtain and pay for all permits required by local governing authorities having jurisdiction.

PROPOSAL DATA

Proposals are to be submitted to the IPL Eagle Valley Station, 4040 Blue Bluff Road, Martinsville, Indiana, 46151-7887, to the attention of Mr. Rick Jacobs, on or before the date given in the Letter of Inquiry. Proposals shall clearly state they are made in response to and in accordance with the Specifications. Each shall be complete and include all data requested hereinafter.

PRICING AND PAYMENT

Section III, Bid List, gives quantities for the work scope items. Pricing is to be submitted on a lump sum basis except for items 3, 4, and 11 on the Bid List. Pricing for items 3, 4, and 11 on the Bid List should be on a per cubic yard basis. Cross-sections will be conducted by the Owner's representative to determine actual cut and fill volumes for payment.

OVERTIME

It is anticipated this contract will be performed on an eight-hour day, forty-hour per week basis. In any event, the Owner will not pay for overtime work without prior written authorization.

QUALIFYING CONDITIONS

Contractors declining to bid are requested to return all data and drawings to the Owner.

STATEMENT OF EXCEPTIONS

The Owner recognizes that the Contractor, due to his position in his field, may possess knowledge or manufacturing techniques (which may be standard to him) that would place his offering at variance with portions of this Specification. Such variations will be considered by the Owner in his evaluation provided conditions of performance and quality of materials and manufacture meet or exceed those specified. However, in order to obtain this consideration, each item at variance with any portion of this Specification must be set forth in a clause or series of articles clearly labeled "Statement of Exceptions". Use, by the Contractor, of a printed form shall not excuse him from this requirement unless a statement under the "Statement of Exceptions" points clearly to specific portions of the printed form. Blanket rejection of entire Sections or Articles will not be permitted.

END OF SECTION

SECTION II

TECHNICAL SPECIFICATIONS

SCOPE OF WORK

The Contractor is to furnish all labor, supervision, equipment, and material except as noted to reconstruct the "D" and "E" levees. All work shall be in accordance with the requirements of this specification and accompanying drawings. It shall be understood and agreed to by the Contractor that he shall perform all work with quality control and assurance procedures, such as to result in providing of material and installation of the best quality in accordance with current recognized standards and practices.

The intention of the Owner is that the work provided under this specification is to be complete in every detail for the designated purpose.

This item of work includes all major earthwork and related items required to reconstruct the ash pond levees to the final finished grades. The work includes establishing and maintaining all lines and grades, clearing and grubbing and other items as may be required.

Finished surfaces in all cases shall conform to the lines, grades, elevations, cross sections and dimensions shown on the plans and any deviation from the plans and working drawings that may be required by conditions encountered during construction shall be approved by the Owner.

DRAWINGS

The drawings included shall be considered as part of the specification further describing the work. The Certified Bid drawings and documents included have been prepared for the guidance of the bidders in preparing proposals on this work. The drawings are intended to agree in every respect with these specifications, but should discrepancies appear, they shall be called to the attention of the Engineer for clarification. No omission from any drawing shall release the Contractor from furnishing any apparatus, materials, or construction called for by other drawings or the specifications, or properly required for complete construction.

The following is a list of drawings included in this specification:

Sheet	Title
1	Cover Sheet
2	Site Plan & General Notes
3	Dike Reconstruction Plan
4	Dike "D" Profile & Cross-Section
5	Dike "E" Profile & Cross-Section
6	Details

MATERIAL AND SERVICES TO BE FURNISHED BY OWNER

The Owner will provide bench marks from which the Contractor can conduct surveying and staking operations. Structural fill (flyash) is to be borrowed from the designated on-site areas.

CONSTRUCTION WORK AREA

The Contractor shall confine his operations and those of his subcontractors to areas adjacent to his work as designated by the Owner so as to cause a minimum amount of interference with the Owner's plant operations. The Contractor shall base his proposal on executing the work without interruption to the Owner's operations.

AS-BUILT DRAWINGS

The Contractor shall maintain a set of working drawing prints in his field office marked up on a current basis showing all changes to the work made in the field. Upon completion of the work, this set of prints shall be turned over to the Owner for use in preparing as-built drawings.

MATERIAL HANDLING

All material shall be supported and blocked during handling to insure that no item will be bent, twisted, or otherwise damaged. Damaged items shall be repaired or replaced by new material by the Contractor at his expense, and corrected to the satisfaction of the Owner.

Pipe should never be allowed to fall from cars or trucks. When unloaded from trucks, it should be handled by a crane or forklift.

Any damage during transit is the common carrier's responsibility. Such damage must be reported to the Owner so that it may be noted in writing on the freight bill by the local freight agent over his own signature before the pipe can be unloaded.

If pipe is to be stored in piles before installation, the same general practice should be followed as is outlined for good loading practice. Care should be taken that piles are not made too high with resulting damage to pipe or coating.

EXECUTION OF WORK

In planning the execution of this work, the Contractor shall make full allowance for any obstructions encountered since this project involves working within an operating plant. In the event the Contractor uncovers any unmarked or unknown plant facility during excavation, he shall immediately report his finding to the Owner and shall receive instruction from him before proceeding further. All pavements, railroads, and improved surfaces such as crushed stone drives shall be restored to as good as or better condition than before construction.

STRUCTURAL FILL DATA

Flyash taken from the designated area will be used as structural fill. Bidders shall examine the pond material and perform testing necessary to achieve the specified compaction.

EXCAVATION, BACKFILLING AND COMPACTING

The work under this item shall consist of all clearing and grubbing, excavating, backfilling, and compacting.

Clearing and Grubbing - All grass, weeds, and other vegetation within the limits of the work area shall be cut and properly disposed of before the ground is broken for excavation.

Excavation - Excavations shall include the removal and satisfactory disposal or stockpiling of all material of whatever character taken from within the limits of the work area. It shall also include such shaping and sloping as is necessary for the construction, preparation, and completion of all embankments, subgrades, shoulders, slopes, intersections and approaches to the required alignment, grade and typical cross sections shown on the plans.

Compacting - Work shall be done in accordance with these specifications and in conformity with the typical sections shown on the plans. Unless otherwise stated, soil shall refer to natural soil material, coal ash, or mixture thereof.

All equipment, tools, and machinery used on this work must be satisfactory to the Engineer, must be suitable for the type of fill to be compacted, and shall be maintained in good operating condition.

Fill material shall be placed in maximum 8" loose lifts and compacted. Fill should be compacted using pneumatic rubber tired rollers or non-vibratory smooth drum rollers. In no case should vibratory compactive effort be used.

Field density testing is the responsibility of the Owner while moisture testing is the responsibility of the Contractor.

RIP-RAP

Rip-rap shall be limestone or random pieces of broken concrete with no projecting reinforcement, stone 3" to 12" in size and shall be placed in areas designated on drawings.

LINES AND GRADES

The Owner has established a plant coordinate system and permanent bench marks on the site. The Contractor shall establish lines and grade for all work under this specification.

The Contractor shall employ a competent surveyor, subject to the Owner's approval, to provide all line stakes, batter boards, or grade stakes as may be required. The Contractor shall be responsible for the correctness of elevations and lines established.

CORRUGATED METAL PIPE

Pipe shall be fully bituminous-coated corrugated galvanized steel pipe conforming to INDOT Specification 908.02 and 908.06. Pipe bedding shall evenly support the pipe and be free from large rocks, timbers, or foreign material.

FINAL INSPECTION

The Engineer will make final inspection of all work included in the contract as soon as possible after being notified by the Contractor that the work is completed. If the work is not acceptable to the Engineer at the time of such inspection, he will advise the Contractor in writing as to the particular defects to be remedied before acceptance. If within ten days after such notice has been given, the Contractor has not taken steps to speedily correct such defects, the Owner may, without further notice and without in any way impairing the contract, make such other arrangements as he deems necessary to correct and complete the work in a manner satisfactory to him. The cost of completing the work in such a manner will be deducted from any monies that are due or may become due to the Contractor under this contract.

END OF SECTION

SECTION III

BID LIST

Item	Quantity
1. Mobilize/Demobilize	1
2. Install Silt Fence	685 L.F.
3. Remove/Stockpile Flyash from Breach Zones	6,800 YD3
4. Haul, Place, and Compact Flyash	20,700 YD3
5. Construct Toe Berm for D Dike	3,500 YD2
6. Install 30" CMP Discharge Pipes	160 LF
7. Construct Drainage Channel	485 YD2
8. Place Revetment Stone Protection on Dike D	670 YD2
9. Place Revetment Stone Protection on Dike E	620 YD2
10. Stone Surface Dikes D and E	3,355 YD2
11. Repair South Levee Dike	500 YD3

END OF SECTION

Request for Quotation # 27572

Addendum #1

Plans for Construction
Eagle Valley Generating Station
Dike Reconstruction
Indianapolis Power and Light Co.
Martinsville, Morgan County, Indiana

The following changes, modifications and clarifications are made to the Request for Quotation Documents for the subject project:

1. The Owner will provide the surveying services required to determine the actual cut volumes and fill volumes for Items 3, 4, and 11 in Section III Bid List. All other surveying services necessary to construct the project shall be provided by the Contractor.
2. The desired completion date for the project is on or before November 2, 2007.
3. A Performance Bond will not be required.
4. The materials and construction requirements for the geotextile fabric under rip-rap and the grouted revetment rip-rap, as referred to in the Bid Documents, shall be in accordance with the applicable requirements of the Indiana Department of Transportation Standard Specifications Section 616.
5. The vegetative material generated as a result of clearing, grubbing and other site activities shall be disposed of in D pond.
6. The Owner will provide the construction testing services referenced in the Bid Documents. One Proctor moisture-density test has been conducted on a sample of ash collected at Pond A. The results of the Proctor test are attached for information only.
7. As stated in the Bid Documents, the proposals/bids are due to the Owner by 12:00 pm EDT on September 12, 2007. The Owner will accept written questions from Bidders until 12:00 pm EDT September 7, 2007. Questions should be addressed in writing via fax to Mr. Rick Jacobs at (765) 349-3456 (fax). The questions and responses will be provided to all Bidders by 5:00 pm EDT September 10, 2007.

Request for Quotation # 27572

Addendum #2
Responses to Bidders' Questions

Plans for Construction
Eagle Valley Generating Station
Dike Reconstruction
Indianapolis Power and Light Co.
Martinsville, Morgan County, Indiana

The following questions have been submitted by bidders on the subject project. The responses are included.

Question 1: The Specs call for a non-vibratory roller, this is correct?

Response: Correct.

Question 2: Is Revetment Rip Rap a special rip rap?

Response: Revetment Rip Rap shall be as specified in Paragraph 904.04 of the 2006 Indiana Department of Transportation *Standard Specifications*.

Question 3: Field Density testing is the responsibility of the owner while moisture testing is the responsibility of the Contractor. Moisture and Density testing is normally completed at the same time. Is the contractor responsible for the moisture testing? Page 5 of 7 Specifications

Response: The Owner will provide field density and moisture content testing in fill areas to determine conformance with the specification requirements for dry density and moisture content of compacted flyash. The Contractor has the option of conducting, at his expense, additional moisture content testing, if he chooses.

Question 4: The moisture spec is of + 2%, seems low is this correct? See Drawings page 2 of 6

Response: The specification on Sheet 2 of 6 (*Construction Notes* Paragraph 5) requires that the flyash be placed and compacted at moisture contents within a range of minus 4 percent to plus 2 percent of the optimum moisture content determined from the Standard Proctor test.

Question 5: Pond E inside south slope do not show dirt cover and seeding. Will this be a requirement? See Drawing page 4 of 6 section 2/4 from elevation 630 to 642

Response: Sheet 4 of 6 of the bid documents references Pond D. There will be no requirement for soil cover and seeding for the inside, south slope of Pond D.

Question 6: Pond E inside and outside north slopes at the failure area does not show dirt cover and seeding. Will this be a requirement? See Drawing page 5 of 6 section 2/5 from elevation top to bottom.

Response: There will be no requirement for soil cover and seeding for the inside north slope of Pond E. See response to Question 7 for discussion of outside north slope of Pond E.

Question 7: Pond E outside north slope looks like it needs material to be added to the slope in the non failure areas. Does the existing dirt need to be removed and ash added to bring the slope to grade? See Drawing 3 of 6

Response: The outside north slope of Pond E should be repaired as shown in the drawings. Sheet 2 of 6 indicates areas to be repaired, and Sheet 3 of 6 indicates final grading. Topsoil, seed and straw shall be added to the repaired areas.

Question 8: Will water be available on site for use, if necessary, in the construction?

Response: A hydrant is available at the south side of the plant as a water source.

PLANS FOR CONSTRUCTION

GLE VALLEY GENERATING STAT
DIKE RECONSTRUCTION

MARTINSVILLE, MORGAN COUNTY, INDIANA

PREPARED FOR

INDIANAPOLIS POWER & LIGHT

INDIANAPOLIS, INDIANA

SHEETS

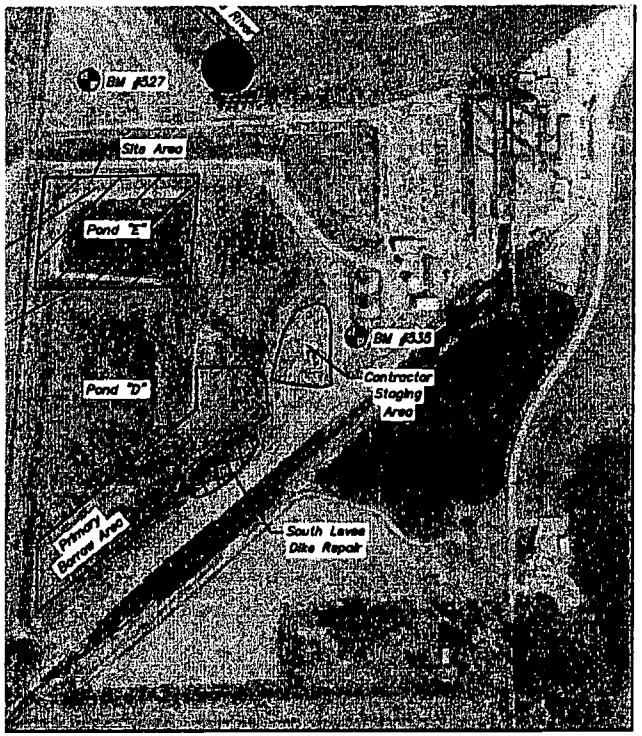
T
GENERAL NOTES
STRUCTION PLAN
OFILE & CROSS-SECTION
OFILE & CROSS-SECTION

PREPARED BY

Fuller Mossbarger Scott & May

FMSM ENGINEERS

FULLER
MOSSBARGER
SCOTT AND MAY
ENGINEERS, INC.
1901 Nelson Miller
Parkway
Louisville, Kentucky



OVERALL SITE PLAN

Not To Scale

CONTROL MONUMENTS			
BENCHMARKS	NORTHING	EASTING	ELEV.
BM #1	724.6917	-2106.5848	629.57
BM #527	997.7872	-1754.7070	609.95
BM #535	148.0991	-651.3312	627.57

OF WORK

A downstream berm will be constructed for Dike "D". The berm will consist of a sand drainage layer across the flyash slope, followed by a revetment rip-rap protection layer. A geotextile fabric will be used at the interface of the flyash/sand and also at the sand/rip-rap interface.

Discharge pipes will be constructed in Dike "D". The pipes will be encased in concrete or flowable fill. The discharge area of the downstream slope will be protected by constructing a rip-rap and grout protected channel down the slope.

A section of the south levee dike approximately 200 feet long (See overall site plan) will be repaired using similar techniques as identified above.

RUCTION NOTES

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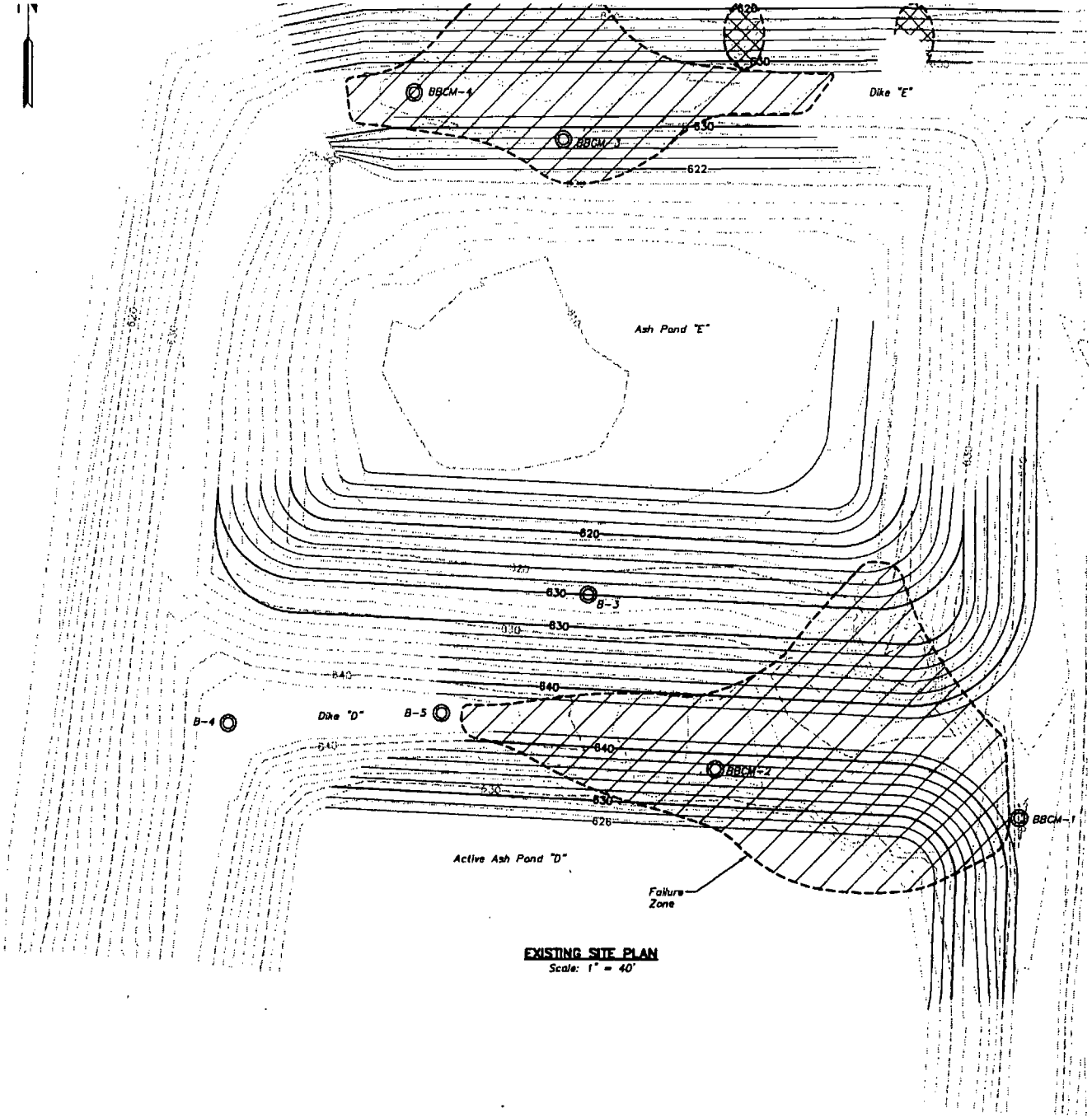
7. Without regard to the materials encountered, all excavation shall be unclassified. It shall be distinctly understood that any reference to rock, soil or any other material on the drawings or in the technical specifications, whether in numbers, words, letters or lines is solely for the Owner and Engineer's information and is not to be taken as an indication of classified excavation or the quantity of either rock, soil or any other material involved. The Contractor must draw his own conclusions as to the conditions to be encountered.

8. The Contractor shall exercise precaution at all times to prevent water pollution caused by the erosion and deposition of sediment in streams, lakes, and reservoirs. He shall conduct and schedule his operations so as to avoid or minimize the siltation of areas downstream of the construction site. All required sediment control features as shown on the plan sheets, shall be in place before construction begins and shall be properly maintained until no longer required.

9. The Contractor shall be responsible for providing sufficient notification to the Engineer or his representative as to when inspections or testing is required for excavations, backfill, or embankment



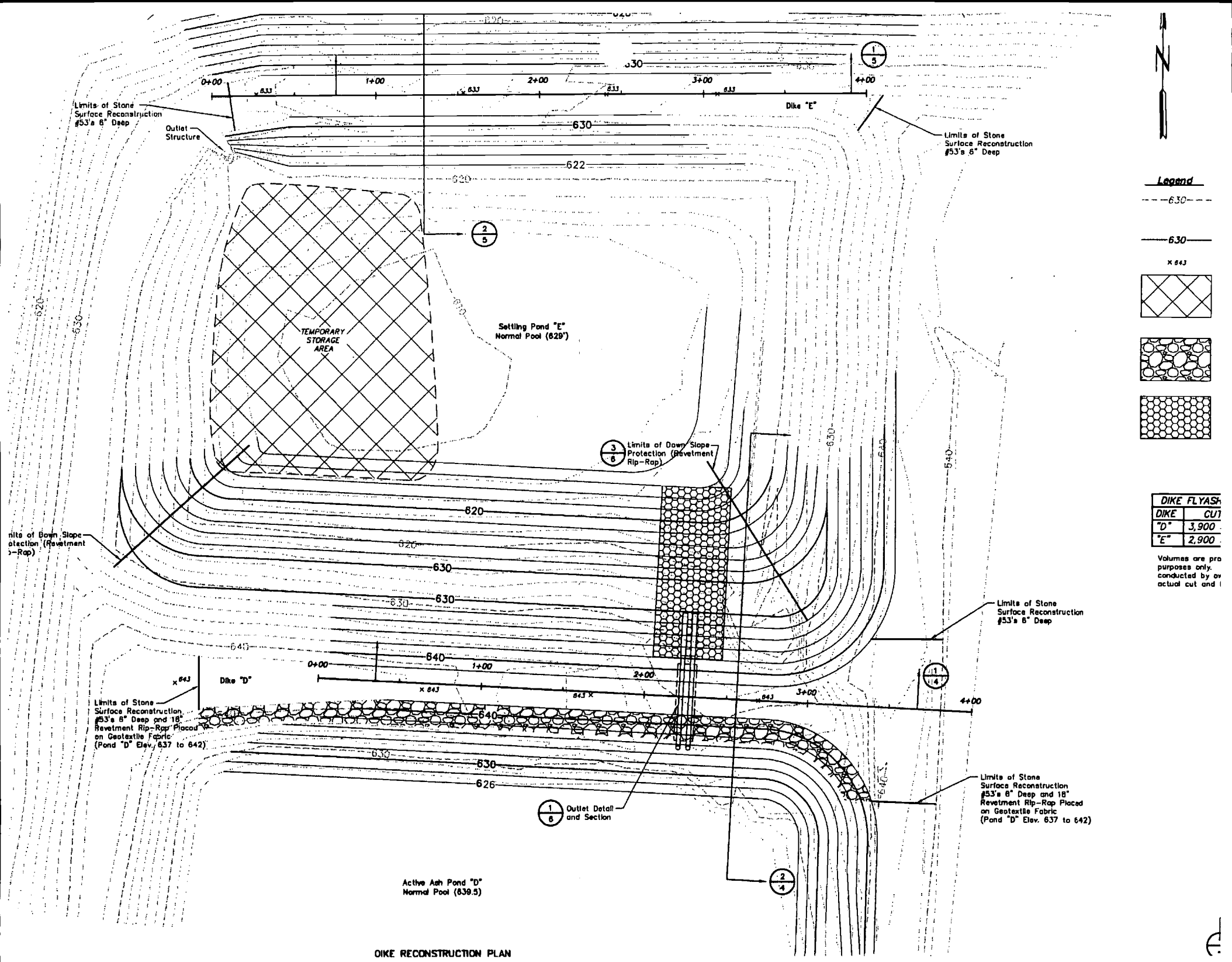
EXISTING SITE PLAN

Scale: 1" = 40'

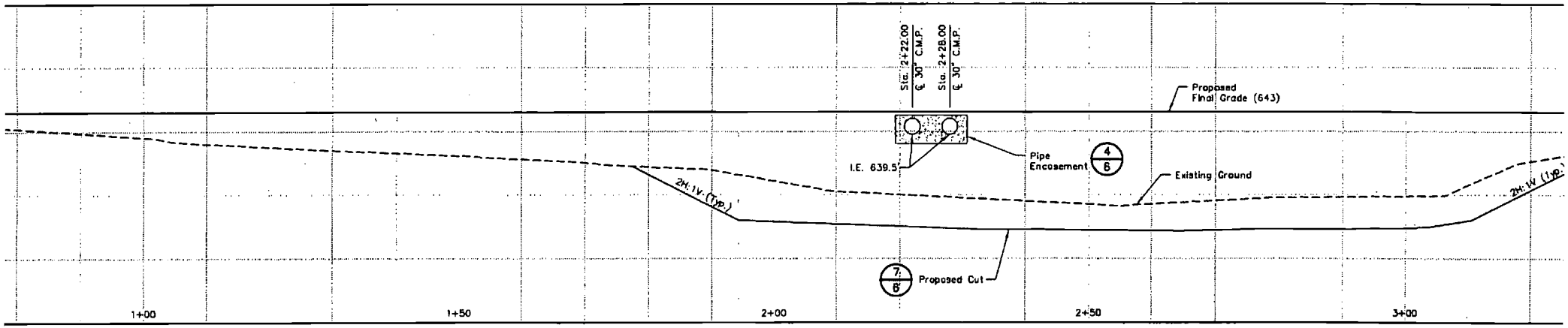
Legend

630

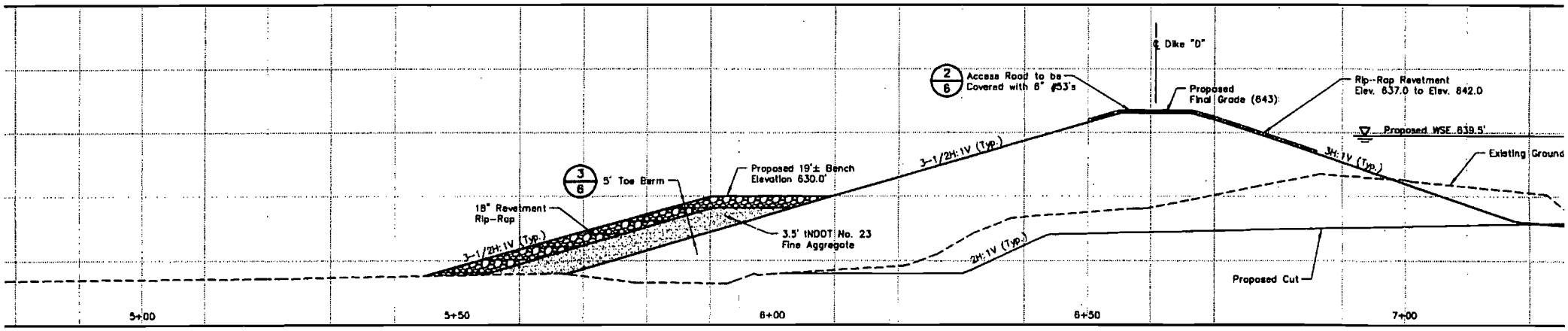
630



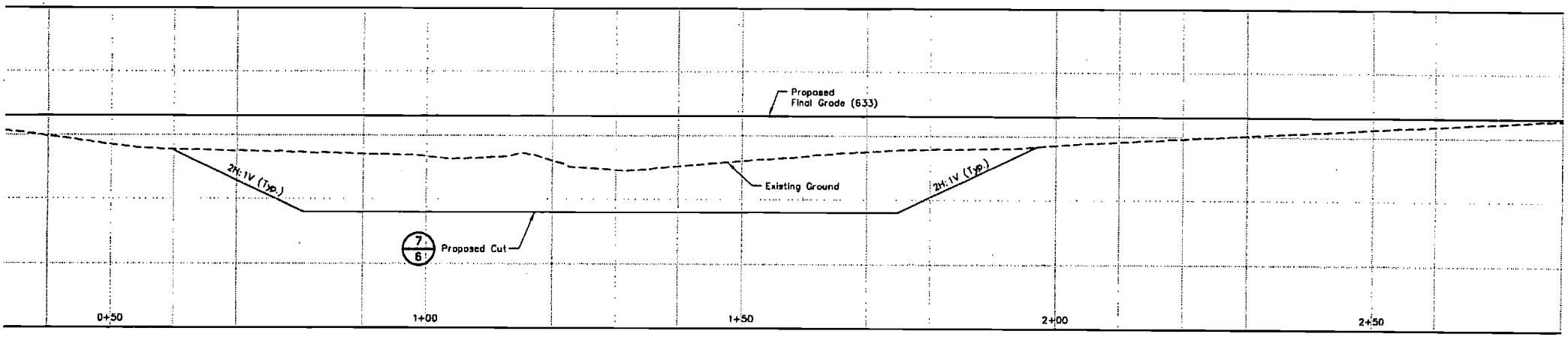
DIKE RECONSTRUCTION PLAN



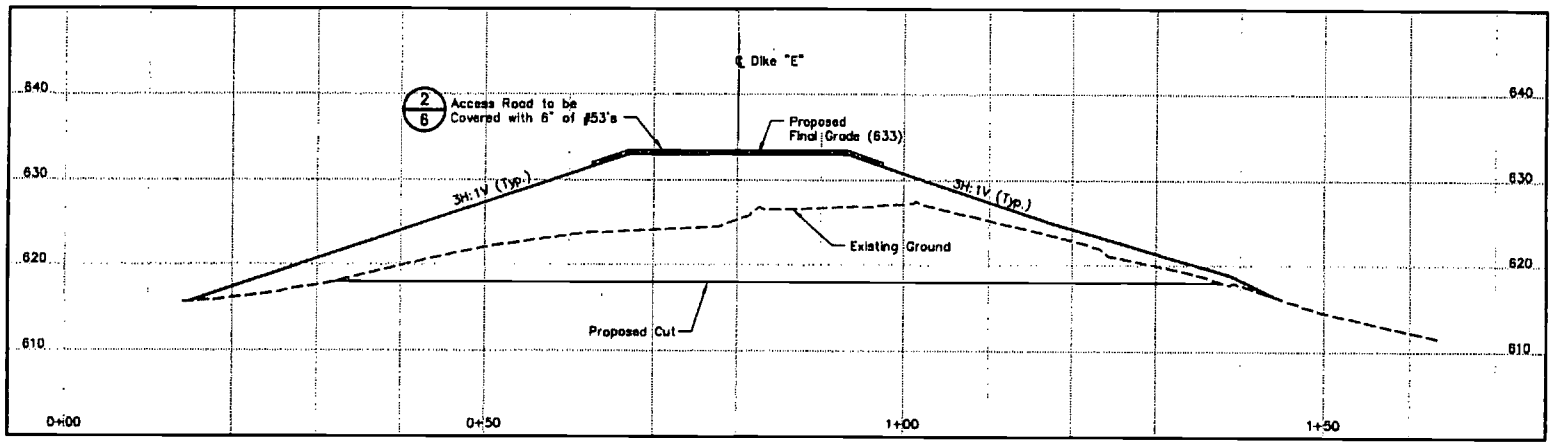
DIKE "D" PROFILE 1/4



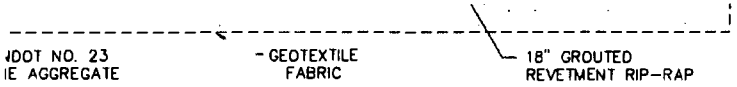
DIKE "D" SECTION 2/4



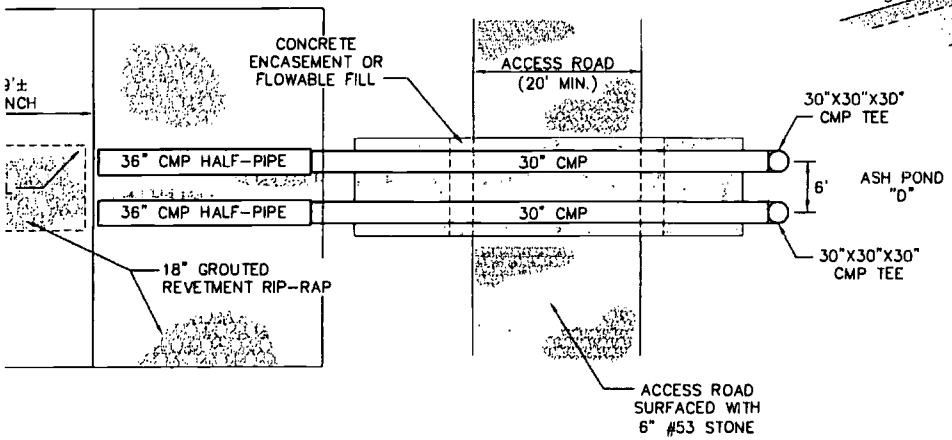
DIKE "E" PROFILE 1/5



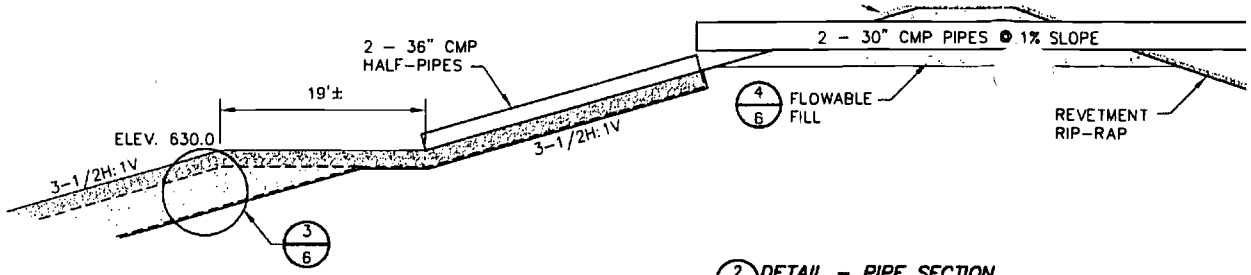
DIKE "E" SECTION 2/5



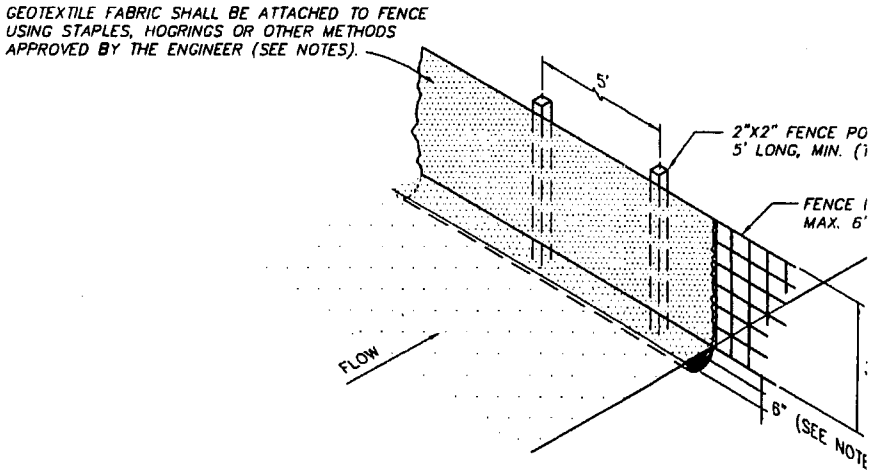
SECTION A-A'

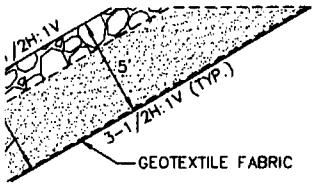


1/6 DETAIL - DIKE "D" OUTLET PLAN AND SECTION
SCALE: Not To Scale

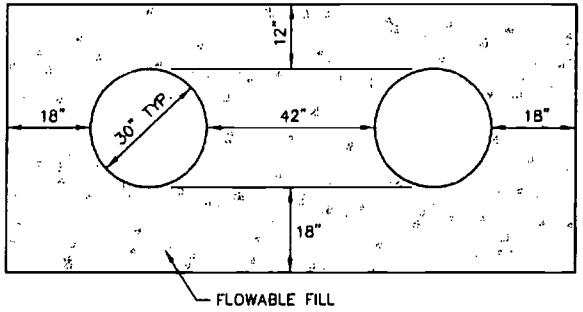


2/6 DETAIL - PIPE SECTION
SCALE: Not To Scale





L - TOE BERM
Not To Scale

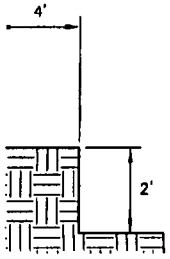


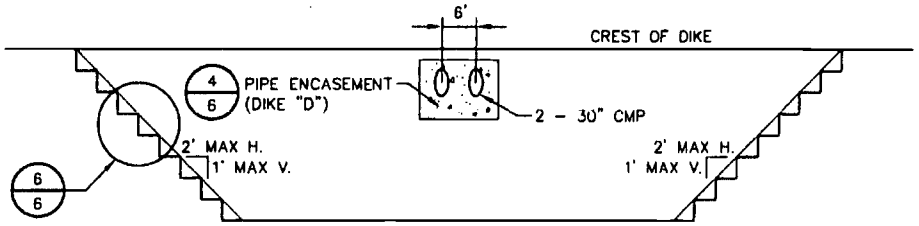
4/6 CMP PIPE ENCASEMENT
SCALE: Not to Scale

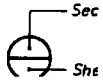
NOTES:

1. THE BOTTOM 12 INCHES OF THE FABRIC SHALL BE BURIED IN A 6-INCH TRENCH CUT INTO THE GROUND OR COVERED BY 6 INCHES OF FILL MATERIAL TO PREVENT SEDIMENT FROM ESCAPING UNDER THE FENCE. ALL EARTH-WORK SHALL BE ON THE UPSTREAM SIDE OF THE FENCE.
2. GEOTEXTILE FABRIC SHALL MEE SPECIFICATION 918.04.

5/6 DETAIL - SILT FENCE
SCALE: Not To Scale







APPENDIX C

Boring Logs, Abandonment, and Well Construction Forms

BT², Inc.
Environmental Engineering and Science

SOIL BORING LOG INFORMATION
10-92

F y/Project Name _ - Martinsville, IN. BT²# 3573	License/Permit/Monitoring Number		Boring Number B1 (PZ1)
Boring Drilled By (Firm name and name of crew chief) ATC Associates, Inc. Warren Bates	Drilling Started 06/11/2008	Drilling Completed 06/11/2008	Drilling Method 3½" HSA
Facility Well No. / Unique Well No. / Common Well Name	Static Water Level Feet	Surface Elevation Feet	Borehole Diam. 7.5 Inches
Boring Location State Plane N, E NE 1/4 of NE 1/4 of Section 16, T. 12 N., R. 1 E.	Lat. Long.	Local Grid Location (If applicable)	
County Morgan	Location Code	Civil Town/City/or Village Martinsville	

Sample Number	Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Standard Penetration	Moisture Content	P200	RQD/ Comments
S1	15	03-04 04-05		4" GRAVEL. FLYASH, gray black; trace coal fragments.	FILL					M		
S2	24	04-04 05-06								M		NM=21.0
S3	24	10-05 06-06	5							M		
S4	24	07-06 06-06								M		
	24	03-03 04-04								M		
S6	24	07-06 09-08	10							M	90.8	NM=23.9
S7	24	04-03 05-06								M		
S8	24	03-06 07-07	15		FILL					M		
S9	24	04-05 07-07								M		NM=26.3
S10	24	04-04 06-07								M		
S11	17	03-05 05-06	20							M		
S12	24	03-05 05-05								M		
S13	24	03-04 04-06	25							M		NM=27.3

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature Rick Joslin

Firm BT², Inc. Rick Joslin

BT², Inc.

Boring Number B1 (PZ1)

Sample Number	Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: P200	RQD/ Comments
S14	20	03-04 08-07								M		
S15	24	02-02 02-03								M		
			30	organics present bottom 1".								
S16	24	02-02 03-02								M		
S17	24	02-01 01-01								M		NM=53.7
				trace organics bottom 6".								
S18	24	02-01 02-01	35							M		
S19	22	02-01 02-01		laminated flyash bottom 6".	FILL					M/ W		
S20	24	01-00 00-01		trace organics; fine to coarse sand @ 39.5'.						W		
			40									
S21	24	01-01 00-01								W	96.6	NM=43.8
S22	16	00-00 01-00		coarser layers of fine sand @ 43'.						W		
S23	24	01-01 04-05	45						0.5	W		
	11	00-01 04-04		CLAY, brown; little silt and fine sand; trace gravel and medium to coarse sand. LL=25% PI=8%;	CL				1.0	W		
S25	-	04-02 01-01		LL=34% PI=15%					0.5	W		
			50	End of boring @ 50'; Set 10' PVC screen to 50'.								
			55	NOTE: Standard penetration tests could not be performed on flyash. Material was noncohesive. Penetration of 0.5 or less.								
				NM=Natural Moisture Content (%) LL=Liquid Limit PI=PLasticity Index K=Permeability								
			60									
			65									

BT², Inc.
Environmental Engineering and Science

SOIL BORING LOG INFORMATION
10-92

ty/Project Name L - Martinsville, IN. BT²# 3573	License/Permit/Monitoring Number		Boring Number B2 (PZ2)
Boring Drilled By (Firm name and name of crew chief) ATC Associates, Inc. Warren Bates	Drilling Started 06/11/2008	Drilling Completed 06/11/2008	Drilling Method 3¼" HSA
Facility Well No. / Unique Well No. / Common Well Name	Static Water Level Feet	Surface Elevation Feet	Borehole Diam. 7.5 Inches
Boring Location State Plane N, E NE 1/4 of NE 1/4 of Section 16, T. 12 N., R. 1 E.	Lat. Long.	Local Grid Location (If applicable)	
County Morgan	Location Code	Civil Town/City/or Village Martinsville	

Sample Number	Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Standard Penetration	Moisture Content	P200	RQD/ Comments
				4" GRAVEL.	FILL							
S1	17	05-06 05-07		FLYASH, gray/black; trace medium to coarse coal fragments.						M		
S2	24	05-06 08-09								M		
S3	24	07-06 06-06	5							M		NM=29.4
S4	24	04-05 09-06								M		
	24	02-04 05-06								M		
			10									
S6	24	04-06 10-11		small boulder (limestone) @ ~11'.						M		
S7	21	06-16 19-10			FILL					M	49.9	NM=15.4
S8	21	06-05 04-03	15							M		
S9	24	03-02 02-02								M		
S10	24	–		missed sample/no recovery-shelby tube.						M		
			20									
S11	24	02-01 01-01								M		
S12	24	02-03 05-05								M		
S13	24	02-03 03-03	25							M		

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature Rick Joslin | Firm BT², Inc. Rick Joslin

BT², Inc.

Boring Number B2 (PZ2)

Sample Number	Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Standard Penetration	Moisture Content	P200	RQD/ Comments
S14	19	01-02 02-02								M		NM=32.7
S15	24	02-02 02-03								M		
			30									
S16	24	03-03 03-03								M		
S17	24	02-01 01-01								M		NM=62.6
S18	24	01-01 00-01	35		FILL					M/ W		
S19	24	01-01 01-01								W		
S20	24	01-00 00-00								W		NM=79.0
			40	real wet; very soft at 40.5'.								
S21	19	00-00 00-00								W	91.6	NM=63.8
S22	24	00-02 03-05		CLAY, brown; little silt; trace fine to coarse sand shelby tube.					1.5	W		
S23	-	–	45	Shelby Tube collected 44-46'.	CL					W		
				End of boring @ 46'; Set 10' PVC screen to 40'.								
			50	NOTE: Standard penetration tests could not be performed on flyash. Material was noncohesive. Penetration of 0.5 or less.								
				NM=Natural Moisture Content (%) LL=Liquid Limit PI=PLasticity Index K=Permeability								
			55									
			60									
			65									

BT², Inc.
Environmental Engineering and Science

SOIL BORING LOG INFORMATION
10-92

y/Project Name L - Martensville, IN	BT²# 3573	License/Permit/Monitoring Number	Boring Number B3
Boring Drilled By (Firm name and name of crew chief) ATC Associates, Inc. Warren Bates	Drilling Started 06/12/2008	Drilling Completed 06/12/2008	Drilling Method 3¼ HSA
Facility Well No. / Unique Well No. / Common Well Name	Static Water Level Feet	Surface Elevation Feet	Borehole Diam. 7.5 Inches
Boring Location State Plane N, E SW 1/4 of NE 1/4 of Section 16, T. 12 N., R. 1 E.	Lat. Long.	Local Grid Location (If applicable)	
County Morgan	Location Code	Civil Town/City/or Village Martinsville	

Sample Number	Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Standard Penetration	Moisture Content	P200	RQD/ Comments
				3" GRAVEL.	FILL							
S1	24	05-05 04-04		FLYASH, gray/black, with coal fragments.						M		
S2	24	04-04 02-02								M		
S3	24	04-03 02-02	5							M		NM=24.5
S4	18	02-03 05-06								M		
	21	03-02 03-02	10							M	86.5	NM=29.1
S6	24	06-11 12-10		1" layer coarse to fine sand; trace coarse sand and gravel size flyash at 12.5'.						M		
S7	24	05-06 07-08			FILL					M		
S8	24	05-08 08-07	15							M		
S9	24	06-06 05-02								M		NM=37.5
S10	24	01-00 03-05	20							W		
S11	24	01-02 04-04								W		
S12	19	04-06 08-07		2" silty clay layer at ~23'.					4.0	W/M		NM=33.9
S13	20	04-04 04-03	25							M		
				laminations in flyash.								

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature Rick Joslin

Firm BT², Inc. Rick Joslin

BT², Inc.

Boring Number B3

Sample Number	Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Standard Penetration	Soil Properties: Moisture Content	Soil Properties: P200	RQD/ Comments
S14	24	02-03 03-03								M		
S15	24	02-03 02-03		2" coarser grained, fine sand-like layer; laminations present 29'.						M		
			30									
S16	23	02-02 03-02								M		NM=34.4
S17	24	02-02 02-03								M		
S18	24	03-02 02-02	35							M		
S19	24	03-03 03-03		cross beds and laminations present.	FILL					M		
S20	24	02-01 01-01								M/ W		NM=43.8
			40									
S21	24	01-00 00-00								W		
S22	24	02-00 00-01								W		
S23	24	02-02 03-04	45							W	90. 1	NM=52.6
+	24	00-00 01-02								W		
				Bottom 2" soft gray/green clay.	CL							
S25	12	00-00 09-11		SAND, brown, fine; some gravel; little medium to coarse sand.						W		
			50		SP							
S26	--	--								W		attempt shelby tube from 50 to 52'; not successful
				End of boring @ 52'; Abandoned with bentonite.								
			55	Note: Standard penetration tests could not be performed on flyash-material was non-cohesive penetrations of 0.5' or less.								
			60	NM=Natural Moisture Content (%) LL=Liquid Limit PI=Plasticity Index K=Permeability								
			65									

BT², Inc.
Environmental Engineering and Science

SOIL BORING LOG INFORMATION
10-92

ity/Project Name L - Martinsville, IN	BT²# 3573	License/Permit/Monitoring Number	Boring Number B4 (PZ3)
Boring Drilled By (Firm name and name of crew chief) ATC Associates, Inc. Warren Bates		Drilling Started 06/12/2008	Drilling Completed 06/12/2008
Drilling Method 3¼" HSA			
Facility Well No.	Unique Well No.	Common Well Name	Static Water Level Feet
Surface Elevation Feet	Borehole Diam. 7.5 Inches		
Boring Location State Plane N, E NW 1/4 of NE 1/4 of Section 16, T. 12 N., R. 1 E.		Lat. Long.	Local Grid Location (If applicable)
County Morton		Location Code	Civil Town/City/or Village Martinsville

Sample Number	Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Standard Penetration	Moisture Content	P200	RQD/ Comments
S1	20	09-05 04-03		3" GRAVEL. FLYASH, gray/black; trace coal fragments.	FILL					M		
S2	24	04-04 06-08								M		
S3	24	04-03 04-06	5							M		NM=22.2
S4	24	09-04 04-07								M		
	24	02-03 03-04								M		
S6	24	09-10 09-08	10							M		NM=33.4
S7	24	03-03 07-10			FILL					M		
S8	24	06-07 05-05	15							M		
S9	23	03-06 06-05		trace organics at 18.5'.						M		NM=26.0
S10	24	03-04 03-04								M		
S11	24	02-03 02-03	20	smaller, coarser grained layers (fine sand-like) at 20.5'.						M		
S12	24	02-01 02-01								M		
S13	24	02-00 02-04	25							M	91.8	NM=33.9

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature Rick Joslin

Firm BT², Inc. Rick Joslin

BT², Inc.

Boring Number B4 (PZ3)

Sample Numb.	Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Soil Properties: Standard Penetration	Moisture Content	P200	RQD/ Comments
S14	22	02-02 02-02								M		
S15	24	01-02 02-02		bottom foot very wet.						M		
			30									
S16	24	02-02 02-02								M		NM=33.5
S17	24	02-01 01-02								M		
S18	24	01-01 02-02	35							M		
S19	24	01-01 02-01			FILL					M/ W	89.6	NM=37.8
S20	24	01-00 00-00								W		
			40									
S21	24	01-00 00-01								W		
S22	24	00-00 00-01								W		NM=43.0
S23	24	00-00 00-00	45							W		
	24	02-02 06-10		SAND, brown, fine; some silt; little medium to coarse sand; trace gravel.						W		
S25	15	06-11 13-18			SM					W		
			50	End of boring @ 50'; Set 10' PVC screen at 50'.								
				Note: Standard penetration tests could not be performed on flyash; material was noncohesive. Penetration of 0.5 or less.								
			55									
				NM=Natural Moisture Content (%) LL=Liquid Limit PI=Plasticity Index K=Permeability								
			60									
			65									

BT², Inc.
Environmental Engineering and Science

SOIL BORING LOG INFORMATION
10-92

ity/Project Name PL - Martinsville, IN	BT²# 3573	License/Permit/Monitoring Number	Boring Number B5 (PZ4)
Boring Drilled By (Firm name and name of crew chief) ATC Associates, Inc. Warren Bates		Drilling Started 06/12/2008	Drilling Completed 06/12/2008
Drilling Method 3¼" HSA			
Facility Well No.	Unique Well No.	Common Well Name	Static Water Level Feet
Surface Elevation Feet	Borehole Diam. 7.5 Inches		
Boring Location State Plane N, E NW 1/4 of NE 1/4 of Section 16, T. 12 N., R. 1 E.		Lat. Long.	Local Grid Location (If applicable)
County Morton	Location Code	Civil Town/City/or Village Martinsville	

Sample Number	Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Standard Penetration	Moisture Content	P200	RQD/ Comments
				3" GRAVEL.	FILL							
S1	16	03-03 03-04		FLYASH, gray/black; trace coal fragments.						M		
S2	24	02-02 02-04								M		
S3	24	02-04 04-07	5							M	60.3	NM=19.1
S4	24	04-07 07-09								M		
	24	06-05 04-06								M		
S6	23	06-05 05-06	10							M		
S7	24	04-04 07-07			FILL					M		NM=26.3
S8	24	06-06 07-07	15							M		
S9	19	06-06 06-06								M		
S10	24	04-05 05-05								M		NM=26.2
S11	24	03-04 03-04	20							M		
S12	3	-		3" recovery; shelby tube failed						M		
S13	24	02-03 02-03	25	6" wet layer						M		NM=38.3

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature] Firm BT², Inc. Rick Joslin

BT², Inc.

Boring Number B5 (PZ4)

Sample Number	Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Standard Penetration	Moisture Content	P200	RQD/ Comments
S14	-	-		Flyhash, gray/black; trace coal fragments.						M		
S15	24	02-01 01-02		shelby tube sample - 15" recovery.						M		
			30									
S16	23	01-02 01-02		Bottom 8" wet.						M		
S17	24	02-01 02-01								M/ W		
S18	24	01-00 00-01	35							W		NM=61.7
S19	24	01-00 00-00		trace organics.	FILL					W		
S20	24	01-00 01-02								W		
			40	6" layer, medium to coarse flyash.								
S21	20	01-00 01-00								W		NM=46.7
S22	20	00-01 00-00								W		
S23	22	00-01 04-05	45	CLAY, brown with gray-green tint; little silt; trace fine sand; shelby tube sample collected 46-48'.	CL-ML				3.0	W		
-	-	-								W		
S25	24	03-03 02-03		CLAY, brown; little silt; trace fine sand. LL=26% PI=6%	CL-ML				0.5	W		
			50									
				End of boring @ 51'; Set 10' PVC screen at 51'.								
				Well fell during construction, could not pull up. Fell about 1' to 51'.								
			55									
				Note: Standard penetration tests could not be performed on flyash; material was noncohesive. Penetration of 0.5 or less.								
			60	NM=Natural Moisture Content LL=Liquid Limit PI=Plasticity Index K=Permeability								
			65									

BT², Inc.
Environmental Engineering and Science

SOIL BORING LOG INFORMATION
10-92

ity/Project Name PL - Martinsville, IN.	BT²# 3573	License/Permit/Monitoring Number	Boring Number B6 (PZ5)
Boring Drilled By (Firm name and name of crew chief) ATC Associates, Inc. Warren Bates		Drilling Started 06/13/2008	Drilling Completed 06/13/2008
Drilling Method 3¼" HSA			
Facility Well No.	Unique Well No.	Common Well Name	Static Water Level Feet
Surface Elevation Feet	Borehole Diam. 7.5 Inches		
Boring Location State Plane N, E NE 1/4 of NE 1/4 of Section 16, T. 12 N., R. 1 E.		Lat. Long.	Local Grid Location (If applicable)
County Morgan		Location Code	Civil Town/City/or Village Martinsville

Sample Number	Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Standard Penetration	Moisture Content	P200	RQD/ Comments
S1	24	02-03 03-03		3" GRAVEL. FLYASH, gray/black; trace coal fragments.	FILL					M		NM=22.9
S2	19	02-03 03-03								M		
S3	23	04-04 04-03	5							M		
S4	24	02-03 03-03								M		
	24	08-09 08-08	10							M		NM=29.3
S6	23	05-09 11-13								M		
S7	24	04-04 04-05			FILL					M		
S8	24	09-10 09-09	15							M		NM=24.1
S9	23	05-12 09-10								M		
S10	24	03-04 03-02	20							M		
S11	21	03-06 06-07								M		
S12	24	02-02 04-06								M		NM=15.6
S13	24	03-04 02-04	25							M		

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature Rick Joslin

Firm BT², Inc. Rick Joslin

BT², Inc.

Boring Number B6 (PZ5)

Sample Number	Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Standard Penetration	Moisture Content	P200	RQD/ Comments
S14	22	06-06 04-04								M		
S15	24	02-02 03-02								M	85.8	NM=69.7
			30	laminations present.								
S16	19	02-01 01-06								M/W		
S17	17	10-05 05-04								W		
S18	19	04-03 02-03	35		FILL					W		
S19	16	03-02 01-01		top 6" medium grained flyash (36-36.5').						W		
				laminations (37.5-38.5').						W	95.4	NM=49.1
S20	24	02-00 00-00								W		
			40									
S21	23	00-00 02-02		CLAY, brown, gray & green; little silt; trace fine to coarse sand.	CL-ML				1.5	W		
S22	16	03-03 04-02		CLAY, brown; little silt; trace fine sand. LL=23% PI=5%.	CL-ML				1.5	W		
S23	24	–	45	SILTY SAND, brown, fine; shelby tube collected.	SP-SM					W		
				End of boring @ 46'; Set 10' PVC screen to 40'.								
			50	NOTE: Standard penetration tests could not be performed on flyash. Material was noncohesive.								
				NM=Natural Moisture Content (%) LL=Liquid Limit PI=Plasticity Index K=Permeability								
			55									
			60									
			65									

BT², Inc.
Environmental Engineering and Science

SOIL BORING LOG INFORMATION
10-92

lity/Project Name PL - Martinsville, IN.	BT²# 3573	License/Permit/Monitoring Number	Boring Number B7
Boring Drilled By (Firm name and name of crew chief) ATC Associates, Inc. Warren Bates		Drilling Started 06/13/2008	Drilling Completed 06/13/2008
Drilling Method 3¼" HSA			
Facility Well No.	Unique Well No.	Common Well Name	Static Water Level Feet
Surface Elevation Feet	Borehole Diam. 7.5 Inches		
Boring Location State Plane N, E NE 1/4 of NE 1/4 of Section 16, T. 12 N., R. 1 E.		Lat. Long.	Local Grid Location (If applicable)
County Morgan		Location Code	Civil Town/City/or Village Martinsville

Sample Number	Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Standard Penetration	Moisture Content	P200	RQD/ Comments
				3" GRAVEL.	FILL							
S1	20	04-04 04-04								M		
S2	22	04-03 03-03								M		NM=26.1
S3	24	07-08 09-11	5							M		
S4	24	06-07 07-08								M		
	22	05-07 07-11	10							M		NM=38.2
S6	5	13-30 50/4	15	poor recovery; debris present (concrete and wood).	FILL					M		
S7	16	03-03 08-10	20	bottom 6", medium grained cinders and brown silty fine sand (19.5' to 20').						M		NM=11.6
S8	19	03-03 09-11	25	bottom 3", medium grained flyash @ ~26'.						M	35.7	NM=24.4

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature Rick Joslin

Firm BT², Inc. Rick Joslin

BT², Inc.

Boring Number B7

Sample Number	Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Standard Penetration	Moisture Content	P200	RQD/ Comments
S9	24	04-04 05-04								M		
S10	24	02-02 02-04								M		NM=33.9
			30									
S11	23	04-04 04-10								M		
S12	18	05-07 11-11		coarser grained flyash layers interbedded in 32-34' sample.	FILL					M		NM=12.2
S13	24	05-04- 04-04	35	medium to coarse grained flyash layer at ~ 36.5'.						M/ W		
S14	16	05-04 03-03								W	27.7	NM=21.8
S15	22	02-00 00-00								W		
			40	SILTY SAND, brown, fine; little medium sand; trace coarse sand and gravel.	SM							
S16	14	00-12 50/4								W		
S17	14	20-27 11-14								W		
			45	End of boring @ 44'; Abandoned with bentonite grout.								
				NOTE: Standard penetration tests could not be performed on flyash. Material was noncohesive.								
			50	NM=Natural Moisture Content (%) LL=Liquid Limit PI=Plasticity Index K=Permeability								
			55									
			60									
			65									

BT², Inc.
Environmental Engineering and Science

SOIL BORING LOG INFORMATION
10-92

ility/Project Name IPL Martinsville, IN	BT²# 3573	License/Permit/Monitoring Number	Boring Number HA1
Boring Drilled By (Firm name and name of crew chief) ATC Associates, Inc. Rick Hackman		Drilling Started 06/30/2008	Drilling Completed 06/30/2008
Drilling Method Hand Auger			
Facility Well No.	Unique Well No.	Common Well Name	Static Water Level Feet
Surface Elevation Feet	Borehole Diam. 3.0 Inches		
Boring Location State Plane N, E NW 1/4 of NE 1/4 of Section 16, T. 12 N., R. 1 E.		Lat. Long.	Local Grid Location (If applicable)
County Morgan	Location Code	Civil Town/City/or Village Martinsville	

Sample Number	Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Standard Penetration	Moisture Content	P200	RQD/ Comments
S1				RIP RAP (fill); GEOTEXTILE FABRIC at 1.2'.	FILL			--	--	M		
S2				SAND, brown, fine to coarse (fill).				--	--	M		
S3					FILL			--	--	M	1.7	
S4			5	Geotextile Fabric @ 6' (4.8' below Rip Rap).				--	--	M		
S5				FLYASH, gray (fill).	FILL			--	--	M		
				End of boring @ 6.7'; Abandoned with cuttings.								
			10									
			15									
			20									
			25									

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Rick Joslin For Rick Hackman

Firm: BT², Inc. Rick Joslin

BT², Inc.
Environmental Engineering and Science

WELL/DRILLHOLE/BOREHOLE ABANDONMENT

(1) GENERAL INFORMATION

Well/Drillhole/Borehole Location: B3
County: Morgan
SW 1/4 of NE 1/4 of Sec. 16 ; T. 12 N;R 1 [X] E. [ ] W.
(If applicable) Gov't Lot _____ Grid Number _____
Grid Location _____ ft. [ ] N. [ ] S. _____ ft. [ ] E. [ ] W.
Civil Town Name: Martinsville, IN
Street Address of Well: 4040 Blue Bluff Road
City, Village: Martinsville, IN

(2) FACILITY NAME

Original Well Owner (If Known): IPL Martinsville, IN
Present Well Owner: IPL Martinsville, IN
Street or Route: 4040 Blue Bluff Road
City, State, Zip Code: Martinsville, IN
Facility Well No. and/or Name (If Applicable):
WI Unique Well No.
Reason For Abandonment: Boring for Soil Sampling Only
Date of Abandonment: 06/12/2008

WELL/DRILLHOLE/BOREHOLE INFORMATION

(3) Original Well/Drill/Borehole Construction Completed On
(Date) 06/12/2008

[ ] Monitoring Well
[ ] Water Well
[ ] Drillhole
[X] Borehole

Construction Report Available? [ ] Yes [ ] No

Construction Type:
[X] Drilled [ ] Driven (Sandpoint) [ ] Dug
[ ] Other (Specify)

Formation Type:
[ ] Unconsolidated Formation [ ] Bedrock

Total Well Depth (ft.) (From groundsurface) 52
Casing Diameter (ins.) NA
Casing Depth (ft.) NA
Lower Drillhole Diameter (in.) 7.5
Was Well Annular Space Grouted? [ ] Yes [ ] No [ ] Unknown
If Yes, To What Depth? _____ Feet

(4) Depth to Water (Feet) 39.5

Pump & Piping Removed?	[ ] Yes	[ ] No	[X] Not Applicable
Liner(s) Removed?	[ ] Yes	[ ] No	[X] Not Applicable
Screen Removed?	[ ] Yes	[ ] No	[X] Not Applicable
Casing Left in Place?	[ ] Yes	[X] No	[ ] Not Applicable

If No, Explain

Was Casing Cut Off Below Surface?	[ ] Yes	[X] No
Did Sealing Material Rise to Surface?	[X] Yes	[ ] No
Did Material Settle After 24 Hours?	[ ] Yes	[X] No
If Yes, Was Hole Retopped?	[ ] Yes	[ ] No

(5) Required Method of Placing Sealing Material
[ ] Conductor Pipe-Gravity [ ] Conductor Pipe-Pumped
[ ] Dump Bailer [X] Other(Explain) Gravity

(6) Sealing Materials
[ ] Neat Cement Grout
[ ] Sand-Cement (Concrete) Grout
[ ] Concrete
[ ] Clay-Sand Slurry
[ ] Bentonite-Sand Slurry
[ ] Chipped Bentonite

For monitoring wells and monitoring well boreholes only
[ ] Bentonite Pellets
[ ] Granular Bentonite
[X] Bentonite -Cement Grout

(7)

Sealing Material Used	From (Ft.)	To (Ft.)	No. Yards, Sacks Sealant or Volume	Mix Ratio or Mud Weight
Gravel	Surface	1.0	0.24 ft3	NA
Volclay High Solids Bentonite Grout	1	52	12.0 ft3	1 to 1 Bentonite/Water

(8) Comments:

(9) Name of Person or Firm Doing Sealing
BT2, Inc. Rick Joslin
Signature of Person Doing Work: [signature]
Date Signed: 7/11/08
Street or Route: 2830 Dairy Drive
Telephone Number: (608) 224-2830
City, State, Zip Code: Madison, WI 53718-6751

BT^2, Inc.
Environmental Engineering and Science

WELL/DRILLHOLE/BOREHOLE ABANDONMENT

(1) GENERAL INFORMATION

Well/Drillhole/Borehole Location: B7
County: Morgan
NE 1/4 of NE 1/4 of Sec. 16 ; T. 12 N;R 1 [X] E. [ ] W.
(If applicable) Gov't Lot _____ Grid Number _____
Grid Location _____ ft. [ ] N. [ ] S. _____ ft. [ ] E. [ ] W.
Civil Town Name: Martinsville, IN
Street Address of Well: 4040 Blue Bluff Road
City, Village: Martinsville, IN

(2) FACILITY NAME

Original Well Owner (If Known): IPL Martinsville, IN
Present Well Owner: IPL Martinsville, IN
Street or Route: 4040 Blue Bluff Road
City, State, Zip Code: Martinsville, IN
Facility Well No. and/or Name (If Applicable):
WI Unique Well No.: _ _ _ _ _
Reason For Abandonment: Boring for Soil Sampling Only
Date of Abandonment: 06/13/2008

WELL/DRILLHOLE/BOREHOLE INFORMATION

(3) Original Well/Drill/Borehole Construction Completed On
(Date) 06/13/2008

[ ] Monitoring Well
[ ] Water Well
[ ] Drillhole
[X] Borehole

Construction Report Available? [ ] Yes [ ] No

Construction Type:
[X] Drilled [ ] Driven (Sandpoint) [ ] Dug
[ ] Other (Specify) _____

Formation Type:
[ ] Unconsolidated Formation [ ] Bedrock

Total Well Depth (ft.) (From groundsurface) 44
Casing Diameter (ins.) NA
Casing Depth (ft.) NA
Lower Drillhole Diameter (in.) 7.0
Was Well Annular Space Grouted? [ ] Yes [ ] No [ ] Unknown
If Yes, To What Depth? _____ Feet

(4) Depth to Water (Feet) ~35'

	Yes	No	Not Applicable
Pump & Piping Removed?	[ ]	[ ]	[X]
Liner(s) Removed?	[ ]	[ ]	[X]
Screen Removed?	[ ]	[ ]	[X]
Casing Left in Place?	[ ]	[X]	[ ]

If No, Explain

	Yes	No
Was Casing Cut Off Below Surface?	[ ]	[X]
Did Sealing Material Rise to Surface?	[X]	[ ]
Did Material Settle After 24 Hours?	[ ]	[X]
If Yes, Was Hole Retopped?	[ ]	[ ]

(5) Required Method of Placing Sealing Material
[ ] Conductor Pipe-Gravity [ ] Conductor Pipe-Pumped
[ ] Dump Bailer [X] Other(Explain) Gravity

(6) Sealing Materials
[ ] Neat Cement Grout
[ ] Sand-Cement (Concrete) Grout
[ ] Concrete
[ ] Clay-Sand Slurry
[ ] Bentonite-Sand Slurry
[ ] Chipped Bentonite

For monitoring wells and monitoring well boreholes only
[ ] Bentonite Pellets
[ ] Granular Bentonite
[X] Bentonite -Cement Grout

(7)

Sealing Material Used	From (Ft.)	To (Ft.)	No. Yards, Sacks Sealant or Volume	Mix Ratio or Mud Weight
Gravel	Surface	0.5	0.12 ft3	NA
Volclay High Solids Bentonite Grout	0.5	44	10.26 ft3	1 to 1

(8) Comments:

(9) Name of Person or Firm Doing Sealing
BT2, Inc. Rick Joslin
Signature of Person Doing Work: [signature]
Date Signed: 7/11/08
Street or Route: 2830 Dairy Drive
Telephone Number: (608) 224-2830
City, State, Zip Code: Madison, WI 53718-6751

BT², Inc.

Environmental Engineering and Science

WELL/DRILLHOLE/BOREHOLE ABANDONMENT

(1) GENERAL INFORMATION

Well/Drillhole/Borehole Location: HA1

County: Morgan

NW 1/4 of NE 1/4 of Sec. 16 ; T. 12 N;R 1 [X] E. [ ] W.

(If applicable) _____ Gov't Lot _____ Grid Number

Grid Location _____ ft. [ ] N. [ ] S. _____ ft. [ ] E. [ ] W.

Civil Town Name: Martinsville, IN

Street Address of Well: 4040 Blue Bluff Road

City, Village: Martinsville, IN

(2) FACILITY NAME

Original Well Owner (If Known): IPL Martinsville, IN BT2 #3573

Present Well Owner: IPL Martinsville, IN

Street or Route: 4040 Blue Bluff Road

City, State, Zip Code: Martinsville, IN

Facility Well No. and/or Name (If Applicable):

WI Unique Well No.: _ _ _ _ _

Reason For Abandonment: Boring for Soil Sampling Only

Date of Abandonment: 06/30/2008

WELL/DRILLHOLE/BOREHOLE INFORMATION

(3) Original Well/Drill/Borehole Construction Completed On (Date): 06/30/2008

[ ] Monitoring Well
[ ] Water Well
[ ] Drillhole
[X] Borehole

Construction Report Available? [ ] Yes [ ] No

Construction Type:
[X] Drilled [ ] Driven (Sandpoint) [ ] Dug
[ ] Other (Specify) Hand Auger

Formation Type:
[X] Unconsolidated Formation [ ] Bedrock

Total Well Depth (ft.) (From groundsurface): 6.7

Casing Diameter (ins.): NA

Casing Depth (ft.): NA

Lower Drillhole Diameter (in.): 3.0

Was Well Annular Space Grouted? [ ] Yes [ ] No [ ] Unknown

If Yes, To What Depth? _____ Feet

(4) Depth to Water (Feet): 6.7

	Yes	No	Not Applicable
Pump & Piping Removed?	[ ]	[ ]	[X]
Liner(s) Removed?	[ ]	[ ]	[X]
Screen Removed?	[ ]	[ ]	[X]
Casing Left in Place?	[ ]	[X]	[ ]

If No, Explain

	Yes	No
Was Casing Cut Off Below Surface?	[ ]	[X]
Did Sealing Material Rise to Surface?	[X]	[ ]
Did Material Settle After 24 Hours?	[ ]	[X]
If Yes, Was Hole Retopped?	[ ]	[ ]

(5) Required Method of Placing Sealing Material
[ ] Conductor Pipe-Gravity [ ] Conductor Pipe-Pumped
[ ] Dump Bailer [X] Other(Explain) Gravity

(6) Sealing Materials
[ ] Neat Cement Grout
[ ] Sand-Cement (Concrete) Grout
[ ] Concrete
[ ] Clay-Sand Slurry
[ ] Bentonite-Sand Slurry
[ ] Chipped Bentonite

For monitoring wells and monitoring well boreholes only
[ ] Bentonite Pellets
[ ] Granular Bentonite
[ ] Bentonite -Cement Grout

(7)

Sealing Material Used	From (Ft.)	To (Ft.)	No. Yards, Sacks Sealant or Volume	Mix Ratio or Mud Weight
Cuttings from Soil Boring	Surface	6.7	0.3 ft3	NA

(8) Comments:

(9) Name of Person or Firm Doing Sealing: BT2, Inc. Rick Joslin

Signature of Person Doing Work: [signature] For Rich Hack

Date Signed: 7/11/08

Street or Route: 2830 Dairy Drive

Telephone Number: (608) 224-2830

City, State, Zip Code: Madison, WI 53718-6751

BT², Inc.
Environmental Engineering and Science

Watershed/water ☐ Waste Management ☐
Remediation ☐ Other ☐

MONITORING WELL CONSTRUCTION
Form GEN-CONS -A Rev. 4-2002

Facility/Project Name: IPL Martinsville, IN

Facility License, Permit or Monitoring Number:

Facility ID:

Type of Well: Well Code ___ / ___

Distance From Waste/Source: ___ ft. Enf. Stds. Apply ☐

Local Grid Location of Well: ___ ft. ☐ N. ☐ S. ___ ft. ☐ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐) or Well Location ☐
Lat. ___ ° ___ ' ___ " Long. ___ ° ___ ' ___ " or
St.Plane ___ ft. N. ___ ft. S.

Section Location of Waste/Source: NE 1/4 of NE 1/4 of Sec. 16 T. 12 N.R. 1 ☒ E. ☐ W.

Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known

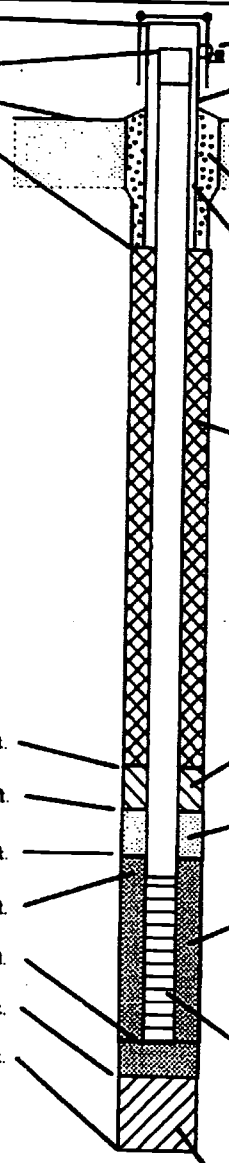
Gov. Lot Number: ___

Well Name: B1 (PZ1)

Unique Well Number: ___ Well ID No. ___

Date Well Installed: 06 / 11 / 2008 (mm dd yyyy)

Well Installed By: Name (first, last) and Firm)
ATC
Warren Bates



A. Protective pipe, top elevation ___ ft. MSL
B. Well casing, top elevation ___ ft. MSL
C. Land surface elevation ___ ft. MSL
D. Surface seal, bottom ___ ft. MSL or 10 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☒ MH ☐ CL ☒ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☐ No

14. Drilling method used: Rotary ☐ 50 Hollow Stem Auger ☒ 41 Other ☐

15. Drilling fluid used: Water ☐ 02 Air ☐ 01 Drilling Mud ☐ 03 None ☒ 99

16. Drilling additives used? ☐ Yes ☒ No
Describe

17. Source of water (attach analysis, if required):

E. Bentonite seal, top ___ ft. MSL or 37.0 ft.
F. Fine sand, top ___ ft. MSL or -.- ft.
G. Filter pack, top ___ ft. MSL or 38.0 ft.
H. Screen joint, top ___ ft. MSL or 40.0 ft.
I. Well bottom ___ ft. MSL or 50.0 ft.
J. Filter pack, bottom ___ ft. MSL or 50.0 ft.
K. Borehole, bottom ___ ft. MSL or 50.0 ft.
L. Borehole, diameter 7.5 in.
M. O.D. well casing 1.67 in.
N. I.D. well casing 1.35 in.

1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
a. Inside diameter: 7.0 in.
b. Length: 10.0 ft.
c. Material: Steel ☒ 04 Other ☐
d. Additional protection? ☐ Yes ☒ No
If yes, describe:
3. Surface Seal: Bentonite ☐ 30 Concrete ☒ 01 Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ 30 Filter Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☐ 33
b. ___ Lbs/gal mud weight...Bentonite-sand slurry ☐ 35
c. 1.0 Lbs/gal mud weight.....Bentonite slurry ☒ 31
d. ___ % Bentonite.....Bentonite-cement grout ☐ 50
e. 8.5 Ft^3 volume added for any of the above
f. How installed: Tremie ☐ 01 Tremie pumped ☐ 02 Gravity ☒ 08
6. Bentonite seal: a. Bentonite granules ☐ 33
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒ 32
c. Bentonite Chips ☐
7. Fine sand material: Manufacturer, product name & mesh size
a. none
b. Volume added ___ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
a. Global Drilling Supplies #4
b. Volume added 2.83 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ 23 Flush threaded PVC schedule 80 ☐ 24 ☐
10. Screen material: Sched. 40 PVC
a. Screen type: Factory cut ☒ 01 Continuous slot ☐ 02 Other ☐
b. Manufacturer: Johnson
c. Slot size: 0.010 in.
d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☒ 14 Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Sig. [signature]

Firm: BT², Inc., 2830 Dairy Drive, Madison, WI 53704-6751

Please complete both Well Construction and Well Development Forms and return them to the appropriate parties

BT², Inc.
Environmental Engineering and Science

Watershedwater ☐ Waste Management ☐
Remediation ☐ Other ☐

MONITORING WELL CONSTRUCTION
Form GEN-CONS -A Rev. 4-2002

Facility/Project Name: IPL Martinsville, IN

Facility License,Permit or Monitoring Number:

Facility ID:

Type of Well: Well Code ___ / ___

Distance From Waste/Source: ___ ft. Enf. Stds. Apply ☐

Local Grid Location of Well: ___ ft. ☐N. ☐S. ___ ft. ☐E. ☐W.

Local Grid Origin ☐ (estimated: ☐) or Well Location ☐
Lat. ___ ° ___ ' ___ " Long. ___ ° ___ ' ___ " or
St.Plane ___ ft. N. ___ ft. S.

Section Location of Waste/Source: NE 1/4 of NE 1/4 of Sec. 16, T. 12 N,R. 1 ☒E. ☐W.

Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known

Gov. Lot Number: ___

Well Name: B2 (PZ 2)

Unique Well Number: ___ Well ID No. ___

Date Well Installed: 06 / 12 / 2008 (mm dd yyyy)

Well Installed By: Name (first, last) and Firm)
ATC
Warren Bates

A. Protective pipe, top elevation ___ ft. MSL

B. Well casing, top elevation ___ ft. MSL

C. Land surface elevation ___ ft. MSL

D. Surface seal, bottom ___ ft. MSL or 1.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☒ MH ☐ CL ☒ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☐ No

14. Drilling method used: Rotary ☐ 50 Hollow Stem Auger ☒ 41 Other ☐

15. Drilling fluid used: Water ☐ 02 Air ☐ 01 Drilling Mud ☐ 03 None ☒ 99

Drilling additives used? ☐ Yes ☒ No

Describe ___

17. Source of water (attach analysis, if required): ___

E. Bentonite seal, top ___ ft. MSL or 27.0 ft.

F. Fine sand, top ___ ft. MSL or -.- ft.

G. Filter pack, top ___ ft. MSL or 28.0 ft.

H. Screen joint, top ___ ft. MSL or 30.0 ft.

I. Well bottom ___ ft. MSL or 40.0 ft.

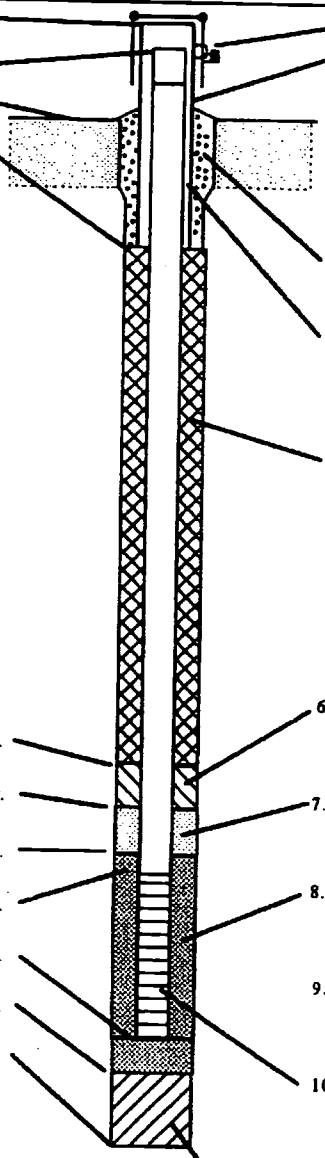
J. Filter pack, bottom ___ ft. MSL or 43.0 ft.

K. Borehole, bottom ___ ft. MSL or 46.0 ft.

L. Borehole, diameter 7.5 in.

M. O.D. well casing 1.67 in.

N. I.D. well casing 1.35 in.



1. Cap and lock? ☒ Yes ☐ No

2. Protective cover pipe:
a. Inside diameter: 7.0 in.
b. Length: 10.0 ft.
c. Material: Steel ☒ 04 Other ☐
d. Additional protection? ☐ Yes ☒ No
If yes, describe: ___

3. Surface Seal: Bentonite ☐ 30 Concrete ☒ 01 Other ☐

4. Material between well casing and protective pipe: Bentonite ☐ 30 Other ☒
Filter Sand

5. Annular space seal:
a. Granular/Chipped Bentonite ☐ 33
b. ___ Lbs/gal mud weight...Bentonite-sand slurry ☐ 35
c. 1.0 Lbs/gal mud weight.....Bentonite slurry ☒ 31
d. ___ % Bentonite.....Bentonite-cement grout ☐ 50
e. 6.13 Ft³ volume added for any of the above
f. How installed: Tremie ☐ 01 Tremie pumped ☐ 02 Gravity ☒ 08

6. Bentonite seal:
a. Bentonite granules ☐ 33
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒ 32
c. Bentonite Chips ☐

7. Fine sand material: Manufacturer, product name & mesh size
a. none
b. Volume added ___ ft³

8. Filter pack material:Manufacturer, product name & mesh size
a. Global Drilling Supplies #4
b. Volume added 3.5 ft³

9. Well casing: Flush threaded PVC schedule 40 ☒ 23 Flush threaded PVC schedule 80 ☐ 24 ☐

10. Screen material: Sched. 40 PVC
a. Screen type: Factory cut ☒ 01 Continuous slot ☐ 02 Other ☐
b. Manufacturer: Johnson
c. Slot size: 0.010 in.
d. Slotted length: 10.0 ft.

11. Backfill material (below filter pack): None ☐ 14 Other ☒
formation collapse

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: [signature]

Firm: BT², Inc., 2830 Dairy Drive, Madison, WI 53704-6751

Please complete both Well Construction and Well Development Forms and return them to the appropriate parties

BT², Inc.
Environmental Engineering and Science

Watershed/water ☐ Waste Management ☐
Remediation ☐ Other ☐

MONITORING WELL CONSTRUCTION
Form GEN-CONS -A Rev. 4-2002

Facility/Project Name: IPL Martinsville, IN

Facility License, Permit or Monitoring Number:

Facility ID:

Type of Well — Well Code: ___ / ___

Distance From Waste/Source: ___ ft. Enf. Stds. Apply ☐

Local Grid Location of Well: ___ ft. ☐ N. ☐ S. ___ ft. ☐ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐) or Well Location ☐
Lat. ___ ° ___ ' ___ " Long. ___ ° ___ ' ___ " or
St.Plane ___ ft. N. ___ ft. S.

Section Location of Waste/Source: NW 1/4 of NE 1/4 of Sec. 16, T. 12 N, R. 1 ☒ E. ☐ W.

Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known

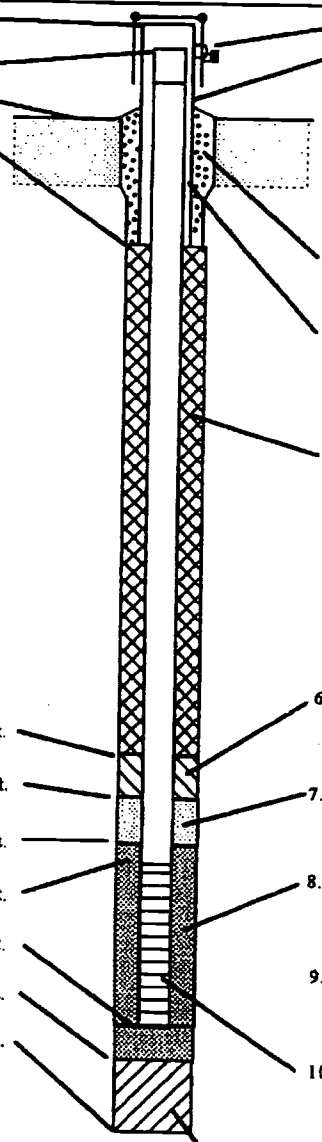
Gov. Lot Number:

Well Name: B4 (PZ 3)

Unique Well Number: ___ Well ID No.: ___

Date Well Installed: 06 / 12 / 2008 (mm dd yyyy)

Well Installed By: Name (first, last) and Firm)
ATC
Warren Bates



A. Protective pipe, top elevation ____.__ ft. MSL

B. Well casing, top elevation ____.__ ft. MSL

C. Land surface elevation ____.__ ft. MSL

D. Surface seal, bottom ____.__ ft. MSL or 1 0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☒ SC ☐ ML ☒ MH ☐ CL ☐ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☐ No

14. Drilling method used: Rotary ☐ 50 Hollow Stem Auger ☒ 41 Other ☐

15. Drilling fluid used: Water ☐ 02 Air ☐ 01 Drilling Mud ☐ 03 None ☒ 99

Drilling additives used? ☐ Yes ☒ No

Describe

17. Source of water (attach analysis, if required):

E. Bentonite seal, top ____.__ ft. MSL or 37 . 0 ft.

F. Fine sand, top ____.__ ft. MSL or __ . __ ft.

G. Filter pack, top ____.__ ft. MSL or 38 . 0 ft.

H. Screen joint, top ____.__ ft. MSL or 40 . 0 ft.

I. Well bottom ____.__ ft. MSL or 50 . 0 ft.

J. Filter pack, bottom ____.__ ft. MSL or 50 . 0 ft.

K. Borehole, bottom ____.__ ft. MSL or 50 . 0 ft.

L. Borehole, diameter 7 . 5 in.

M. O.D. well casing 1 . 67 in.

N. I.D. well casing 1 . 35 in.

1. Cap and lock? ☒ Yes ☐ No

2. Protective cover pipe:
a. Inside diameter: 7 0 in.
b. Length: 10 0 ft.
c. Material: Steel ☒ 04 Other ☐
d. Additional protection? ☐ Yes ☒ No
If yes, describe:

3. Surface Seal: Bentonite ☐ 30 Concrete ☒ 01 Other ☐

4. Material between well casing and protective pipe: Bentonite ☐ 30 Other ☒
Filter Sand

5. Annular space seal: a. Granular/Chipped Bentonite ☐ 33
b. ___ Lbs/gal mud weight...Bentonite-sand slurry ☐ 35
c. 1.0 Lbs/gal mud weight.....Bentonite slurry ☒ 31
d. ___ % Bentonite.....Bentonite-cement grout ☐ 50
e. 8.5 Ft³ volume added for any of the above
f. How installed: Tremie ☐ 01 Tremie pumped ☐ 02 Gravity ☒ 08

6. Bentonite seal: a. Bentonite granules ☐ 33
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒ 32
c.

7. Fine sand material: Manufacturer, product name & mesh size
a. none
b. Volume added ___ ft³

8. Filter pack material: Manufacturer, product name & mesh size
a. Global Drilling Supplies #4
b. Volume added 2.8 ft³

9. Well casing: Flush threaded PVC schedule 40 ☒ 23 Flush threaded PVC schedule 80 ☐ 24

10. Screen material: Sched. 40 PVC
a. Screen type: Factory cut ☒ 01 Continuous slot ☐ 02 Other ☐
b. Manufacturer: Johnson
c. Slot size: 0.010 in.
d. Slotted length: 10.0 ft.

11. Backfill material (below filter pack): None ☒ 14 Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: [signature] Firm: BT², Inc., 2830 Dairy Drive, Madison, WI 53704-6751

Please complete both Well Construction and Well Development Forms and return them to the appropriate parties

BT², Inc.
Environmental Engineering and Science

Watershedwater [ ] Waste Management [ ]
Remediation [ ] Other [ ]

MONITORING WELL CONSTRUCTION
Form GEN-CONS -A **Rev. 4-2002**

Facility/Project Name: IPL Martinsville, IN

Facility License,Permit or Monitoring Number:

Facility ID:

Type of Well — Well Code: ___ / ___

Distance From Waste/Source: ___ ft. Enf. Stds. Apply [ ]

Local Grid Location of Well: ___ ft. [ ] N. [ ] S. ___ ft. [ ] E. [ ] W.

Local Grid Origin [ ] (estimated [ ]) or Well Location [ ]
Lat. ___ ° ___ ' ___ " Long. ___ ° ___ ' ___ " or
St.Plane ___ ft. N. ___ ft. S.

Section Location of Waste/Source: NW 1/4 of NE 1/4 of Sec. 16 T. 12 N,R. 1 [ ] W. [X] E.

Location of Well Relative to Waste/Source: u [ ] Upgradient s [ ] Sidegradient d [ ] Downgradient n [ ] Not Known

Gov. Lot Number:

Well Name: B5 (PZ 4)

Unique Well Number:

Well ID No.:

Date Well Installed: 06 / 13 / 2008 (mm dd yyyy)

Well Installed By: Name (first, last) and Firm
ATC
Warren Bates

A. Protective pipe, top elevation ___ ft. MSL
B. Well casing, top elevation ___ ft. MSL
C. Land surface elevation ___ ft. MSL
D. Surface seal, bottom ___ ft. MSL or 1.0 ft.

12. USCS classification of soil near screen:
GP [ ] GM [ ] GC [ ] GW [ ] SW [ ] SP [ ]
SM [ ] SC [ ] ML [X] MH [ ] CL [X] CH [ ]
Bedrock [ ]

13. Sieve analysis attached? [ ] Yes [ ] No

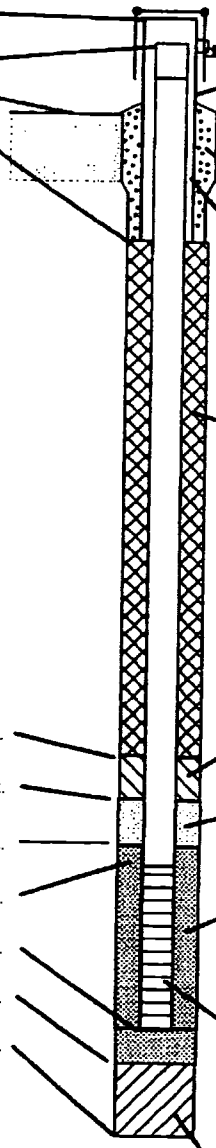
14. Drilling method used: Rotary [ ] 50 Hollow Stem Auger [X] 41 Other [ ]

15. Drilling fluid used: Water [ ] 02 Air [ ] 01 Drilling Mud [ ] 03 None [X] 99

16. Drilling additives used? [ ] Yes [X] No
Describe

17. Source of water (attach analysis, if required):

E. Bentonite seal, top ___ ft. MSL or 38.0 ft.
F. Fine sand, top ___ ft. MSL or ___ ft.
G. Filter pack, top ___ ft. MSL or 39.0 ft.
H. Screen joint, top ___ ft. MSL or 41.0 ft.
I. Well bottom ___ ft. MSL or 51.0 ft.
J. Filter pack, bottom ___ ft. MSL or 51.0 ft.
K. Borehole, bottom ___ ft. MSL or 51.0 ft.
L. Borehole, diameter 7.5 in.
M. O.D. well casing 1.67 in.
N. I.D. well casing 1.35 in.



1. Cap and lock? [X] Yes [ ] No
2. Protective cover pipe:
a. Inside diameter: 7.0 in.
b. Length: 10.0 ft.
c. Material: Steel [X] 04 Other [ ]
d. Additional protection? [ ] Yes [X] No
If yes, describe:
3. Surface Seal: Bentonite [ ] 30 Concrete [X] 01 Other [ ]
4. Material between well casing and protective pipe: Bentonite [ ] 30 Filter Sand Other [X]
5. Annular space seal: a. Granular/Chipped Bentonite [ ] 33
b. ___ Lbs/gal mud weight...Bentonite-sand slurry [ ] 35
c. 1.0 Lbs/gal mud weight.....Bentonite slurry [X] 31
d. ___ % Bentonite.....Bentonite-cement grout [ ] 50
e. 8.7 Ft³ volume added for any of the above
f. How installed: Tremie [ ] 01 Tremie pumped [ ] 02 Gravity [X] 08
6. Bentonite seal: a. Bentonite granules [ ] 33
b. [ ] 1/4 in. [X] 3/8 in. [ ] 1/2 in. Bentonite chips [X] 32
c.
7. Fine sand material: Manufacturer, product name & mesh size
a. none
b. Volume added ___ ft³
8. Filter pack material: Manufacturer, product name & mesh size
a. Global Drilling Supplies #4
b. Volume added 2.8 ft³
9. Well casing: Flush threaded PVC schedule 40 [X] 23 Flush threaded PVC schedule 80 [ ] 24
10. Screen material: Sched. 40 PVC
a. Screen type: Factory cut [X] 01 Continuous slot [ ] 02 Other [ ]
b. Manufacturer: Johnson
c. Slot size: 0.010 in.
d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None [ ] 14 Other [X]
formation collapse

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: [signature]

Firm: BT², Inc., 2830 Dairy Drive, Madison, WI 53704-6751

Please complete both Well Construction and Well Development Forms and return them to the appropriate parties

BT², Inc.
Environmental Engineering and Science

Watershedwater [ ] Waste Management [ ]
Remediation [ ] Other [ ]

MONITORING WELL CONSTRUCTION
Form GEN-CONS -A Rev. 4-2002

Facility/Project Name: IPL Martinsville, IN	Local Grid Location of Well: ___ ft. [ ] N. [ ] S. ___ ft. [ ] E. [ ] W.	Well Name: B6 (PZ5)
Facility License,Permit or Monitoring Number:	Local Grid Origin [ ] (estimated: [ ]) or Well Location [ ] Lat. ___ ° ___ ' ___ " Long. ___ ° ___ ' ___ " or St.Plane ___ ft. N. ___ ft. S.	Unique Well Number: ___ Well ID No. ___
Facility ID:		Date Well Installed: 06 / 13 / 2008 (mm dd yyyy)
Type of Well: Well Code ___ / ___	Section Location of Waste/Source: NE 1/4 of NE 1/4 of Sec. 16, T. 12 N,R. 1 [X] E. [ ] W.	Well Installed By: Name (first, last) and Firm: ATC, Warren Bates
Distance From Waste/Source ___ ft. Enf. Stds. Apply [ ]	Location of Well Relative to Waste/Source: u [ ] Upgradient s [ ] Sidegradient d [ ] Downgradient n [ ] Not Known	Gov. Lot Number: ___

A. Protective pipe, top elevation ____.__ ft. MSL
B. Well casing, top elevation ____.__ ft. MSL
C. Land surface elevation ____.__ ft. MSL
D. Surface seal, bottom ____.__ ft. MSL or 1 0 ft.

12. USCS classification of soil near screen:
GP [ ] GM [ ] GC [ ] GW [ ] SW [ ] SP [ ]
SM [ ] SC [ ] ML [X] MH [ ] CL [X] CH [ ]
Bedrock [ ]

13. Sieve analysis attached? [ ] Yes [ ] No

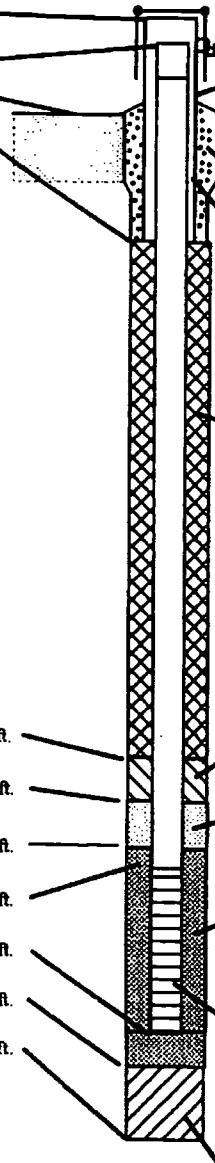
14. Drilling method used: Rotary [ ] 5 0; Hollow Stem Auger [X] 4 1; Other [ ]

15. Drilling fluid used: Water [ ] 0 2; Air [ ] 0 1; Drilling Mud [ ] 0 3; None [X] 9 9

16. Drilling additives used? [ ] Yes [X] No
Describe ___

17. Source of water (attach analysis, if required): ___

E. Bentonite seal, top ____.__ ft. MSL or ___.__ ft.
F. Fine sand, top ____.__ ft. MSL or 27 . 0 ft.
G. Filter pack, top ____.__ ft. MSL or 28 . 0 ft.
H. Screen joint, top ____.__ ft. MSL or 30 . 0 ft.
I. Well bottom ____.__ ft. MSL or 40 . 0 ft.
J. Filter pack, bottom ____.__ ft. MSL or 43 . 0 ft.
K. Borehole, bottom ____.__ ft. MSL or 46 . 0 ft.
L. Borehole, diameter 7 . 5 in.
M. O.D. well casing 1 67 in.
N. I.D. well casing 1 35 in.



1. Cap and lock? [X] Yes [ ] No
2. Protective cover pipe:
a. Inside diameter: 7 0 in.
b. Length: 10 0 ft.
c. Material: Steel [X] 04; Other [ ]
d. Additional protection? [ ] Yes [X] No
If yes, describe: ___
3. Surface Seal: Bentonite [ ] 3 0; Concrete [X] 0 1; Other [ ]
4. Material between well casing and protective pipe: Bentonite [ ] 3 0; Other [X]
Filter Sand
5. Annular space seal: a. Granular/Chipped Bentonite [ ] 3 3
b. ___ Lbs/gal mud weight...Bentonite-sand slurry [ ] 3 5
c. 1.0 Lbs/gal mud weight.....Bentonite slurry [X] 3 1
d. ___ % Bentonite.....Bentonite-cement grout [ ] 5 0
e. 6.13 Ft^3 volume added for any of the above
f. How installed: Tremie [ ] 0 1; Tremie pumped [ ] 0 2; Gravity [X] 0 8
6. Bentonite seal: a. Bentonite granules [ ] 3 3
b. [ ] 1/4 in. [X] 3/8 in. [ ] 1/2 in. Bentonite chips [X] 3 2
c. Bentonite Chips
7. Fine sand material: Manufacturer, product name & mesh size
a. none
b. Volume added ___ ft^3
8. Filter pack material:Manufacturer, product name & mesh size
a. Global Drilling Supplies #4
b. Volume added 3.5 ft^3
9. Well casing: Flush threaded PVC schedule 40 [X] 2 3; Flush threaded PVC schedule 80 [ ] 2 4; [ ]
10. Screen material Sched. 40 PVC
a. Screen type: Factory cut [X] 0 1; Continuous slot [ ] 0 2; Other [ ]
b. Manufacturer Johnson
c. Slot size: 0.010 in.
d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None [X] 1 4; Other [ ]

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: [signature]

Firm: BT², Inc., 2830 Dairy Drive, Madison, WI 53704-6751

Please complete both Well Construction and Well Development Forms and return them to the appropriate parties

APPENDIX D

Laboratory Test Reports

CGC, Inc.

Geotechnical Laboratory Work Set-Up Sheet

Job Name: Indianapolis Power & Light
Job Location: Martinsville, IN

Job No. 3573
Date 6/18/08
Sheet 1 of 4

☒ Unit Price ☐ Hourly ☐ Cost Sheet in _____ Data Storage _____ Attn: _____

Testing Applicability _____ Set Up By: Rick Jaslin (BT2)

Type of Sample: (Special Lab Instructions or Notes)

"X" Jar Sample _____

"B" Bag Sample _____

"ST" Shelby Tube _____

"P" Pail _____

* Mix UP Natural Moisture *

Boring Test	Sample Lift	Layer Area	Location	Elev. Depth	Color	Type	Laboratory Tests							Lab Plan
							NM	LL	PL	LI	W/S	HYD	K	
B1	2			2-4'	Gray/Blk	X	X							
B1	6			10-12'		X	X				X			
B1	9			16-18'		X	X							
B1	~~12~~ 13			24-26'		X	X							
B1	17			32-34'		X	X							
B1	21			40-42'		X	X				X	X		
B1	24			46-48'	Brown	X	X	X	X		X			
B1	25			48-50'	Brown	X	X	X	X		X			
B2	3			4-6'	Gray/Black	X	X							
B2	7			12-14'		X	X				X	X		
B2	10			18-20'		ST	X						X	
B2	14			26-28'		X	X							
B2	17			32-34'		X	X							
B2	20			38-40'		X	X							
B2	21			40-42'		X	X				X	X		
B2	23			44-46'	Brown	ST	X	X	X		X			
B3	3			4-6'	Gray/Black	X	X							

(Please use a pencil, write legibly and space out the entries)
*Primary Sample Designation for Reporting

Remarks: _____

CGC, Inc.

Geotechnical Laboratory Work Set-Up Sheet

Job Name: Indianapolis Power & Light
Job Location: Martinsville, ID

Job No. 3573
Date 6/18/08
Sheet 2 of 4

☒ Unit Price ☐ Hourly ☐ Cost Sheet in _____ Data Storage _____ Attn: _____

Testing Applicability _____ Set Up By: Rick Joslin (BT2)

Type of Sample: (Special Lab Instructions or Notes)

"X" Jar Sample _____

"B" Bag Sample _____

"ST" Shelby Tube _____

"P" Pail _____

* Mix Up Natural Moisture *

Boring Test	Sample Lift	Layer Area	Location	Elev. Depth	Color	Type	Laboratory Tests							Lab Plan
							NM	LL	PL	LI	W/S	HYD	K	
B3	5			8-10'	Gray/Black	X	X				X	X		
B3	9			16-18'		X	X							
B3	12			22-24'		X	X							
B3	16			30-32'		X	X							
B3	20			38-40'		X	X							
B3	23			44-46'		X	X				X			
B3	25			48-50'	Brown	X	X				X	X		
B4	3			4-6'	Gray/Black	X	X							
B4	6			10-12'		X	X							
B4	9			16-18'		X	X							
B4	13			24-26'		X	X				X	X		
B4	16			30-32'		X	X							
B4	19			36-38'		X	X				X			
B4	22			42-44'		X	X							
B4	25			48-50'	Brown	X	X				X	X		
B5	3			4-6'	Gray/Black	X	X				X			
B5	7			12-14'		X	X							

(Please use a pencil, write legibly and space out the entries)
*Primary Sample Designation for Reporting

Remarks: _____

CGC, Inc.

Geotechnical Laboratory Work Set-Up Sheet

Job Name: Indianapolis Power & Light
Job Location: Martinsville, IN

Job No. 3573
Date 6/19/08
Sheet 3 of 4

☒ Unit Price ☐ Hourly ☐ Cost Sheet in _____ Data Storage _____ Attn: _____

Testing Applicability _____ Set Up By: Rick Joslin (BT2)

Type of Sample: (Special Lab Instructions or Notes)

"X" Jar Sample _____

"B" Bag Sample _____

"ST" Shelby Tube _____

"P" Pail _____

* Mix UP Natural Moisture

Boring Test	Sample Lift	Layer Area	Location	Elev. Depth	Color	Type	Laboratory Tests							Lab Plan
							NM	LL	PL	LI	W/S	HYD	K	
B5	10			18-20'	Gray/Black	X	X							
B5	13			24-26'		X	X							
B5	14			26-28'		ST	X						X	
B5	18			34-36'		X	X							
B5	21			40-42'		X	X				X	X		
B5	25			48-50'	Brown	X	X	X	X		X			
B6	1			0-2'	Gray/Black	X	X							
B6	5			8-10'		X	X							
B6	8			14-16'		X	X							
B6	12			22-24'		X	X							
B6	15			28-30'		X	X				X	X		
B6	19			36-38'		X	X				X			
B6	22			42-44'	Brown	X	X	X	X		X			
B6	23			44-46'	Brown	ST	X				X		X	
B7	2			2-4'	Gray/Black	X	X							
B7	5 (B3)			8-10'		X	X							
B7	~~10~~ 9			18-20'		X	X							

(Please use a pencil, write legibly and space out the entries)
*Primary Sample Designation for Reporting

Remarks: _____

CGC, Inc.

Geotechnical Laboratory Work Set-Up Sheet

Job Name: Indianapolis Power & Light
Job Location: ~~[illegible]~~ Martinsville, IN

Job No. 3523
Date 6/18/08
Sheet 4 of 4

☐ Unit Price ☐ Hourly ☐ Cost Sheet in _____ Data Storage _____ Attn: _____

Testing Applicability _____ Set Up By: Rick Joslin (B72)

Type of Sample: (Special Lab Instructions or Notes)

"X" Jar Sample _____

"B" Bag Sample _____

"ST" Shelby Tube _____

"P" Pail _____

* Mix UP Natural Moisture *

Boring Test	Sample Lift	Layer Area	Location	Elev. Depth	Color	Type	Laboratory Tests							Lab Plan
							NM	LL	PL	LI	W/S	HYD	K	
B7	8			24-26'	Gray Black	X	X				X			
B7	10			28-30'		X	X							
B7	12			32-34'		X	X							
B7	14			36-38'		X	X				X	X		
B7	16			40-42'	Brown	X	X				X	X		

(Please use a pencil, write legibly and space out the entries)
*Primary Sample Designation for Reporting

Remarks: _____

CGC, Geotechnical Laboratory
Test Results

Date: 6/29/2008
CGC Job # C07016-24
Tests by: KJS/JSG
Test No.

Job: Indianapolis Power and Light

Client: BT Squared

Sample No.	Depth (ft)	Description	Natural Moisture (%)	Atterberg Limits			Organic Content (%)	Unit Weight (pcf)	Specific Gravity	P200 Content (%)
				Liquid Limit (%)	Plastic Limit (%)	PI				
B1-S2	2'-4'		21.0	*	*	*	*	*	*	*
B1-S6	10'-12'		23.9	*	*	*	*	*	*	90.8
B1-S9	16'-18'		26.3	*	*	*	*	*	*	*
B1-S17	32'-34'		53.7	*	*	*	*	*	*	*
B1-S21	40'-42'		43.8	*	*	*	*	*	*	96.6
B1-S25	48'-50'		23.0	34	19	15	*	*	*	72.6

Notes:

* - Not tested.

CGC, Geotechnical Laboratory
Test Results

Date: 6/29/2008
CGC Job # C07016-24
Tests by: KJS/JSG
Test No.

Job: Indianapolis Power and Light

Client: BT Squared

Sample No.	Depth (ft)	Description	Natural Moisture (%)	Atterberg Limits			Organic Content (%)	Unit Weight (pcf)	Specific Gravity	P200 Content (%)
				Liquid Limit (%)	Plastic Limit (%)	PI				
B2-S3	4'-6'		29.4	*	*	*	*	*	*	*
B2-S7	12'-14'		15.4	*	*	*	*	*	*	49.9
B2-S14	26'-28'		32.7	*	*	*	*	*	*	*
B2-S17	32'-34'		62.6	*	*	*	*	*	*	*
B2-S20	38'-40'		79.0	*	*	*	*	*	*	*
B2-S21	40'-42'		63.8	*	*	*	*	*	*	91.6
B3-S3	4'-6'		24.5	*	*	*	*	*	*	*

Notes:

* - Not tested.

CGC, Geotechnical Laboratory
Test Results

Date: 6/29/2008
CGC Job # C07016-24
Tests by: KJS/JSG
Test No.

Job: Indianapolis Power and Light **Client:** BT Squared

Sample No.	Depth (ft)	Description	Natural Moisture (%)	Atterberg Limits			Organic Content (%)	Unit Weight (pcf)	Specific Gravity	P200 Content (%)
				Liquid Limit (%)	Plastic Limit (%)	PI				
B3-S5	8'-10'		29.1	*	*	*	*	*	*	86.5
B3-S9	16'-18'		37.5	*	*	*	*	*	*	*
B3-S12	22'-24'		33.9	*	*	*	*	*	*	*
B3-S16	30'-32'		34.4	*	*	*	*	*	*	*
B3-S20	38'-40'		43.8	*	*	*	*	*	*	*
B3-S23	44'-46'		52.6	*	*	*	*	*	*	90.1
B3-S25	48'-50'		16.9	*	*	*	*	*	*	4.3
B4-S3	4'-6'		22.2	*	*	*	*	*	*	*

Notes:

* - Not tested.

CGC, Geotechnical Laboratory
Test Results

Date: 6/29/2008
CGC Job # C07016-24
Tests by: KJS/JSG
Test No.

Job: Indianapolis Power and Light

Client: BT Squared

Sample No.	Depth (ft)	Description	Natural Moisture (%)	Atterberg Limits			Organic Content (%)	Unit Weight (pcf)	Specific Gravity	P200 Content (%)
				Liquid Limit (%)	Plastic Limit (%)	PI				
B4-S6	10'-12'		33.4	*	*	*	*	*	*	*
B4-S9	16'-18'		26.0	*	*	*	*	*	*	*
B4-S13	24'-26'		33.9	*	*	*	*	*	*	91.8
B4-S16	30'-32'		33.5	*	*	*	*	*	*	*
B4-S19	36'-38'		37.8	*	*	*	*	*	*	89.6
B4-S22	42'-44'		43.0	*	*	*	*	*	*	*
B4-S25	48'-50'		9.2	*	*	*	*	*	*	18.0
B5-S3	4'-6'		19.1	*	*	*	*	*	*	60.3

Notes:

* - Not tested.

CGC, Geotechnical Laboratory
Test Results

Date: 6/29/2008
CGC Job # C07016-24
Tests by: KJS/JSG
Test No.

Job: Indianapolis Power and Light

Client: BT Squared

Sample No.	Depth (ft)	Description	Natural Moisture (%)	Atterberg Limits			Organic Content (%)	Unit Weight (pcf)	Specific Gravity	P200 Content (%)
				Liquid Limit (%)	Plastic Limit (%)	PI				
B5-S7	12'-14'		26.3	*	*	*	*	*	*	*
B5-S10	18'-20'		26.2	*	*	*	*	*	*	*
B5-S13	24'-26'		38.3	*	*	*	*	*	*	*
B5-S18	34'-36'		61.7	*	*	*	*	*	*	*
B5-S21	40'-42'		46.7	*	*	*	*	*	*	80.9
B5-S25	48'-50'		25.7	26	20	6	*	*	*	76.4

Notes:

* - Not tested.

CGC, Geotechnical Laboratory
Test Results

Date: 6/29/2008
CGC Job # C07016-24
Tests by: KJS/JSG
Test No.

Job: Indianoplis Power and Light

Client: BT Squared

Sample No.	Depth (ft)	Description	Natural Moisture (%)	Atterberg Limits			Organic Content (%)	Unit Weight (pcf)	Specific Gravity	P200 Content (%)
				Liquid Limit (%)	Plastic Limit (%)	PI				
B6-S1	0-2'		22.9	*	*	*	*	*	*	*
B6-S5	8'-10'		29.3	*	*	*	*	*	*	*
B6-S8	14'-16'		24.1	*	*	*	*	*	*	*
B6-S12	22'-24'		15.6	*	*	*	*	*	*	*
B6-S15	28'-30'		69.7	*	*	*	*	*	*	85.8
B6-S19	36'-38'		49.1	*	*	*	*	*	*	95.4
B6-S22	42'-44'		23.8	23	18	5	*	*	*	65.7

Notes:

* - Not tested.

CGC, Geotechnical Laboratory
Test Results

Date: 6/29/2008
CGC Job # C07016-24
Tests by: KJS/JSG
Test No.

Job: Indianapolis Power and Light

Client: BT Squared

Sample No.	Depth (ft)	Description	Natural Moisture (%)	Atterberg Limits			Organic Content (%)	Unit Weight (pcf)	Specific Gravity	P200 Content (%)
				Liquid Limit (%)	Plastic Limit (%)	PI				
B7-S2	2'-4'		26.1	*	*	*	*	*	*	*
B7-S5	8'-10'		38.2	*	*	*	*	*	*	*
B7-S8	24'-26'		24.4	*	*	*	*	*	*	35.7
B7-S10	28'-30'		33.9	*	*	*	*	*	*	*
B7-S12	32'-34'		12.2	*	*	*	*	*	*	*
B7-S14	36'-38'		21.8	*	*	*	*	*	*	27.7
B7-S16	40'-42'		10.1	*	*	*	*	*	*	27.2

Notes:

* - Not tested.

CGC, Geotechnical Laboratory
Test Results

Date: 6/29/2008
CGC Job # C07016-24
Tests by: KJS/JSG
Test No.

Job: Indianapolis Power and Light

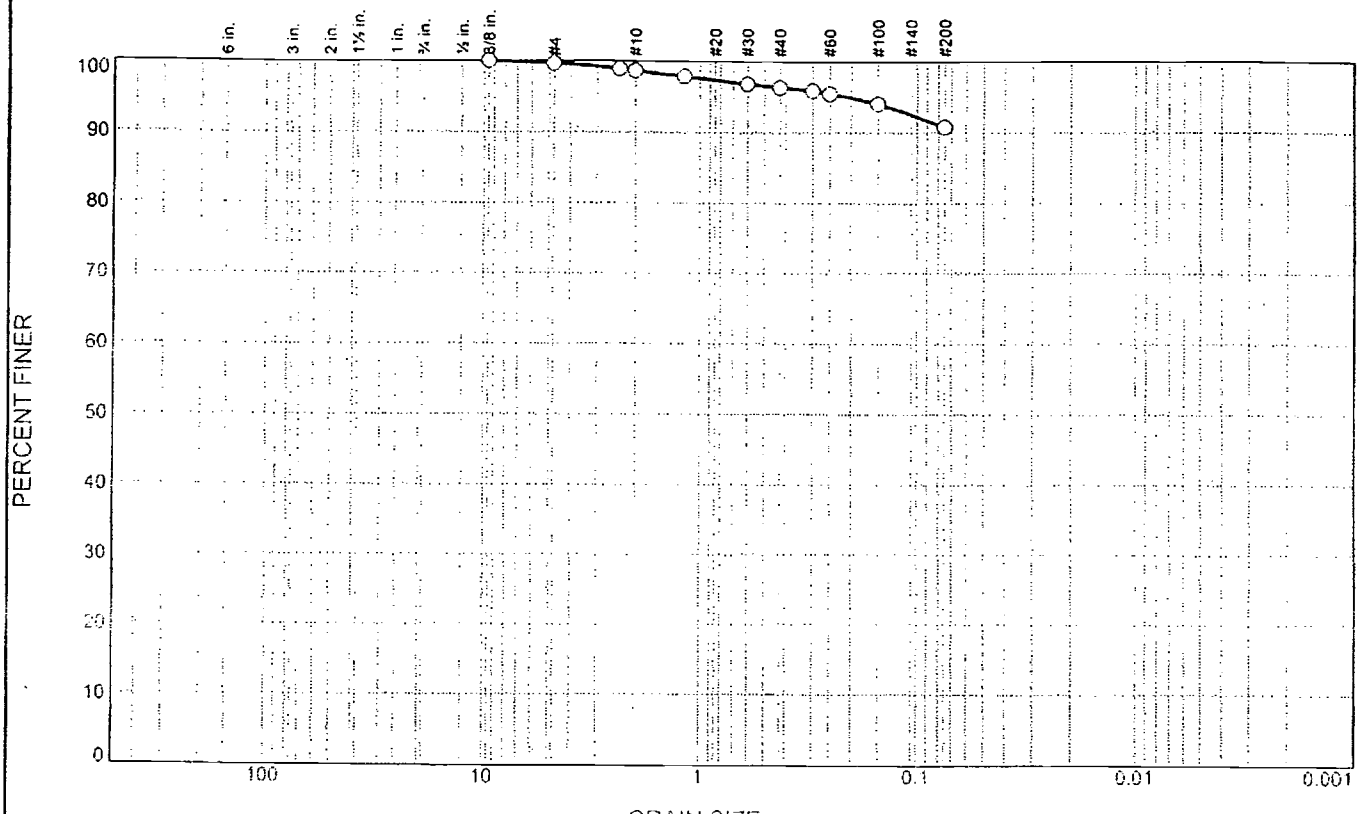
Client: BT Squared

Sample No.	Depth (ft)	Description	Natural Moisture (%)	Atterberg Limits			Organic Content (%)	Unit Weight (pcf)	Specific Gravity	P200 Content (%)
				Liquid Limit (%)	Plastic Limit (%)	PI				
B1-S13	24'-26'		27.3	*	*	*	*	*	*	*
B1-S24	46'-48'		21.3	25	17	8	*	*	*	61.2
B7-S7	18'-20'		11.6	*	*	*	*	*	*	*
B2-S23	44'-46'	(ST)	23.5	39	23	16	*	*	*	96.1
B6-S23	44'-46'	(ST)	31.4	*	*	*	*	*	*	76.9

Notes:

* - Not tested.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.3	1.0	2.3	5.6	90.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.7		
#8	98.9		
#10	98.7		
#16	97.9		
#30	96.8		
#40	96.4		
#50	95.9		
#60	95.5		
#100	94.1		
#200	90.8		

* (no specification provided)

Material Description

Gray Silt, Little Sand (Flyash)

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO=

Remarks

Natural Moisture = 23.9%

Sample Number: B1-S6 **Depth:** 10'-12'

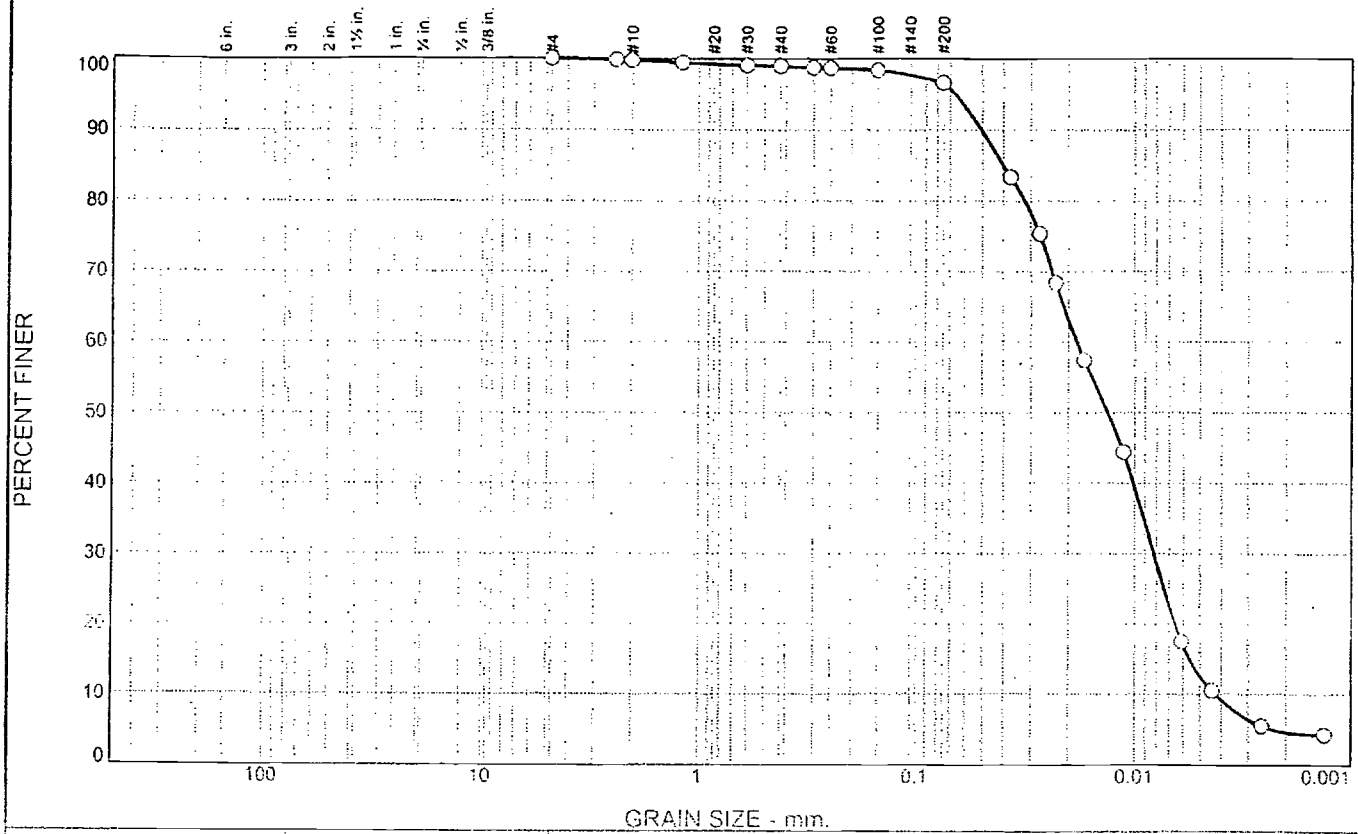
Date: 6/29/08

CGC, Inc.

Client: BT Squared
Project: Indianapolis Power and Light
Project No: C07016-24 **Figure**

Tested By: MAS **Checked By:** DAS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.2	0.8	2.4	84.1	12.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#8	99.8		
#10	99.8		
#16	99.4		
#30	99.1		
#40	99.0		
#50	98.8		
#60	98.7		
#100	98.4		
#200	96.6		

* (no specification provided)

Material Description

Gray Silt, Some Clay, Trace Sand (Flyash)

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.0400 D_{60}= 0.0183 D_{50}= 0.0132
D_{30}= 0.0082 D_{15}= 0.0056 D_{10}= 0.0042
C_u= 4.31 C_c= 0.86

Classification

USCS= ML AASHTO=

Remarks

Natural Moisture = 43.8%

Sample Number: B1-S21 **Depth:** 40'-42'

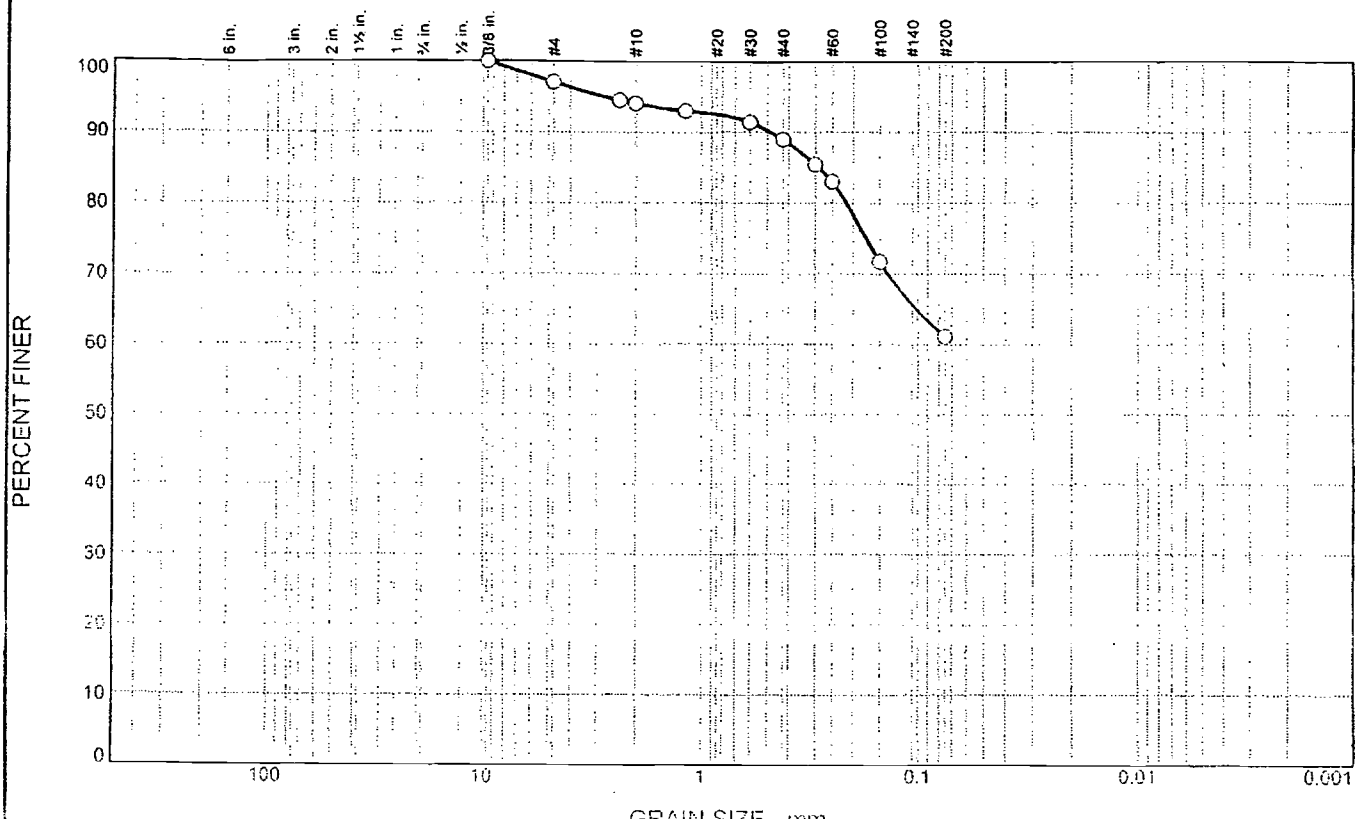
Date: 7/10/08

CGC, Inc.

Client: BT Squared
Project: Indianapolis Power and Light
Project No: C07016-24 **Figure**

Tested By: JSG **Checked By:** DAS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.9	3.0	5.1	27.8	61.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	97.1		
#8	94.5		
#10	94.1		
#16	93.0		
#30	91.4		
#40	89.0		
#50	85.4		
#60	83.0		
#100	71.8		
#200	61.2		

* (no specification provided)

Material Description

Brown Sandy Lean Clay, Trace Gravel

Atterberg Limits

PL= 17 LL= 25 PI= 8

Coefficients

D_{85}= 0.2887 D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL AASHTO=

Remarks

Natural Moisture = 21.3%

Sample Number: B1-S24 **Depth:** 46'-48'

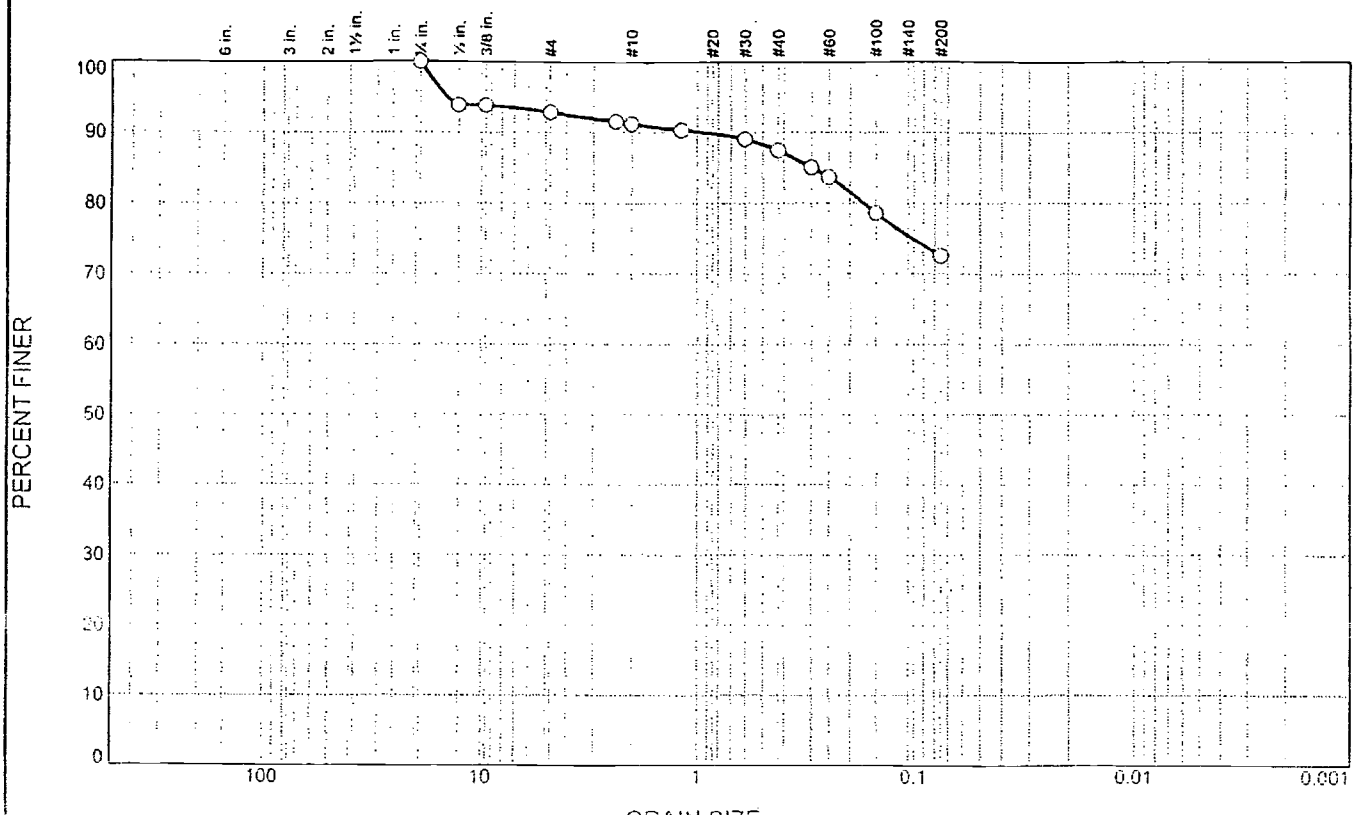
Date: 7/2/08

CGC, Inc.

Client: BT Squared
Project: Indianapolis Power and Light
Project No: C07016-24 **Figure**

Tested By: KJS **Checked By:** DAS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	7.1	1.7	3.7	14.9	72.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.5	93.8		
.375	93.8		
#4	92.9		
#8	91.6		
#10	91.2		
#16	90.3		
#30	89.1		
#40	87.5		
#50	85.1		
#60	83.7		
#100	78.6		
#200	72.6		

* (no specification provided)

Material Description

Brown Lean Clay, Some Sand, Little Gravel

Atterberg Limits

PL= 19 LL= 34 PI= 15

Coefficients

D_{85}= 0.2975 D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL AASHTO= A-6(9)

Remarks

Natural Moisture = 23.0%

Sample Number: B1-S25 **Depth:** 48'-50'

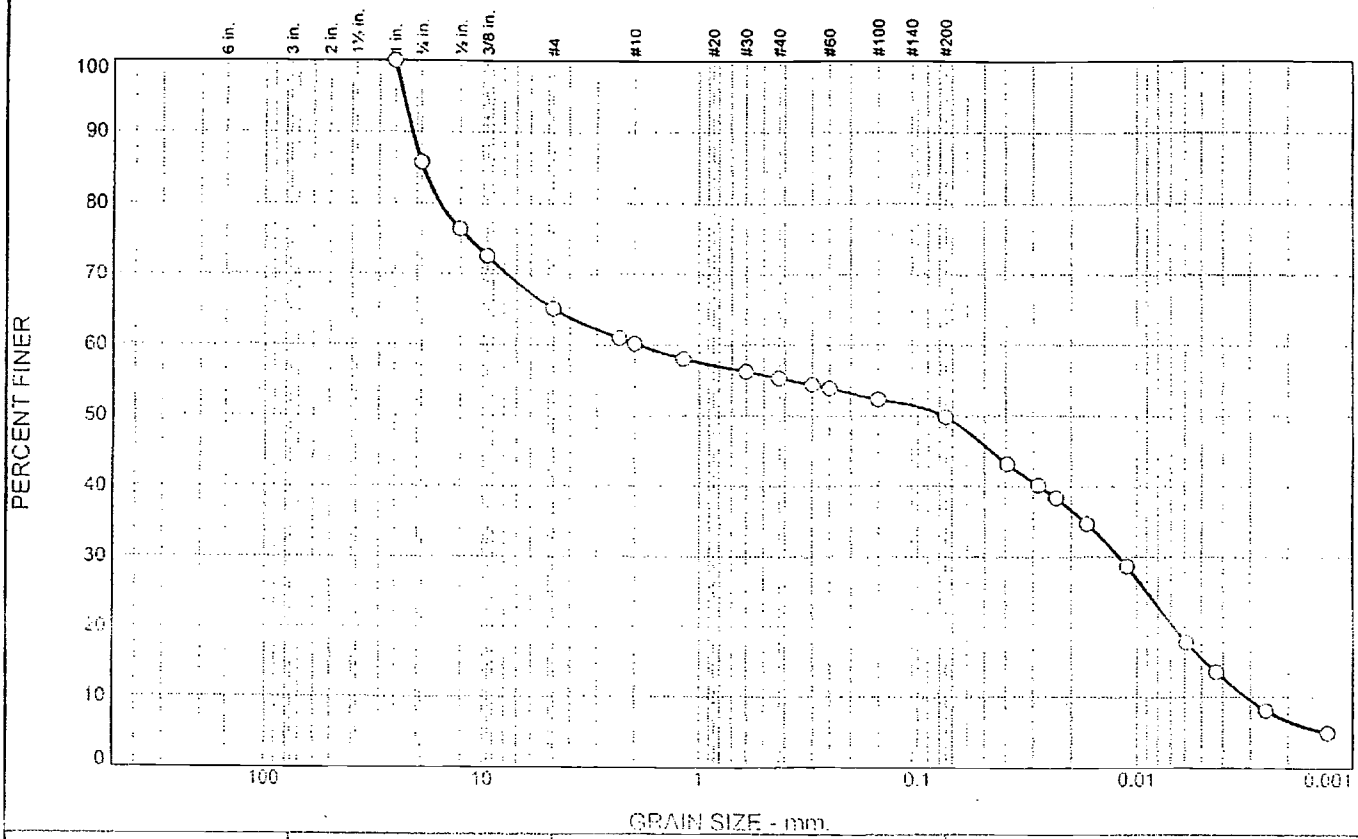
Date: 7/2/08

CGC, Inc.

Client: BT Squared
Project: Indianapolis Power and Light
Project No: C07016-24 **Figure**

Tested By: KJS **Checked By:** DAS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	14.3	20.6	4.9	4.9	5.4	34.3	15.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	85.7		
.5	76.4		
.375	72.5		
#4	65.1		
#8	61.0		
#10	60.2		
#16	58.1		
#30	56.3		
#40	55.3		
#50	54.4		
#60	53.9		
#100	52.3		
#200	49.9		

(no specification provided)

Material Description

Gray Silty Gravel, Some Sand and Clay (Flyash)

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 18.6890 D_{60}= 1.9115 D_{50}= 0.0764
D_{30}= 0.0120 D_{15}= 0.0048 D_{10}= 0.0031
C_u= 619.30 C_c= 0.02

Classification

USCS= GM AASHTO=

Remarks

Natural Moisture = 15.4%

Sample Number: B2-S7 **Depth:** 12'-14'

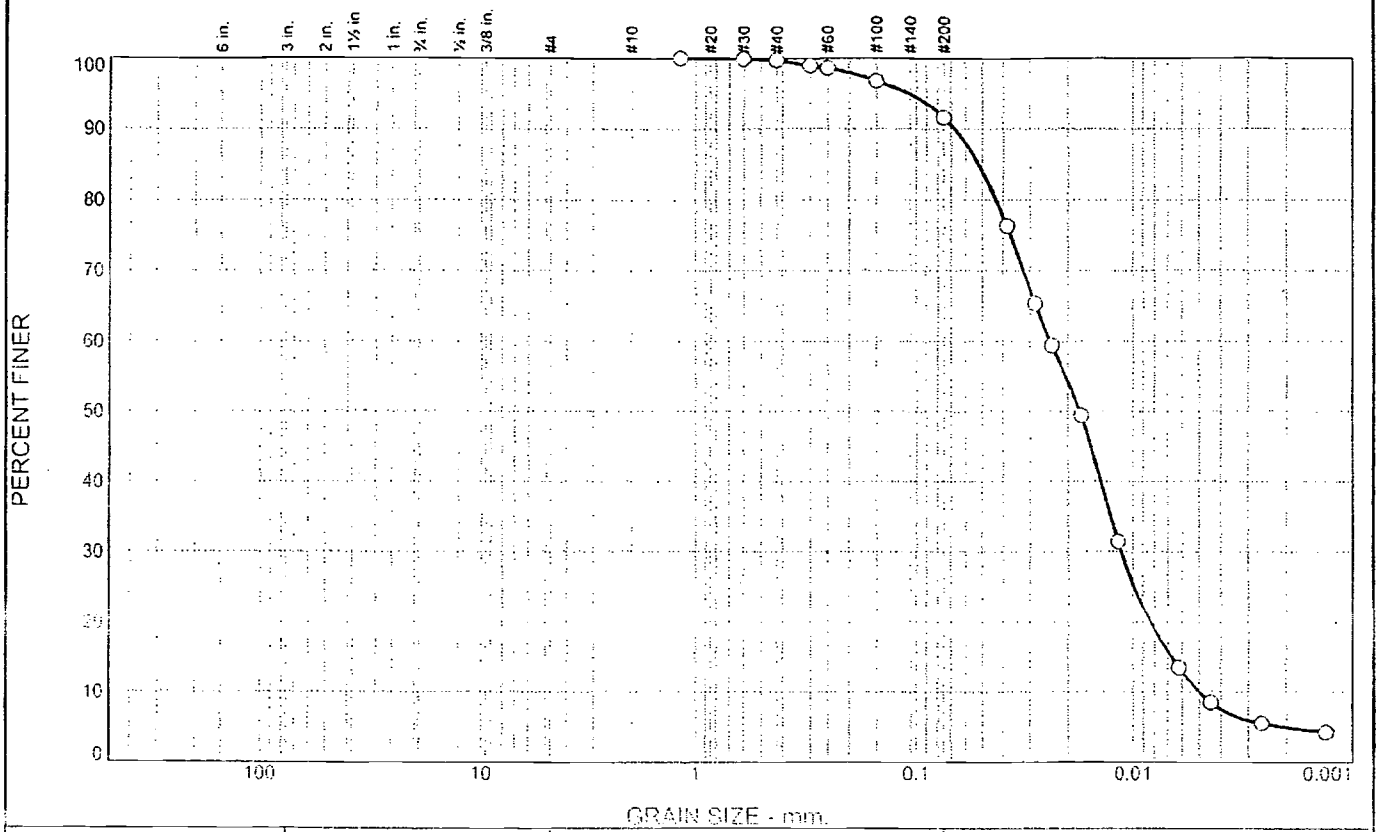
Date: 7/10/08

CGC, Inc.

Client: BT Squared
Project: Indianapolis Power and Light
Project No: C07016-24 **Figure**

Tested By: JSG **Checked By:** DAS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.2	8.2	81.6	10.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#16	100.0		
#30	99.9		
#40	99.8		
#50	99.0		
#60	98.6		
#100	96.8		
#200	91.6		

* (no specification provided)

Material Description

Gray Silt, Little Sand and Clay (Flyash)

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.0518 D_{60}= 0.0242 D_{50}= 0.0177
D_{30}= 0.0113 D_{15}= 0.0067 D_{10}= 0.0050
C_u= 4.85 C_c= 1.06

Classification

USCS= ML AASHTO=

Remarks

Natural Moisture = 63.8%

Sample Number: B2-S21 **Depth:** 40'-42'

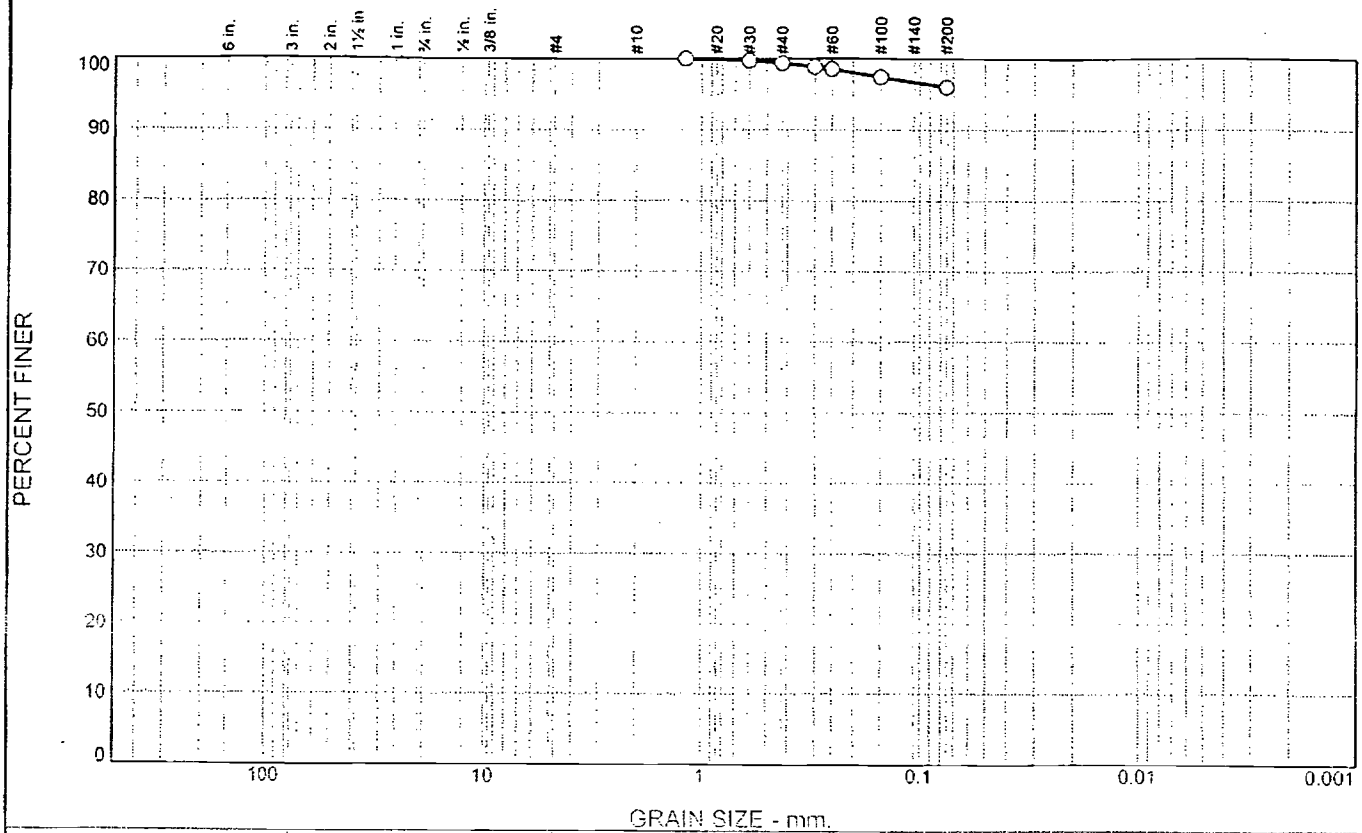
Date: 7/10/08

CGC, Inc.

Client: BT Squared
Project: Indianapolis Power and Light
Project No: C07016-24 **Figure**

Tested By: JSG **Checked By:** DAS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.6	3.3	96.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#16	100.0		
#30	99.7		
#40	99.4		
#50	98.9		
#60	98.6		
#100	97.5		
#200	96.1		

* (no specification provided)

Material Description

Gray Lean Clay, Trace Sand

Atterberg Limits

PL= 23 LL= 39 PI= 16

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL AASHTO=

Remarks

Natural Moisture = 23.5%

Sample Number: B2-S23 (ST) **Depth:** 44'-46'

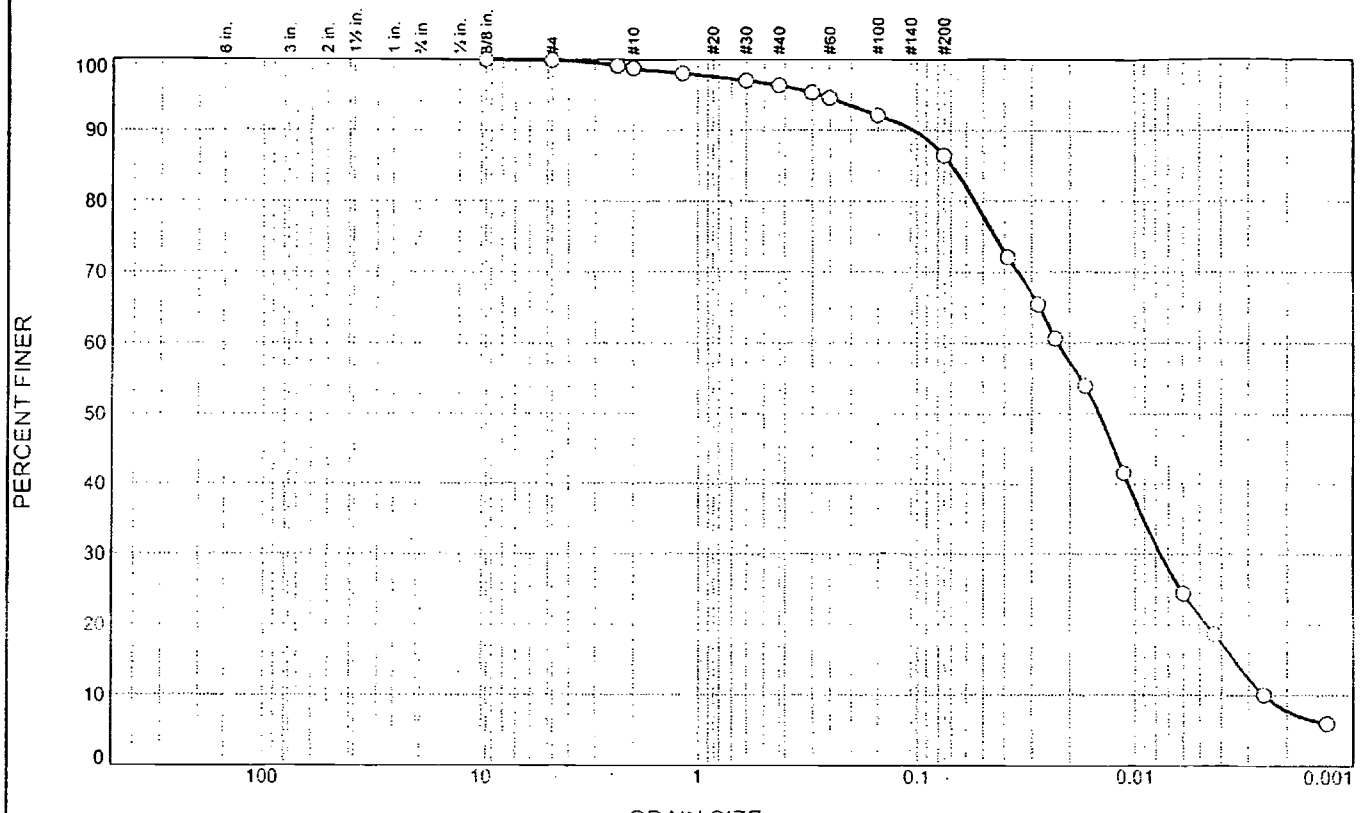
Date: 7/18/08

CGC, Inc.

Client: BT Squared
Project: Indianapolis Power and Light
Project No: C07016-24 **Figure**

Tested By: KJS **Checked By:** DAS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.1	1.1	2.4	9.9	65.3	21.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.9		
#8	99.2		
#10	98.8		
#16	98.1		
#30	97.1		
#40	96.4		
#50	95.3		
#60	94.6		
#100	92.1		
#200	86.5		

* (no specification provided)

Material Description

Gray Silt, Some Sand and Clay, Trace Gravel (Flyash)

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.0690 D_{60}= 0.0227 D_{50}= 0.0146
D_{30}= 0.0076 D_{15}= 0.0035 D_{10}= 0.0025
C_u= 8.97 C_c= 1.01

Classification

USCS= ML AASHTO=

Remarks

Natural Moisture = 29.1%

Sample Number: B3-S5 **Depth:** 8'-10'

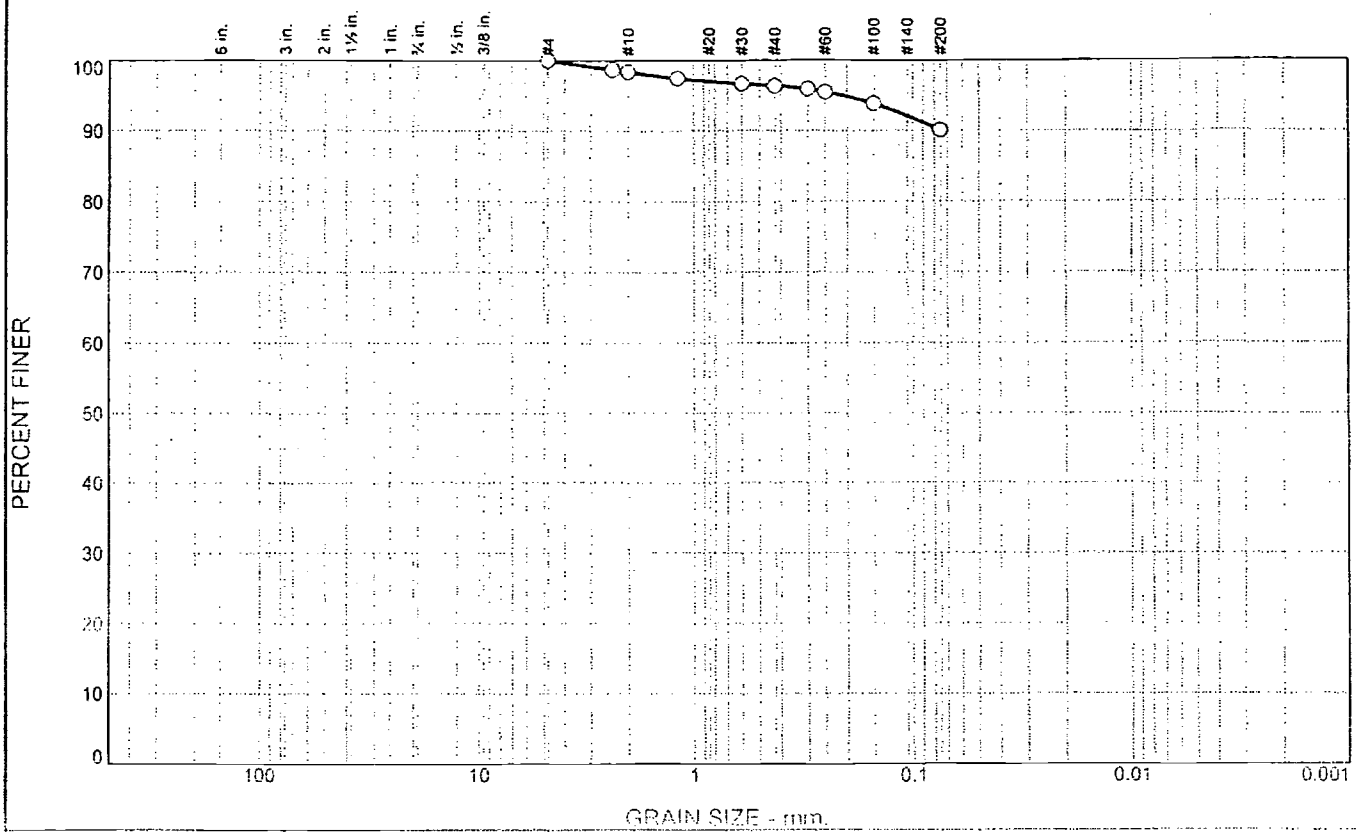
Date: 7/10/08

CGC, Inc.

Client: BT Squared
Project: Indianapolis Power and Light
Project No: C07016-24 **Figure**

Tested By: JSG **Checked By:** DAS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	1.6	2.0	6.3	90.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#8	98.7		
#10	98.4		
#16	97.4		
#30	96.7		
#40	96.4		
#50	95.9		
#60	95.5		
#100	93.8		
#200	90.1		

* (no specification provided)

Material Description

Gray Silt, Little Sand (Flyash)

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO=

Remarks

Natural Moisture = 52.6%

Sample Number: B3-S23 **Depth:** 44'-46'

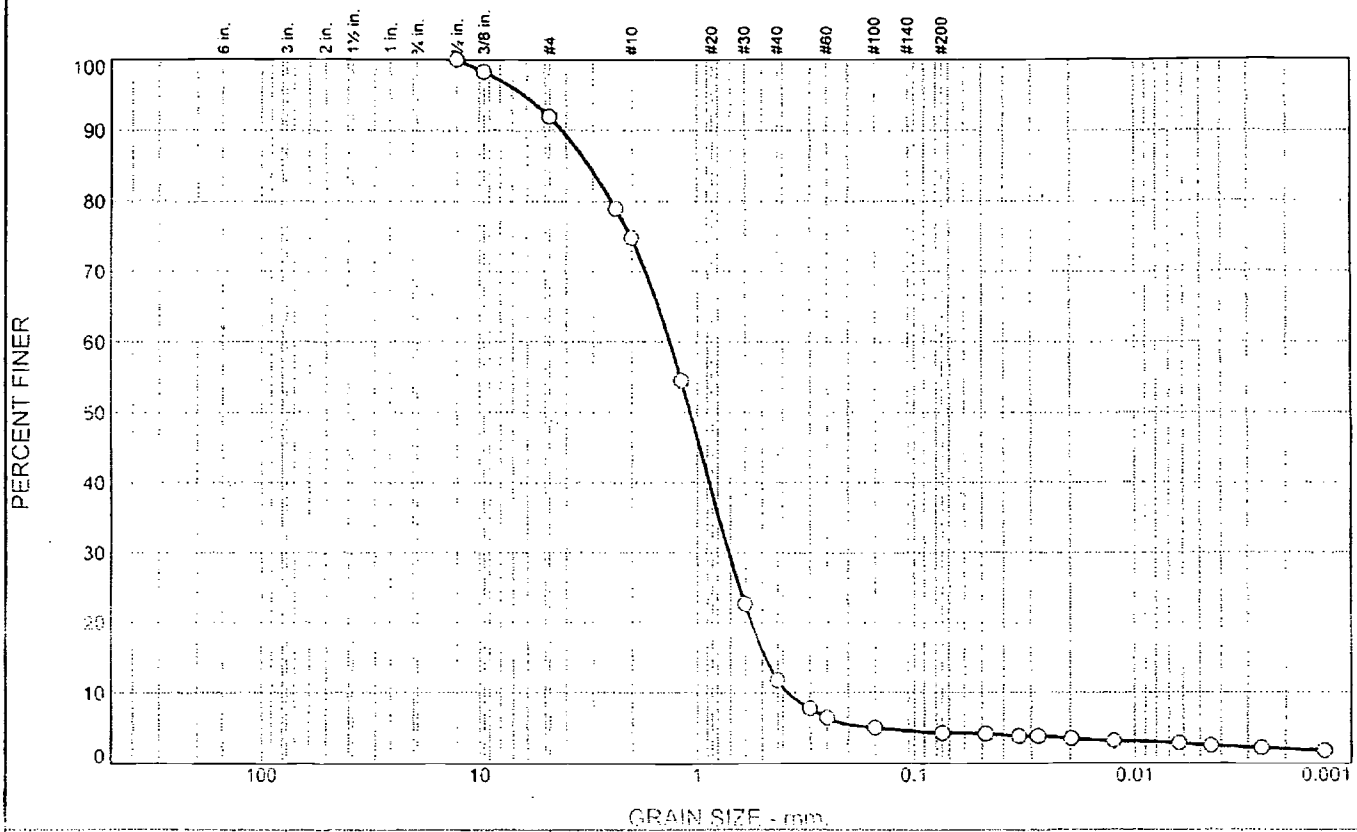
Date: 6/29/08

CGC, Inc.

Client: BT Squared
Project: Indianapolis Power and Light
Project No: C07016-24 **Figure**

Tested By: MAS **Checked By:** DAS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	8.0	17.2	63.0	7.5	1.6	2.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.5	100.0		
.375	98.3		
#4	92.0		
#8	79.0		
#10	74.8		
#16	54.5		
#30	22.7		
#40	11.8		
#50	7.8		
#60	6.5		
#100	5.1		
#200	4.3		

* (no specification provided)

Material Description

Brown Fine to Coarse Sand, Little Gravel, Trace Silt and Clay

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 3.1205 D_{60}= 1.3330 D_{50}= 1.0730
D_{30}= 0.7095 D_{15}= 0.4829 D_{10}= 0.3801
C_u= 3.51 C_c= 0.99

Classification

USCS= SP AASHTO=

Remarks

Natural Moisture = 16.9%

Sample Number: B3-S25 **Depth:** 48'-50'

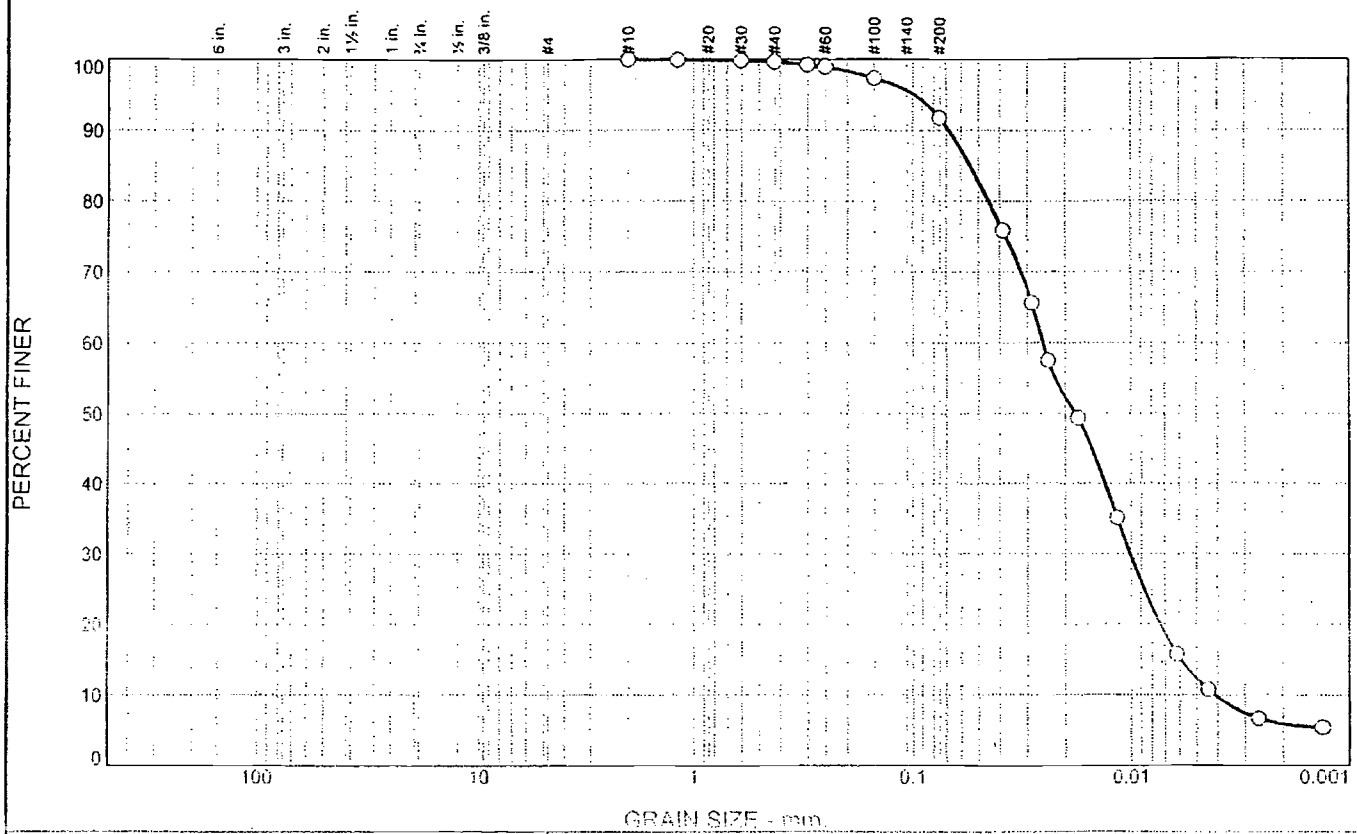
Date: 7/10/08

CGC, Inc.

Client: BT Squared
Project: Indianapolis Power and Light
Project No: C07016-24 **Figure**

Tested By: JSG **Checked By:** DAS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.3	7.9	79.5	12.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#16	99.9		
#30	99.8		
#40	99.7		
#50	99.2		
#60	99.0		
#100	97.4		
#200	91.8		

* (no specification provided)

Material Description

Gray Silt, Some Clay, Little Sand (Flyash)

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.0544 D_{60}= 0.0254 D_{50}= 0.0179
D_{30}= 0.0101 D_{15}= 0.0059 D_{10}= 0.0041
C_u= 6.16 C_c= 0.97

Classification

USCS= ML AASHTO=

Remarks

Natural Moisture = 33.9%

Sample Number: B4-S13 **Depth:** 24'-26'

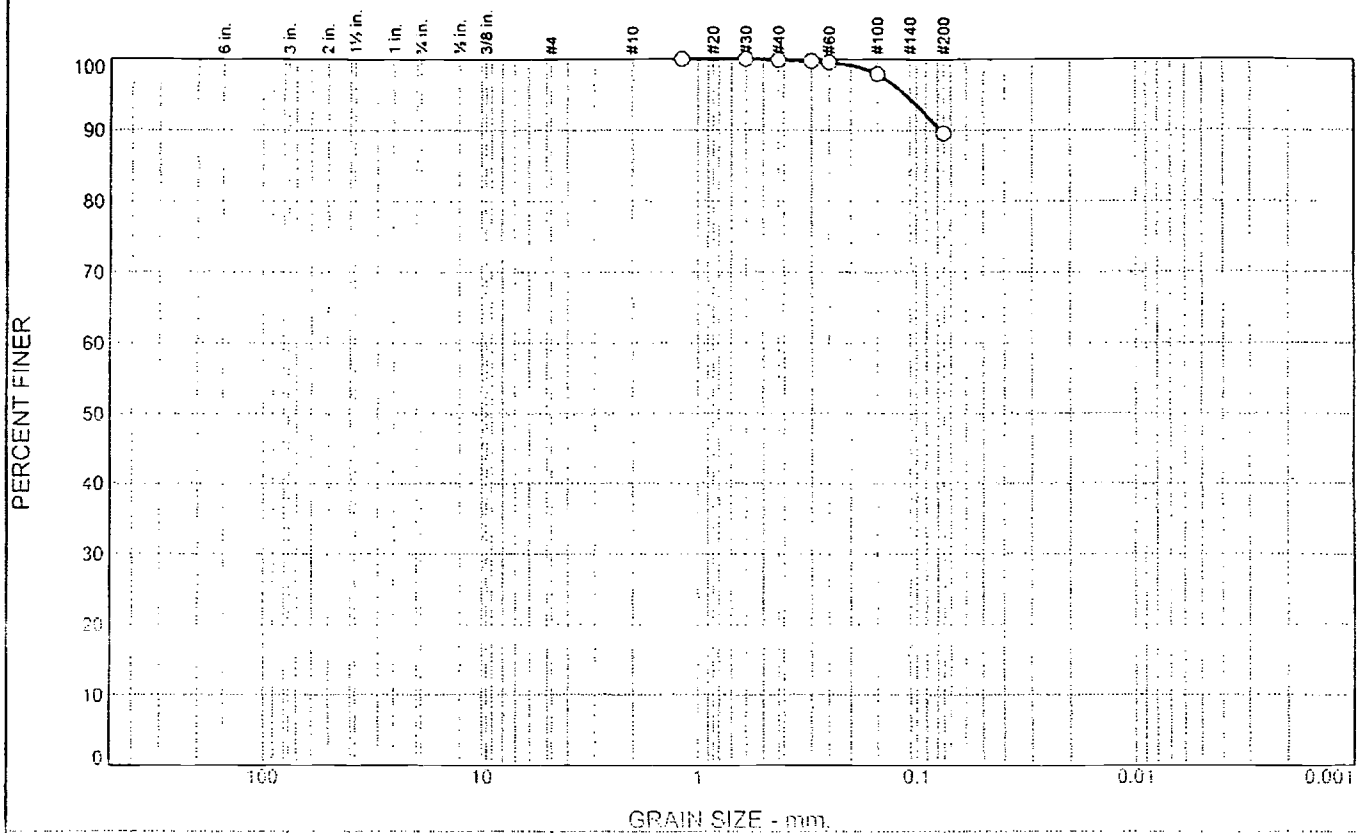
Date: 7/10/08

CGC,Inc.

Client: BT Squared
Project: Indianapolis Power and Light
Project No: C07016-24 **Figure**

Tested By: JSG **Checked By:** DAS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.1	10.3	89.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#16	100.0		
#30	100.0		
#40	99.9		
#50	99.8		
#60	99.6		
#100	97.9		
#200	89.6		

* (no specification provided)

Material Description

Gray Silt, Little Sand (Flyash)

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO=

Remarks

Natural Moisture = 37.8%

Sample Number: B4-S19 **Depth:** 36'-38'

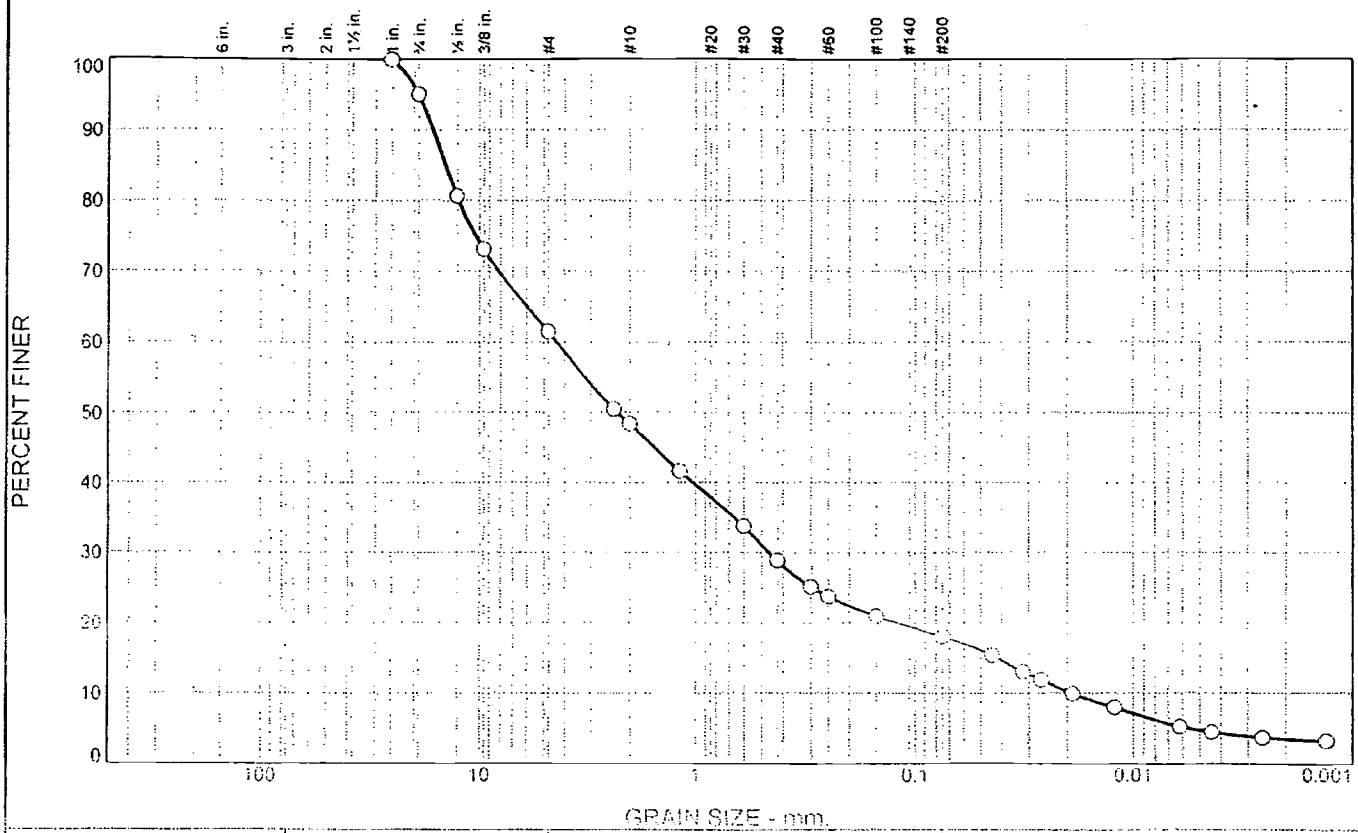
Date: 6/29/08

CGC, Inc.

Client: BT Squared
Project: Indianapolis Power and Light
Project No: C07016-24 **Figure**

Tested By: MAS **Checked By:** DAS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	4.9	33.6	13.1	19.5	10.9	13.3	4.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	95.1		
.5	80.7		
.375	73.1		
#4	61.5		
#8	50.5		
#10	48.4		
#16	41.6		
#30	33.8		
#40	28.9		
#50	25.1		
#60	23.7		
#100	21.0		
#200	18.0		

* (no specification provided)

Material Description

Brown Gravelly Fine to Coarse Sand, Some Silt, Trace Clay

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 14.3063 D_{60}= 4.3362 D_{50}= 2.2721
D_{30}= 0.4610 D_{15}= 0.0418 D_{10}= 0.0191
C_u= 226.87 C_c= 2.56

Classification

USCS= SM AASHTO=

Remarks

Natural Moisture = 9.2%

Sample Number: B4-S25 **Depth:** 48'-50'

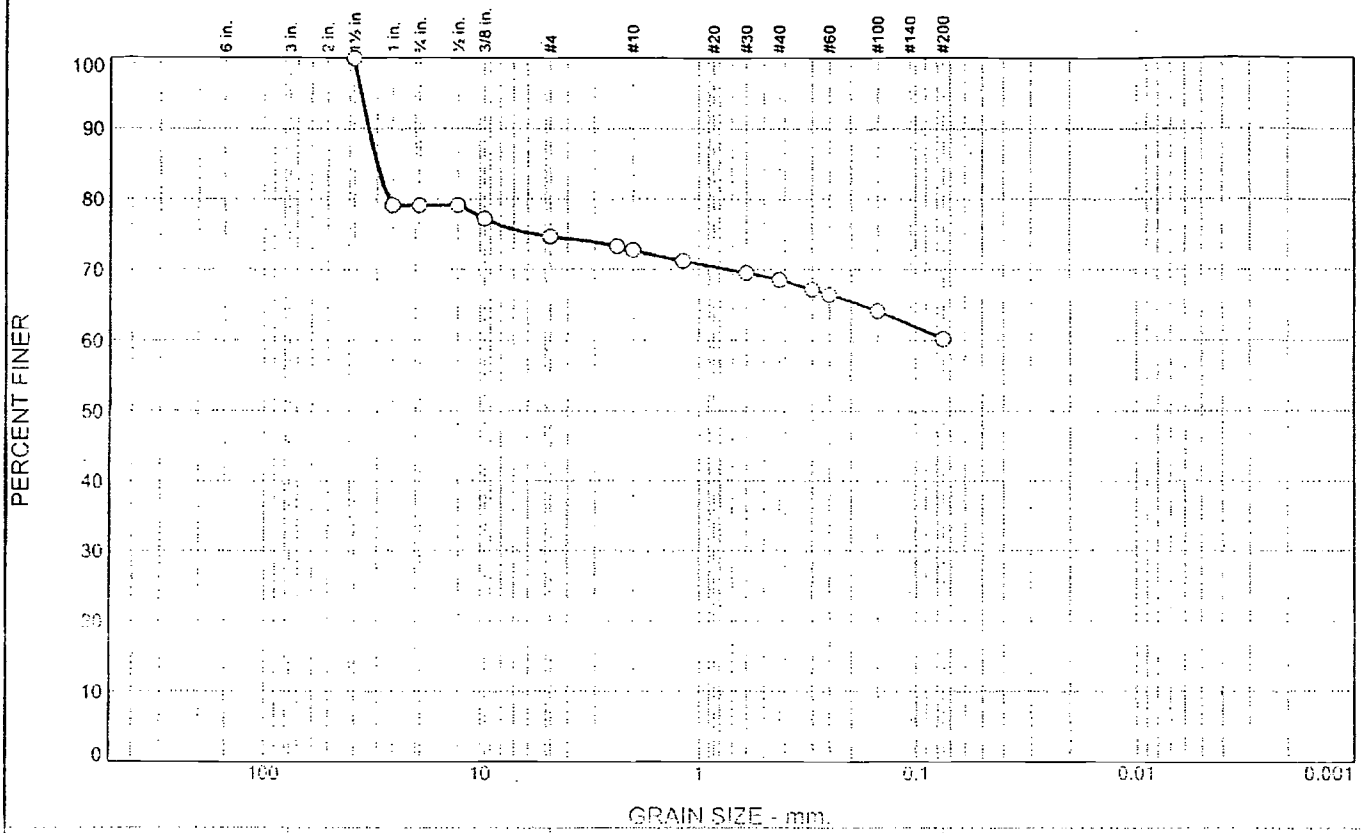
Date: 7/10/08

CGC, Inc.

Client: BT Squared
Project: Indianapolis Power and Light
Project No: C07016-24 **Figure**

Tested By: JSG **Checked By:** DAS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	20.9	4.4	1.9	4.2	8.3	60.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1	79.1		
.75	79.1		
.5	79.1		
.375	77.2		
#4	74.7		
#8	73.3		
#10	72.8		
#16	71.2		
#30	69.6		
#40	68.6		
#50	67.2		
#60	66.5		
#100	64.2		
#200	60.3		

* (no specification provided)

Material Description

Gray Silt, Some Gravel and Sand (Flyash)

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 29.8533 D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO=

Remarks

Natural Moisture = 19.1%

Sample Number: B5-S3 **Depth:** 4'-6'

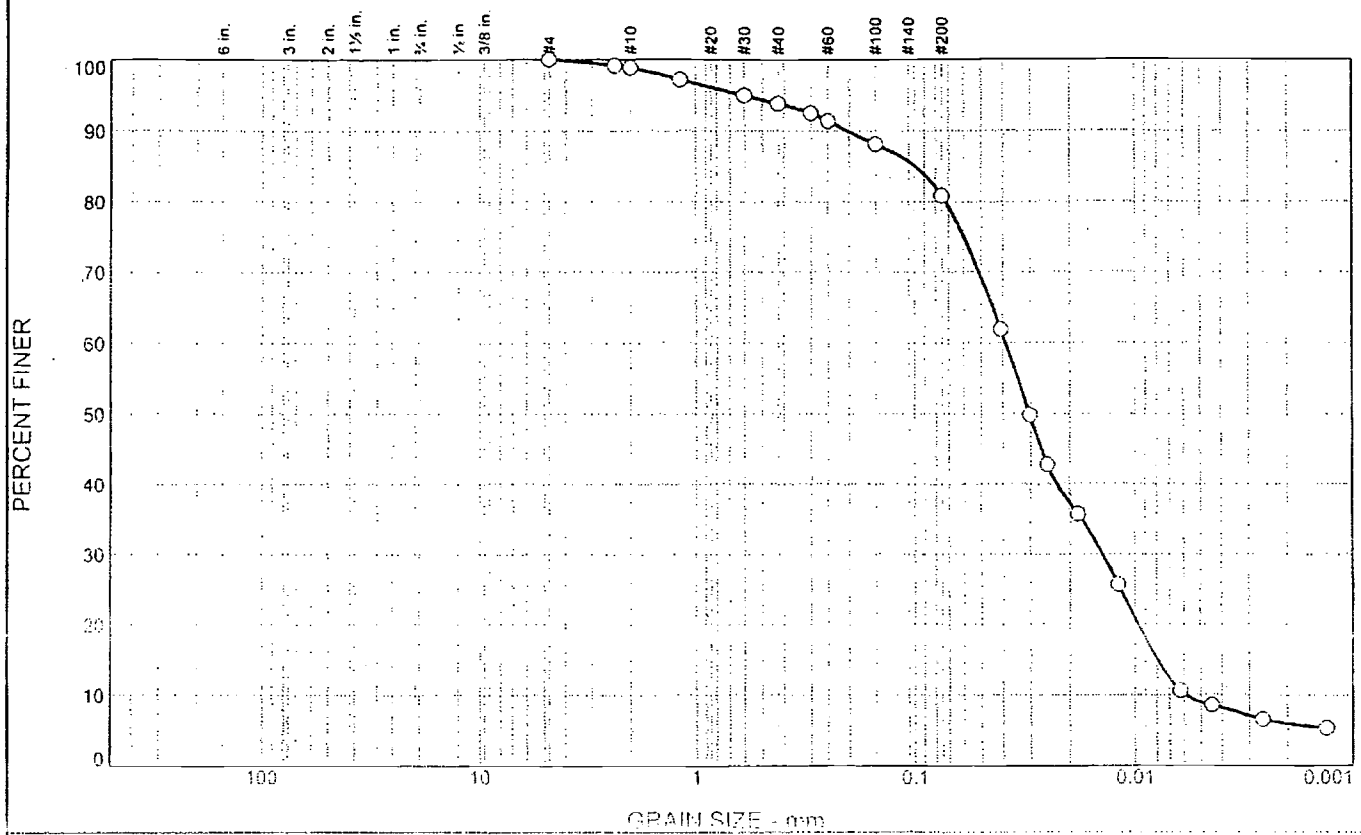
Date: 6/29/08

CGC, Inc.

Client: BT Squared
Project: Indianapolis Power and Light
Project No: C07016-24 **Figure**

Tested By: MAS **Checked By:** DAS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	1.2	4.9	13.0	71.9	9.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#8	99.2		
#10	98.8		
#16	97.2		
#30	95.0		
#40	93.9		
#50	92.5		
#60	91.4		
#100	88.1		
#200	80.9		

* (no specification provided)

Material Description

Gray Silt, Little Clay, Some Sand (Flyash)

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.0983 D_{60}= 0.0388 D_{50}= 0.0303
D_{30}= 0.0141 D_{15}= 0.0080 D_{10}= 0.0059
C_u= 6.60 C_c= 0.87

Classification

USCS= ML AASHTO=

Remarks

Natural Moisture = 46.7%

Sample Number: B5-S21 **Depth:** 40'-42'

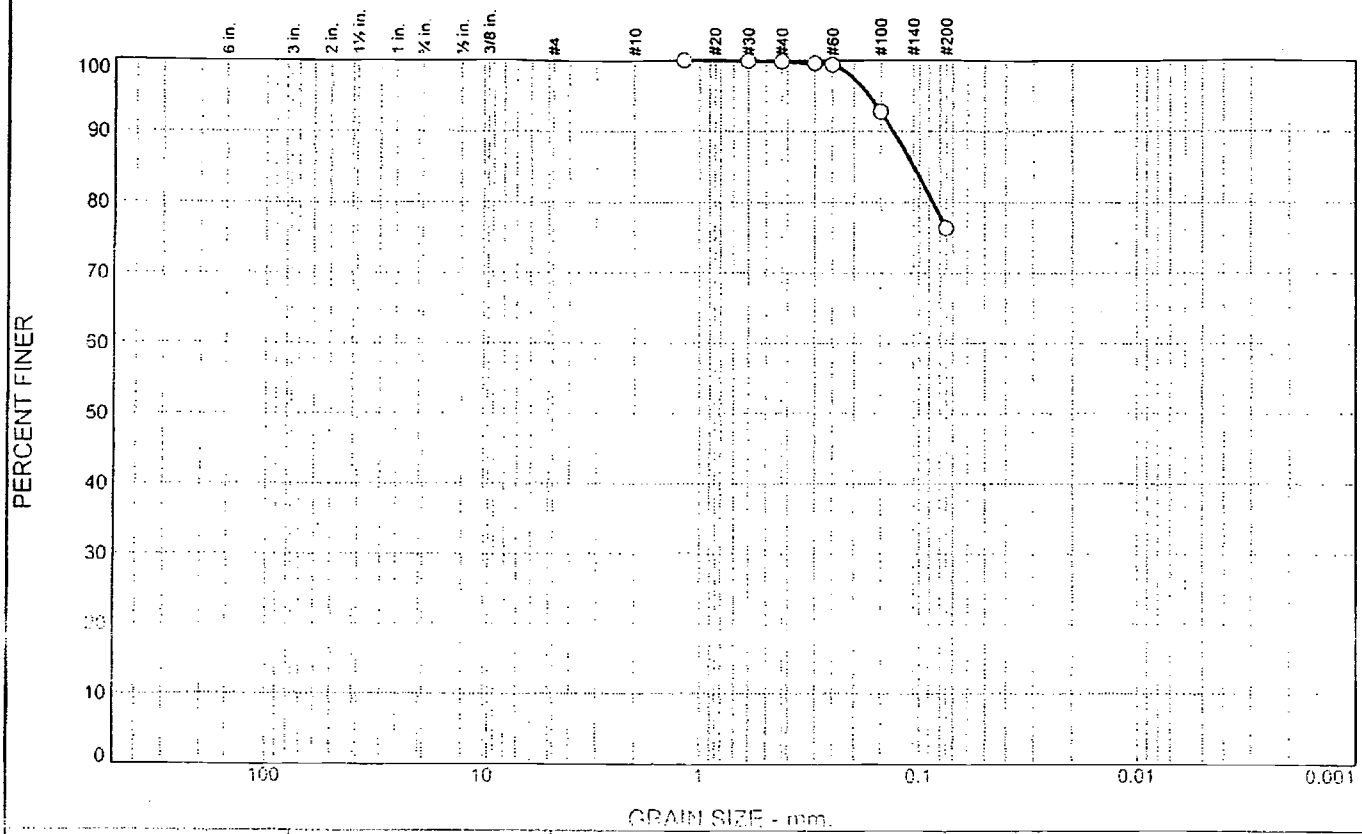
Date: 7/10/08

CGC, Inc.

Client: BT Squared
Project: Indianapolis Power and Light
Project No: C07016-24 **Figure**

Tested By: JSG **Checked By:** DAS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.1	23.5	76.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#16	100.0		
#30	99.9		
#40	99.9		
#50	99.6		
#60	99.4		
#100	92.8		
#200	76.4		

* (no specification provided)

Material Description

Brown Silty Clay, Some Sand

Atterberg Limits

PL= 20 LL= 26 PI= 6

Coefficients

D_{85}= 0.1055 D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL-ML AASHTO= A-4(3)

Remarks

Natural Moisture = 25.7%

Sample Number: B5-S25 **Depth:** 48'-50'

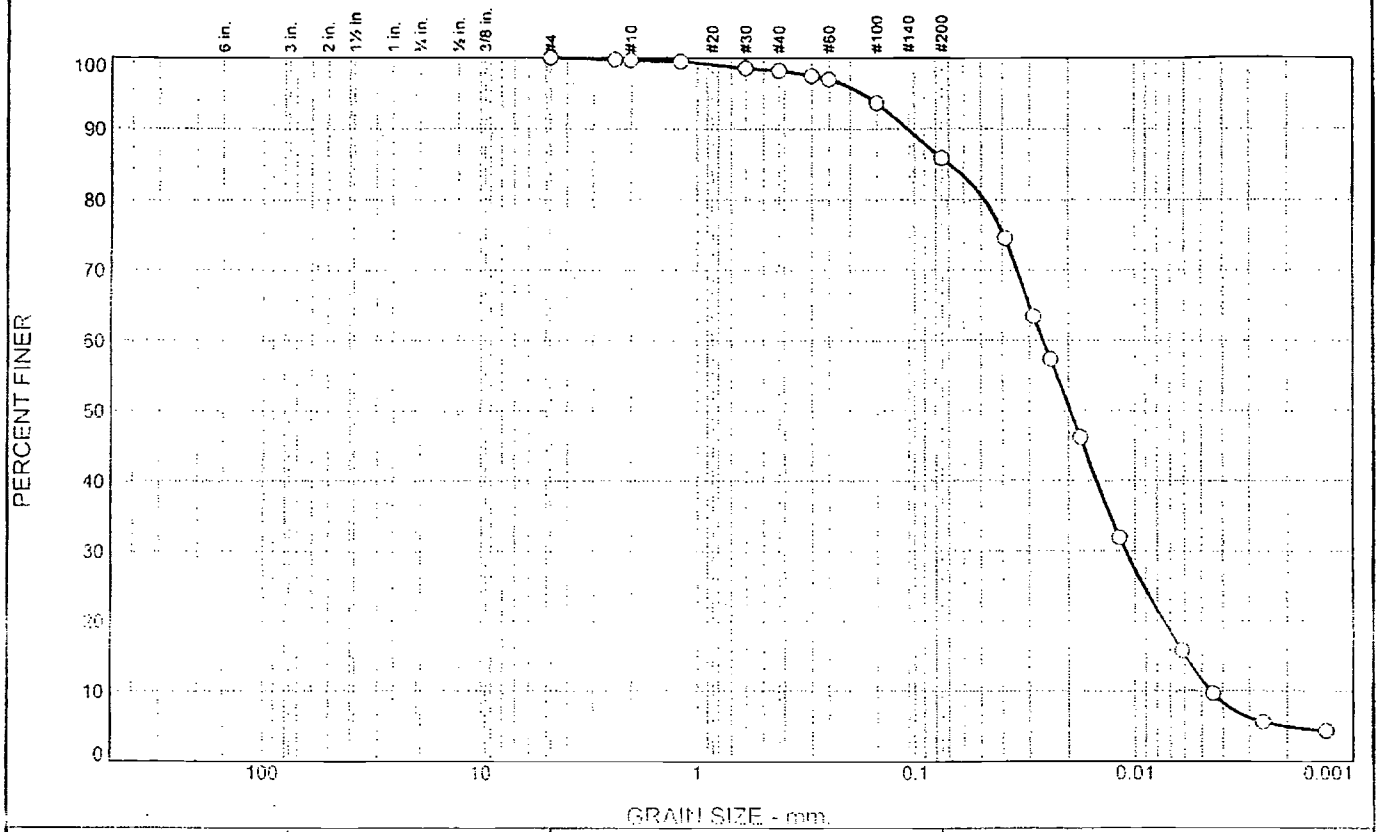
Date: 7/2/08

CGC, Inc.

Client: BT Squared
Project: Indianapolis Power and Light
Project No: C07016-24 **Figure**

Tested By: KJS **Checked By:** DAS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.4	1.4	12.4	74.1	11.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#8	99.7		
#10	99.6		
#16	99.5		
#30	98.6		
#40	98.2		
#50	97.5		
#60	97.0		
#100	93.6		
#200	85.8		

* (no specification provided)

Material Description

Gray Silt, Some Sand, Little Clay (Flyash)

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.0693 D_{60}= 0.0260 D_{50}= 0.0196
D_{30}= 0.0110 D_{15}= 0.0059 D_{10}= 0.0045
C_u= 5.75 C_c= 1.02

Classification

USCS= ML AASHTO=

Remarks

Natural Moisture = 69.7%

Sample Number: B6-S15 **Depth:** 28'-30'

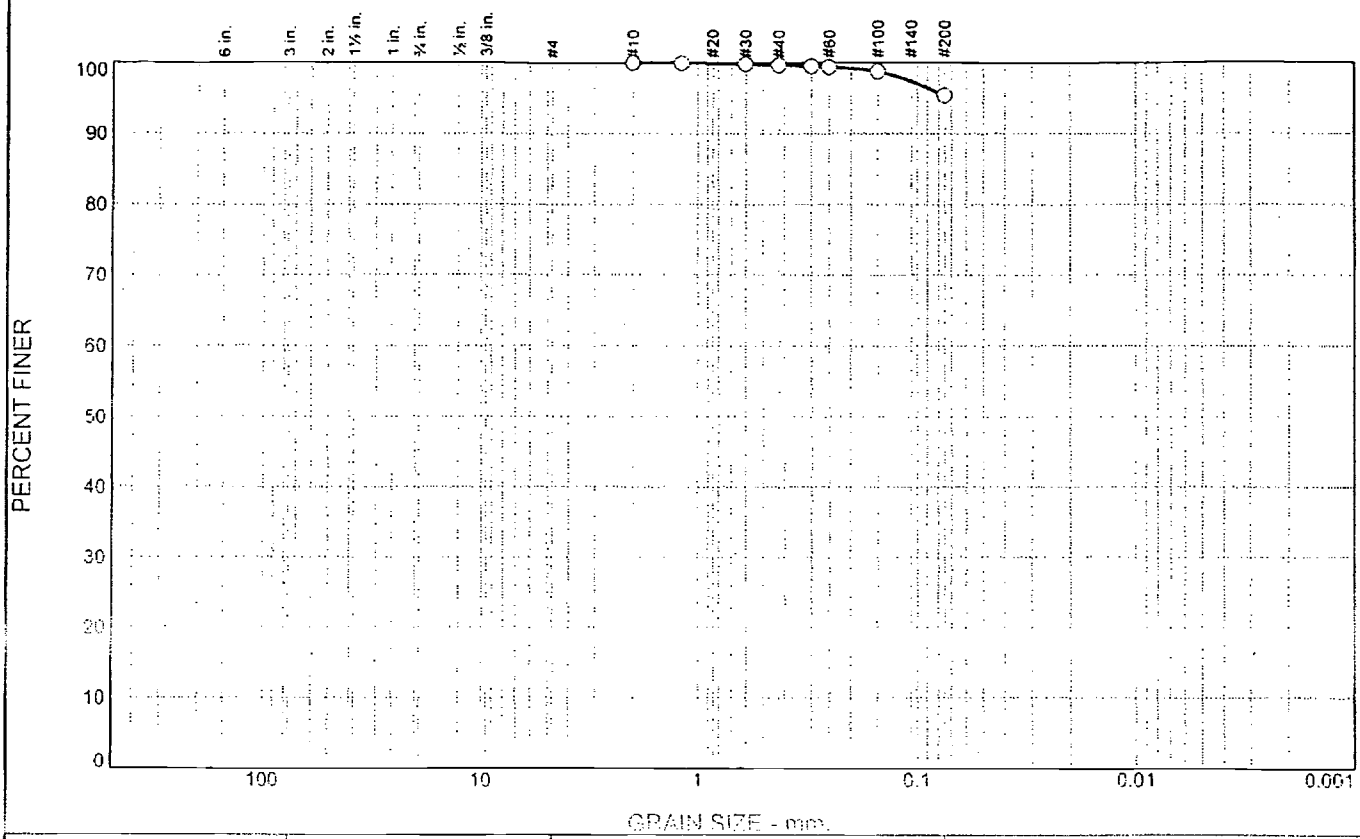
Date: 7/10/08

CGC, Inc.

Client: BT Squared
Project: Indianapolis Power and Light
Project No: C07016-24 **Figure**

Tested By: JSG **Checked By:** DAS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.3	4.3	95.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#16	99.9		
#30	99.8		
#40	99.7		
#50	99.5		
#60	99.4		
#100	98.8		
#200	95.4		

* (no specification provided)

Material Description

Gray Silt, Trace Sand (Flyash)

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO=

Remarks

Natural Moisture = 49.1%

Sample Number: B6-S19 **Depth:** 36'-38'

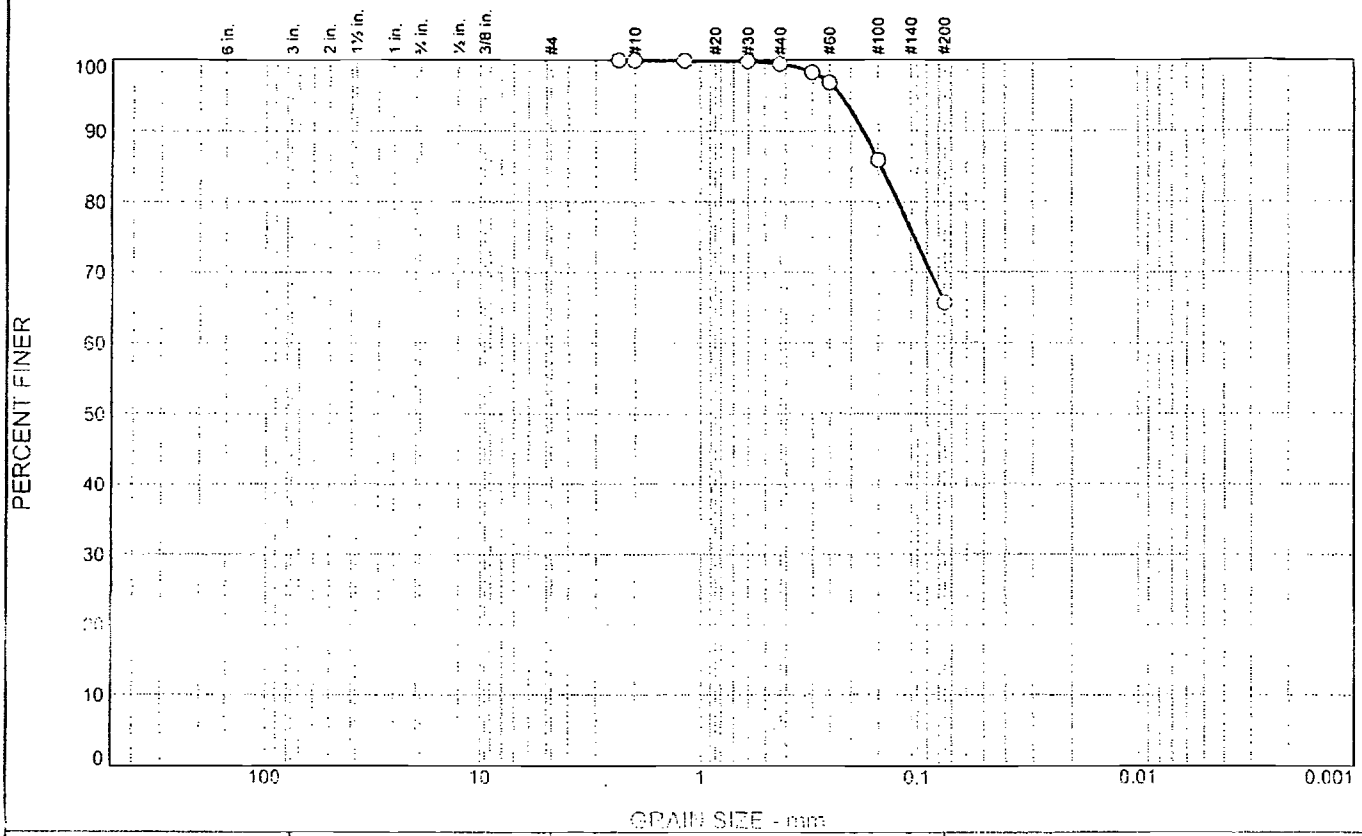
Date: 6/29/08

CGC,Inc.

Client: BT Squared
Project: Indianapolis Power and Light
Project No: C07016-24 **Figure**

Tested By: MAS **Checked By:** DAS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.6	33.7	65.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#8	100.0		
#10	100.0		
#16	99.9		
#30	99.8		
#40	99.4		
#50	98.3		
#60	96.8		
#100	85.9		
#200	65.7		

* (no specification provided)

Material Description

Brown Silty Clay, Some Sand

Atterberg Limits

PL= 18 LL= 23 PI= 5

Coefficients

D_{85}= 0.1451 D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL-ML AASHTO= A-4(1)

Remarks

Natural Moisture = 23.8%

Sample Number: B6-S22 **Depth:** 42'-44'

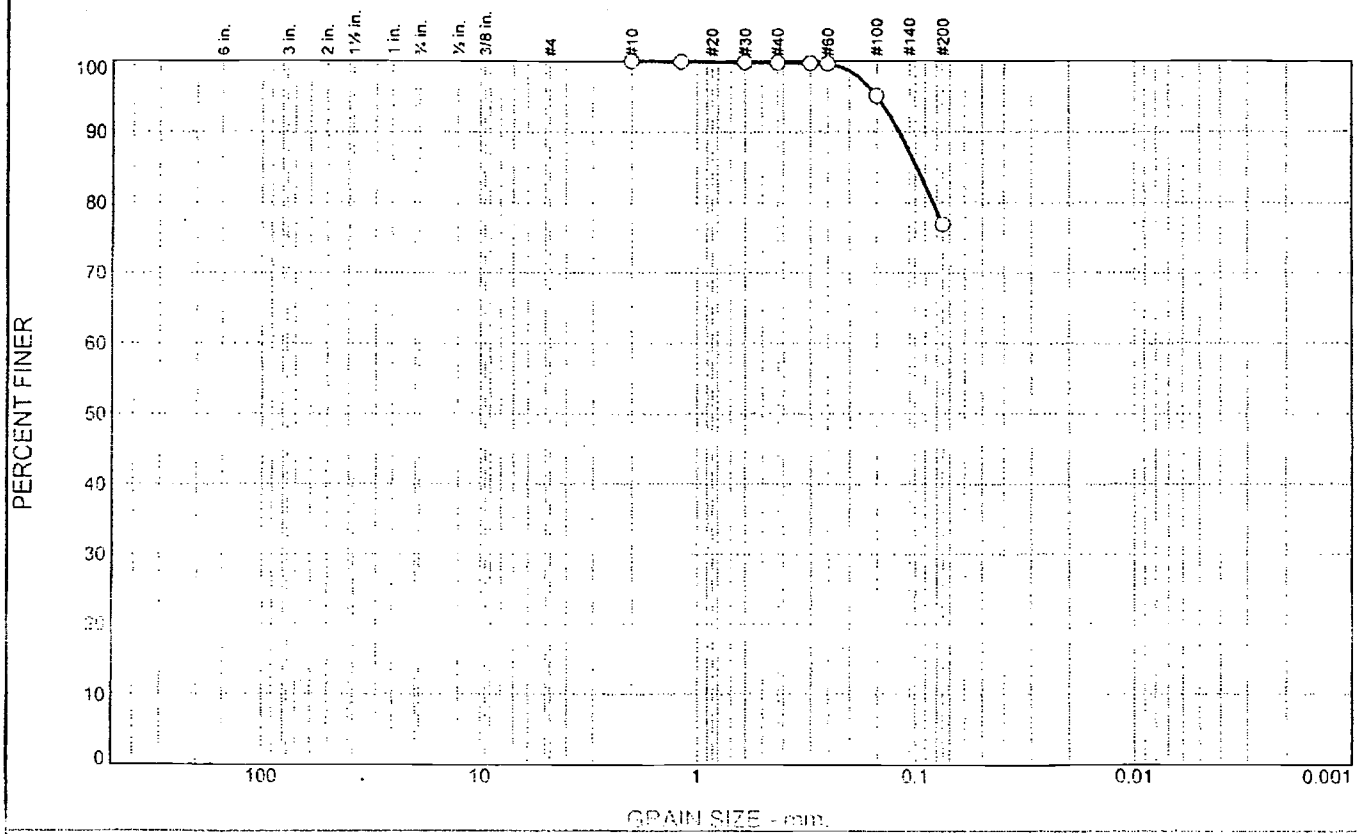
Date: 7/2/08

CGC,Inc.

Client: BT Squared
Project: Indianapolis Power and Light
Project No: C07016-24 **Figure**

Tested By: KJS **Checked By:** DAS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.2	22.9	76.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#16	100.0		
#30	99.8		
#40	99.8		
#50	99.7		
#60	99.6		
#100	95.1		
#200	76.9		

(no specification provided)

Material Description

Gray Silt, Some Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.0982 D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO=

Remarks

Natural Moisture = 31.4%

Sample Number: B6-S23 (ST) **Depth:** 44'-46'

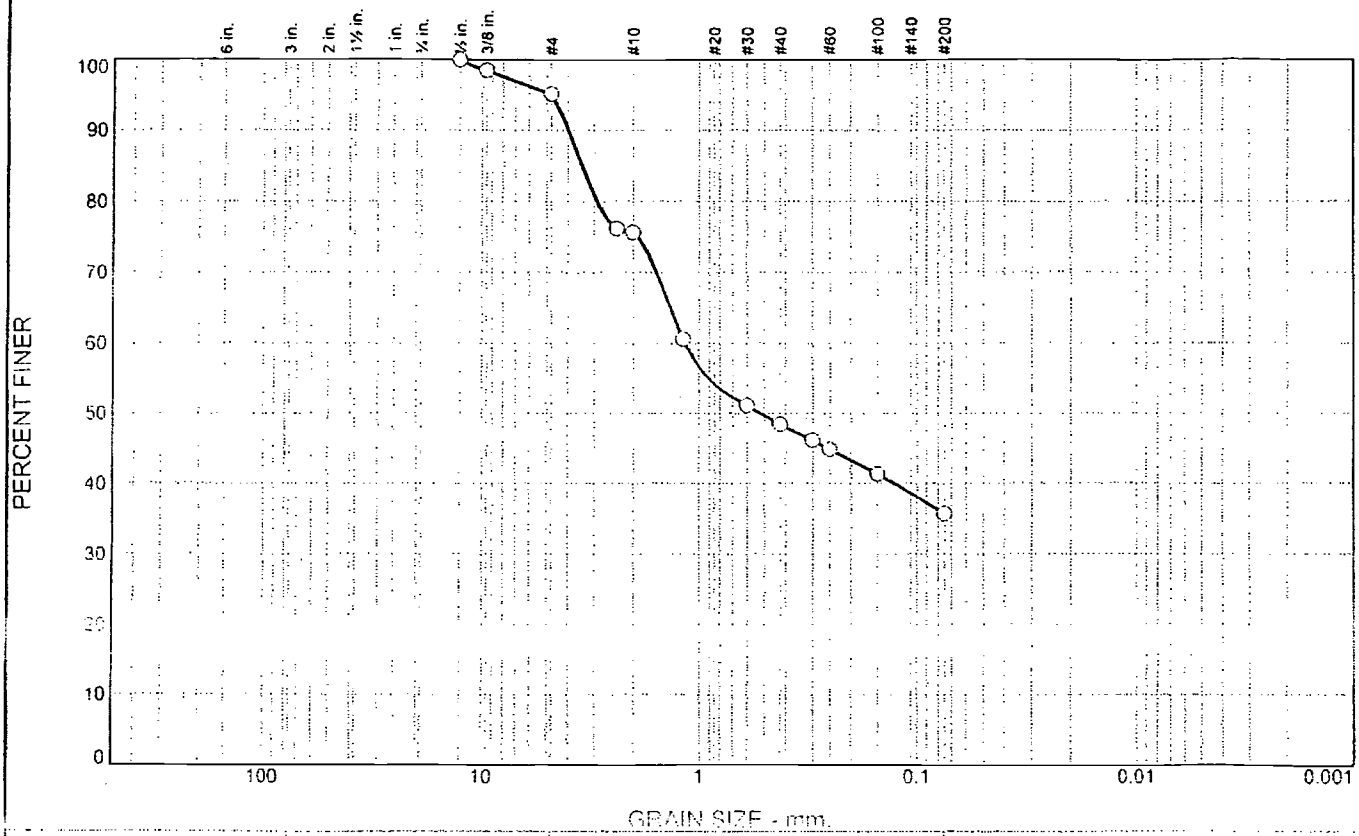
Date: 7/18/08

CGC, Inc.

Client: BT Squared
Project: Indianapolis Power and Light
Project No: C07016-24 **Figure**

Tested By: KJS **Checked By:** DAS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	4.8	19.5	27.3	12.7	35.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.5	100.0		
.375	98.5		
#4	95.2		
#8	76.2		
#10	75.7		
#16	60.6		
#30	51.2		
#40	48.4		
#50	46.2		
#60	44.9		
#100	41.3		
#200	35.7		

* (no specification provided)

Material Description

Gray Silty Fine to Coarse Sand, Trace Gravel (Flyash)

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 3.4093 D_{60}= 1.1553 D_{50}= 0.5192
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Natural Moisture = 24.4%

Sample Number: B7-S8 **Depth:** 24'-26'

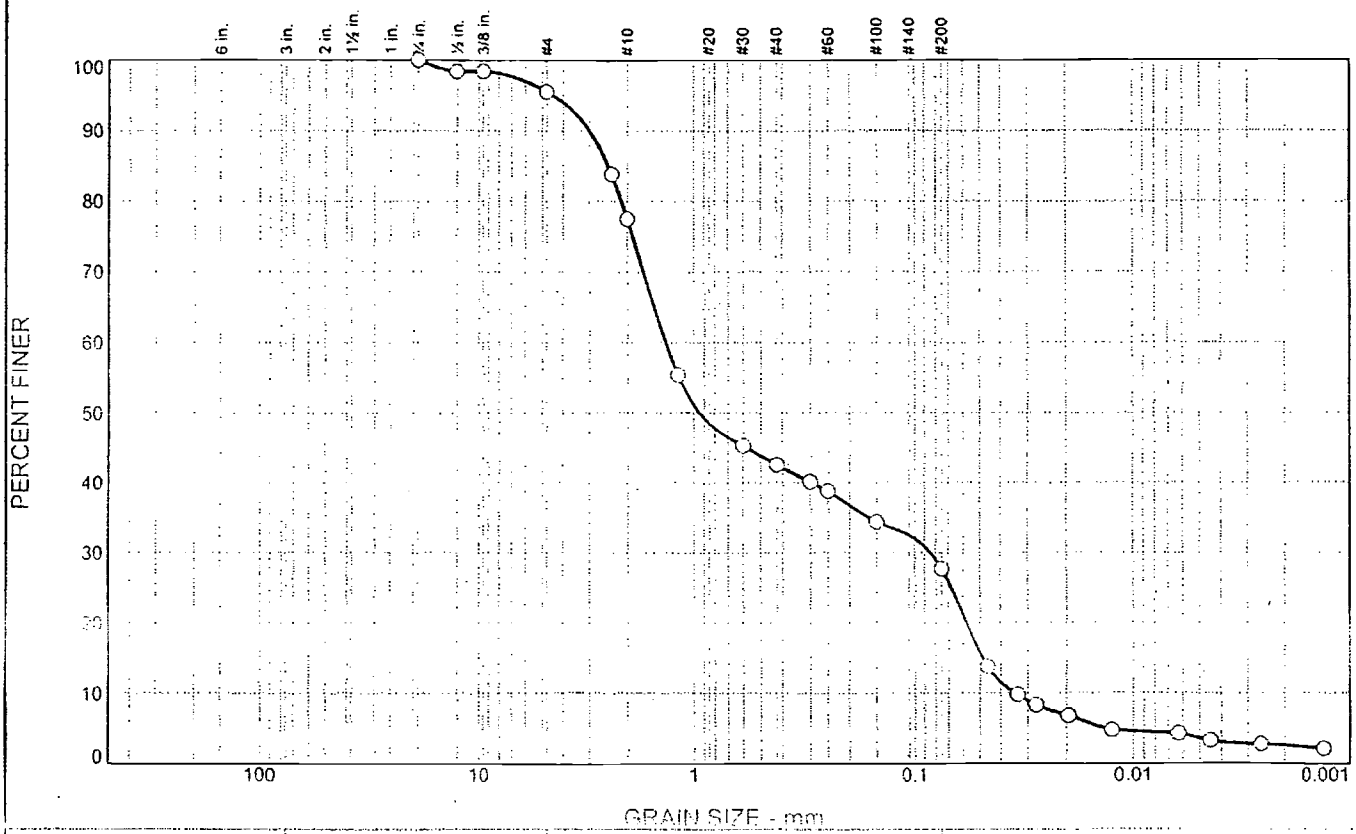
Date: 6/29/08

CGC, Inc.

Client: BT Squared
Project: Indianapolis Power and Light
Project No: C07016-24 **Figure**

Tested By: MAS **Checked By:** DAS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	4.4	18.1	34.9	14.9	24.1	3.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.5	98.4		
.375	98.4		
#4	95.6		
#8	83.8		
#10	77.5		
#16	55.4		
#30	45.3		
#40	42.6		
#50	40.1		
#60	38.8		
#100	34.4		
#200	27.7		

* (no specification provided)

Material Description

Gray Fine to Coarse Sand, Some Silt, Trace Gravel and Clay (Flyash)

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 2.4474 D_{60}= 1.3394 D_{50}= 0.9398
D_{30}= 0.0845 D_{15}= 0.0484 D_{10}= 0.0341
C_u= 39.31 C_c= 0.16

Classification

USCS= SM AASHTO=

Remarks

Natural Moisture = 21.8%

Sample Number: B7-S14 **Depth:** 36'-38'

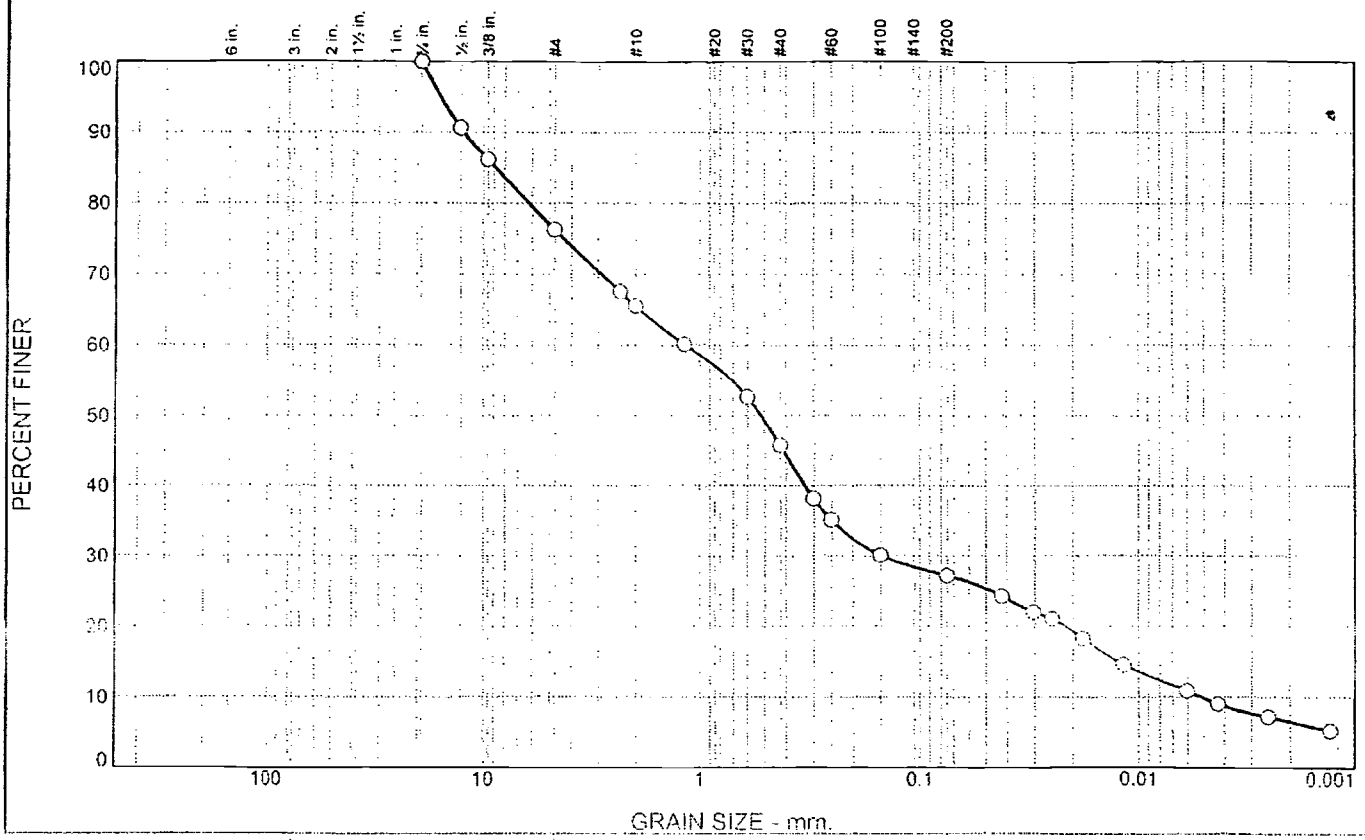
Date: 7/10/08

CGC,Inc.

Client: BT Squared
Project: Indianapolis Power and Light
Project No: C07016-24 **Figure**

Tested By: JSG **Checked By:** DAS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	23.7	10.8	19.7	18.6	17.4	9.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.5	90.7		
.375	86.2		
#4	76.3		
#8	67.5		
#10	65.5		
#16	60.1		
#30	52.7		
#40	45.8		
#50	38.2		
#60	35.2		
#100	30.1		
#200	27.2		

(no specification provided)

Material Description

Brown Fine to Coarse Sand, Some Gravel and Silt, Little Clay

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 8.7517 D_{60}= 1.1611 D_{50}= 0.5179
D_{30}= 0.1468 D_{15}= 0.0124 D_{10}= 0.0051
C_u= 226.19 C_c= 3.61

Classification

USCS= SM AASHTO=

Remarks

Natural Moisture = 10.1%

Sample Number: B7-S16 **Depth:** 40'-42'

Date: 7/10/08

CGC,Inc.

Client: BT Squared
Project: Indianapolis Power and Light
Project No: C07016-24 **Figure**

Tested By: JSG **Checked By:** DAS

QC: JM
QA: KN

Falling Head Permeability Test (ASTM D5084)

Project Name: INDIANAPOLIS POWER & LIGHT
Project #: L07016-24
Sample Name: B2, 18-20'
Visual Descript: Silt (Fly ash)

Cell #: 20
USCS Description: N/A
USCS Classification: N/A
Average Kv = 2.3E-04 cm/sec

Sample Type: Undisturbed

	Initial Values	Final Values
Sample Dia. (in)	2.87	2.95
Sample Ht. (in)	2.30	2.35
Tare & Wet (g)	203.88	445.04
Tare & Dry (g)	180.13	297.89
Tare (g)	11.72	0.00
Sample Wt. (g)	339.89	445.04
Moisture (%)	14.1	49.4
Wet Density (pcf)	87.0	105.6
Dry Density (pcf)	76.3	70.7
Saturation (%)	33.1	100.6

Permeant:	Water
Permeant Specific Gravity:	1.00
Sample Specific Gravity:	2.55 Est.
Confining Pressure (psi):	100.0
Burette Diameter (in):	0.250
Burette Zero (cm):	70.0
Final Sample Condition:	Swelled
Maximum Gradient:	10.4
Average Gradient:	7.2
Max. Effect. Stress (psi):	5.3
Min. Effect. Stress (psi):	4.2
Ave. Effect. Stress (psi):	4.8

	Date			Time		Run	Temp	Pressure (psi)			Chan.		Bot.		Top		Flow	Kv ***	Ave.*
	Yr.	Mo.	Day	Hr.	Min.	Time	C***	Bot	Top	Chan.	Dif.	Bot	Dif.	Top	Dif	Dif %	cm/sec	0,1
1	2008	6	26	15	16.00		0.0	95	95	44.90		3.50		65.50				
2	2008	6	26	15	16.25	15	20.0	95	95	44.90	0.00	8.60	5.10	60.40	5.10	0.0	2.6E-04	
3	2008	6	26	15	16.50	15	20.0	95	95	44.90	0.00	12.60	4.00	56.40	4.00	0.0	2.4E-04	
4	2008	6	26	15	16.75	15	20.0	95	95	44.90	0.00	16.00	3.40	53.00	3.40	0.0	2.4E-04	
5	2008	6	26	15	17.00	15	20.0	95	95	44.90	0.00	18.90	2.90	50.10	2.90	0.0	2.4E-04	
6	2008	6	26	15	17.25	15	20.0	95	95	44.90	0.00	21.50	2.60	47.50	2.60	0.0	2.6E-04	
7	2008	6	26	15	17.50	15	20.0	95	95	44.90	0.00	23.50	2.00	45.50	2.00	0.0	2.4E-04	
8	2008	6	27	14	50.00		0.0	95	95	49.60		5.60		66.20				
9	2008	6	27	14	50.25	15	20.0	95	95	49.60	0.00	10.30	4.70	61.50	4.70	0.0	2.4E-04	
10	2008	6	27	14	50.50	15	20.0	95	95	49.60	0.00	14.20	3.90	57.60	3.90	0.0	2.4E-04	
11	2008	6	27	14	50.75	15	20.0	95	95	49.60	0.00	17.60	3.40	54.20	3.40	0.0	2.6E-04	
12	2008	6	27	14	51.00	15	20.0	95	95	49.60	0.00	20.70	2.90	51.10	2.90	0.0	2.5E-04	
13	2008	6	27	14	51.25	15	20.0	95	95	49.60	0.00	23.10	2.40	48.70	2.40	0.0	2.5E-04	
14	2008	6	27	14	51.50	15	20.0	95	95	49.60	0.00	25.10	2.00	46.70	2.00	0.0	2.4E-04	
15	2008	6	30	13	50.00		0.0	95	95	52.30		4.05		66.60				
16	2008	6	30	13	50.25	15	20.0	95	95	52.30	0.00	8.90	4.85	61.75	4.85	0.0	2.4E-04	
17	2008	6	30	13	50.50	15	20.0	95	95	52.30	0.00	13.20	4.30	57.45	4.30	0.0	2.5E-04	
18	2008	6	30	13	50.75	15	20.0	95	95	52.30	0.00	16.60	3.40	54.05	3.40	0.0	2.4E-04	
19	2008	6	30	13	51.00	15	20.0	95	95	52.30	0.00	19.70	3.10	50.95	3.10	0.0	2.6E-04	
20	2008	6	30	13	51.25	15	20.0	95	95	52.30	0.00	22.10	2.40	48.55	2.40	0.0	2.4E-04	
21	2008	7	1	12	50.00		0.0	95	95	59.00		4.95		66.90				
22	2008	7	1	12	50.25	15	20.0	95	95	59.00	0.00	9.10	4.15	62.75	4.15	0.0	2.1E-04	1
23	2008	7	1	12	50.50	15	20.0	95	95	59.00	0.00	13.10	4.00	58.75	4.00	0.0	2.3E-04	1
24	2008	7	1	12	50.75	15	20.0	95	95	59.00	0.00	16.90	3.80	54.95	3.80	0.0	2.6E-04	1
25	2008	7	1	12	51.00	15	20.0	95	95	59.00	0.00	19.75	2.85	52.10	2.85	0.0	2.3E-04	1
26	2008	7	1	12	51.25	15	20.0	95	95	59.00	0.00	22.20	2.45	49.65	2.45	0.0	2.3E-04	1

** A zero in this column starts a series of measurements.
*Average Kv for those rows with a 1 in the Ave. column. 2.3E-04 cm/sec
(Termination determined by stable Kv and low flow differential.)
***Kv adjusted for temperature.

QC: MP
QA: AJ

Falling Head Permeability Test (ASTM D5084)

Project Name: INDIANAPOLIS POWER & LIGHT
Project #: 07016-24
Sample Name: B2, 44-46'
Visual Descript: Silty clay

Cell #: 21
USCS Description: N/A
USCS Classification: N/A
Average Kv = 8.5E-08 cm/sec

Sample Type: Undisturbed	Initial Values	Final Values		
Sample Dia. (in)	2.85	2.85	Permeant:	Water
Sample Ht. (in)	2.31	2.31	Permeant Specific Gravity:	1.00
Tare & Wet (g)	233.87	755.80	Sample Specific Gravity:	2.70 Est.
Tare & Dry (g)	211.78	658.20	Confining Pressure (psi):	100.0
Tare (g)	117.75	257.57	Burette Diameter (in):	0.250
Sample Wt. (g)	496.30	498.23	Burette Zero (cm):	70.0
Moisture (%)	23.5	24.4	Maximum Gradient:	5.4
Wet Density (pcf)	128.3	128.2	Average Gradient:	4.7
Dry Density (pcf)	103.9	103.1	Max. Effect. Stress (psi):	5.6
Saturation (%)	98.4	100.1	Min. Effect. Stress (psi):	4.5
			Ave. Effect. Stress (psi):	5.0

	Date Yr.	Mo.	Day	Time Hr.	Min.	Run Time	Temp C***	Pressure (psi) Bot	Top	Chamb	Chamb. Dif.	Bot	Bot. Dif.	Top	Top Dif.	Flow Dif.%	Kv *** cm/sec	Ave.* 0,1
1	2008	6	26	6	2.00		0.0	95	95	24.00		3.55		68.45				
2	2008	6	26	7	35.00	5580	20.0	95	95	26.00	2.00	4.15	0.60	67.30	1.15	-31.4	1.1E-07	
3	2008	6	26	9	50.00	8100	19.0	95	95	26.20	0.20	5.25	1.10	66.35	0.95	7.3	9.4E-08	
4	2008	6	26	11	50.00	7200	20.0	95	95	26.10	-0.10	6.25	1.00	65.60	0.75	14.3	9.1E-08	
5	2008	6	26	14	9.00	8340	20.0	95	95	27.40	1.30	7.20	0.95	64.60	1.00	-2.6	9.0E-08	
6	2008	6	27	5	58.00	56940	19.0	95	95	29.75	2.35	13.10	5.90	58.70	5.90	0.0	9.3E-08	
7	2008	6	27	8	30.00	9120	19.0	95	95	29.30	-0.45	14.00	0.90	57.95	0.75	9.1	9.3E-08	
8	2008	6	27	10	43.00	7980	19.0	95	95	30.60	1.30	14.65	0.65	57.30	0.65	0.0	8.7E-08	
9	2008	6	27	12	47.00	7440	19.0	95	95	30.55	-0.05	15.30	0.65	56.65	0.65	0.0	9.6E-08	
10	2008	6	27	14	54.00	7020	19.0	95	95	30.85	0.30	15.00	0.70	56.10	0.55	12.0	9.3E-08	
11	2008	6	30	13	13.00		0.0	95	95	36.00		4.60		63.20				
12	2008	6	30	15	10.50	7020	20.0	95	95	36.30	-0.60	5.70	0.90	64.45	0.85	2.9	9.4E-08	
13	2008	6	30	16	13.00	3780	20.0	95	95	36.50	0.20	6.15	0.45	64.10	0.35	12.5	8.2E-08	
14	2008	7	1	6	55.00	52920	19.0	95	95	36.80	0.30	11.55	5.40	58.75	5.35	0.5	9.0E-08	
15	2008	7	1	9	29.00	9240	19.0	95	95	37.90	1.10	12.40	0.85	58.00	0.75	6.2	8.6E-08	
16	2008	7	1	11	11.00	6120	19.0	95	95	38.30	0.40	12.90	0.50	57.50	0.50	0.0	8.4E-08	
17	2008	7	1	13	13.00	7320	20.0	95	95	38.75	0.45	13.55	0.65	56.90	0.60	4.0	8.8E-08	
18	2008	7	1	15	2.00	6540	20.0	95	95	38.10	-0.65	14.10	0.55	56.30	0.60	-4.3	9.3E-08	
19	2008	7	2	5	21.00	51540	19.0	95	95	38.80	0.70	17.85	3.75	52.55	3.75	0.0	8.8E-08	
20	2008	7	2	7	47.00	8760	19.0	95	95	39.40	0.60	18.50	0.65	52.15	0.40	23.8	8.1E-08	
21	2008	7	2	9	48.00	7260	20.0	95	95	39.60	0.20	18.95	0.45	51.75	0.40	5.9	7.9E-08	
22	2008	7	2	11	47.00	7140	20.0	95	95	40.05	0.45	19.45	0.50	51.35	0.40	11.1	8.8E-08	
23	2008	7	2	14	22.00	9300	20.0	95	95	40.40	0.35	19.95	0.50	50.80	0.55	-4.8	8.1E-08	1
24	2008	7	2	16	20.00	7080	20.0	95	95	39.85	-0.55	20.40	0.45	50.40	0.40	5.9	8.9E-08	1
25	2008	7	3	5	37.00	47820	19.0	95	95	41.20	1.35	22.75	2.35	47.80	2.60	-5.1	8.7E-08	1
26	2008	7	3	8	6.00	8940	19.0	95	95	41.30	0.10	23.25	0.50	47.50	0.30	25.0	8.4E-08	1

**A zero in this column starts a series of measurements.
*Average Kv for those rows with a 1 in the Ave. column. 8.5E-08 cm/sec
(Termination determined by stable Kv and low flow differential.)
***Kv adjusted for temperature.

QC: [illegible]
QA: [illegible]

Falling Head Permeability Test (ASTM D5084)

Project Name: INDIANAPOLIS POWER & LIGHT
Project #: C070016-24
Sample Name: B-5, 26-28'
Visual Descript: Silt (Fly ash)

Cell #: 22
USCS Description: N/A
USCS Classification: N/A
Average Kv = 1.0E-04 cm/sec

Sample Type: Undisturbed	Initial Values	Final Values			
Sample Dia. (in)	2.86	2.89	Permeant:	Water	
Sample Ht. (in)	2.30	2.33	Permeant Specific Gravity:	1.00	
Tare & Wet (g)	220.88	425.95	Sample Specific Gravity:	2.56	Est.
Tare & Dry (g)	194.83	286.83	Confining Pressure (psi):	100.0	
Tare (g)	111.99	0.00	Burette Diameter (in):	0.250	
Sample Wt. (g)	376.90	425.95	Burette Zero (cm):	70.0	
Moisture (%)	31.4	48.5	Maximum Gradient:	10.5	
Wet Density (pcf)	97.2	106.2	Average Gradient:	8.9	
Dry Density (pcf)	73.9	71.5	Max. Effect. Stress (psi):	5.4	
Saturation (%)	69.4	100.6	Min. Effect. Stress (psi):	4.4	
			Ave. Effect. Stress (psi):	4.9	

	Date Yr.	Mo.	Day	Time Hr.	Min.	Run Time	Temp C***	Pressure (psi) Bot	Top	Cham	Cham. Dif.	Bot	Bot. Dif.	Top	Top Dif.	Flow Dif.%	Kv *** cm/sec	Ave.* 0,1
1	2008	6	27	14	55.00		0.0	95	95	37.30		5.80		65.10				
2	2008	6	27	14	55.25	15	20.0	95	95	37.30	0.00	7.90	2.10	63.00	2.10	0.0	1.1E-04	
3	2008	6	27	14	55.50	15	20.0	95	95	37.30	0.00	9.80	1.90	61.10	1.90	0.0	1.1E-04	
4	2008	6	27	14	55.75	15	20.0	95	95	37.30	0.00	11.60	1.80	59.30	1.80	0.0	1.1E-04	
5	2008	6	27	14	56.00	15	20.0	95	95	37.30	0.00	13.10	1.50	57.80	1.50	0.0	9.6E-05	
6	2008	6	27	14	56.25	15	20.0	95	95	37.30	0.00	14.50	1.40	56.40	1.40	0.0	9.5E-05	
7	2008	6	27	14	56.50	15	20.0	95	95	37.30	0.00	16.10	1.60	54.80	1.60	0.0	1.2E-04	
8	2008	6	30	13	16.00		0.0	95	95	44.80		6.05		67.20				
9	2008	6	30	13	16.25	15	20.0	95	95	44.80	0.00	8.10	2.05	65.15	2.05	0.0	1.0E-04	
10	2008	6	30	13	16.50	15	20.0	95	95	44.80	0.00	10.10	2.00	63.15	2.00	0.0	1.0E-04	
11	2008	6	30	13	16.75	15	20.0	95	95	44.80	0.00	12.00	1.90	61.25	1.90	0.0	1.1E-04	
12	2008	6	30	13	17.00	15	20.0	95	95	44.80	0.00	13.40	1.40	59.85	1.40	0.0	8.6E-05	
13	2008	6	30	13	17.25	15	20.0	95	95	44.80	0.00	14.85	1.45	58.40	1.45	0.0	9.5E-05	
14	2008	6	30	13	17.50	15	20.0	95	95	44.80	0.00	16.40	1.55	56.85	1.55	0.0	1.1E-04	
15	2008	7	1	12	49.00		0.0	95	95	46.60		6.05		68.25				
16	2008	7	1	12	49.25	15	20.0	95	95	46.60	0.00	8.20	2.15	66.10	2.15	0.0	1.1E-04	1
17	2008	7	1	12	49.50	15	20.0	95	95	46.60	0.00	10.15	1.95	64.15	1.95	0.0	1.0E-04	1
18	2008	7	1	12	49.75	15	20.0	95	95	46.60	0.00	12.10	1.95	62.20	1.95	0.0	1.1E-04	1
19	2008	7	1	12	50.00	15	20.0	95	95	46.60	0.00	13.70	1.60	60.60	1.60	0.0	9.7E-05	1
20	2008	7	1	12	50.25	15	20.0	95	95	46.60	0.00	15.10	1.40	59.20	1.40	0.0	9.1E-05	1
21																		
22																		
23																		
24																		
25																		
26																		

**A zero in this column starts a series of measurements.
(Termination determined by stable Kv and low flow differential.)

*Average Kv for those rows with a 1 in the Ave. column.

1.0E-04 cm/sec

***Kv adjusted for temperature.

QC: [illegible]
QA: [illegible]

Falling Head Permeability Test (ASTM D5084)

Project Name: INDIANAPOLIS POWER & LIGHT
Project #: C07016-24
Sample Name: B-6, 44-46'
Visual Descript: Silt

Cell #: 23
USCS Description: N/A
USCS Classification: N/A
Average Kv = 1.0E-03 cm/sec

Sample Type: Undisturbed	Initial Values	Final Values			
Sample Dia. (in)	2.86	2.86	Permeant:	Water	
Sample Ht. (in)	2.30	2.30	Permeant Specific Gravity:	1.00	
Tare & Wet (g)	248.69	745.40	Sample Specific Gravity:	2.70	Est.
Tare & Dry (g)	219.23	634.80	Confining Pressure (psi):	100.0	
Tare (g)	118.72	277.27	Burette Diameter (in):	0.250	
Sample Wt. (g)	456.10	468.13	Burette Zero (cm):	70.0	

Moisture (%)	29.3	30.9	Maximum Gradient:	10.6
Wet Density (pcf)	117.6	120.7	Average Gradient:	5.9
Dry Density (pcf)	90.9	92.2	Max. Effect. Stress (psi):	5.4
Saturation (%)	92.8	100.9	Min. Effect. Stress (psi):	4.4
			Ave. Effect. Stress (psi):	4.8

	Date		Time		Run	Temp	Pressure (psi)			Chem.		Bot.		Top	Flow	Kv ***	Ave.*
	Yr.	Mo.	Day	Hr.	Min.	Time	C**	Bot	Top	Cham	Dif.	Bot	Dif.	Top	Dif.	Dif.%	cm/sec	0,1
1	2008	6	27	15	0.00		0.0	95	95	37.80		5.40		63.80				
2	2008	6	27	15	0.17	10	20.0	95	95	37.80	0.00	15.90	10.50	53.30	10.50	0.0	9.8E-04	
3	2008	6	27	15	0.33	10	20.0	95	95	37.80	0.00	22.30	6.40	46.90	6.40	0.0	9.7E-04	
4	2008	6	27	15	0.50	10	20.0	95	95	37.80	0.00	26.50	4.20	42.70	4.20	0.0	9.1E-04	
5	2008	6	30	13	20.00		0.0	95	95	45.50		5.20		66.30				
6	2008	6	30	13	20.17	10	20.0	95	95	45.50	0.00	16.50	11.20	55.10	11.20	0.0	1.0E-03	
7	2008	6	30	13	20.33	10	20.0	95	95	45.50	0.00	23.10	6.60	48.50	6.60	0.0	9.7E-04	
8	2008	6	30	13	20.50	10	20.0	95	95	45.50	0.00	27.30	4.20	44.30	4.20	0.0	8.8E-04	
9	2008	7	1	12	54.00		0.0	95	95	47.60		5.45		67.20				
10	2008	7	1	12	54.17	10	20.0	95	95	47.60	0.00	16.10	10.65	56.55	10.65	0.0	9.5E-04	1
11	2008	7	1	12	54.33	10	20.0	95	95	47.60	0.00	23.80	7.70	48.85	7.70	0.0	1.1E-03	1
12	2008	7	1	12	54.50	10	20.0	95	95	47.60	0.00	28.40	4.60	44.25	4.60	0.0	1.0E-03	1
13																		
14																		
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26																		

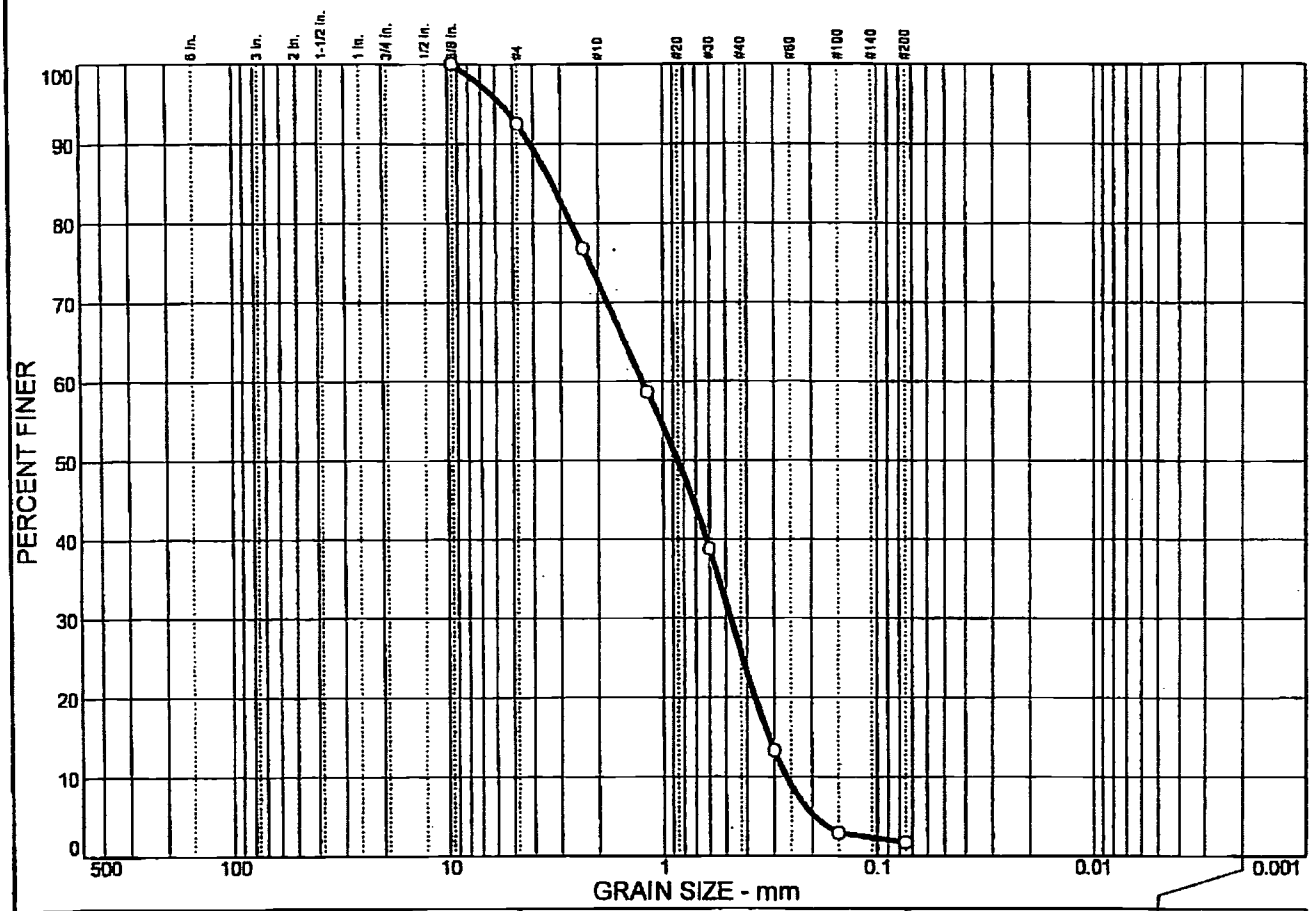
**A zero in this column starts a series of measurements.
(Termination determined by stable Kv and low flow differential.)

*Average Kv for those rows with a 1 in the Ave. column.

1.0E-03 cm/sec

***Kv adjusted for temperature.

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	7.5	90.8	1.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8 in.	100.0		
#4	92.5		
#8	76.8		
#16	58.7		
#30	38.8		
#50	13.3		
#100	2.9		
#200	1.7		

* (no specification provided)

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 3.28 D_{60}= 1.24 D_{50}= 0.854
D_{30}= 0.477 D_{15}= 0.318 D_{10}= 0.263
C_u= 4.71 C_c= 0.70

Classification

USCS= AASHTO=

Remarks

Sample No.: HA; S-3 **Source of Sample:** 1055 **Date:** 07/03/08
Location: **Elev./Depth:** 3.0'-4.0'

ATC ASSOCIATES, INC.

Client: BT2, Inc.
Project: Eagle Valley IPL
Project No: 37640.0001

APPENDIX E

Literature

Fly Ash Shear Strength

THE FLY ASH RESOURCE CENTER

Fly Ash in Soil Stabilization and As An Engineered Construction Material

SOIL STABILIZATION

Class F Fly Ash (from bituminous coal)

This fly ash may be a suitable filler for poorly graded sandy soils where it would aid in compaction and would increase density.

For silts, lime is required 24 hours prior to fly ash addition to reduce soil plasticity and improve its workability. Lime is required to promote the pozzolanic reaction (which produces cementitious products.) Lime reacts with clay minerals and the fly ash.

Class C Fly Ash (self-cementing ash from subbituminous or lignite coal)

Class C fly ash is used to control the swell potential of expansive soils and is used to stabilize coarse-grained soils.

Class C fly ash contains 15-35% total CaO. Most of this CaO, as measured by elemental analysis, exists in the glassy phase. Some of the CaO is present as free lime (0-7 %) which might provide some cation exchange and ion crowding to fine-grained soils (if calcium exists in crystalline phase, it can react with clay minerals) when used in amounts exceeding 20 % by dry weight of soil. Class C fly ash may contain calcium aluminosilicate glass, tricalcium aluminate, free CaO, MgO, CaSO4, alkali sulfates, carbon and magnetite/hematite.

However many class C fly ashes are poor sources of free lime (since most of the CaO is combined in the glassy phase), and thus would do little to reduce soil plasticity. If cementation is a desired attribute, especially for coarse-grained soils, this fly ash may be appropriate since it is self-cementing. To bind the soil particles, it is important not to delay compaction to take full advantage of its self-cementing properties (otherwise one will observe a decrease in density.) Retarders such as sodium borate and sodium citrate have been used to retard the set in order to allow for a delay in compaction. Treatment rates of 10-16 % by oven-dry weight of soil have been used.

See ASTM D 5239, Standard Practice for Characterizing Fly Ash for Use in Soil Stabilization. Class C fly ash should be carefully evaluated for its potential to form expansive compounds within the subgrade resulting in heaving of the pavement. Free CaO that is retained on a 45 um sieve may react after soil compaction. Also expansion might result from delayed formation of ettringite due to the presence of aluminates and sulfates in the soil (fly ash also contributes CaO and sulfates.) Evaluate the soil for its sulfate content and evaluate the fly ash for its free CaO and sulfate content. Evaluate the combination. The SO3 in fly ash should not exceed 10 %. Most of the SO3 in the fly ash is present as calcium sulfate or alkali sulfate. The fly ash supplier must be able to provide a uniform product and should have at least six months of testing history.

Determine the moisture density relationship and immediate bearing value for the untreated soil and for increasing additions of fly ash. The Engineer will determine the optimal and economical fly ash content. The swell potential of the treated soil is often of great importance for modified subgrades.

ENGINEERED CONSTRUCTION MATERIAL

Engineering and Physical Properties of Fly Ash (Class F)

Moisture Content	<1 % for dry ash
	5-40 % for stockpiled ash
	50-110 % for ponded ash
Optimum moisture	13-30% modified proctor
Maximum dry density	75-105 % modified proctor
Specific Gravity	2.2-2.6
Particle size/shape	0.5 to 250 micrometers/spheroidal

Fly ash particles, carried out of the boiler by the exhaust gases, are extremely variable but have some characteristics of interest. The particles are generally less than 250 micrometres in size, spheroidal, have a high mechanical strength, a range of densities from about 3 to less than 0.6, a melting point above 1000°C, low thermal conductivity and are mostly chemically inert.

Density **of a soil is important because it determinesthe load which a structural fill will apply to itself and to its foundation and because it influences the permeability, stiffness and strength of the fill, thus affecting the settlement and ultimate stability. Increased density means increased strength and stiffness and decreased permeability. At a specified density, the soil should have the strength values used in the design of the fill. Each soil is represented by a bell-shaped curve of dry density vs. moisture. Peak of the curve represents the maximun dry density. Particle size of soils vary from gravel size to sand size to silts to clays. Fly ash is in the silt category. Fly ash is rated as**

non-plastic **as defined by liquid and plastic limits.**

The strength of fly ash when used as a fill material will determine the steepness of fill slopes which can safely be constructed and the magnitude of foundation loads it will support. For retaining walls, the *shear strength* of the backfill will determine the load the wall must support. Shear strength is the primary strength parameter used in the design of fly ash embankments and backfills. Shear strength is related to cohesion and the angle of internal friction.*Cohesion* of non self-cementing fly ash is only apparent as cohesion is easily destroyed by complete drying or saturation. *Angle of internal friction* is reported to be 25-40 degrees. For fly ash, the *compression index* is rated as 0.1-0.25 and the *coefficient of permeability* is reported to be 4 x 10-4 to 5 x 10-7 cm/sec.

Engineered Ash Fill Projects:

Title: Ash Recovery Project Manager Company: Duke Energy Corporation BusStr: 400 S. Tryon St. BusCt: CharlotteBusSt BusZip: NC 28201 BusPhone: (704) 382-8991Email: jwnewell@dpcmail.dukepower.comURL: http://www.duke-energy.comInterest: Duke Energy's most successful engineered ash fill project to date was completed in Nov 97.

The

COAL FLY ASH **User Guideline**

Embankment or Fill

INTRODUCTION

Coal fly ash has been successfully used as a structural fill or embankment material for highway construction projects in a number of different locations throughout the United States. Compared with conventional soils used to build embankments, fly ash is somewhat of a unique engineering material. When dry, fly ash is cohesionless and considered by many as a dusty nuisance. When saturated, fly ash becomes an unmanageable mess. But, as with most fine-grained soils, fly ash can be easily handled and compacted at more intermediate moisture contents, and does exhibit some cohesion.

Nearly all of the fly ash used for embankment construction is anthracite or bituminous coal fly ash. Lignite or subbituminous fly ashes, which are usually self-cementing, can harden prematurely when moisture is added, resulting in potential handling problems and inability to achieve the required degree of compaction. Fly ash use as a structural fill or embankment material was pioneered during the 1950's in Great Britain, where it is still bid as an alternate borrow material on roadway fill projects in areas where it is available.

PERFORMANCE RECORD

It has been reported that since 1970 at least 14 states have used fly ash to construct or repair embankments.(1) Fly ash has also been used as a structural backfill material behind retaining walls and bridge abutments. States that have thus far used fly ash as an embankment or structural backfill material include Arizona, Delaware, Illinois, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Ohio, Oklahoma, Pennsylvania, Virginia, West Virginia, and Wisconsin. At least nine states have a specification for the use of fly ash as an embankment material.(1)

Table 5-4 provides a list of the number, estimated size, location, and year of construction of the known fly ash embankment or structural backfill projects that have been built in each of these states. This list, which may not be complete, encompasses at least 21 highway construction projects,(2) involving an estimated 2 million or more cubic yards of fly ash, in some cases mixed with bottom ash.

Although very few of these projects have been monitored for long-term performance, none of the states in which these projects have been constructed have indicated any dissatisfaction or concern with the embankments or backfills constructed using fly ash in their states. Two of the ash embankment projects listed in Table 5-4 (one in Delaware and one in Pennsylvania) were monitored for construction and postconstruction performance over a 3-year time period.(3,4) The monitoring consisted of sampling and analyzing ash physical and engineering characteristics, evaluating ash placement and compaction behavior, collecting and analyzing samples from groundwater monitoring wells, and periodically taking settlement readings from selected locations within each embankment. Neither of these two projects showed any signs of undue settlement or adverse environmental impacts over the 3-year monitoring period.

Table 5-4. List of fly ash embankment or structural backfill projectsconstructed in the United States.

State	No. of Projects	Year Built	Project Location	Estimated Tonnage or Volume
Arizona	1	1980	I-40, Joseph City	47,600 m^3 (61,000 yd^3)
Delaware	2	1987 1992	I-495, Wilmington Route 1, Dover	6,300 m^3 (8,300 yd^3) 237,000 T (262,000 t)

Illinois	1	1972	Waukegan	190,000 m^3 (246,000 yd^3)
Maryland	1	1993	Rt 213, Easton	91,000 T (100,000 t)
Massachusetts	1	1978	Norton	3,800 m^3 (5,000 yd^3)
Michigan	1	1978	Railroad Bridge, Monroe	2,030 m^3 (2,650 yd^3)
Minnesota	2	1971 1978	St. Paul Rt. 13, Eagan	38,000 m^3 (50,000 yd^3)270,000 m^3 (350,000 yd^3)
Missouri	1	1983	ASB Bridge, Kansas City	107,000 m^3 (140,000 yd^3)
Ohio	3	1979 1981 1983	Rt. 7, Powhatan Point I-480, Avon Rt. 35, Gallia Co.	5,200 T (5,700 t) 27,000 T (30,000 t) 24,000 T (27,000 t)
Oklahoma	1	1982	US 62, Muskogee	450 T (500 t)
Pennsylvania	2	1977 1988	Culver Rd., Pittsburgh I-279, Pittsburgh	57,000 m^3 (75,000 yd^3) 321,000 T (353,000 t)
Virginia	1	1978	Rt. 665, Carbo	270 T (300 t)
West Virginia	2	1971 1976	Rt 250, Fairmont Rt. 60/12, Malden	4,500 T (5,000 t) 15,300 m^3 (20,000 yd^3)
Wisconsin	At least 4	1977 1978-90	Airport Spur, Milwaukee Various Projects	109,000 T (120,000 t) 270,000 T (300,000 t)

When used in structural fills or embankments, fly ash offers several advantages over natural soil or rock. Its relatively low unit weight makes it well suited for placement over soft or low bearing strength soils, and its high shear strength, compared with its unit weight, results in good bearing support and minimal settlement. The ease with which fly ash can be placed and compacted, especially when placed at the proper moisture content, can reduce construction time and equipment costs. In areas where fly ash is readily available in bulk quantities, costs for the purchase, permitting, and operation of a borrow pit can be reduced or eliminated.[5]

There are some disadvantages of using fly ash in structural fills or embankments. Unless delivered to the project site within the proper moisture range, dust control measures may be needed. Also, since fly ash is a predominantly silt-size material, it is subject to erosion and, as a result, erosion control procedures may be needed.

MATERIAL PROCESSING REQUIREMENTS

Moisture Control

The only property or characteristic of fly ash that may need to be adjusted or modified before delivery of the ash to the job site is its moisture content. The optimum moisture content of the fly ash to be used must be determined well in advance of starting the project. To achieve the desired degree of compaction in the field, the fly ash being supplied to the job must be delivered to the site as close to its optimum moisture content as possible.

Although specification requirements may vary somewhat from job to job, fly ash for embankment construction should usually be delivered to the job site within 3 to 4 percent of its optimum moisture content, preferably on the dry side of optimum.[3] Dry fly ash from a silo must be water conditioned to the desired moisture content. Conditioned fly ash from a landfill should be excavated from the landfill, stockpiled, and additional moisture added, if needed, prior to delivery. Ponded fly ash must be removed from a lagoon, stockpiled until the moisture content has been sufficiently reduced for placement, then delivered to the job site

Since most lignite or subbituminous fly ashes are self-cementing, the addition of moisture in amounts approaching the optimum moisture content may result in flash setting or sudden hardening of the ash. To prepare this type of fly ash for use as embankment material, the ash may need to be lightly conditioned with water (10 to 15 percent), stockpiled for several weeks, and passed through a crusher to remove agglomerations prior to its use as fill. Additional water, if needed, should be added only after the lignite or subbituminous fly ash has been placed and just prior to compaction.

ENGINEERING PROPERTIES

Some of the engineering properties of fly ash that are of particular interest when fly ash is used as an embankment or fill material are its moisture-density relationship, particle size distribution, shear strength, consolidation characteristics, bearing strength, and permeability. *Moisture-Density Relationship*: Fly ash has a relatively low compacted density, thereby reducing the applied loading and resultant settlement to the supporting subgrade. Conditioned fly ash tailgated over the slope of an embankment can have a loose dry density as low as 650 to 810 kg/m^3 (40 to 50 lb/ft^3). However, when it has been well compacted at an optimum moisture content (usually between 20 and 35 percent), the dry unit weight of fly ash may be greater than 1380 kg/m^3 (85 lb/ft^3), possibly even as high as 1620 kg/m^3 (100 lb/ft^3).

Particle Size Distribution: Fly ash is predominantly a silt-sized nonplastic material. Between 60 and 90 percent of fly ash particles are finer than a 0.075 mm (No. 200) sieve. As such, its particle size distribution falls essentially within the normally recognized limits for frost-susceptible soils.[6] The potential for frost susceptibility of fly ash may account for the reluctance on the part of some geotechnical engineers to use fly ash as a fill material. The fine particle sizing of fly ash, together with the relative uniformity of the gradation in the coarse silt range, makes it imperative that the ash be handled with sufficient water to prevent dusting. Since fine-grained soils can be fairly easily eroded, enough moisture must also be present to support compaction equipment and to permit the material to be well densified, in order to prevent or minimize erodibility.

Shear Strength: Shear strength tests conducted on freshly compacted fly ash samples show that fly ash derives most of its shear strength from internal friction, although some apparent cohesion has been observed in certain bituminous (pozzolanic) fly ashes.[7] The shear strength of fly ash is affected by the density and moisture content of the test sample, with maximum shear strength exhibited at the optimum moisture content.[8] Bituminous fly ash has been determined to have a friction angle that is usually in the range of 26° to 42°. A test program involving shear strength testing for 51 different ash samples resulted in a mean friction angle value of 34°, with a fairly wide range.[9]

Consolidation Characteristics: An embankment or structural backfill should possess low compressibility to minimize roadway settlements or differential settlements between structures and adjacent approaches. Consolidation has been shown to occur more rapidly in compacted fly ash than in silty clay soil because the fly ash has a higher void ratio and greater permeability than the soil. For fly ashes with age-hardening properties, including most "high lime" fly ashes from lignite or subbituminous coals, the age-hardening can reduce the time rate of consolidation, as well as the magnitude of the compressibility.

Bearing Strength: California bearing ratio (CBR) values for "low lime" fly ash from the burning of anthracite or bituminous coals have been found to range from 6.8 to 13.5 percent in the soaked condition (an optional procedure in the test method)[10] to 10.8 to 15.4 percent in the unsoaked condition.[11] For naturally occurring soils, CBR values normally range from 3 to 15 percent for fine-grained materials (silts and clays), from 10 to 40 percent for sand and sandy soils, and from 20 to 80 percent for gravels and gravelly soils.[12]

Permeability: The permeability of well-compacted fly ash has been found to range from 10^{-4} to 10^{-6} cm/s, which is roughly equivalent to the normal range of permeability of a silty sand to silty clay soil.[12] The permeability of a material is affected by its density or degree of compaction, its grain size distribution, and its internal pore structure. Since fly ash consists almost entirely of spherical shaped particles, the particles are able to be densely packed during compaction, resulting in comparatively low permeability values and minimizing seepage of water through a fly ash embankment.

DESIGN CONSIDERATIONS

Virtually any fly ash can be used as an embankment or structural backfill material, including ponded ash that has been reclaimed from an ash lagoon. The principal technical considerations related to the design of a fly ash embankment or structural backfill are essentially the same as the considerations for the design of an earthen embankment or backfill. There are certain special design considerations, however, that should be considered when fly ash is used in embankment or fill applications.

Site Drainage

Fly ash, because of its predominance of silt-size particles, tends to wick water into itself, making it possible that the lower extremities of a fly ash embankment could become saturated, resulting in a loss of shear strength. It is, therefore, important that the base of a fly ash embankment not be exposed to free moisture, wetlands, or the presence of a high water table condition. Adequate provisions should be made to handle maximum flows anticipated from surface waterways, swales, or seepage from springs or high water table conditions.

An effective way to prevent capillary rise or the effects of seepage in fly ash embankments and backfills is the placement of a drainage layer of well-drained granular material at the base of the embankment. An ASTM recommended practice for the use of fly ash in structural fills recommends placement of a drainage layer at a height that is at least 5 feet above the historical high water table.[13]

Slope Stability

To determine a safe and appropriate design slope ratio (the ratio of vertical to horizontal distance), an analysis of the slope stability of a design cross-section of the fly ash embankment must be performed. The basic principle of slope stability analysis is to compare the factors contributing to instability with those resisting failure. The principal resistance to failure is the shear strength of the embankment material. For long-term stability of fly ash embankments, a factor of safety (ratio of the resisting forces to the driving forces along a potential failure surface) of 1.5 is recommended using the Swedish circle method of slope stability analysis.[14] Unless the fly ash is self-hardening, the cohesion (c) value should be zero for these calculations.

Erosion Control Analysis

The slope ratio described above is also a factor in the potential for erodibility of compacted fly ash slopes. These slopes must be protected as soon as possible after attaining final grade because they are subject to severe erosion by runoff, or even high winds, if left unprotected. One way to prevent such erosion is to construct a fly ash embankment within dikes of granular soil, which serve to protect the slopes throughout construction. Another way is to cover the slopes with topsoil as the embankment is being constructed. It is also possible to overfill the slopes and trim the excess fly ash back to the appropriate slope once the final layer is completed. Finally, short-term erosion control may be accomplished by stabilizing the surface fly ash on the slopes with a low percentage of Portland cement or lime,[14] or covering with a blanket of coarse bottom ash.

Soil Bearing Capacity

The ability of the top portion of a fly ash embankment to support a pavement structure can be predicted by a determination of the California Bearing Ratio (CBR) for a flexible asphalt pavement system or by a determination of the modulus of subgrade reaction (K-value) for a rigid or concrete pavement system. These bearing values can then be used to design pavement layer thicknesses in accordance with the AASHTO Design Guide.[15]

Climatic Conditions

Although no frost susceptibility criteria have been established in the United States, the British Road Research Laboratory has developed a test method to evaluate frost susceptibility.[16] The test method involves subjecting a compacted 150 mm (6 in) high specimen to freezing temperatures that simulate

actual field conditions. The test is run over a 250-hour time period, after which the total amount of frost heave of the test specimen is measured. Frost-susceptible materials heave 18 mm (0.7 in) or more after testing.

of the top portion of a fly ash embankment to frost heaving can be substantially increased by the addition of moderate amounts of cement or lime. Objections to the use of compacted fly ash within the frost depth can be overcome by substituting a soil that is not susceptible to frost for fly ash within the frost zone.

During times of heavy or prolonged precipitation, the delivered moisture content of the fly ash may have to be reduced to compensate for the effects of the precipitation. Fly ash, unlike most soils, can usually be compacted throughout much of the winter, although it is recommended that fly ash not be spread and compacted when the ambient air temperature is below -4°C (25°F).[14]

Protection of Underground Pipes and Adjacent Concrete

Chemical and/or electrical resistivity tests of some fly ashes have indicated that certain ash sources may be potentially corrosive to metal pipes placed within an embankment. Each source of fly ash should be individually evaluated for its corrosivity potential. If protection of metal pipes is deemed necessary, the exterior of the pipes may be coated with tar or asphalt cement, the pipes may be wrapped with polyethylene sheeting, or the pipes can be backfilled with sand or an inert material.[14]

The sulfate content of fly ash, particularly self-cementing ash, has caused some concern about the possibility of sulfate attack on adjacent concrete foundations or walls. Precautions that can be taken against potential sulfate attack of concrete include painting concrete faces with tar or an asphalt cement, using a waterproof membrane (such as polyethylene sheeting or tar paper), or possibly even using a Type V sulfate-resistant cement in the adjacent concrete.

CONSTRUCTION PROCEDURES

Material Handling and Storage

Bituminous (pozzolanic) fly ash is usually conditioned with water at the power plant and hauled in covered dump trucks with sealed tailgates. Subbituminous or lignite (self-cementing) fly ash may be partially conditioned at the plant and hauled in covered dump trucks to the project site, or hauled dry in pneumatic tank trucks from the plant to the project site, where it is placed in a silo and conditioned with water when ready for placement.

If a temporary stockpile of fly ash is built at the project site, the surface of the stockpile must be kept damp enough to prevent dusting. The stockpile should be placed in a well-drained area so the ash is not inundated with water following a rainfall.[14] >

Placing and Compacting

The minimum amount of construction equipment needed to properly place and compact fly ash in an embankment or structural backfill includes a bulldozer for spreading the material, a compactor, either a vibrating or pneumatic tired roller, a water truck to provide water for compaction (if needed) and to control dusting, and a motor grader, where final grade control is critical.

The suitability of any proposed construction equipment should be verified by using it on a test strip prior to its use in actual construction. The test strip may also be used to evaluate the specified compaction procedure, as well as any proposed modifications to the procedure. If fly ash from a power plant's landfill or lagoon contains any lumps when spread for compaction, it may be necessary to break down the lumps using a disk harrow or a rotary tiller as a supplemental piece of equipment.[14]

Fly ash should be placed in uniform lifts no thicker than 0.3 m (12 in) when loose. Experience has shown that steel-wheel vibratory compactors and/or pneumatic tired rollers have provided the best performance. If a vibratory roller is used, the first pass should be made with the roller in the static mode

(without any vibration), followed by two passes with the roller in the vibratory mode and traveling relatively fast. Additional passes should be in the vibratory mode at slow speed.[13]

In general, six passes of the roller are usually needed to meet specified compaction requirements. In most cases, 90 to 95 percent of a standard Proctor maximum dry density is the minimum specified density to be achieved. This is almost always achievable when the moisture content of the fly ash is within 2 or 3 percent of optimum, preferably on the dry side of optimum.[17]

For each project, the type of compactor, the moisture content of the fly ash at placement, the lift thickness, and the number of passes of the compaction equipment should be evaluated using a test strip before the actual construction. If a vibratory compactor is to be used, the test strip can be used to evaluate the speed at which the compactor should be operated, the static weight, dynamic force and frequency of vibration of the compactor, and the number of passes required to achieve the specified density.[14]

During periods of moderate rainfall, construction may proceed by reducing the amount of water added at the power plant or jobsite to compensate for precipitation. Dry fly ash can also be mixed into excessively wet fly ash to reduce the moisture content to an acceptable level.

Because fly ash obtained directly from silos or hoppers dissipates heat slowly, fly ash may be placed during cold weather. If frost does penetrate a few inches into the top surface of the fly ash, the ash can be removed from the surface by a bulldozer, or recompacted after thawing and drying.[13] Construction should be suspended during severe weather conditions, such as heavy rainfall, snowstorms, or prolonged and/or excessively cold temperatures. >

Quality Control

Quality control programs for fly ash embankments or structural backfills are similar to such programs for conventional earthwork projects. These programs typically include visual observations of lift thickness, number of compactor passes per lift, and behavior of fly ash under the weight of the compaction equipment, supplemented by laboratory and field testing to confirm that the compacted fly ash has been constructed in accordance with design specifications.[13] >

Special Considerations

Dust Control

If allowed to dry out, fly ash surfaces can be susceptible to dusting. Dust control measures that are routinely used on earthwork projects are effective in minimizing airborne particulates at ash fill projects. Typical controls include hauling fly ash in covered dump trucks (for "low lime") or in pneumatic tankers (for "high lime"), moisture conditioning fly ash at the power plant (especially "low lime"), wetting or covering exposed fly ash surfaces, and sealing the top surface of compacted fly ash by the compactor at the conclusion of each day's placement.[13]

Drainage/Erosion Protection

Fly ash surfaces must be graded or sloped at the end of each working day to provide positive drainage and prevent the ponding of water or the formation of runoff channels that could erode slopes and produce sediment in nearby surface waters. Compacted fly ash slopes must be protected as soon as possible after being finish graded because, if left unprotected, they can be severely eroded. Erosion control on side slopes is usually provided by placing from 150 mm (6 in) to 600 mm (2 ft) of soil cover on the slopes. An alternative approach is to build outside dikes of soil to contain the fly ash as the embankment is being constructed.[14]

UNRESOLVED ISSUES

Since coal fly ash consists of predominantly silt-sized particles, there is sometimes a concern about the

possible frost susceptibility of fly ash as an embankment or structural backfill material, especially in northern climates. Normally, earthen materials that are primarily in the silt grain size range are frost susceptible. However, some fly ashes are frost susceptible while others are not. More testing of fly ashes needs to be done to determine why this is so and to develop a more accurate predictor for frost susceptibility.

Bituminous (pozzolanic) fly ash is more frequently used to construct embankments and structural backfills than subbituminous or lignite (self-cementing) fly ash. This is due in part to the self-cementing characteristics of the latter type, which hardens almost immediately after the addition of water. Current practice is to lightly condition self-cementing fly ashes with water, allow them to stockpile for a period of time, then run the partially hardened fly ash through a primary crusher before taking it to the project site. There is a need to develop more well-defined handling and preconditioning procedures for using self-cementing fly ash as a fill material.

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[Stabilized Base] [Flowable Fill] [Material Description] [Asphalt Concrete] [Portland Cement Concrete]

Geotextile Filter Analysis

landfilldesign.com

Geotextile Filter - Design Calculator

Problem Statement

The function of a geotextile filter is to retain the soil while allowing the liquid to flow as freely as possible. In order to achieve this objective, a geotextile filter needs to meet: (1) **Retention criterion**: the filter opening size must be sufficiently small to retain soil particles. (2) **Permeability criterion**: the filter must be sufficiently permeable to ensure that the liquid flow is as free as possible, and (3) **Porosity criterion**: the filter should remain a high porosity so the probability for clogging is small.

Giroud's filter criteria is used in the calculation. It is recommended that AASHTO M288-96 minimum hydraulic requirements as shown in the table below be also considered in the selection of a geotextiles filter.

Table 1 - **Geotextile Criteria for Subsurface Drainage**
(after AASHTO M288-96)

Filter Criteria	Percent Soil Passing No. 200 (0.075mm) Sieve		
	<15	15 - 50	>50
Minimum Permittivity, ASTM D-4491	0.5 sec^{-1}	0.2 sec^{-1}	0.1 sec^{-1}
Maximum AOS, ASTM D-4751	0.43 mm	0.25 mm	0.22 mm

Retention Criterion

Giroud (2000) uses a linearization of the particle distribution curve that, when plotted with the classical log scale horizontal axis, is as close as possible to the actual particle distribution curve (Figure 1). A least variance approach was used to determine the best linearization of the central portion (Equation 1 & 2). It should be noted in Figure 1 that there is greater uncertainty on the two extremities (d_0 and d_{100}) of the actual particle size distribution. This justifies the use of the linear particle size distribution curve. The result obtained using Giroud's retention criterion is not affected by the truncation of the particle size distribution curve. A coefficient of determination (R2) is calculated to indicate the effectiveness of the linearization (Equation 3).

$m = \frac{n(\Sigma xy)-(\Sigma x)(\Sigma y)}{n(\Sigma(x^2))-(\Sigma x)^2}$	$b = \frac{(\Sigma y)(\Sigma(x^2))-(\Sigma x)(\Sigma xy)}{(\Sigma(x^2))-(\Sigma x)^2}$	$R^2 = \frac{n(\Sigma xy)-(\Sigma x)(\Sigma y)}{\sqrt{[n\Sigma x^2-(\Sigma x)^2][n\Sigma y^2-(\Sigma y)^2]}}$
Eq. 1 - Slope determination by the method of the least squares	Eq. 2 - Intercept determination by the method of the least squares	Eq. 3 - The r-squared value can be interpreted as the proportion of the variance in y attributable, to the variance in x

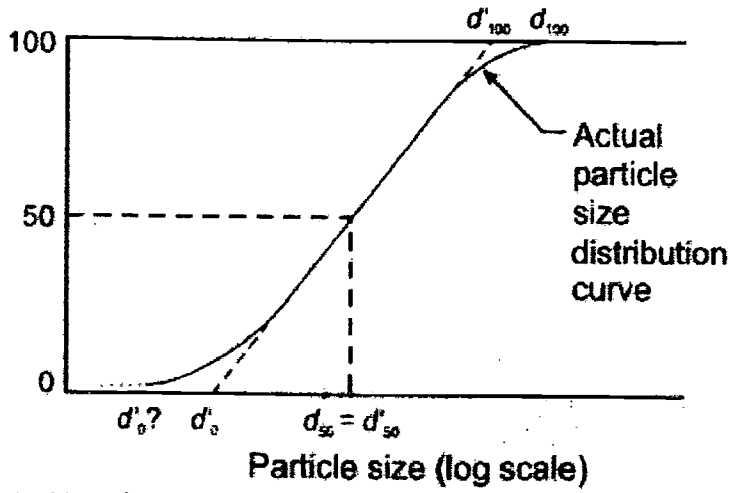

Figure 1 - Linearization of Particle Size Distribution Curve (after Giroud, 2000)

Table 2 - **Retention Criterion for the Hyperstable Case (C'_{cu} = 3) expressed using d'_{85S}**

Soil Density	Density Index (Relative Density) I_D	Relative Compaction (R_C)	Linear coefficient of uniformity of the soil, C'_u	
			$1 \le C'_u \le 3$	$C'_u \ge 3$
loose	$I_D \le 35\%$	$R_C \le 86\%$	$O_F \le (C'_u)^{0.3}\, d'_{85S}$	$O_F \le (9/C'^{1.7}_u)\, d'_{85S}$
medium dense	$35\% < I_D \le 65\%$	$86\% < R_C \le 92\%$	$O_F \le 1.5\, (C'_u)^{0.3}\, d'_{85S}$	$O_F \le (13.5/C'^{1.7}_u)\, d'_{85S}$
dense	$I_D > 65\%$	$R_C > 92\%$	$O_F \le 2\, (C'_u)^{0.3}\, d'_{85S}$	$O_F \le (18/C'^{1.7}_u)\, d'_{85S}$

Table 3 - **Retention Criterion for the Hyperstable Case (C'_{cu} = 3) expressed using d'_{50S}**

Soil Density	Density Index (Relative Density) I_D	Relative Compaction (R_C)	Linear coefficient of uniformity of the soil, C'_u	
			$1 \le C'_u \le 3$	$C'_u \ge 3$
loose	$I_D \le 35\%$	$R_C \le 86\%$	$O_F \le (C'_u)\, d'_{50S}$	$O_F \le (9/C'_u)\, d'_{50S}$
medium dense	$35\% < I_D \le 65\%$	$86\% < R_C \le 92\%$	$O_F \le 1.5\, (C'_u)\, d'_{50S}$	$O_F \le (13.5/C'_u)\, d'_{50S}$
dense	$I_D > 65\%$	$R_C > 92\%$	$O_F \le 2\, (C'_u)\, d'_{50S}$	$O_F \le (18/C'_u)\, d'_{50S}$

where:

C'_u	linear coefficient of uniformity of the soil $= d'_{60S} / d'_{10S}$
I_D	relative density or density index of the soil
d'_{ms}	the particle size such that m% (on the linear particle size distribution curve) of the linear soil particles by mass are smaller than d'_{ms}

R_C relative compaction

O_F maximum filter opening size

Permeability Criteria

$k_f \geq k_s * I_s$ -> against excessive pore water pressure

$k_f \geq k_s$ -> against excessive reduction of flow rate

where:

k_f - Hydraulic conductivity of the geotextile filter

k_s - Hydraulic conductivity of the soil

I_s - Hydraulic gradient in the soil (typical values presented in Table 4)

Table 4 - **Typical Hydraulic Gradients in the Soil in the Vicinity of the Filter**

Application	Typical hydraulic gradient
Ordinary dewatering trench	1
Vertical wall drain	1.5
Pavement edge drain	1
Landfill leachate collection/detection removal system	1
Landfill closure surface water collection removal system	1
Dam toe drains	2
Dam clay cores	3 to 10
Island channel protection	1
Shoreline protection	10
Liquid impoundment with clay liners	>10

Porosity Criteria

$$N_{GTX} > 0.3$$

where N_{GTX} is the porosity of geotextile filter.

There are two mechanisms that are known to cause progressive clogging in a filter: (1) Chemical, biological and biochemical clogging. (2) Accumulation of soil particles on or in the filter.

Input Values

Particle Size Distribution

d_{10}	0.01	mm
d_{20}	0.035	mm

d_{50}	0.4	mm
d_{60}	0.9	mm
d_{85}	6.5	mm
w factor	2	

w Factor

loose	medium dense	dense
1	1.5	2

Geotextile Filter Calculation

References

Giroud, J.P., 2000, "Filter Criteria", in Jubilee Volume 75th Anniversary of K. Terzaghi's Erdbaumechanik (Soil Mechanics), Technical University, Vienna, Austria, Vol 5/2000, Brandl, H., editor.

Giroud, J. P., 1994, "Quantification of Geosynthetics Behavior", Special Lecture, Proceedings of the Fifth International Conference on Geotextiles, Geomembranes and Related Products, Singapore, September 1994, Vol. 4, pp. 1249-1273.

Giroud, J. P., 1988, "Review of Geotextile Filter Criteria", Proceedings of the First Indian Geotextiles Conference, Bombay, India, December 1998, pp. 1-6.

Giroud, J. P., 1982, "Filter Criteria for Geotextiles", Proceedings of the Second International Conference of Geotextiles, Vol. 1, Las Vegas, Nevada, USA, August 1982, pp. 103-108.

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WinStabl

ABSTRACT

This help file is a user manual for the computer program named STABL, developed to handle general slope stability problems by an adaptation of the Modified Bishop Method. The adaptation allows for analysis assuming shear surfaces of general shape. The value of the factor of safety obtained by this limiting equilibrium procedure, although not satisfying complete equilibrium, does compare favorably to more accurate methods, which use considerably more computing time and require evaluation of results for reasonableness.

Critical surface searching options include three which generate trial failure surfaces pseudo-randomly of circular shape, of sliding block character, and of general irregular shape. Data are read from spreadsheet-type input screens and checked for compliance with program requirements. Errors are noted, if compliance is not satisfied. The profile and trial failure surfaces are plotted. Problem capabilities include: general profile definition; ground surface surcharge boundary loads; pore pressures approximately defined with respect to a free water surface, defined as a constant through a zone, related proportionally to the overburden, or defined as a combination of the aforementioned; anisotropic strength definition; and pseudo-static earthquake loadings. Tiebacks and reinforcement layers can also be analyzed. The program also can employ Spencer's method to analyze for both force and moment equilibrium.

INTRODUCTION

WinStabl is a graphics user interface (GUI) for the main STABL engine. STABL is a computer program written in FORTRAN source language for the general solution of slope stability problems by a two-dimensional limiting equilibrium method. The calculation of the factor of safety against instability of a slope is performed by a method of slices. The particular method employed in this version of STABL is an adaptation of the Modified Bishop method. The adaptation of this method allows the analysis of trial failure surfaces other than those of circular shape.

STABL features unique random techniques for general potential failure surfaces for subsequent determination of the more critical surfaces and their corresponding factors of safety. One technique generates circular surfaces; another, surfaces of sliding block character; and a third, more general irregular surfaces of random shape. The means for defining a specific trial failure surface and analyzing it is also provided.

Complications which STABL is programmed to handle include the following: heterogeneous soil systems, anisotropic soil strength properties, excess pore water pressure due to shear, static groundwater and surface water, pseudo-static earthquake loading, surcharge boundary loading, tiebacks and reinforcing layers.

Plotted output is provided as a visual aid to confirm whether the problem input data are correct. STABL-generated error messages pinpoint locations where input data are inconsistent with STABL's input requirements. WinStabl's data input eases the task of preparing data, resulting in a reduction of input errors. This Manual is not intended to explain how STABL functions or what assumptions are made to arrive at a solution. However, it has sometimes been found useful to do so when explanations of the use of certain features of STABL are presented. For a more detailed explanation of the logical operation of STABL and mathematical models employed refer to the JHRP Report by the author, "Computer Analysis of General Slope Stability Problems", JHRP-75-8, June 1975.

APPENDIX F

Slope Stability Analysis

Appendix F

Slope Stability Analysis

A slope stability analysis of the ash berm was performed using the WinStabl program, version 3.00. The WinStabl program was developed to handle general slope stability problems by an adaptation of the Modified Bishop Method.

Inputs in the WinStabl program include the soil profile, isotropic soil parameters, and a piezometric surface.

Safety factors for each scenario were calculated using the Modified Janbu Method.

Scenario 1

Scenario 1 replicates the stability section for the original as-built as prepared by Fuller, Mossbarger, Scott & May (FMSM) Stability Section B-B' in June 2007. This stability section was prepared after the February 2007 Ash Berm failure. The FMSM slope stability used a flyash friction angle of 33°. There is a water elevation in Pond D of 639.5 and a water elevation in Pond E of 611.0. There is a 10-foot seepage face on the downslope face of the berm.

Scenario 2

Scenario 2 replicates the stability section for the Improved Slope Stability profile as prepared by FMSM in June 2007. The FMSM slope stability used a flyash friction angle of 33°. A granular toe berm was added to the original stability section of Scenario 1. There is a water elevation in Pond D of 639.5 and a water elevation in Pond E of 611.0. There is a 10-foot seepage face on the downslope face of the berm.

This Scenario is the basis for the majority of the remaining Scenarios.

Scenario 3

Scenario 3 is identical to Scenario 2, except the flyash friction angle has been reduced to 20°.

Scenario 4

Scenario 4 is identical to Scenario 3, except the seepage face has been removed from the downslope face of the berm.

Scenario 5

Scenario 5 is identical to Scenario 3, except the water level in Pond E has been lowered to elevation 600.0.

Scenario 6

Scenario 6 is identical to Scenario 3, except the flyash friction angle has been increased to 22° to raise the Safety Factor to 1.0.

Scenario 7

Scenario 7 is identical to Scenario 4, except the flyash friction angle has been increased to 21° to raise the Safety Factor to 1.0.

Scenario 8

Scenario 8 is identical to Scenario 6, except the toe drain has been extended 20 feet into Pond E and the thickness of the toe drain on the slope has been increased from 5 feet to 10 feet. The height of the toe drain is 10 feet.

Scenario 9

Scenario 9 is identical to Scenario 6, except the width of the berm has been increased to 50 feet and the toe drain has been extended 20 feet into Pond E. The height of the toe drain is 10 feet. The flyash friction angle is 21°.

Scenario 10

Scenario 10 is identical to Scenario 6, except the toe drain has been extended 50 feet into Pond E and the thickness of the toe drain on the slope has been increased from 5 feet to 10 feet. The height of the toe drain is 10 feet. The flyash friction angle is 21°.

Scenario 11

Scenario 11 represents the current configuration of dikes in Pond D.

Scenario 12

Scenario 12 is identical to Scenario 11 except that a 5-foot thick toe berm has been added on the downstream slope.

Scenario 13

Scenario 13 is identical to Scenario 12 except that the pond level has been lowered to elevation 630.

Scenario 14

Scenario 14 represents the current configuration of dikes in Pond E.

Scenario 15

Scenario 15 is identical to Scenario 14 except that a 5-foot thick toe berm has been added on the downstream slope.

Scenario 16

Scenario 16 is identical to Scenario 15 except that the pond level has been lowered to elevation 620.

KRG/DLN
I:\3573\Stability Summary Report.doc

Stability Analysis Summary

Ash Pond Dike
Eagle Valley Generating Station
Martinsville, Indiana
BT^2 Project # 3573

Scenario	Top Elevation	Top Width	Fly Ash Friction Angle	Toe Drain	Pond E Water Elevation	Seepage Face	Safety Factor
1 - FMSM Profile	642	20	33	No	611	Yes	0.92
2 - FMSM Profile with toe drain	642	20	33	Yes	611	Yes	1.41
3 - FMSM Profile with toe drain	642	20	20	Yes	611	Yes	0.91
4 - FMSM Profile with toe drain	642	20	20	Yes	611	No	0.96
5 - FMSM Profile with toe drain	642	20	20	Yes	600	No	0.98
6 - FMSM Profile with toe drain	642	20	22	Yes	611	Yes	1.01
7 - FMSM Profile with toe drain	642	20	21	Yes	611	No	0.99
8 - Toe Drain Extended 20 ft	642	20	21	Yes -extended 20 ft and thickened on slope	611	Yes	1.54
9 - 50 ft berm and extended Toe Drain	642	50	21	Yes -extended 20 ft	611	Yes	1.54
10 - Toe Drain Extended 50 ft	642	20	21	Yes -extended 50 ft and thickened on slope	611	Yes	1.95
11 - Dike D	642	20	21	No	639.5 (Pond D)	No	0.79
12 - Dike D - with Toe Drain	642	20	21	Yes	639.5 (Pond D)	No	1.14
13 - Dike D - with Toe Drain and Lower Water	642	20	21	Yes	630 (Pond D)	No	1.37
14 - Dike E	633	20	21	No	629 (Pond E)	No	0.87
15 - Dike E - with Toe Drain	633	20	21	Yes	629 (Pond E)	No	1.38
16 - Dike E - with Toe Drain and Lower Water	633	20	21	Yes	620 (Pond E)	No	1.57

KRG/DN
08/04/08
I:\3573\Tables-General\[Stability summary 2.xls]Sheet2

BT² inc.

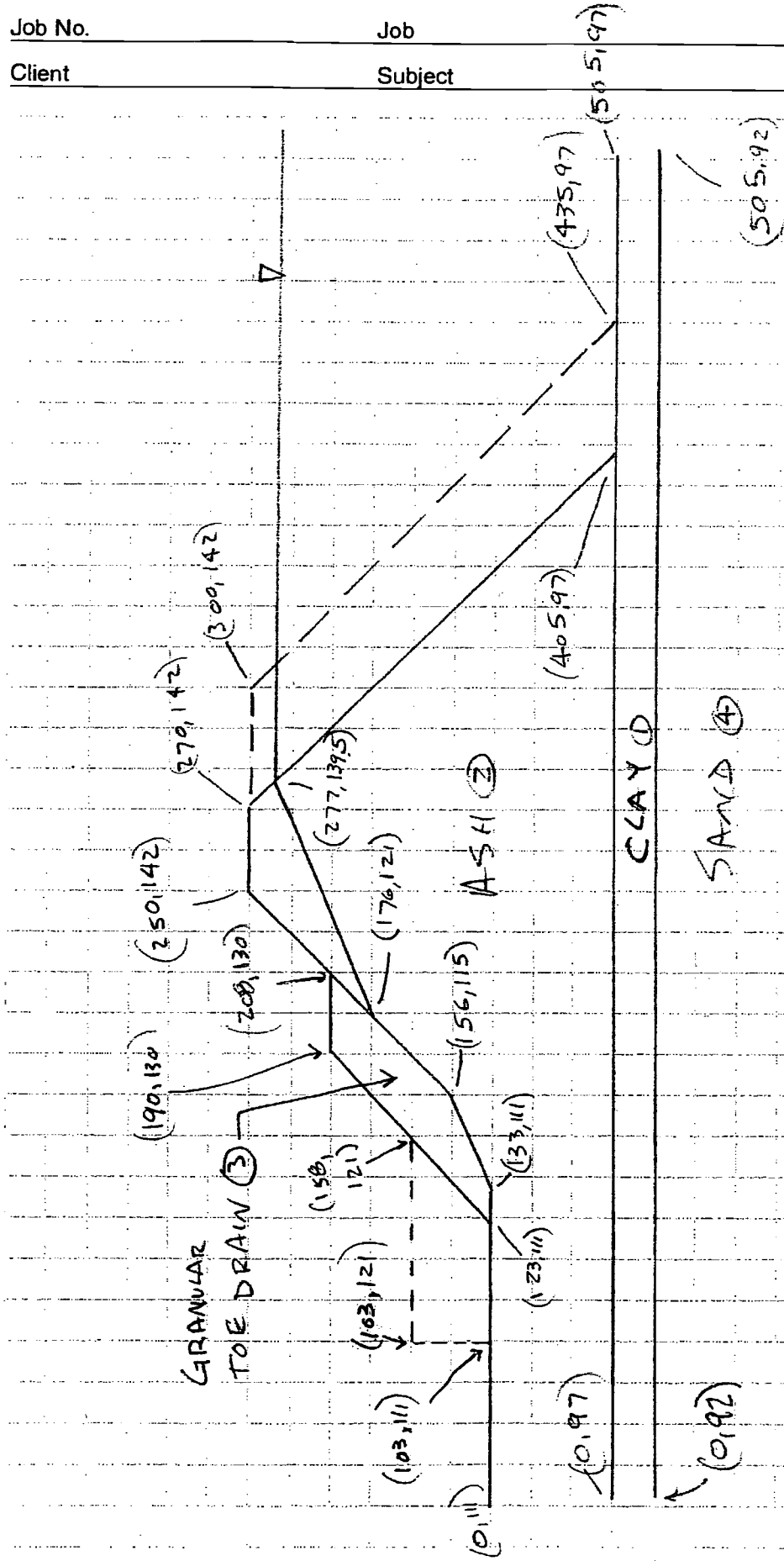
Sheet No.

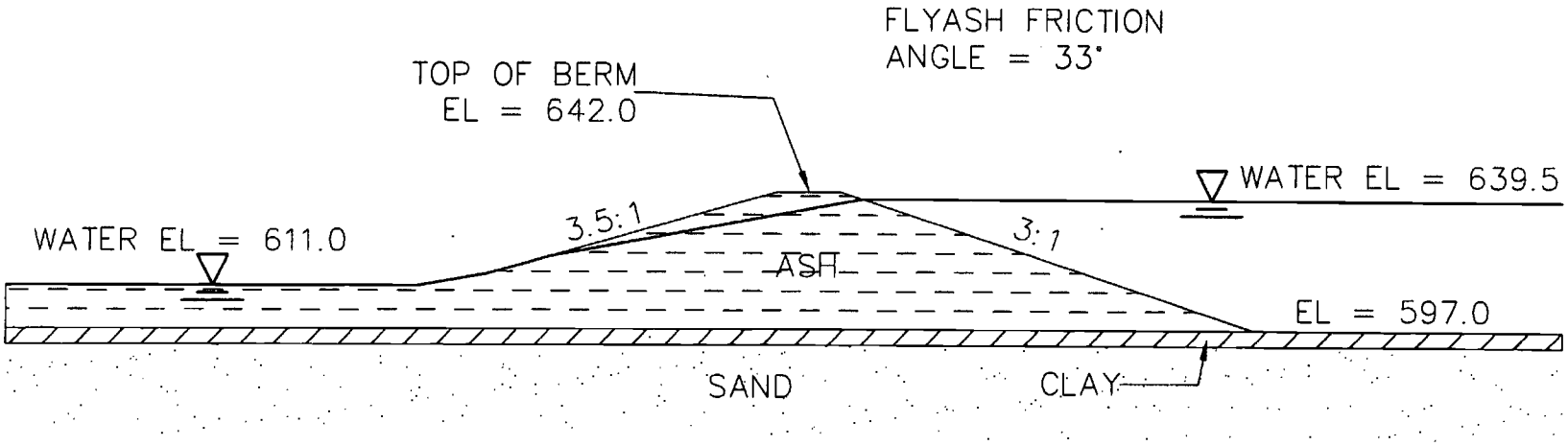
Calc. No.

Rev. No.

Job No. | Job | By | Date

Client | Subject | Chk'd. | Date




FLYASH FRICTION
ANGLE = 33°
TOP OF BERM
EL = 642.0
WATER EL = 639.5
WATER EL = 611.0
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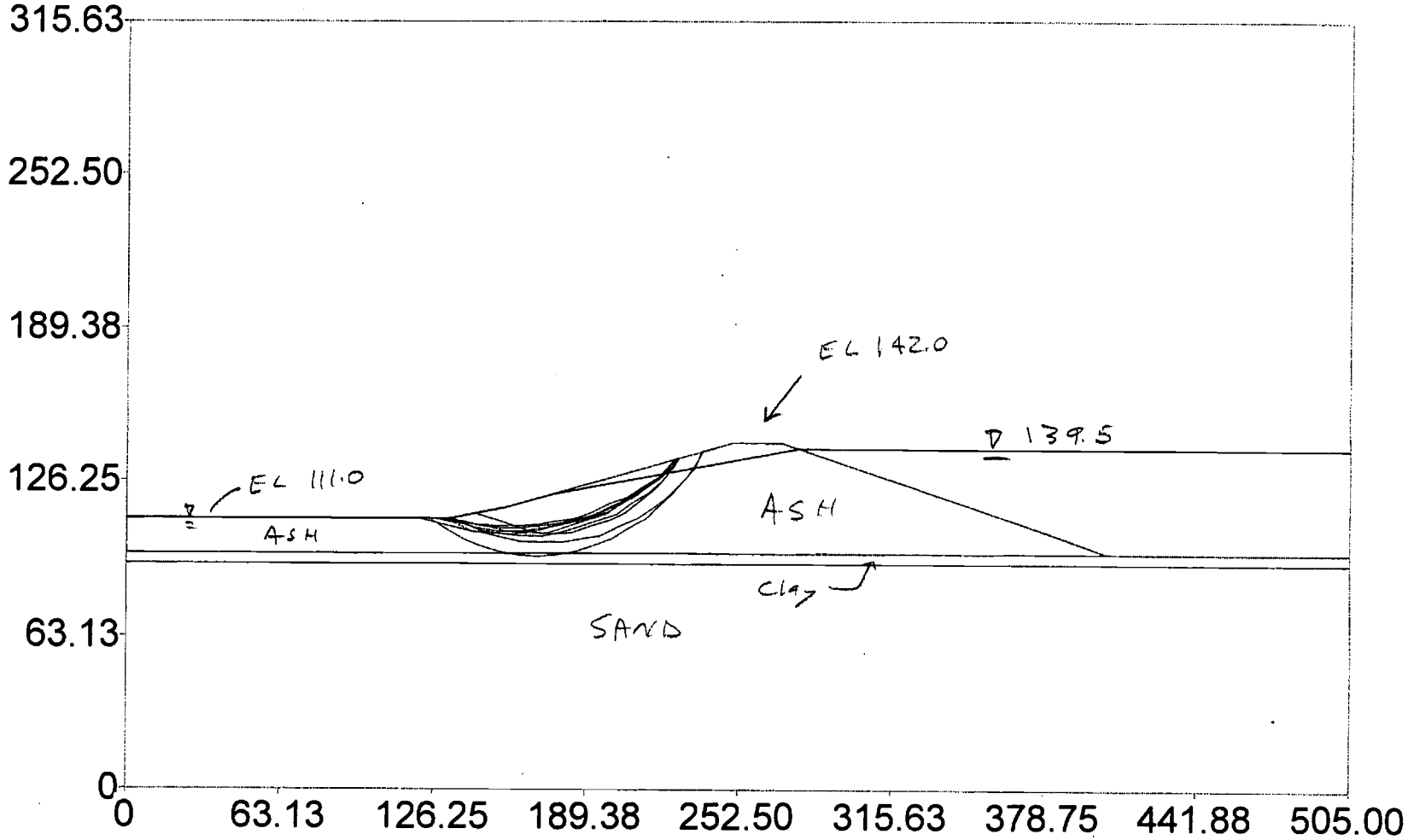
3:1
ASH
EL = 597.0
SAND
CLAY

SCENARIO 1

1

Indianpolis Power and Light - FMSM Profile



Safety Factor
0.92
0.92
0.92
0.93
0.93
0.94
0.94
0.95
0.96
0.96

Profile.out
** PCSTABL6 **

by
Purdue University

modified by
Peter J. Bosscher
University of Wisconsin-Madison

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

PROBLEM DESCRIPTION Indianpolis Power and Light - FMSM Profi
le

BOUNDARY COORDINATES

6 Top Boundaries
8 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	111.00	133.00	111.00	2
2	133.00	111.00	156.00	115.00	2
3	156.00	115.00	250.00	142.00	2
4	250.00	142.00	270.00	142.00	2
5	270.00	142.00	405.00	97.00	2
6	405.00	97.00	505.00	97.00	1
7	0.00	97.00	405.00	97.00	1
8	0.00	92.00	505.00	92.00	3

ISOTROPIC SOIL PARAMETERS

3 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	50.0	25.0	0.00	0.0	1
2	90.0	90.0	0.0	33.0	0.00	0.0	1
3	120.0	120.0	0.0	31.0	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 6 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	111.00
2	133.00	111.00
3	156.00	115.00
4	176.00	121.00
5	277.00	139.50
6	505.00	139.50

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

1000 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of100 Points Equally Spaced Along The Ground Surface Between X = 0.00 ft.
and X = 160.00 ft.

Each Surface Terminates Between X = 225.00 ft.
and X = 300.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 0.00 ft.

8.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)

1	127.68	111.00
2	135.21	108.29
3	142.95	106.30
4	150.85	105.04
5	158.84	104.52
6	166.83	104.75
7	174.77	105.72
8	182.59	107.42
9	190.21	109.85
10	197.58	112.98
11	204.62	116.78
12	211.27	121.22
13	217.48	126.26
14	223.20	131.86
15	225.92	135.08

*** 0.919 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	132.53	111.00
2	140.19	108.72
3	148.04	107.14
4	155.99	106.27
5	163.99	106.13
6	171.97	106.72
7	179.86	108.02
8	187.60	110.03
9	195.13	112.73
10	202.39	116.10
11	209.31	120.12
12	215.84	124.74
13	221.92	129.94
14	227.34	135.49

*** 0.920 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	129.29	111.00
2	136.94	108.65
3	144.76	106.98
4	152.70	105.99
5	160.70	105.69
6	168.69	106.08
7	176.61	107.17
8	184.42	108.94
9	192.04	111.37
10	199.42	114.46

11	206.50	118.17
12	213.24	122.49
13	219.58	127.37
14	225.47	132.78
15	228.17	135.73

*** 0.924 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	132.53	111.00
2	139.97	108.06
3	147.67	105.89
4	155.55	104.51
5	163.52	103.92
6	171.52	104.15
7	179.45	105.18
8	187.24	107.01
9	194.81	109.61
10	202.07	112.96
11	208.96	117.03
12	215.40	121.77
13	221.34	127.14
14	226.70	133.08
15	228.77	135.90

*** 0.925 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	130.91	111.00
2	138.63	108.90
3	146.50	107.46
4	154.46	106.67
5	162.46	106.56
6	170.44	107.12
7	178.34	108.34
8	186.12	110.22
9	193.71	112.75
10	201.06	115.90
11	208.13	119.66
12	214.85	124.00
13	221.19	128.88
14	227.09	134.28
15	228.54	135.83

*** 0.928 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	129.29	111.00
2	137.09	109.19
3	144.99	107.98
4	152.97	107.38
5	160.97	107.39
6	168.95	108.01
7	176.85	109.24
8	184.64	111.07
9	192.26	113.49
10	199.68	116.49
11	206.85	120.04
12	213.72	124.13
13	220.26	128.74
14	226.43	133.83
15	228.50	135.82

*** 0.936 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	121.21	111.00
2	128.82	108.54
3	136.61	106.69
4	144.52	105.49
5	152.50	104.93
6	160.50	105.02
7	168.46	105.75
8	176.34	107.13
9	184.09	109.14
10	191.64	111.77
11	198.96	115.00
12	205.99	118.82
13	212.69	123.19
14	219.02	128.09
15	224.92	133.48
16	226.60	135.28

*** 0.939 ***

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)

1	145.46	113.17
2	152.61	109.59
3	160.18	107.01
4	168.03	105.46
5	176.02	104.99
6	184.00	105.59
7	191.82	107.25
8	199.35	109.95
9	206.45	113.64
10	212.99	118.25
11	218.85	123.69
12	223.93	129.87
13	227.42	135.51

*** 0.949 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	134.14	111.20
2	141.24	107.51
3	148.69	104.58
4	156.40	102.46
5	164.29	101.15
6	172.28	100.69
7	180.27	101.06
8	188.18	102.28
9	195.91	104.32
10	203.39	107.16
11	210.53	110.77
12	217.25	115.11
13	223.48	120.13
14	229.14	125.78
15	234.18	131.99
16	238.54	138.70
17	238.54	138.71

*** 0.962 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	124.45	111.00
2	131.13	106.60
3	138.24	102.93
4	145.69	100.04
5	153.41	97.94
6	161.31	96.67
7	169.30	96.24
8	177.29	96.66
9	185.19	97.92

10	192.92	100.00
11	200.38	102.89
12	207.49	106.55
13	214.18	110.94
14	220.37	116.01
15	225.99	121.71
16	230.97	127.96
17	235.27	134.71
18	237.05	138.28

*** 0.963 ***

```
            Y            A     X     I     S            F     T

            0.00     63.13    126.25    189.38    252.50    315.63

X       0.00 +---------+----*--*-+---------+---------+---------+
             -               ...
             -             .....
             -            ......
             -           .......
             -           .......
        63.13 +          ........
             -         .........
             -        ..........
             -        ..........
             -        ..........
             -       ...........
A     126.25 +       .........71
             -       ........01*
             -       ........018
             -       .......091*
             -        ......041..
             -        ......091.W
X     189.38 +        .......913.
             -         ......041..
             -         .......0815
             -          .......9911
             -          .........923
             -           ..........9
I     252.50 +            .........*
             -             .........
             -              .......*
             -                ......
             -                  ...
             -                    .
S     315.63 +
             -
             -
             -
             -
             -
      378.75 +
             -
             -              *
             -
             -
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F     441.88 +
                  -
                  -
                  -
                  -
                  -
T     505.00 +                 *       W
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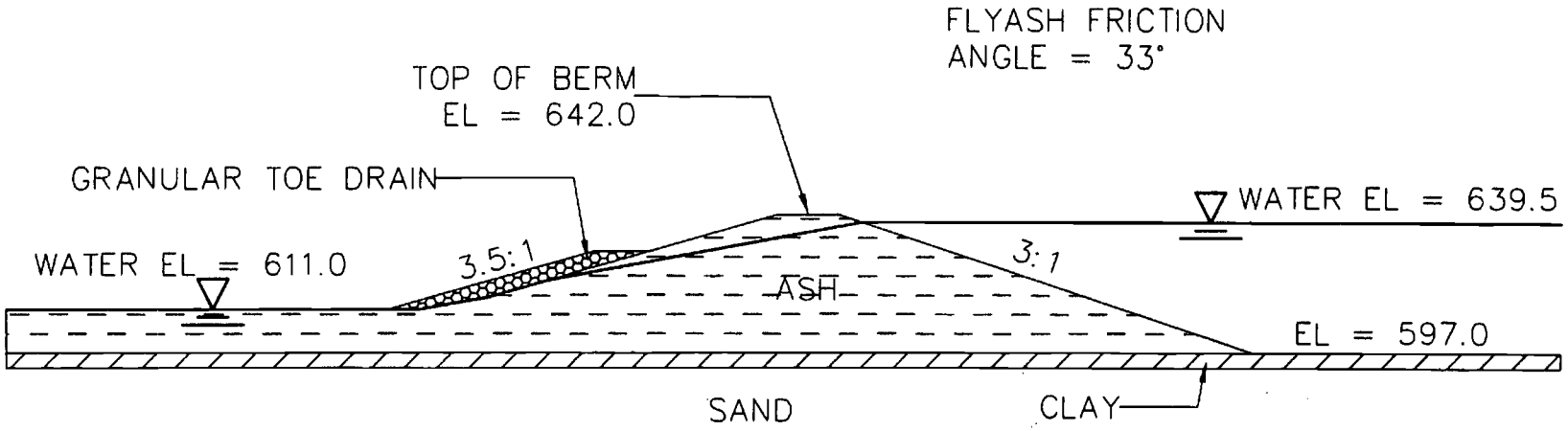

SCENARIO 2

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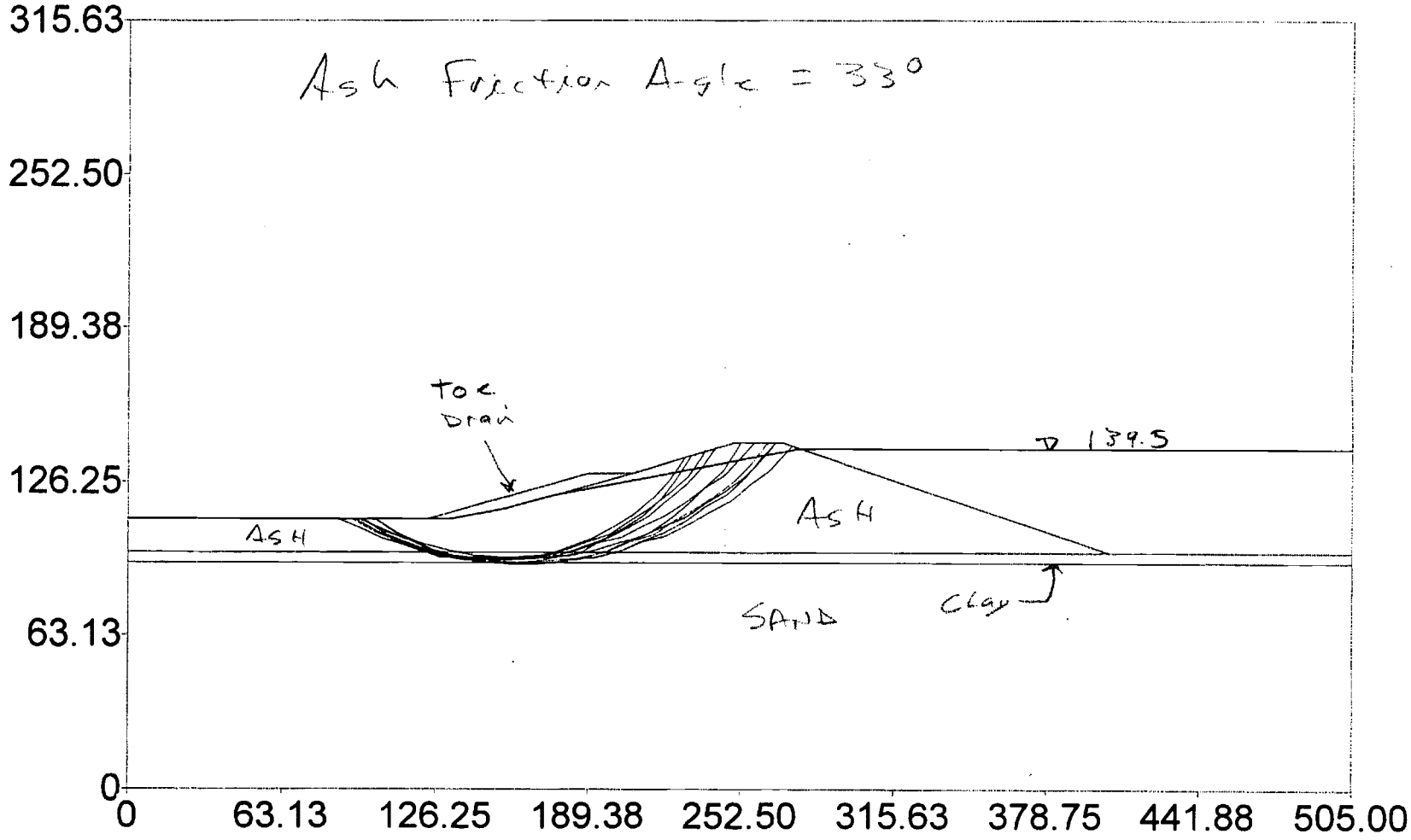
(2)

FMSM Profile with Toe Drain



Safety Factor
1.41
1.41
1.44
1.44
1.45
1.45
1.45
1.45
1.46
1.46

Profile.out
** PCSTABL6 **

by
Purdue University

modified by
Peter J. Bosscher
University of Wisconsin-Madison

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

PROBLEM DESCRIPTION FMSM Profile with Toe Drain

BOUNDARY COORDINATES

7 Top Boundaries
12 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	111.00	123.00	111.00	2
2	123.00	111.00	190.00	130.00	3
3	190.00	130.00	208.00	130.00	3
4	208.00	130.00	250.00	142.00	2
5	250.00	142.00	270.00	142.00	2
6	270.00	142.00	405.00	97.00	2
7	405.00	97.00	505.00	97.00	1
8	123.00	111.00	133.00	111.00	2
9	133.00	111.00	156.00	115.00	2
10	156.00	115.00	208.00	130.00	2
11	0.00	97.00	405.00	97.00	1
12	0.00	92.00	505.00	92.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.

1	125.0	125.0	50.0	25.0	0.00	0.0	1
2	90.0	90.0	0.0	33.0	0.00	0.0	1
3	140.0	140.0	0.0	35.0	0.00	0.0	1
4	120.0	120.0	0.0	31.0	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 6 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	111.00
2	133.00	111.00
3	156.00	115.00
4	176.00	121.00
5	277.00	139.50
6	505.00	139.50

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

1000 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of100 Points Equally Spaced Along The Ground Surface Between X = 0.00 ft.
and X = 160.00 ft.

Each Surface Terminates Between X = 225.00 ft.
and X = 300.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 0.00 ft.

10.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	92.12	111.00
2	100.92	106.25
3	110.05	102.16
4	119.45	98.76
5	129.09	96.08
6	138.89	94.12
7	148.82	92.90
8	158.80	92.42
9	168.80	92.68
10	178.75	93.69
11	188.60	95.44
12	198.28	97.92
13	207.76	101.11
14	216.97	105.00
15	225.87	109.56
16	234.41	114.78
17	242.53	120.61
18	250.19	127.04
19	257.35	134.01
20	263.98	141.51
21	264.35	142.00

*** 1.413 ***

Failure Surface Specified By 20 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	96.97	111.00
2	105.71	106.15
3	114.80	101.98
4	124.19	98.52
5	133.81	95.80
6	143.61	93.82
7	153.54	92.60
8	163.53	92.14
9	173.52	92.45
10	183.46	93.53
11	193.29	95.37
12	202.95	97.96
13	212.38	101.28
14	221.53	105.32
15	230.35	110.04
16	238.77	115.43
17	246.75	121.45
18	254.25	128.07
19	261.22	135.24
20	266.86	142.00

*** 1.414 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	92.12	111.00
2	100.73	105.91
3	109.76	101.62
4	119.14	98.16
5	128.80	95.57
6	138.66	93.86
7	148.62	93.06
8	158.62	93.16
9	168.57	94.17
10	178.39	96.07
11	187.99	98.86
12	197.30	102.50
13	206.25	106.98
14	214.75	112.25
15	222.74	118.26
16	230.15	124.98
17	236.92	132.33
18	242.72	139.92

*** 1.440 ***

Failure Surface Specified By 20 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	87.27	111.00
2	96.25	106.59
3	105.51	102.82
4	115.02	99.74
5	124.73	97.33
6	134.58	95.63
7	144.54	94.64
8	154.53	94.37
9	164.52	94.80
10	174.46	95.96
11	184.28	97.81
12	193.95	100.37
13	203.41	103.61
14	212.61	107.52
15	221.51	112.08
16	230.07	117.26
17	238.22	123.05
18	245.95	129.40
19	253.20	136.28
20	258.42	142.00

*** 1.443 ***

Failure Surface Specified By 20 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	95.35	111.00
2	104.36	106.65
3	113.65	102.95
4	123.18	99.91
5	132.89	97.54
6	142.75	95.87
7	152.70	94.88
8	162.70	94.60
9	172.69	95.03
10	182.63	96.15
11	192.46	97.97
12	202.14	100.47
13	211.62	103.65
14	220.86	107.48
15	229.80	111.96
16	238.41	117.05
17	246.64	122.73
18	254.45	128.98
19	261.80	135.76
20	267.68	142.00

*** 1.448 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	96.97	111.00
2	105.39	105.60
3	114.34	101.14
4	123.71	97.65
5	133.40	95.19
6	143.30	93.78
7	153.30	93.44
8	163.27	94.17
9	173.11	95.97
10	182.70	98.80
11	191.93	102.65
12	200.70	107.46
13	208.90	113.18
14	216.44	119.74
15	223.24	127.08
16	229.21	135.10
17	229.89	136.25

*** 1.452 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	93.74	111.00
2	102.40	106.01
3	111.49	101.84
4	120.93	98.53
5	130.63	96.12
6	140.52	94.62
7	150.50	94.04
8	160.50	94.39
9	170.41	95.67
10	180.17	97.87
11	189.68	100.96
12	198.86	104.93
13	207.63	109.73
14	215.92	115.32
15	223.66	121.66
16	230.77	128.69
17	237.19	136.35
18	238.91	138.83

*** 1.453 ***

Failure Surface Specified By 22 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	87.27	111.00
2	96.18	106.46
3	105.37	102.51
4	114.79	99.16
5	124.41	96.43
6	134.19	94.33
7	144.08	92.88
8	154.05	92.06
9	164.05	91.90
10	174.04	92.39
11	183.97	93.53
12	193.81	95.31
13	203.52	97.72
14	213.04	100.76
15	222.35	104.42
16	231.40	108.67
17	240.16	113.50
18	248.58	118.89
19	256.64	124.81
20	264.29	131.25
21	271.51	138.17
22	273.85	140.72

*** 1.454 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	101.82	111.00
2	110.24	105.61
3	119.13	101.04
4	128.42	97.33
5	138.02	94.51
6	147.84	92.62
7	157.79	91.67
8	167.79	91.67
9	177.75	92.61
10	187.57	94.49
11	197.17	97.30
12	206.46	101.00
13	215.35	105.56
14	223.78	110.95
15	231.66	117.11
16	238.91	123.99
17	245.49	131.53
18	251.32	139.65
19	252.69	142.00

*** 1.458 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	101.82	111.00
2	109.97	105.20
3	118.73	100.38
4	127.98	96.60
5	137.61	93.90
6	147.49	92.32
7	157.48	91.89
8	167.45	92.60
9	177.28	94.46
10	186.83	97.43
11	195.97	101.47
12	204.59	106.54
13	212.57	112.57
14	219.81	119.47
15	226.21	127.15
16	231.69	135.52
17	232.41	136.98

*** 1.461 ***

Y A X I S F T

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                0.00      63.13     126.25     189.38     252.50     315.63
X        0.00 +---------+----*--*-+---------+---------+---------+
              -              ....
              -             .....
              -            ......
              -            ......
              -          ........
         63.13 +          ........
              -         .........
              -        .........4
              -        ........41
              -        .......119
              -       ........1..
A       126.25 +       .......12.*
              -       .......1..*
              -       .......1....
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              -       .......1....
              -        ......16..W.
X       189.38 +        ......13....*
              -        ......816...
              -         ......133..*
              -          ......1436.
              -           .....214366
              -           ......21433
I       252.50 +            ......811*
              -             .......21
              -               ......*
              -                ......
              -                  ...
              -                    .
S       315.63 +
              -
              -
              -
              -
              -
        378.75 +
              -
              -              *
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              -
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F       441.88 +
              -
              -
              -
              -
              -
T       505.00 +              *      W
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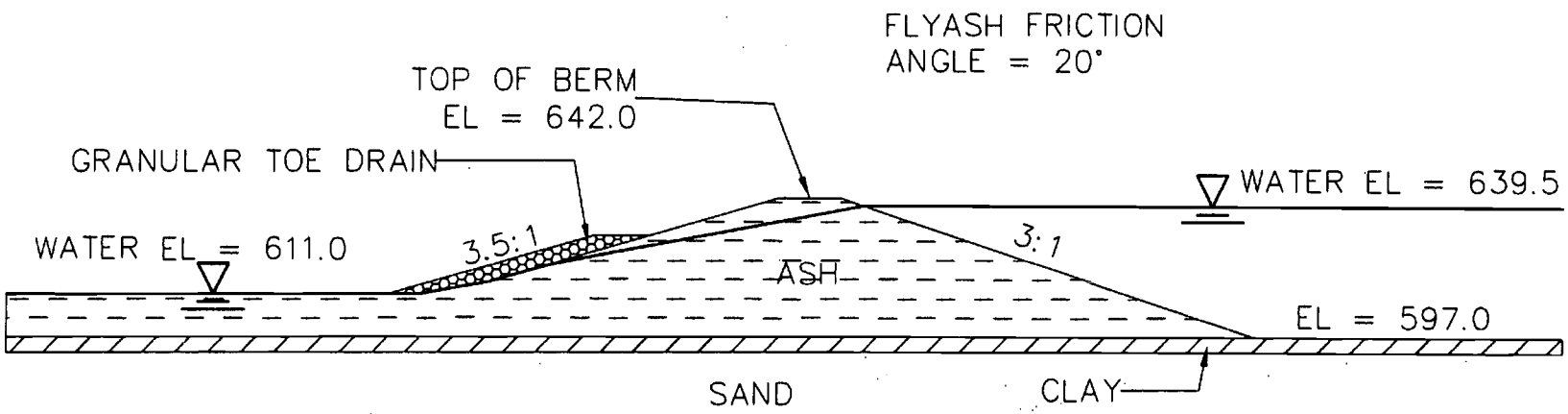
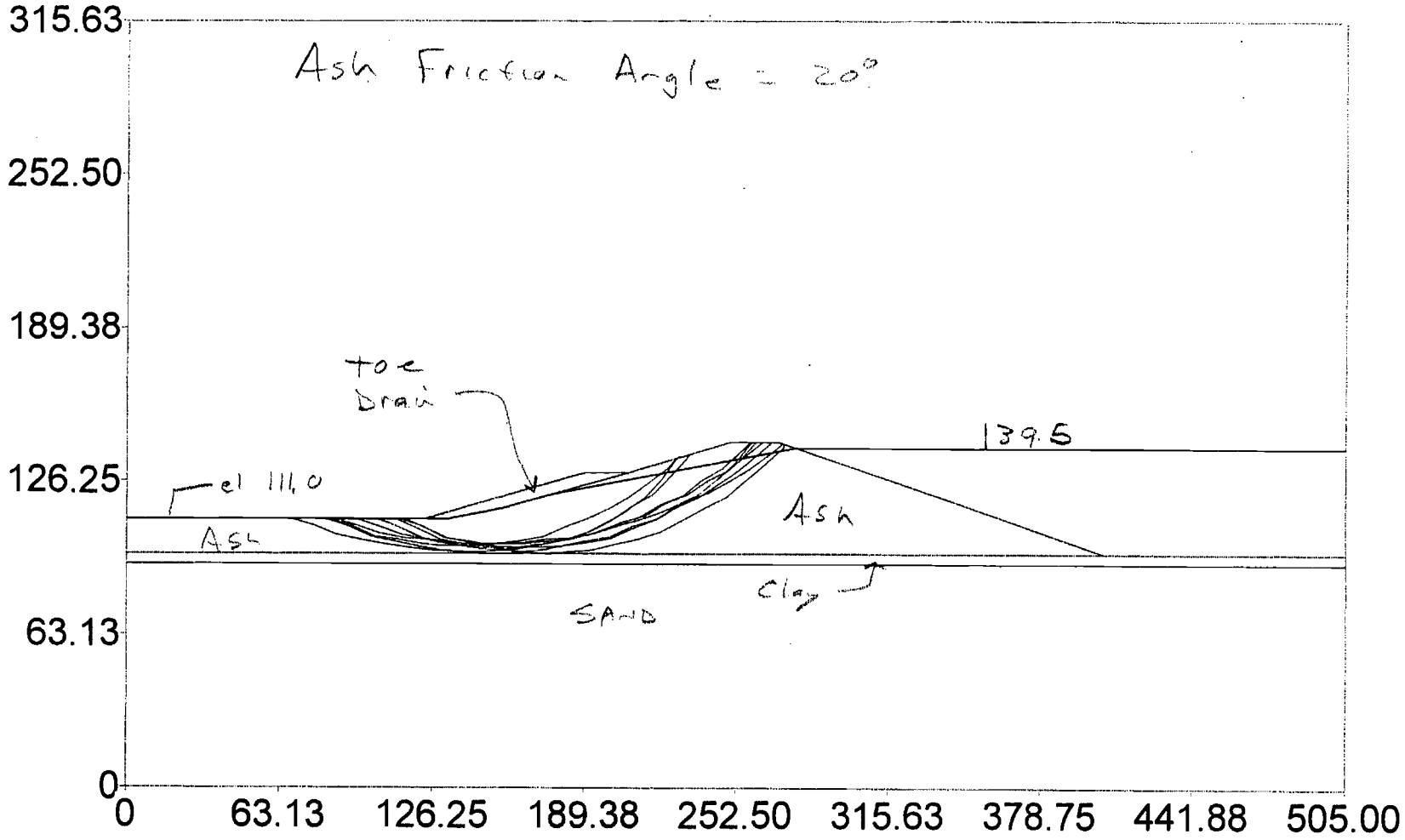


SCENARIO 3

I:\3573\Drawings-General\Stability Analysis Scenarios.dwg, 7/11/2008 3:22:36 PM

C

FMSM Profile with Toe Drain



Safety Factor
0.91
0.91
0.93
0.93
0.94
0.94
0.94
0.95
0.95
0.95

Profile.out
** PCSTABL6 **

by
Purdue University

modified by
Peter J. Bosscher
University of Wisconsin-Madison

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

PROBLEM DESCRIPTION FMSM Profile with Toe Drain

BOUNDARY COORDINATES

7 Top Boundaries
12 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	111.00	123.00	111.00	2
2	123.00	111.00	190.00	130.00	3
3	190.00	130.00	208.00	130.00	3
4	208.00	130.00	250.00	142.00	2
5	250.00	142.00	270.00	142.00	2
6	270.00	142.00	405.00	97.00	2
7	405.00	97.00	505.00	97.00	1
8	123.00	111.00	133.00	111.00	2
9	133.00	111.00	156.00	115.00	2
10	156.00	115.00	208.00	130.00	2
11	0.00	97.00	405.00	97.00	1
12	0.00	92.00	505.00	92.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.

1	125.0	125.0	50.0	25.0	0.00	0.0	1
2	90.0	90.0	0.0	20.0	0.00	0.0	1
3	140.0	140.0	0.0	35.0	0.00	0.0	1
4	120.0	120.0	0.0	31.0	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 6 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	111.00
2	133.00	111.00
3	156.00	115.00
4	176.00	121.00
5	277.00	139.50
6	505.00	139.50

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

1000 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of100 Points Equally Spaced Along The Ground Surface Between X = 0.00 ft.
and X = 160.00 ft.

Each Surface Terminates Between X = 225.00 ft.
and X = 300.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 0.00 ft.

10.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	103.43	111.00
2	112.63	107.06
3	122.08	103.81
4	131.76	101.28
5	141.59	99.47
6	151.53	98.39
7	161.53	98.05
8	171.52	98.46
9	181.45	99.60
10	191.28	101.48
11	200.93	104.08
12	210.37	107.39
13	219.53	111.39
14	228.38	116.06
15	236.85	121.37
16	244.90	127.30
17	252.50	133.81
18	259.59	140.86
19	260.57	142.00

*** 0.909 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	82.42	111.00
2	91.75	107.39
3	101.27	104.31
4	110.94	101.78
5	120.74	99.80
6	130.64	98.39
7	140.60	97.53
8	150.60	97.24
9	160.60	97.52
10	170.56	98.37
11	180.46	99.78
12	190.26	101.75
13	199.94	104.28
14	209.46	107.34
15	218.79	110.95
16	227.89	115.08
17	236.75	119.71
18	245.34	124.85
19	253.61	130.46
20	261.56	136.53
21	267.93	142.00

*** 0.910 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	95.35	111.00
2	104.76	107.62
3	114.37	104.85
4	124.14	102.70
5	134.02	101.18
6	143.99	100.30
7	153.98	100.07
8	163.97	100.47
9	173.92	101.52
10	183.78	103.20
11	193.50	105.52
12	203.06	108.45
13	212.42	111.99
14	221.52	116.13
15	230.34	120.84
16	238.84	126.11
17	246.98	131.91
18	254.74	138.23
19	258.80	142.00

*** 0.925 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	105.05	111.00
2	114.03	106.60
3	123.40	103.11
4	133.07	100.57
5	142.95	99.00
6	152.93	98.41
7	162.92	98.82
8	172.83	100.21
9	182.54	102.58
10	191.97	105.90
11	201.03	110.14
12	209.62	115.25
13	217.67	121.20
14	225.08	127.90
15	231.80	135.32
16	233.19	137.20

*** 0.927 ***

Failure Surface Specified By 18 Coordinate Points

Point	X-Surf	Y-Surf

No.	(ft)	(ft)
1	113.13	111.00
2	122.30	107.00
3	131.76	103.77
4	141.46	101.33
5	151.32	99.68
6	161.29	98.85
7	171.29	98.85
8	181.25	99.66
9	191.12	101.28
10	200.82	103.71
11	210.29	106.93
12	219.46	110.91
13	228.28	115.63
14	236.68	121.06
15	244.60	127.16
16	252.00	133.89
17	258.83	141.20
18	259.46	142.00

*** 0.937 ***

Failure Surface Specified By 22 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	67.88	111.00
2	77.30	107.65
3	86.88	104.77
4	96.59	102.39
5	106.41	100.49
6	116.31	99.10
7	126.27	98.20
8	136.26	97.80
9	146.26	97.92
10	156.24	98.53
11	166.18	99.65
12	176.05	101.26
13	185.82	103.37
14	195.48	105.97
15	204.99	109.06
16	214.34	112.62
17	223.49	116.65
18	232.43	121.13
19	241.13	126.06
20	249.57	131.42
21	257.73	137.19
22	263.85	142.00

*** 0.939 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	84.04	111.00
2	93.32	107.27
3	102.85	104.25
4	112.59	101.96
5	122.47	100.42
6	132.44	99.64
7	142.44	99.62
8	152.41	100.35
9	162.30	101.84
10	172.04	104.08
11	181.59	107.05
12	190.89	110.74
13	199.88	115.12
14	208.51	120.17
15	216.73	125.87
16	224.49	132.17
17	228.34	135.81

*** 0.945 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	111.52	111.00
2	120.41	106.43
3	129.76	102.88
4	139.44	100.39
5	149.35	99.01
6	159.34	98.75
7	169.31	99.61
8	179.11	101.57
9	188.64	104.63
10	197.76	108.73
11	206.36	113.82
12	214.34	119.85
13	221.60	126.73
14	228.04	134.38
15	229.14	136.04

*** 0.949 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	114.75	111.00
2	123.89	106.96
3	133.31	103.60
4	142.96	100.96

5	152.77	99.04
6	162.70	97.85
7	172.69	97.41
8	182.69	97.71
9	192.63	98.75
10	202.47	100.53
11	212.16	103.04
12	221.62	106.25
13	230.83	110.17
14	239.71	114.75
15	248.23	119.99
16	256.34	125.84
17	263.99	132.28
18	271.14	139.27
19	272.74	141.09

*** 0.951 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	85.66	111.00
2	95.22	108.07
3	104.91	105.61
4	114.71	103.63
5	124.60	102.14
6	134.55	101.14
7	144.54	100.62
8	154.54	100.60
9	164.53	101.07
10	174.48	102.02
11	184.38	103.47
12	194.19	105.40
13	203.89	107.81
14	213.47	110.70
15	222.89	114.05
16	232.13	117.87
17	241.18	122.13
18	250.00	126.83
19	258.59	131.96
20	266.91	137.51
21	272.05	141.32

*** 0.952 ***

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          Y            A     X     I     S            F     T

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X      0.00 +---------+----*--*-+---------+---------+---------+
            -                ....
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                -             ......
                -             ......
                -           ........
        63.13 +           .......6
                -          .......6.
                -         ........62
                -         .......623
                -         .......621
                -        ........215
A      126.25 +        ........15*
                -        .......21.*
                -        .......21...
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                -        .......91...
                -         ......917.W.
X      189.38 +         .......137..*
                -         .......127..
                -          ......9137.*
                -           ......91447
                -            .....913.44
                -            ......9113.
I      252.50 +             ......991*
                -              .......91
                -                ......*
                -                 ......
                -                   ...
                -                     .
S      315.63 +
                -
                -
                -
                -
                -
       378.75 +
                -
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F      441.88 +
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                -
                -
T      505.00 +               *       W
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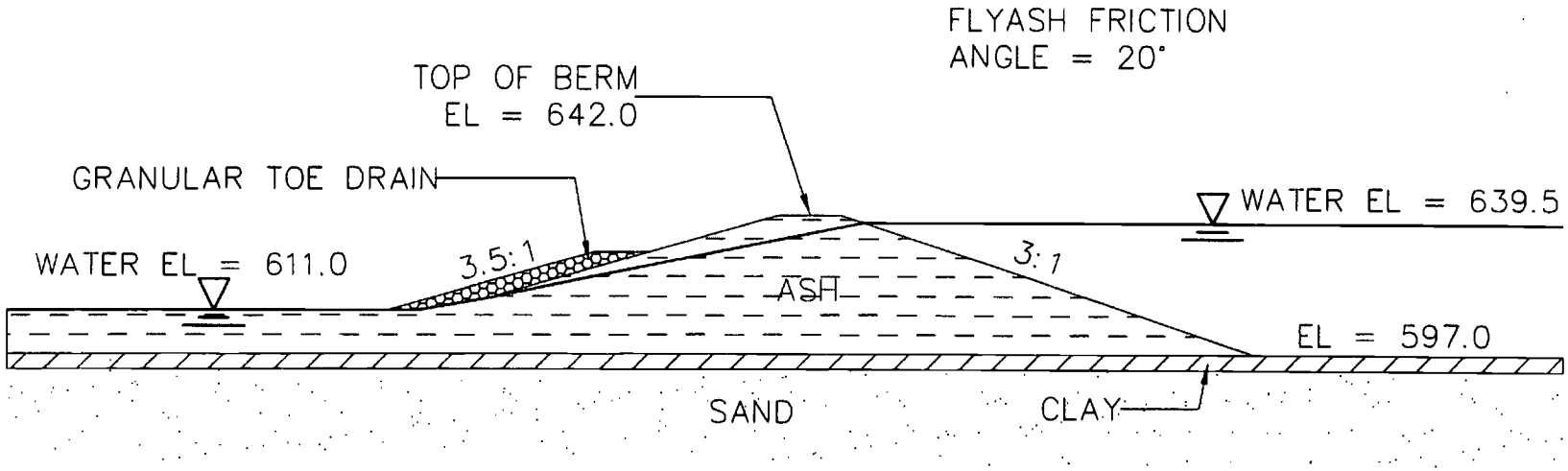

SCENARIO 4

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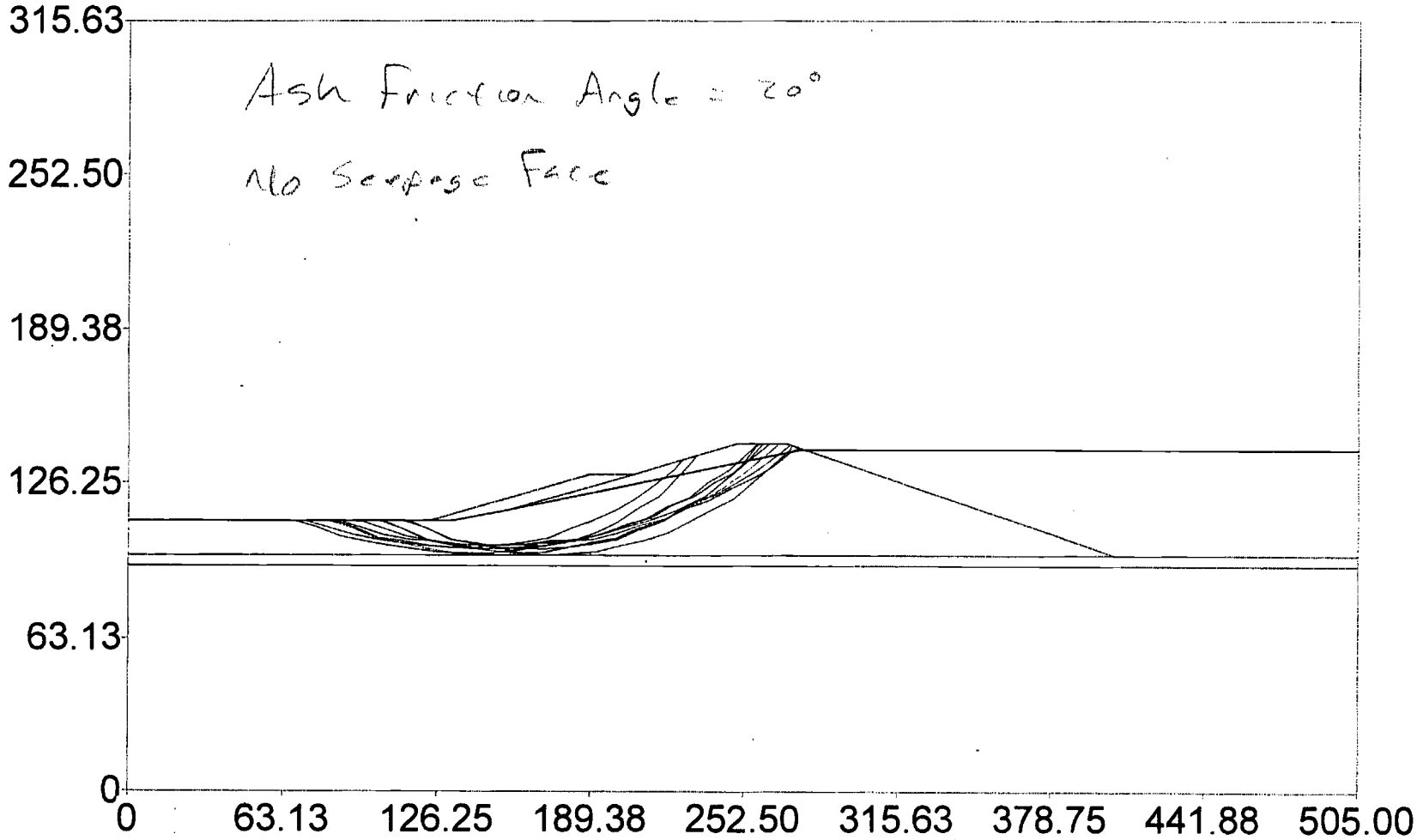
(4)

FMSM Profile with Toe Drain



Safety Factor

0.96
0.96
0.98
0.98
0.99
0.99
1.00
1.00
1.00
1.01

Profile.out
** PCSTABL6 **

by
Purdue University

modified by
Peter J. Bosscher
University of Wisconsin-Madison

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

PROBLEM DESCRIPTION FMSM Profile with Toe Drain

BOUNDARY COORDINATES

7 Top Boundaries
12 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	111.00	123.00	111.00	2
2	123.00	111.00	190.00	130.00	3
3	190.00	130.00	208.00	130.00	3
4	208.00	130.00	250.00	142.00	2
5	250.00	142.00	270.00	142.00	2
6	270.00	142.00	405.00	97.00	2
7	405.00	97.00	505.00	97.00	1
8	123.00	111.00	133.00	111.00	2
9	133.00	111.00	156.00	115.00	2
10	156.00	115.00	208.00	130.00	2
11	0.00	97.00	405.00	97.00	1
12	0.00	92.00	505.00	92.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.

1	125.0	125.0	50.0	25.0	0.00	0.0	1
2	90.0	90.0	0.0	20.0	0.00	0.0	1
3	140.0	140.0	0.0	35.0	0.00	0.0	1
4	120.0	120.0	0.0	31.0	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	111.00
2	133.00	111.00
3	156.00	115.00
4	277.00	139.50
5	505.00	139.50

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

1000 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of100 Points Equally Spaced Along The Ground Surface Between X = 0.00 ft.
and X = 160.00 ft.

Each Surface Terminates Between X = 225.00 ft.
and X = 300.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 0.00 ft.

10.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	82.42	111.00
2	91.75	107.39
3	101.27	104.31
4	110.94	101.78
5	120.74	99.80
6	130.64	98.39
7	140.60	97.53
8	150.60	97.24
9	160.60	97.52
10	170.56	98.37
11	180.46	99.78
12	190.26	101.75
13	199.94	104.28
14	209.46	107.34
15	218.79	110.95
16	227.89	115.08
17	236.75	119.71
18	245.34	124.85
19	253.61	130.46
20	261.56	136.53
21	267.93	142.00

*** 0.957 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	103.43	111.00
2	112.63	107.06
3	122.08	103.81
4	131.76	101.28
5	141.59	99.47
6	151.53	98.39
7	161.53	98.05
8	171.52	98.46
9	181.45	99.60
10	191.28	101.48
11	200.93	104.08
12	210.37	107.39
13	219.53	111.39
14	228.38	116.06
15	236.85	121.37
16	244.90	127.30
17	252.50	133.81
18	259.59	140.86
19	260.57	142.00

*** 0.959 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	95.35	111.00
2	104.76	107.62
3	114.37	104.85
4	124.14	102.70
5	134.02	101.18
6	143.99	100.30
7	153.98	100.07
8	163.97	100.47
9	173.92	101.52
10	183.78	103.20
11	193.50	105.52
12	203.06	108.45
13	212.42	111.99
14	221.52	116.13
15	230.34	120.84
16	238.84	126.11
17	246.98	131.91
18	254.74	138.23
19	258.80	142.00

*** 0.980 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	105.05	111.00
2	114.03	106.60
3	123.40	103.11
4	133.07	100.57
5	142.95	99.00
6	152.93	98.41
7	162.92	98.82
8	172.83	100.21
9	182.54	102.58
10	191.97	105.90
11	201.03	110.14
12	209.62	115.25
13	217.67	121.20
14	225.08	127.90
15	231.80	135.32
16	233.19	137.20

*** 0.984 ***

Failure Surface Specified By 22 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)

1	67.88	111.00
2	77.30	107.65
3	86.88	104.77
4	96.59	102.39
5	106.41	100.49
6	116.31	99.10
7	126.27	98.20
8	136.26	97.80
9	146.26	97.92
10	156.24	98.53
11	166.18	99.65
12	176.05	101.26
13	185.82	103.37
14	195.48	105.97
15	204.99	109.06
16	214.34	112.62
17	223.49	116.65
18	232.43	121.13
19	241.13	126.06
20	249.57	131.42
21	257.73	137.19
22	263.85	142.00

*** 0.989 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	113.13	111.00
2	122.30	107.00
3	131.76	103.77
4	141.46	101.33
5	151.32	99.68
6	161.29	98.85
7	171.29	98.85
8	181.25	99.66
9	191.12	101.28
10	200.82	103.71
11	210.29	106.93
12	219.46	110.91
13	228.28	115.63
14	236.68	121.06
15	244.60	127.16
16	252.00	133.89
17	258.83	141.20
18	259.46	142.00

*** 0.989 ***

Failure Surface Specified By 19 Coordinate Points

Point	X-Surf	Y-Surf

No.	(ft)	(ft)
1	114.75	111.00
2	123.89	106.96
3	133.31	103.60
4	142.96	100.96
5	152.77	99.04
6	162.70	97.85
7	172.69	97.41
8	182.69	97.71
9	192.63	98.75
10	202.47	100.53
11	212.16	103.04
12	221.62	106.25
13	230.83	110.17
14	239.71	114.75
15	248.23	119.99
16	256.34	125.84
17	263.99	132.28
18	271.14	139.27
19	272.74	141.09

*** 0.998 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	84.04	111.00
2	93.32	107.27
3	102.85	104.25
4	112.59	101.96
5	122.47	100.42
6	132.44	99.64
7	142.44	99.62
8	152.41	100.35
9	162.30	101.84
10	172.04	104.08
11	181.59	107.05
12	190.89	110.74
13	199.88	115.12
14	208.51	120.17
15	216.73	125.87
16	224.49	132.17
17	228.34	135.81

*** 1.004 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	85.66	111.00

2	95.22	108.07
3	104.91	105.61
4	114.71	103.63
5	124.60	102.14
6	134.55	101.14
7	144.54	100.62
8	154.54	100.60
9	164.53	101.07
10	174.48	102.02
11	184.38	103.47
12	194.19	105.40
13	203.89	107.81
14	213.47	110.70
15	222.89	114.05
16	232.13	117.87
17	241.18	122.13
18	250.00	126.83
19	258.59	131.96
20	266.91	137.51
21	272.05	141.32

*** 1.005 ***

Failure Surface Specified By 23 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	72.73	111.00
2	82.27	108.01
3	91.93	105.44
4	101.70	103.30
5	111.56	101.60
6	121.48	100.33
7	131.44	99.50
8	141.43	99.12
9	151.43	99.17
10	161.42	99.67
11	171.38	100.61
12	181.28	101.99
13	191.12	103.80
14	200.86	106.05
15	210.50	108.72
16	220.00	111.82
17	229.37	115.33
18	238.56	119.26
19	247.58	123.59
20	256.39	128.31
21	264.99	133.42
22	273.36	138.90
23	275.24	140.25

*** 1.006 ***

```
                Y            A     X     I     S            F     T

                0.00     63.13    126.25    189.38    252.50    315.63

X        0.00 +---------+----*--*-+---------+---------+---------+
              -              ....
              -             .....
              -            ......
              -            ......
              -          ........
         63.13 +          .......5
              -         .......50
              -        ........51
              -        .......513
              -        .......512
              -       ........126
A       126.25 +       ........16*
              -       .......12.*
              -       .......12...
              -       .......12.*.
              -       .......71...
              -        ......718...
X       189.38 +        .......138..*
              -        .......218..
              -         ......7138.*
              -          ......71448
              -           .....713.44
              -           ......7113.
I       252.50 +            ......771*
              -             .......71
              -               ......*
              -                ......
              -                  ...
              -                    .
S       315.63 +
              -
              -
              -
              -
              -
        378.75 +
              -
              -              *
              -
              -
              -
F       441.88 +
              -
              -
              -
              -
              -
T       505.00 +              *      W
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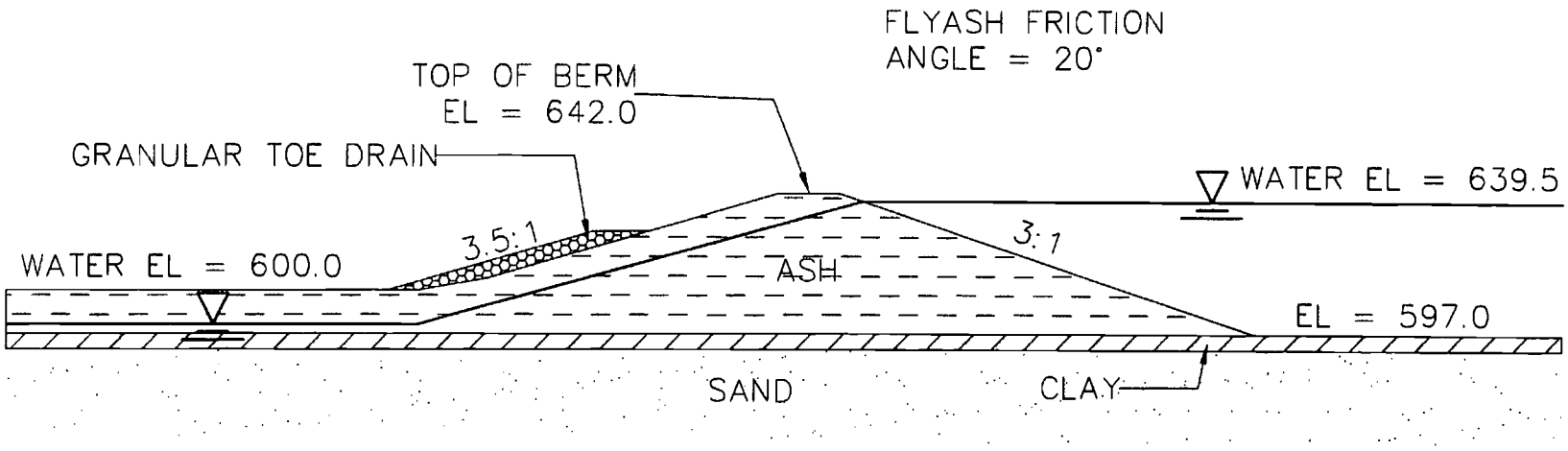

SCENARIO 5

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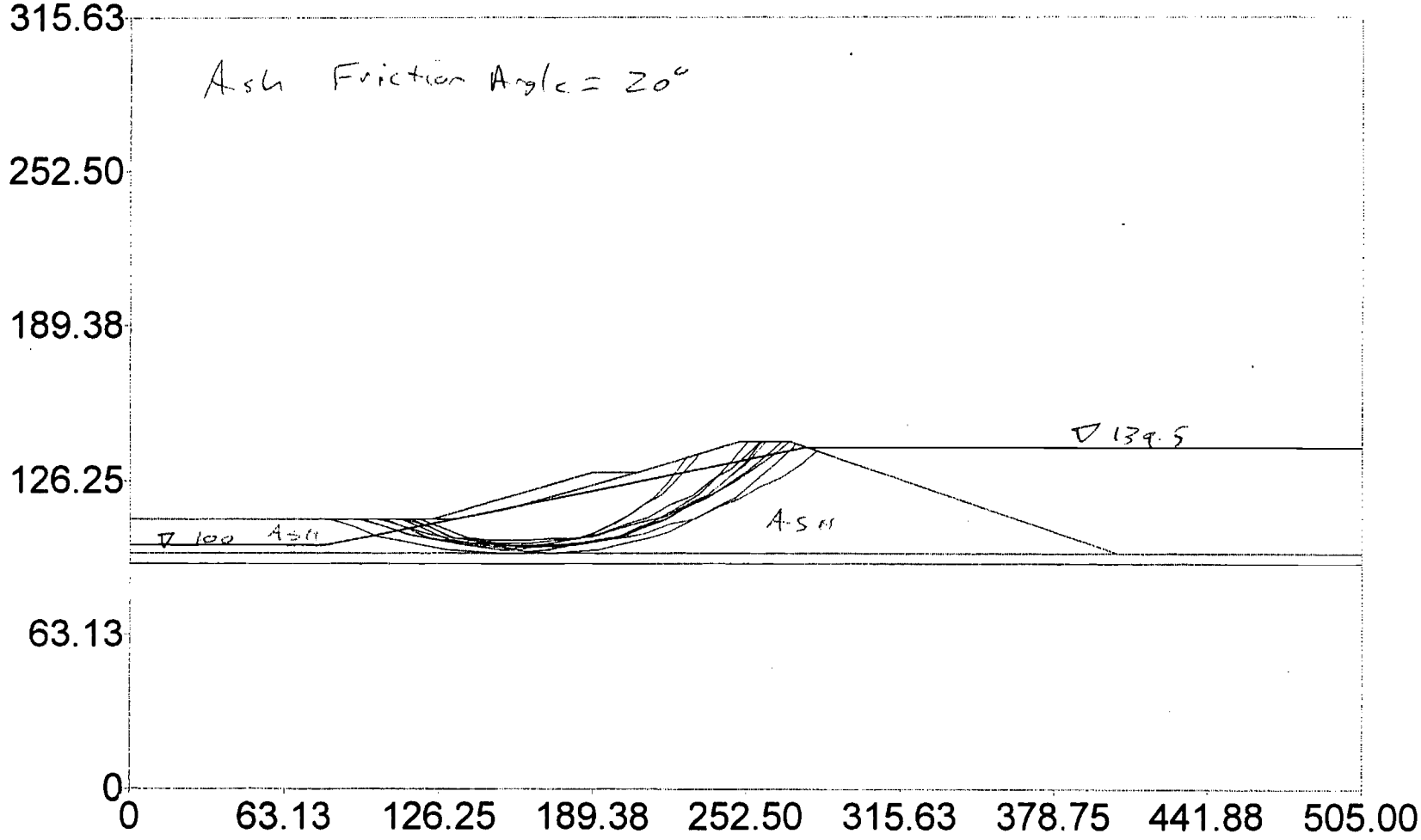
FMSM Profile with Toe Drain



Safety Factor
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0.99
0.99
1.01
1.01
1.02
1.02
1.02
1.03
1.04

Profile.out
** PCSTABL6 **

by
Purdue University

modified by
Peter J. Bosscher
University of Wisconsin-Madison

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

PROBLEM DESCRIPTION FMSM Profile with Toe Drain

BOUNDARY COORDINATES

7 Top Boundaries
12 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	111.00	123.00	111.00	2
2	123.00	111.00	190.00	130.00	3
3	190.00	130.00	208.00	130.00	3
4	208.00	130.00	250.00	142.00	2
5	250.00	142.00	270.00	142.00	2
6	270.00	142.00	405.00	97.00	2
7	405.00	97.00	505.00	97.00	1
8	123.00	111.00	133.00	111.00	2
9	133.00	111.00	156.00	115.00	2
10	156.00	115.00	208.00	130.00	2
11	0.00	97.00	405.00	97.00	1
12	0.00	92.00	505.00	92.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.

1	125.0	125.0	50.0	25.0	0.00	0.0	1
2	90.0	90.0	0.0	20.0	0.00	0.0	1
3	140.0	140.0	0.0	35.0	0.00	0.0	1
4	120.0	120.0	0.0	31.0	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	100.00
2	80.00	100.00
3	133.00	111.00
4	277.00	139.50
5	505.00	139.50

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

1000 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of100 Points Equally Spaced Along The Ground Surface Between X = 0.00 ft.
and X = 160.00 ft.

Each Surface Terminates Between X = 225.00 ft.
and X = 300.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 0.00 ft.

10.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	103.43	111.00
2	112.63	107.06
3	122.08	103.81
4	131.76	101.28
5	141.59	99.47
6	151.53	98.39
7	161.53	98.05
8	171.52	98.46
9	181.45	99.60
10	191.28	101.48
11	200.93	104.08
12	210.37	107.39
13	219.53	111.39
14	228.38	116.06
15	236.85	121.37
16	244.90	127.30
17	252.50	133.81
18	259.59	140.86
19	260.57	142.00

*** 0.977 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	113.13	111.00
2	122.30	107.00
3	131.76	103.77
4	141.46	101.33
5	151.32	99.68
6	161.29	98.85
7	171.29	98.85
8	181.25	99.66
9	191.12	101.28
10	200.82	103.71
11	210.29	106.93
12	219.46	110.91
13	228.28	115.63
14	236.68	121.06
15	244.60	127.16
16	252.00	133.89
17	258.83	141.20
18	259.46	142.00

*** 0.988 ***

Failure Surface Specified By 19 Coordinate Points

Point	X-Surf	Y-Surf

No.	(ft)	(ft)
1	114.75	111.00
2	123.89	106.96
3	133.31	103.60
4	142.96	100.96
5	152.77	99.04
6	162.70	97.85
7	172.69	97.41
8	182.69	97.71
9	192.63	98.75
10	202.47	100.53
11	212.16	103.04
12	221.62	106.25
13	230.83	110.17
14	239.71	114.75
15	248.23	119.99
16	256.34	125.84
17	263.99	132.28
18	271.14	139.27
19	272.74	141.09

*** 0.994 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	105.05	111.00
2	114.03	106.60
3	123.40	103.11
4	133.07	100.57
5	142.95	99.00
6	152.93	98.41
7	162.92	98.82
8	172.83	100.21
9	182.54	102.58
10	191.97	105.90
11	201.03	110.14
12	209.62	115.25
13	217.67	121.20
14	225.08	127.90
15	231.80	135.32
16	233.19	137.20

*** 1.008 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	95.35	111.00
2	104.76	107.62

3	114.37	104.85
4	124.14	102.70
5	134.02	101.18
6	143.99	100.30
7	153.98	100.07
8	163.97	100.47
9	173.92	101.52
10	183.78	103.20
11	193.50	105.52
12	203.06	108.45
13	212.42	111.99
14	221.52	116.13
15	230.34	120.84
16	238.84	126.11
17	246.98	131.91
18	254.74	138.23
19	258.80	142.00

*** 1.015 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	119.60	111.00
2	128.64	106.73
3	138.05	103.35
4	147.74	100.88
5	157.62	99.36
6	167.61	98.79
7	177.60	99.19
8	187.51	100.54
9	197.24	102.84
10	206.71	106.06
11	215.82	110.17
12	224.50	115.14
13	232.66	120.93
14	240.23	127.46
15	247.13	134.70
16	252.87	142.00

*** 1.016 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	111.52	111.00
2	120.41	106.43
3	129.76	102.88
4	139.44	100.39
5	149.35	99.01
6	159.34	98.75

7	169.31	99.61
8	179.11	101.57
9	188.64	104.63
10	197.76	108.73
11	206.36	113.82
12	214.34	119.85
13	221.60	126.73
14	228.04	134.38
15	229.14	136.04

*** 1.018 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	82.42	111.00
2	91.75	107.39
3	101.27	104.31
4	110.94	101.78
5	120.74	99.80
6	130.64	98.39
7	140.60	97.53
8	150.60	97.24
9	160.60	97.52
10	170.56	98.37
11	180.46	99.78
12	190.26	101.75
13	199.94	104.28
14	209.46	107.34
15	218.79	110.95
16	227.89	115.08
17	236.75	119.71
18	245.34	124.85
19	253.61	130.46
20	261.56	136.53
21	267.93	142.00

*** 1.023 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	101.82	111.00
2	111.37	108.03
3	121.07	105.61
4	130.89	103.74
5	140.81	102.44
6	150.78	101.71
7	160.78	101.54
8	170.77	101.95
9	180.72	102.93

10	190.60	104.47
11	200.38	106.57
12	210.02	109.23
13	219.49	112.43
14	228.77	116.17
15	237.82	120.43
16	246.60	125.20
17	255.11	130.47
18	263.29	136.21
19	270.44	141.85

*** 1.028 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	93.74	111.00
2	103.26	107.93
3	112.91	105.33
4	122.68	103.19
5	132.54	101.54
6	142.47	100.36
7	152.45	99.66
8	162.45	99.45
9	172.44	99.72
10	182.41	100.47
11	192.34	101.71
12	202.19	103.42
13	211.95	105.61
14	221.59	108.27
15	231.09	111.39
16	240.42	114.97
17	249.58	119.00
18	258.53	123.46
19	267.25	128.35
20	275.72	133.66
21	281.97	138.01

*** 1.045 ***

```
          Y            A     X     I     S            F     T

          0.00     63.13    126.25    189.38    252.50    315.63

X      0.00 +---------+----*W-*-+---------+---------+---------+
            -              ....
            -             .....
            -            .......
            -            .......
            -          ........
       63.13 +          ........
```

```
                 -          .........
                 -        .......W.8
                 -        ........85
                 -        ........51
                 -       ........812
A     126.25     +       ........12*
                 -       .......81.*
                 -       .......81...
                 -       .......81.*.
                 -       .......31...
                 -        .......31....
X     189.38     +         .......14...*
                 -         .......14...
                 -          ......3147.*
                 -           ......3144.
                 -            .....312.44
                 -            ......3115.
I     252.50     +             ......331*
                 -             ......031
                 -               .....0*
                 -                .....0
                 -                  ...
                 -                    .
S     315.63     +
                 -
                 -
                 -
                 -
                 -
      378.75     +
                 -
                 -              *
                 -
                 -
                 -
F     441.88     +
                 -
                 -
                 -
                 -
                 -
T     505.00     +              *       W
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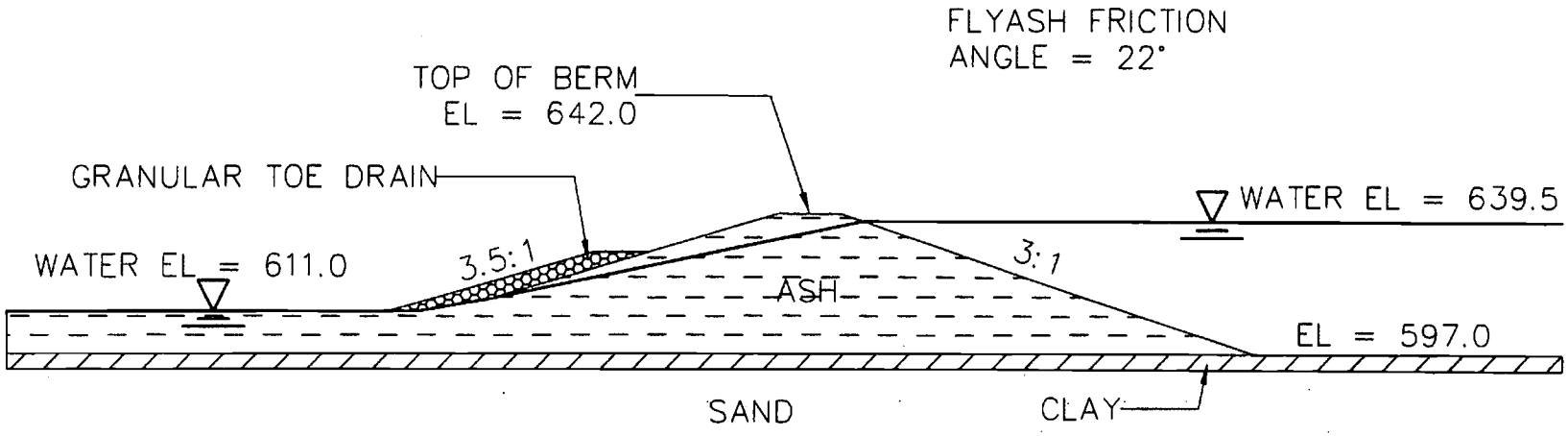

SCENARIO 6

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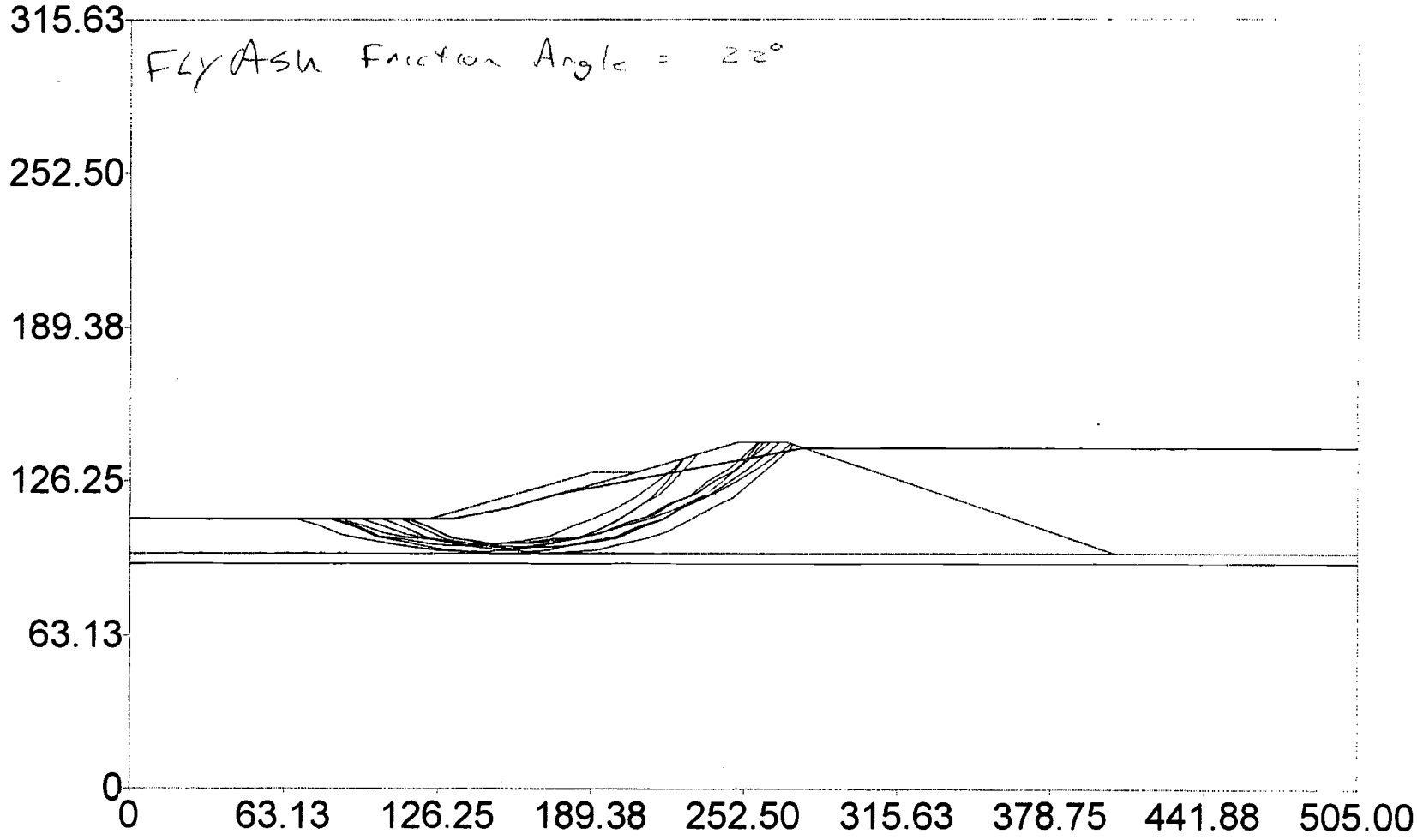
6

FMSM Profile with Toe Drain



Safety Factor
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1.03
1.03
1.04
1.04
1.05
1.05
1.06
1.06

Profile.out
** PCSTABL6 **

by
Purdue University

modified by
Peter J. Bosscher
University of Wisconsin-Madison

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

PROBLEM DESCRIPTION FMSM Profile with Toe Drain

BOUNDARY COORDINATES

7 Top Boundaries
12 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	111.00	123.00	111.00	2
2	123.00	111.00	190.00	130.00	3
3	190.00	130.00	208.00	130.00	3
4	208.00	130.00	250.00	142.00	2
5	250.00	142.00	270.00	142.00	2
6	270.00	142.00	405.00	97.00	2
7	405.00	97.00	505.00	97.00	1
8	123.00	111.00	133.00	111.00	2
9	133.00	111.00	156.00	115.00	2
10	156.00	115.00	208.00	130.00	2
11	0.00	97.00	405.00	97.00	1
12	0.00	92.00	505.00	92.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.

1	125.0	125.0	50.0	25.0	0.00	0.0	1
2	90.0	90.0	0.0	22.0	0.00	0.0	1
3	140.0	140.0	0.0	35.0	0.00	0.0	1
4	120.0	120.0	0.0	31.0	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 6 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	111.00
2	133.00	111.00
3	156.00	115.00
4	176.00	121.00
5	277.00	139.50
6	505.00	139.50

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

1000 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of100 Points Equally Spaced Along The Ground Surface Between X = 0.00 ft.
and X = 160.00 ft.

Each Surface Terminates Between X = 225.00 ft.
and X = 300.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 0.00 ft.

10.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	103.43	111.00
2	112.63	107.06
3	122.08	103.81
4	131.76	101.28
5	141.59	99.47
6	151.53	98.39
7	161.53	98.05
8	171.52	98.46
9	181.45	99.60
10	191.28	101.48
11	200.93	104.08
12	210.37	107.39
13	219.53	111.39
14	228.38	116.06
15	236.85	121.37
16	244.90	127.30
17	252.50	133.81
18	259.59	140.86
19	260.57	142.00

*** 1.009 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	82.42	111.00
2	91.75	107.39
3	101.27	104.31
4	110.94	101.78
5	120.74	99.80
6	130.64	98.39
7	140.60	97.53
8	150.60	97.24
9	160.60	97.52
10	170.56	98.37
11	180.46	99.78
12	190.26	101.75
13	199.94	104.28
14	209.46	107.34
15	218.79	110.95
16	227.89	115.08
17	236.75	119.71
18	245.34	124.85
19	253.61	130.46
20	261.56	136.53
21	267.93	142.00

*** 1.010 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	95.35	111.00
2	104.76	107.62
3	114.37	104.85
4	124.14	102.70
5	134.02	101.18
6	143.99	100.30
7	153.98	100.07
8	163.97	100.47
9	173.92	101.52
10	183.78	103.20
11	193.50	105.52
12	203.06	108.45
13	212.42	111.99
14	221.52	116.13
15	230.34	120.84
16	238.84	126.11
17	246.98	131.91
18	254.74	138.23
19	258.80	142.00

*** 1.027 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	105.05	111.00
2	114.03	106.60
3	123.40	103.11
4	133.07	100.57
5	142.95	99.00
6	152.93	98.41
7	162.92	98.82
8	172.83	100.21
9	182.54	102.58
10	191.97	105.90
11	201.03	110.14
12	209.62	115.25
13	217.67	121.20
14	225.08	127.90
15	231.80	135.32
16	233.19	137.20

*** 1.028 ***

Failure Surface Specified By 18 Coordinate Points

Point	X-Surf	Y-Surf

No.	(ft)	(ft)
1	113.13	111.00
2	122.30	107.00
3	131.76	103.77
4	141.46	101.33
5	151.32	99.68
6	161.29	98.85
7	171.29	98.85
8	181.25	99.66
9	191.12	101.28
10	200.82	103.71
11	210.29	106.93
12	219.46	110.91
13	228.28	115.63
14	236.68	121.06
15	244.60	127.16
16	252.00	133.89
17	258.83	141.20
18	259.46	142.00

*** 1.040 ***

Failure Surface Specified By 22 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	67.88	111.00
2	77.30	107.65
3	86.88	104.77
4	96.59	102.39
5	106.41	100.49
6	116.31	99.10
7	126.27	98.20
8	136.26	97.80
9	146.26	97.92
10	156.24	98.53
11	166.18	99.65
12	176.05	101.26
13	185.82	103.37
14	195.48	105.97
15	204.99	109.06
16	214.34	112.62
17	223.49	116.65
18	232.43	121.13
19	241.13	126.06
20	249.57	131.42
21	257.73	137.19
22	263.85	142.00

*** 1.042 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	84.04	111.00
2	93.32	107.27
3	102.85	104.25
4	112.59	101.96
5	122.47	100.42
6	132.44	99.64
7	142.44	99.62
8	152.41	100.35
9	162.30	101.84
10	172.04	104.08
11	181.59	107.05
12	190.89	110.74
13	199.88	115.12
14	208.51	120.17
15	216.73	125.87
16	224.49	132.17
17	228.34	135.81

*** 1.049 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	111.52	111.00
2	120.41	106.43
3	129.76	102.88
4	139.44	100.39
5	149.35	99.01
6	159.34	98.75
7	169.31	99.61
8	179.11	101.57
9	188.64	104.63
10	197.76	108.73
11	206.36	113.82
12	214.34	119.85
13	221.60	126.73
14	228.04	134.38
15	229.14	136.04

*** 1.054 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	114.75	111.00
2	123.89	106.96
3	133.31	103.60
4	142.96	100.96

5	152.77	99.04
6	162.70	97.85
7	172.69	97.41
8	182.69	97.71
9	192.63	98.75
10	202.47	100.53
11	212.16	103.04
12	221.62	106.25
13	230.83	110.17
14	239.71	114.75
15	248.23	119.99
16	256.34	125.84
17	263.99	132.28
18	271.14	139.27
19	272.74	141.09

*** 1.056 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	85.66	111.00
2	95.22	108.07
3	104.91	105.61
4	114.71	103.63
5	124.60	102.14
6	134.55	101.14
7	144.54	100.62
8	154.54	100.60
9	164.53	101.07
10	174.48	102.02
11	184.38	103.47
12	194.19	105.40
13	203.89	107.81
14	213.47	110.70
15	222.89	114.05
16	232.13	117.87
17	241.18	122.13
18	250.00	126.83
19	258.59	131.96
20	266.91	137.51
21	272.05	141.32

*** 1.057 ***

```
          Y            A     X     I     S            F     T

          0.00      63.13    126.25    189.38    252.50    315.63

X       0.00 +---------+----*--*-+---------+---------+---------+
                                ....
```

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                -              .....
                -             ......
                -             ......
                -           ........
        63.13 +           .......6
                -         .......6.
                -        ........62
                -        .......623
                -        .......621
                -       ........215
A      126.25 +        ........15*
                -       .......21.*
                -       .......21...
                -       .......21.*.
                -       .......91...
                -        ......917.W.
X      189.38 +         .......137..*
                -        .......127..
                -         ......9137.*
                -          ......91447
                -           .....913.44
                -           ......9113.
I      252.50 +             ......991*
                -             .......91
                -               ......*
                -                ......
                -                  ...
                -                    .
S      315.63 +
                -
                -
                -
                -
                -
       378.75 +
                -
                -              *
                -
                -
                -
F      441.88 +
                -
                -
                -
                -
                -
T      505.00 +               *      W
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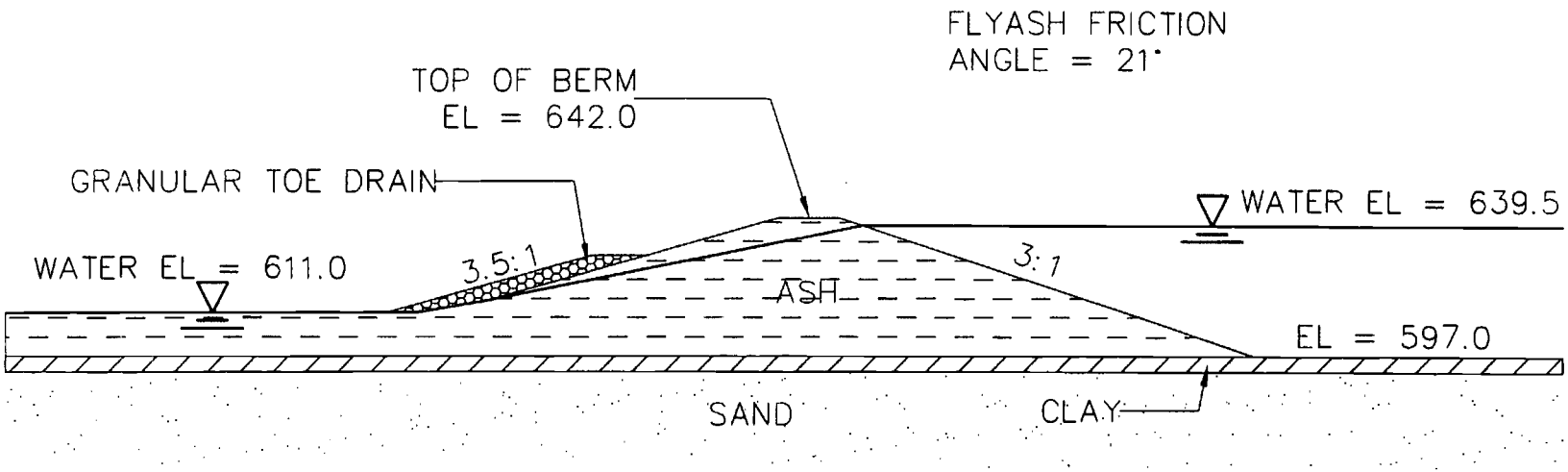

SCENARIO 7

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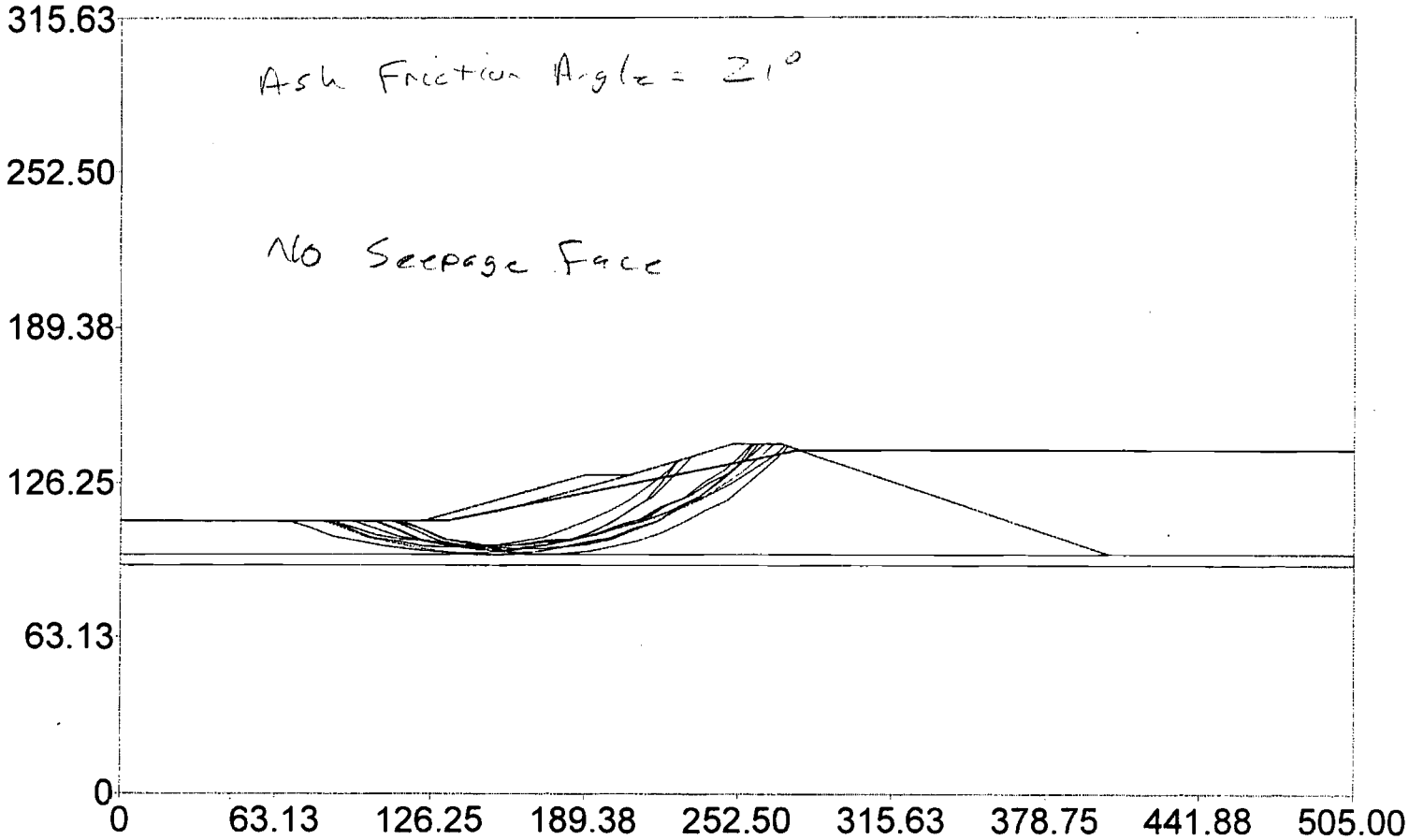
FMSM Profile with Toe Drain



Safety Factors

0.99
0.99
1.01
1.02
1.02
1.02
1.03
1.04
1.04
1.04

Profile.out
** PCSTABL6 **

by
Purdue University

modified by
Peter J. Bosscher
University of Wisconsin-Madison

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

PROBLEM DESCRIPTION FMSM Profile with Toe Drain

BOUNDARY COORDINATES

7 Top Boundaries
12 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	111.00	123.00	111.00	2
2	123.00	111.00	190.00	130.00	3
3	190.00	130.00	208.00	130.00	3
4	208.00	130.00	250.00	142.00	2
5	250.00	142.00	270.00	142.00	2
6	270.00	142.00	405.00	97.00	2
7	405.00	97.00	505.00	97.00	1
8	123.00	111.00	133.00	111.00	2
9	133.00	111.00	156.00	115.00	2
10	156.00	115.00	208.00	130.00	2
11	0.00	97.00	405.00	97.00	1
12	0.00	92.00	505.00	92.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.

1	125.0	125.0	50.0	25.0	0.00	0.0	1
2	90.0	90.0	0.0	21.0	0.00	0.0	1
3	140.0	140.0	0.0	35.0	0.00	0.0	1
4	120.0	120.0	0.0	31.0	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	111.00
2	133.00	111.00
3	277.00	139.50
4	505.00	139.50

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

1000 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of100 Points Equally Spaced Along The Ground Surface Between X = 0.00 ft.
and X = 160.00 ft.

Each Surface Terminates Between X = 225.00 ft.
and X = 300.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 0.00 ft.

10.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	82.42	111.00
2	91.75	107.39
3	101.27	104.31
4	110.94	101.78
5	120.74	99.80
6	130.64	98.39
7	140.60	97.53
8	150.60	97.24
9	160.60	97.52
10	170.56	98.37
11	180.46	99.78
12	190.26	101.75
13	199.94	104.28
14	209.46	107.34
15	218.79	110.95
16	227.89	115.08
17	236.75	119.71
18	245.34	124.85
19	253.61	130.46
20	261.56	136.53
21	267.93	142.00

*** 0.992 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	103.43	111.00
2	112.63	107.06
3	122.08	103.81
4	131.76	101.28
5	141.59	99.47
6	151.53	98.39
7	161.53	98.05
8	171.52	98.46
9	181.45	99.60
10	191.28	101.48
11	200.93	104.08
12	210.37	107.39
13	219.53	111.39
14	228.38	116.06
15	236.85	121.37
16	244.90	127.30
17	252.50	133.81
18	259.59	140.86
19	260.57	142.00

*** 0.994 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	95.35	111.00
2	104.76	107.62
3	114.37	104.85
4	124.14	102.70
5	134.02	101.18
6	143.99	100.30
7	153.98	100.07
8	163.97	100.47
9	173.92	101.52
10	183.78	103.20
11	193.50	105.52
12	203.06	108.45
13	212.42	111.99
14	221.52	116.13
15	230.34	120.84
16	238.84	126.11
17	246.98	131.91
18	254.74	138.23
19	258.80	142.00

*** 1.014 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	105.05	111.00
2	114.03	106.60
3	123.40	103.11
4	133.07	100.57
5	142.95	99.00
6	152.93	98.41
7	162.92	98.82
8	172.83	100.21
9	182.54	102.58
10	191.97	105.90
11	201.03	110.14
12	209.62	115.25
13	217.67	121.20
14	225.08	127.90
15	231.80	135.32
16	233.19	137.20

*** 1.016 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)

1	113.13	111.00
2	122.30	107.00
3	131.76	103.77
4	141.46	101.33
5	151.32	99.68
6	161.29	98.85
7	171.29	98.85
8	181.25	99.66
9	191.12	101.28
10	200.82	103.71
11	210.29	106.93
12	219.46	110.91
13	228.28	115.63
14	236.68	121.06
15	244.60	127.16
16	252.00	133.89
17	258.83	141.20
18	259.46	142.00

*** 1.024 ***

Failure Surface Specified By 22 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	67.88	111.00
2	77.30	107.65
3	86.88	104.77
4	96.59	102.39
5	106.41	100.49
6	116.31	99.10
7	126.27	98.20
8	136.26	97.80
9	146.26	97.92
10	156.24	98.53
11	166.18	99.65
12	176.05	101.26
13	185.82	103.37
14	195.48	105.97
15	204.99	109.06
16	214.34	112.62
17	223.49	116.65
18	232.43	121.13
19	241.13	126.06
20	249.57	131.42
21	257.73	137.19
22	263.85	142.00

*** 1.025 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)

1	114.75	111.00
2	123.89	106.96
3	133.31	103.60
4	142.96	100.96
5	152.77	99.04
6	162.70	97.85
7	172.69	97.41
8	182.69	97.71
9	192.63	98.75
10	202.47	100.53
11	212.16	103.04
12	221.62	106.25
13	230.83	110.17
14	239.71	114.75
15	248.23	119.99
16	256.34	125.84
17	263.99	132.28
18	271.14	139.27
19	272.74	141.09

*** 1.035 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	84.04	111.00
2	93.32	107.27
3	102.85	104.25
4	112.59	101.96
5	122.47	100.42
6	132.44	99.64
7	142.44	99.62
8	152.41	100.35
9	162.30	101.84
10	172.04	104.08
11	181.59	107.05
12	190.89	110.74
13	199.88	115.12
14	208.51	120.17
15	216.73	125.87
16	224.49	132.17
17	228.34	135.81

*** 1.037 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	85.66	111.00
2	95.22	108.07

3	104.91	105.61
4	114.71	103.63
5	124.60	102.14
6	134.55	101.14
7	144.54	100.62
8	154.54	100.60
9	164.53	101.07
10	174.48	102.02
11	184.38	103.47
12	194.19	105.40
13	203.89	107.81
14	213.47	110.70
15	222.89	114.05
16	232.13	117.87
17	241.18	122.13
18	250.00	126.83
19	258.59	131.96
20	266.91	137.51
21	272.05	141.32

*** 1.041 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	111.52	111.00
2	120.41	106.43
3	129.76	102.88
4	139.44	100.39
5	149.35	99.01
6	159.34	98.75
7	169.31	99.61
8	179.11	101.57
9	188.64	104.63
10	197.76	108.73
11	206.36	113.82
12	214.34	119.85
13	221.60	126.73
14	228.04	134.38
15	229.14	136.04

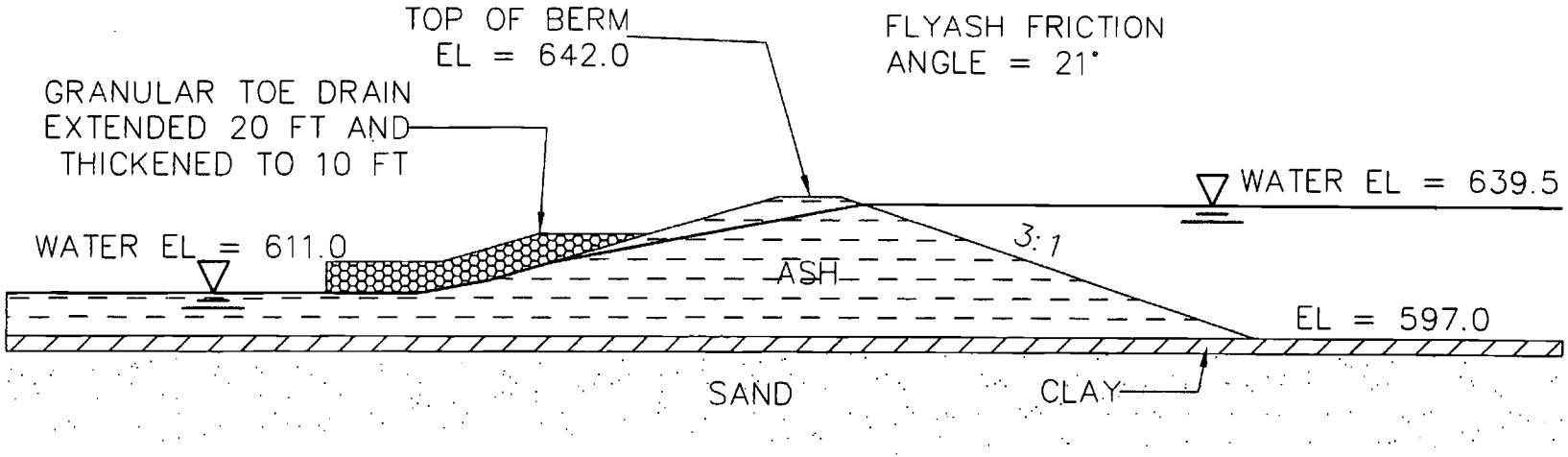
*** 1.042 ***

```
          Y            A     X     I     S            F     T

          0.00     63.13    126.25    189.38    252.50    315.63

X      0.00 +---------+----*--*-+---------+---------+---------+
            -               ....
            -              .....
            -             ......
```

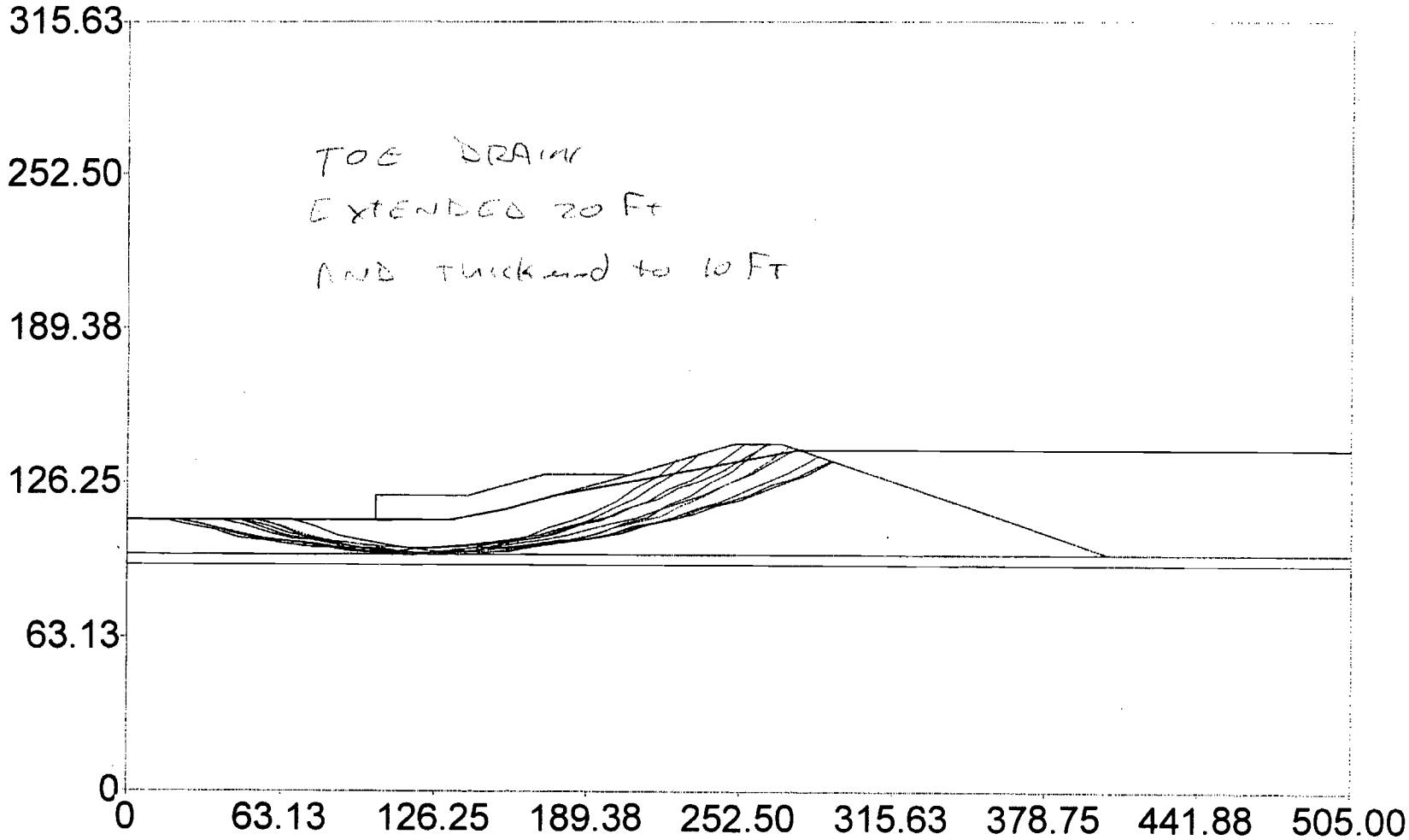
```
                -          ......
                -        ........
        63.13 +          .......6
                -       .......6.
                -      ........61
                -      .......613
                -      .......612
                -     ........125
A       126.25 +     ........15*
                -     .......12.*
                -     .......12...
                -     .......12.*.
                -     .......71...
                -      ......718...
X       189.38 +      .......138..*
                -      .......218..
                -       ......7138.*
                -        ......71448
                -         .....713.44
                -         ......7113.
I       252.50 +          ......771*
                -           .......71
                -             ......*
                -              ......
                -                ...
                -                  .
S       315.63 +
                -
                -
                -
                -
                -
        378.75 +
                -
                -            *
                -
                -
                -
F       441.88 +
                -
                -
                -
                -
                -
T       505.00 +            *      W
```


TOP OF BERM
EL = 642.0
FLYASH FRICTION
ANGLE = 21°
GRANULAR TOE DRAIN
EXTENDED 20 FT AND
THICKENED TO 10 FT
WATER EL = 639.5
WATER EL = 611.0
3:1
ASH
EL = 597.0
SAND
CLAY

SCENARIO 8

8

FMSM Profile with Extended Toe Drain



Safety Factor
1.54
1.55
1.56
1.57
1.58
1.59
1.59
1.59
1.60
1.60

Profile.out
** PCSTABL6 **

by
Purdue University

modified by
Peter J. Bosscher
University of Wisconsin-Madison

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

PROBLEM DESCRIPTION FMSM Profile with Extended Toe Drain

BOUNDARY COORDINATES

9 Top Boundaries
14 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	111.00	103.00	111.00	2
2	103.00	111.00	103.10	121.00	3
3	103.10	121.00	140.00	121.00	3
4	140.00	121.00	172.00	130.00	3
5	172.00	130.00	208.00	130.00	3
6	208.00	130.00	250.00	142.00	2
7	250.00	142.00	270.00	142.00	2
8	270.00	142.00	405.00	97.00	2
9	405.00	97.00	505.00	97.00	1
10	103.00	111.00	133.00	111.00	2
11	133.00	111.00	156.00	115.00	2
12	156.00	115.00	208.00	130.00	2
13	0.00	97.00	405.00	97.00	1
14	0.00	92.00	505.00	92.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type	Total Unit Wt.	Saturated Unit Wt.	Cohesion Intercept	Friction Angle	Pore Pressure	Pressure Constant	Piez. Surface

No.	(pcf)	(pcf)	(psf)	(deg)	Param.	(psf)	No.
1	125.0	125.0	50.0	25.0	0.00	0.0	1
2	90.0	90.0	0.0	21.0	0.00	0.0	1
3	140.0	140.0	0.0	35.0	0.00	0.0	1
4	120.0	120.0	0.0	31.0	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 6 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	111.00
2	133.00	111.00
3	156.00	115.00
4	176.00	121.00
5	277.00	139.50
6	505.00	139.50

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

1000 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of100 Points Equally Spaced Along The Ground Surface Between X = 0.00 ft.
and X = 160.00 ft.

Each Surface Terminates Between X = 225.00 ft.
and X = 300.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 0.00 ft.

10.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 25 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	53.33	111.00
2	62.86	107.96
3	72.50	105.31
4	82.24	103.05
5	92.07	101.18
6	101.96	99.70
7	111.90	98.63
8	121.88	97.96
9	131.87	97.69
10	141.87	97.82
11	151.86	98.35
12	161.81	99.29
13	171.73	100.63
14	181.57	102.36
15	191.34	104.49
16	201.02	107.01
17	210.59	109.92
18	220.03	113.21
19	229.34	116.87
20	238.48	120.91
21	247.46	125.31
22	256.26	130.08
23	264.85	135.19
24	273.23	140.64
25	273.51	140.83

*** 1.537 ***

Failure Surface Specified By 28 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	22.63	111.00
2	32.27	108.35
3	41.99	105.99
4	51.77	103.92
5	61.61	102.15
6	71.50	100.68
7	81.44	99.52
8	91.40	98.65
9	101.38	98.09
10	111.38	97.83
11	121.38	97.87
12	131.37	98.22
13	141.35	98.87
14	151.31	99.82
15	161.23	101.07
16	171.11	102.62
17	180.93	104.47
18	190.70	106.62
19	200.40	109.07

20	210.02	111.80
21	219.55	114.83
22	228.98	118.14
23	238.31	121.74
24	247.53	125.62
25	256.62	129.78
26	265.59	134.21
27	274.41	138.92
28	276.19	139.94

*** 1.547 ***

Failure Surface Specified By 27 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	38.79	111.00
2	48.42	108.29
3	58.12	105.89
4	67.90	103.79
5	77.74	101.99
6	87.62	100.50
7	97.55	99.32
8	107.52	98.45
9	117.50	97.89
10	127.50	97.65
11	137.50	97.71
12	147.49	98.09
13	157.47	98.78
14	167.42	99.77
15	177.33	101.08
16	187.20	102.70
17	197.01	104.62
18	206.76	106.85
19	216.44	109.38
20	226.03	112.21
21	235.53	115.34
22	244.92	118.76
23	254.21	122.47
24	263.37	126.48
25	272.41	130.76
26	281.30	135.33
27	284.58	137.14

*** 1.560 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	46.87	111.00
2	56.23	107.48
3	65.77	104.48

4	75.46	102.01
5	85.27	100.07
6	95.17	98.67
7	105.13	97.81
8	115.13	97.50
9	125.13	97.74
10	135.10	98.52
11	145.01	99.85
12	154.83	101.71
13	164.54	104.12
14	174.10	107.04
15	183.49	110.49
16	192.67	114.44
17	201.63	118.90
18	210.33	123.83
19	218.74	129.23
20	226.85	135.09
21	227.42	135.55

*** 1.572 ***

Failure Surface Specified By 27 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	22.63	111.00
2	32.27	108.35
3	41.99	106.02
4	51.79	104.01
5	61.65	102.33
6	71.55	100.96
7	81.50	99.93
8	91.48	99.22
9	101.47	98.84
10	111.47	98.79
11	121.46	99.06
12	131.45	99.67
13	141.40	100.60
14	151.32	101.85
15	161.20	103.44
16	171.01	105.34
17	180.76	107.57
18	190.43	110.11
19	200.01	112.98
20	209.50	116.15
21	218.87	119.64
22	228.12	123.43
23	237.25	127.52
24	246.23	131.91
25	255.07	136.59
26	263.75	141.56
27	264.46	142.00

*** 1.582 ***

Failure Surface Specified By 23 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	48.49	111.00
2	58.03	108.01
3	67.69	105.44
4	77.46	103.30
5	87.31	101.58
6	97.23	100.30
7	107.19	99.45
8	117.18	99.04
9	127.18	99.07
10	137.17	99.53
11	147.13	100.43
12	157.04	101.76
13	166.89	103.53
14	176.64	105.73
15	186.29	108.35
16	195.82	111.39
17	205.20	114.84
18	214.43	118.70
19	223.47	122.97
20	232.33	127.62
21	240.97	132.65
22	249.38	138.06
23	254.95	142.00

*** 1.586 ***

Failure Surface Specified By 22 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	67.88	111.00
2	77.30	107.65
3	86.88	104.77
4	96.59	102.39
5	106.41	100.49
6	116.31	99.10
7	126.27	98.20
8	136.26	97.80
9	146.26	97.92
10	156.24	98.53
11	166.18	99.65
12	176.05	101.26
13	185.82	103.37
14	195.48	105.97
15	204.99	109.06
16	214.34	112.62
17	223.49	116.65
18	232.43	121.13
19	241.13	126.06
20	249.57	131.42
21	257.73	137.19
22	263.85	142.00

*** 1.587 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	54.95	111.00
2	64.30	107.45
3	73.83	104.43
4	83.52	101.94
5	93.33	100.01
6	103.23	98.62
7	113.20	97.80
8	123.19	97.53
9	133.19	97.83
10	143.15	98.68
11	153.05	100.10
12	162.86	102.06
13	172.54	104.57
14	182.06	107.62
15	191.40	111.20
16	200.52	115.30
17	209.40	119.90
18	218.01	124.99
19	226.31	130.56
20	234.30	136.58
21	235.96	137.99

*** 1.589 ***

Failure Surface Specified By 30 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	16.16	111.00
2	25.86	108.56
3	35.62	106.37
4	45.42	104.41
5	55.27	102.69
6	65.16	101.22
7	75.09	99.98
8	85.04	98.99
9	95.01	98.25
10	105.00	97.75
11	115.00	97.49
12	125.00	97.48
13	134.99	97.71
14	144.98	98.19
15	154.96	98.91
16	164.91	99.88
17	174.84	101.08
18	184.73	102.54

19	194.59	104.23
20	204.40	106.16
21	214.16	108.34
22	223.86	110.75
23	233.50	113.40
24	243.08	116.28
25	252.58	119.40
26	262.00	122.75
27	271.34	126.33
28	280.59	130.14
29	289.74	134.17
30	291.30	134.90

*** 1.598 ***

Failure Surface Specified By 29 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	21.01	111.00
2	30.72	108.59
3	40.48	106.42
4	50.29	104.50
5	60.15	102.83
6	70.05	101.40
7	79.98	100.23
8	89.94	99.30
9	99.91	98.62
10	109.90	98.20
11	119.90	98.02
12	129.90	98.10
13	139.90	98.42
14	149.88	99.00
15	159.85	99.83
16	169.79	100.90
17	179.70	102.23
18	189.58	103.80
19	199.41	105.63
20	209.19	107.69
21	218.92	110.01
22	228.59	112.56
23	238.19	115.36
24	247.72	118.40
25	257.16	121.68
26	266.53	125.19
27	275.80	128.93
28	284.97	132.91
29	290.11	135.30

*** 1.602 ***

Y A X I S F T

```
                0.00      63.13     126.25     189.38     252.50     315.63

X         0.00 +---------+----*--*-+---------+---------+---------+
               -               ....
               -              ...92
               -             ....2.
               -             ....23
               -           .....231
          63.13 +           .....217
               -          ......21.
               -         .......17.
               -         .......1..
               -         ......41.**
               -        .......21...
A       126.25 +        .......31...
               -        .......12.**
               -        ........1....
               -        ........1.*..
               -        ........15...*
               -         .......124W.
X       189.38 +         .......314..
               -         ........154.
               -          .......1264*
               -           ......3154.
               -            ......31548
               -            ......9155.
I       252.50 +             ......311*
               -              .....9315
               -                ....93*
               -                 ....33
               -                   ..9
               -                     .
S       315.63 +
               -
               -
               -
               -
               -
        378.75 +
               -
               -               *
               -
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F       441.88 +
               -
               -
               -
               -
               -
T       505.00 +               *      W
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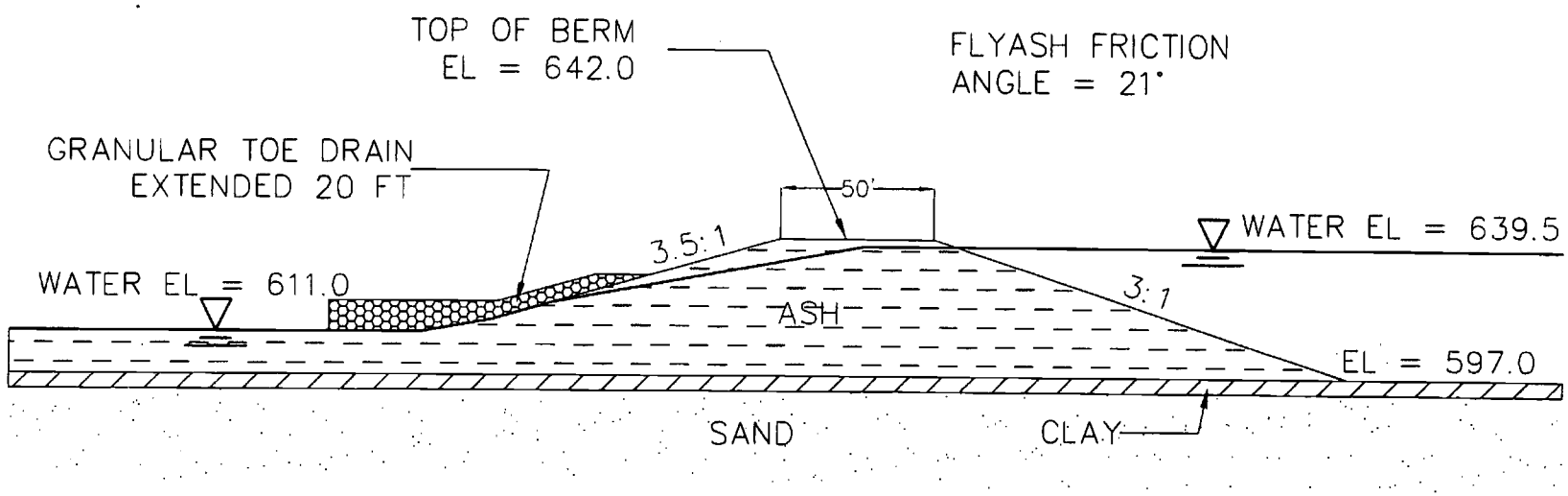

SCENARIO 9

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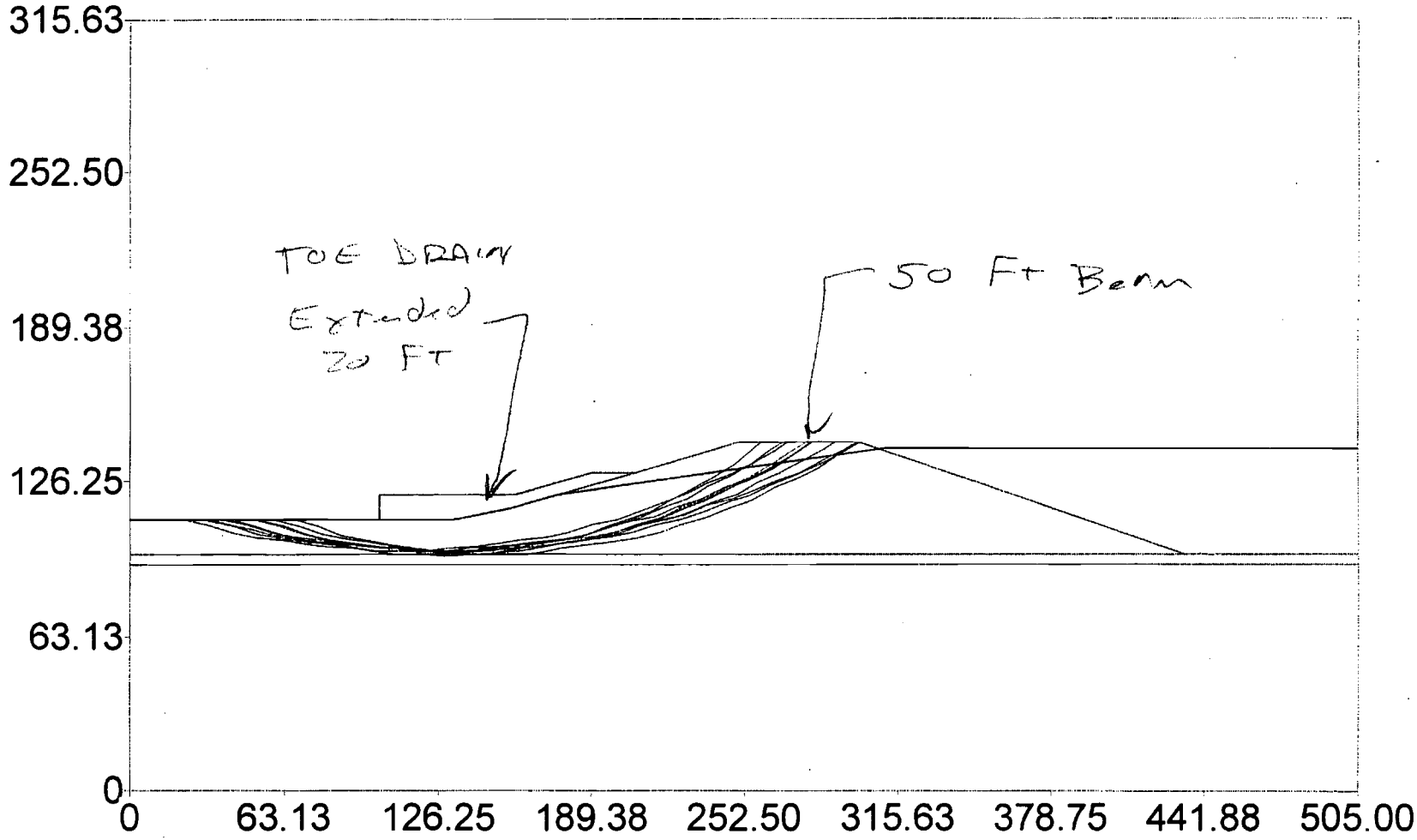
FMSM Profile with Toe Drain



Safety Factor
1.54
1.55
1.57
1.57
1.58
1.58
1.58
1.59
1.60
1.60

Profile.out
** PCSTABL6 **

by
Purdue University

modified by
Peter J. Bosscher
University of Wisconsin-Madison

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

PROBLEM DESCRIPTION FMSM Profile with Toe Drain

BOUNDARY COORDINATES

9 Top Boundaries
14 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	111.00	103.00	111.00	2
2	103.00	111.00	103.10	121.00	3
3	103.10	121.00	158.00	121.00	3
4	158.00	121.00	190.00	130.00	3
5	190.00	130.00	208.00	130.00	3
6	208.00	130.00	250.00	142.00	2
7	250.00	142.00	300.00	142.00	2
8	300.00	142.00	435.00	97.00	2
9	435.00	97.00	505.00	97.00	1
10	103.00	111.00	133.00	111.00	2
11	133.00	111.00	156.00	115.00	2
12	156.00	115.00	208.00	130.00	2
13	0.00	97.00	435.00	97.00	1
14	0.00	92.00	505.00	92.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type	Total Unit Wt.	Saturated Unit Wt.	Cohesion Intercept	Friction Angle	Pore Pressure	Pressure Constant	Piez. Surface

No.	(pcf)	(pcf)	(psf)	(deg)	Param.	(psf)	No.
1	125.0	125.0	50.0	25.0	0.00	0.0	1
2	90.0	90.0	0.0	21.0	0.00	0.0	1
3	140.0	140.0	0.0	35.0	0.00	0.0	1
4	120.0	120.0	0.0	31.0	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 6 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	111.00
2	133.00	111.00
3	156.00	115.00
4	176.00	121.00
5	309.00	139.50
6	505.00	139.50

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

1000 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of100 Points Equally Spaced Along The Ground Surface Between X = 0.00 ft.
and X = 160.00 ft.

Each Surface Terminates Between X = 225.00 ft.
and X = 300.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 0.00 ft.

10.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 25 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	51.72	111.00
2	61.25	107.97
3	70.89	105.31
4	80.62	103.03
5	90.44	101.14
6	100.33	99.63
7	110.27	98.52
8	120.24	97.79
9	130.23	97.45
10	140.23	97.51
11	150.22	97.95
12	160.19	98.79
13	170.11	100.02
14	179.98	101.64
15	189.78	103.64
16	199.49	106.02
17	209.10	108.79
18	218.60	111.92
19	227.96	115.43
20	237.18	119.30
21	246.24	123.53
22	255.13	128.11
23	263.83	133.04
24	272.34	138.31
25	277.81	142.00

*** 1.538 ***

Failure Surface Specified By 24 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	53.33	111.00
2	62.86	107.96
3	72.51	105.32
4	82.26	103.10
5	92.09	101.28
6	101.99	99.88
7	111.94	98.89
8	121.93	98.32
9	131.92	98.18
10	141.92	98.45
11	151.90	99.14
12	161.83	100.25
13	171.72	101.78
14	181.53	103.72
15	191.25	106.07
16	200.86	108.83
17	210.35	111.98
18	219.70	115.54
19	228.88	119.48

20	237.90	123.81
21	246.73	128.51
22	255.35	133.57
23	263.75	139.00
24	268.00	142.00

*** 1.553 ***

Failure Surface Specified By 27 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	38.79	111.00
2	48.42	108.29
3	58.13	105.91
4	67.91	103.85
5	77.76	102.11
6	87.66	100.70
7	97.60	99.63
8	107.57	98.88
9	117.57	98.46
10	127.57	98.38
11	137.56	98.63
12	147.55	99.21
13	157.50	100.13
14	167.43	101.37
15	177.30	102.94
16	187.12	104.84
17	196.87	107.06
18	206.54	109.61
19	216.12	112.48
20	225.60	115.66
21	234.97	119.16
22	244.22	122.96
23	253.33	127.07
24	262.31	131.48
25	271.13	136.19
26	279.79	141.19
27	281.10	142.00

*** 1.566 ***

Failure Surface Specified By 26 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	42.02	111.00
2	51.57	108.02
3	61.21	105.38
4	70.95	103.10
5	80.76	101.17
6	90.64	99.60
7	100.56	98.38

8	110.52	97.52
9	120.51	97.02
10	130.51	96.89
11	140.51	97.11
12	150.49	97.70
13	160.45	98.64
14	170.36	99.95
15	180.22	101.61
16	190.02	103.63
17	199.73	106.00
18	209.35	108.72
19	218.87	111.78
20	228.27	115.19
21	237.55	118.93
22	246.68	123.01
23	255.66	127.41
24	264.47	132.14
25	273.11	137.18
26	280.72	142.00

*** 1.572 ***

Failure Surface Specified By 26 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	59.80	111.00
2	69.36	108.08
3	79.02	105.50
4	88.77	103.26
5	98.59	101.37
6	108.47	99.83
7	118.40	98.64
8	128.36	97.80
9	138.35	97.32
10	148.35	97.19
11	158.35	97.41
12	168.33	97.99
13	178.29	98.93
14	188.21	100.21
15	198.07	101.85
16	207.87	103.83
17	217.60	106.16
18	227.23	108.84
19	236.77	111.85
20	246.19	115.20
21	255.49	118.88
22	264.65	122.89
23	273.66	127.22
24	282.52	131.87
25	291.20	136.83
26	299.55	142.00

*** 1.579 ***

Failure Surface Specified By 28 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	33.94	111.00
2	43.54	108.20
3	53.22	105.71
4	62.98	103.52
5	72.81	101.65
6	82.68	100.08
7	92.60	98.83
8	102.56	97.90
9	112.54	97.27
10	122.54	96.97
11	132.54	96.98
12	142.53	97.31
13	152.51	97.95
14	162.46	98.90
15	172.38	100.18
16	182.26	101.76
17	192.08	103.66
18	201.83	105.86
19	211.51	108.37
20	221.10	111.19
21	230.60	114.31
22	240.00	117.73
23	249.29	121.44
24	258.45	125.44
25	267.48	129.74
26	276.37	134.31
27	285.12	139.17
28	289.86	142.00

*** 1.580 ***

Failure Surface Specified By 28 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	38.79	111.00
2	48.45	108.41
3	58.18	106.09
4	67.97	104.07
5	77.82	102.33
6	87.71	100.89
7	97.64	99.73
8	107.61	98.86
9	117.59	98.29
10	127.59	98.01
11	137.59	98.02
12	147.58	98.32
13	157.56	98.92
14	167.52	99.81
15	177.45	100.99
16	187.34	102.46
17	197.19	104.22

18	206.98	106.27
19	216.70	108.60
20	226.35	111.22
21	235.92	114.12
22	245.40	117.30
23	254.79	120.75
24	264.07	124.48
25	273.23	128.48
26	282.28	132.74
27	291.20	137.27
28	299.87	142.00

*** 1.582 ***

Failure Surface Specified By 27 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	22.63	111.00
2	32.27	108.35
3	41.99	106.00
4	51.78	103.96
5	61.63	102.24
6	71.53	100.83
7	81.47	99.73
8	91.44	98.96
9	101.43	98.50
10	111.43	98.35
11	121.43	98.53
12	131.41	99.02
13	141.38	99.83
14	151.32	100.96
15	161.21	102.40
16	171.06	104.15
17	180.84	106.22
18	190.56	108.60
19	200.19	111.28
20	209.73	114.27
21	219.17	117.56
22	228.51	121.15
23	237.72	125.04
24	246.81	129.21
25	255.76	133.67
26	264.56	138.42
27	270.73	142.00

*** 1.586 ***

Failure Surface Specified By 22 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	67.88	111.00

2	77.30	107.65
3	86.88	104.79
4	96.60	102.43
5	106.43	100.58
6	116.34	99.25
7	126.31	98.43
8	136.30	98.13
9	146.30	98.35
10	156.27	99.09
11	166.19	100.34
12	176.03	102.11
13	185.77	104.39
14	195.38	107.17
15	204.83	110.45
16	214.09	114.21
17	223.15	118.45
18	231.97	123.16
19	240.54	128.31
20	248.83	133.91
21	256.81	139.93
22	259.29	142.00

*** 1.596 ***

Failure Surface Specified By 29 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.71	111.00
2	40.41	108.57
3	50.17	106.40
4	59.99	104.50
5	69.85	102.87
6	79.76	101.50
7	89.70	100.39
8	99.66	99.56
9	109.65	98.99
10	119.64	98.70
11	129.64	98.68
12	139.64	98.92
13	149.63	99.43
14	159.60	100.22
15	169.54	101.27
16	179.45	102.59
17	189.33	104.18
18	199.15	106.03
19	208.93	108.15
20	218.64	110.53
21	228.28	113.17
22	237.85	116.07
23	247.34	119.23
24	256.74	122.64
25	266.04	126.31
26	275.25	130.22
27	284.34	134.39
28	293.32	138.79
29	299.43	142.00

```
***      1.604    ***


          Y            A      X      I      S            F      T

          0.00     63.13    126.25    189.38    252.50    315.63

X       0.00 +---------+----*--*-+---------+---------+---------+
             -              ....
             -             ....8
             -            ....86
             -            ....63
             -          .....831
       63.13 +          .....315
             -         ......31.
             -        .......15.
             -        .......1..
             -        .......1.**
             -        ......12...
A     126.25 +       .......12...
             -       .......12.*.
             -       .......41...
             -       .......51.**
             -        .......1...
             -        .......18.W.
X     189.38 +        .......12...*
             -         ......518..
             -         ......512..*
             -          ......518..
             -           .....5129..
             -            .....511..
I     252.50 +             .....512*
             -              ....5612
             -               ....561
             -                 ...53
             -                   ..5
             -                     *
S     315.63 +
             -
             -
             -
             -
             -
      378.75 +
             -
             -
             -
             -
             -              *
F     441.88 +
             -
             -
             -
             -
             -
T     505.00 +              *      W
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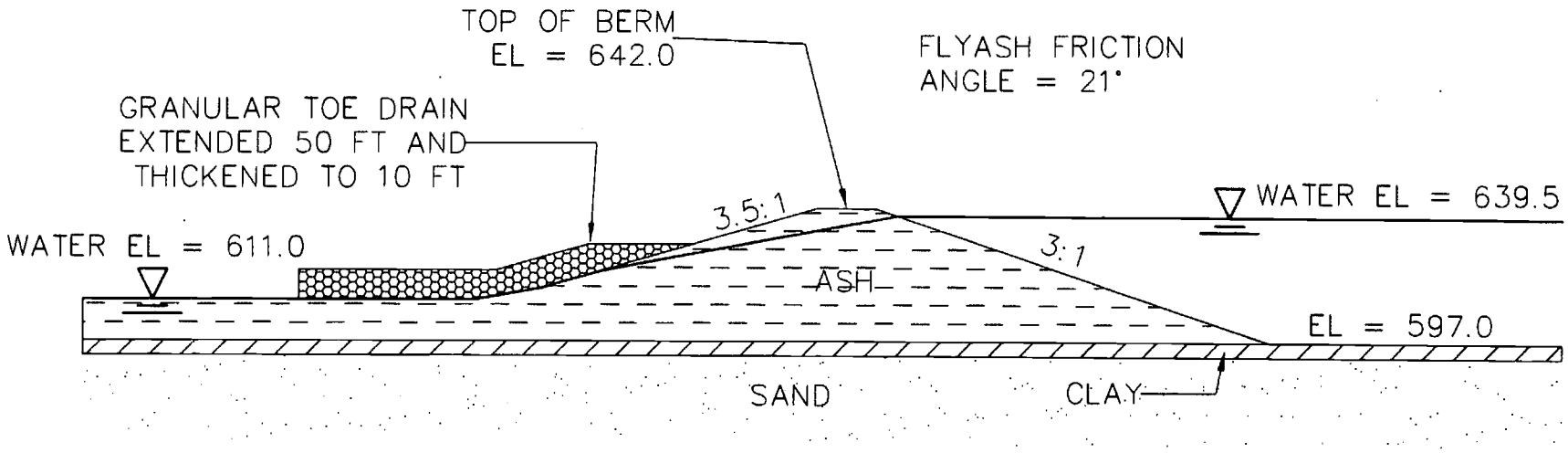

SCENARIO 10

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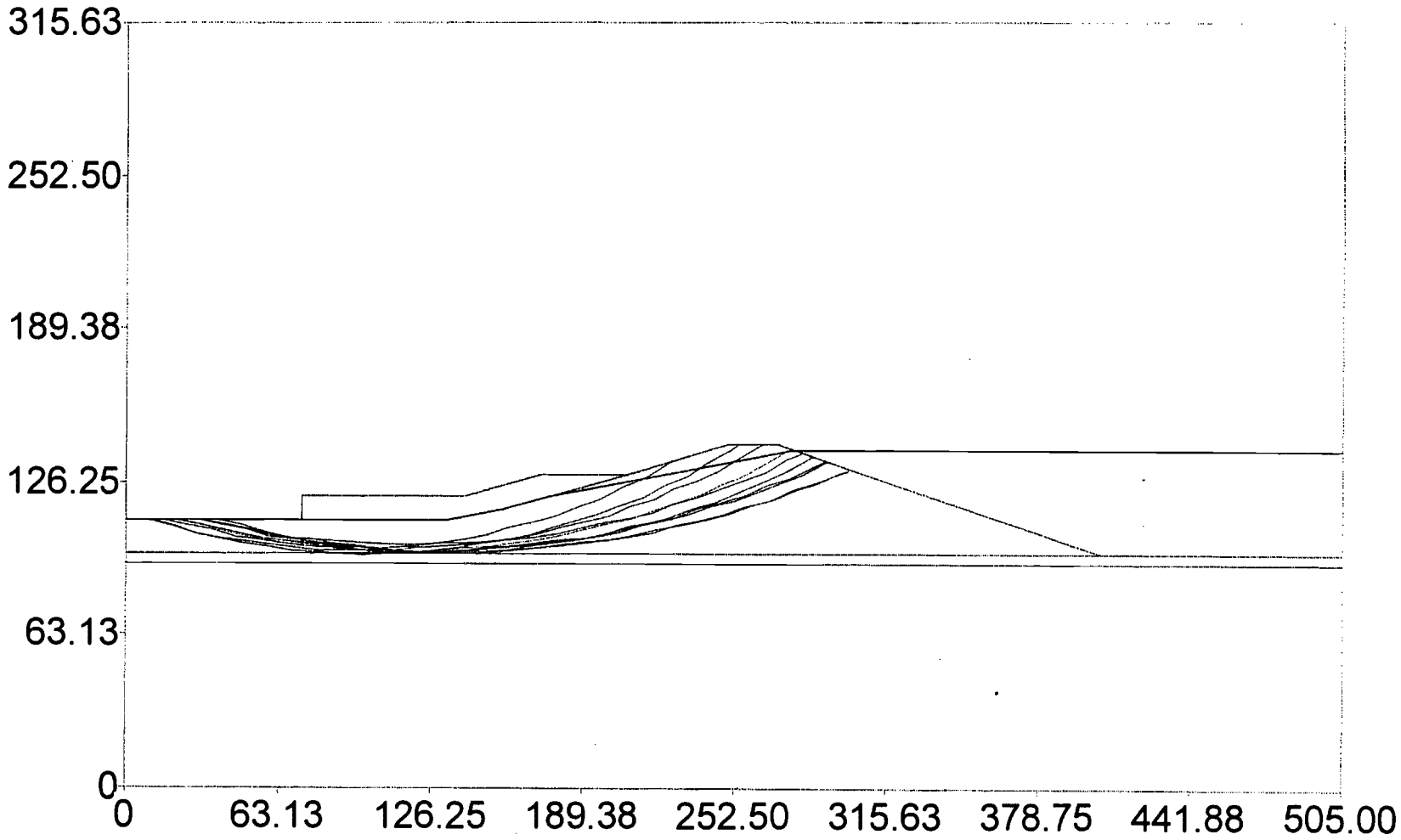
FMSM Profile with Extended Toe Drain



Safety Factor

1.95
1.98
2.00
2.02
2.03
2.05
2.08
2.09
2.10
2.10

Profile.out
** PCSTABL6 **

by
Purdue University

modified by
Peter J. Bosscher
University of Wisconsin-Madison

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

PROBLEM DESCRIPTION FMSM Profile with Extended Toe Drain

BOUNDARY COORDINATES

9 Top Boundaries
14 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	111.00	73.00	111.00	2
2	73.00	111.00	73.10	121.00	3
3	73.10	121.00	140.00	121.00	3
4	140.00	121.00	172.00	130.00	3
5	172.00	130.00	208.00	130.00	3
6	208.00	130.00	250.00	142.00	2
7	250.00	142.00	270.00	142.00	2
8	270.00	142.00	405.00	97.00	2
9	405.00	97.00	505.00	97.00	1
10	73.00	111.00	133.00	111.00	2
11	133.00	111.00	156.00	115.00	2
12	156.00	115.00	208.00	130.00	2
13	0.00	97.00	405.00	97.00	1
14	0.00	92.00	505.00	92.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type	Total Unit Wt.	Saturated Unit Wt.	Cohesion Intercept	Friction Angle	Pore Pressure	Pressure Constant	Piez. Surface

No.	(pcf)	(pcf)	(psf)	(deg)	Param.	(psf)	No.
1	125.0	125.0	50.0	25.0	0.00	0.0	1
2	90.0	90.0	0.0	21.0	0.00	0.0	1
3	140.0	140.0	0.0	35.0	0.00	0.0	1
4	120.0	120.0	0.0	31.0	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 6 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	111.00
2	133.00	111.00
3	156.00	115.00
4	176.00	121.00
5	277.00	139.50
6	505.00	139.50

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

1000 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of100 Points Equally Spaced Along The Ground Surface Between X = 0.00 ft.
and X = 160.00 ft.

Each Surface Terminates Between X = 225.00 ft.
and X = 300.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 0.00 ft.

10.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 28 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	22.63	111.00
2	32.27	108.35
3	41.99	105.99
4	51.77	103.92
5	61.61	102.15
6	71.50	100.68
7	81.44	99.52
8	91.40	98.65
9	101.38	98.09
10	111.38	97.83
11	121.38	97.87
12	131.37	98.22
13	141.35	98.87
14	151.31	99.82
15	161.23	101.07
16	171.11	102.62
17	180.93	104.47
18	190.70	106.62
19	200.40	109.07
20	210.02	111.80
21	219.55	114.83
22	228.98	118.14
23	238.31	121.74
24	247.53	125.62
25	256.62	129.78
26	265.59	134.21
27	274.41	138.92
28	276.19	139.94

*** 1.951 ***

Failure Surface Specified By 30 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	16.16	111.00
2	25.86	108.56
3	35.62	106.37
4	45.42	104.41
5	55.27	102.69
6	65.16	101.22
7	75.09	99.98
8	85.04	98.99
9	95.01	98.25
10	105.00	97.75
11	115.00	97.49
12	125.00	97.48
13	134.99	97.71
14	144.98	98.19
15	154.96	98.91
16	164.91	99.88

17	174.84	101.08
18	184.73	102.54
19	194.59	104.23
20	204.40	106.16
21	214.16	108.34
22	223.86	110.75
23	233.50	113.40
24	243.08	116.28
25	252.58	119.40
26	262.00	122.75
27	271.34	126.33
28	280.59	130.14
29	289.74	134.17
30	291.30	134.90

*** 1.977 ***

Failure Surface Specified By 29 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	21.01	111.00
2	30.72	108.59
3	40.48	106.42
4	50.29	104.50
5	60.15	102.83
6	70.05	101.40
7	79.98	100.23
8	89.94	99.30
9	99.91	98.62
10	109.90	98.20
11	119.90	98.02
12	129.90	98.10
13	139.90	98.42
14	149.88	99.00
15	159.85	99.83
16	169.79	100.90
17	179.70	102.23
18	189.58	103.80
19	199.41	105.63
20	209.19	107.69
21	218.92	110.01
22	228.59	112.56
23	238.19	115.36
24	247.72	118.40
25	257.16	121.68
26	266.53	125.19
27	275.80	128.93
28	284.97	132.91
29	290.11	135.30

*** 1.999 ***

Failure Surface Specified By 27 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	22.63	111.00
2	32.27	108.35
3	41.99	106.02
4	51.79	104.01
5	61.65	102.33
6	71.55	100.96
7	81.50	99.93
8	91.48	99.22
9	101.47	98.84
10	111.47	98.79
11	121.46	99.06
12	131.45	99.67
13	141.40	100.60
14	151.32	101.85
15	161.20	103.44
16	171.01	105.34
17	180.76	107.57
18	190.43	110.11
19	200.01	112.98
20	209.50	116.15
21	218.87	119.64
22	228.12	123.43
23	237.25	127.52
24	246.23	131.91
25	255.07	136.59
26	263.75	141.56
27	264.46	142.00

*** 2.015 ***

Failure Surface Specified By 27 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	38.79	111.00
2	48.42	108.29
3	58.12	105.89
4	67.90	103.79
5	77.74	101.99
6	87.62	100.50
7	97.55	99.32
8	107.52	98.45
9	117.50	97.89
10	127.50	97.65
11	137.50	97.71
12	147.49	98.09
13	157.47	98.78
14	167.42	99.77
15	177.33	101.08
16	187.20	102.70
17	197.01	104.62
18	206.76	106.85
19	216.44	109.38
20	226.03	112.21

21	235.53	115.34
22	244.92	118.76
23	254.21	122.47
24	263.37	126.48
25	272.41	130.76
26	281.30	135.33
27	284.58	137.14

*** 2.030 ***

Failure Surface Specified By 27 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	9.70	111.00
2	19.26	108.07
3	28.92	105.48
4	38.66	103.22
5	48.47	101.29
6	58.35	99.71
7	68.27	98.47
8	78.23	97.57
9	88.21	97.02
10	98.21	96.81
11	108.21	96.94
12	118.20	97.42
13	128.16	98.24
14	138.10	99.41
15	147.98	100.92
16	157.81	102.77
17	167.57	104.96
18	177.24	107.48
19	186.83	110.33
20	196.31	113.52
21	205.67	117.03
22	214.91	120.86
23	224.01	125.00
24	232.96	129.46
25	241.75	134.22
26	250.38	139.29
27	254.65	142.00

*** 2.048 ***

Failure Surface Specified By 27 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.71	111.00
2	40.45	108.76
3	50.26	106.79
4	60.11	105.08
5	70.01	103.65

6	79.94	102.48
7	89.90	101.58
8	99.88	100.96
9	109.87	100.60
10	119.87	100.52
11	129.87	100.70
12	139.86	101.16
13	149.83	101.89
14	159.78	102.89
15	169.70	104.16
16	179.58	105.70
17	189.42	107.51
18	199.20	109.58
19	208.92	111.92
20	218.58	114.52
21	228.16	117.38
22	237.66	120.50
23	247.07	123.88
24	256.39	127.52
25	265.60	131.40
26	274.71	135.53
27	280.68	138.44

*** 2.078 ***

Failure Surface Specified By 29 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.71	111.00
2	40.41	108.57
3	50.17	106.38
4	59.97	104.43
5	69.83	102.72
6	79.72	101.25
7	89.64	100.02
8	99.59	99.03
9	109.56	98.29
10	119.55	97.79
11	129.55	97.54
12	139.55	97.53
13	149.55	97.77
14	159.53	98.25
15	169.51	98.97
16	179.46	99.94
17	189.39	101.15
18	199.28	102.61
19	209.14	104.30
20	218.95	106.24
21	228.71	108.41
22	238.41	110.82
23	248.06	113.47
24	257.63	116.36
25	267.13	119.47
26	276.55	122.82
27	285.89	126.40
28	295.14	130.21
29	299.55	132.15

*** 2.087 ***

Failure Surface Specified By 24 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	11.31	111.00
2	20.90	108.15
3	30.59	105.67
4	40.36	103.55
5	50.20	101.80
6	60.11	100.42
7	70.06	99.41
8	80.04	98.78
9	90.04	98.53
10	100.03	98.65
11	110.02	99.14
12	119.98	100.01
13	129.91	101.26
14	139.77	102.88
15	149.58	104.86
16	159.29	107.21
17	168.92	109.93
18	178.43	113.01
19	187.83	116.44
20	197.08	120.22
21	206.19	124.35
22	215.14	128.82
23	223.91	133.62
24	226.88	135.40

*** 2.100 ***

Failure Surface Specified By 29 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	32.32	111.00
2	42.03	108.58
3	51.79	106.40
4	61.60	104.46
5	71.45	102.76
6	81.34	101.30
7	91.27	100.09
8	101.22	99.12
9	111.20	98.39
10	121.18	97.90
11	131.18	97.66
12	141.18	97.67
13	151.18	97.92
14	161.17	98.41
15	171.14	99.15

16	181.09	100.14
17	191.02	101.36
18	200.91	102.83
19	210.76	104.54
20	220.57	106.49
21	230.32	108.68
22	240.03	111.11
23	249.66	113.77
24	259.23	116.67
25	268.73	119.80
26	278.15	123.17
27	287.48	126.76
28	296.72	130.58
29	299.96	132.01

*** 2.101 ***

```
          Y            A     X     I     S            F     T

          0.00     63.13    126.25    189.38    252.50    315.63

X      0.00 +---------+----*--*-+---------+---------+---------+
            -              ...6
            -             ...21
            -            ....17
            -            ...615
            -          .....13.
      63.13 +          .....15.
            -         .....61.**
            -        ......61...
            -        ......61...
            -        ......21...
            -       .......13...
A    126.25 +       .......21...
            -       .......21.**
            -       .......819...
            -       ........19*..
            -       ........14...*
            -        .......219w.
X    189.38 +        .......219..
            -        .......8149.
            -         .......2169*
            -          ......31469
            -           .....82146.
            -           ......2144.
I    252.50 +            .....8211*
            -             ....02314
            -               ...825*
            -                ...825
            -                  ..2
            -                    0
S    315.63 +
            -
            -
            -
            -
            -
```

```
        378.75 +
               -
               -          *
               -
               -
               -
F       441.88 +
               -
               -
               -
               -
               -
T       505.00 +          *       W
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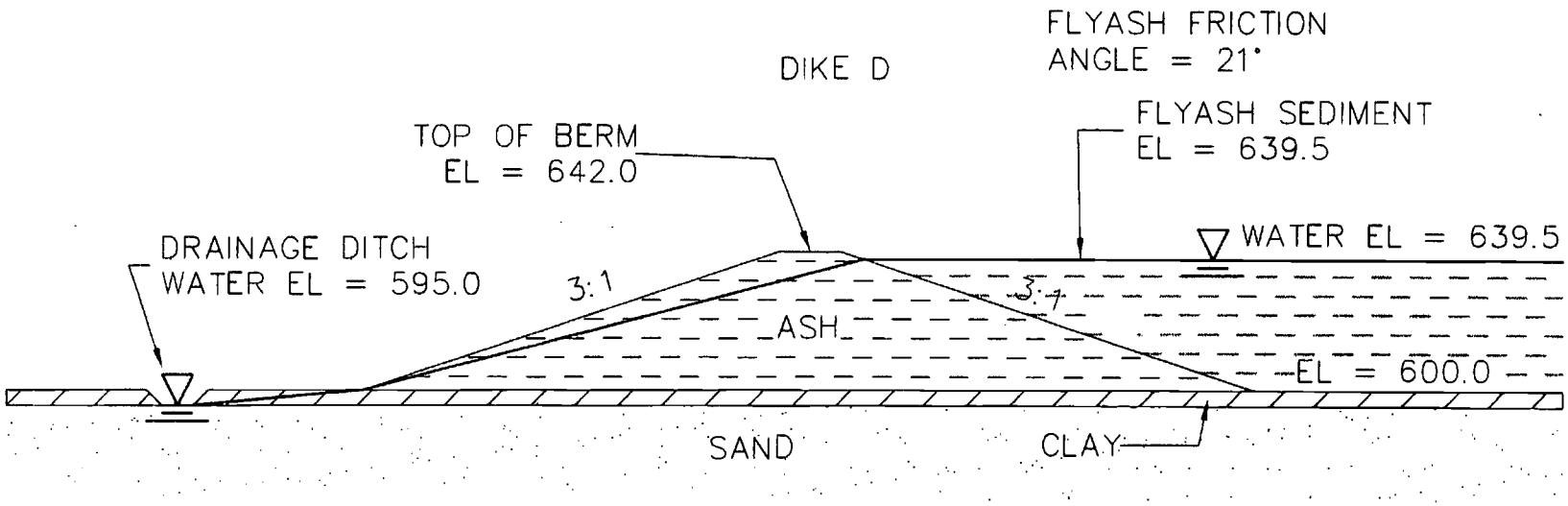

SCENARIO 11

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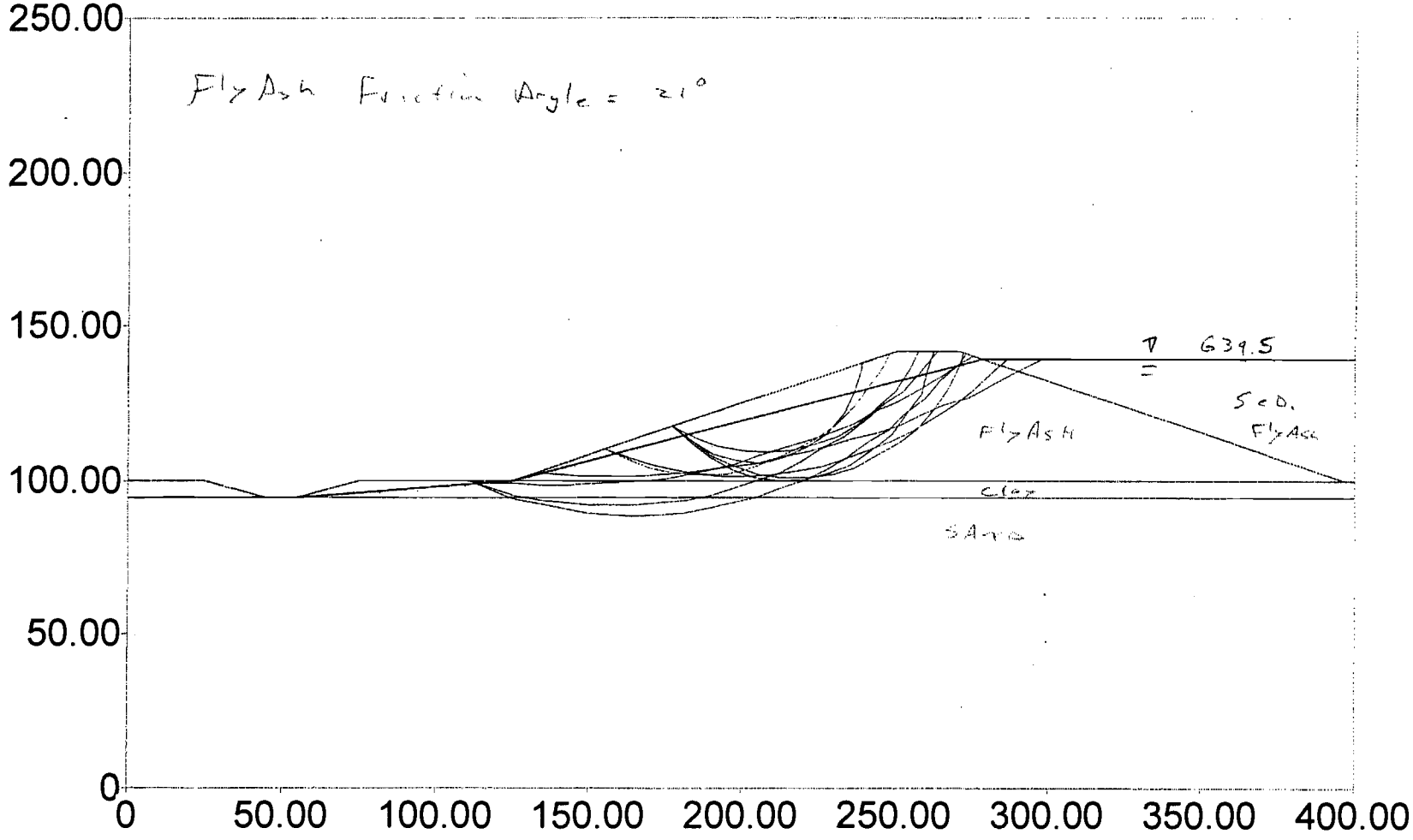
Indianapolis PL - Dike D



Safety Factor
0.79
0.86
0.88
0.89
0.92
0.94
0.98
0.99
1.01
1.01

Profile.out
** PCSTABL6 **

by
Purdue University

modified by
Peter J. Bosscher
University of Wisconsin-Madison

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

PROBLEM DESCRIPTION Indianapolis P&L - Dike D

BOUNDARY COORDINATES

9 Top Boundaries
13 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	100.00	25.00	100.00	4
2	25.00	100.00	45.00	95.00	4
3	45.00	95.00	55.00	95.00	4
4	55.00	95.00	75.00	100.00	2
5	75.00	100.00	125.00	100.00	2
6	125.00	100.00	251.00	142.00	1
7	251.00	142.00	271.00	142.00	1
8	271.00	142.00	278.50	139.50	1
9	278.50	139.50	400.00	139.50	3
10	278.50	139.50	397.00	100.00	1
11	397.00	100.00	400.00	100.00	2
12	125.00	100.00	397.00	100.00	2
13	55.00	95.00	400.00	95.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.

1	100.0	100.0	0.0	21.0	0.00	0.0	1
2	125.0	125.0	50.0	25.0	0.00	0.0	1
3	90.0	90.0	0.0	21.0	0.00	0.0	1
4	120.0	120.0	0.0	31.0	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	95.00
2	55.00	95.00
3	125.00	100.00
4	278.50	139.50
5	400.00	139.50

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 0.00 ft.
and X = 200.00 ft.

Each Surface Terminates Between X = 225.00 ft.
and X = 300.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 50.00 ft.

8.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	155.56	110.19
2	162.83	106.86
3	170.45	104.43
4	178.31	102.91
5	186.29	102.33
6	194.28	102.70
7	202.17	104.02
8	209.85	106.26
9	217.21	109.39
10	224.15	113.37
11	230.57	118.14
12	236.38	123.65
13	241.49	129.80
14	245.85	136.51
15	248.07	141.02

*** 0.785 ***

Failure Surface Specified By 23 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	111.11	100.00
2	119.08	99.25
3	127.06	98.76
4	135.06	98.52
5	143.06	98.55
6	151.05	98.83
7	159.03	99.37
8	166.99	100.17
9	174.92	101.23
10	182.82	102.54
11	190.66	104.11
12	198.45	105.93
13	206.18	108.00
14	213.83	110.32
15	221.41	112.88
16	228.90	115.69
17	236.30	118.75
18	243.59	122.03
19	250.77	125.56
20	257.84	129.31
21	264.78	133.29
22	271.58	137.49
23	275.91	140.36

*** 0.858 ***

Failure Surface Specified By 23 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	133.33	102.78
2	141.32	102.26
3	149.31	101.96
4	157.31	101.88
5	165.31	102.03
6	173.30	102.40
7	181.28	102.99
8	189.24	103.80
9	197.17	104.83
10	205.07	106.08
11	212.94	107.55
12	220.76	109.24
13	228.53	111.14
14	236.24	113.26
15	243.89	115.60
16	251.48	118.14
17	258.99	120.89
18	266.42	123.85
19	273.77	127.02
20	281.02	130.39
21	288.18	133.96
22	295.24	137.73
23	298.35	139.50

*** 0.882 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	155.56	110.19
2	163.11	107.54
3	170.81	105.40
4	178.65	103.77
5	186.57	102.66
6	194.55	102.08
7	202.55	102.03
8	210.53	102.50
9	218.47	103.51
10	226.33	105.03
11	234.06	107.07
12	241.65	109.61
13	249.05	112.65
14	256.23	116.17
15	263.17	120.16
16	269.82	124.59
17	276.17	129.46
18	282.19	134.74
19	286.94	139.50

*** 0.889 ***

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	177.78	117.59
2	184.80	113.76
3	192.31	111.00
4	200.14	109.35
5	208.12	108.86
6	216.09	109.53
7	223.88	111.35
8	231.33	114.29
9	238.26	118.27
10	244.55	123.22
11	250.05	129.03
12	254.64	135.58
13	257.87	142.00

*** 0.919 ***

Failure Surface Specified By 23 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	111.11	100.00
2	118.72	97.52
3	126.45	95.48
4	134.29	93.90
5	142.21	92.76
6	150.19	92.09
7	158.18	91.87
8	166.18	92.12
9	174.15	92.83
10	182.06	93.99
11	189.90	95.61
12	197.63	97.68
13	205.22	100.19
14	212.66	103.13
15	219.92	106.50
16	226.97	110.27
17	233.79	114.45
18	240.36	119.02
19	246.65	123.96
20	252.66	129.25
21	258.34	134.87
22	263.69	140.82
23	264.64	142.00

*** 0.942 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	177.78	117.59
2	183.48	111.98
3	190.03	107.38
4	197.24	103.92
5	204.92	101.68
6	212.86	100.74
7	220.85	101.12
8	228.68	102.80
9	236.12	105.74
10	242.97	109.86
11	249.06	115.05
12	254.21	121.17
13	258.29	128.05
14	261.18	135.51
15	262.53	142.00

*** 0.980 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	177.78	117.59
2	183.87	112.41
3	190.63	108.12
4	197.91	104.82
5	205.59	102.57
6	213.51	101.42
7	221.51	101.38
8	229.44	102.45
9	237.13	104.63
10	244.46	107.85
11	251.25	112.07
12	257.40	117.19
13	262.77	123.12
14	267.26	129.74
15	270.78	136.93
16	272.30	141.57

*** 0.990 ***

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	177.78	117.59
2	183.77	112.29
3	190.79	108.46
4	198.50	106.31

5	206.49	105.93
6	214.36	107.36
7	221.71	110.51
8	228.17	115.23
9	233.41	121.27
10	237.16	128.34
11	239.24	136.07
12	239.31	138.10

*** 1.007 ***

Failure Surface Specified By 24 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	111.11	100.00
2	118.57	97.10
3	126.18	94.63
4	133.92	92.61
5	141.76	91.03
6	149.68	89.91
7	157.65	89.25
8	165.65	89.05
9	173.65	89.32
10	181.61	90.04
11	189.53	91.22
12	197.36	92.85
13	205.08	94.94
14	212.67	97.46
15	220.11	100.42
16	227.36	103.81
17	234.40	107.60
18	241.21	111.80
19	247.77	116.38
20	254.05	121.33
21	260.04	126.63
22	265.71	132.28
23	271.05	138.24
24	273.41	141.20

*** 1.012 ***

```
          Y            A     X     I     S            F     T

          0.00      50.00    100.00    150.00    200.00    250.00
X      0.00 +---------+--------W*---------+---------+---------+
            -                 ..
            -                ...
            -               ....*
            -              .....
            -            ......*
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        50.00 +            ......
              -           .......*
              -           ....... .
              -          .........*
              -          .........
              -          ..........
A      100.00 +         ..........
              -         ......... 2
              -         .........02
              -         .........6*
              -         .........623
              -         ........062.
X      150.00 +         ........6.2.
              -         ........6.2.1
              -          .......6.214
              -          .......0621..5
              -          .......061275.
              -          .......06415..
I      200.00 +           .......0415...
              -           .......0612...
              -            ......0741....
              -            .......7431....
              -             ......8403119.
              -              .......4325199
S      250.00 +               ......843251*
              -                ......430255
              -                 ......43826
              -                   .....342*
              -                    .....344
              -                       ...33
       300.00 +                         ..3
              -
              -
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              -
F      350.00 +
              -
              -
              -
              -
              -
T      400.00 +                  **       *
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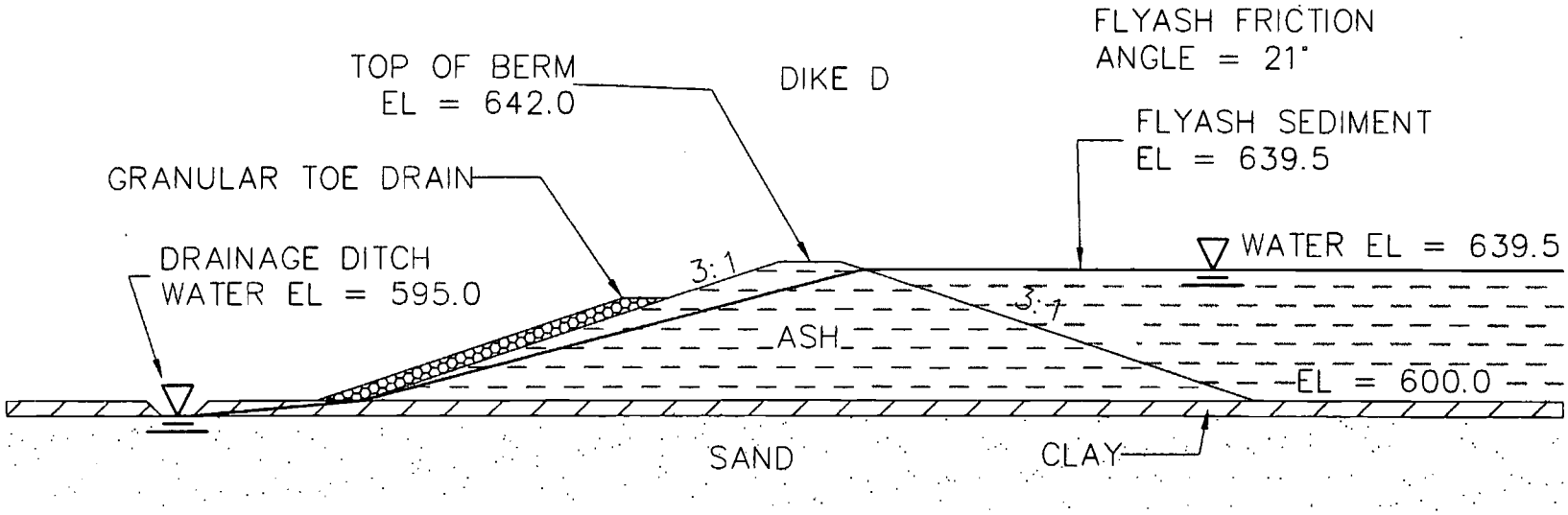

SCENARIO 12

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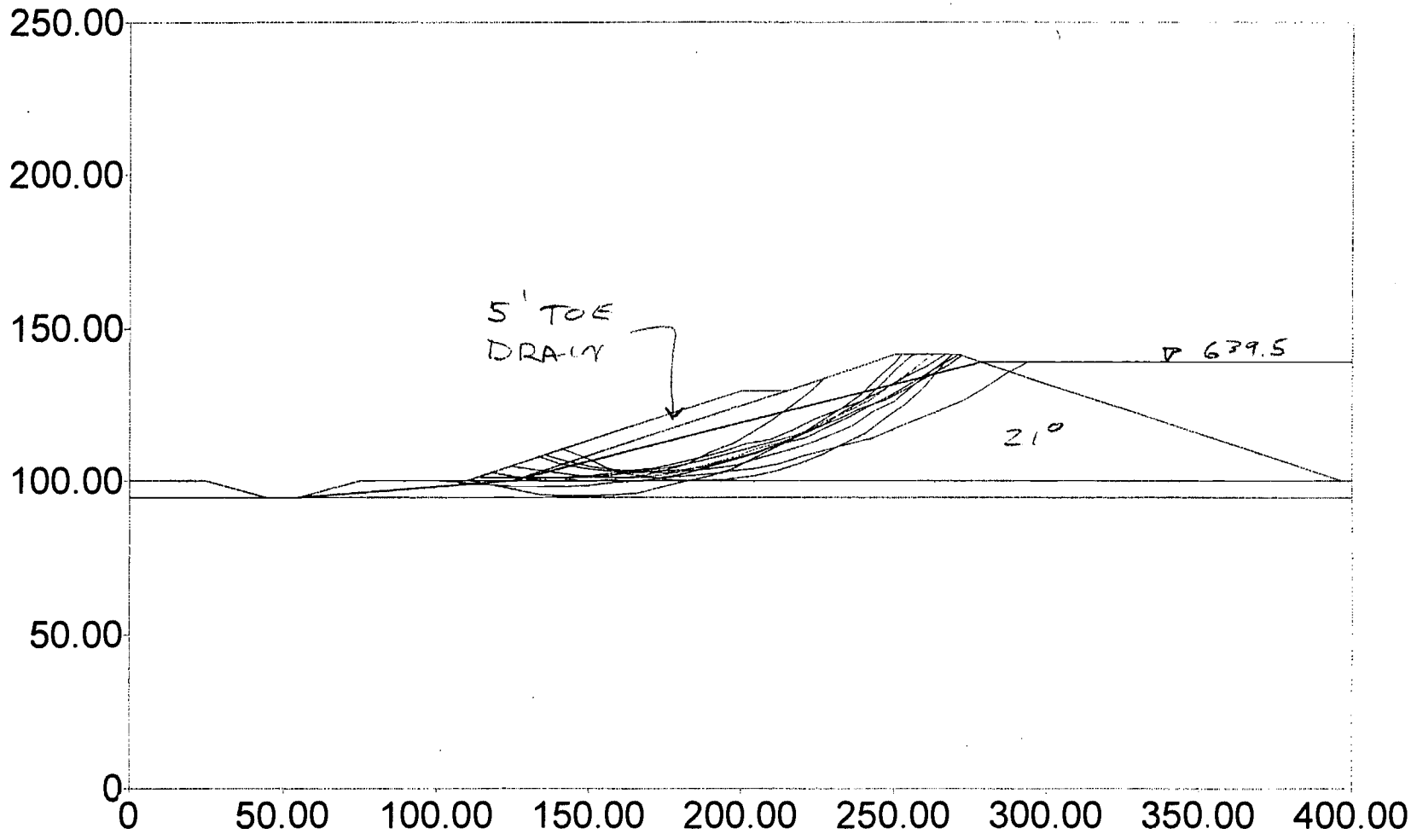
Indianapolis PL - Dike D



Safety Factor
1.14
1.16
1.19
1.19
1.20
1.20
1.20
1.20
1.22
1.22

Profile.out
** PCSTABL6 **

by
Purdue University

modified by
Peter J. Bosscher
University of Wisconsin-Madison

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

PROBLEM DESCRIPTION Indianapolis P&L - Dike D

BOUNDARY COORDINATES

11 Top Boundaries
17 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	100.00	25.00	100.00	4
2	25.00	100.00	45.00	95.00	4
3	45.00	95.00	55.00	95.00	4
4	55.00	95.00	75.00	100.00	2
5	75.00	100.00	110.00	100.00	2
6	110.00	100.00	200.00	130.00	5
7	200.00	130.00	215.00	130.00	5
8	215.00	130.00	251.00	142.00	1
9	251.00	142.00	271.00	142.00	1
10	271.00	142.00	278.50	139.50	1
11	278.50	139.50	400.00	139.50	3
12	278.50	139.50	397.00	100.00	1
13	397.00	100.00	400.00	100.00	2
14	110.00	100.00	125.00	100.00	2
15	125.00	100.00	215.00	130.00	1
16	125.00	100.00	397.00	100.00	2
17	55.00	95.00	400.00	95.00	4

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	100.0	100.0	0.0	21.0	0.00	0.0	1
2	125.0	125.0	50.0	25.0	0.00	0.0	1
3	90.0	90.0	0.0	21.0	0.00	0.0	1
4	120.0	120.0	0.0	31.0	0.00	0.0	1
5	140.0	140.0	0.0	35.0	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	95.00
2	55.00	95.00
3	125.00	100.00
4	278.50	139.50
5	400.00	139.50

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

1000 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of100 Points Equally Spaced Along The Ground Surface Between X = 0.00 ft.
and X = 200.00 ft.

Each Surface Terminates Between X = 225.00 ft.
and X = 300.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 50.00 ft.

8.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	119.19	103.06
2	127.11	101.95
3	135.08	101.20
4	143.07	100.79
5	151.07	100.75
6	159.06	101.05
7	167.04	101.72
8	174.97	102.73
9	182.85	104.10
10	190.67	105.82
11	198.40	107.88
12	206.03	110.29
13	213.54	113.03
14	220.93	116.10
15	228.17	119.50
16	235.25	123.22
17	242.17	127.25
18	248.89	131.58
19	255.42	136.20
20	261.73	141.12
21	262.77	142.00

*** 1.140 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	119.19	103.06
2	127.04	101.50
3	134.97	100.49
4	142.96	100.03
5	150.96	100.12
6	158.93	100.76
7	166.84	101.96
8	174.65	103.69
9	182.32	105.97
10	189.82	108.77
11	197.10	112.08
12	204.14	115.88
13	210.89	120.17
14	217.34	124.91
15	223.44	130.08
16	227.70	134.23

*** 1.163 ***

Failure Surface Specified By 22 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	115.15	101.72
2	123.14	101.28
3	131.14	101.09
4	139.14	101.14
5	147.13	101.44
6	155.11	101.99
7	163.07	102.78
8	171.01	103.81
9	178.91	105.09
10	186.76	106.60
11	194.56	108.36
12	202.31	110.36
13	209.99	112.59
14	217.60	115.06
15	225.13	117.76
16	232.58	120.69
17	239.93	123.85
18	247.18	127.23
19	254.32	130.83
20	261.35	134.65
21	268.26	138.68
22	272.67	141.44

*** 1.188 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	141.41	110.47
2	148.76	107.30
3	156.33	104.70
4	164.07	102.70
5	171.95	101.30
6	179.91	100.52
7	187.91	100.35
8	195.90	100.80
9	203.82	101.87
10	211.65	103.55
11	219.32	105.82
12	226.79	108.69
13	234.01	112.12
14	240.95	116.10
15	247.56	120.60
16	253.81	125.60
17	259.65	131.07
18	265.04	136.98
19	268.97	142.00

*** 1.193 ***

Failure Surface Specified By 24 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	103.03	100.00
2	110.98	99.10
3	118.95	98.46
4	126.95	98.10
5	134.95	98.01
6	142.94	98.18
7	150.93	98.63
8	158.90	99.34
9	166.84	100.32
10	174.74	101.58
11	182.60	103.09
12	190.39	104.87
13	198.13	106.92
14	205.79	109.22
15	213.37	111.78
16	220.86	114.60
17	228.25	117.66
18	235.53	120.97
19	242.69	124.53
20	249.74	128.33
21	256.64	132.36
22	263.41	136.63
23	270.04	141.12
24	271.17	141.94

*** 1.199 ***

Failure Surface Specified By 20 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	135.35	108.45
2	143.11	106.50
3	150.97	105.00
4	158.90	103.96
5	166.88	103.37
6	174.88	103.25
7	182.87	103.59
8	190.83	104.38
9	198.73	105.64
10	206.55	107.35
11	214.25	109.51
12	221.82	112.10
13	229.22	115.13
14	236.44	118.59
15	243.45	122.45
16	250.22	126.71
17	256.73	131.35

18	262.97	136.36
19	268.90	141.73
20	269.17	142.00

*** 1.200 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	115.15	101.72
2	123.14	101.36
3	131.14	101.25
4	139.14	101.41
5	147.13	101.82
6	155.10	102.48
7	163.05	103.40
8	170.96	104.58
9	178.83	106.01
10	186.66	107.69
11	194.42	109.62
12	202.12	111.80
13	209.74	114.23
14	217.28	116.90
15	224.73	119.81
16	232.09	122.95
17	239.34	126.33
18	246.48	129.95
19	253.50	133.79
20	260.39	137.85
21	266.94	142.00

*** 1.200 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	133.33	107.78
2	141.11	105.89
3	148.99	104.50
4	156.94	103.62
5	164.93	103.25
6	172.93	103.40
7	180.90	104.06
8	188.81	105.23
9	196.64	106.90
10	204.33	109.08
11	211.88	111.74
12	219.23	114.89
13	226.37	118.50
14	233.27	122.56
15	239.88	127.05

16	246.20	131.96
17	252.19	137.27
18	256.88	142.00

*** 1.202 ***

Failure Surface Specified By 24 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	125.25	105.08
2	133.15	103.80
3	141.09	102.80
4	149.05	102.06
5	157.04	101.60
6	165.04	101.42
7	173.04	101.50
8	181.03	101.87
9	189.00	102.50
10	196.95	103.41
11	204.86	104.60
12	212.73	106.05
13	220.54	107.77
14	228.29	109.76
15	235.97	112.02
16	243.56	114.53
17	251.06	117.31
18	258.47	120.34
19	265.76	123.62
20	272.94	127.15
21	279.99	130.93
22	286.91	134.95
23	293.69	139.20
24	294.13	139.50

*** 1.218 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	111.11	100.37
2	118.89	98.51
3	126.76	97.09
4	134.70	96.11
5	142.69	95.59
6	150.69	95.52
7	158.68	95.90
8	166.63	96.74
9	174.53	98.02
10	182.34	99.75
11	190.04	101.92
12	197.61	104.52

13	205.02	107.54
14	212.24	110.98
15	219.26	114.82
16	226.05	119.05
17	232.58	123.66
18	238.85	128.63
19	244.83	133.95
20	250.49	139.60
21	252.64	142.00

*** 1.219 ***

```
          Y            A     X     I     S            F     T

          0.00     50.00    100.00    150.00    200.00    250.00

X      0.00 +---------+--------W*---------+---------+---------+
            -                 ...
            -                ....
            -               ....*
            -              ......
            -            ......*
      50.00 +            .......
            -           .......*
            -           .........
            -          .........*
            -          ..........
            -          ..........
A    100.00 +         ..........5
            -         ..........*
            -         ..........31
            -         .........0*9
            -         .........0196
            -         .........0164
X    150.00 +         .........014..
            -         .........014..
            -         .........013...
            -         ..........41....
            -         ..........417...
            -          .........412....
I    200.00 +          .........4512..*
            -           .........4132..
            -           .........451.2*
            -            .........411.22
            -             ........4631..
            -             .........46100.
S    250.00 +              ........94317*
            -                .......9.311
            -                 .......9.41
            -                  ......9..*
            -                    .....99.
            -                       ....9
     300.00 +                         ...
            -
            -
            -
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F      350.00 +
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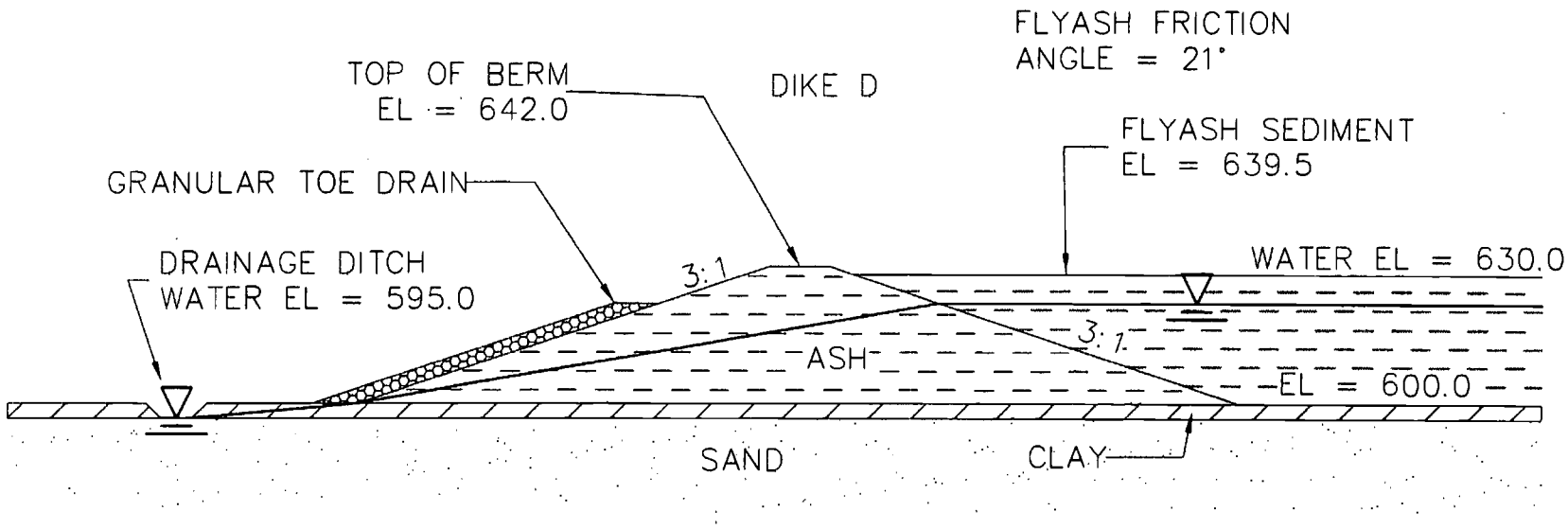

SCENARIO 13

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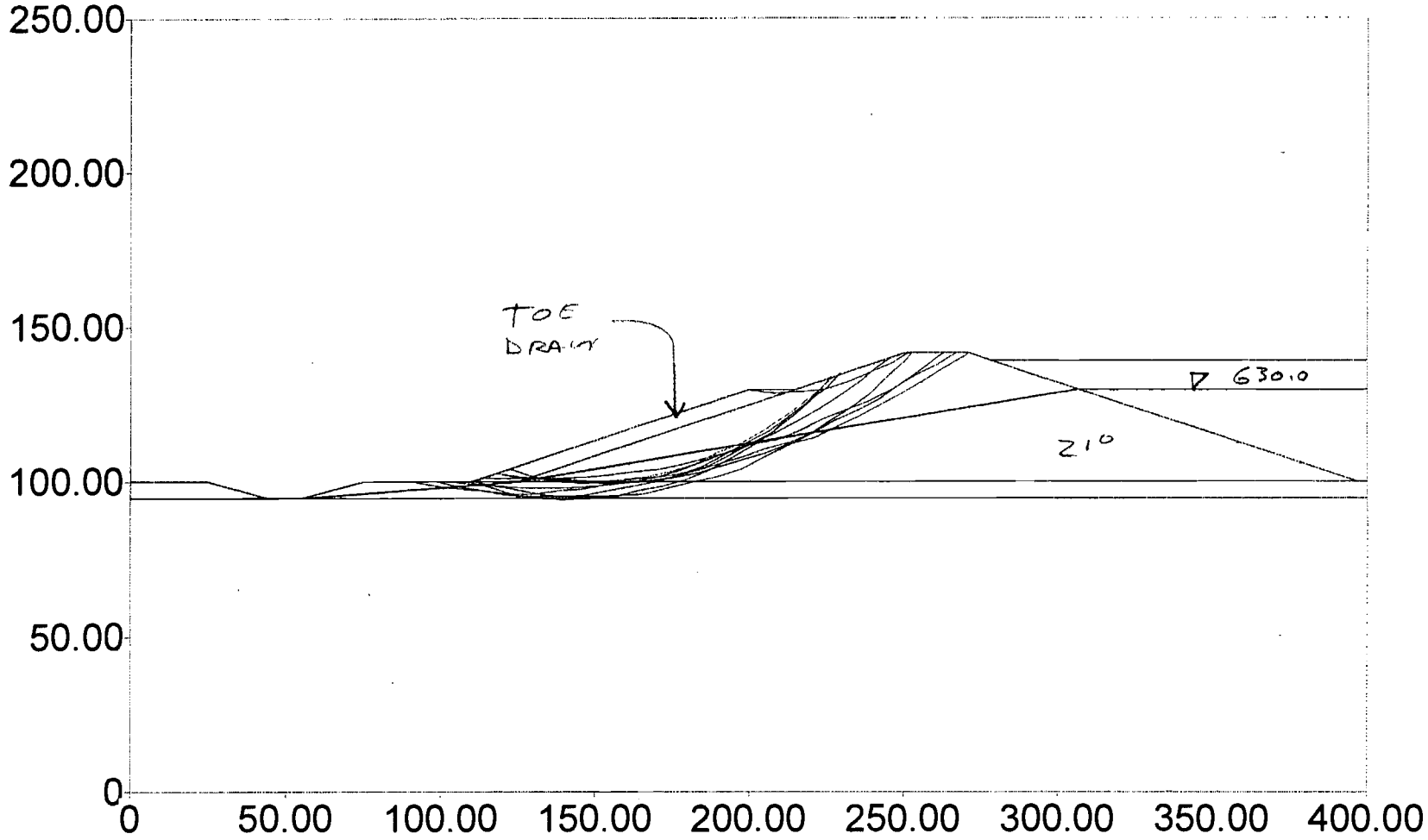
Indianapolis PL - Dike D



Safety Factor
1.37
1.41
1.41
1.44
1.45
1.46
1.47
1.47
1.47
1.47

Profile.out
** PCSTABL6 **

by
Purdue University

modified by
Peter J. Bosscher
University of Wisconsin-Madison

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

PROBLEM DESCRIPTION Indianapolis P&L - Dike D

BOUNDARY COORDINATES

11 Top Boundaries
17 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	100.00	25.00	100.00	4
2	25.00	100.00	45.00	95.00	4
3	45.00	95.00	55.00	95.00	4
4	55.00	95.00	75.00	100.00	2
5	75.00	100.00	110.00	100.00	2
6	110.00	100.00	200.00	130.00	5
7	200.00	130.00	215.00	130.00	5
8	215.00	130.00	251.00	142.00	1
9	251.00	142.00	271.00	142.00	1
10	271.00	142.00	278.50	139.50	1
11	278.50	139.50	400.00	139.50	3
12	278.50	139.50	397.00	100.00	1
13	397.00	100.00	400.00	100.00	2
14	110.00	100.00	125.00	100.00	2
15	125.00	100.00	215.00	130.00	1
16	125.00	100.00	397.00	100.00	2
17	55.00	95.00	400.00	95.00	4

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	100.0	100.0	0.0	21.0	0.00	0.0	1
2	125.0	125.0	50.0	25.0	0.00	0.0	1
3	90.0	90.0	0.0	21.0	0.00	0.0	1
4	120.0	120.0	0.0	31.0	0.00	0.0	1
5	140.0	140.0	0.0	35.0	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	95.00
2	55.00	95.00
3	125.00	100.00
4	307.00	130.00
5	400.00	130.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

1000 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of100 Points Equally Spaced Along The Ground Surface Between X = 0.00 ft.
and X = 200.00 ft.

Each Surface Terminates Between X = 225.00 ft.
and X = 300.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 50.00 ft.

8.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	119.19	103.06
2	127.04	101.50
3	134.97	100.49
4	142.96	100.03
5	150.96	100.12
6	158.93	100.76
7	166.84	101.96
8	174.65	103.69
9	182.32	105.97
10	189.82	108.77
11	197.10	112.08
12	204.14	115.88
13	210.89	120.17
14	217.34	124.91
15	223.44	130.08
16	227.70	134.23

*** 1.365 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	119.19	103.06
2	127.11	101.95
3	135.08	101.20
4	143.07	100.79
5	151.07	100.75
6	159.06	101.05
7	167.04	101.72
8	174.97	102.73
9	182.85	104.10
10	190.67	105.82
11	198.40	107.88
12	206.03	110.29
13	213.54	113.03
14	220.93	116.10
15	228.17	119.50
16	235.25	123.22
17	242.17	127.25
18	248.89	131.58
19	255.42	136.20
20	261.73	141.12
21	262.77	142.00

*** 1.408 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	98.99	100.00
2	106.77	98.15
3	114.65	96.77
4	122.60	95.85
5	130.59	95.40
6	138.59	95.43
7	146.57	95.93
8	154.51	96.90
9	162.38	98.34
10	170.15	100.25
11	177.80	102.61
12	185.29	105.41
13	192.60	108.66
14	199.71	112.33
15	206.59	116.42
16	213.21	120.90
17	219.56	125.77
18	225.61	131.01
19	229.55	134.85

*** 1.413 ***

Failure Surface Specified By 22 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	90.91	100.00
2	98.80	98.65
3	106.73	97.64
4	114.70	96.98
5	122.70	96.65
6	130.70	96.67
7	138.69	97.03
8	146.66	97.74
9	154.59	98.78
10	162.47	100.17
11	170.28	101.89
12	178.01	103.94
13	185.65	106.32
14	193.18	109.03
15	200.58	112.06
16	207.85	115.40
17	214.97	119.05
18	221.92	123.01
19	228.70	127.26
20	235.29	131.79
21	241.68	136.60
22	246.37	140.46

*** 1.439 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	111.11	100.37
2	118.89	98.51
3	126.76	97.09
4	134.70	96.11
5	142.69	95.59
6	150.69	95.52
7	158.68	95.90
8	166.63	96.74
9	174.53	98.02
10	182.34	99.75
11	190.04	101.92
12	197.61	104.52
13	205.02	107.54
14	212.24	110.98
15	219.26	114.82
16	226.05	119.05
17	232.58	123.66
18	238.85	128.63
19	244.83	133.95
20	250.49	139.60
21	252.64	142.00

*** 1.446 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	123.23	104.41
2	130.91	102.17
3	138.76	100.59
4	146.70	99.67
5	154.70	99.43
6	162.69	99.86
7	170.61	100.96
8	178.41	102.73
9	186.04	105.15
10	193.43	108.20
11	200.55	111.86
12	207.32	116.11
13	213.72	120.92
14	219.69	126.25
15	225.18	132.06
16	226.63	133.88

*** 1.458 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	115.15	101.72
2	123.14	101.36
3	131.14	101.25
4	139.14	101.41
5	147.13	101.82
6	155.10	102.48
7	163.05	103.40
8	170.96	104.58
9	178.83	106.01
10	186.66	107.69
11	194.42	109.62
12	202.12	111.80
13	209.74	114.23
14	217.28	116.90
15	224.73	119.81
16	232.09	122.95
17	239.34	126.33
18	246.48	129.95
19	253.50	133.79
20	260.39	137.85
21	266.94	142.00

*** 1.465 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	109.09	100.00
2	116.79	97.82
3	124.63	96.22
4	132.56	95.18
5	140.55	94.73
6	148.55	94.86
7	156.51	95.57
8	164.41	96.87
9	172.19	98.73
10	179.81	101.15
11	187.24	104.13
12	194.43	107.64
13	201.34	111.66
14	207.95	116.18
15	214.20	121.16
16	220.08	126.59
17	225.55	132.43
18	226.74	133.91

*** 1.468 ***

Failure Surface Specified By 24 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	103.03	100.00
2	110.98	99.10
3	118.95	98.46
4	126.95	98.10
5	134.95	98.01
6	142.94	98.18
7	150.93	98.63
8	158.90	99.34
9	166.84	100.32
10	174.74	101.58
11	182.60	103.09
12	190.39	104.87
13	198.13	106.92
14	205.79	109.22
15	213.37	111.78
16	220.86	114.60
17	228.25	117.66
18	235.53	120.97
19	242.69	124.53
20	249.74	128.33
21	256.64	132.36
22	263.41	136.63
23	270.04	141.12
24	271.17	141.94

*** 1.470 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	200.00	130.00
2	207.96	129.18
3	215.96	129.26
4	223.90	130.24
5	231.68	132.10
6	239.20	134.83
7	246.36	138.39
8	251.96	142.00

*** 1.472 ***

Y A X I S F T

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                                Profile.out
              0.00      50.00     100.00     150.00     200.00     250.00

X       0.00 +---------+--------W*---------+---------+---------+
             -                  ...
             -                 ....
             -                ....*
             -               ......
             -             ......*
       50.00 +             .......
             -            .......*
             -            .........
             -           .........*
             -           ..........
             -           .........4
A     100.00 +          ..........3
             -          ..........*
             -          .........351
             -          .........3*6
             -          .........31..
             -          .........31..
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             -          ..........51....
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             -           .........521....
I     200.00 +           ..........511..*
             -            ..........231.0
             -            ..........9231*
             -             ..........22411
             -              ..........9243
             -              ...........254.
S     250.00 +               ...........27*
             -                 .........922
             -                  .........92
             -                   .........*
             -                     ........
             -                        .....
      300.00 +                          ...
             -                          W
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F     350.00 +
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             -
T     400.00 +                   **     W *
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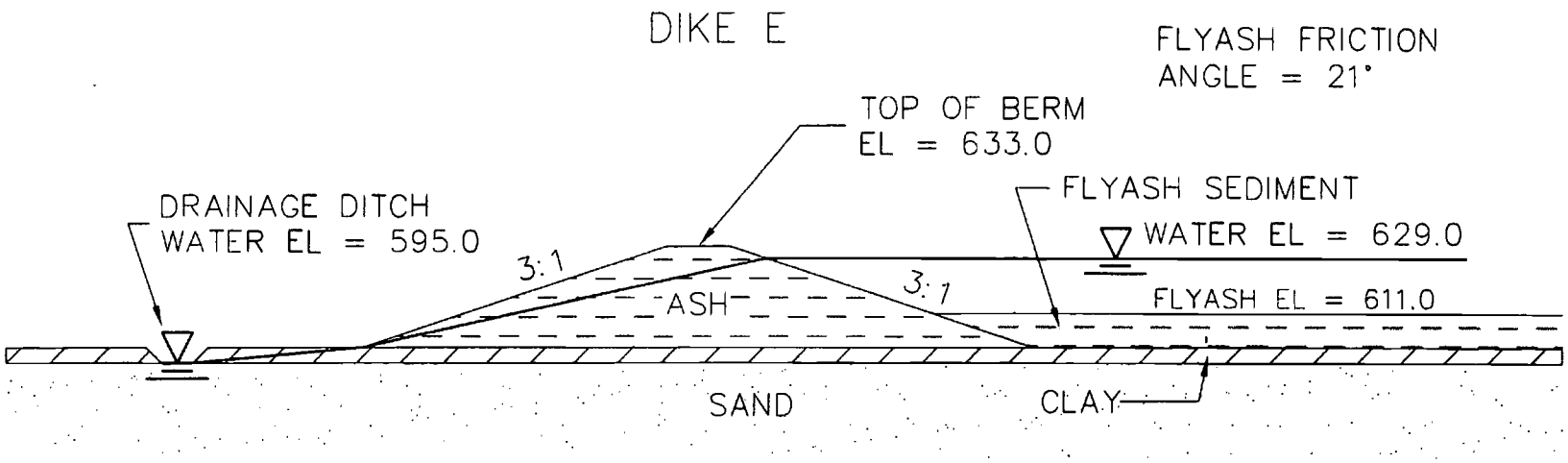

SCENARIO 14

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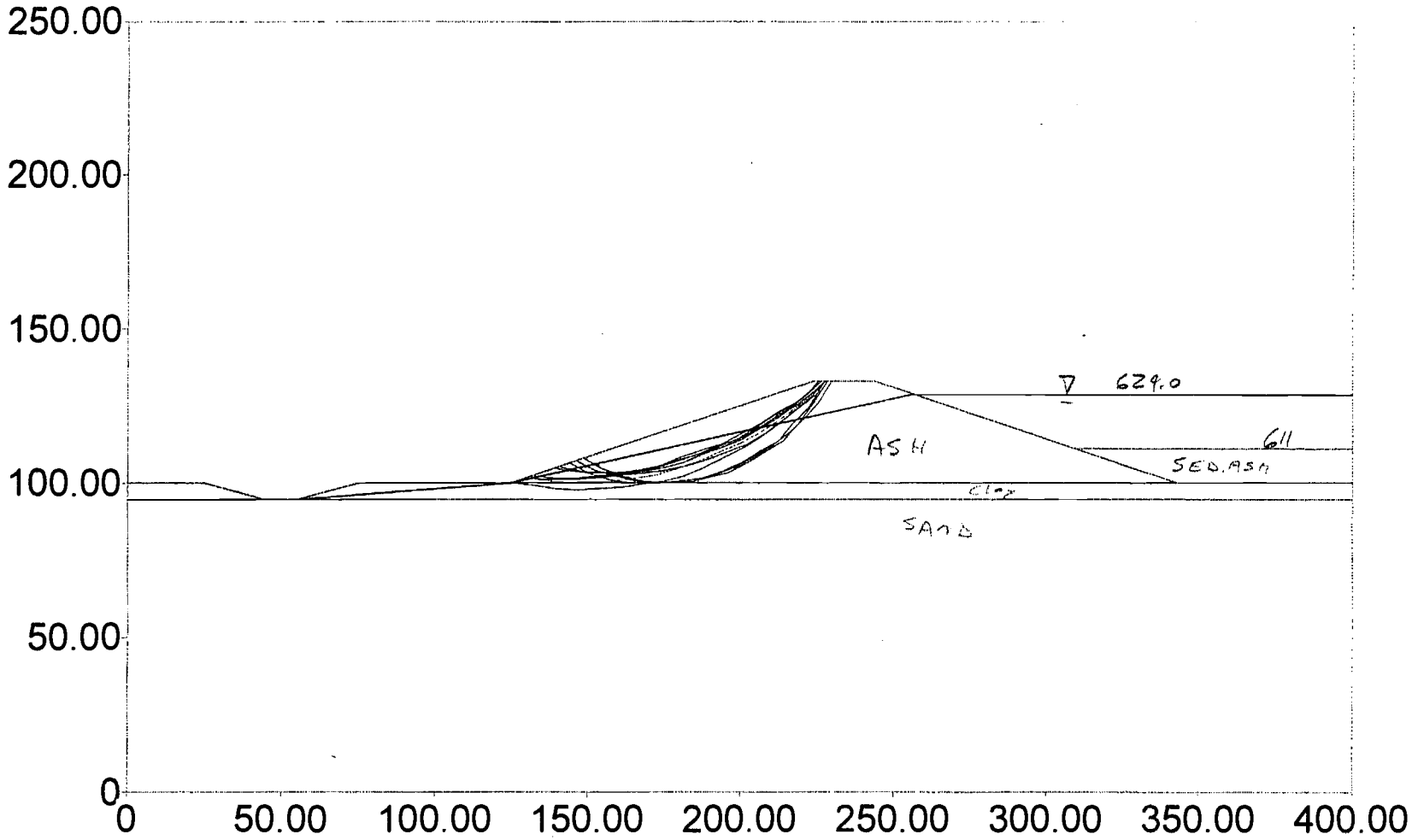
Indianapolis PL - Dike E



Safety Factor
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0.89
0.90
0.91
0.91
0.93
0.93
0.94
0.94
0.95

Profile.out
** PCSTABL6 **

by
Purdue University

modified by
Peter J. Bosscher
University of Wisconsin-Madison

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

PROBLEM DESCRIPTION Indianapolis P&L - Dike E

BOUNDARY COORDINATES

9 Top Boundaries
14 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	100.00	25.00	100.00	2
2	25.00	100.00	45.00	95.00	2
3	45.00	95.00	55.00	95.00	3
4	55.00	95.00	75.00	100.00	2
5	75.00	100.00	125.00	100.00	2
6	125.00	100.00	224.00	133.00	1
7	224.00	133.00	244.00	133.00	1
8	244.00	133.00	310.00	111.00	1
9	310.00	111.00	400.00	111.00	4
10	310.00	111.00	343.00	100.00	1
11	343.00	100.00	400.00	100.00	2
12	125.00	100.00	343.00	100.00	2
13	0.00	95.00	45.00	95.00	3
14	55.00	95.00	400.00	95.00	3

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type	Total Unit Wt.	Saturated Unit Wt.	Cohesion Intercept	Friction Angle	Pore Pressure	Pressure Constant	Piez. Surface

No.	(pcf)	(pcf)	(psf)	(deg)	Param.	(psf)	No.
1	100.0	100.0	0.0	21.0	0.00	0.0	1
2	125.0	125.0	50.0	25.0	0.00	0.0	1
3	120.0	120.0	0.0	31.0	0.00	0.0	1
4	90.0	90.0	0.0	21.0	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	95.00
2	55.00	95.00
3	125.00	100.00
4	256.00	129.00
5	400.00	129.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

1000 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of100 Points Equally Spaced Along The Ground Surface Between X = 100.00 ft.
and X = 150.00 ft.

Each Surface Terminates Between X = 225.00 ft.
and X = 300.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 50.00 ft.

7.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	131.31	102.10
2	138.25	101.16
3	145.23	100.67
4	152.23	100.61
5	159.22	101.01
6	166.17	101.84
7	173.05	103.12
8	179.84	104.83
9	186.50	106.97
10	193.02	109.54
11	199.36	112.51
12	205.49	115.87
13	211.40	119.63
14	217.06	123.75
15	222.45	128.22
16	227.51	133.00

*** 0.869 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	143.94	106.31
2	150.43	103.69
3	157.15	101.75
4	164.05	100.52
5	171.03	100.03
6	178.03	100.26
7	184.96	101.22
8	191.75	102.90
9	198.34	105.28
10	204.64	108.33
11	210.58	112.02
12	216.11	116.32
13	221.16	121.16
14	225.68	126.51
15	229.62	132.30
16	229.99	133.00

*** 0.886 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	146.47	107.16

2	152.88	104.35
3	159.57	102.29
4	166.45	101.03
5	173.44	100.56
6	180.43	100.89
7	187.34	102.03
8	194.07	103.96
9	200.53	106.64
10	206.64	110.05
11	212.32	114.15
12	217.49	118.86
13	222.09	124.14
14	226.05	129.92
15	227.67	133.00

*** 0.899 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	148.49	107.83
2	154.78	104.77
3	161.40	102.50
4	168.25	101.05
5	175.22	100.44
6	182.22	100.69
7	189.13	101.79
8	195.86	103.72
9	202.30	106.46
10	208.36	109.96
11	213.95	114.18
12	218.99	119.04
13	223.40	124.48
14	227.11	130.41
15	228.31	133.00

*** 0.913 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	130.81	101.94
2	137.79	101.50
3	144.79	101.44
4	151.79	101.77
5	158.75	102.48
6	165.67	103.57
7	172.51	105.04
8	179.26	106.88
9	185.91	109.09
10	192.42	111.65

11	198.78	114.57
12	204.97	117.84
13	210.98	121.43
14	216.78	125.35
15	222.36	129.58
16	226.38	133.00

*** 0.913 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	141.41	105.47
2	148.29	104.17
3	155.25	103.41
4	162.25	103.19
5	169.24	103.52
6	176.18	104.39
7	183.04	105.80
8	189.77	107.74
9	196.32	110.21
10	202.66	113.17
11	208.75	116.62
12	214.55	120.53
13	220.03	124.89
14	225.16	129.66
15	228.23	133.00

*** 0.929 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	132.32	102.44
2	139.31	102.03
3	146.31	102.00
4	153.30	102.34
5	160.27	103.06
6	167.18	104.15
7	174.03	105.61
8	180.78	107.44
9	187.43	109.63
10	193.95	112.18
11	200.33	115.07
12	206.54	118.30
13	212.57	121.86
14	218.39	125.74
15	224.00	129.92
16	227.70	133.00

*** 0.932 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	139.90	104.97
2	146.83	103.97
3	153.81	103.49
4	160.81	103.53
5	167.79	104.07
6	174.71	105.13
7	181.53	106.69
8	188.22	108.75
9	194.75	111.29
10	201.06	114.31
11	207.14	117.78
12	212.95	121.69
13	218.46	126.01
14	223.63	130.73
15	225.78	133.00

*** 0.940 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	132.32	102.44
2	139.32	102.14
3	146.32	102.21
4	153.30	102.64
5	160.26	103.46
6	167.16	104.63
7	173.98	106.18
8	180.72	108.08
9	187.35	110.34
10	193.84	112.95
11	200.19	115.90
12	206.37	119.18
13	212.37	122.78
14	218.17	126.70
15	223.76	130.93
16	226.22	133.00

*** 0.944 ***

Failure Surface Specified By 17 Coordinate Points

Point	X-Surf	Y-Surf

No.	(ft)	(ft)
1	126.26	100.42
2	133.13	99.05
3	140.07	98.15
4	147.06	97.73
5	154.06	97.78
6	161.04	98.30
7	167.97	99.30
8	174.81	100.77
9	181.54	102.70
10	188.12	105.08
11	194.52	107.91
12	200.72	111.16
13	206.68	114.83
14	212.38	118.89
15	217.79	123.34
16	222.89	128.14
17	227.39	133.00

*** 0.948 ***

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          Y            A     X     I     S            F     T

          0.00     50.00    100.00    150.00    200.00    250.00

X      0.00 +---------+--------**---------+---------+---------+
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            -
            -                   *
            -
            -                  *
       50.00 +
            -                  *
            -
            -                   *
            -
            -
A    100.00 +                   .
            -                 ...
            -                ....
            -               ....*
            -              .....1.
            -             ......12
X    150.00 +            .......124
            -            .......14.
            -            .......15.
            -           ........21..
            -           ........215.
            -           ........4219.
I    200.00 +           .........261.
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            -           ...........231.
            -            ...........221*
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S    250.00 +             .............
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T       400.00 +                     ** *    W
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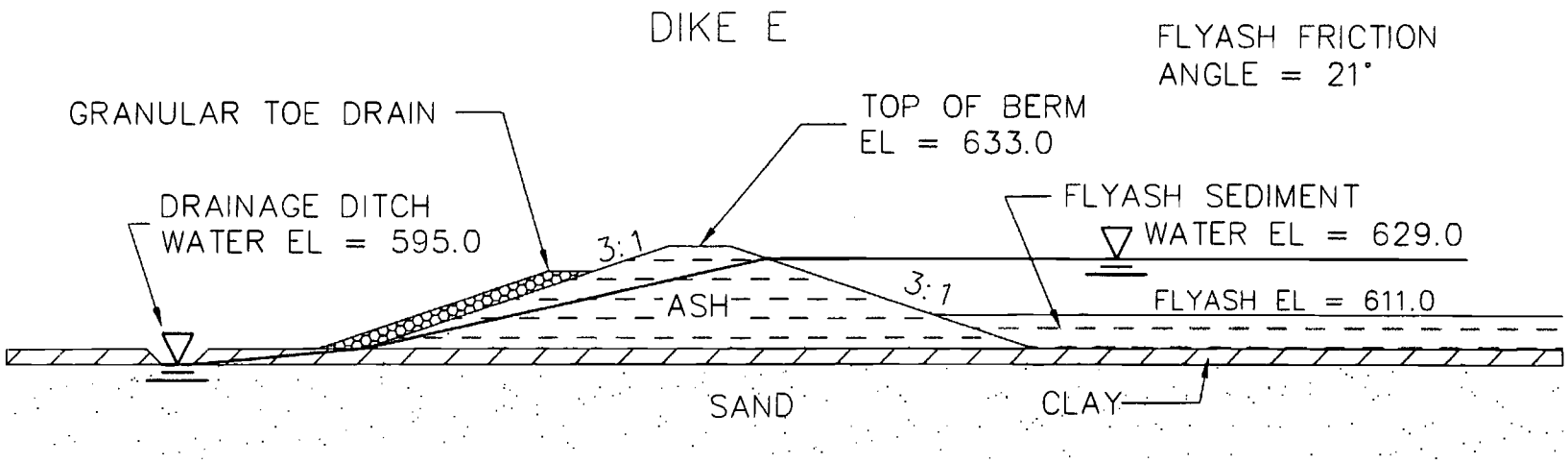

SCENARIO 15

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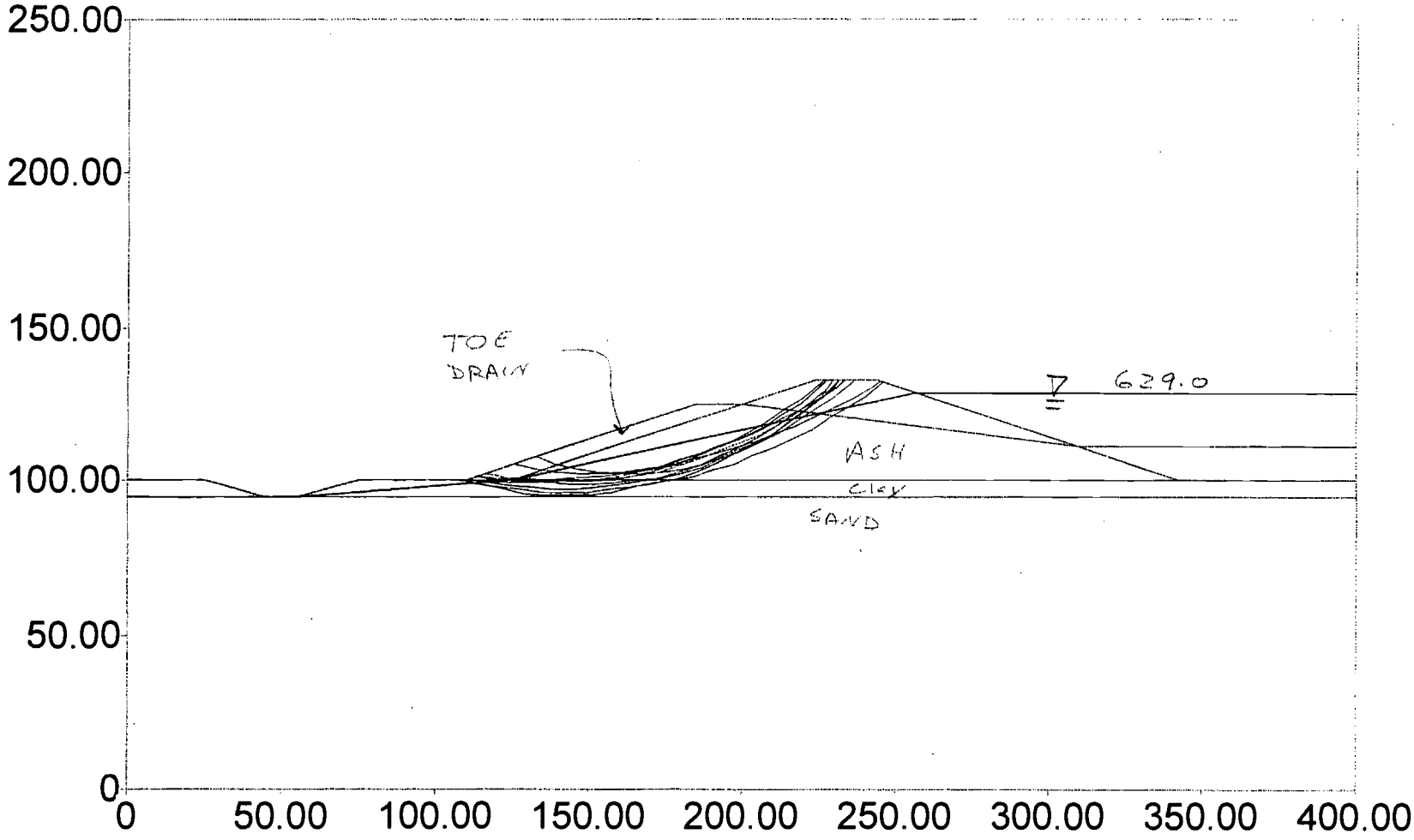
Indianapolis PL - Dike E



Safety Factor
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1.40
1.41
1.42
1.42
1.42
1.44
1.45
1.46
1.47

Profile.out
** PCSTABL6 **

by
Purdue University

modified by
Peter J. Bosscher
University of Wisconsin-Madison

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

PROBLEM DESCRIPTION Indianapolis P&L - Dike E

BOUNDARY COORDINATES

11 Top Boundaries
18 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	100.00	25.00	100.00	2
2	25.00	100.00	45.00	95.00	2
3	45.00	95.00	55.00	95.00	3
4	55.00	95.00	75.00	100.00	2
5	75.00	100.00	110.00	100.00	2
6	110.00	100.00	185.00	125.00	5
7	185.00	125.00	200.00	125.00	5
8	200.00	125.00	224.00	133.00	1
9	224.00	133.00	244.00	133.00	1
10	244.00	133.00	310.00	111.00	1
11	310.00	111.00	400.00	111.00	4
12	110.00	100.00	125.00	100.00	2
13	125.00	100.00	200.00	125.00	1
14	310.00	111.00	343.00	100.00	1
15	343.00	100.00	400.00	100.00	2
16	125.00	100.00	343.00	100.00	2
17	0.00	95.00	45.00	95.00	3
18	55.00	95.00	400.00	95.00	3

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	100.0	100.0	0.0	21.0	0.00	0.0	1
2	125.0	125.0	50.0	25.0	0.00	0.0	1
3	120.0	120.0	0.0	31.0	0.00	0.0	1
4	90.0	90.0	0.0	21.0	0.00	0.0	1
5	140.0	140.0	0.0	35.0	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	95.00
2	55.00	95.00
3	125.00	100.00
4	256.00	129.00
5	400.00	129.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

1000 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of100 Points Equally Spaced Along The Ground Surface Between X = 100.00 ft.
and X = 150.00 ft.

Each Surface Terminates Between X = 225.00 ft.
and X = 300.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 50.00 ft.

7.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	117.17	102.39
2	124.07	101.22
3	131.03	100.40
4	138.01	99.95
5	145.01	99.86
6	152.00	100.13
7	158.98	100.76
8	165.91	101.76
9	172.77	103.11
10	179.56	104.81
11	186.25	106.87
12	192.83	109.26
13	199.27	112.00
14	205.57	115.06
15	211.69	118.45
16	217.64	122.15
17	223.38	126.15
18	228.91	130.45
19	231.86	133.00

*** 1.378 ***

Failure Surface Specified By 20 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	110.10	100.03
2	117.08	99.46
3	124.07	99.16
4	131.07	99.13
5	138.07	99.36
6	145.05	99.87
7	152.01	100.64
8	158.93	101.69
9	165.81	102.99
10	172.63	104.56
11	179.38	106.40
12	186.06	108.49
13	192.66	110.83
14	199.16	113.43
15	205.55	116.28
16	211.83	119.37
17	217.99	122.70
18	224.01	126.27
19	229.90	130.06
20	234.09	133.00

*** 1.400 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	109.09	100.00
2	115.88	98.31
3	122.76	97.00
4	129.70	96.08
5	136.68	95.55
6	143.68	95.42
7	150.67	95.68
8	157.64	96.33
9	164.57	97.37
10	171.42	98.80
11	178.18	100.61
12	184.83	102.80
13	191.34	105.36
14	197.70	108.28
15	203.89	111.56
16	209.88	115.18
17	215.66	119.12
18	221.21	123.39
19	226.51	127.96
20	231.55	132.83
21	231.71	133.00

*** 1.411 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	114.65	101.55
2	121.55	100.41
3	128.51	99.65
4	135.50	99.27
5	142.50	99.26
6	149.49	99.63
7	156.45	100.37
8	163.36	101.50
9	170.20	102.99
10	176.95	104.85
11	183.59	107.06
12	190.10	109.64
13	196.46	112.56
14	202.65	115.82
15	208.66	119.41
16	214.47	123.32
17	220.06	127.54
18	225.41	132.05
19	226.42	133.00

*** 1.420 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	111.11	100.37
2	117.99	99.06
3	124.92	98.09
4	131.89	97.46
5	138.89	97.17
6	145.89	97.22
7	152.88	97.61
8	159.84	98.34
9	166.76	99.41
10	173.61	100.81
11	180.40	102.54
12	187.08	104.61
13	193.66	106.99
14	200.12	109.70
15	206.44	112.71
16	212.60	116.03
17	218.60	119.64
18	224.41	123.55
19	230.02	127.73
20	235.43	132.18
21	236.34	133.00

*** 1.423 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	115.15	101.72
2	122.13	101.15
3	129.12	100.82
4	136.12	100.72
5	143.12	100.87
6	150.11	101.26
7	157.08	101.89
8	164.03	102.76
9	170.94	103.86
10	177.81	105.20
11	184.63	106.78
12	191.39	108.59
13	198.09	110.63
14	204.71	112.90
15	211.25	115.39
16	217.70	118.11
17	224.05	121.05
18	230.30	124.20

19	236.44	127.56
20	242.46	131.14
21	244.90	132.70

*** 1.424 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	126.26	105.42
2	133.13	104.05
3	140.07	103.12
4	147.05	102.63
5	154.05	102.58
6	161.04	102.98
7	167.99	103.82
8	174.87	105.10
9	181.66	106.81
10	188.32	108.94
11	194.84	111.50
12	201.18	114.47
13	207.32	117.83
14	213.24	121.57
15	218.90	125.68
16	224.30	130.14
17	227.34	133.00

*** 1.441 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	117.17	102.39
2	123.99	100.79
3	130.88	99.59
4	137.84	98.82
5	144.83	98.46
6	151.83	98.52
7	158.81	99.01
8	165.76	99.91
9	172.63	101.23
10	179.41	102.96
11	186.08	105.09
12	192.61	107.62
13	198.97	110.54
14	205.14	113.84
15	211.11	117.50
16	216.85	121.51
17	222.33	125.86
18	227.54	130.53
19	229.99	133.00

*** 1.445 ***

Failure Surface Specified By 22 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	107.58	100.00
2	114.45	98.69
3	121.38	97.67
4	128.34	96.94
5	135.33	96.49
6	142.32	96.35
7	149.32	96.49
8	156.31	96.92
9	163.27	97.65
10	170.20	98.66
11	177.07	99.97
12	183.89	101.56
13	190.64	103.43
14	197.30	105.58
15	203.86	108.01
16	210.32	110.71
17	216.66	113.68
18	222.87	116.91
19	228.94	120.39
20	234.86	124.13
21	240.62	128.11
22	246.16	132.28

*** 1.457 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	103.54	100.00
2	110.25	98.01
3	117.07	96.42
4	123.97	95.26
5	130.93	94.52
6	137.92	94.19
7	144.92	94.30
8	151.90	94.83
9	158.83	95.78
10	165.70	97.15
11	172.47	98.94
12	179.12	101.13
13	185.62	103.72
14	191.95	106.70
15	198.09	110.06
16	204.02	113.79
17	209.70	117.87

```
18        215.13      122.29
19        220.29      127.03
20        225.14      132.07
21        225.93      133.00

   ***     1.470   ***


          Y           A     X     I     S           F     T

          0.00     50.00    100.00    150.00    200.00    250.00

X      0.00 +---------+--------**---------+---------+---------+
            -
            -
            -                   *
            -
            -                  *
      50.00 +
            -                  *
            -
            -                   *
            -
            -
A    100.00 +                   0
            -                 ..*
            -                ..01.
            -               ...3*7
            -              ....317.
            -             .....317.
X    150.00 +            ......317..
            -            ......317..
            -            ......312..
            -           ........31...
            -           ........912..*
            -           .........31...
I    200.00 +           .........912.*
            -           ..........911.
            -           ...........5124
            -            ..........9611*
            -            ............621
            -             ............6*
S    250.00 +             ............9
            -              ...........W
            -               ..........
            -                .........
            -                 .......
            -                   .....
     300.00 +                     ..
            -                     *
            -
            -
            -
            -                   *
F    350.00 +
            -
            -
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                 -
                 -
T      400.00 +                    ** *    W
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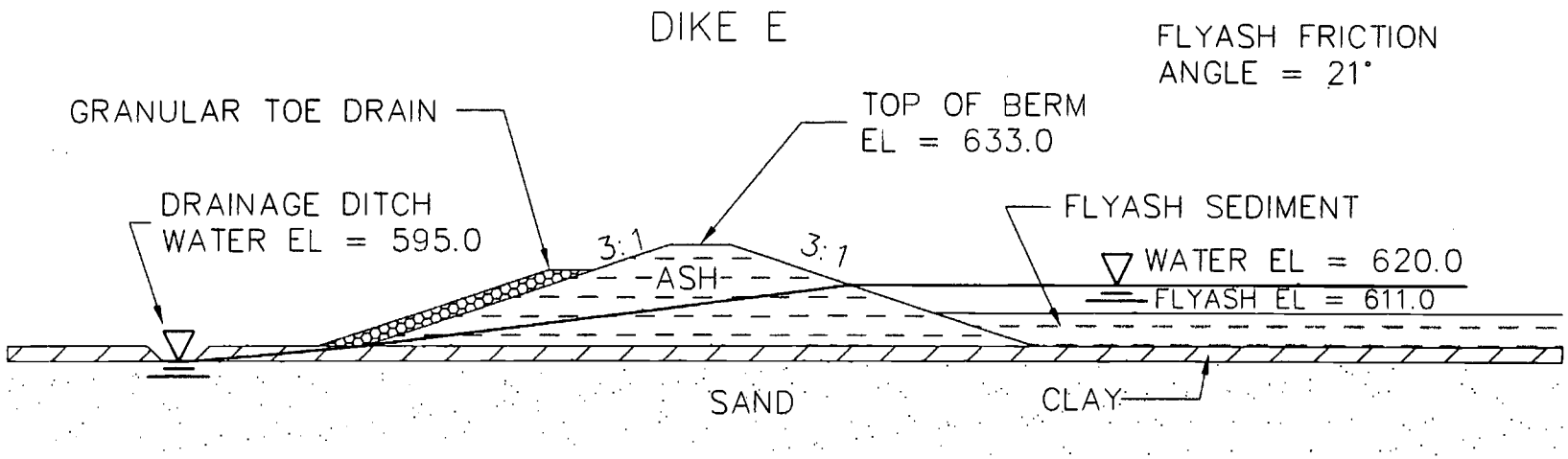
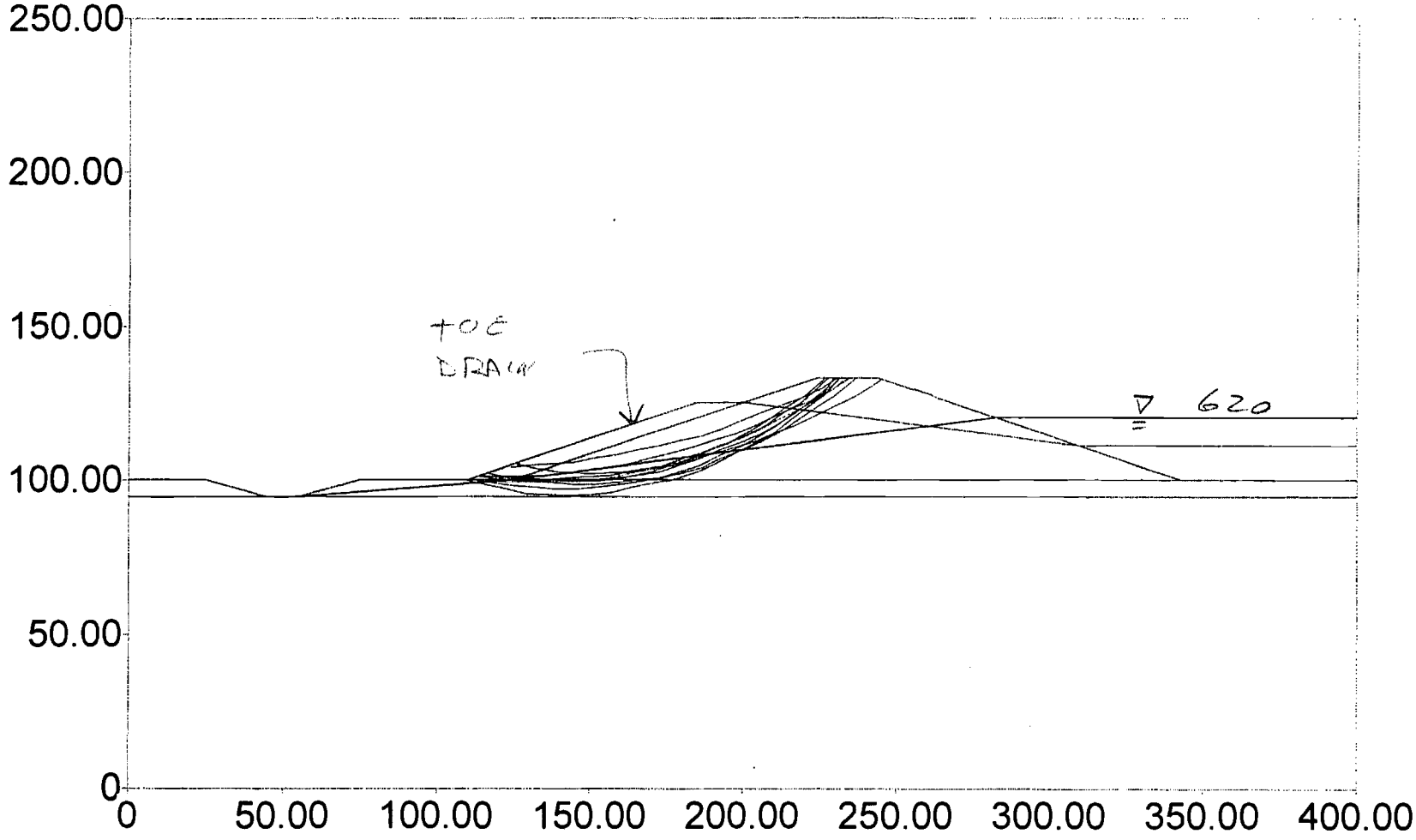


SCENARIO 16

I:\3573\Drawings-General\Stability Analysis Scenarios.dwg, Model, 7/24/2008 11:34:55 AM

Indianapolis PL - Dike E



Safety Factor
1.57
1.58
1.60
1.60
1.61
1.63
1.64
1.64
1.65
1.66

Profile.out
** PCSTABL6 **

by
Purdue University

modified by
Peter J. Bosscher
University of Wisconsin-Madison

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

PROBLEM DESCRIPTION Indianapolis P&L - Dike E

BOUNDARY COORDINATES

11 Top Boundaries
18 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	100.00	25.00	100.00	2
2	25.00	100.00	45.00	95.00	2
3	45.00	95.00	55.00	95.00	3
4	55.00	95.00	75.00	100.00	2
5	75.00	100.00	110.00	100.00	2
6	110.00	100.00	185.00	125.00	5
7	185.00	125.00	200.00	125.00	5
8	200.00	125.00	224.00	133.00	1
9	224.00	133.00	244.00	133.00	1
10	244.00	133.00	310.00	111.00	1
11	310.00	111.00	400.00	111.00	4
12	110.00	100.00	125.00	100.00	2
13	125.00	100.00	200.00	125.00	1
14	310.00	111.00	343.00	100.00	1
15	343.00	100.00	400.00	100.00	2
16	125.00	100.00	343.00	100.00	2
17	0.00	95.00	45.00	95.00	3
18	55.00	95.00	400.00	95.00	3

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	100.0	100.0	0.0	21.0	0.00	0.0	1
2	125.0	125.0	50.0	25.0	0.00	0.0	1
3	120.0	120.0	0.0	31.0	0.00	0.0	1
4	90.0	90.0	0.0	21.0	0.00	0.0	1
5	140.0	140.0	0.0	35.0	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	95.00
2	55.00	95.00
3	125.00	100.00
4	283.00	120.00
5	400.00	120.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

1000 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of100 Points Equally Spaced Along The Ground Surface Between X = 100.00 ft.
and X = 150.00 ft.

Each Surface Terminates Between X = 225.00 ft.
and X = 300.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 50.00 ft.

7.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 20 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	110.10	100.03
2	117.08	99.46
3	124.07	99.16
4	131.07	99.13
5	138.07	99.36
6	145.05	99.87
7	152.01	100.64
8	158.93	101.69
9	165.81	102.99
10	172.63	104.56
11	179.38	106.40
12	186.06	108.49
13	192.66	110.83
14	199.16	113.43
15	205.55	116.28
16	211.83	119.37
17	217.99	122.70
18	224.01	126.27
19	229.90	130.06
20	234.09	133.00

*** 1.574 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	117.17	102.39
2	124.07	101.22
3	131.03	100.40
4	138.01	99.95
5	145.01	99.86
6	152.00	100.13
7	158.98	100.76
8	165.91	101.76
9	172.77	103.11
10	179.56	104.81
11	186.25	106.87
12	192.83	109.26
13	199.27	112.00
14	205.57	115.06
15	211.69	118.45
16	217.64	122.15
17	223.38	126.15
18	228.91	130.45
19	231.86	133.00

*** 1.579 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	114.65	101.55
2	121.65	101.47
3	128.65	101.60
4	135.64	101.96
5	142.61	102.54
6	149.57	103.34
7	156.49	104.36
8	163.38	105.59
9	170.23	107.04
10	177.03	108.71
11	183.77	110.59
12	190.45	112.68
13	197.06	114.99
14	203.60	117.49
15	210.05	120.21
16	216.41	123.12
17	222.68	126.24
18	228.85	129.55
19	234.82	133.00

*** 1.599 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	114.65	101.55
2	121.55	100.41
3	128.51	99.65
4	135.50	99.27
5	142.50	99.26
6	149.49	99.63
7	156.45	100.37
8	163.36	101.50
9	170.20	102.99
10	176.95	104.85
11	183.59	107.06
12	190.10	109.64
13	196.46	112.56
14	202.65	115.82
15	208.66	119.41
16	214.47	123.32
17	220.06	127.54
18	225.41	132.05
19	226.42	133.00

*** 1.600 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	109.09	100.00
2	115.88	98.31
3	122.76	97.00
4	129.70	96.08
5	136.68	95.55
6	143.68	95.42
7	150.67	95.68
8	157.64	96.33
9	164.57	97.37
10	171.42	98.80
11	178.18	100.61
12	184.83	102.80
13	191.34	105.36
14	197.70	108.28
15	203.89	111.56
16	209.88	115.18
17	215.66	119.12
18	221.21	123.39
19	226.51	127.96
20	231.55	132.83
21	231.71	133.00

*** 1.608 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	111.11	100.37
2	117.99	99.06
3	124.92	98.09
4	131.89	97.46
5	138.89	97.17
6	145.89	97.22
7	152.88	97.61
8	159.84	98.34
9	166.76	99.41
10	173.61	100.81
11	180.40	102.54
12	187.08	104.61
13	193.66	106.99
14	200.12	109.70
15	206.44	112.71
16	212.60	116.03
17	218.60	119.64
18	224.41	123.55
19	230.02	127.73
20	235.43	132.18

21	236.34	133.00

*** 1.634 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	124.24	104.75
2	131.24	104.99
3	138.22	105.45
4	145.19	106.12
5	152.14	106.99
6	159.05	108.07
7	165.93	109.36
8	172.77	110.85
9	179.56	112.55
10	186.30	114.45
11	192.98	116.55
12	199.59	118.86
13	206.13	121.35
14	212.59	124.05
15	218.97	126.93
16	225.25	130.01
17	230.93	133.00

*** 1.644 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	126.26	105.42
2	133.13	104.05
3	140.07	103.12
4	147.05	102.63
5	154.05	102.58
6	161.04	102.98
7	167.99	103.82
8	174.87	105.10
9	181.66	106.81
10	188.32	108.94
11	194.84	111.50
12	201.18	114.47
13	207.32	117.83
14	213.24	121.57
15	218.90	125.68
16	224.30	130.14
17	227.34	133.00

*** 1.644 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	103.54	100.00
2	110.25	98.01
3	117.07	96.42
4	123.97	95.26
5	130.93	94.52
6	137.92	94.19
7	144.92	94.30
8	151.90	94.83
9	158.83	95.78
10	165.70	97.15
11	172.47	98.94
12	179.12	101.13
13	185.62	103.72
14	191.95	106.70
15	198.09	110.06
16	204.02	113.79
17	209.70	117.87
18	215.13	122.29
19	220.29	127.03
20	225.14	132.07
21	225.93	133.00

*** 1.653 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	115.15	101.72
2	122.13	101.15
3	129.12	100.82
4	136.12	100.72
5	143.12	100.87
6	150.11	101.26
7	157.08	101.89
8	164.03	102.76
9	170.94	103.86
10	177.81	105.20
11	184.63	106.78
12	191.39	108.59
13	198.09	110.63
14	204.71	112.90
15	211.25	115.39
16	217.70	118.11
17	224.05	121.05
18	230.30	124.20
19	236.44	127.56
20	242.46	131.14
21	244.90	132.70

```
***      1.654    ***


          Y            A     X     I     S            F     T

          0.00     50.00    100.00    150.00    200.00    250.00
X      0.00 +---------+--------**---------+---------+---------+
            -
            -
            -                  *
            -
            -                 *
      50.00 +
            -                 *
            -
            -                  *
            -
            -
A    100.00 +                  9
            -                ..*
            -               ..91.
            -              ...5*7
            -             ....517.
            -            .....513.
X    150.00 +           ......513..
            -           ......5137.
            -           ......5217.
            -          ........513..
            -          .........117.*
            -          .........513..
I    200.00 +          ..........217*
            -          ...........11.
            -          ...........6214
            -           ...........012*
            -           ............011
            -            ............0*
S    250.00 +            .............
            -             ............
            -              ..........
            -               .........
            -                ......W
            -                  .....
     300.00 +                    ..
            -                    *
            -
            -
            -
            -                  *
F    350.00 +
            -
            -
            -
            -
            -
T    400.00 +                 ** * W
```

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Fax (317) 231-7433

www.btlaw.com

Anthony C. Sullivan
(317) 231-7472
tony.sullivan@btlaw.com

RECEIVED BY
OCT 21 2008
IDEM-ENFORCEMENT

October 17, 2008

Mark W. Stanifer, Section Chief
Water Enforcement Section
Office of Enforcement
Indiana Department of Environmental Management
100 North Senate Avenue, IGCN 1315
Indianapolis, Indiana 46204

Re: ***IDEM v. Indianapolis Power & Light Company***
Case Nos. 2007-16780-W and 2008-17693-W

Dear Mark:

Regarding the approved Agreed Order for the above-referenced matter dated April 22, 2008, please note that IPL Eagle Valley has completed the detailed study of the ash pond levee at Eagle Valley in the areas of the breach as required in paragraph 3. The study satisfies the timelines requirement of that paragraph. If you have any questions or need anything further, please call.

Sincerely,

Anthony C. Sullivan

ACS:naw

INDS01 TCS 1074951v1

Mitchell E. Daniels, Jr., Governor
Robert E. Carter, Jr., Director

DNR Indiana Department of Natural Resources

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Certified No: 7000 0600 0024 8133 0198

RECEIVED BY
JUL 31 2008
IDEM-ENFORCEMENT

July 8, 2008

Indianapolis Power and Light
4040 Blue Bluff Road
Martinsville, IN 46151

RE: Discharge of Deleterious Substance
White River, Morgan County, January 2008

Dear Sir/Madam:

The Director of the Indiana Department of Natural Resources (IDNR) is in receipt of information regarding an unlawful discharge into the White River in Morgan County, Indiana on January 30, 2008. The incident was investigated by a conservation officer of the IDNR, as well as staff from the Indiana Department of Environmental Management (IDEM). This letter serves as a warning with regard to activities that could potentially harm Indiana wildlife.

As part of an extensive investigation conducted on January 30, 2008, an IDNR conservation officer walked along the White River to confirm the source of contamination. A breached fly ash pond was observed. A milky discoloration was noted downstream of the Indianapolis Power and Light (IPL) discharge channel. The discharge origin was confirmed by IPL staff to be the breached fly ash ponds at the Martinsville facility.

The January 2008 release marks the second spill from this facility in a period of less than 12 months. The State of Indiana is concerned that the continued release of substances that are harmful to wild animals will eventually cause serious damage to wild animals. The IDNR wishes to advise you of the potential consequences of such results. Indiana Code 14-22-10-6 provides for the liability attached to killing a wild animal by pollutant; it states in relevant part:

> A person who discharges or releases waste materials, chemicals, or other substances: either accidentally, negligently or willfully; in any quantity, concentration or manner onto or in any water of Indiana, the boundary waters of the state, or onto or in public or private land; and so that wild animals are killed as a result; is responsible for the kill.
>
> The director shall, in the name of the state, recover damages from the person.
>
> Under the statute, the definition of "wild animal" includes, but is not limited to, fish and

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11 South Meridian Street
Indianapolis, IN 46204-3535 U.S.A.
(317) 236-1313
Fax (317) 231-7433

www.btlaw.com

Anthony C. Sullivan
(317) 231-7472
tony.sullivan@btlaw.com

March 21, 2008

Justin D. Barrett, Esquire
Indiana Office of the Attorney General
Indiana Government Center South, 5th Floor
302 West Washington Street
Indianapolis, Indiana 46204

Re: ***IDEM v. IPL***
Case No. 2007-16780-W

Dear Justin:

As discussed in our meeting on September 10, enclosed please find the following information that provides more details regarding the specific studies that IPL is proposing in order to satisfy its proposed paragraphs 3 and 4 of the proposed agreed order regarding the above-referenced matter. This information includes:

- a Scope of Work for the detailed study for the Eagle Valley Pond D embankments;
- a Scope of Work which defines the elements of the system-wide embankment field reviews; and
- the "IPL Dike Field Review Checklist."

These action items were developed after consultation with internal and external experts in the field of levee design and construction, and are based on their recommendations. Please review the attached and call with any questions that you have. Thank you.

Sincerely,

Anthony C. Sullivan

ACS:naw
Attachments
Via E-mail and Regular Mail

INDS01 ACS 995603v2

ATTACHMENT A

Indiana Department of Environmental Management
Office of Enforcement – Air Section
100 North Senate Avenue
MC 60-02 N1315
Indianapolis, IN 46204-2251

RE: Case No. 2008-17693-W, IPL Eagle Valley Generating Station, events of January 30, 2008.

I, Ronald E. Talbot (print name), on behalf of Indianapolis Power & Light Co. waive issuance of a Notice of Violation and the settlement period of sixty (60) days as provided for by IC 13-30-3-3.

Signed _____

Date 4/8/8

An AES Company

RECEIVED
FEB 19 2008
By

765-349-3413
Fax 765-342-2311

February 11, 2008

CERTIFIED MAIL # 7006 2150 0005 5611 5877

Indiana Department of Environmental Management
Ms. Beth Tallon, Chief
Industrial NPDES Permit Section
Office Water Quality
100 North Senate Ave.
Indianapolis, IN 46204

RECEIVED
FEB 14 2008
DEPARTMENT OF
ENVIRONMENTAL MANAGEMENT
OFFICE OF LAND QUALITY

RE: NPDES Noncompliance, Permit No. IN0004693
Incident No. 2008-01229

Dear Ms. Tallon:

Please find enclosed sample analyses for the IPL Eagle Valley Generating Station Plant, NPDES Permit No. IN0004693, - Incident No. 2008-01229. The Incident occurred on January 30, 2008. Reference the follow up written notification (letter attached) submitted to your office on February 5, 2008.

Reference the enclosed documents:

* Aerial view of the Eagle Valley Generating Station for the sample locations of the analyses being submitted.

* IPL – Eagle Valley Summary Sheet of Analyses.

* Laboratory Analyses Sheets.

Also, the following is a summary of the dates the samples were taken, the time sampling started, the sample point number and location (refer. aerial view), and the laboratory sample identification numbers -

Date:	Sample Point Number and Location:	Laboratory Sample Number:
WATER SAMPLES -		
01-30-08	#1 – Up Stream at Circulating Water Inlet	A797257
Samples	#2 – Discharge Canal after Release	A797255
@0750	#3 – White River at Boat Ramp	A797256

01-30-08	#1 – Up Stream at Circulating Water Inlet	A797260
	#2 – Discharge Canal after Release	A797258
@1140	#3 – White River at Boat Ramp	A797259
01-30-08 @1115	#4 – Field South of Plant	A797261
01-30-08	#1 – Up Stream at Circulating Water Inlet	A797262
@1450	#2 – Discharge Canal after Release	A797263
& 1550	#3 – White River at Boat Ramp	A797264
01-31-08	#1 – Up Stream at Circulating Water Inlet	A797419
	#2 – Discharge Canal after Release	A797418
@1130	#3 – White River at Boat Ramp	A797417

SEDIMENT SAMPLES –

01-30-08	#1 – Up Stream at Circulating Water Inlet (@1300)	A797265
	#2 – Discharge Canal after Release (@1550)	A797267
	#3 –White River at Boat Ramp (@1140)	A797266
	#5 – Material at "E" Levee Breach (@1550)	A797268
1-31-08	#2 –Discharge Canal after Release (@1130)	A797424
	#3 –White River at Boat Ramp (@1130)	A797423

Footnotes -

The TSS and Metal Analyses on the water samples were performed by a contract lab.

The TCLP - Metal Analyses on the sediment samples were performed by a contract lab.

The pH analyses on the water samples were performed by IPL- Eagle Valley lab.

A visual inspection of the West Fork of the White River indicated no fish kill and no apparent harm to the environment or aquatic life.

Nothing in this letter is intended to be an admission of liability regarding this incident or a waiver of any available rights of IPL.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and

belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

If you have any questions, please contact me at (765) 349-3472.

Sincerely,

J. Kyle Noah

J. Kyle Noah
Eagle Valley Environmental Team Leader

Encls:

xc: ✓David Cage – IDEM Emergency Response Section,
On-Scene Coordinator.
Cert. Mail #7006 2150 0005 5611 5884
Dr. Wayne C. Faatz – IDNR - Division of Fish & Wildlife,
Contaminants Program Coordinator.
Cert. Mail #7006 2150 0005 5611 5907
Jennifer Campbell-Allison – IDNR - Division of Fish & Wildlife/
Fisheries/Contaminants Restoration Biologist.
Cert. Mail #7006 2150 0005 5611 5891

An AES Company

February 5, 2008

CERTIFIED MAIL # 7006 2150 0005 5611 5860

Indiana Department of Environmental Management
Ms. Beth Tallon, Chief
Industrial NPDES Permit Section
Office Water Quality
100 North Senate Ave.
Indianapolis, IN 46204

RE: NPDES Noncompliance, Permit No. IN0004693
Incident No. 2008-01229

Dear Ms. Tallon:

As required by the IC Rules and the IPL Eagle Valley Generating Station Plant NPDES Permit, No. IN0004693 attached is a follow up written report for the Incident No. 2008-01229.

Location of spill/ release: IPL Eagle Valley Generating Station
4040 Blue Bluff Road
Martinsville, IN 46151

Contact information: Kyle Noah, Plant Environmental Leader
IPL Eagle Valley Generation Station
4040 Blue Bluff Road
Martinsville, IN 46151
765-349-3472

or

Dwayne Burke, Director, Environmental Affairs
Indianapolis Power & Light
One Monument Circle
Indianapolis, IN 46204
317-501-0278

Time of spill/release: January 30, 2008, at 02:20 a.m.

Substance released: Ash sluice water

Amount released: Approximately 30 million gallons

Source of spill/ release: Ash Pond external levee breached at the Eagle Valley Generating Station prompting the release.

Name of waters: Sluice water was initially released to the IPL discharge canal which then enters the West Fork of the White River.

Agencies notified: Timely reports were made to IDEM, DNR, National Response Center, and the Morgan County Local Emergency Planning Commission.

Agencies responding: IDEM – David Cage, Emergency Response Section, On-Scene Coordinator.

IDEM – Ron Pearson, Water Inspector (NPDES).

IDNR – David Reese, Conservation Officer.

Spill response:

(1) Plant Corrective Actions – partial list

a. IPL took Ash Sluice Pumps Out of Service and redirected Outfall Pump flow to an alternate site.
b. IPL called in additional plant personnel to assist with corrective actions.
c. IPL called in Out of State Contractor that constructed the Levee.
d. Contractor ordered Heavy Equipment to plug the breach.
e. IPL called in Out of State Engineering Contractor that designed and oversaw the levee construction.
f. Contractor plugged levee breach.

(2) Timely notifications made to appropriate agencies;

(3) External levee plugged on January 30, 2008 at 1350.

Additional action: IDEM, DNR, and IPL representatives met to discuss an action plan to verify that the environment had not been harmed. It was determined that IPL would take samples every 4 hours upstream and downstream from the levee breach until the breach was plugged. Also, sample after the levee was successfully plugged and

again the following day. Samples (both water quality and sediments) would be analyzed for pH, solids, and metals. Results will be communicated to IDEM and IDNR as soon as reasonable.

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

Sincerely,

J. Kyle Noah

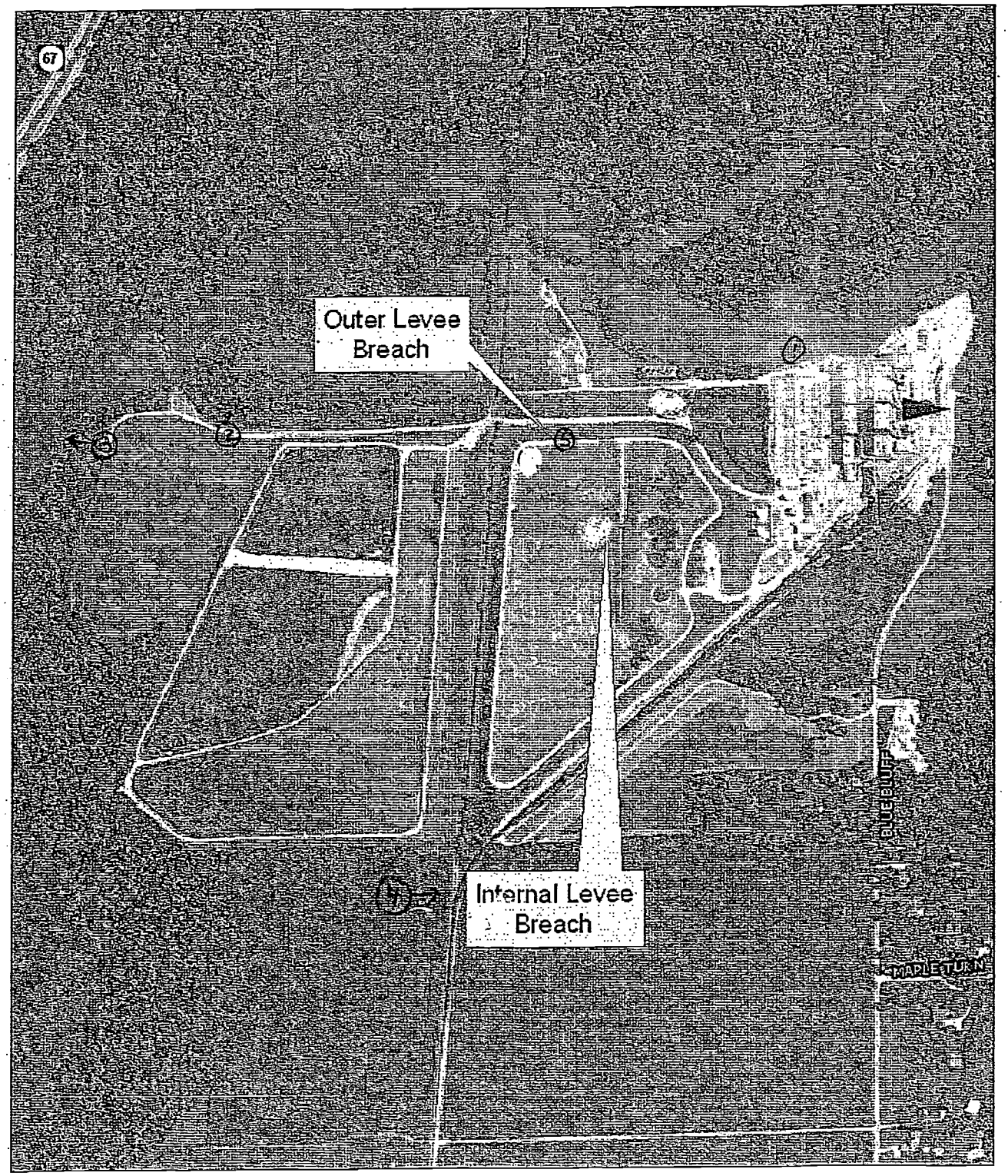
J. Kyle Noah
Eagle Valley Environmental Team Leader

xc: Mr. David Cage – IDEM Emergency Response Section,
On-Scene Coordinator. Cert. Mail #7006 2150 0005 5611 5846
Dr. Wayne C. Faatz – Division of Fish & Wildlife,
Contaminants Program Coordinator.
Cert. Mail #7006 2150 0005 5611 5853
Ms. Jennifer Campbell-Allison – IDNR, Division of Fish & Wildlife, Restoration
Biologist. Cert. Mail # 7004 2510 0002 9448 9926

IDEM ER ArcMap
IPL - 2007-02-093
Morgan Co

N

0 255 510 1,020 Meters



SAMPLES FOR LEVEE BREACH AT IPL EAGLE VALLEY

(SUMMARY SHEET)

ORGANIZED BY SAMPLE LOCATION

	Sample ID #	pH	TSS mg/l	METALS As ug/L	Cd ug/L	Cr ug/L	Cu ug/L	Pb ug/L	Ni ug/L	Se ug/L	Zn ug/L	Hg ug/L	Cr 6 + mg/L
Dection Limit:				10	5	10	10	10	5	10	20	0.2	0.01
Upstream from spill, Sample point # 1, 01/30/08 07:50am	A797257	8.05	15	BDL	BDL	BDL	BDL	BDL	BDL	BDL	30	BDL	BDL
Upstream from spill, Sample point # 1, 01/30/08 11:40am	A797260	8.06	23	BDL	BDL	BDL	BDL	BDL	BDL	BDL	25	BDL	BDL
Upstream from spill, Sample point # 1, 01/30/08 02:50pm	A797262	8.13	18	BDL	BDL	BDL	BDL	BDL	BDL	BDL	23	BDL	BDL
Upstream from spill, Sample point # 1, 01/31/08 11:30am	A797419	7.98	16	BDL	BDL	BDL	BDL	BDL	BDL	BDL	25	BDL	BDL
Canal down from spill, Sample point # 2, 01/30/08 7:50am	A797255	8.05	220	31	BDL	10	17	21	27	BDL	90	BDL	BDL
Canal down from spill, Sample point # 2, 01/30/08 11:40am	A797258	8.04	71	BDL	BDL	BDL	10	BDL	7.6	BDL	35	BDL	BDL
Canal down from spill, Sample point # 2, 01/30/08 3:50pm	A797263	8.05	42	BDL	BDL	BDL	BDL	BDL	BDL	BDL	28	BDL	BDL
Canal down from spill, Sample point # 2, 01/31/08 11:30am	A797418	7.95	30	BDL	BDL	BDL	BDL	BDL	5.9	BDL	29	BDL	BDL
River ramp down from spill, Sample point # 3, 01/30/08 07:50am	A797256	8.13	120	BDL	BDL	BDL	13	15	20	BDL	74	BDL	BDL
River ramp down from spill, Sample point # 3, 01/30/08 11:40am	A797259	7.94	140	BDL	BDL	BDL	BDL	BDL	11	11	40	BDL	BDL
River ramp down from spill, Sample point # 3, 01/30/08 03:50pm	A797264	8.10	34	BDL	BDL	BDL	BDL	BDL	5.2	BDL	29	BDL	BDL
River ramp down from spill, Sample point # 3, 01/31/08 011:30am	A797417	7.98	17	BDL	BDL	BDL	BDL	BDL	BDL	BDL	25	BDL	BDL
FIELD, Sample point # 4, 01/30/08 11:15am	A797261		550	180	BDL	41	31	57	66	BDL	22	BDL	30

	METALS EXTRACTED BY TCLP FROM SEDIMENT As ug/L	Cd ug/L	Cr ug/L	Cu ug/L	Ni ug/L	Pb ug/L	Se ug/L	Zn ug/L	Hg ug/L	Cr 6 + mg/L
	50	25	50	50	25	50	50	100	2	10
Sediment sample Upstream of pond Breach 01/30/08 1:00pm	BDL	BDL	BDL	BDL	54	BDL	BDL	470	BDL	BDL
Sediment sample from E pond Breach 01/30/08 3:50 pm	56	BDL	BDL	BDL	27	BDL	BDL	200	BDL	BDL
Sediment sample from Canal below Breach 01/30/08 3:50pm	67	BDL	BDL	BDL	41	BDL	BDL	170	BDL	BDL
Sediment sample at boat ramp in river 01/30/08 11:40 am	BDL	BDL	BDL	BDL	54	BDL	BDL	290	BDL	BDL
Sediment sample from Canal below Breach 01/31/08 11:30	BDL	BDL	BDL	BDL	BDL	BDL	BDL	110	BDL	BDL
Sediment sample at boat ramp in river 01/31/08 11:30 am	BDL	BDL	BDL	BDL	26	BDL	BDL	180	BDL	BDL

HERITAGE

CERTIFICATE OF ANALYSIS

Service Location	Received	Project	Lab ID
HERITAGE ENVIRONMENTAL SERVICES, LLC COMMERCIAL LABORATORY OPERATIONS 7901 W. MORRIS ST. INDIANAPOLIS, IN 46231 (317)243-8304	30-JAN-08		A797257
	Completed	PO Number	
	31-JAN-08	WAIVER	
	Printed	Sampled	
	01-FEB-08	30-JAN-08 07:50	

Report To	Bill To
MARK MCFARLAND INDIANAPOLIS POWER & LIGHT 4040 BLUE BLUFF ROAD MARTINSVILLE, IN 46151	INDIANAPOLIS POWER & LIGHT 4040 BLUE BLUFF ROAD MARTINSVILLE, IN 46151

Sample Description

CLIENT ID: CIRC WATER PUMP
MATRIX TYPE: NON-SPECIFIC WATER
SUBMITTER CODE: 9364
PWS NAME: IPL EAGLE VALLEY STATION
PWS ADDRESS: 4040 BLUE BLUFF ROAD MARTINSVILLE IN

FAA OR ICP ACID DIGESTION EPA 200.0

Analyst: J. KRAMER — Analysis Date: 30-JAN-08 19:00 — Instrument: PREP — Test: P129.2.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	50		mL
FINAL VOLUME	50		mL

ARSENIC ICP EPA 200.7 REV. 4.4 — NELAC-Y

Analyst: J. KRAMER — Analysis Date: 31-JAN-08 02:09 — Instrument: ICP — Test: M403.3.0
Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
ARSENIC	BDL	0.010	mg/L

CADMIUM ICP EPA 200.7 REV. 4.4 — NELAC-Y

Analyst: J. KRAMER — Analysis Date: 31-JAN-08 02:09 — Instrument: ICP — Test: M408.3.0
Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
CADMIUM	BDL	0.0050	mg/L

CHROMIUM ICP EPA 200.7 REV. 4.4 — NELAC-Y

Analyst: J. KRAMER — Analysis Date: 31-JAN-08 02:09 — Instrument: ICP — Test: M410.3.0
Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
CHROMIUM	BDL	0.010	mg/L

HERITAGE

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797257 CIRC WATER PUMP

COPPER ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:09 Instrument: ICP Test: M412.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
COPPER	BDL	0.010	mg/L

LEAD ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:09 Instrument: ICP Test: M416.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
LEAD	BDL	0.010	mg/L

NICKEL ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:09 Instrument: ICP Test: M422.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
NICKEL	BDL	0.0050	mg/L

SELENIUM ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:09 Instrument: ICP Test: M428.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
SELENIUM	BDL	0.010	mg/L

ZINC ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:09 Instrument: ICP Test: M439.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
ZINC	0.030	0.020	mg/L

MERCURY CVAA ACID DIGESTION EPA 245.1 REV. 3.0

Analyst: W. WATNESS Analysis Date: 31-JAN-08 04:30 Instrument: PREP Test: P131.2.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	40		mL
FINAL VOLUME	40		mL

MERCURY, MANUAL COLD VAPOR BY AAS EPA 245.5 NELAC:Y

Analyst: W. WATNESS Analysis Date: 31-JAN-08 07:28 Instrument: CVAA Test: M420.1.0

Prep: MERCURY CVAA ACID DIGESTION EPA 245.1 REV. 3.0 P131.2.0

Parameter	Result	Det. Limit	Units
MERCURY	BDL	0.00020	mg/L

HEXAVALENT CHROMIUM SM 3500-CR D 18TH ED NELAC:Y

Analyst: E. SOTKIEWICZ Analysis Date: 31-JAN-08 10:00 Test: M410.6.0

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797257 CIRC WATER PUMP

Parameter	Result	Det. Limit	Units
HEXAVALENT CHROMIUM	BDL	0.01	mg/L

Sample was reanalyzed out of hold time due to possible error on first analysis.

TOTAL SUSPENDED SOLIDS DRIED AT 103-105 DEGREES C SM 2540 D, 19TH ED. NELAC Y

Analyst: T. PESTER Analysis Date: 30-JAN-08 19:40 Test: G403.8.0

Parameter	Result	Det. Limit	Units
SUSPENDED SOLIDS	15	1	mg/L

Sample Comments

BDL Below Detection Limit

Sample was received on ice at temperature 5.6 C.
Sample chain of custody number 52802.

This Certificate shall not be reproduced, except in full, without the written approval of the lab.

The sample results relate only to the analytes of interest tested or to the sample as received by the lab.

Heritage Environmental Services, LLC certifies that the test results indicated as NELAC (National Environmental Laboratory Accreditation Conference) accredited (Yes for NELAC) meet all requirements of NELAC and Illinois EPA Part 186 unless otherwise explained or justified as to the the exact nature of the deviations.

Heritage Environmental Services, LLC is accredited under Illinois NELAC accreditation number 100401.

Indiana SDWA Lab Accred. No. C-49-01

Scott A Bryan

Approved by: SCOTT BRYAN 01-FEB-08

HERITAGE

CERTIFICATE OF ANALYSIS

Service Location	Received	Project	Lab ID
HERITAGE ENVIRONMENTAL SERVICES, LLC COMMERCIAL LABORATORY OPERATIONS 7901 W. MORRIS ST. INDIANAPOLIS, IN 46231 (317)243-8304	30-JAN-08		A797255
	Completed	PO Number	
	31-JAN-08	WAIVER	
	Printed	Sampled	
	01-FEB-08	30-JAN-08 07:50	

Report To	Bill To
MARK MCFARLAND INDIANAPOLIS POWER & LIGHT 4040 BLUE BLUFF ROAD MARTINSVILLE, IN 46151	INDIANAPOLIS POWER & LIGHT 4040 BLUE BLUFF ROAD MARTINSVILLE, IN 46151

Sample Description

CLIENT ID: CANAL NPDES POINT
MATRIX TYPE: NON-SPECIFIC WATER
SUBMITTER CODE: 9364
PWS NAME: IPL EAGLE VALLEY STATION
PWS ADDRESS: 4040 BLUE BLUFF ROAD MARTINSVILLE IN

FAA OR ICP ACID DIGESTION EPA 200.0

Analyst: J. KRAMER — Analysis Date: 30-JAN-08 19:00 — Instrument: PREP — Test: P129.2.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	50		mL
FINAL VOLUME	50		mL

ARSENIC ICP EPA 200.7 REV. 4.4 — NELAC Y

Analyst: J. KRAMER — Analysis Date: 31-JAN-08 02:25 — Instrument: ICP — Test: M403.3.0
Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
ARSENIC	0.031	0.010	mg/L

CADMIUM ICP EPA 200.7 REV. 4.4 — NELAC Y

Analyst: J. KRAMER — Analysis Date: 31-JAN-08 02:25 — Instrument: ICP — Test: M408.3.0
Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
CADMIUM	BDL	0.0050	mg/L

CHROMIUM ICP EPA 200.7 REV. 4.4 — NELAC Y

Analyst: J. KRAMER — Analysis Date: 31-JAN-08 02:25 — Instrument: ICP — Test: M410.3.0
Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
CHROMIUM	0.010	0.010	mg/L

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797255 CANAL NPDES POINT

COPPER ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:25 Instrument: ICP Test: M412.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
COPPER	0.017	0.010	mg/L

LEAD ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:25 Instrument: ICP Test: M416.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
LEAD	0.021	0.010	mg/L

NICKEL ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:25 Instrument: ICP Test: M422.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
NICKEL	0.027	0.0050	mg/L

SELENIUM ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:25 Instrument: ICP Test: M428.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
SELENIUM	BDL	0.010	mg/L

ZINC ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:25 Instrument: ICP Test: M439.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
ZINC	0.090	0.020	mg/L

MERCURY CVAA ACID DIGESTION EPA 245.1 REV. 3.0

Analyst: W. WATNESS Analysis Date: 31-JAN-08 04:30 Instrument: PREP Test: P131.2.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	40		mL
FINAL VOLUME	40		mL

MERCURY, MANUAL COLD VAPOR BY AAS EPA 245.5 NELAC:Y

Analyst: W. WATNESS Analysis Date: 31-JAN-08 07:28 Instrument: CVAA Test: M420.1.0

Prep: MERCURY CVAA ACID DIGESTION EPA 245.1 REV. 3.0 P131.2.0

Parameter	Result	Det. Limit	Units
MERCURY	BDL	0.00020	mg/L

HEXAVALENT CHROMIUM SM 3500-CR D 18TH ED NELAC:Y

Analyst: E. SOTKIEWICZ Analysis Date: 31-JAN-08 10:00 Test: M410.6.0

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797255 CANAL NPDES POINT

Parameter	Result	Det. Limit	Units
HEXAVALENT CHROMIUM	BDL	0.01	mg/L

Sample was reanalyzed out of hold time due to possible error on first analysis.

The concentration due to the color and turbidity of the original sample

was subtracted out.

TOTAL SUSPENDED SOLIDS DRIED AT 103-105 DEGREES C SM 2540 D, 19TH ED NELAC Y

Analyst: T PESTER Analysis Date: 30-JAN-08 19:40 Test: G403 8.0

Parameter	Result	Det. Limit	Units
SUSPENDED SOLIDS	220	1	mg/L

Sample Comments

BDL Below Detection Limit

Sample was received on ice at temperature 5.6 C.
Sample chain of custody number 52802.

This Certificate shall not be reproduced, except in full,
without the written approval of the lab.
The sample results relate only to the analytes of interest tested
or to the sample as received by the lab.
Heritage Environmental Services, LLC certifies that the test results
indicated as NELAC (National Environmental Laboratory Accreditation
Conference) accredited (Yes for NELAC) meet all requirements of NELAC and
Illinois EPA Part 186 unless otherwise explained or justified as to the
the exact nature of the deviations.
Heritage Environmental Services, LLC is accredited under Illinois NELAC
accreditation number 100401.
Indiana SDWA Lab Accred. No. C-49-01

Scott A Bryan

Approved by: SCOTT BRYAN 01-FEB-08

HERITAGE

CERTIFICATE OF ANALYSIS

Service Location	Received	Project	Lab ID
HERITAGE ENVIRONMENTAL SERVICES, LLC COMMERCIAL LABORATORY OPERATIONS 7901 W. MORRIS ST. INDIANAPOLIS, IN 46231 (317)243-8304	30-JAN-08		A797256
	Completed	**PO Number**	
	31-JAN-08	WAIVER	
	Printed	**Sampled**	
	01-FEB-08	30-JAN-08 07:50	

Report To	Bill To
MARK MCFARLAND INDIANAPOLIS POWER & LIGHT 4040 BLUE BLUFF ROAD MARTINSVILLE, IN 46151	INDIANAPOLIS POWER & LIGHT 4040 BLUE BLUFF ROAD MARTINSVILLE, IN 46151

Sample Description

CLIENT ID: BOAT RAMP
MATRIX TYPE: NON-SPECIFIC WATER
SUBMITTER CODE: 9364
PWS NAME: IPL EAGLE VALLEY STATION
PWS ADDRESS: 4040 BLUE BLUFF ROAD MARTINSVILLE IN

FAA OR ICP ACID DIGESTION EPA 200.0

Analyst: J. KRAMER — Analysis Date: 30-JAN-08 19:00 — Instrument: PREP — Test: P129.2.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	50		mL
FINAL VOLUME	50		mL

ARSENIC ICP EPA 200.7 REV. 4.4

NELAC:Y

Analyst: J. KRAMER — Analysis Date: 31-JAN-08 02:29 — Instrument: ICP — Test: M403.3.0
Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
ARSENIC	BDL	0.020	mg/L

Detection limit raised due to matrix interference.

CADMIUM ICP EPA 200.7 REV. 4.4

NELAC:Y

Analyst: J. KRAMER — Analysis Date: 31-JAN-08 02:29 — Instrument: ICP — Test: M408.3.0
Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
CADMIUM	BDL	0.0050	mg/L

CHROMIUM ICP EPA 200.7 REV. 4.4

NELAC:Y

Analyst: J. KRAMER — Analysis Date: 31-JAN-08 02:29 — Instrument: ICP — Test: M410.3.0
Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
CHROMIUM	BDL	0.010	mg/L

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797256 BOAT RAMP

COPPER ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:29 Instrument: ICP Test: M412.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
COPPER	0.013	0.010	mg/L

LEAD ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:29 Instrument: ICP Test: M416.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
LEAD	0.015	0.010	mg/L

NICKEL ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:29 Instrument: ICP Test: M422.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
NICKEL	0.020	0.0050	mg/L

SELENIUM ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:29 Instrument: ICP Test: M428.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
SELENIUM	BDL	0.010	mg/L

ZINC ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:29 Instrument: ICP Test: M439.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
ZINC	0.074	0.020	mg/L

MERCURY CVAA ACID DIGESTION EPA 245.1 REV. 3.0

Analyst: W. WATNESS Analysis Date: 31-JAN-08 04:30 Instrument: PREP Test: P131.2.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	40		mL
FINAL VOLUME	40		mL

MERCURY, MANUAL COLD VAPOR BY AAS EPA 245.5 NELAC:Y

Analyst: W. WATNESS Analysis Date: 31-JAN-08 07:28 Instrument: CVAA Test: M420.1.0

Prep: MERCURY CVAA ACID DIGESTION EPA 245.1 REV. 3.0 P131.2.0

Parameter	Result	Det. Limit	Units
MERCURY	BDL	0.00020	mg/L

HEXAVALENT CHROMIUM SM 3500-CR D 18TH ED NELAC:Y

Analyst: E. SOTKIEWICZ Analysis Date: 31-JAN-08 10:00 Test: M410.6.0

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797256 BOAT RAMP

Parameter	Result	Det. Limit	Units
HEXAVALENT CHROMIUM	BDL	0.01	mg/L

Sample was reanalyzed out of hold time due to possible error on first analysis.

The concentration due to the color and turbidity of the original sample

was subtracted out.

TOTAL SUSPENDED SOLIDS DRIED AT 103-105 DEGREES C SM 2540 D, 19TH ED. NELAC:Y

Analyst: T. PESTER Analysis Date: 30-JAN-08 19:40 Test: G403.8.0

Parameter	Result	Det. Limit	Units
SUSPENDED SOLIDS	120	1	mg/L

Sample Comments

BDL Below Detection Limit

Sample was received on ice at temperature 5.6 C.
Sample chain of custody number 52802.

This Certificate shall not be reproduced, except in full,
without the written approval of the lab.
The sample results relate only to the analytes of interest tested
or to the sample as received by the lab.
Heritage Environmental Services, LLC certifies that the test results
indicated as NELAC (National Environmental Laboratory Accreditation
Conference) accredited (Yes for NELAC) meet all requirements of NELAC and
Illinois EPA Part 186 unless otherwise explained or justified as to the
the exact nature of the deviations.
Heritage Environmental Services, LLC is accredited under Illinois NELAC
accreditation number 100401.
Indiana SDWA Lab Accred. No. C-49-01

Scott A Bryan

Approved by: SCOTT BRYAN 01-FEB-08

HERITAGE

CERTIFICATE OF ANALYSIS

Service Location	Received	Project	Lab ID
HERITAGE ENVIRONMENTAL SERVICES, LLC COMMERCIAL LABORATORY OPERATIONS 7901 W. MORRIS ST. INDIANAPOLIS, IN 46231 (317)243-8304	30-JAN-08		A797260
	Completed	PO Number	
	31-JAN-08	WAIVER	
	Printed	Sampled	
	01-FEB-08	30-JAN-08 11:40	

Report To	Bill To
MARK MCFARLAND INDIANAPOLIS POWER & LIGHT 4040 BLUE BLUFF ROAD MARTINSVILLE, IN 46151	INDIANAPOLIS POWER & LIGHT 4040 BLUE BLUFF ROAD MARTINSVILLE, IN 46151

Sample Description

CLIENT ID: CIRC WATER PUMP
MATRIX TYPE: NON-SPECIFIC WATER
SUBMITTER CODE: 9364
PWS NAME: IPL EAGLE VALLEY STATION
PWS ADDRESS: 4040 BLUE BLUFF ROAD MARTINSVILLE IN

FAA OR ICP ACID DIGESTION EPA 200.0

Analyst: J. KRAMER — Analysis Date: 30-JAN-08 19:00 — Instrument: PREP — Test: P129.2.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	50		mL
FINAL VOLUME	50		mL

ARSENIC ICP EPA 200.7 REV. 4.4 — NELAC-Y

Analyst: J. KRAMER — Analysis Date: 31-JAN-08 02:38 — Instrument: ICP — Test: M403.3.0
Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
ARSENIC	BDL	0.010	mg/L

CADMIUM ICP EPA 200.7 REV. 4.4 — NELAC-Y

Analyst: J. KRAMER — Analysis Date: 31-JAN-08 02:38 — Instrument: ICP — Test: M408.3.0
Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
CADMIUM	BDL	0.0050	mg/L

CHROMIUM ICP EPA 200.7 REV. 4.4 — NELAC-Y

Analyst: J. KRAMER — Analysis Date: 31-JAN-08 02:38 — Instrument: ICP — Test: M410.3.0
Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
CHROMIUM	BDL	0.010	mg/L

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797260 CIRC WATER PUMP

COPPER ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:38 Instrument: ICP Test: M412.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
COPPER	BDL	0.010	mg/L

LEAD ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:38 Instrument: ICP Test: M416.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
LEAD	BDL	0.010	mg/L

NICKEL ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:38 Instrument: ICP Test: M422.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
NICKEL	BDL	0.0050	mg/L

SELENIUM ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:38 Instrument: ICP Test: M428.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
SELENIUM	BDL	0.010	mg/L

ZINC ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:38 Instrument: ICP Test: M439.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
ZINC	0.025	0.020	mg/L

MERCURY CVAA ACID DIGESTION EPA 245.1 REV. 3.0

Analyst: W. WATNESS Analysis Date: 31-JAN-08 04:30 Instrument: PREP Test: P131.2.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	40		mL
FINAL VOLUME	40		mL

MERCURY, MANUAL COLD VAPOR BY AAS EPA 245.5 NELAC:Y

Analyst: W. WATNESS Analysis Date: 31-JAN-08 07:28 Instrument: CVAA Test: M420.1.0

Prep: MERCURY CVAA ACID DIGESTION EPA 245.1 REV. 3.0 P131.2.0

Parameter	Result	Det. Limit	Units
MERCURY	BDL	0.00020	mg/L

HEXAVALENT CHROMIUM SM 3500-CR D 18TH ED NELAC:Y

Analyst: E. SOTKIEWICZ Analysis Date: 31-JAN-08 10:00 Test: M410.6.0

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797260 CIRC WATER PUMP

Parameter	Result	Det. Limit	Units
HEXAVALENT CHROMIUM	BDL	0.01	mg/L

The concentration due to the color and turbidity of the original sample was subtracted out.

TOTAL SUSPENDED SOLIDS DRIED AT 103-105 DEGREES C SM 2540 D, 19TH ED NELAC:Y

Analyst: T. PESTER Analysis Date: 30-JAN-08 19:40 Test: G403.8.0

Parameter	Result	Det. Limit	Units
SUSPENDED SOLIDS	23	1	mg/L

Sample Comments

BDL Below Detection Limit

Sample was received on ice at temperature 5.6 C.
Sample chain of custody number 52802.

This Certificate shall not be reproduced, except in full, without the written approval of the lab.
The sample results relate only to the analytes of interest tested or to the sample as received by the lab.
Heritage Environmental Services, LLC certifies that the test results indicated as NELAC (National Environmental Laboratory Accreditation Conference) accredited (Yes for NELAC) meet all requirements of NELAC and Illinois EPA Part 186 unless otherwise explained or justified as to the the exact nature of the deviations.
Heritage Environmental Services, LLC is accredited under Illinois NELAC accreditation number 100401.
Indiana SDWA Lab Accred. No. C-49-01

Scott A Bryan

Approved by: SCOTT BRYAN 01-FEB-08

HERITAGE

CERTIFICATE OF ANALYSIS

Service Location	Received	Project	Lab ID
HERITAGE ENVIRONMENTAL SERVICES, LLC COMMERCIAL LABORATORY OPERATIONS 7901 W. MORRIS ST. INDIANAPOLIS, IN 46231 (317)243-8304	30-JAN-08		A797258
	Completed	PO Number	
	31-JAN-08	WAIVER	
	Printed	Sampled	
	01-FEB-08	30-JAN-08 11:40	

Report To	Bill To
MARK MCFARLAND INDIANAPOLIS POWER & LIGHT 4040 BLUE BLUFF ROAD MARTINSVILLE, IN 46151	INDIANAPOLIS POWER & LIGHT 4040 BLUE BLUFF ROAD MARTINSVILLE, IN 46151

Sample Description

CLIENT ID: CANAL NPDES POINT
MATRIX TYPE: NON-SPECIFIC WATER
SUBMITTER CODE: 9364
PWS NAME: IPL EAGLE VALLEY STATION
PWS ADDRESS: 4040 BLUE BLUFF ROAD MARTINSVILLE IN

FAA OR ICP ACID DIGESTION EPA 200.0
Analyst: J. KRAMER — Analysis Date: 30-JAN-08 19:00 — Instrument: PREP — Test: P129.2.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	50		mL
FINAL VOLUME	50		mL

ARSENIC ICP EPA 200.7 REV. 4.4 — NELAC:Y
Analyst: J. KRAMER — Analysis Date: 31-JAN-08 02:32 — Instrument: ICP — Test: M403.3.0
Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
ARSENIC	BDL	0.010	mg/L

CADMIUM ICP EPA 200.7 REV. 4.4 — NELAC:Y
Analyst: J. KRAMER — Analysis Date: 31-JAN-08 02:32 — Instrument: ICP — Test: M408.3.0
Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
CADMIUM	BDL	0.0050	mg/L

CHROMIUM ICP EPA 200.7 REV. 4.4 — NELAC:Y
Analyst: J. KRAMER — Analysis Date: 31-JAN-08 02:32 — Instrument: ICP — Test: M410.3.0
Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
CHROMIUM	BDL	0.010	mg/L

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797258 CANAL NPDES POINT

COPPER ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:32 Instrument: ICP Test: M412.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
COPPER	0.010	0.010	mg/L

LEAD ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:32 Instrument: ICP Test: M416.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
LEAD	BDL	0.010	mg/L

NICKEL ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:32 Instrument: ICP Test: M422.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
NICKEL	0.0076	0.0050	mg/L

SELENIUM ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:32 Instrument: ICP Test: M428.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
SELENIUM	BDL	0.010	mg/L

ZINC ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:32 Instrument: ICP Test: M439.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
ZINC	0.035	0.020	mg/L

MERCURY CVAA ACID DIGESTION EPA 245.1 REV. 3.0

Analyst: W. WATNESS Analysis Date: 31-JAN-08 04:30 Instrument: PREP Test: P131.2.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	40		mL
FINAL VOLUME	40		mL

MERCURY, MANUAL COLD VAPOR BY AAS EPA 245.5 NELAC:Y

Analyst: W. WATNESS Analysis Date: 31-JAN-08 07:28 Instrument: CVAA Test: M420.1.0

Prep: MERCURY CVAA ACID DIGESTION EPA 245.1 REV. 3.0 P131.2.0

Parameter	Result	Det. Limit	Units
MERCURY	BDL	0.00020	mg/L

HEXAVALENT CHROMIUM SM 3500-CR D 18TH ED NELAC:Y

Analyst: E. SOTKIEWICZ Analysis Date: 31-JAN-08 10:00 Test: M410.6.0

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797258 CANAL NPDES POINT

Parameter	Result	Det. Limit	Units
HEXAVALENT CHROMIUM	BDL	0.01	mg/L

The concentration due to the color and turbidity of the original sample was subtracted out.

TOTAL SUSPENDED SOLIDS DRIED AT 103-105 DEGREES C SM 2540 D, 19TH ED. NELAC Y

Analyst: T. PESTER Analysis Date: 30-JAN-08 19:40 Test: G403.8.0

Parameter	Result	Det. Limit	Units
SUSPENDED SOLIDS	71	1	mg/L

Sample Comments

BDL Below Detection Limit

Sample was received on ice at temperature 5.6 C.
Sample chain of custody number 52802.

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The sample results relate only to the analytes of interest tested or to the sample as received by the lab.
Heritage Environmental Services, LLC certifies that the test results indicated as NELAC (National Environmental Laboratory Accreditation Conference) accredited (Yes for NELAC) meet all requirements of NELAC and Illinois EPA Part 186 unless otherwise explained or justified as to the the exact nature of the deviations.
Heritage Environmental Services, LLC is accredited under Illinois NELAC accreditation number 100401.
Indiana SDWA Lab Accred. No. C-49-01

Scott A Bryan

Approved by: SCOTT BRYAN 01-FEB-08

HERITAGE

CERTIFICATE OF ANALYSIS

Service Location	Received	Project	Lab ID
HERITAGE ENVIRONMENTAL SERVICES, LLC COMMERCIAL LABORATORY OPERATIONS 7901 W. MORRIS ST. INDIANAPOLIS, IN 46231 (317)243-8304	30-JAN-08		A797259
	Completed	PO Number	
	31-JAN-08	WAIVER	
	Printed	Sampled	
	01-FEB-08	30-JAN-08 11:40	

Report To	Bill To
MARK MCFARLAND INDIANAPOLIS POWER & LIGHT 4040 BLUE BLUFF ROAD MARTINSVILLE, IN 46151	INDIANAPOLIS POWER & LIGHT 4040 BLUE BLUFF ROAD MARTINSVILLE, IN 46151

Sample Description

CLIENT ID: BOAT RAMP
MATRIX TYPE: NON-SPECIFIC WATER
SUBMITTER CODE: 9364
PWS NAME: IPL EAGLE VALLEY STATION
PWS ADDRESS: 4040 BLUE BLUFF ROAD MARTINSVILLE IN

FAA OR ICP ACID DIGESTION EPA 200.0

Analyst: J. KRAMER — Analysis Date: 30-JAN-08 19:00 — Instrument: PREP — Test: P129.2.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	50		mL
FINAL VOLUME	50		mL

ARSENIC ICP EPA 200.7 REV. 4.4 — NELAC-Y

Analyst: J. KRAMER — Analysis Date: 31-JAN-08 02:35 — Instrument: ICP — Test: M403.3.0
Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
ARSENIC	BDL	0.010	mg/L

CADMIUM ICP EPA 200.7 REV. 4.4 — NELAC-Y

Analyst: J. KRAMER — Analysis Date: 31-JAN-08 02:35 — Instrument: ICP — Test: M408.3.0
Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
CADMIUM	BDL	0.0050	mg/L

CHROMIUM ICP EPA 200.7 REV. 4.4 — NELAC-Y

Analyst: J. KRAMER — Analysis Date: 31-JAN-08 02:35 — Instrument: ICP — Test: M410.3.0
Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
CHROMIUM	BDL	0.010	mg/L

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797259 BOAT RAMP

COPPER ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:35 Instrument: ICP Test: M412.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
COPPER	BDL	0.010	mg/L

LEAD ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:35 Instrument: ICP Test: M416.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
LEAD	BDL	0.010	mg/L

NICKEL ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:35 Instrument: ICP Test: M422.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
NICKEL	0.011	0.0050	mg/L

SELENIUM ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:35 Instrument: ICP Test: M428.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
SELENIUM	0.011	0.010	mg/L

ZINC ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:35 Instrument: ICP Test: M439.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
ZINC	0.040	0.020	mg/L

MERCURY CVAA ACID DIGESTION EPA 245.1 REV. 3.0

Analyst: W. WATNESS Analysis Date: 31-JAN-08 04:30 Instrument: PREP Test: P131.2.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	40		mL
FINAL VOLUME	40		mL

MERCURY, MANUAL COLD VAPOR BY AAS EPA 245.5 NELAC:Y

Analyst: W. WATNESS Analysis Date: 31-JAN-08 07:28 Instrument: CVAA Test: M420.1.0

Prep: MERCURY CVAA ACID DIGESTION EPA 245.1 REV. 3.0 P131.2.0

Parameter	Result	Det. Limit	Units
MERCURY	BDL	0.00020	mg/L

HEXAVALENT CHROMIUM SM 3500-CR D 18TH ED NELAC:Y

Analyst: E. SOTKIEWICZ Analysis Date: 31-JAN-08 10:00 Test: M410.6.0

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797259 BOAT RAMP

Parameter	Result	Det. Limit	Units
HEXAVALENT CHROMIUM	BDL	0.01	mg/L

The concentration due to the color and turbidity of the original sample was subtracted out.

TOTAL SUSPENDED SOLIDS DRIED AT 103-105 DEGREES C SM 2540 D, 19TH ED. NELAC-Y

Analyst: T. PESTER Analysis Date: 30-JAN-08 19:40 Test: G403.8.0

Parameter	Result	Det. Limit	Units
SUSPENDED SOLIDS	140	1	mg/L

Sample Comments

BDL Below Detection Limit

Sample was received on ice at temperature 5.6 C.
Sample chain of custody number 52802.

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Heritage Environmental Services, LLC certifies that the test results indicated as NELAC (National Environmental Laboratory Accreditation Conference) accredited (Yes for NELAC) meet all requirements of NELAC and Illinois EPA Part 186 unless otherwise explained or justified as to the the exact nature of the deviations.
Heritage Environmental Services, LLC is accredited under Illinois NELAC accreditation number 100401.
Indiana SDWA Lab Accred. No. C-49-01

Scott A Bryan

Approved by: SCOTT BRYAN 01-FEB-08

HERITAGE

CERTIFICATE OF ANALYSIS

Service Location	Received	Project	Lab ID
HERITAGE ENVIRONMENTAL SERVICES, LLC COMMERCIAL LABORATORY OPERATIONS 7901 W. MORRIS ST. INDIANAPOLIS, IN 46231 (317)243-8304	30-JAN-08		A797262
	Completed	PO Number	
	31-JAN-08	WAIVER	
	Printed	Sampled	
	01-FEB-08	30-JAN-08 14:50	

Report To	Bill To
MARK MCFARLAND INDIANAPOLIS POWER & LIGHT 4040 BLUE BLUFF ROAD MARTINSVILLE, IN 46151	INDIANAPOLIS POWER & LIGHT 4040 BLUE BLUFF ROAD MARTINSVILLE, IN 46151

Sample Description

CLIENT ID: CIRC WATER PUMP
MATRIX TYPE: NON-SPECIFIC WATER
SUBMITTER CODE: 9364
PWS NAME: IPL EAGLE VALLEY STATION
PWS ADDRESS: 4040 BLUE BLUFF ROAD MARTINSVILLE IN

FAA OR ICP ACID DIGESTION EPA 200.0
Analyst: J. KRAMER — Analysis Date: 30-JAN-08 19:00 — Instrument: PREP — Test: P129.2.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	50		mL
FINAL VOLUME	50		mL

ARSENIC ICP EPA 200.7 REV. 4.4 — NELAC:Y
Analyst: J. KRAMER — Analysis Date: 31-JAN-08 02:45 — Instrument: ICP — Test: M403.3.0
Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
ARSENIC	BDL	0.010	mg/L

CADMIUM ICP EPA 200.7 REV. 4.4 — NELAC:Y
Analyst: J. KRAMER — Analysis Date: 31-JAN-08 02:45 — Instrument: ICP — Test: M408.3.0
Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
CADMIUM	BDL	0.0050	mg/L

CHROMIUM ICP EPA 200.7 REV. 4.4 — NELAC:Y
Analyst: J. KRAMER — Analysis Date: 31-JAN-08 02:45 — Instrument: ICP — Test: M410.3.0
Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
CHROMIUM	BDL	0.010	mg/L

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797262 CIRC WATER PUMP

COPPER ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:45 Instrument: ICP Test: M412.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
COPPER	BDL	0.010	mg/L

LEAD ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:45 Instrument: ICP Test: M416.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
LEAD	BDL	0.010	mg/L

NICKEL ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:45 Instrument: ICP Test: M422.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
NICKEL	BDL	0.0050	mg/L

SELENIUM ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:45 Instrument: ICP Test: M428.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
SELENIUM	BDL	0.010	mg/L

ZINC ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:45 Instrument: ICP Test: M439.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
ZINC	0.023	0.020	mg/L

MERCURY CVAA ACID DIGESTION EPA 245.1 REV. 3.0

Analyst: W. WATNESS Analysis Date: 31-JAN-08 04:30 Instrument: PREP Test: P131.2.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	40		mL
FINAL VOLUME	40		mL

MERCURY, MANUAL COLD VAPOR BY AAS EPA 245.5 NELAC:Y

Analyst: W. WATNESS Analysis Date: 31-JAN-08 07:28 Instrument: CVAA Test: M420.1.0

Prep: MERCURY CVAA ACID DIGESTION EPA 245.1 REV. 3.0 P131.2.0

Parameter	Result	Det. Limit	Units
MERCURY	BDL	0.00020	mg/L

HEXAVALENT CHROMIUM SM 3500-CR D 18TH ED NELAC:Y

Analyst: E. SOTKIEWICZ Analysis Date: 31-JAN-08 10:00 Test: M410.6.0

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797262 CIRC WATER PUMP

Parameter	Result	Det. Limit	Units
HEXAVALENT CHROMIUM	BDL	0.01	mg/L

The concentration due to the color and turbidity of the original sample was subtracted out.

TOTAL SUSPENDED SOLIDS DRIED AT 103-105 DEGREES C SM 2540 D, 19TH ED. NELAC Y

Analyst: T PESTER Analysis Date: 30-JAN-08 19:40 Test: G403.8.0

Parameter	Result	Det. Limit	Units
SUSPENDED SOLIDS	18	1	mg/L

Sample Comments

BDL Below Detection Limit

Sample was received on ice at temperature 5.6 C.
Sample chain of custody number 52802.

This Certificate shall not be reproduced, except in full, without the written approval of the lab.
The sample results relate only to the analytes of interest tested or to the sample as received by the lab.
Heritage Environmental Services, LLC certifies that the test results indicated as NELAC (National Environmental Laboratory Accreditation Conference) accredited (Yes for NELAC) meet all requirements of NELAC and Illinois EPA Part 186 unless otherwise explained or justified as to the the exact nature of the deviations.
Heritage Environmental Services, LLC is accredited under Illinois NELAC accreditation number 100401.
Indiana SDWA Lab Accred. No. C-49-01

Scott A Bryan

Approved by: SCOTT BRYAN 01-FEB-08

HERITAGE

CERTIFICATE OF ANALYSIS

Service Location	Received	Project	Lab ID
HERITAGE ENVIRONMENTAL SERVICES, LLC COMMERCIAL LABORATORY OPERATIONS 7901 W. MORRIS ST. INDIANAPOLIS, IN 46231 (317)243-8304	30-JAN-08		A797263
	Completed	PO Number	
	31-JAN-08	WAIVER	
	Printed	Sampled	
	01-FEB-08	30-JAN-08 15:50	

Report To	Bill To
MARK MCFARLAND INDIANAPOLIS POWER & LIGHT 4040 BLUE BLUFF ROAD MARTINSVILLE, IN 46151	INDIANAPOLIS POWER & LIGHT 4040 BLUE BLUFF ROAD MARTINSVILLE, IN 46151

Sample Description

CLIENT ID: CANAL NPDES POINT
MATRIX TYPE: NON-SPECIFIC WATER
SUBMITTER CODE: 9364
PWS NAME: IPL EAGLE VALLEY STATION
PWS ADDRESS: 4040 BLUE BLUFF ROAD MARTINSVILLE IN

FAA OR ICP ACID DIGESTION EPA 200.0
Analyst: J. KRAMER — Analysis Date: 30-JAN-08 19:00 — Instrument: PREP — Test: P129.2.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	50		mL
FINAL VOLUME	50		mL

ARSENIC ICP EPA 200.7 REV. 4.4 — NELAC-Y
Analyst: J. KRAMER — Analysis Date: 31-JAN-08 02:48 — Instrument: ICP — Test: M403.3.0
Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
ARSENIC	BDL	0.010	mg/L

CADMIUM ICP EPA 200.7 REV. 4.4 — NELAC-Y
Analyst: J. KRAMER — Analysis Date: 31-JAN-08 02:48 — Instrument: ICP — Test: M408.3.0
Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
CADMIUM	BDL	0.0050	mg/L

CHROMIUM ICP EPA 200.7 REV. 4.4 — NELAC-Y
Analyst: J. KRAMER — Analysis Date: 31-JAN-08 02:48 — Instrument: ICP — Test: M410.3.0
Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
CHROMIUM	BDL	0.010	mg/L

HERITAGE

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797263 CANAL NPDES POINT

COPPER ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:48 Instrument: ICP Test: M412.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
COPPER	BDL	0.010	mg/L

LEAD ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:48 Instrument: ICP Test: M416.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
LEAD	BDL	0.010	mg/L

NICKEL ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:48 Instrument: ICP Test: M422.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
NICKEL	BDL	0.0050	mg/L

SELENIUM ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:48 Instrument: ICP Test: M428.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
SELENIUM	BDL	0.010	mg/L

ZINC ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:48 Instrument: ICP Test: M439.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
ZINC	0.028	0.020	mg/L

MERCURY CVAA ACID DIGESTION EPA 245.1 REV. 3.0

Analyst: W. WATNESS Analysis Date: 31-JAN-08 04:30 Instrument: PREP Test: P131.2.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	40		mL
FINAL VOLUME	40		mL

MERCURY, MANUAL COLD VAPOR BY AAS EPA 245.5 NELAC:Y

Analyst: W. WATNESS Analysis Date: 31-JAN-08 07:28 Instrument: CVAA Test: M420.1.0

Prep: MERCURY CVAA ACID DIGESTION EPA 245.1 REV. 3.0 P131.2.0

Parameter	Result	Det. Limit	Units
MERCURY	BDL	0.00020	mg/L

HEXAVALENT CHROMIUM SM 3500-CR D 18TH ED NELAC:Y

Analyst: E. SOTKIEWICZ Analysis Date: 31-JAN-08 10:00 Test: M410.6.0

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797263 CANAL NPDES POINT

Parameter	Result	Det. Limit	Units
HEXAVALENT CHROMIUM	BDL	0.01	mg/L

The concentration due to the color and turbidity of the original sample was subtracted out.

TOTAL SUSPENDED SOLIDS DRIED AT 103-105 DEGREES C SM 2540 D, 19TH ED. NELAC Y

Analyst: T. PESTER Analysis Date: 30-JAN-08 19:40 Test: G403.8.0

Parameter	Result	Det. Limit	Units
SUSPENDED SOLIDS	42	1	mg/L

Sample Comments

BDL Below Detection Limit

Sample was received on ice at temperature 5.6 C.
Sample chain of custody number 52802.

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Heritage Environmental Services, LLC certifies that the test results indicated as NELAC (National Environmental Laboratory Accreditation Conference) accredited (Yes for NELAC) meet all requirements of NELAC and Illinois EPA Part 186 unless otherwise explained or justified as to the the exact nature of the deviations.
Heritage Environmental Services, LLC is accredited under Illinois NELAC accreditation number 100401.
Indiana SDWA Lab Accred. No. C-49-01

Scott A Bryan

Approved by: SCOTT BRYAN 01-FEB-08

HERITAGE

CERTIFICATE OF ANALYSIS

Service Location	Received	Project	Lab ID
HERITAGE ENVIRONMENTAL SERVICES, LLC COMMERCIAL LABORATORY OPERATIONS 7901 W. MORRIS ST. INDIANAPOLIS, IN 46231 (317)243-8304	30-JAN-08		A797264
	Completed	PO Number	
	31-JAN-08	WAIVER	
	Printed	Sampled	
	01-FEB-08	30-JAN-08 15:50	

Report To	Bill To
MARK MCFARLAND INDIANAPOLIS POWER & LIGHT 4040 BLUE BLUFF ROAD MARTINSVILLE, IN 46151	INDIANAPOLIS POWER & LIGHT 4040 BLUE BLUFF ROAD MARTINSVILLE, IN 46151

Sample Description

CLIENT ID: BOAT RAMP
MATRIX TYPE: NON-SPECIFIC WATER
SUBMITTER CODE: 9364
PWS NAME: IPL EAGLE VALLEY STATION
PWS ADDRESS: 4040 BLUE BLUFF ROAD MARTINSVILLE IN

FAA OR ICP ACID DIGESTION EPA 200.0

Analyst: J. KRAMER — Analysis Date: 30-JAN-08 19:00 — Instrument: PREP — Test: P129.2.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	50		mL
FINAL VOLUME	50		mL

ARSENIC ICP EPA 200.7 REV. 4.4 — NELAC:Y

Analyst: J. KRAMER — Analysis Date: 31-JAN-08 02:51 — Instrument: ICP — Test: M403.3.0
Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
ARSENIC	BDL	0.010	mg/L

CADMIUM ICP EPA 200.7 REV. 4.4 — NELAC:Y

Analyst: J. KRAMER — Analysis Date: 31-JAN-08 02:51 — Instrument: ICP — Test: M408.3.0
Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
CADMIUM	BDL	0.0050	mg/L

CHROMIUM ICP EPA 200.7 REV. 4.4 — NELAC:Y

Analyst: J. KRAMER — Analysis Date: 31-JAN-08 02:51 — Instrument: ICP — Test: M410.3.0
Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
CHROMIUM	BDL	0.010	mg/L

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797264 BOAT RAMP

COPPER ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:51 Instrument: ICP Test: M412.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
COPPER	BDL	0.010	mg/L

LEAD ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:51 Instrument: ICP Test: M416.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
LEAD	BDL	0.010	mg/L

NICKEL ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:51 Instrument: ICP Test: M422.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
NICKEL	0.0052	0.0050	mg/L

SELENIUM ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:51 Instrument: ICP Test: M428.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
SELENIUM	BDL	0.010	mg/L

ZINC ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:51 Instrument: ICP Test: M439.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
ZINC	0.029	0.020	mg/L

MERCURY CVAA ACID DIGESTION EPA 245.1 REV. 3.0

Analyst: W. WATNESS Analysis Date: 31-JAN-08 04:30 Instrument: PREP Test: P131.2.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	40		mL
FINAL VOLUME	40		mL

MERCURY, MANUAL COLD VAPOR BY AAS EPA 245.5 NELAC:Y

Analyst: W. WATNESS Analysis Date: 31-JAN-08 07:28 Instrument: CVAA Test: M420.1.0

Prep: MERCURY CVAA ACID DIGESTION EPA 245.1 REV. 3.0 P131.2.0

Parameter	Result	Det. Limit	Units
MERCURY	BDL	0.00020	mg/L

HEXAVALENT CHROMIUM SM 3500-CR D 18TH ED NELAC:Y

Analyst: E. SOTKIEWICZ Analysis Date: 31-JAN-08 10:00 Test: M410.6.0

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797264 BOAT RAMP

Parameter	Result	Det. Limit	Units
HEXAVALENT CHROMIUM	BDL	0.01	mg/L

The concentration due to the color and turbidity of the original sample was subtracted out.

TOTAL SUSPENDED SOLIDS DRIED AT 103-105 DEGREES C SM 2540 D, 19TH ED. NELAC:Y

Analyst: T. PESTER Analysis Date: 30-JAN-08 19:40 Test: G403.8.0

Parameter	Result	Det. Limit	Units
SUSPENDED SOLIDS	34	1	mg/L

Sample Comments

BDL Below Detection Limit

Sample was received on ice at temperature 5.6 C.
Sample chain of custody number 52802.

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Heritage Environmental Services, LLC is accredited under Illinois NELAC accreditation number 100401.
Indiana SDWA Lab Accred. No. C-49-01

Scott A Bryan

Approved by: SCOTT BRYAN 01-FEB-08

HERITAGE

CERTIFICATE OF ANALYSIS

Service Location	Received	Project	Lab ID
HERITAGE ENVIRONMENTAL SERVICES, LLC COMMERCIAL LABORATORY OPERATIONS 7901 W. MORRIS ST. INDIANAPOLIS, IN 46231 (317)243-8304	30-JAN-08		A797261
	Completed	PO Number	
	31-JAN-08	WAIVER	
	Printed	Sampled	
	01-FEB-08	30-JAN-08 11:15	

Report To	Bill To
MARK MCFARLAND INDIANAPOLIS POWER & LIGHT 4040 BLUE BLUFF ROAD MARTINSVILLE, IN 46151	INDIANAPOLIS POWER & LIGHT 4040 BLUE BLUFF ROAD MARTINSVILLE, IN 46151

Sample Description

CLIENT ID: FIELD
MATRIX TYPE: NON-SPECIFIC WATER
SUBMITTER CODE: 9364
PWS NAME: IPL EAGLE VALLEY STATION
PWS ADDRESS: 4040 BLUE BLUFF ROAD MARTINSVILLE IN

FAA OR ICP ACID DIGESTION EPA 200.0
Analyst: J. KRAMER — Analysis Date: 30-JAN-08 19:00 — Instrument: PREP — Test: P129.2.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	50		mL
FINAL VOLUME	50		mL

ARSENIC ICP EPA 200.7 REV. 4.4 — NELAC:Y
Analyst: J. KRAMER — Analysis Date: 31-JAN-08 02:42 — Instrument: ICP — Test: M403.3.0
Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
ARSENIC	0.18	0.010	mg/L

CADMIUM ICP EPA 200.7 REV. 4.4 — NELAC:Y
Analyst: J. KRAMER — Analysis Date: 31-JAN-08 02:42 — Instrument: ICP — Test: M408.3.0
Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
CADMIUM	BDL	0.0050	mg/L

CHROMIUM ICP EPA 200.7 REV. 4.4 — NELAC:Y
Analyst: J. KRAMER — Analysis Date: 31-JAN-08 02:42 — Instrument: ICP — Test: M410.3.0
Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
CHROMIUM	0.041	0.010	mg/L

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797261 FIELD

COPPER ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:42 Instrument: ICP Test: M412.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
COPPER	0.031	0.010	mg/L

LEAD ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:42 Instrument: ICP Test: M416.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
LEAD	0.057	0.010	mg/L

NICKEL ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:42 Instrument: ICP Test: M422.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
NICKEL	0.066	0.0050	mg/L

SELENIUM ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 06:46 Instrument: ICP Test: M428.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
SELENIUM	BDL	0.010	mg/L

ZINC ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 31-JAN-08 02:42 Instrument: ICP Test: M439.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
ZINC	0.22	0.020	mg/L

MERCURY CVAA ACID DIGESTION EPA 245.1 REV. 3.0

Analyst: W. WATNESS Analysis Date: 31-JAN-08 04:30 Instrument: PREP Test: P131.2.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	40		mL
FINAL VOLUME	40		mL

MERCURY, MANUAL COLD VAPOR BY AAS EPA 245.5 NELAC:Y

Analyst: W. WATNESS Analysis Date: 31-JAN-08 07:28 Instrument: CVAA Test: M420.1.0

Prep: MERCURY CVAA ACID DIGESTION EPA 245.1 REV. 3.0 P131.2.0

Parameter	Result	Det. Limit	Units
MERCURY	BDL	0.00020	mg/L

HEXAVALENT CHROMIUM SM 3500-CR D 18TH ED NELAC:Y

Analyst: E. SOTKIEWICZ Analysis Date: 31-JAN-08 10:00 Test: M410.6.0

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797261 FIELD

Parameter	Result	Det. Limit	Units
HEXAVALENT CHROMIUM	0.03	0.01	mg/L

Sample was filtered due to interferences.

TOTAL SUSPENDED SOLIDS DRIED AT 103-105 DEGREES C SM 2540 D, 19TH ED. NELAC Y

Analyst: T. PESTER Analysis Date: 30-JAN-08 19:40 Test: G403.8.0

Parameter	Result	Det. Limit	Units
SUSPENDED SOLIDS	550	1	mg/L

Sample Comments

BDL Below Detection Limit

Sample was received on ice at temperature 5.6 C.
Sample chain of custody number 52802.

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Heritage Environmental Services, LLC is accredited under Illinois NELAC accreditation number 100401.
Indiana SDWA Lab Accred. No. C-49-01

Scott A Bryan

Approved by: SCOTT BRYAN 01-FEB-08

HERITAGE

CERTIFICATE OF ANALYSIS

Service Location	Received	Project	Lab ID
HERITAGE ENVIRONMENTAL SERVICES, LLC COMMERCIAL LABORATORY OPERATIONS 7901 W. MORRIS ST. INDIANAPOLIS, IN 46231 (317)243-8304	31-JAN-08		A797419
	Completed	PO Number	
	01-FEB-08	WAIVER	
	Printed	Sampled	
	04-FEB-08	31-JAN-08 11:30	

Report To	Bill To
MARK MCFARLAND INDIANAPOLIS POWER & LIGHT 4040 BLUE BLUFF ROAD MARTINSVILLE, IN 46151	INDIANAPOLIS POWER & LIGHT 4040 BLUE BLUFF ROAD MARTINSVILLE, IN 46151

Sample Description

CLIENT ID: CIRC WATER
MATRIX TYPE: NON-SPECIFIC WATER
SUBMITTER CODE: 9364
PWS NAME: IPL EAGLE VALLEY STATION
PWS ADDRESS: 4040 BLUE BLUFF ROAD MARTINSVILLE IN

FAA OR ICP ACID DIGESTION EPA 200.0
Analyst: J. KRAMER — Analysis Date: 31-JAN-08 21:00 — Instrument: PREP — Test: P129.2.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	50		mL
FINAL VOLUME	50		mL

ARSENIC ICP EPA 200.7 REV. 4.4 — NELAC-Y
Analyst: J. KRAMER — Analysis Date: 01-FEB-08 02:09 — Instrument: ICP — Test: M403.3.0
Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
ARSENIC	BDL	0.010	mg/L

CADMIUM ICP EPA 200.7 REV. 4.4 — NELAC-Y
Analyst: J. KRAMER — Analysis Date: 01-FEB-08 02:09 — Instrument: ICP — Test: M408.3.0
Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
CADMIUM	BDL	0.0050	mg/L

CHROMIUM ICP EPA 200.7 REV. 4.4 — NELAC-Y
Analyst: J. KRAMER — Analysis Date: 01-FEB-08 02:09 — Instrument: ICP — Test: M410.3.0
Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
CHROMIUM	BDL	0.010	mg/L

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797419 CIRC WATER

COPPER ICP EPA 200.7 REV. 4.4 — NELAC:Y

Analyst: J. KRAMER — Analysis Date: 01-FEB-08 02:09 — Instrument: ICP — Test: M412.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
COPPER	BDL	0.010	mg/L

LEAD ICP EPA 200.7 REV. 4.4 — NELAC:Y

Analyst: J. KRAMER — Analysis Date: 01-FEB-08 02:09 — Instrument: ICP — Test: M416.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
LEAD	BDL	0.010	mg/L

NICKEL ICP EPA 200.7 REV. 4.4 — NELAC:Y

Analyst: J. KRAMER — Analysis Date: 01-FEB-08 02:09 — Instrument: ICP — Test: M422.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
NICKEL	BDL	0.0050	mg/L

SELENIUM ICP EPA 200.7 REV. 4.4 — NELAC:Y

Analyst: J. KRAMER — Analysis Date: 01-FEB-08 02:09 — Instrument: ICP — Test: M428.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
SELENIUM	BDL	0.010	mg/L

ZINC ICP EPA 200.7 REV. 4.4 — NELAC:Y

Analyst: J. KRAMER — Analysis Date: 01-FEB-08 02:09 — Instrument: ICP — Test: M439.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
ZINC	0.025	0.020	mg/L

MERCURY CVAA ACID DIGESTION EPA 245.1 REV. 3.0

Analyst: W. WATNESS — Analysis Date: 31-JAN-08 17:00 — Instrument: PREP — Test: P131.2.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	40		mL
FINAL VOLUME	40		mL

MERCURY, MANUAL COLD VAPOR BY AAS EPA 245.5 — NELAC:Y

Analyst: W. WATNESS — Analysis Date: 01-FEB-08 06:17 — Instrument: CVAA — Test: M420.1.0

Prep: MERCURY CVAA ACID DIGESTION EPA 245.1 REV. 3.0 P131.2.0

Parameter	Result	Det. Limit	Units
MERCURY	BDL	0.00020	mg/L

HEXAVALENT CHROMIUM SM 3500-CR D 18TH ED — NELAC:Y

Analyst: E. SOTKIEWICZ — Analysis Date: 31-JAN-08 16:50 — Test: M410.6.0

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797419 CIRC WATER

Parameter	Result	Det. Limit	Units
HEXAVALENT CHROMIUM	BDL	0.01	mg/L

The concentration due to the color and turbidity of the original sample was subtracted out.

TOTAL SUSPENDED SOLIDS DRIED AT 103-105 DEGREES C SM 2540 D 19TH ED. NELAC-Y

Analyst: T PESTER Analysis Date: 31-JAN-08 17:45 Test: G403.8.0

Parameter	Result	Det. Limit	Units
SUSPENDED SOLIDS	16	1	mg/L

Sample Comments

BDL Below Detection Limit

Sample was received on ice at temperature 11.2 C.
Sample chain of custody number 52807.

This Certificate shall not be reproduced, except in full, without the written approval of the lab.
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Heritage Environmental Services, LLC certifies that the test results indicated as NELAC (National Environmental Laboratory Accreditation Conference) accredited (Yes for NELAC) meet all requirements of NELAC and Illinois EPA Part 186 unless otherwise explained or justified as to the the exact nature of the deviations.
Heritage Environmental Services, LLC is accredited under Illinois NELAC accreditation number 100401.
Indiana SDWA Lab Accred. No. C-49-01

Scott A Bryan

Approved by: SCOTT BRYAN 04-FEB-08

HERITAGE

CERTIFICATE OF ANALYSIS

Service Location	Received	Project	Lab ID
HERITAGE ENVIRONMENTAL SERVICES, LLC COMMERCIAL LABORATORY OPERATIONS 7901 W. MORRIS ST. INDIANAPOLIS, IN 46231 (317)243-8304	31-JAN-08		A797418
	Completed	PO Number	
	01-FEB-08	WAIVER	
	Printed	Sampled	
	04-FEB-08	31-JAN-08 11:30	

Report To	Bill To
MARK MCFARLAND INDIANAPOLIS POWER & LIGHT 4040 BLUE BLUFF ROAD MARTINSVILLE, IN 46151	INDIANAPOLIS POWER & LIGHT 4040 BLUE BLUFF ROAD MARTINSVILLE, IN 46151

Sample Description

CLIENT ID: CANAL NPDES
MATRIX TYPE: NON-SPECIFIC WATER
SUBMITTER CODE: 9364
PWS NAME: IPL EAGLE VALLEY STATION
PWS ADDRESS: 4040 BLUE BLUFF ROAD MARTINSVILLE IN

FAA OR ICP ACID DIGESTION EPA 200.0
Analyst: J. KRAMER — Analysis Date: 31-JAN-08 21:00 — Instrument: PREP — Test: P129.2.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	50		mL
FINAL VOLUME	50		mL

ARSENIC ICP EPA 200.7 REV. 4.4 — NELAC Y
Analyst: J. KRAMER — Analysis Date: 01-FEB-08 01:56 — Instrument: ICP — Test: M403.3.0
Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
ARSENIC	BDL	0.010	mg/L

CADMIUM ICP EPA 200.7 REV. 4.4 — NELAC Y
Analyst: J. KRAMER — Analysis Date: 01-FEB-08 01:56 — Instrument: ICP — Test: M408.3.0
Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
CADMIUM	BDL	0.0050	mg/L

CHROMIUM ICP EPA 200.7 REV. 4.4 — NELAC Y
Analyst: J. KRAMER — Analysis Date: 01-FEB-08 01:56 — Instrument: ICP — Test: M410.3.0
Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
CHROMIUM	BDL	0.010	mg/L

HERITAGE

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797418 CANAL NPDES

COPPER ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 01-FEB-08 01:56 Instrument: ICP Test: M412.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
COPPER	BDL	0.010	mg/L

LEAD ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 01-FEB-08 01:56 Instrument: ICP Test: M416.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
LEAD	BDL	0.010	mg/L

NICKEL ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 01-FEB-08 01:56 Instrument: ICP Test: M422.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
NICKEL	0.0059	0.0050	mg/L

SELENIUM ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 01-FEB-08 01:56 Instrument: ICP Test: M428.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
SELENIUM	BDL	0.010	mg/L

ZINC ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 01-FEB-08 01:56 Instrument: ICP Test: M439.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
ZINC	0.029	0.020	mg/L

MERCURY CVAA ACID DIGESTION EPA 245.1 REV. 3.0

Analyst: W. WATNESS Analysis Date: 31-JAN-08 17:00 Instrument: PREP Test: P131.2.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	40		mL
FINAL VOLUME	40		mL

MERCURY, MANUAL COLD VAPOR BY AAS EPA 245.5 NELAC:Y

Analyst: W. WATNESS Analysis Date: 01-FEB-08 06:17 Instrument: CVAA Test: M420.1.0

Prep: MERCURY CVAA ACID DIGESTION EPA 245.1 REV. 3.0 P131.2.0

Parameter	Result	Det. Limit	Units
MERCURY	BDL	0.00020	mg/L

HEXAVALENT CHROMIUM SM 3500-CR D 18TH ED NELAC:Y

Analyst: E. SOTKIEWICZ Analysis Date: 31-JAN-08 16:50 Test: M410.6.0

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797418 CANAL NPDES

Parameter	Result	Det. Limit	Units
HEXAVALENT CHROMIUM	BDL	0.01	mg/L

The concentration due to the color and turbidity of the original sample was subtracted out.

TOTAL SUSPENDED SOLIDS DRIED AT 103-105 DEGREES C SM 2540 D, 19TH ED. NELAC-Y

Analyst: T. PESTER Analysis Date: 31-JAN-08 17:45 Test: G403.8.0

Parameter	Result	Det. Limit	Units
SUSPENDED SOLIDS	30	1	mg/L

Sample Comments

BDL Below Detection Limit

Sample was received on ice at temperature 11.2 C.
Sample chain of custody number 52807.

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Heritage Environmental Services, LLC is accredited under Illinois NELAC accreditation number 100401.
Indiana SDWA Lab Accred. No. C-49-01

Scott A Bryan

Approved by: SCOTT BRYAN 04-FEB-08

HERITAGE

CERTIFICATE OF ANALYSIS

Service Location	Received	Project	Lab ID
HERITAGE ENVIRONMENTAL SERVICES, LLC COMMERCIAL LABORATORY OPERATIONS 7901 W. MORRIS ST. INDIANAPOLIS, IN 46231 (317)243-8304	31-JAN-08		A797417
	Completed	PO Number	
	01-FEB-08	WAIVER	
	Printed	Sampled	
	04-FEB-08	31-JAN-08 11:30	

Report To	Bill To
MARK MCFARLAND INDIANAPOLIS POWER & LIGHT 4040 BLUE BLUFF ROAD MARTINSVILLE, IN 46151	INDIANAPOLIS POWER & LIGHT 4040 BLUE BLUFF ROAD MARTINSVILLE, IN 46151

Sample Description

CLIENT ID: BOAT RAMP
MATRIX TYPE: NON-SPECIFIC WATER
SUBMITTER CODE: 9364
PWS NAME: IPL EAGLE VALLEY STATION
PWS ADDRESS: 4040 BLUE BLUFF ROAD MARTINSVILLE IN

FAA OR ICP ACID DIGESTION EPA 200.0
Analyst: J. KRAMER — Analysis Date: 31-JAN-08 21:00 — Instrument: PREP — Test: P129.2.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	50		mL
FINAL VOLUME	50		mL

ARSENIC ICP EPA 200.7 REV. 4.4 — NELAC Y
Analyst: J. KRAMER — Analysis Date: 01-FEB-08 02:06 — Instrument: ICP — Test: M403.3.0
Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
ARSENIC	BDL	0.010	mg/L

CADMIUM ICP EPA 200.7 REV. 4.4 — NELAC Y
Analyst: J. KRAMER — Analysis Date: 01-FEB-08 02:06 — Instrument: ICP — Test: M408.3.0
Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
CADMIUM	BDL	0.0050	mg/L

CHROMIUM ICP EPA 200.7 REV. 4.4 — NELAC Y
Analyst: J. KRAMER — Analysis Date: 01-FEB-08 02:06 — Instrument: ICP — Test: M410.3.0
Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
CHROMIUM	BDL	0.010	mg/L

HERITAGE

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797417 BOAT RAMP

COPPER ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 01-FEB-08 02:06 Instrument: ICP Test: M412.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
COPPER	BDL	0.010	mg/L

LEAD ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 01-FEB-08 02:06 Instrument: ICP Test: M416.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
LEAD	BDL	0.010	mg/L

NICKEL ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 01-FEB-08 02:06 Instrument: ICP Test: M422.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
NICKEL	BDL	0.0050	mg/L

SELENIUM ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 01-FEB-08 02:06 Instrument: ICP Test: M428.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
SELENIUM	BDL	0.010	mg/L

ZINC ICP EPA 200.7 REV. 4.4 NELAC:Y

Analyst: J. KRAMER Analysis Date: 01-FEB-08 02:06 Instrument: ICP Test: M439.3.0

Prep: FAA OR ICP ACID DIGESTION EPA 200.0 P129.2.0

Parameter	Result	Det. Limit	Units
ZINC	0.025	0.020	mg/L

MERCURY CVAA ACID DIGESTION EPA 245.1 REV. 3.0

Analyst: W. WATNESS Analysis Date: 31-JAN-08 17:00 Instrument: PREP Test: P131.2.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	40		mL
FINAL VOLUME	40		mL

MERCURY, MANUAL COLD VAPOR BY AAS EPA 245.5 NELAC:Y

Analyst: W. WATNESS Analysis Date: 01-FEB-08 06:17 Instrument: CVAA Test: M420.1.0

Prep: MERCURY CVAA ACID DIGESTION EPA 245.1 REV. 3.0 P131.2.0

Parameter	Result	Det. Limit	Units
MERCURY	BDL	0.00020	mg/L

HEXAVALENT CHROMIUM SM 3500-CR D 18TH ED NELAC:Y

Analyst: E. SOTKIEWICZ Analysis Date: 31-JAN-08 16:50 Test: M410.6.0

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797417 BOAT RAMP

Parameter	Result	Det. Limit	Units
HEXAVALENT CHROMIUM	BDL	0.01	mg/L

The concentration due to the color and turbidity of the original sample was subtracted out.

TOTAL SUSPENDED SOLIDS DRIED AT 103-105 DEGREES C SM 2540 D, 19TH ED. NELAC Y

Analyst: T PESTER Analysis Date: 31-JAN-08 17:45 Test: G403.8.0

Parameter	Result	Det. Limit	Units
SUSPENDED SOLIDS	17	1	mg/L

Sample Comments

BDL Below Detection Limit

Sample was received on ice at temperature 11.2 C.
Sample chain of custody number 52807.

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Heritage Environmental Services, LLC is accredited under Illinois NELAC accreditation number 100401.

Indiana SDWA Lab Accred. No. C-49-01

Scott A Bryan

Approved by: SCOTT BRYAN 04-FEB-08

HERITAGE

CERTIFICATE OF ANALYSIS

Service Location	Received	Project	Lab ID
HERITAGE ENVIRONMENTAL SERVICES, LLC COMMERCIAL LABORATORY OPERATIONS 7901 W. MORRIS ST. INDIANAPOLIS, IN 46231 (317)243-8304	30-JAN-08		A797265
	Completed	PO Number	
	04-FEB-08	WAIVER	
	Printed	Sampled	
	06-FEB-08	30-JAN-08 13:00	

Report To	Bill To
MARK MCFARLAND INDIANAPOLIS POWER & LIGHT 4040 BLUE BLUFF ROAD MARTINSVILLE, IN 46151	INDIANAPOLIS POWER & LIGHT 4040 BLUE BLUFF ROAD MARTINSVILLE, IN 46151

Sample Description

CLIENT ID: UPSTREAM SOLIDS
MATRIX TYPE: SLUDGE, SOIL, SOLID OR SEDIMENT
SUBMITTER CODE: 9364
PWS NAME: IPL EAGLE VALLEY STATION
PWS ADDRESS: 4040 BLUE BLUFF ROAD MARTINSVILLE IN

TOX CHAR LEACHING PROCEDURE (TCLP METALS ONLY) SW846-1311

Analyst: V PATEL Analysis Date: 31-JAN-08 Instrument: PREP Test: P1061.0

Parameter	Result	Det. Limit	Units
TOTAL SAMPLE WEIGHT	468.8		Grams
LIQUID FRACTION (GRAMS)	418.4		Grams
EXTRACTED SAMPLE	25.0		Grams
SOLIDS	11		Percent
9.5 MM SIEVE TEST	YES		Passed
INITIAL PH	9.0		Std. Units
ADJUSTED PH	6.2		Std. Units
BUFFER SOLUTION PH	2.91		Std. Units
FINAL PH	5.3		Std. Units
VOLUME BUFFERED SOLUTION	500		mL
VOLUME EXTRACT FILTERED	500		mL
VOLUME LIQUID (ADD BACK)	208		mL
TOTAL VOLUME FILTRATE	708		mL
AMBIENT TEMPERATURE	21.9		Degrees C
INITIAL TIME	18241.7		Hours
FINAL TIME	18259.3		Hours
PHASE 0 VOLUME (REP 0)	709		mL
PHASE 0 WEIGHT	NA		Grams
PHASE 0 DENSITY	NA		g/mL
PHASE 1 VOLUME (REP 1)	NA		mL
PHASE 1 WEIGHT	NA		Grams
PHASE 1 DENSITY	NA		g/mL

HERITAGE

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797265 UPSTREAM SOLIDS

FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A

Analyst: P. MATAKA Analysis Date: 01-FEB-08 10:00 Instrument: PREP Test: P130.8.0

Prep: TOX CHAR LEACHING PROCEDURE (TCLP METALS ONLY) SW846-1311 P106.1.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	50		mL
FINAL VOLUME	50		mL

MERCURY CVAA ACID DIGESTION (LEACHATE) SW846-7470A

Analyst: W. WATNESS Analysis Date: 01-FEB-08 08:00 Instrument: PREP Test: P131.9.0

Prep: TOX CHAR LEACHING PROCEDURE (TCLP METALS ONLY) SW846-1311 P106.1.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	40		mL
FINAL VOLUME	40		mL

TCLP ARSENIC ICP SW846-6010B NELAC Y

Analyst: J. KRAMER Analysis Date: 01-FEB-08 19:53 Instrument: ICP Test: M603.8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0

Parameter	Result	Det. Limit	Units
ARSENIC	BDL	0.050	mg/L

1:5 Dilution.

TCLP CADMIUM ICP SW846-6010B NELAC Y

Analyst: J. KRAMER Analysis Date: 01-FEB-08 19:53 Instrument: ICP Test: M608.8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0

Parameter	Result	Det. Limit	Units
CADMIUM	BDL	0.025	mg/L

1:5 Dilution.

TCLP CHROMIUM ICP SW846-6010B NELAC Y

Analyst: J. KRAMER Analysis Date: 01-FEB-08 19:53 Instrument: ICP Test: M610.8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0

Parameter	Result	Det. Limit	Units
CHROMIUM	BDL	0.050	mg/L

1:5 Dilution.

TCLP COPPER ICP SW846-6010B NELAC Y

Analyst: J. KRAMER Analysis Date: 01-FEB-08 19:53 Instrument: ICP Test: M612.8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0

Parameter	Result	Det. Limit	Units
COPPER	BDL	0.050	mg/L

1:5 Dilution.

HERITAGE

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797265 UPSTREAM SOLIDS

TCLP NICKEL ICP SW846-6010B NELAC:Y

Analyst: J. KRAMER Analysis Date: 01-FEB-08 19:53 Instrument: ICP Test: M622.8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0

Parameter	Result	Det. Limit	Units
NICKEL	0.054	0.025	mg/L

1:5 Dilution.

TCLP LEAD ICP SW846-6010B NELAC:Y

Analyst: J. KRAMER Analysis Date: 01-FEB-08 19:53 Instrument: ICP Test: M616.8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0

Parameter	Result	Det. Limit	Units
LEAD	BDL	0.050	mg/L

1:5 Dilution.

TCLP SELENIUM ICP SW846-6010B NELAC:Y

Analyst: J. KRAMER Analysis Date: 01-FEB-08 19:53 Instrument: ICP Test: M628.8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0

Parameter	Result	Det. Limit	Units
SELENIUM	BDL	0.050	mg/L

1:5 Dilution.

TCLP ZINC ICP SW846-6010B NELAC:Y

Analyst: J. KRAMER Analysis Date: 01-FEB-08 19:53 Instrument: ICP Test: M639.8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0

Parameter	Result	Det. Limit	Units
ZINC	0.47	0.10	mg/L

1:5 Dilution.

TCLP MERCURY CVAA SW846-7470A NELAC:Y

Analyst: W. WATNESS Analysis Date: 01-FEB-08 13:15 Instrument: CVAA Test: M620.4.0

Prep: MERCURY CVAA ACID DIGESTION (LEACHATE) SW846-7470A P131.9.0

Parameter	Result	Det. Limit	Units
MERCURY	BDL	0.0020	mg/L

TOXICITY CHARACTERISTIC LEACHING PROCEDURE (NEUTRAL LEACH) SW846-1311 MOD

Analyst: V. PATEL Analysis Date: 31-JAN-08 Instrument: PREP Test: P105.1.0

Parameter	Result	Det. Limit	Units
TOTAL SAMPLE WEIGHT	468.8		Grams
LIQUID FRACTION (GRAMS)	418.4		Grams
EXTRACTED SAMPLE	20.0		Grams
SOLIDS	11		Percent

9.5 MM SIEVE TEST	YES		Passed
INITIAL PH	8.8		Std. Units
ADJUSTED PH	NA		Std. Units
BUFFER SOLUTION PH	NA		Std. Units
FINAL PH	8.5		Std. Units
VOLUME BUFFERED SOLUTION	320		mL
VOLUME EXTRACT FILTERED	400		mL
VOLUME LIQUID (ADD BACK)	166		mL
TOTAL VOLUME FILTRATE	566		mL
AMBIENT TEMPERATURE	21.9		Degrees C
INITIAL TIME	2162.1		Hours
FINAL TIME	2186.1		Hours
PHASE 0 VOLUME (REP 0)	566		mL
PHASE 0 WEIGHT	NA		Grams
PHASE 0 DENSITY	NA		g/mL
PHASE 1 VOLUME (REP 1)	NA		mL
PHASE 1 WEIGHT	NA		Grams
PHASE 1 DENSITY	NA		g/mL

HEXAVALENT CHROMIUM SW846-7196A NELAC Y

Analyst: T. DRIGGERS Analysis Date: 01-FEB-08 16:00 Test: M110.6.0

Prep: TOXICITY CHARACTERISTIC LEACHING PROCEDURE (NEUTRAL LEACH) SW846-1311 MOD P105-1.0

Parameter	Result	Det. Limit	Units
HEXAVALENT CHROMIUM	BDL	0.01	mg/L

Sample Comments

BDL Below Detection Limit

NA Not Applicable

YES Yes

Sample was received on ice at temperature 5.6 C.
Sample chain of custody number 52803.

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Heritage Environmental Services, LLC is accredited under Illinois NELAC accreditation number 100401.

Indiana SDWA Lab Accred. No. C-49-01

Scott A Bryan

Approved by: SCOTT BRYAN 05-FEB-08

HERITAGE

CERTIFICATE OF ANALYSIS

Service Location	Received	Project	Lab ID
HERITAGE ENVIRONMENTAL SERVICES, LLC COMMERCIAL LABORATORY OPERATIONS 7901 W. MORRIS ST. INDIANAPOLIS, IN 46231 (317)243-8304	30-JAN-08		A797268
	Completed	PO Number	
	04-FEB-08	WAIVER	
	Printed	Sampled	
	06-FEB-08	30-JAN-08 15:50	

Report To	Bill To
MARK MCFARLAND INDIANAPOLIS POWER & LIGHT 4040 BLUE BLUFF ROAD MARTINSVILLE, IN 46151	INDIANAPOLIS POWER & LIGHT 4040 BLUE BLUFF ROAD MARTINSVILLE, IN 46151

Sample Description

CLIENT ID: E POND ASH SOLIDS
MATRIX TYPE: SLUDGE, SOIL, SOLID OR SEDIMENT
SUBMITTER CODE: 9364
PWS NAME: IPL EAGLE VALLEY STATION
PWS ADDRESS: 4040 BLUE BLUFF ROAD MARTINSVILLE IN

TOX CHAR LEACHING PROCEDURE (TCLP METALS ONLY) SW846-1311

Analyst: V. PATEL | Analysis Date: 31-JAN-08 | Instrument: PREP | Test: P106 1.0

Parameter	Result	Det. Limit	Units
TOTAL SAMPLE WEIGHT	654.0		Grams
LIQUID FRACTION (GRAMS)	173.8		Grams
EXTRACTED SAMPLE	50.0		Grams
SOLIDS	73		Percent
9.5 MM SIEVE TEST	YES		Passed
INITIAL PH	8.9		Std. Units
ADJUSTED PH	3.5		Std. Units
BUFFER SOLUTION PH	4.96		Std. Units
FINAL PH	5.4		Std. Units
VOLUME BUFFERED SOLUTION	1000		mL
VOLUME EXTRACT FILTERED	1000		mL
VOLUME LIQUID (ADD BACK)	18		mL
TOTAL VOLUME FILTRATE	1018		mL
AMBIENT TEMPERATURE	21.9		Degrees C
INITIAL TIME	18241.7		Hours
FINAL TIME	18259.3		Hours
PHASE 0 VOLUME (REP 0)	1018		mL
PHASE 0 WEIGHT	NA		Grams
PHASE 0 DENSITY	NA		g/mL
PHASE 1 VOLUME (REP 1)	NA		mL
PHASE 1 WEIGHT	NA		Grams
PHASE 1 DENSITY	NA		g/mL

HERITAGE

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797268 E POND ASH SOLIDS

FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A

Analyst: P. MATAKA | Analysis Date: 01-FEB-08 10:00 | Instrument: PREP | Test: P130.8.0

Prep: TOX CHAR LEACHING PROCEDURE (TCLP METALS ONLY) SW846-1311 P106.1.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	50		mL
FINAL VOLUME	50		mL

MERCURY CVAA ACID DIGESTION (LEACHATE) SW846-7470A

Analyst: W. WATNESS | Analysis Date: 01-FEB-08 08:00 | Instrument: PREP | Test: P131.9.0

Prep: TOX CHAR LEACHING PROCEDURE (TCLP METALS ONLY) SW846-1311 P106.1.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	40		mL
FINAL VOLUME	40		mL

TCLP ARSENIC ICP SW846-6010B NELAC Y

Analyst: J. KRAMER | Analysis Date: 01-FEB-08 20:09 | Instrument: ICP | Test: M603.8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0

Parameter	Result	Det. Limit	Units
ARSENIC	0.056	0.050	mg/L

1:5 Dilution.

TCLP CADMIUM ICP SW846-6010B NELAC Y

Analyst: J. KRAMER | Analysis Date: 01-FEB-08 20:09 | Instrument: ICP | Test: M608.8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0

Parameter	Result	Det. Limit	Units
CADMIUM	BDL	0.025	mg/L

1:5 Dilution.

TCLP CHROMIUM ICP SW846-6010B NELAC Y

Analyst: J. KRAMER | Analysis Date: 01-FEB-08 20:09 | Instrument: ICP | Test: M610.8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0

Parameter	Result	Det. Limit	Units
CHROMIUM	BDL	0.050	mg/L

1:5 Dilution.

TCLP COPPER ICP SW846-6010B NELAC Y

Analyst: J. KRAMER | Analysis Date: 01-FEB-08 20:09 | Instrument: ICP | Test: M612.8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0

Parameter	Result	Det. Limit	Units
COPPER	BDL	0.050	mg/L

1:5 Dilution.

HERITAGE

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797268 E POND ASH SOLIDS

TCLP NICKEL ICP SW846-6010B NELAC:Y

Analyst: J. KRAMER Analysis Date: 01-FEB-08 20:09 Instrument: ICP Test: M622.8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0

Parameter	Result	Det. Limit	Units
NICKEL	0.027	0.025	mg/L

1:5 Dilution.

TCLP LEAD ICP SW846-6010B NELAC:Y

Analyst: J. KRAMER Analysis Date: 01-FEB-08 20:09 Instrument: ICP Test: M616.8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0

Parameter	Result	Det. Limit	Units
LEAD	BDL	0.050	mg/L

1:5 Dilution.

TCLP SELENIUM ICP SW846-6010B NELAC:Y

Analyst: J. KRAMER Analysis Date: 01-FEB-08 20:28 Instrument: ICP Test: M628.8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0

Parameter	Result	Det. Limit	Units
SELENIUM	BDL	0.050	mg/L

TCLP ZINC ICP SW846-6010B NELAC:Y

Analyst: J. KRAMER Analysis Date: 01-FEB-08 20:09 Instrument: ICP Test: M639.8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0

Parameter	Result	Det. Limit	Units
ZINC	0.20	0.10	mg/L

1:5 Dilution.

TCLP MERCURY CVAA SW846-7470A NELAC:Y

Analyst: W. WATNESS Analysis Date: 01-FEB-08 13:15 Instrument: CVAA Test: M620.4.0

Prep: MERCURY CVAA ACID DIGESTION (LEACHATE) SW846-7470A P131.9.0

Parameter	Result	Det. Limit	Units
MERCURY	BDL	0.0020	mg/L

TOXICITY CHARACTERISTIC LEACHING PROCEDURE (NEUTRAL LEACH) SW846-1311 MOD

Analyst: V. PATEL Analysis Date: 31-JAN-08 Instrument: PREP Test: P105.1.0

Parameter	Result	Det. Limit	Units
TOTAL SAMPLE WEIGHT	654.0		Grams
LIQUID FRACTION (GRAMS)	173.8		Grams
EXTRACTED SAMPLE	50.0		Grams
SOLIDS	73		Percent
9.5 MM SIEVE TEST	YES		Passed
INITIAL PH	9.1		Std. Units

ADJUSTED PH	NA		Std. Units
BUFFER SOLUTION PH	NA		Std. Units
FINAL PH	8.7		Std. Units
VOLUME BUFFERED SOLUTION	800		mL
VOLUME EXTRACT FILTERED	1000		mL
VOLUME LIQUID (ADD BACK)	18		mL
TOTAL VOLUME FILTRATE	1018		mL
AMBIENT TEMPERATURE	21.9		Degrees C
INITIAL TIME	2162.1		Hours
FINAL TIME	2186.1		Hours
PHASE 0 VOLUME (REP 0)	1018		mL
PHASE 0 WEIGHT	NA		Grams
PHASE 0 DENSITY	NA		g/mL
PHASE 1 VOLUME (REP 1)	NA		mL
PHASE 1 WEIGHT	NA		Grams
PHASE 1 DENSITY	NA		g/mL

HEXAVALENT CHROMIUM SW846-7196A NELAC Y

Analyst: T. DRIGGERS Analysis Date: 01-FEB-08 16:00 Test: M110.6.0

Prep: TOXICITY CHARACTERISTIC LEACHING PROCEDURE (NEUTRAL LEACH) SW846-1311 MOD P105.1.0

Parameter	Result	Det. Limit	Units
HEXAVALENT CHROMIUM	BDL	0.01	mg/L

Sample Comments

BDL Below Detection Limit

NA Not Applicable

YES Yes

Sample was received on ice at temperature 5.6 C.
Sample chain of custody number 52803.

This Certificate shall not be reproduced, except in full, without the written approval of the lab.

The sample results relate only to the analytes of interest tested or to the sample as received by the lab.

Heritage Environmental Services, LLC certifies that the test results indicated as NELAC (National Environmental Laboratory Accreditation Conference) accredited (Yes for NELAC) meet all requirements of NELAC and Illinois EPA Part 186 unless otherwise explained or justified as to the the exact nature of the deviations.

Heritage Environmental Services, LLC is accredited under Illinois NELAC accreditation number 100401.

Indiana SDWA Lab Accred. No. C-49-01

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797268 E POND ASH SOLIDS

Scott A Bryan

Approved by: SCOTT BRYAN 05-FEB-08

HERITAGE

CERTIFICATE OF ANALYSIS

Service Location	Received	Project	Lab ID
HERITAGE ENVIRONMENTAL SERVICES, LLC COMMERCIAL LABORATORY OPERATIONS 7901 W. MORRIS ST. INDIANAPOLIS, IN 46231 (317)243-8304	30-JAN-08		A797267
	Completed	**PO Number**	
	04-FEB-08	WAIVER	
	Printed	**Sampled**	
	06-FEB-08	30-JAN-08 15:50	

Report To	Bill To
MARK MCFARLAND INDIANAPOLIS POWER & LIGHT 4040 BLUE BLUFF ROAD MARTINSVILLE, IN 46151	INDIANAPOLIS POWER & LIGHT 4040 BLUE BLUFF ROAD MARTINSVILLE, IN 46151

Sample Description

CLIENT ID: CANAL SOLIDS
MATRIX TYPE: SLUDGE, SOIL, SOLID OR SEDIMENT
SUBMITTER CODE: 9364
PWS NAME: IPL EAGLE VALLEY STATION
PWS ADDRESS: 4040 BLUE BLUFF ROAD MARTINSVILLE IN

TOX CHAR LEACHING PROCEDURE (TCLP METALS ONLY) SW846-1311

Analyst: V. PATEL | Analysis Date: 31-JAN-08 | Instrument: PREP | Test: P106-1.0

Parameter	Result	Det. Limit	Units
TOTAL SAMPLE WEIGHT	578.6		Grams
LIQUID FRACTION (GRAMS)	394.0		Grams
EXTRACTED SAMPLE	50.0		Grams
SOLIDS	32		Percent
9.5 MM SIEVE TEST	YES		Passed
INITIAL PH	9.1		Std. Units
ADJUSTED PH	4.1		Std. Units
BUFFER SOLUTION PH	4.96		Std. Units
FINAL PH	5.5		Std. Units
VOLUME BUFFERED SOLUTION	1000		mL
VOLUME EXTRACT FILTERED	1000		mL
VOLUME LIQUID (ADD BACK)	107		mL
TOTAL VOLUME FILTRATE	1107		mL
AMBIENT TEMPERATURE	21.9		Degrees C
INITIAL TIME	18241.7		Hours
FINAL TIME	18259.3		Hours
PHASE 0 VOLUME (REP 0)	1107		mL
PHASE 0 WEIGHT	NA		Grams
PHASE 0 DENSITY	NA		g/mL
PHASE 1 VOLUME (REP 1)	NA		mL
PHASE 1 WEIGHT	NA		Grams
PHASE 1 DENSITY	NA		g/mL

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797267 CANAL SOLIDS

FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A

Analyst: P. MATAKA | Analysis Date: 01-FEB-08 10:00 | Instrument: PREP | Test: P130.8.0

Prep: TOX CHAR LEACHING PROCEDURE (TCLP-METALS ONLY) SW846-1311 P106.1.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	50		mL
FINAL VOLUME	50		mL

MERCURY CVAA ACID DIGESTION (LEACHATE) SW846-7470A

Analyst: W. WATNESS | Analysis Date: 01-FEB-08 08:00 | Instrument: PREP | Test: P131.9.0

Prep: TOX CHAR LEACHING PROCEDURE (TCLP-METALS ONLY) SW846-1311 P106.1.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	40		mL
FINAL VOLUME	40		mL

TCLP ARSENIC ICP SW846-6010B

NELAC-Y

Analyst: J. KRAMER | Analysis Date: 01-FEB-08 20:06 | Instrument: ICP | Test: M603.8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0

Parameter	Result	Det. Limit	Units
ARSENIC	0.067	0.050	mg/L

1:5 Dilution.

TCLP CADMIUM ICP SW846-6010B

NELAC-Y

Analyst: J. KRAMER | Analysis Date: 01-FEB-08 20:06 | Instrument: ICP | Test: M608.8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0

Parameter	Result	Det. Limit	Units
CADMIUM	BDL	0.025	mg/L

1:5 Dilution.

TCLP CHROMIUM ICP SW846-6010B

NELAC-Y

Analyst: J. KRAMER | Analysis Date: 01-FEB-08 20:06 | Instrument: ICP | Test: M610.8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0

Parameter	Result	Det. Limit	Units
CHROMIUM	BDL	0.050	mg/L

1:5 Dilution.

TCLP COPPER ICP SW846-6010B

NELAC-Y

Analyst: J. KRAMER | Analysis Date: 01-FEB-08 20:06 | Instrument: ICP | Test: M612.8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0

Parameter	Result	Det. Limit	Units
COPPER	BDL	0.050	mg/L

1:5 Dilution.

HERITAGE

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797267 CANAL SOLIDS

TCLP NICKEL ICP SW846-6010B NELAC:Y

Analyst: J. KRAMER Analysis Date: 01-FEB-08 20:06 Instrument: ICP Test: M622.8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0

Parameter	Result	Det. Limit	Units
NICKEL	0.041	0.025	mg/L

1:5 Dilution.

TCLP LEAD ICP SW846-6010B NELAC:Y

Analyst: J. KRAMER Analysis Date: 01-FEB-08 20:06 Instrument: ICP Test: M616.8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0

Parameter	Result	Det. Limit	Units
LEAD	BDL	0.050	mg/L

1:5 Dilution.

TCLP SELENIUM ICP SW846-6010B NELAC:Y

Analyst: J. KRAMER Analysis Date: 01-FEB-08 20:06 Instrument: ICP Test: M628.8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0

Parameter	Result	Det. Limit	Units
SELENIUM	BDL	0.050	mg/L

1:5 Dilution.

TCLP ZINC ICP SW846-6010B NELAC:Y

Analyst: J. KRAMER Analysis Date: 01-FEB-08 20:06 Instrument: ICP Test: M639.8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0

Parameter	Result	Det. Limit	Units
ZINC	0.17	0.10	mg/L

1:5 Dilution.

TCLP MERCURY CVAA SW846-7470A NELAC:Y

Analyst: W. WATNESS Analysis Date: 01-FEB-08 13:15 Instrument: CVAA Test: M620.4.0

Prep: MERCURY CVAA ACID DIGESTION (LEACHATE) SW846-7470A P131.9.0

Parameter	Result	Det. Limit	Units
MERCURY	BDL	0.0020	mg/L

TOXICITY CHARACTERISTIC LEACHING PROCEDURE (NEUTRAL LEACH) SW846-1311 MOD

Analyst: V. PATEL Analysis Date: 31-JAN-08 Instrument: PREP Test: P105.1.0

Parameter	Result	Det. Limit	Units
TOTAL SAMPLE WEIGHT	578.6		Grams
LIQUID FRACTION (GRAMS)	394.0		Grams
EXTRACTED SAMPLE	50.0		Grams
SOLIDS	32		Percent

HERITAGE

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797267 CANAL SOLIDS

9.5 MM SIEVE TEST	YES		Passed
INITIAL PH	8.9		Std. Units
ADJUSTED PH	NA		Std. Units
BUFFER SOLUTION PH	NA		Std. Units
FINAL PH	8.7		Std. Units
VOLUME BUFFERED SOLUTION	800		mL
VOLUME EXTRACT FILTERED	1000		mL
VOLUME LIQUID (ADD BACK)	107		mL
TOTAL VOLUME FILTRATE	1107		mL
AMBIENT TEMPERATURE	21.9		Degrees C
INITIAL TIME	2162.1		Hours
FINAL TIME	2186.1		Hours
PHASE 0 VOLUME (REP 0)	1107		mL
PHASE 0 WEIGHT	NA		Grams
PHASE 0 DENSITY	NA		g/mL
PHASE 1 VOLUME (REP 1)	NA		mL
PHASE 1 WEIGHT	NA		Grams
PHASE 1 DENSITY	NA		g/mL

HEXAVALENT CHROMIUM SW846-7196A NELAC:Y

Analyst: T. DRIGGERS Analysis Date: 01-FEB-08 16:00 Test: M110.6.0

Prep: TOXICITY CHARACTERISTIC LEACHING PROCEDURE (NEUTRAL LEACH) SW846-1311 MOD P105.1.0

Parameter	Result	Det. Limit	Units
HEXAVALENT CHROMIUM	BDL	0.01	mg/L

Sample Comments

BDL Below Detection Limit

NA Not Applicable

YES Yes

Sample was received on ice at temperature 5.6 C.
Sample chain of custody number 52803.

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without the written approval of the lab.

The sample results relate only to the analytes of interest tested
or to the sample as received by the lab.

Heritage Environmental Services, LLC certifies that the test results
indicated as NELAC (National Environmental Laboratory Accreditation
Conference) accredited (Yes for NELAC) meet all requirements of NELAC and
Illinois EPA Part 186 unless otherwise explained or justified as to the
the exact nature of the deviations.

Heritage Environmental Services, LLC is accredited under Illinois NELAC
accreditation number 100401.

Indiana SDWA Lab Accred. No. C-49-01

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797267 CANAL SOLIDS

Scott A Bryan

Approved by: SCOTT BRYAN 05-FEB-08

HERITAGE

CERTIFICATE OF ANALYSIS

Service Location	Received	Project	Lab ID
HERITAGE ENVIRONMENTAL SERVICES, LLC COMMERCIAL LABORATORY OPERATIONS 7901 W. MORRIS ST. INDIANAPOLIS, IN 46231 (317)243-8304	30-JAN-08		A797266
	Completed	PO Number	
	04-FEB-08	WAIVER	
	Printed	Sampled	
	06-FEB-08	30-JAN-08 11:40	

Report To	Bill To
MARK MCFARLAND INDIANAPOLIS POWER & LIGHT 4040 BLUE BLUFF ROAD MARTINSVILLE, IN 46151	INDIANAPOLIS POWER & LIGHT 4040 BLUE BLUFF ROAD MARTINSVILLE, IN 46151

Sample Description

CLIENT ID: BOAT RAMP SOLIDS
MATRIX TYPE: SLUDGE, SOIL, SOLID OR SEDIMENT
SUBMITTER CODE: 9364
PWS NAME: IPL EAGLE VALLEY STATION
PWS ADDRESS: 4040 BLUE BLUFF ROAD MARTINSVILLE IN

TOX CHAR LEACHING PROCEDURE (TCLP METALS ONLY) SW846 1311

Analyst: V PATEL | Analysis Date: 31-JAN-08 | Instrument: PREP | Test: P106 1.0

Parameter	Result	Det. Limit	Units
TOTAL SAMPLE WEIGHT	687.6		Grams
LIQUID FRACTION (GRAMS)	287.3		Grams
EXTRACTED SAMPLE	50.0		Grams
SOLIDS	58		Percent
9.5 MM SIEVE TEST	YES		Passed
INITIAL PH	9.1		Std. Units
ADJUSTED PH	5.3		Std. Units
BUFFER SOLUTION PH	2.91		Std. Units
FINAL PH	4.9		Std. Units
VOLUME BUFFERED SOLUTION	1000		mL
VOLUME EXTRACT FILTERED	1000		mL
VOLUME LIQUID (ADD BACK)	36		mL
TOTAL VOLUME FILTRATE	1036		mL
AMBIENT TEMPERATURE	21.9		Degrees C
INITIAL TIME	18241.7		Hours
FINAL TIME	18259.3		Hours
PHASE 0 VOLUME (REP 0)	1036		mL
PHASE 0 WEIGHT	NA		Grams
PHASE 0 DENSITY	NA		g/mL
PHASE 1 VOLUME (REP 1)	NA		mL
PHASE 1 WEIGHT	NA		Grams
PHASE 1 DENSITY	NA		g/mL

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797266 BOAT RAMP SOLIDS

FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A

Analyst: P. MATAKA | Analysis Date: 01-FEB-08 10:00 | Instrument: PREP | Test: P130.8.0

Prep: TOX CHAR LEACHING PROCEDURE (TCLP METALS ONLY) SW846-1311 P106.1.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	50		mL
FINAL VOLUME	50		mL

MERCURY CVAA ACID DIGESTION (LEACHATE) SW846-7470A

Analyst: W. WATNESS | Analysis Date: 01-FEB-08 08:00 | Instrument: PREP | Test: P131.9.0

Prep: TOX CHAR LEACHING PROCEDURE (TCLP METALS ONLY) SW846-1311 P106.1.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	40		mL
FINAL VOLUME	40		mL

TCLP ARSENIC ICP SW846-6010B

NELAC Y

Analyst: J. KRAMER | Analysis Date: 01-FEB-08 20:02 | Instrument: ICP | Test: M603.8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0

Parameter	Result	Det. Limit	Units
ARSENIC	BDL	0.050	mg/L

1:5 Dilution.

TCLP CADMIUM ICP SW846-6010B

NELAC Y

Analyst: J. KRAMER | Analysis Date: 01-FEB-08 20:02 | Instrument: ICP | Test: M608.8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0

Parameter	Result	Det. Limit	Units
CADMIUM	BDL	0.025	mg/L

1:5 Dilution.

TCLP CHROMIUM ICP SW846-6010B

NELAC Y

Analyst: J. KRAMER | Analysis Date: 01-FEB-08 20:02 | Instrument: ICP | Test: M610.8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0

Parameter	Result	Det. Limit	Units
CHROMIUM	BDL	0.050	mg/L

1:5 Dilution.

TCLP COPPER ICP SW846-6010B

NELAC Y

Analyst: J. KRAMER | Analysis Date: 01-FEB-08 20:02 | Instrument: ICP | Test: M612.8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0

Parameter	Result	Det. Limit	Units
COPPER	BDL	0.050	mg/L

1:5 Dilution.

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797266 BOAT RAMP SOLIDS

TCLP NICKEL ICP SW846-6010B NELAC:Y

Analyst: J. KRAMER Analysis Date: 01-FEB-08 20:02 Instrument: ICP Test: M622 8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130 8.0

Parameter	Result	Det. Limit	Units
NICKEL	0.054	0.025	mg/L

1:5 Dilution.

TCLP LEAD ICP SW846-6010B NELAC:Y

Analyst: J. KRAMER Analysis Date: 01-FEB-08 20:02 Instrument: ICP Test: M616 8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130 8.0

Parameter	Result	Det. Limit	Units
LEAD	BDL	0.050	mg/L

1:5 Dilution.

TCLP SELENIUM ICP SW846-6010B NELAC:Y

Analyst: J. KRAMER Analysis Date: 01-FEB-08 20:02 Instrument: ICP Test: M628 8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130 8.0

Parameter	Result	Det. Limit	Units
SELENIUM	BDL	0.050	mg/L

1:5 Dilution.

TCLP ZINC ICP SW846-6010B NELAC:Y

Analyst: J. KRAMER Analysis Date: 01-FEB-08 20:02 Instrument: ICP Test: M639 8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130 8.0

Parameter	Result	Det. Limit	Units
ZINC	0.29	0.10	mg/L

1:5 Dilution.

TCLP MERCURY CVAA SW846-7470A NELAC:Y

Analyst: W. WATNESS Analysis Date: 01-FEB-08 13:15 Instrument: CVAA Test: M620 4.0

Prep: MERCURY CVAA ACID DIGESTION (LEACHATE) SW846-7470A P131 9.0

Parameter	Result	Det. Limit	Units
MERCURY	BDL	0.0020	mg/L

TOXICITY CHARACTERISTIC LEACHING PROCEDURE (NEUTRAL LEACH) SW846-1311 MOD

Analyst: V. PATEL Analysis Date: 31-JAN-08 Instrument: PREP Test: P105 1.0

Parameter	Result	Det. Limit	Units
TOTAL SAMPLE WEIGHT	687.6		Grams
LIQUID FRACTION (GRAMS)	287.3		Grams
EXTRACTED SAMPLE	50.0		Grams
SOLIDS	58		Percent

HERITAGE

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797266 BOAT RAMP SOLIDS

9.5 MM SIEVE TEST	YES		Passed
INITIAL PH	9.2		Std. Units
ADJUSTED PH	NA		Std. Units
BUFFER SOLUTION PH	NA		Std. Units
FINAL PH	8.9		Std. Units
VOLUME BUFFERED SOLUTION	800		mL
VOLUME EXTRACT FILTERED	1000		mL
VOLUME LIQUID (ADD BACK)	36		mL
TOTAL VOLUME FILTRATE	1036		mL
AMBIENT TEMPERATURE	21.9		Degrees C
INITIAL TIME	2162.1		Hours
FINAL TIME	2186.1		Hours
PHASE 0 VOLUME (REP 0)	566		mL
PHASE 0 WEIGHT	NA		Grams
PHASE 0 DENSITY	NA		g/mL
PHASE 1 VOLUME (REP 1)	NA		mL
PHASE 1 WEIGHT	NA		Grams
PHASE 1 DENSITY	NA		g/mL

HEXAVALENT CHROMIUM SW846-7196A NELAC Y

Analyst: T. DRIGGERS Analysis Date: 01-FEB-08 16:00 Test: M110.6.0

Prep: TOXICITY CHARACTERISTIC LEACHING PROCEDURE (NEUTRAL LEACH) SW846-1311 MOD P105.1.0

Parameter	Result	Det. Limit	Units
HEXAVALENT CHROMIUM	BDL	0.01	mg/L

Sample Comments

BDL Below Detection Limit

NA Not Applicable

YES Yes

Sample was received on ice at temperature 5.6 C.
Sample chain of custody number 52803.

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Heritage Environmental Services, LLC is accredited under Illinois NELAC accreditation number 100401.

Indiana SDWA Lab Accred. No. C-49-01

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797266 BOAT RAMP SOLIDS

Scott A Bryan

Approved by: SCOTT BRYAN 05-FEB-08

HERITAGE

CERTIFICATE OF ANALYSIS

Service Location	Received	Project	Lab ID
HERITAGE ENVIRONMENTAL SERVICES, LLC COMMERCIAL LABORATORY OPERATIONS 7901 W. MORRIS ST. INDIANAPOLIS, IN 46231 (317)243-8304	31-JAN-08		A797424
	Completed	PO Number	
	04-FEB-08	WAIVER	
	Printed	Sampled	
	06-FEB-08	31-JAN-08 11:30	

Report To	Bill To
MARK MCFARLAND INDIANAPOLIS POWER & LIGHT 4040 BLUE BLUFF ROAD MARTINSVILLE, IN 46151	INDIANAPOLIS POWER & LIGHT 4040 BLUE BLUFF ROAD MARTINSVILLE, IN 46151

Sample Description

CLIENT ID: CANAL NPDES SOLIDS
MATRIX TYPE: SLUDGE, SOIL, SOLID OR SEDIMENT
SUBMITTER CODE: 9364
PWS NAME: IPL EAGLE VALLEY STATION
PWS ADDRESS: 4040 BLUE BLUFF ROAD MARTINSVILLE IN

TOX CHAR LEACHING PROCEDURE (TCLP METALS ONLY) SW846 1311

Analyst: V. PATEL | Analysis Date: 01-FEB-08 | Instrument: PREP | Test: P106 1.0

Parameter	Result	Det. Limit	Units
TOTAL SAMPLE WEIGHT	705.6		Grams
LIQUID FRACTION (GRAMS)	663.0		Grams
EXTRACTED SAMPLE	20.0		Grams
SOLIDS	6		Percent
9.5 MM SIEVE TEST	YES		Passed
INITIAL PH	9.3		Std. Units
ADJUSTED PH	4.4		Std. Units
BUFFER SOLUTION PH	4.96		Std. Units
FINAL PH	6.0		Std. Units
VOLUME BUFFERED SOLUTION	400		mL
VOLUME EXTRACT FILTERED	400		mL
VOLUME LIQUID (ADD BACK)	311		mL
TOTAL VOLUME FILTRATE	711		mL
AMBIENT TEMPERATURE	22.5		Degrees C
INITIAL TIME	2186.1		Hours
FINAL TIME	2203.4		Hours
PHASE 0 VOLUME (REP 0)	711		mL
PHASE 0 WEIGHT	NA		Grams
PHASE 0 DENSITY	NA		g/mL
PHASE 1 VOLUME (REP 1)	NA		mL
PHASE 1 WEIGHT	NA		Grams
PHASE 1 DENSITY	NA		g/mL

HERITAGE

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797424 CANAL NPDES SOLIDS

FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A

Analyst: J. KRAMER Analysis Date: 02-FEB-08 22:30 Instrument: PREP Test: P130.8.0

Prep: TOX CHAR LEACHING PROCEDURE (TCLP METALS ONLY) SW846-1311 P106.1.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	50		mL
FINAL VOLUME	50		mL

MERCURY CVAA ACID DIGESTION (LEACHATE) SW846-7470A

Analyst: W. WATNESS Analysis Date: 02-FEB-08 09:00 Instrument: PREP Test: P131.9.0

Prep: TOX CHAR LEACHING PROCEDURE (TCLP METALS ONLY) SW846-1311 P106.1.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	4		mL
FINAL VOLUME	40		mL

TCLP ARSENIC ICP SW846-6010B NELAC Y

Analyst: J. KRAMER Analysis Date: 03-FEB-08 03:25 Instrument: ICP Test: M603.8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0

Parameter	Result	Det. Limit	Units
ARSENIC	BDL	0.050	mg/L

1:5 Dilution.

TCLP CADMIUM ICP SW846-6010B NELAC Y

Analyst: J. KRAMER Analysis Date: 03-FEB-08 03:25 Instrument: ICP Test: M608.8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0

Parameter	Result	Det. Limit	Units
CADMIUM	BDL	0.025	mg/L

1:5 Dilution.

TCLP CHROMIUM ICP SW846-6010B NELAC Y

Analyst: J. KRAMER Analysis Date: 03-FEB-08 03:25 Instrument: ICP Test: M610.8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0

Parameter	Result	Det. Limit	Units
CHROMIUM	BDL	0.050	mg/L

1:5 Dilution.

TCLP COPPER ICP SW846-6010B NELAC Y

Analyst: J. KRAMER Analysis Date: 03-FEB-08 03:25 Instrument: ICP Test: M612.8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0

Parameter	Result	Det. Limit	Units
COPPER	BDL	0.050	mg/L

1:5 Dilution.

HERITAGE

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797424 CANAL NPDES SOLIDS

TCLP NICKEL ICP SW846-6010B NELAC Y

Analyst: J. KRAMER Analysis Date: 03-FEB-08 03:25 Instrument: ICP Test: M622.8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0

Parameter	Result	Det. Limit	Units
NICKEL	BDL	0.025	mg/L

1:5 Dilution.

TCLP LEAD ICP SW846-6010B NELAC Y

Analyst: J. KRAMER Analysis Date: 03-FEB-08 03:25 Instrument: ICP Test: M616.8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0

Parameter	Result	Det. Limit	Units
LEAD	BDL	0.050	mg/L

1:5 Dilution.

TCLP SELENIUM ICP SW846-6010B NELAC Y

Analyst: J. KRAMER Analysis Date: 03-FEB-08 03:25 Instrument: ICP Test: M628.8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0

Parameter	Result	Det. Limit	Units
SELENIUM	BDL	0.050	mg/L

1:5 Dilution.

TCLP ZINC ICP SW846-6010B NELAC Y

Analyst: J. KRAMER Analysis Date: 03-FEB-08 03:25 Instrument: ICP Test: M639.8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0

Parameter	Result	Det. Limit	Units
ZINC	0.11	0.10	mg/L

1:5 Dilution.

TCLP MERCURY CVAA SW846-7470A NELAC Y

Analyst: W. WATNESS Analysis Date: 02-FEB-08 13:12 Instrument: CVAA Test: M620.4.0

Prep: MERCURY CVAA ACID DIGESTION (LEACHATE) SW846-7470A P131.9.0

Parameter	Result	Det. Limit	Units
MERCURY	BDL	0.0020	mg/L

TOXICITY CHARACTERISTIC LEACHING PROCEDURE (NEUTRAL LEACH) SW846-1311 MOD

Analyst: V. PATEL Analysis Date: 01-FEB-08 Instrument: PREP Test: P105.1.0

Parameter	Result	Det. Limit	Units
TOTAL SAMPLE WEIGHT	705.6		Grams
LIQUID FRACTION (GRAMS)	66.3		Grams
EXTRACTED SAMPLE	16.0		Grams
SOLIDS	6		Percent

9.5 MM SIEVE TEST	YES		Passed
INITIAL PH	9.6		Std. Units
ADJUSTED PH	NA		Std. Units
BUFFER SOLUTION PH	NA		Std. Units
FINAL PH	8.7		Std. Units
VOLUME BUFFERED SOLUTION	320		mL
VOLUME EXTRACT FILTERED	400		mL
VOLUME LIQUID (ADD BACK)	249		mL
TOTAL VOLUME FILTRATE	649		mL
AMBIENT TEMPERATURE	22.5		Degrees C
INITIAL TIME	474.3		Hours
FINAL TIME	498.8		Hours
PHASE 0 VOLUME (REP 0)	649		mL
PHASE 0 WEIGHT	NA		Grams
PHASE 0 DENSITY	NA		g/mL
PHASE 1 VOLUME (REP 1)	NA		mL
PHASE 1 WEIGHT	NA		Grams
PHASE 1 DENSITY	NA		g/mL

HEXAVALENT CHROMIUM SW846-7196A NELAC:Y

Analyst: T. DRIGGERS Analysis Date: 02-FEB-08 14:30 Test: M110 6.0

Prep: TOXICITY CHARACTERISTIC LEACHING PROCEDURE (NEUTRAL LEACH) SW846-1311 MOD P105 1.0

Parameter	Result	Det. Limit	Units
HEXAVALENT CHROMIUM	BDL	0.01	mg/L

The concentration due to the color and turbidity of the original sample

was subtracted out.

No Pink Color.

Sample Comments

BDL Below Detection Limit

NA Not Applicable

YES Yes

Sample was received on ice at temperature 11.2 C.
Sample chain of custody number 52806.

This Certificate shall not be reproduced, except in full,

without the written approval of the lab.

The sample results relate only to the analytes of interest tested

or to the sample as received by the lab.

Heritage Environmental Services, LLC certifies that the test results

indicated as NELAC (National Environmental Laboratory Accreditation

Conference) accredited (Yes for NELAC) meet all requirements of NELAC and

Illinois EPA Part 186 unless otherwise explained or justified as to the

Sample Comments

the exact nature of the deviations.

Heritage Environmental Services, LLC is accredited under Illinois NELAC accreditation number 100401.

Indiana SDWA Lab Accred. No. C-49-01

Scott A Bryan

Approved by: SCOTT BRYAN 05-FEB-08

HERITAGE

CERTIFICATE OF ANALYSIS

Service Location	Received	Project	Lab ID
HERITAGE ENVIRONMENTAL SERVICES, LLC COMMERCIAL LABORATORY OPERATIONS 7901 W. MORRIS ST. INDIANAPOLIS, IN 46231 (317)243-8304	31-JAN-08		A797423
	Completed	PO Number	
	04-FEB-08	WAIVER	
	Printed	Sampled	
	06-FEB-08	31-JAN-08 11:30	

Report To	Bill To
MARK MCFARLAND INDIANAPOLIS POWER & LIGHT 4040 BLUE BLUFF ROAD MARTINSVILLE, IN 46151	INDIANAPOLIS POWER & LIGHT 4040 BLUE BLUFF ROAD MARTINSVILLE, IN 46151

Sample Description

CLIENT ID: BOAT RAMP SOLIDS
MATRIX TYPE: SLUDGE, SOIL, SOLID OR SEDIMENT
SUBMITTER CODE: 9364
PWS NAME: IPL EAGLE VALLEY STATION
PWS ADDRESS: 4040 BLUE BLUFF ROAD MARTINSVILLE IN

TOX CHAR LEACHING PROCEDURE (TCLP METALS ONLY) SW846-1311

Analyst: V. PATEL — Analysis Date: 01-FEB-08 — Instrument: PREP — Test: P106.1.0

Parameter	Result	Det. Limit	Units
TOTAL SAMPLE WEIGHT	470.6		Grams
LIQUID FRACTION (GRAMS)	125.6		Grams
EXTRACTED SAMPLE	50.0		Grams
SOLIDS	73		Percent
9.5 MM SIEVE TEST	YES		Passed
INITIAL PH	9.9		Std. Units
ADJUSTED PH	5.3		Std. Units
BUFFER SOLUTION PH	2.91		Std. Units
FINAL PH	5.0		Std. Units
VOLUME BUFFERED SOLUTION	1000		mL
VOLUME EXTRACT FILTERED	1000		mL
VOLUME LIQUID (ADD BACK)	18		mL
TOTAL VOLUME FILTRATE	1018		mL
AMBIENT TEMPERATURE	22.5		Degrees C
INITIAL TIME	2186.1		Hours
FINAL TIME	2203.4		Hours
PHASE 0 VOLUME (REP 0)	1018		mL
PHASE 0 WEIGHT	NA		Grams
PHASE 0 DENSITY	NA		g/mL
PHASE 1 VOLUME (REP 1)	NA		mL
PHASE 1 WEIGHT	NA		Grams
PHASE 1 DENSITY	NA		g/mL

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797423 BOAT RAMP SOLIDS

FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A

Analyst: J. KRAMER | Analysis Date: 02-FEB-08 | Instrument: PREP | Test: P130.8.0

Prep: TOX CHAR LEACHING PROCEDURE (TCLP METALS ONLY) SW846-1311 P106.1.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	50		mL
FINAL VOLUME	50		mL

MERCURY CVAA ACID DIGESTION (LEACHATE) SW846-7470A

Analyst: W. WATNESS | Analysis Date: 02-FEB-08 09:00 | Instrument: PREP | Test: P131.9.0

Prep: TOX CHAR LEACHING PROCEDURE (TCLP METALS ONLY) SW846-1311 P106.1.0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	4		mL
FINAL VOLUME	40		mL

TCLP ARSENIC ICP SW846-6010B

NELAC Y

Analyst: J. KRAMER | Analysis Date: 03-FEB-08 03:15 | Instrument: ICP | Test: M603.8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0

Parameter	Result	Det. Limit	Units
ARSENIC	BDL	0.050	mg/L

1:5 Dilution.

TCLP CADMIUM ICP SW846-6010B

NELAC Y

Analyst: J. KRAMER | Analysis Date: 03-FEB-08 03:15 | Instrument: ICP | Test: M608.8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0

Parameter	Result	Det. Limit	Units
CADMIUM	BDL	0.025	mg/L

1:5 Dilution.

TCLP CHROMIUM ICP SW846-6010B

NELAC Y

Analyst: J. KRAMER | Analysis Date: 03-FEB-08 03:15 | Instrument: ICP | Test: M610.8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0

Parameter	Result	Det. Limit	Units
CHROMIUM	BDL	0.050	mg/L

1:5 Dilution.

TCLP COPPER ICP SW846-6010B

NELAC Y

Analyst: J. KRAMER | Analysis Date: 03-FEB-08 03:15 | Instrument: ICP | Test: M612.8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130.8.0

Parameter	Result	Det. Limit	Units
COPPER	BDL	0.050	mg/L

1:5 Dilution.

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797423 BOAT RAMP SOLIDS

TCLP NICKEL ICP SW846-6010B NELAC:Y

Analyst: J. KRAMER Analysis Date: 03-FEB-08 03:15 Instrument: ICP Test: M622 8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130 8.0

Parameter	Result	Det. Limit	Units
NICKEL	0.026	0.025	mg/L

1:5 Dilution.

TCLP LEAD ICP SW846-6010B NELAC:Y

Analyst: J. KRAMER Analysis Date: 03-FEB-08 03:15 Instrument: ICP Test: M616 8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130 8.0

Parameter	Result	Det. Limit	Units
LEAD	BDL	0.050	mg/L

1:5 Dilution.

TCLP SELENIUM ICP SW846-6010B NELAC:Y

Analyst: J. KRAMER Analysis Date: 03-FEB-08 03:15 Instrument: ICP Test: M628 8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130 8.0

Parameter	Result	Det. Limit	Units
SELENIUM	BDL	0.050	mg/L

1:5 Dilution.

TCLP ZINC ICP SW846-6010B NELAC:Y

Analyst: J. KRAMER Analysis Date: 03-FEB-08 03:15 Instrument: ICP Test: M639 8.0

Prep: FAA OR ICP ACID DIGESTION (LEACHATE) SW846-3010A P130 8.0

Parameter	Result	Det. Limit	Units
ZINC	0.18	0.10	mg/L

1:5 Dilution.

TCLP MERCURY CVAA SW846-7470A NELAC:Y

Analyst: W. WATNESS Analysis Date: 02-FEB-08 13:12 Instrument: CVAA Test: M620 4.0

Prep: MERCURY CVAA ACID DIGESTION (LEACHATE) SW846-7470A P131 9.0

Parameter	Result	Det. Limit	Units
MERCURY	BDL	0.0020	mg/L

TOXICITY CHARACTERISTIC LEACHING PROCEDURE (NEUTRAL LEACH) SW846-1311 MOD

Analyst: V. PATEL Analysis Date: 01-FEB-08 Instrument: PREP Test: P105 1.0

Parameter	Result	Det. Limit	Units
TOTAL SAMPLE WEIGHT	470.6		Grams
LIQUID FRACTION (GRAMS)	125.6		Grams
EXTRACTED SAMPLE	50.0		Grams
SOLIDS	73		Percent

HERITAGE ENVIRONMENTAL SERVICES, LLC

Sample ID: A797423 BOAT RAMP SOLIDS

9.5 MM SIEVE TEST	YES		Passed
INITIAL PH	9.2		Std. Units
ADJUSTED PH	NA		Std. Units
BUFFER SOLUTION PH	NA		Std. Units
FINAL PH	9.4		Std. Units
VOLUME BUFFERED SOLUTION	800		mL
VOLUME EXTRACT FILTERED	1000		mL
VOLUME LIQUID (ADD BACK)	18		mL
TOTAL VOLUME FILTRATE	1018		mL
AMBIENT TEMPERATURE	22.5		Degrees C
INITIAL TIME	474.8		Hours
FINAL TIME	498.8		Hours
PHASE 0 VOLUME (REP 0)	1018		mL
PHASE 0 WEIGHT	NA		Grams
PHASE 0 DENSITY	NA		g/mL
PHASE 1 VOLUME (REP 1)	NA		mL
PHASE 1 WEIGHT	NA		Grams
PHASE 1 DENSITY	NA		g/mL

HEXAVALENT CHROMIUM SW846-7196A NELAC Y

Analyst: T. DRIGGERS Analysis Date: 02-FEB-08 14:30 Test: M110:6:0

Prep: TOXICITY CHARACTERISTIC LEACHING PROCEDURE (NEUTRAL LEACH) SW846-1311 MOD P105:1.0

Parameter	Result	Det. Limit	Units
HEXAVALENT CHROMIUM	BDL	0.01	mg/L

Sample Comments

BDL Below Detection Limit

NA Not Applicable

YES Yes

Sample was received on ice at temperature 11.2 C.
Sample chain of custody number 52806.

This Certificate shall not be reproduced, except in full,
without the written approval of the lab.

The sample results relate only to the analytes of interest tested
or to the sample as received by the lab.

Heritage Environmental Services, LLC certifies that the test results
indicated as NELAC (National Environmental Laboratory Accreditation
Conference) accredited (Yes for NELAC) meet all requirements of NELAC and
Illinois EPA Part 186 unless otherwise explained or justified as to the
the exact nature of the deviations.

Heritage Environmental Services, LLC is accredited under Illinois NELAC
accreditation number 100401.

Indiana SDWA Lab Accred. No. C-49-01

Scott A Bryan

Approved by: SCOTT BRYAN 05-FEB-08

O&G---------- GR
TSS---------- 24 HR
pH---------- GR

INDIANAPOLIS POWER & LIGHT CO.
H.T. PRITCHARD GENERATING STATION
NPDES-WASTEWATER MONITORING

SAMPLE NO. HTP163-013008-1
FLOW (MGD):

pH - STANDARD METHODS 18th EDITION PAGE 4-65, METHOD 4500-H+ - LIMIT 6.0 - 9.0
TOTAL SUSPENDED SOLIDS - STANDARD METHODS 18th EDITION PAGE 2-56, METHOD 2540 D - LIMIT 30 AVG, 100 MAX
OIL LAND GREASE - STANDARD METHODS 18th EDITION PAGE 5-24, METHOD 5520 B - LIMIT 15 AVG, 20 MAX

** OIL AND GREASE **

SAMPLE DATE & TIME
SAMPLE VOL (ml)
SAMPLED BY
RECVD BY
DLVRD TO LAB BY
RECVD IN LAB BY
RECVD DATE & TIME
PRESERVATION
ANALYSIS DATE
ANALYSIS TIME
ANALYSIS VOL (ml)
ANALYZED BY

** SAMPLE **

FINAL CRUCIBLE WT (g)
EMPTY CRUCIBLE WT
WEIGHT DIFFERENCE
SAMPLE WT MINUS BLANK
WT DIFFERENCE
FINAL RESULT

** DUPLICATE (1/MON) **

FINAL CRUCIBLE WT
EMPTY CRUCIBLE WT
SAMPLE WT MINUS BLANK
WT DIFFERENCE
FINAL RESULT

** BLANK **

FINAL CRUCIBLE WT (g)
EMPTY CRUCIBLE WT
WEIGHT DIFFERENCE

FINAL O&G(mg/l)IS CALCULATED AS:

(SAMPLE WT DIFF-BLANK WT DIFF) X 1,000,000
ml OF SAMPLE

IS 02/24/95

** TSS **

SAMPLE DATE & TIME
SAMPLE VOL (ml)
SAMPLED BY
RECVD BY
DLVRD TO LAB BY
RECVD IN LAB BY
RECVD DATE & TIME
PRESERVATION
ANALYSIS DATE
ANALYSIS TIME
ANALYSIS VOL (ml)
ANALYZED BY

** SAMPLE **

FINAL CRUCIBLE WT (g)
EMPTY CRUCIBLE WT
WEIGHT DIFFERENCE
FINAL RESULT (mg/l)

** DUPLICATE (2/MO) **

FINAL CRUCIBLE WT (g)
EMPTY CRUCIBLE WT
WEIGHT DIFFENENCE
FINAL RESULT (mg/l)

FINAL TSS(mg/l)IS CALCULATED AS:

WEIGHT DIFFERENCE X 1,000,000
ml OF SAMPLE

** pH **

SAMPLE DATE & TIME 1-30-08 7:50am
SAMPLE VOL (ml) 1000
SAMPLED BY C. McCammack
RECVD BY C. McCammack
DLVRD TO LAB BY C. McCammack
RECVD IN LAB BY C. McCammack
RECVD DATE & TIME 1-30-08 8:20am
PRESERVATION None
ANALYSIS DATE 1-30-08
ANALYSIS TIME 8:20 am
ANALYSIS VOL (ml) 200
ANALYZED BY C. McCammack

** SAMPLE **

pH (S.U.) 8.05
TEMPERATURE (deg C) 15

** DUPLICATE (1/MO) **

pH (S.U.) 8.05
TEMPERATURE (deg C) 15

COMMENTS: pH
Also sampled at
Cric. 8.05
Boat Ramp 8.13

O & G------ GR
TSS---------- 24 HR
pH---------- GR

INDIANAPOLIS POWER & LIGHT CO.
H.T. PRITCHARD GENERATING STATION
NPDES-WASTEWATER MONITORING

SAMPLE NO. HTP 103-013008-
FLOW (MGD):

pH - STANDARD METHODS 18th EDITION PAGE 4-65, METHOD 4500-H+ - LIMIT 6.0 - 9.0
TOTAL SUSPENDED SOLIDS - STANDARD METHODS 18th EDITION PAGE 2-56, METHOD 2540 D - LIMIT 30 AVG, 100 MAX
OIL LAND GREASE - STANDARD METHODS 18th EDITION PAGE 5-24, METHOD 5520 B - LIMIT 15 AVG, 20 MAX

** OIL AND GREASE **

SAMPLE DATE & TIME
SAMPLE VOL (ml)
SAMPLED BY
RECVD BY
DLVRD TO LAB BY
RECVD IN LAB BY
RECVD DATE & TIME
PRESERVATION
ANALYSIS DATE
ANALYSIS TIME
ANALYSIS VOL (ml)
ANALYZED BY

** SAMPLE **

FINAL CRUCIBLE WT (g)
EMPTY CRUCIBLE WT
WEIGHT DIFFERENCE
SAMPLE WT MINUS BLANK
WT DIFFERENCE
FINAL RESULT

** DUPLICATE (1/MON) **

FINAL CRUCIBLE WT
EMPTY CRUCIBLE WT
SAMPLE WT MINUS BLANK
WT DIFFERENCE
FINAL RESULT

** BLANK **

FINAL CRUCIBLE WT (g)
EMPTY CRUCIBLE WT
WEIGHT DIFFERENCE

FINAL O&G(mg/l)IS CALCULATED AS:

(SAMPLE WT DIFF-BLANK WT DIFF) X 1,000,000
ml OF SAMPLE

EJS 02/24/95

** TSS **

SAMPLE DATE & TIME
SAMPLE VOL (ml)
SAMPLED BY
RECVD BY
DLVRD TO LAB BY
RECVD IN LAB BY
RECVD DATE & TIME
PRESERVATION
ANALYSIS DATE
ANALYSIS TIME
ANALYSIS VOL (ml)
ANALYZED BY

** SAMPLE **

FINAL CRUCIBLE WT (g)
EMPTY CRUCIBLE WT
WEIGHT DIFFERENCE
FINAL RESULT (mg/l)

** DUPLICATE (2/MO) **

FINAL CRUCIBLE WT (g)
EMPTY CRUCIBLE WT
WEIGHT DIFFENENCE
FINAL RESULT (mg/l)

FINAL TSS(mg/l)IS CALCULATED AS:

WEIGHT DIFFERENCE X 1,000,000
ml OF SAMPLE

** pH **

SAMPLE DATE & TIME 1/30/08 11 AM
SAMPLE VOL (ml) 1000
SAMPLED BY MRA
RECVD BY MRA
DLVRD TO LAB BY MRA
RECVD IN LAB BY MRA
RECVD DATE & TIME 1/30/08 12 PM
PRESERVATION —
ANALYSIS DATE 1/30/08
ANALYSIS TIME 1235/P
ANALYSIS VOL (ml) 200
ANALYZED BY MRA

** SAMPLE **

pH (S.U.) 8.04
TEMPERATURE (deg C) 18.5

** DUPLICATE (1/MO) **

pH (S.U.) MRA
TEMPERATURE (deg C)

COMMENTS: PH TEMP
BIOT RBAP 7.94 11.5
CIRC 8.06 6.9

CHAIN OF CUSTODY FORM - 1

O & G---------- GR
TSS---------- 24 HR
pH---------- GR

INDIANAPOLIS POWER & LIGHT CO.
H.T. PRITCHARD GENERATING STATION
NPDES-WASTEWATER MONITORING

SAMPLE NO. HTP103-013108-3
FLOW (MGD): _____

pH - STANDARD METHODS 18th EDITION PAGE 4-65, METHOD 4500-H+ - LIMIT 6.0 - 9.0
TOTAL SUSPENDED SOLIDS - STANDARD METHODS 18th EDITION PAGE 2-56, METHOD 2540 D - LIMIT 30 AVG, 100 MAX
OIL LAND GREASE - STANDARD METHODS 18th EDITION PAGE 5-24, METHOD 5520 B - LIMIT 15 AVG, 20 MAX

** OIL AND GREASE **

SAMPLE DATE & TIME _____ _____
SAMPLE VOL (ml) _____
SAMPLED BY _____
RECVD BY _____
DLVRD TO LAB BY _____
RECVD IN LAB BY _____
RECVD DATE & TIME _____ _____
PRESERVATION _____
ANALYSIS DATE _____
ANALYSIS TIME _____
ANALYSIS VOL (ml) _____
ANALYZED BY _____

** SAMPLE **

FINAL CRUCIBLE WT (g) _____
EMPTY CRUCIBLE WT _____
WEIGHT DIFFERENCE _____
SAMPLE WT MINUS BLANK _____
WT DIFFERENCE _____
FINAL RESULT _____

** DUPLICATE (1/MON) **

FINAL CRUCIBLE WT _____
EMPTY CRUCIBLE WT _____
SAMPLE WT MINUS BLANK _____
WT DIFFERENCE _____
FINAL RESULT _____

** BLANK **

FINAL CRUCIBLE WT (g) _____
EMPTY CRUCIBLE WT _____
WEIGHT DIFFERENCE _____

FINAL O&G(mg/l)IS CALCULATED AS:

(SAMPLE WT DIFF-BLANK WT DIFF) X 1,000,000
ml OF SAMPLE

EJS 02/24/95

** TSS **

SAMPLE DATE & TIME _____ _____
SAMPLE VOL (ml) _____
SAMPLED BY _____
RECVD BY _____
DLVRD TO LAB BY _____
RECVD IN LAB BY _____
RECVD DATE & TIME _____ _____
PRESERVATION _____
ANALYSIS DATE _____
ANALYSIS TIME _____
ANALYSIS VOL (ml) _____
ANALYZED BY _____

** SAMPLE **

FINAL CRUCIBLE WT (g) _____
EMPTY CRUCIBLE WT _____
WEIGHT DIFFERENCE _____
FINAL RESULT (mg/l) _____

** DUPLICATE (2/MO) **

FINAL CRUCIBLE WT (g) _____
EMPTY CRUCIBLE WT _____
WEIGHT DIFFENENCE _____
FINAL RESULT (mg/l) _____

FINAL TSS(mg/l)IS CALCULATED AS:

WEIGHT DIFFERENCE X 1,000,000
ml OF SAMPLE

** pH **

SAMPLE DATE & TIME 1-30-08 3:50 pm
SAMPLE VOL (ml) 1000
SAMPLED BY MRM
RECVD BY MRM
DLVRD TO LAB BY MRM
RECVD IN LAB BY C. McCammack
RECVD DATE & TIME 1-30-08 4:10 pm
PRESERVATION None
ANALYSIS DATE 1-30-08
ANALYSIS TIME 4:10 pm
ANALYSIS VOL (ml) 200
ANALYZED BY C. McCammack

** SAMPLE **

pH (S.U.) 8.05
TEMPERATURE (deg C) 15.7

** DUPLICATE (1/MO) **

pH (S.U.) _____
TEMPERATURE (deg C) _____

COMMENTS: pH
also sampled at
Circ. 8.13
Bat room 8.10

CHAIN OF CUSTODY FORM - 1

O & G---------- GR
TSS---------- 24 HR
pH---------- GR

INDIANAPOLIS POWER & LIGHT CO.
H.T. PRITCHARD GENERATING STATION
NPDES-WASTEWATER MONITORING

SAMPLE NO. HTP103 -013108-1
FLOW (MGD): _____

pH - STANDARD METHODS 18th EDITION PAGE 4-65, METHOD 4500-H+ - LIMIT 6.0 - 9.0
TOTAL SUSPENDED SOLIDS - STANDARD METHODS 18th EDITION PAGE 2-56, METHOD 2540 D - LIMIT 30 AVG, 100 MAX
OIL LAND GREASE - STANDARD METHODS 18th EDITION PAGE 5-24, METHOD 5520 B - LIMIT 15 AVG, 20 MAX

** OIL AND GREASE **

SAMPLE DATE & TIME _____ _____
SAMPLE VOL (ml) _____
SAMPLED BY _____
RECVD BY _____
DLVRD TO LAB BY _____
RECVD IN LAB BY _____
RECVD DATE & TIME _____ _____
PRESERVATION _____
ANALYSIS DATE _____
ANALYSIS TIME _____
ANALYSIS VOL (ml) _____
ANALYZED BY _____

** SAMPLE **

FINAL CRUCIBLE WT (g) _____
EMPTY CRUCIBLE WT _____
WEIGHT DIFFERENCE _____
SAMPLE WT MINUS BLANK _____
WT DIFFERENCE _____
FINAL RESULT _____

** DUPLICATE (1/MON) **

FINAL CRUCIBLE WT _____
EMPTY CRUCIBLE WT _____
SAMPLE WT MINUS BLANK _____
WT DIFFERENCE _____
FINAL RESULT _____

** BLANK **

FINAL CRUCIBLE WT (g) _____
EMPTY CRUCIBLE WT _____
WEIGHT DIFFERENCE _____

FINAL O&G(mg/l)IS CALCULATED AS:

(SAMPLE WT DIFF-BLANK WT DIFF) X 1,000,000
ml OF SAMPLE

** TSS **

SAMPLE DATE & TIME _____ _____
SAMPLE VOL (ml) _____
SAMPLED BY _____
RECVD BY _____
DLVRD TO LAB BY _____
RECVD IN LAB BY _____
RECVD DATE & TIME _____ _____
PRESERVATION _____
ANALYSIS DATE _____
ANALYSIS TIME _____
ANALYSIS VOL (ml) _____
ANALYZED BY _____

** SAMPLE **

FINAL CRUCIBLE WT (g) _____
EMPTY CRUCIBLE WT _____
WEIGHT DIFFERENCE _____
FINAL RESULT (mg/l) _____

** DUPLICATE (2/MO) **

FINAL CRUCIBLE WT (g) _____
EMPTY CRUCIBLE WT _____
WEIGHT DIFFENENCE _____
FINAL RESULT (mg/l) _____

FINAL TSS(mg/l)IS CALCULATED AS:

WEIGHT DIFFERENCE X 1,000,000
ml OF SAMPLE

** pH **

SAMPLE DATE & TIME 1/31/08 11:30 A
SAMPLE VOL (ml) 1000
SAMPLED BY MRM
RECVD BY MRM
DLVRD TO LAB BY MRM
RECVD IN LAB BY MRM
RECVD DATE & TIME 1/31/08 12:00 P
PRESERVATION —
ANALYSIS DATE 1/31/08
ANALYSIS TIME 12:25 A
ANALYSIS VOL (ml) 200
ANALYZED BY MRM

** SAMPLE **

pH (S.U.) 7.95
TEMPERATURE (deg C) 18.8

** DUPLICATE (1/MO) **

pH (S.U.) _____
TEMPERATURE (deg C) _____

COMMENTS:	PH	TEMP	TIME
Circ	7.98	6.7	11:30 A
Boat Ramp	7.98	13.4	11:30 A

EJS 02/24/95

BARNES & THORNBURG LLP

11 South Meridian Street
Indianapolis, IN 46204-3535 U.S.A.
(317) 236-1313
Fax (317) 231-7433

www.btlaw.com

RECEIVED
JAN 07 2008
By

Anthony C. Sullivan
(317) 231-7472
tony.sullivan@btlaw.com

January 4, 2008

Mr. Mark Stanifer
Indiana Department of Environmental Management
100 North Senate Avenue, Room 1315
Indianapolis, Indiana 46204

Re: August 10, 1997 Notice of Violation
Case No. 2007-16780-W

Dear Mark:

As I indicated on my voice mail to you on this day, Indianapolis Power & Light Company - Eagle Valley Generating Station has returned "D" Ash Pond to service as of December 24, 2007.

If you have any comments or questions, please call me at 317-231-7472 or Kyle Noah at 765-349-3472.

Sincerely,

Tony Sullivan

Anthony C. Sullivan

ACS:naw
cc: Mr. Kyle Noah
Ms. Nysa Hogue

INDS01 ACS 1007538v1

EFILE

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

We make Indiana a cleaner, healthier place to live.

Mitchell E. Daniels, Jr.
Governor

Thomas W. Easterly
Commissioner

January 3, 2008

100 North Senate Avenue
Mail Code 60-02
Indianapolis, Indiana 46204-2251
(317) 232-8603
(800) 451-6027
www.idem.in.gov

VIA CERTIFIED MAIL 7002 0510 0002 5824 7493

Tony Sullivan, Esquire
Barnes & Thornburg LLP
11 South Meridian Street
Indianapolis, IN 46204-3535

Re: IPL Eagle Valley Station
Case No. 2007-16780-W

Dear Mr. Sullivan:

This is to inform you that we have reviewed the draft documents (which we will generically refer to as the Compliance Plan (CP)) that you submitted for the IPL Eagle Valley Generating Station and other ash ponds within the IPL system, pursuant to Paragraphs 3 and 4 of the draft Agreed Order in the above-referenced case. The CP appears to conform to what we discussed should be included. We did not evaluate the engineering aspects of the CP, but the general concept of the plan is acceptable.

As we discussed at our September 10 meeting, you wanted the approved CP to be included in the Agreed Order. At this point, I will begin to finalize a proposed Agreed Order that considers IPL's comments and the CP, which hopefully will be acceptable to all parties.

If you have any questions, please contact me at 317/232-8431.

Sincerely,

Mark W. Stanifer

Mark W. Stanifer, Chief
Water Enforcement Section
Office of Enforcement

cc: Justin Barrett, DAG

DNR Indiana Department of Natural Resources

Mitchell E. Daniels, Jr., Governor
Robert E. Carter, Jr., Director

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Certified No: 7001 0360 0000 6410 1704

November 20, 2007

Indianapolis Power and Light
4040 Blue Bluff Road
Martinsville, IN 46151

RE: Discharge of Deleterious Substance
White River, Morgan County, February 2007

Dear Sir/Madam:

The Director of the Indiana Department of Natural Resources (IDNR) is in receipt of information regarding an unlawful discharge into the White River in Morgan County, Indiana on February 14, 2007. The incident was investigated and documented by a conservation officer of the IDNR, as well as staff from the Indiana Department of Environmental Management (IDEM). This letter serves as a warning with regard to activities that could potentially harm Indiana wildlife.

As part of an extensive investigation on February 14, 2007, the IDNR conservation officer walked along the White River to confirm the source of contamination. A milky discoloration was observed downstream of the Indianapolis Power and Light discharge channel and breached ash ponds. The discharge origin was confirmed to be the breached ash ponds at the Indianapolis Power and Light Martinsville facility.

At this time, the IDNR does not plan to seek damages separate or in addition to those pursued by IDEM. However, the State of Indiana is concerned that the continued release of substances that are harmful to wild animals will eventually cause serious damage to wild animals. The IDNR wishes to advise you of the potential consequences of such results. Indiana Code 14-22-10-6 provides for the liability attached to killing a wild animal by pollutant; it states in relevant part:

> A person who discharges or releases waste materials, chemicals, or other substances: either accidentally, negligently or willfully; in any quantity, concentration or manner onto or in any water of Indiana, the boundary waters of the state, or onto or in public or private land; and so that wild animals are killed as a result; is responsible for the kill.
>
> The director shall, in the name of the state, recover damages from the person.
>
> Under the statute, the definition of "wild animal" includes, but is not limited to, fish and

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INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

We make Indiana a cleaner, healthier place to live.

Mitchell E. Daniels, Jr.
Governor

Thomas W. Easterly
Commissioner

August 10, 2007

100 North Senate Avenue
Mail Code 60-02
Indianapolis, Indiana 46204-2251
(317) 232-8603
(800) 451-6027
www.in.gov/idem

NOTICE OF VIOLATION

Via Certified Mail No.: 7002 0510 0002 5824 7324
To: Ann D. Murtlow, President
Indianapolis Power & Light Co.
One Monument Circle
Indianapolis, IN 46204

Via Certified Mail No.: 7002 0510 0002 5824 7317
To: S. Michael Woodard, Registered Agent
Indianapolis Power & Light Co.
One Monument Circle
Indianapolis, IN 46204

Case No. 2007-16780-W

Based on an investigation on February 14, 2007, the Indiana Department of Environmental Management ("IDEM") has reason to believe the Indianapolis Power & Light Co., Eagle Valley Generating Station ("Respondent") has violated environmental rules and its NPDES permit. The violations are based on the following:

1. Respondent owns and operates a steam electric power plant located at 4040 Blue Bluff Road, Martinsville, Morgan County, Indiana (the "Site").

2. Respondent is authorized by National Pollutant Discharge Elimination System (NPDES) Permit Number IN 0004693 (Permit) to discharge wastewater in accordance with the terms and conditions of the NPDES Permit into the West Fork of White River (waters of the State) via Outfalls 002, 003, and 103.

3. Pursuant to 327 IAC 5-2-2, any discharge of pollutants into waters of the state as a point source discharge, except for exclusions made in 327 IAC 5-2-4, is prohibited unless in conformity with a valid NPDES permit obtained prior to the discharge. Respondent discharged ash pond water into the West Fork of White River on February 14, 2007, of a nature and from a location not authorized by the Permit, in violation of 327 IAC 5-2-2.

4. Pursuant to 327 IAC 2-1-6(a) and Part I. B. of the Permit, all waters at all times and at all places, including the mixing zone, shall meet the minimum conditions of being free from substances, materials, floating debris, oil, or scum attributable to municipal, industrial, agricultural, and other land use practices, or other discharges:
   (A) that will settle to form putrescent or otherwise objectionable deposits;
   (B) that are in amounts sufficient to be unsightly or deleterious;

required to correct the violations and, as necessary and appropriate, for the payment of a civil penalty. The Commissioner is not required to extend this offer for more than sixty (60) days.

As provided in IC 13-30-3-3, an alleged violator may enter into an Agreed Order without admitting that the violations occurred. IDEM encourages settlement by Agreed Order, thereby resulting in quicker correction of the environmental violations and avoidance of extensive litigation. Timely settlement by Agreed Order may result in a reduced civil penalty. Also, settlement discussions will allow the opportunity to present any mitigating factors that may be relevant to the violations.

If an Agreed Order is not entered into within sixty (60) days of receipt of this Notice of Violation, the Commissioner may issue a Notice and Order under IC 13-30-3-4 containing the actions that must be taken to correct the violations and requiring the payment of an appropriate civil penalty. Pursuant to IC 13-30-4-1, the Commissioner may assess penalties of up to $25,000 per day for each violation.

Please contact Mark Stanifer at 317-232-8431 within fifteen (15) days after receipt of this Notice to discuss resolution of this matter.

For the Commissioner:

Date: 8/9/07

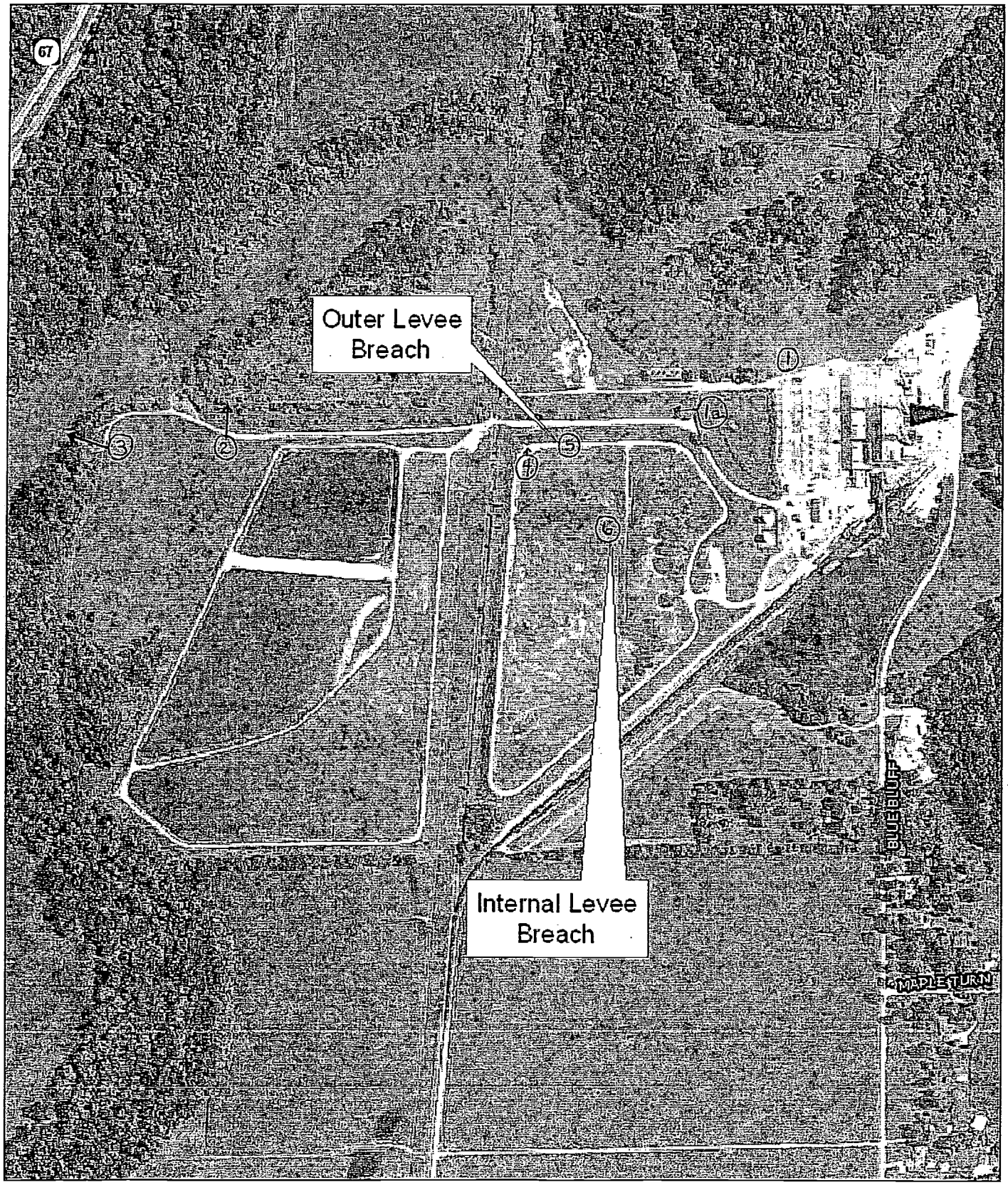
Nancy L Johnston for
Lori Kyle Endris
Chief
Office of Enforcement

cc: Morgan, County Health Department
Jason Sewell, Office of Land Quality
IPL Eagle Valley NPDES Public File
http://www.in.gov/idem

IDEM ER ArcMap
IPL - 2007-02-093
Morgan Co

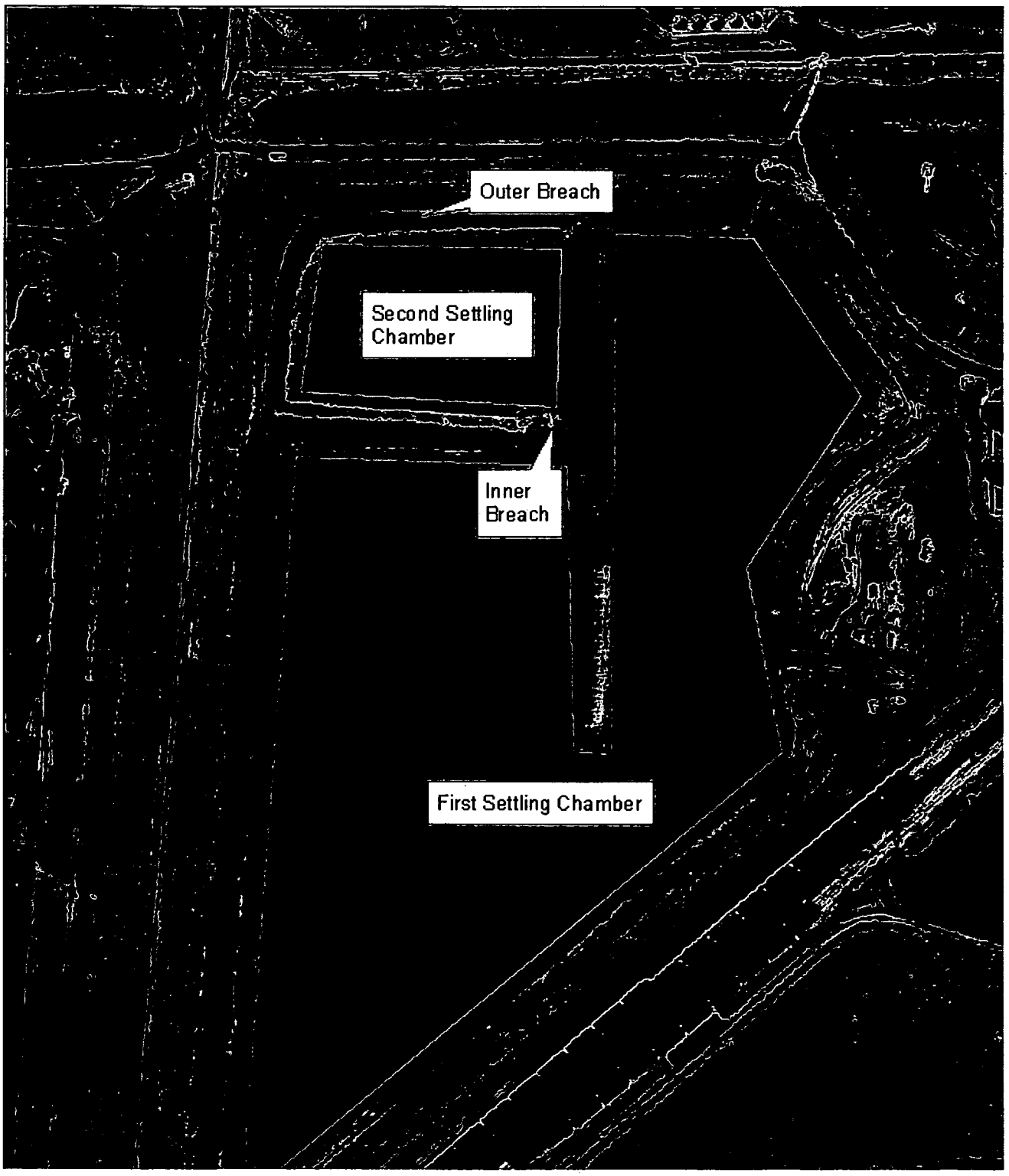
N

0 255 510 1,020 Meters



IDEM Emergency Response
2007-02-093, MORGAN CO
IPALCO

0 250,000 500,000 1,



INCIDENT REPORT

State Form 13490 (R4/1-04)
INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
EMERGENCY RESPONSE SECTION

Incident Number: 2007-02-093
County: Morgan
Priority Level: 1
ER Staff: Jason Sewell
Spill Type: Spill
SARA Title III Release: No
Referred To:

NOTE: - For Department Use Only.
- To report Spills and Environmental Emergencies in Indiana 24 Hours a day call **888-233-7745**

Incident Date/Time: 02/14/2007 02:00:00	**Notification Date/Time:** 02/14/2007 10:33:23

Source Information		Reporter Information	
Source Name: EAGLE VALLEY/INDIANAPOLIS POWER AND LIGHT Contact Name: DAWYNE BURKE/KYLE NOAK		Reporter Name: EAGLE VALLEY/INDIANAPOLIS POWER AND LIGHT Contact Name: DAWYNE BURKE/KYLE NOAK	
Street Address: 4040 BLUE BLUFF RD City/State/ZIP: MARTINSVILLE, IN 46151		Street Address: 4040 BLUE BLUFF RD City/State/ZIP: MARTINSVILLE, IN 46151	
Mailing Address: City/State/ZIP: ,		Mailing Address: City/State/ZIP: ,	
Office Phone (765)349-3472	Mobile Phone (317)439-1251	Office Phone (765)349-3472	Mobile Phone (317)439-1251
Fax	Pager	Fax	Pager

Source Type: Other	**Reported By:** Responsible Party (RP)
Circumstances: Equipment Failure	**Environmental Consequence:** Water Quality Violation

Investigation Performed By: ERS - Field Response

Spill Location Information

Location: 4040 BLUE BLUFF RD

City/State/ZIP: MARTINSVILLE, IN 46151 **Affected Area:** 6+ MILES WHITE RIVER

Incident/Area Description: ASH POND LEVEEL FAILURE, ASH AND WATER RELEASE TO WHITE RIVER

Water Affected? Yes **Receiving Water:** WHITE RIVER

Public Drinking Water Intake:

Material Information

Material Name: ASH SLUICE WATER **Quantity:** 30,000,000 Gallons

Other Information:

Notification/Contacts

Name/Agency: BRIAN KNOY / DNR **Date/Time:** 02/14/2007 10:59:00

Comments: **Telephone:** (812)837-9536 X

Notification/Contacts

Name/Agency: JEFF NEAL / COUNTY EMA
Comments:
Date/Time: 02/14/2007 11:12:19
Telephone: (765)342-8467 X

Name/Agency: MIKE RABERTY / EPA REGION V
Comments:
Date/Time: 02/14/2007 10:59:00
Telephone: (312)886-4592 X

Name/Agency: WAYNE FAATZ / DNR FISH AND WILDLIFE
Comments:
Date/Time:
Telephone: ()- X

IDEM Personnel

Name/Agency: Mark Stanifer/Office of Enforcement
Comments: RFRD TO
Date / Time:
Telephone: (317)232-8431

Name/Agency: George Oliver/NPDES Permit #1
Comments: LEFT A MESSAGE REQUESTING FURTHER INFO ON POWER PLANT ASH WATER
Date / Time: 02/14/2007 11:58:49
Telephone: (317)232-8702

Name/Agency: Ronald Pearson/Inspection South
Comments: OWQ INSPECTOR, RFRD TO
Date / Time:
Telephone: (317)233-9874

Name/Agency: David Cage/Compliance/Response Br.
Comments: ASSISTED RESPONSE
Date / Time:
Telephone: (317)308-3029

Name/Agency: Max Michael/Compliance/Response Br.
Comments:
Date / Time:
Telephone: (317)308-3049

Name/Agency: Rose Beauchamp-Hamblen/Compliance/Response Br.
Comments: Took initial call.
Date / Time: 02/14/2007 10:30:00
Telephone: (317)308-3038

Name/Agency: James Smith/Remediation Services
Comments: REPORTED SENSITIVE SPECIES DOWNSTREAM
Date / Time: 02/14/2007 11:58:16
Telephone: (317)308-3003

Notes

02/14/2007 10:30: Dwayne Burke with Indiana Power and Light called in a release of 30,000,000 gallona of ash sluice water into White River. This was due to a breach in the ash pond. At this time it is still on going and may loose up to 4,000,000 more gallons.

Sewell and Cage, IDEM ER, responded to location. DNR officers also responded.

The release was caused by the massive breach of an internal lagoon levee that separated one settling chamber of the lagoon from another. The first stage/chamber of the lagoon has over ten feet of elevation over the secondary chamber. The levee breach allowed the primary chamber to fill the secondary chamber up and overflow 2 levee walls of the second chamber. This overflowing went on for hours until a levee wall in chamber 2 breached and allowed nearly all of the lagoon liquids to drain. The outer levee breach was immediately adjacent to IPL's cooling water discharge ditch, and spilled materials entered the ditch where they discharged to the White River.

Cage, IDEM, drove downstream of release location to visually assess impacts to White River. White River was running clear upstream of the release, but cloudy/muddy downstream of the IPL release. Cloudy water was visible as far downstream as 4.5 river miles.

IDEM, DNR, and IPL met to discuss release. IPL advised the lagoon was originally constructed in 1990s, but an inner lagoon levee was constructed in 2005 (completed). IPL advised they discovered the breach at 8:30AM, 2-14-07. No one had inspected the lagoon since the night before. IPL advised they halted discharging water to the failed lagoon and began discharging it to one of the other lagoons. IPL was asked to get equipment onsite to close the breach. A snow emergency was in effect at the time of the breach. IPL was having problems getting permits to move oversized loads (excavating equipment) over roadways to location. Sewell, IDEM, requested containment of lagoon as soon as possible. IPL had to move snow from the lagoon levees to allow movement towards the breach. IDEM requested water sampling to get an idea of what was leaving the ponds. IPL advised the lagoon walls were constructed of fly ash with a 2 foot clay cap. IPL claims little, if any, ash left the pond. However, they do admit levee construction materials were flushed away, and levee construction materials were made of fly ash.

Due to snow emergency, Sewell was unable to contact OWQ employees with site knowledge, as some employees were unable to get to work.

1700 Hrs, Kyle Noah, IPL, advised their discharge canal is monitored for temperature (due to cooling water discharge permitting). The overnight temperature records show a drastic temperature change at 2:36AM, when the first, inner, lagoon levee would have failed and caused an overtopping of the outer lagoon walls. Noah advised a second temperature change was noted after 9AM when the second/outer lagoon levee was breached. Sewell pointed out the second breach would have occurred after IPL reports they discovered the breach at 8:30AM. Noah admits they found the overtopping before the second breach. IPL did not report any release to IDEM until 10:33A.

Work was halted at dark due to risks from slippery and narrow levee drives, darkness, and steep and tall fall offs from the levees tops to hard surfaces below. Lagoon containment was not reached on 2-14-07.

2-15-07 - Sewell responded to location. Sewell notified Pearson, IDEM OWQ, of release. Pearson advised IPL had problems in 2006 with the internal levee where this breach occurred. Pearson advised IDEM OWQ does not have permitting or approval process for construction of fly ash ponds.

Sewell met with IPL and DNR Fish and Wildlife. DNR requested sediment samples to coincide with water sample locations.

Sewell asked about recent problems with levee wall. IPL advised the levee was eroding at the overflow from the first chamber to the second chamber. The area was repaired with rip rap and corrugated piping was installed to help divert the spill way from coming in to direct contact with the levee construction materials. IPL admitted the problems were the same location as where the initial breach occurred.

Due to transportation problems (snow emergency) and sizes of breach, the breaches were not temporarily closed until 2-15-07. Measures to repair breaches in lagoons and test remaining levees for structural integrity were unknown.

IDEM ER referred site to OE for water quality violation.

An AES Company

765-349-3413
Fax 765-342-2311

February 20, 2007

CERTIFIED MAIL # 7004 2510 0002 9448 9650

Indiana Department of Environmental Management
Ms. Beth Tallon, Chief
Industrial NPDES Permit Section
Office Water Quality
100 North Senate Ave.
Indianapolis, IN 46204

RE: NPDES Noncompliance, Permit No. IN0004693
Incident No. 2007-02-093

Dear Ms. Tallon:

As required by the IC Rules and the IPL Eagle Valley Generating Station Plant NPDES Permit, No. IN0004693 attached is a follow up written report for the Incident No. 2007-02-093.

Location of spill/ release: IPL Eagle Valley Generating Station
4040 Blue Bluff Road
Martinsville, IN 46151

Contact information: Kyle Noah, Plant Environmental Leader
IPL Eagle Valley Generation Station
4040 Blue Bluff Road
Martinsville, IN 46151
317/439-1251
or

Dwayne Burke, Director, Environmental Affairs
Indianapolis Power & Light
One Monument Circle
Indianapolis, IN 46204
317/501-0278

Time of spill/release: February 14, 2006 at 8:30 a.m.

Substance released: Ash sluice water

Amount released: Approximately 30 million gallons

Source of spill/ release: Both an internal and then an external levee breached at the Eagle Valley Generating Station prompting the release.

Name of waters: Sluice water was initially released to the IPL discharge canal which then enters the White River.

Agencies notified: Timely reports were made to IDEM, DNR, National Response Center, and the Morgan County Local Emergency Planning Commission.

Agencies responding: IDEM – Jason Sewell, Emergency Response Section, On-Scene Coordinator.
David Cage, Emergency Response Section, On-Scene Coordinator.

IDNR – Bryan Knoy and Joel Arthur, Conservation Officers
Chip Long, Division of, Fish, and Wildlife
Angela Goldman, PR-Bloomington
Dr. Wayne C. Faatz, Division of Fish & Wildlife, Contaminants Program Coordinator.

Spill response: (1) Plant Corrective Actions – Partial list

a. IPL took Ash Sluice Pumps Out of Service.
b. IPL called in Local Excavation Contractor.
c. IPL called in Internal Civil Engineering Expert on Levees.
d. IPL called in Out of State Contractor that constructed Levees.
e. IPL cleared snow and ice from levees and roadways to permit access.
f. IPL called in additional plant personnel to assist with corrective actions.
g. Contractors ordered Heavy Equipment.
h. Contractor called in External Civil Engineering Expert on Ash Levees.
i. Contractors worked to plug levees.
j. Contractors ordered additional Heavy Equipment.
k. IPL directed Contracted Vacuum Trucks to Haul Ash.
l. IPL ordered Emergency Lighting.

m. Contractors obtained emergency DOT permits for Heavy Equipment to be shipped to site.
n. Corrective actions suspended on February 14, 2007 due to darkness, contracted personnel safety, and hazard to equipment.
o. Additional Heavy Equipment arrived on-site.
p. Contractors resumed work to plug levees the morning of February 15, 2007.
q. Contractor to begin removing solids from plant discharge canal on February 20, 2007.

(2) Timely notifications made to appropriate agencies;

(3) Internal levee plugged on February 15, 2007 at 1022.

(4) External levee plugged on February 15, 2007 at 1305.

Additional action: IDEM, DNR, and IPL representatives met on 2 occasions to discuss an action plan to verify that the environment had not been harmed. It was determined that IPL would take (4) samples upstream and downstream from the levee breach. Samples (both water quality and sediments) would be analyzed for pH, solids, and metals. Results will be communicated to IDEM and IDNR as soon as reasonable.

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

Sincerely,

J. Kyle Noah

J. Kyle Noah
Eagle Valley Environmental Team Leader

xc: Jason Sewell – IDEM Emergency Response Section,
On-Scene Coordinator. Cert. Mail #7004 2510 0002 9448 9629
George Oliver – IDEM NPDES Permits Branch
Dr. Wayne C. Faatz – Division of Fish & Wildlife,
Contaminants Program Coordinator.
Cert. Mail #7004 2510 0002 9448 9643

Indianapolis Power & Light Company
Eagle Valley Generating Station

D & E Ash Pond Work History

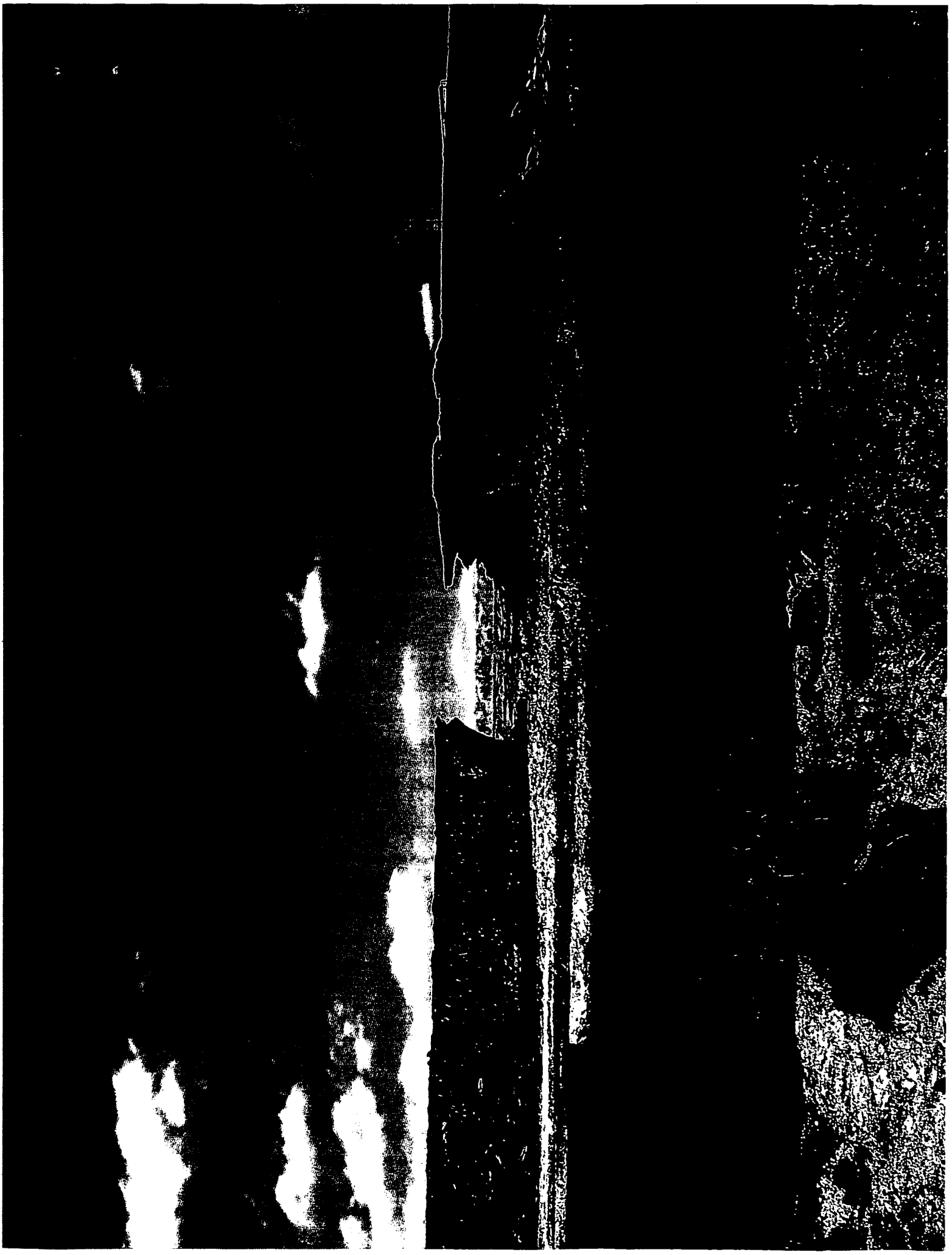
Date	Description	Design	Construction
2000	Raise D Ash Pond	Jeff Munger Principal Engineer Indianapolis Power & Light Co. One Monument Circle P.O. Box 1595 Indianapolis, IN 46206-1595 317-261-8643	Bob Gerbus President Trans-Ash, Inc. 617 Shepherd Drive P.O. Box 15396 Cincinnati, OH 45215 513-733-4770
December 2000	Repair D Ash Pond levee at inlet pipes	Jeff Munger Principal Engineer Indianapolis Power & Light Co. One Monument Circle P.O. Box 1595 Indianapolis, IN 46206-1595 317-261-8643	Norris Brothers, Inc. 5700 W. Minnesota St. Building E, Suite A Indianapolis, IN 46241 317-481-0771
May 2003	Construct an interior levee in D Ash Pond to create E Ash Pond	Jeff Munger Engineer Ter Horst, Lamson & Fisk, Inc. 8675 Purdue Rd. Indianapolis, IN 46268 317-334-1500	Linchris Corporation Highway 67 P.O. Box 68 Gosport, IN 47433 812-879-4290
2004 - 2005	Raise D Ash Pond including modifications to prevent erosion of slopes and roadway	Jeff Munger Engineer Manager CMID 5851 East 34th Street Indianapolis, IN 46218 317-917-4240	Bob Gerbus President Trans-Ash, Inc. 617 Shepherd Drive P.O. Box 15396 Cincinnati, OH 45215 513-733-4770
July 2005	Install concrete anti-seep collar on D-E Ash Pond crossover pipes	No design firm – Bob Gerbus, Trans-Ash, Inc., verbal suggestion	Broyer Construction, Inc. 1309 S. Josephine Street Martinsville, IN 46151 765-342-5916

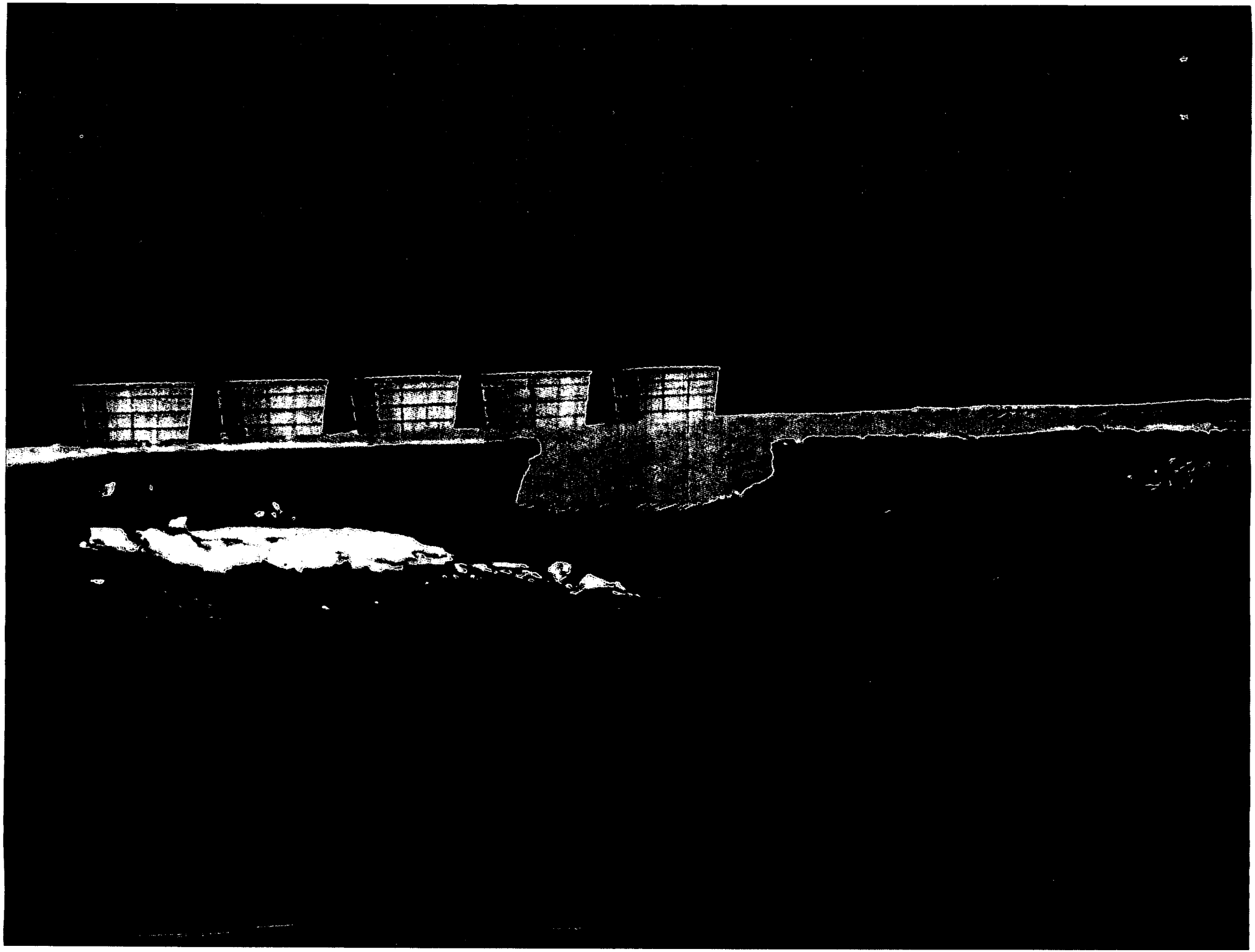
Indianapolis Power & Light Company
Eagle Valley Generating Station

D & E Ash Pond Work History

Date	Description	Design	Construction
December 2006	Repair E Ash Pond slope erosion damage at D-E Ash Pond crossover pipes	No design firm – Returned levee to original design dimensions using clay in lieu of ash as construction material	Sub-Surface of Indiana, Inc. Subcontractor: Chad Smith SSI Excavation 7225 W. 700 S. Morgantown, IN 46160 317-691-5977
February 2007	Prepare design scope for D Ash Pond and E Ash Pond levee repairs	Trans-Ash, Inc. Subcontractor: BBCM 11699 Chesterdale Road Cincinnati, OH 45246-1424 513-771-8471	Not Applicable
2007	Repair D Ash Pond and E Ash Pond levees	Don Fuller Associate FMSM Engineers 1409 North Forbes Road Lexington, KY 40511-2050 859-422-3000	To Be Determined

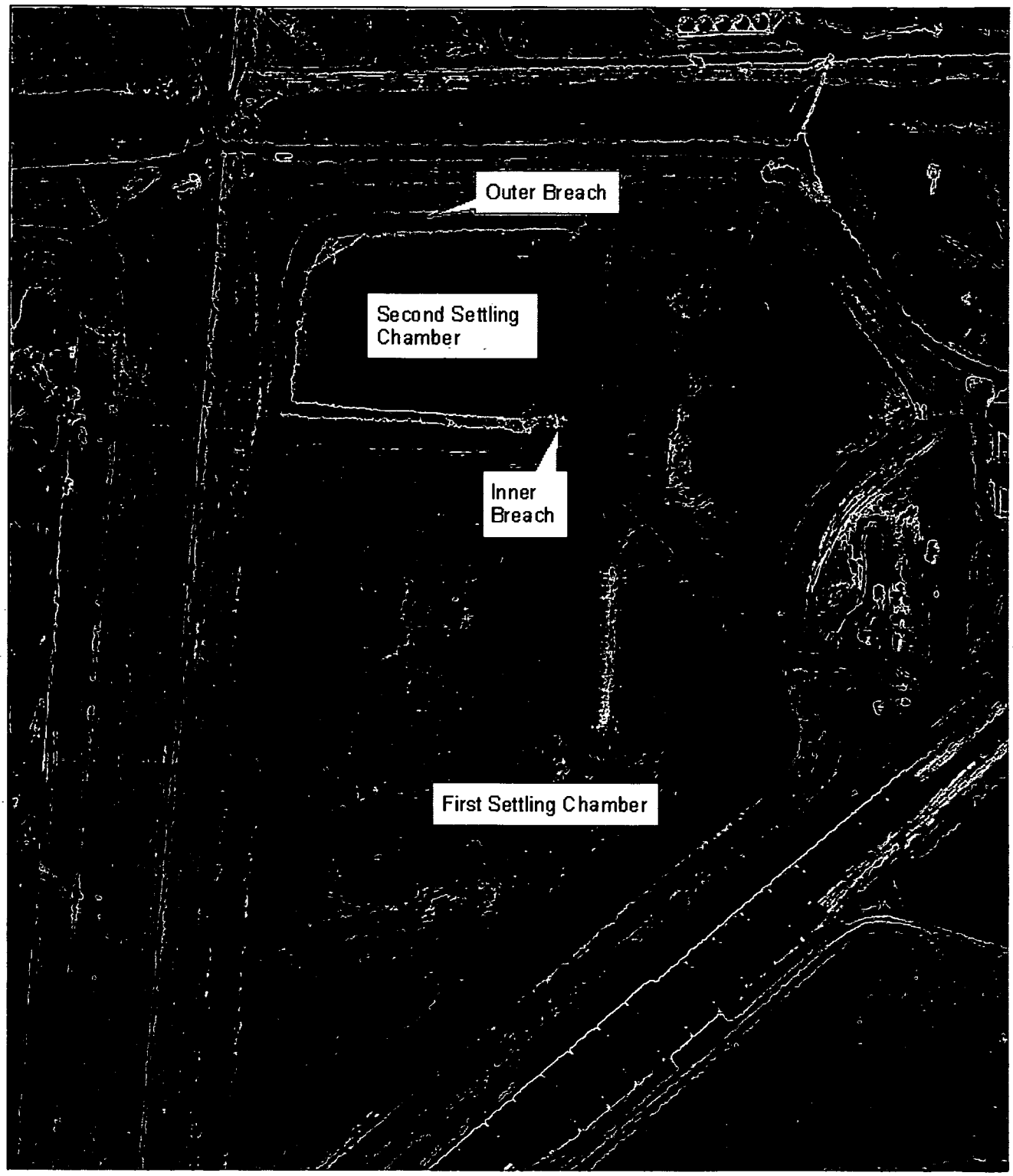
GJD
4/18/07





IDEM Emergency Response
2007-02-093, MORGAN CO
IPALCO

0 250 000 500 000 1,



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IDEM ER ArcMap
IPL - 2007-02-093
Morgan Co

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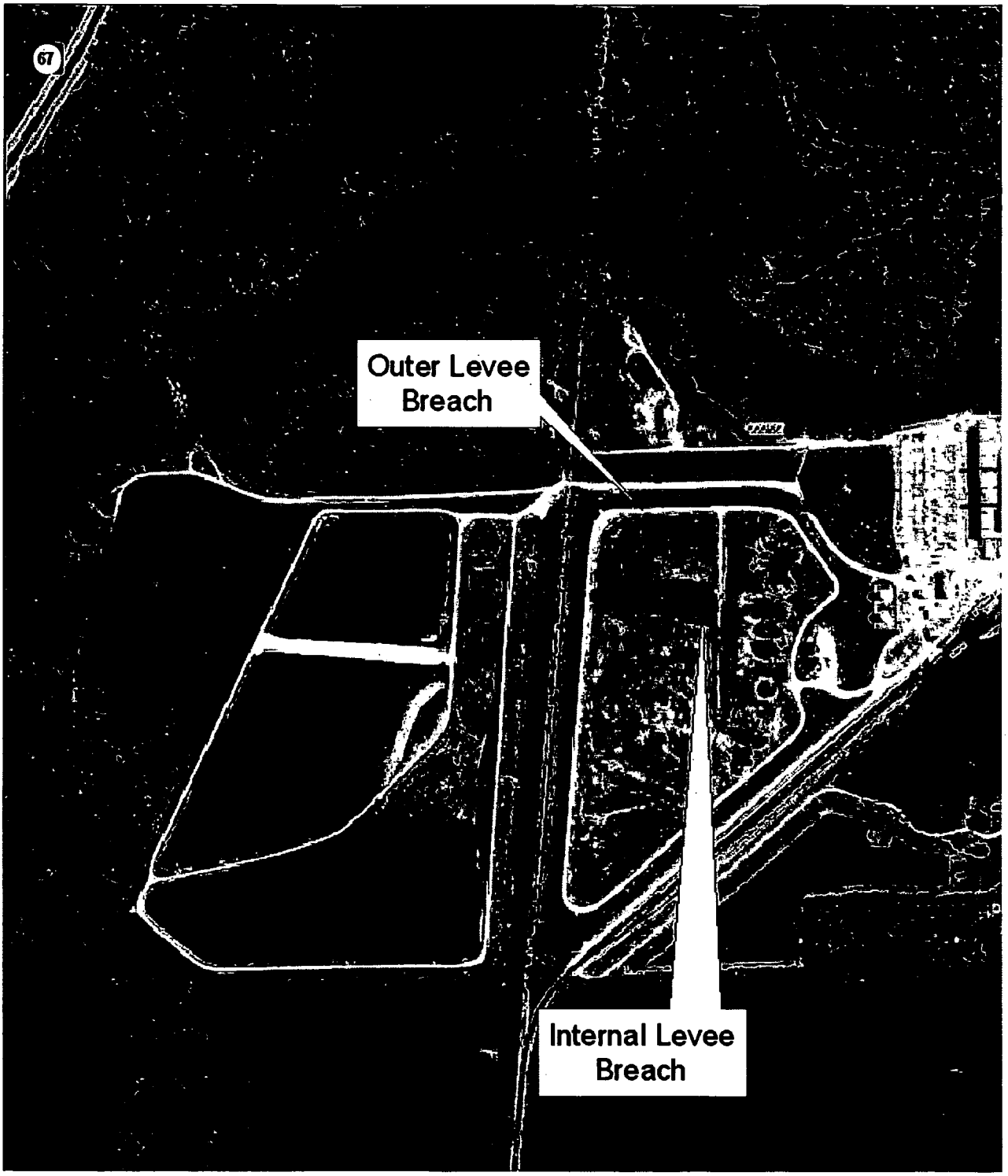
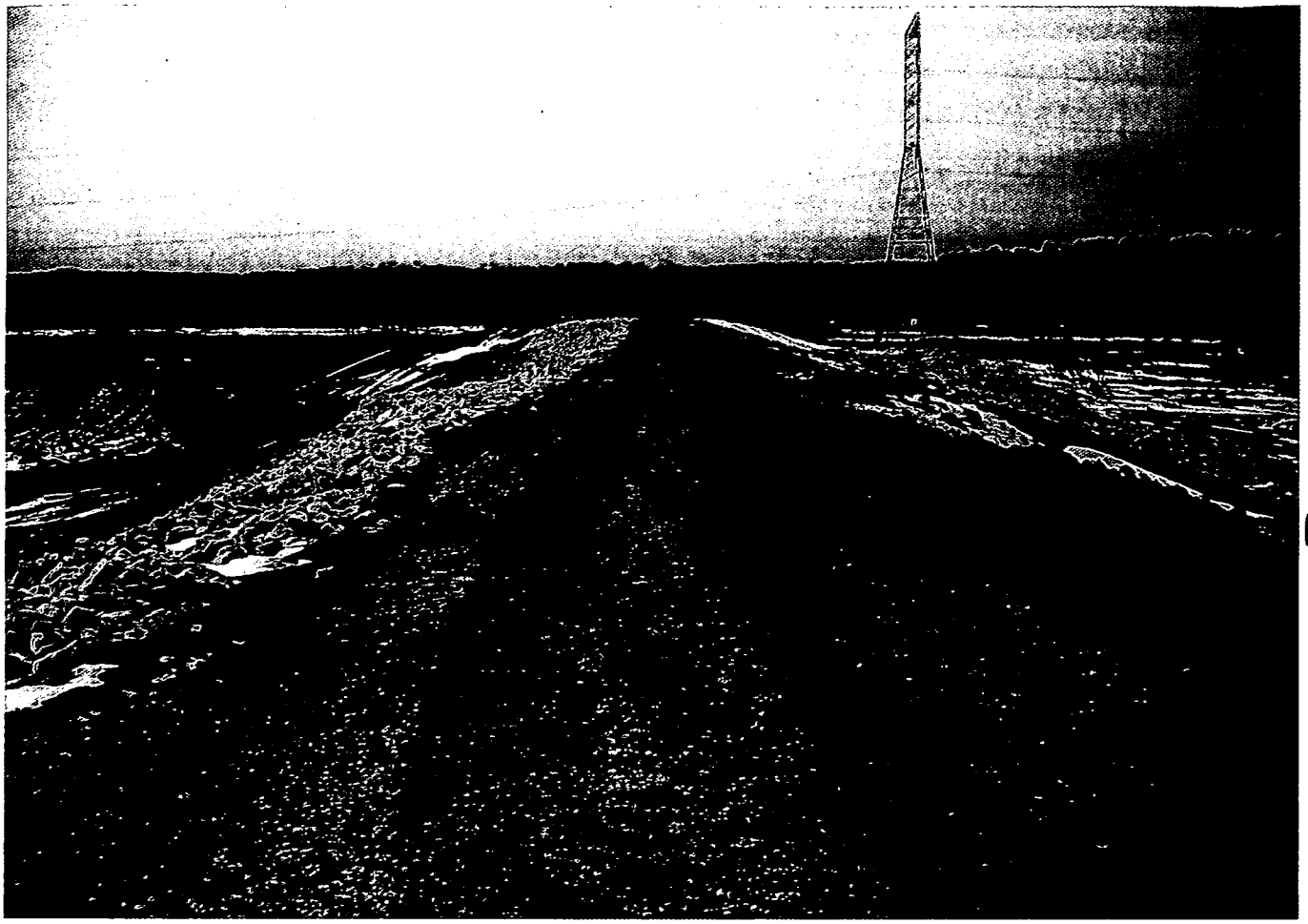


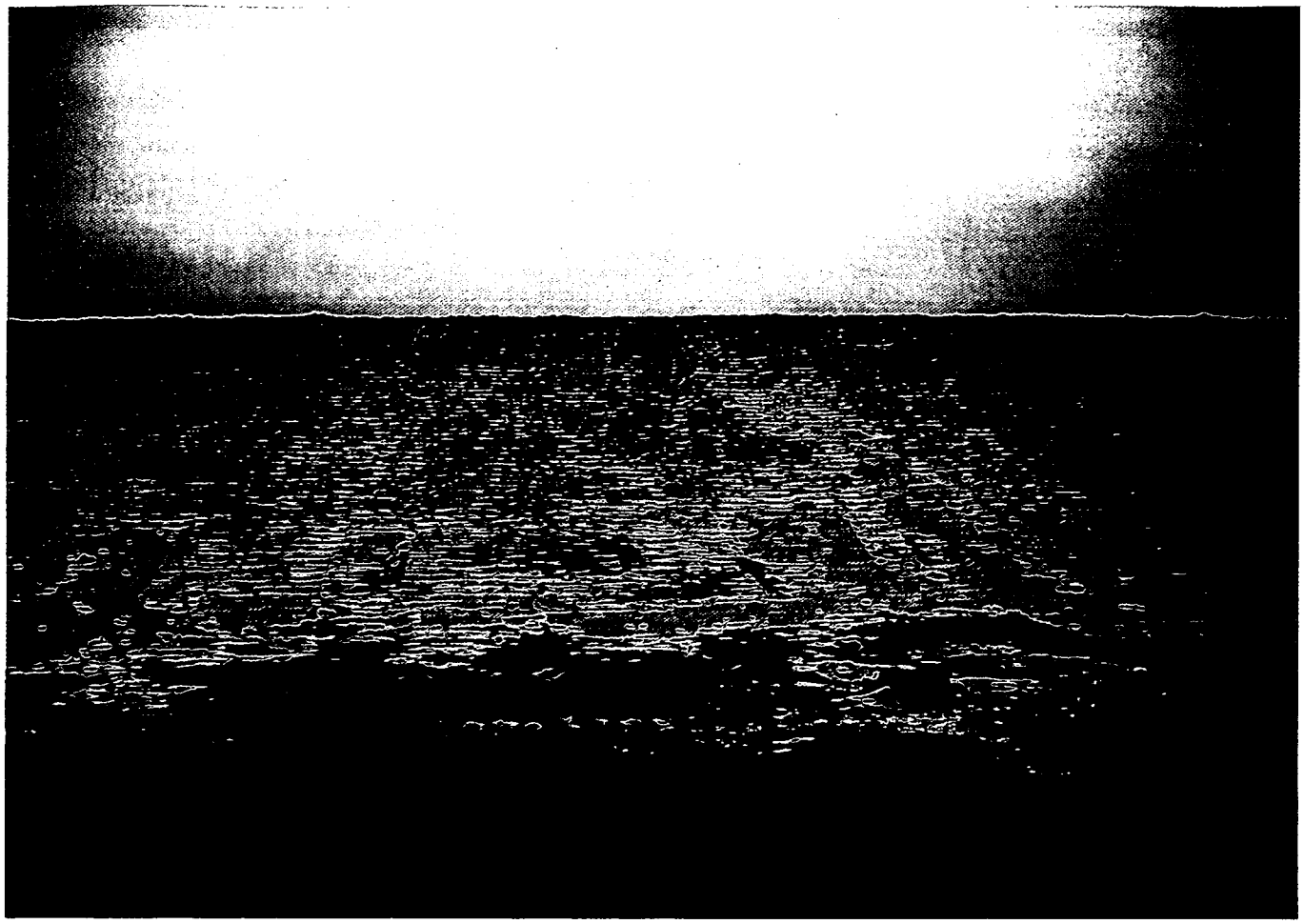


12-07
LOOKING
W
on D-E
levy

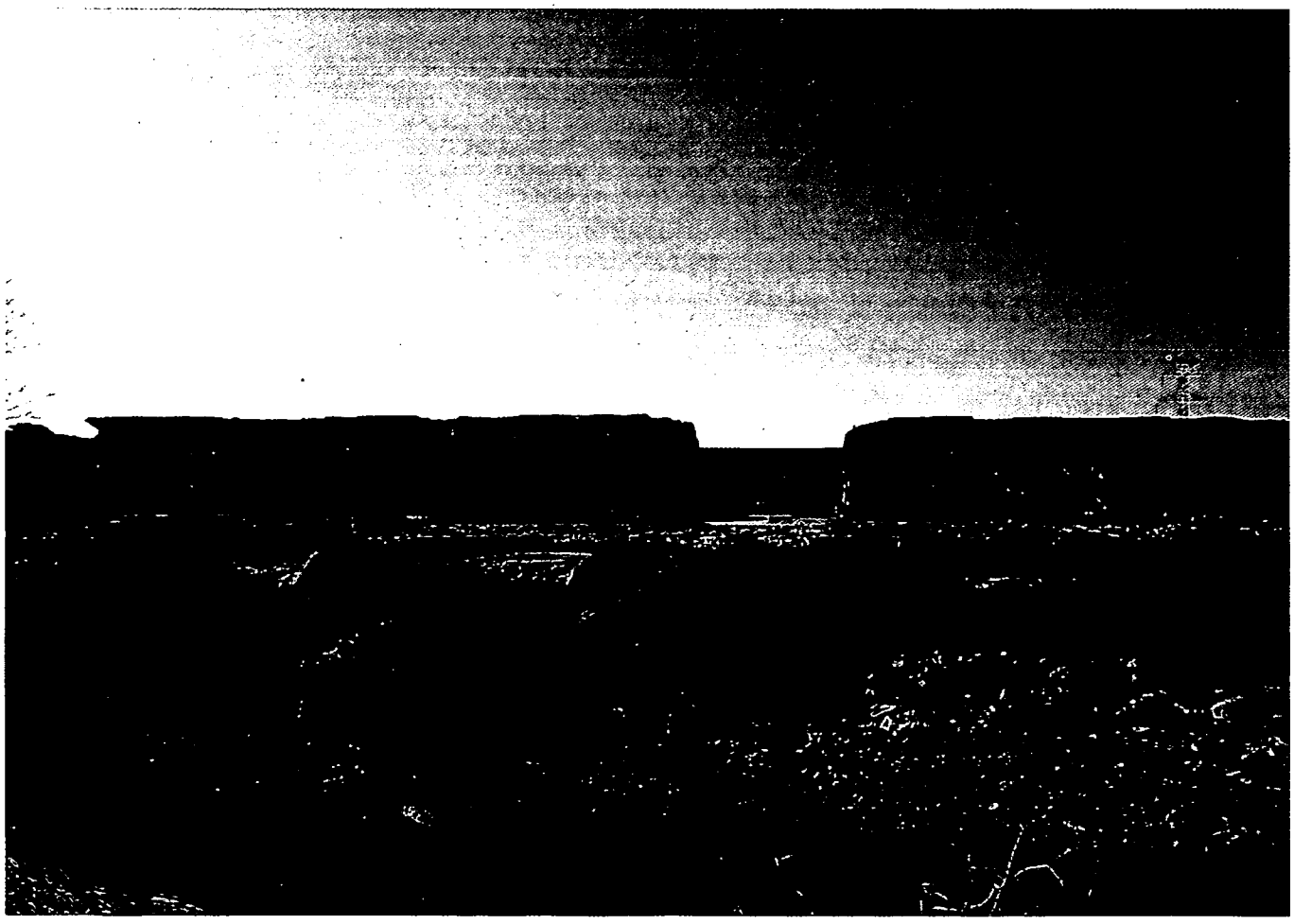
1-30-08

12-07

1-30-08



12-07
repaired
area at
E bank
looking
S.



RIVER
→
600-700
yards