Cynthia Vodopivec
Illinois Power Generating Company
Luminant
6555 Sierra Dr.
Irving, TX 75039

November 25, 2020

Sent via email

Mr. Andrew R. Wheeler, EPA Administrator
Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Mail Code 5304-P
Washington, DC 20460

Re: Newton Power Station Revised Alternative Closure Demonstration

Dear Administrator Wheeler:

Illinois Power Generating Company (IPGC) submits this revised request to the U.S. Environmental Protection Agency (EPA) for approval of a site-specific alternative deadline to initiate closure pursuant to 40 C.F.R. § 257.103(f)(2) for the Primary Ash Pond located at the Newton Power Station near Newton, Illinois. IPGC is requesting an extension pursuant to 40 C.F.R. § 257.103(f)(2) so that the Primary Ash Pond may continue to receive CCR and non-CCR wastestreams after April 11, 2021, and complete closure no later than October 17, 2028.

The enclosed demonstration prepared by Burns & McDonnell replaces the demonstration that was previously submitted by IPGC to EPA on September 29, 2020. This demonstration addresses all of the criteria in 40 C.F.R. § 257.103(f)(2)(i)-(iv) and contains the documentation required by 40 C.F.R. § 257.103(f)(2)(v). As allowed by the agency, in lieu of hard copies of these documents, electronic files were submitted to Kirsten Hillyer, Frank Behan, and Richard Huggins via email. The demonstration is also available on IPGC's publicly available website: https://www.luminant.com/ccr/

Sincerely,

Cynthia Vodopivec
VP - Environmental Health & Safety

Enclosure

cc: Kirsten Hillyer
Frank Behan
Richard Huggins

CCR Surface Impoundment Demonstration for a Site-Specific Alternative to Initiation of Closure Deadline

Illinois Power Generating Company

Newton Power Station
Project No. 122702

Revision 1
11/25/2020

CCR Surface Impoundment Demonstration for a Site-Specific Alternative to Initiation of Closure Deadline

prepared for

Illinois Power Generating Company
Newton Power Station
Newton, Illinois

Project No. 122702

Revision 1
11/25/2020

prepared by

Burns & McDonnell Engineering Company, Inc.
Kansas City, Missouri

INDEX AND CERTIFICATION

Illinois Power Generating Company
CCR Surface Impoundment
Demonstration for a Site-Specific Alternative to Initiation of Closure Deadline
Project No. 122702

Report Index

Certification

I hereby certify, as a Professional Engineer in the state of Illinois, that the information in this document as noted in the above Report Index was assembled under my direct personal charge. This report is not intended or represented to be suitable for reuse by the Illinois Power Generating Company or others without specific verification or adaptation by the Engineer.

Edward T. Tohill

Edward T. Tohill, P.E. (Illinois License No. 062-056915)

Date: 11/25/20

LICENSED PROFESSIONAL ENGINEER
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11/25/20
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11/30/21

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LIST OF ABBREVIATIONS

<u>**Abbreviation**</u>	<u>**Term/Phrase/Name**</u>
CCR	Coal Combustion Residual
CFR	Code of Federal Regulations
ELG Rule	Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category
EPA	Environmental Protection Agency
IPGC	Illinois Power Generating Company
POTW	Publicly Owned Treatment Works
PSD	Prevention of Significant Deterioration
Newton	Newton Power Station
RCRA	Resource Conservation and Recovery Act
SWPPP	Stormwater Pollution Prevention Plan

1.0 EXECUTIVE SUMMARY

Illinois Power Generating Company (IPGC) submits this request to the U.S. Environmental Protection Agency (EPA) for approval of a site-specific alternative deadline to initiate closure pursuant to 40 C.F.R. § 257.103(f)(2) —"Permanent Cessation of a Coal-Fired Boiler(s) by a Date Certain"— for the Primary Ash Pond located at the Newton Power Station (Newton) in Illinois. The Primary Ash Pond is a 404-acre CCR surface impoundment used to manage CCR and non-CCR wastestreams at Newton. As discussed herein, the remaining boiler at the station will cease coal-fired operation no later than July 17, 2027, and the impoundment will complete closure no later than October 17, 2028. Therefore, IPGC is requesting an extension pursuant to 40 C.F.R. § 257.103(f)(2) so that the Primary Ash Pond may continue to receive CCR and non-CCR waste streams after April 11, 2021, and complete closure no later than October 17, 2028.

2.0 INTRODUCTION

Newton is a 615-megawatt coal-fueled electric generating station near Newton, Illinois. Unit 1 remains in operation; however, Unit 2 was retired in 2016. Unit 1 is scheduled to cease coal-fired operation no later than July 17, 2027. The Newton facility includes two CCR units: the Primary Ash Pond that is the subject of this demonstration, and CCR Landfill 2. Newton uses the 404-acre Primary Ash Pond, which was constructed in 1977, to manage sluiced bottom ash, fly ash, economizer ash, and mill rejects, as well as non-marketable dry fly ash and non-CCR wastewaters. Fly ash is typically collected dry and either hauled offsite for beneficial use or disposed of in the Primary Ash Pond; however, there are certain operating conditions, typically associated with silo maintenance activities that require use of the hydrovactor to sluice fly ash to the impoundment. The various non-CCR wastewaters received originate from the coal pile runoff pond, oil water separator, wastewater sump (including ash hopper overflows, air heater wash water, boiler blowdown, boiler wash, other non-chemical metal cleaning and miscellaneous plant drains and sumps), water treatment building sump (including microfilter backwash, reverse osmosis reject, demineralizer regeneration flows, and condensate polisher regeneration flows), polisher pre-coat sump, and miscellaneous stormwater sources (including overflow from Lake Jake which does not receive any process flows). A site plan is provided in Appendix A, and the plant water balance diagram is included in Appendix B. Note that Lake Jake is not depicted on the water balance diagram.

On April 17, 2015, the Environmental Protection Agency (EPA) issued the federal Coal Combustion Residual (CCR) Rule, 40 C.F.R. Part 257, Subpart D, to regulate the disposal of CCR materials generated at coal-fueled units. The rule is being administered under Subtitle D of the Resource Conservation and Recovery Act (RCRA, 42 U.S.C. § 6901 et seq.). On August 28, 2020, the EPA Administrator issued revisions to the CCR Rule that require all unlined surface impoundments to initiate closure by April 11, 2021, unless an alternative deadline is requested and approved. 40 C.F.R. § 257.101(a)(1) (85 Fed. Reg. 53,516 (Aug. 28, 2020)). Specifically, owners and operators of a CCR surface impoundment may continue to receive CCR and non-CCR wastestreams if the facility will cease operation of the coal-fired boiler(s) and complete closure of the impoundments within certain specified timeframes. 40 C.F.R. § 257.103(f)(2). To qualify for an alternative closure deadline under § 257.103(f)(2), a facility must meet the following four criteria:

1. **§ 257.103(f)(2)(i)** – No alternative disposal capacity is available on-site or off-site. An increase in costs or the inconvenience of existing capacity is not sufficient to support qualification.
2. **§ 257.103(f)(2)(ii) -** Potential risks to human health and the environment from the continued operation of the CCR surface impoundment have been adequately mitigated;

3. **§ 257.103(f)(2)(iii) -** The facility is in compliance with the CCR rule, including the requirement to conduct any necessary corrective action; and
4. **§ 257.103(f)(2)(iv) -** The coal-fired boilers must cease operation and closure of the impoundment must be completed within the following timeframes:
    a. For a CCR surface impoundment that is 40 acres or smaller, the coal-fired boiler(s) must cease operation and the CCR surface impoundment must complete closure no later than October 17, 2023.
    b. For a CCR surface impoundment that is larger than 40 acres, the coal-fired boiler(s) must cease operation, and the CCR surface impoundment must complete closure no later than October 17, 2028.

Section 257.103(f)(2)(v) sets out the documentation that must be provided to EPA to demonstrate that the four criteria set out above have been met. Therefore, this demonstration is organized based on the documentation requirements of §§ 257.103(f)(2)(v)(A) – (D).

3.0 DOCUMENTATION OF NO ALTERNATIVE DISPOSAL CAPACITY

To demonstrate that the criteria in § 257.103(f)(2)(i) has been met, the following provides documentation that no alternative disposal capacity is currently available on-site or off-site for each CCR and non-CCR wastestream that IPGC seeks to continue placing into the Primary Ash Pond after April 11, 2021. Consistent with the regulations, neither an increase in costs nor the inconvenience of existing capacity was used to support qualification under this criteria. Instead, as EPA explained in the preamble to the proposed Part A revisions, "it would be illogical to require [] facilities [ceasing power generation] to construct new capacity to manage CCR and non-CCR wastestreams." 84 Fed. Reg. 65,941, 65,956 (Dec. 2, 2019). EPA again reiterated in the preamble to the final revisions that "[i]n contrast to the provision under § 257.103(f)(1), the owner or operator does not need to develop alternative capacity because of the impending closure of the coal fired boiler. Since the coal-fired boiler will shortly cease power generation, it would be illogical to require these facilities to construct new capacity to manage CCR and non-CCR wastestreams." 85 Fed. Reg. at 53,547. Thus, new construction or the development of new alternative disposal capacity was not considered a viable option for any wastestream discussed below.

3.1 Site-Layout and Wastewater Processes

The Primary Ash Pond receives all CCR sluice flows and a majority of the non-CCR wastewater flows onsite before discharging to the Secondary Pond and eventually to Newton Lake. The remaining plant process flows (non-contact cooling water) are routed through the Cooling Basin or Construction Runoff Pond, as shown on the water balance diagram in Appendix B. Sewage treatment flows and intake screen backwash are discharged to Newton Lake. The other onsite impoundments (Coal Pile Runoff Pond, Cooling Basin, Lake Jake, landfill ponds, the Secondary Pond, and Construction Runoff Pond) are not authorized to receive the CCR material and are not large enough to independently treat the total volume of the plant process water flows. The existing, active on-site landfill operates with one open landfill cell (Ash Landfill 2 on Figure 1). The existing landfill cell is substantially filled with CCR with limited long-term available airspace (less than one year of capacity) to accept an increased volume of CCR for disposal. A separate landfill cell (Ash Landfill 3) was constructed for the disposal of gypsum materials from the plant scrubber system, but the scrubber was ultimately not installed at Newton and the landfill cell was never placed into operation and therefore is currently inactive. Since the cell has been inactive for several years and having never been placed into service, it is currently unusable due to deterioration of the landfill cell freeze protection layer, and damage to the leachate collection system and cell separation tie-in berm. Neither landfill cell can accept sluiced materials and they are not currently permitted to receive bottom ash material (only fly ash and gypsum).

3.2 CCR Wastestreams

IPGC evaluated each CCR wastestream placed in the Primary Ash Pond at Newton. For the reasons discussed below in Table 3-1, each of the following CCR wastestreams must continue to be placed in the Primary Ash Pond due to lack of alternative capacity both on and off-site.

Table 3-1: Newton CCR Wastestreams

CCR Wastestreams	Estimated Average Flow (MGD)	Alternative Disposal Capacity Currently Available? YES/NO	Details
Bottom Ash Sluice (includes economizer ash and non-CCR mill rejects)	2.3	NO	Alternative capacity is not currently available on or off-site and would have to be developed. Alternative capacity would need to be designed, permitted, and installed. Off-site alternative capacity would include development of on-site temporary tanks to support transport of sluice material offsite for disposal. Refer to the discussion below for a more detailed evaluation on the development of alternative capacity.
Dry Fly Ash	NA (Dry) ~27,500 tons/year based on 2019 rates	Limited	The fly ash is initially collected dry, conditioned, and either sent off-site for beneficial reuse or placed in the Primary Ash Pond or landfill. The conditioned fly ash placed in the Primary Ash Pond will facilitate pond closure in the near future. This beneficial reuse of the fly ash will be reflected in the final pond closure plan. As discussed above, the active on-site landfill operates with one open landfill cell. The existing cell is nearly full, with less than one year of capacity available. The inactive landfill cell is not currently operational and would require extensive work before waste placement could begin. Currently, off-site alternative capacity is not available as discussed below.
Fly Ash Vacuum (Hydrovactor)	1.4	NO	This flow is used to create a vacuum through the cyclone separators that remove the dry fly ash. This water must continue to be routed to the Primary Ash Pond as there is no other vacuum source available onsite to remove fly ash from the unit and no other ponds are large enough to treat these surges of water or receive any potential CCR carryover. Alternative capacity would need to be designed, permitted, and installed. Off-site alternative capacity would include development of on-site temporary tanks to support transport of sluice material offsite for disposal. Refer to the discussion below for a more detailed evaluation on the development of alternative capacity.

CCR Wastestreams	Estimated Average Flow (MGD)	Alternative Disposal Capacity Currently Available? YES/NO	Details
Fly Ash Sluice	Intermittent	NA	The sluicing system is used as a back-up to the dry system during maintenance of that equipment or to empty the silos for maintenance at those locations. IPGC will cease sluicing fly ash to the Primary Ash Pond by April 11, 2021.

IPGC evaluated the following on-site and off-site alternative capacity options for these CCR wastestreams:

- Bottom ash sluice (2.3 MGD):
  - On-site alternative capacity is currently not available and would need to be developed. The Coal Pile Runoff Pond, Cooling Basin, Lake Jake, landfill ponds, Secondary Pond, and Construction Runoff Pond are not CCR surface impoundments and cannot receive CCR material.
  - Development of on-site alternative capacity would require the design, permitting, and installation of a new treatment system including CCR ponds, clarifiers, and/or storage tank(s), to provide the necessary retention time to meet the NPDES permit limits. The environmental permitting would include a modification to the current individual NPDES permit (to allow for the rerouting of this wastestream to another outfall), a general NPDES stormwater construction permit (includes threatened and endangered species and historic preservation assessments), a construction & operating permit under the Illinois CCR rule (35 IAC 845), and a Stormwater Pollution Prevention Plan (SWPPP) at a minimum which would require a minimum of three years to implement.
  - Off-site alternative capacity is currently not available and would need to be developed. Developed off-site alternative capacity would consist of both temporary on-site wet storage (frac tanks) and off-site transportation via tanker trucks. With an average daily flow of 2.3 MGD of sluice water, approximately 110 frac tanks and 307 daily tanker trucks (~7,500 gallons per truck to maintain DOT weight restrictions) would be required, if a local publicly owned treatment works (POTW) could be identified to receive it. The daily tanker truck traffic would result in increased potential for safety and noise impacts and further increases in fugitive dust, greenhouse gas emissions and carbon footprint which may require a Prevention of Significant Deterioration (PSD) permit and modification under the Clean Air Act Permit Program if the calculated increases in emissions are over the PSD limits. Setting up

arrangements for a local POTW to accept the wastewater would prove to be difficult since this amount of wastewater would most likely upset their treatment systems causing them to exceed their NPDES discharge limits. The potential for leaks/spills from the tank system or transportation of the wastewater offsite does exist. Furthermore, the temporary wet storage needed to accommodate off-site disposal would require reconfiguration, design, installation, and associated environmental permitting which would require a minimum of two years to implement. For all of these reasons, IPGC has determined that offsite disposal is not feasible for these flows at Newton.

- Dry fly ash (Approx. 27,500 tons/year handled dry in 2019):
  - Limited on-site alternative capacity is currently available, therefore additional on-site capacity would need to be developed.
  - On-site alternative capacity would require the design, permitting, and installation of a new CCR unit or improvements to the existing inactive landfill cell (Ash Landfill 3, which must meet the criteria for a new CCR landfill and collect the necessary groundwater data before being placed into service). The environmental permitting would include a general NPDES stormwater construction permit (includes threatened and endangered species and historic preservation assessments), a construction & operating permit under the Illinois CCR rule (35 IAC 845), and a SWPPP at a minimum. Based on our experience with environmental permitting, this effort could require three to four years.
  - Off-site alternative capacity is currently not available and would need to be developed. Developed off-site alternative capacity for fly ash would consist of off-site transportation to a contracted landfill. The fly ash is normally conditioned (@ 10% moisture) in an on-site pug mill due to fugitive dusting concerns. This low-sulfur Powder River Basin Class C fly ash develops cementitious characteristics when conditioned with water rather quickly. Because of this, off-site transportation must be limited to less than a one-hour haul time, or within 40 miles of the station, to prevent the fly ash from setting up and hardening and causing adverse disposal / unloading issues at the offsite landfill. There is one offsite landfill within approximately 40 miles of the station (see Figure 2 in Appendix A) who has confirmed they cannot accept Newton's fly ash. Off-site alternative capacity would consist of off-site transportation utilizing approximately 6 trucks daily. The daily truck traffic would result in increased potential for safety and noise impacts and further increases in fugitive dust, greenhouse gas emissions and carbon footprint which may require a PSD permit and modification under the Clean Air Act Permit Program if the calculated increases in emissions are over the PSD limits.

- Fly Ash Vacuum (Hydrovactor) (1.4 MGD):
  - Similar to the Bottom Ash Sluice flows, development of on-site alternative capacity would require the design, permitting, and installation of a new treatment system including CCR ponds, clarifiers, and/or storage tank(s), to provide the necessary retention time to meet the NPDES permit limits as well as necessary volume to allow operation of the cyclone separators. The environmental permitting would require a minimum of three years to implement.
  - Developed off-site alternative capacity would consist of both temporary on-site wet storage (frac tanks) and off-site transportation via tanker trucks. With an average daily flow of 1.4 MGD of sluice water, approximately 67 frac tanks and 187 daily tanker trucks (~7,500 gallons per truck to maintain DOT weight restrictions) would be required, if a local POTW could be identified to receive it. The daily truck traffic would result in increased potential for safety and noise impacts and further increases in fugitive dust, greenhouse gas emissions and carbon footprint which may require a PSD permit and modification under the Clean Air Act Permit Program if the calculated increases in emissions are over the PSD limits. Setting up arrangements for a local POTW to accept the wastewater would still prove to be difficult since this amount of wastewater would most likely upset their treatment systems causing them to exceed their NPDES discharge limits. The potential for leaks/spills from the tank system or transportation of the wastewater offsite does exist. Furthermore, the temporary wet storage needed to accommodate off-site disposal would require reconfiguration, design, installation, and associated environmental permitting which would require a minimum of two years to implement. For all of these reasons, IPGC has determined that offsite disposal is not feasible for these flows at Newton.

As stated previously, because IPGC has elected to pursue the option to permanently cease coal-fired operation of the remaining boiler at the station by no later than July 17, 2027, developing alternative disposal capacity is “illogical,” to use EPA’s words, and also counterproductive to the work to cease coal-fired operation of the boiler and close the impoundment. As long as IPGC continues to wet handle the ash materials, there are no other onsite CCR impoundments available to receive and treat these flows and it is not feasible to dispose of the wet-handled material offsite. As EPA explained in the preamble of the 2015 rule, it is not possible for sites that sluice CCR material to an impoundment to eliminate the impoundment and dispose of the material offsite. *See* 80 Fed. Reg. 21,301, 21,423 (Apr. 17, 2015) (“[W]hile it is possible to transport dry ash off-site to [an] alternate disposal facility that is simply not feasible for wet-generated

CCR. Nor can facilities immediately convert to dry handling systems.”). As a result, the conditions at Newton satisfy the demonstration requirement in § 257.103(f)(2)(i).

Consequently, in order to continue to operate and generate electricity, Newton must continue to use the Primary Ash Pond to manage the CCR wastestreams discussed above. Accordingly, the dry fly ash materials that cannot be sold must continue to be placed in either the Newton Primary Ash Pond or in the limited space available in the onsite CCR landfill due to lack of alternative capacity both on and off-site.

3.3 Non-CCR Wastestreams

IPGC evaluated each non-CCR wastestream placed in the Primary Ash Pond at Newton. For the reasons discussed below in Table 3-2, each of the following non-CCR wastestreams must continue to be placed in the Primary Ash Pond due to lack of alternative capacity both on and off-site.

Table 3-2: Newton Non-CCR Wastestreams

Non-CCR Wastestreams	Estimated Average Flow (MGD)	Alternative Disposal Capacity Currently Available? YES/NO	Details
Unit 1 Oil Water Separator	0.01	NO	Currently, alternative capacity is not available nor is there a feasible option for all these wastestreams as discussed below. On-site alternative capacity would need to be designed, permitted, and installed. Off-site alternative capacity would include development of on-site temporary tanks and transporting of this sluice material offsite for disposal.
Wastewater Sump (including Air Heater Wash, Boiler wash, other non-chemical metal cleaning wastewaters, ash hopper overflow, boiler sumps, boiler blowdown, and miscellaneous plant drains)	3.35	NO	
Water Treatment Building Sump (including microfilter backwash, RO Reject, demineralizer regeneration flows, condensate polisher regeneration flows, and precoat sump)	0.09	NO	
Stormwater (including Lake Jake and Coal Pile Runoff Pond [including Rotary Car Dumper Sump and Coal handling equipment wash water] Overflow)	Intermittent (7.43 for 10-year, 24-hour storm)	NO	

IPGC evaluated on-site and off-site alternative capacity options for these non-CCR wastestreams. The existing non-CCR impoundments onsite include:

- The Coal Pile Runoff Pond, which is undersized to provide full treatment of the flows currently routed to it and does not have a permitted outfall but only forwards flow to the Primary Ash Pond

- The Cooling Basin, Lake Jake, and the Construction Runoff Pond, which are only permitted to receive and discharge non-contact cooling water or site stormwater
- The landfill ponds, which receive stormwater runoff from the site landfills, are located approximately 1 mile away from the end of the current piping routed to the Primary Ash Pond
- The Secondary Pond, which currently only receives overflow from the Primary Ash Pond and is located approximately 1.25 miles away from the end of the current piping routed to the Primary Ash Pond

Development of on-site alternative capacity would require the design, permitting, and installation of a new treatment system including the addition of sumps, pumps, power supplies, and permit modifications to reroute the flows to new or existing non-CCR ponds, clarifiers, and/or storage tank(s) to provide the necessary retention time for TSS removal to meet the NPDES permit limits. The environmental permitting would include a modification to the current individual NPDES permit (to allow for the rerouting of these wastestreams to another outfall), general NPDES stormwater construction permit (includes threatened and endangered species and historic preservation assessments), a construction & operating permit, and a SWPPP at a minimum which would require a minimum of three years to implement.

Development of off-site alternative capacity would consist of both temporary on-site wet storage (frac tanks) and off-site transportation via tanker trucks assuming a local POTW could be identified to receive these streams. The required daily frac tanks and tanker trucks (~7,500 gallons per truck to maintain DOT weight restrictions) for each wastestream during each sluicing event is provided in Table 3-3. The daily tanker truck traffic would result in increased potential for safety and noise impacts and further increases in fugitive dust, greenhouse gas emissions and carbon footprint which may require a PSD permit and modification under the Clean Air Act Permit Program if the calculated increases in emissions are over the PSD limits. Setting up arrangements for a local POTW to accept this wastewater could prove to be difficult if this amount of wastewater would upset their treatment systems, causing them to exceed their NPDES discharge limits. IPGC is continuing to have discussions with local POTW's to determine if they have the capacity and the infrastructure to handle these daily volumes of wastewater. This will also include efforts to characterize the wastestreams. IPGC will update EPA in forthcoming progress reports if offsite disposal capacity becomes available. The potential for leaks/spills from the tank system or transportation of the wastewater offsite does also exist. Furthermore, the temporary wet storage needed to accommodate off-site disposal would require reconfiguration, design, installation, and associated environmental permitting which would require a minimum of two years to implement. For all of these reasons, IPGC has determined that offsite disposal is not feasible for these flows at Newton at this time.

Table 3-3: Non-CCR Wastestream Offsite Disposal

Non-CCR Wastestreams	Estimated Flow (MGD)	No. of Frac Tanks required (21,000 gallons each)	No. of Trucks required per day (7,500 gallons each)
Unit 1 Oil Water Separator	0.01	1	2
Wastewater Sump	3.35	160	447
Water Treatment Building Sump	0.09	5	12
Stormwater	0 – 7.43	NA	0 - 997
	Total	**166**	**461 – 1,458**

As stated previously, because IPGC has elected to pursue the option to permanently cease the use of the remaining coal fired boiler at the station by no later than July 17, 2027, developing alternative disposal capacity is "illogical," to use EPA's words, and also counterproductive to the work to cease coal-fired operation of the boiler and close the impoundment. There is currently no available infrastructure at the plant to support reroute of these flows. For the reasons discussed above, each of the non-CCR wastestreams must continue to be placed in the Primary Ash Pond due to lack of alternative capacity both on and off-site. Consequently, in order to continue to operate and generate electricity, Newton must continue to use the Primary Ash Pond to manage the non-CCR wastestreams discussed above.

4.0 RISK MITIGATION PLAN

To demonstrate that the criteria in § 257.103(f)(2)(ii) has been met, IPGC has prepared and attached a Risk Mitigation Plan for the Newton Primary Ash Pond (see Attachment 1). Per § 257.103(f)(2)(v)(B), this Risk Mitigation Plan is only required for the specific CCR Unit(s) that are the subject of this demonstration.

5.0 DOCUMENTATION AND CERTIFICATION OF COMPLIANCE

In the Part A rule preamble, EPA reiterates that compliance with the CCR rule is a prerequisite to qualifying for an alternative closure extension, as it "provides some guarantee that the risks at the facility are properly managed and adequately mitigated." 85 Fed. Reg. at 53,543. EPA further stated that it "must be able to affirmatively conclude that facility meets this criterion prior to any continued operation." 85 Fed. Reg. at 53,543. Accordingly, EPA "will review a facility's current compliance with the requirements governing groundwater monitoring systems." 85 Fed. Reg. at 53,543. In addition, EPA will also "require and examine a facility's corrective action documentation, structural stability documents and other pertinent compliance information." 85 Fed. Reg. at 53,543. Therefore, EPA is requiring a certification of compliance and specific compliance documentation be submitted as part of the demonstration. 40 C.F.R. § 257.103(f)(2)(v)(C).

The Newton facility includes two CCR units: the Primary Ash Pond that is the subject of this demonstration, and CCR Landfill 2. To demonstrate that the criteria in § 257.103(f)(2)(iii) has been met, IPGC is submitting the following information as required by § 257.103(f)(2)(v)(C):

5.1 Owner's Certification of Compliance - § 257.103(f)(2)(v)(C)(1)

I hereby certify that, based on my inquiry of those persons who are immediately responsible for compliance with environmental regulations for Newton, the facility is in compliance with all of the requirements contained in 40 C.F.R. Part 257, Subpart D – Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments. The Newton CCR compliance website is up-to-date and contains all the necessary documentation and notification postings.

On behalf of IPGC:

Cynthia E Vodopivec

Cynthia Vodopivec
VP - Environmental Health & Safety
November 25, 2020

5.2 Visual representation of hydrogeologic information - § 257.103(f)(2)(v)(C)(2)

Consistent with the requirements of § 257.103(f)(2)(v)(C)(2)(i) – (iii), IPGC has attached the following items to this demonstration:

- Map(s) of groundwater monitoring well locations in relation to the CCR units (see Attachment 2 for the Primary Ash Pond and Figure 2 of Attachment 6 for CCR Landfill 2)
- Well construction diagrams and drilling logs for all groundwater monitoring wells (see Attachment 3 for the Primary Ash Pond and CCR Landfill 2)
- Maps that characterize the direction of groundwater flow accounting for seasonal variations (see Attachment 4 for the Primary Ash Pond and Appendix D of Attachment 6 for CCR Landfill 2)

5.3 Groundwater monitoring results - § 257.103(f)(2)(v)(C)(3)

Tables summarizing constituent concentrations at each groundwater monitoring well through the first 2020 semi-annual monitoring period are included as Attachment 5. Samples were taken for the second 2020 semi-annual monitoring period, but results are still under review.

5.4 Description of site hydrogeology including stratigraphic cross-sections - § 257.103(f)(2)(v)(C)(4)

A description of the site hydrogeology for the Primary Ash Pond, stratigraphic cross-sections of the site, and the Newton Hydrogeologic Monitoring Plan are included as Attachment 6. See Section 2 of the Hydrogeologic Monitoring Plan for a comprehensive discussion of site hydrogeology and Appendix A for geologic cross sections.

5.5 Corrective measures assessment - § 257.103(f)(2)(v)(C)(5)

For the Primary Ash Pond, background sampling began in late 2015 and continued for eight consecutive quarters. The first semiannual detection monitoring samples were collected in November 2017. These samples, and those collected since, have been analyzed and potential SSIs were identified for calcium, chloride, fluoride, and sulfate (all Appendix III constituents). However, successful Alternate Source Demonstrations were completed in January 2019, July 2019, October 2019, April 2020, and October 2020 and are included as part of Attachment 1 (Risk Mitigation Plan). The Newton Primary Ash Pond remains in detection monitoring, with no exceedances of Appendix III parameters. Accordingly, an assessment of corrective measures is not currently required at the site. Newton will continue to conduct groundwater monitoring in accordance with all state and federal requirements.

For CCR Landfill 2, background sampling began in late 2015 and continued for eight consecutive quarters. The first semiannual detection monitoring samples were collected in November 2017. These samples, and those collected since, have been analyzed and potential SSIs were identified for boron, calcium, chloride, fluoride, sulfate, and total dissolved solids (all Appendix III constituents). However, successful Alternate Source Demonstrations were prepared for the CCR Landfill 2 in April 2018, January 2019, July 2019, October 2019, April 2020, and October 2020 and are included as part of Attachment 5. CCR Landfill 2 remains in detection monitoring, with no exceedances of Appendix III parameters. Accordingly, an assessment of corrective measures is not currently required at the site. Newton will continue to conduct groundwater monitoring in accordance with all state and federal requirements.

5.6 Remedy selection progress report - § 257.103(f)(2)(v)(C)(6)

As noted above, an assessment of corrective measures and the resulting selection of remedy are not currently required for the Primary Ash Pond or CCR Landfill 2.

5.7 Structural stability assessment - § 257.103(f)(2)(v)(C)(7)

Pursuant to § 257.73(d), the initial structural stability assessment for the Primary Ash Pond was prepared in October 2016 and is included as Attachment 7. Periodic structural stability assessments are not required for landfills.

5.8 Safety factor assessment - § 257.103(f)(2)(v)(C)(8)

Pursuant to § 257.73(e), the initial safety factor assessment for the Primary Ash Pond was prepared in October 2016 and is included as Attachment 8. Periodic safety factor assessments are not required for landfills.

6.0 DOCUMENTATION OF CLOSURE COMPLETION TIMEFRAME

To demonstrate that the criteria in § 257.103(f)(2)(iv) has been met, "the owner or operator must submit the closure plan required by § 257.102(b) and a narrative that specifies and justifies the date by which they intend to cease receipt of waste into the unit in order to meet the closure deadlines. The closure plan for the Primary Ash Pond, along with an addendum, is included as Attachment 9.

In order for a CCR surface impoundment over 40 acres to continue to receive CCR and non-CCR wastestreams after the initial April 11, 2021 deadline, the coal-fired boiler(s) at the facility must cease operation and the CCR surface impoundment must complete closure no later than October 17, 2028. As discussed below, Newton will begin construction of the Primary Ash Pond closure by July 17, 2024, the remaining boiler will cease coal-fired operation no later than July 17, 2027, and Newton will cease placing wastestreams into the Primary Ash Pond by September 17, 2027, in order for closure to be completed by this deadline.

Table 6-1 is included below to summarize the major tasks and estimated durations associated with closing the Primary Ash Pond in place. These durations are consistent with the durations experienced with the closure of approximately 500 acres of other CCR impoundments already completed by IPGC and its affiliates to date as noted below:

- Baldwin Fly Ash Pond System – 230 acres closed in-place with an approximate 30-month construction schedule
- Hennepin West Ash Ponds System – 35 acres closed in-place with an approximate 24-month construction schedule (includes closure by removal of an adjacent 6-acre settling pond and installing a sheet pile wall)
- Hennepin East Ash Ponds 2 and 4 – 25 acres closed in-place with an approximate 6-month construction schedule
- Coffeen Ash Pond 2 – 60 acres closed in-place with an approximate 24-month construction schedule
- Duck Creek Ash Ponds 1 and 2 – 130 acres closed in-place with an approximate 24-month construction schedule

Each CCR impoundment closure indicated above utilized a closely coordinated passive or gravity dewatering method, which consisted of the use of trenches excavated to lower the phreatic surface in portions of the impoundment to obtain a stable ash surface to permit the safe construction of the final cover system. The phreatic water in the trenches flows by gravity to sumps constructed within the impoundment.

The major benefit associated with this passive or gravity dewatering method is that the sumps are designed to provide holding time to allow the TSS to settle within the impoundment prior to discharge (an active dewatering method with wells would result in potential discharges of unsettled TSS). After solids settling, the water is discharged through the NPDES outfall in compliance with permitted limits.

Construction progressed sequentially as the dewatering of an area stabilized the ash surface. The CCR was graded to subgrade level, then overlain with the compacted clay layers and/or geomembrane liners. Vegetative soil cover was then placed on top of the infiltration layer. As each section of the impoundment was closed, this sequencing progressed to the completion of the pond closure. A similar process will be utilized to close the Newton Primary Ash Pond in order to allow the final open section of the impoundment to be large enough for the impoundment to remain in operation until the pond ceases the receipt of waste. This would provide sufficient time for closure to be completed by October 17, 2028.

The first construction effort will involve modifying the pond operations by relocating the influent lines, minimizing the pond water levels, and isolating flow to a smaller portion of the current 404-acre impoundment that can be closed during the last two construction seasons. The smaller active portion of the pond will remain in operation while IPGC begins dewatering and closing the impoundment as described above. This reduction in footprint may require the addition of chemical feeds to provide adequate treatment but that has not been the case at our other sequenced closures. This approach simultaneously allows for continued operation of the plant to maintain generating capacity for the MISO markets and minimizes the risk to the environment both by minimizing the pond size and the potential for any impacts to groundwater and by opening up a significant portion of the remaining impoundment to allow for dewatering, grading, and closure (in Phase 1).

Table 6-1 provides estimates for the durations required to close a portion of the pond footprint after the date noted to begin construction of closure (Phase 1), as well as the current estimates for the closure of the active area (Phase 2, remaining 40-50 acres). In order to dewater the impoundment, IPGC will likely release pond water through the existing Outfall 001.

Table 6-1: Newton Primary Ash Pond Closure Schedule

Action	Estimated Timeline (Months)
Spec, bid, and Award Engineering Services for CCR Impoundment Closure	3
Finalize CCR unit closure plan and seek IEPA approval for CCR unit closure	12

Action	Estimated Timeline (Months)
Obtain environmental permits (based on IEPA approval of closure plan): • State Waste Pollution Control Construction/Operating Permit • NPDES Industrial Wastewater Permit Modification (*modification would be required to allow the associated ponded and subsurface free liquids generated before the pond closure to be discharged to Waters of the US and to allow reconfiguration of the various wastestreams to either other NPDES-permitted outfalls or newly-constructed NPDES-permitted outfalls*) • General NPDES Permit for Storm Water Discharges from Construction Site Activities and Storm Water Pollution Prevention Plan (SWPPP) • Proposed 35 Ill. Admin Code 845 operating permit application is due NLT September 2021. Construction permit application is anticipated to be due NLT July 2022.	21
Spec, bid, and Award Construction Services for CCR Impoundment Closure	3
Begin Construction of Closure	July 17, 2024
Minimize Active Area of Impoundment / Dewater Phase 1 Area	9
Regrade CCR Material in Phase 1 Area	24
Install Cover System – Phase 1 Area*	18
Establish Vegetation – Phase 1 Area**	2
Cease Coal-Fired Operations of the Six Boilers onsite (No Later Than)	July 17, 2027
Begin Dewatering Impoundment – Phase 2 Area	2
Cease Placement of Waste (No Later Than, allowing for plant cleanup and dredging of impoundments following coal pile and plant closure)	September 17, 2027
Continue Dewatering Impoundment – Phase 2 Area	1
Regrade CCR Material – Phase 2 Area	6
Install Cover System – Phase 2 Area	5

Action	Estimated Timeline (Months)
Establish Vegetation, Perform Site Restoration Activities, Complete Closure, and Initiate Post-Closure Care**	2
Total Estimated Time to Complete Closure	90 months
Date by Which Closure Must be Complete	October 17, 2028

* Activity expected to overlap with grading operations, finishing 2 months after grading is completed.

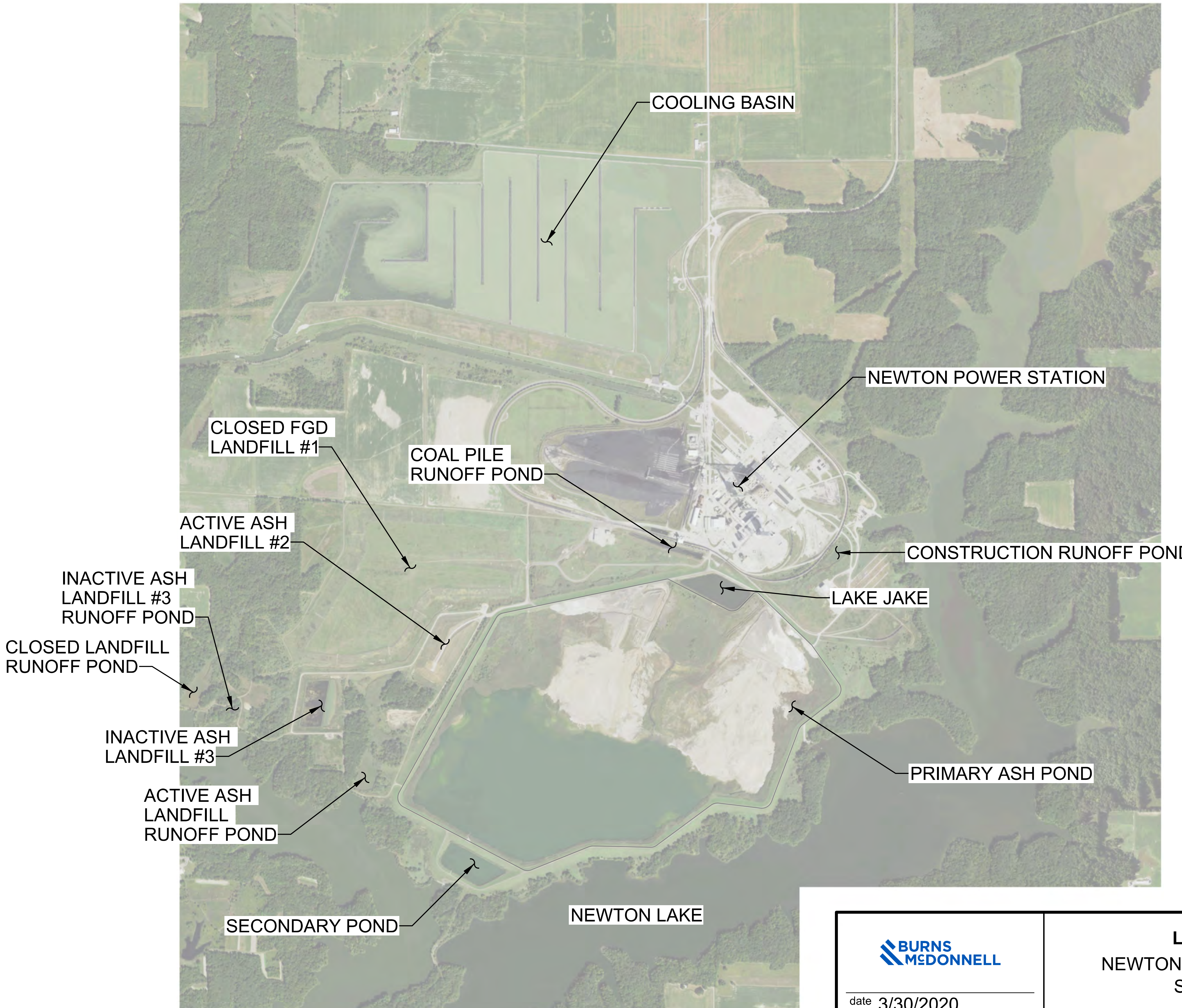
** Activity expected to overlap with cover system installation, finishing 1 month after cover installation is completed.

7.0 CONCLUSION

Based upon the information included in and attached to this demonstration, IPGC has demonstrated that the requirements of 40 C.F.R. § 257.103(f)(2) are satisfied for the 404-acre Primary Ash Pond at Newton. This CCR surface impoundment is needed to continue to manage the CCR and non-CCR wastestreams identified in Section 3.2 and 3.3 above, is larger than 40 acres, the remaining boiler at the station will cease coal-fired operation no later than July 17, 2027, and the Primary Ash Pond will be closed by the October 17, 2028, deadline. Therefore, this CCR unit qualifies for the site-specific alternative deadline for the initiation of closure authorized by 40 C.F.R. § 257.103(f)(2).

Therefore, it is requested that EPA approve IPGC's demonstration and authorize the Primary Ash Pond at Newton to continue to receive CCR and non-CCR wastestreams notwithstanding the deadline in § 257.101(a)(1) and to grant the alternative deadline of October 17, 2028, by which to complete closure of the impoundment.

APPENDIX A – SITE PLAN AND NEARBY LANDFILLS



PRELIMINARY - NOT FOR CONSTRUCTION

0 1500' 3000'
SCALE IN FEET

N

BURNS McDONNELL

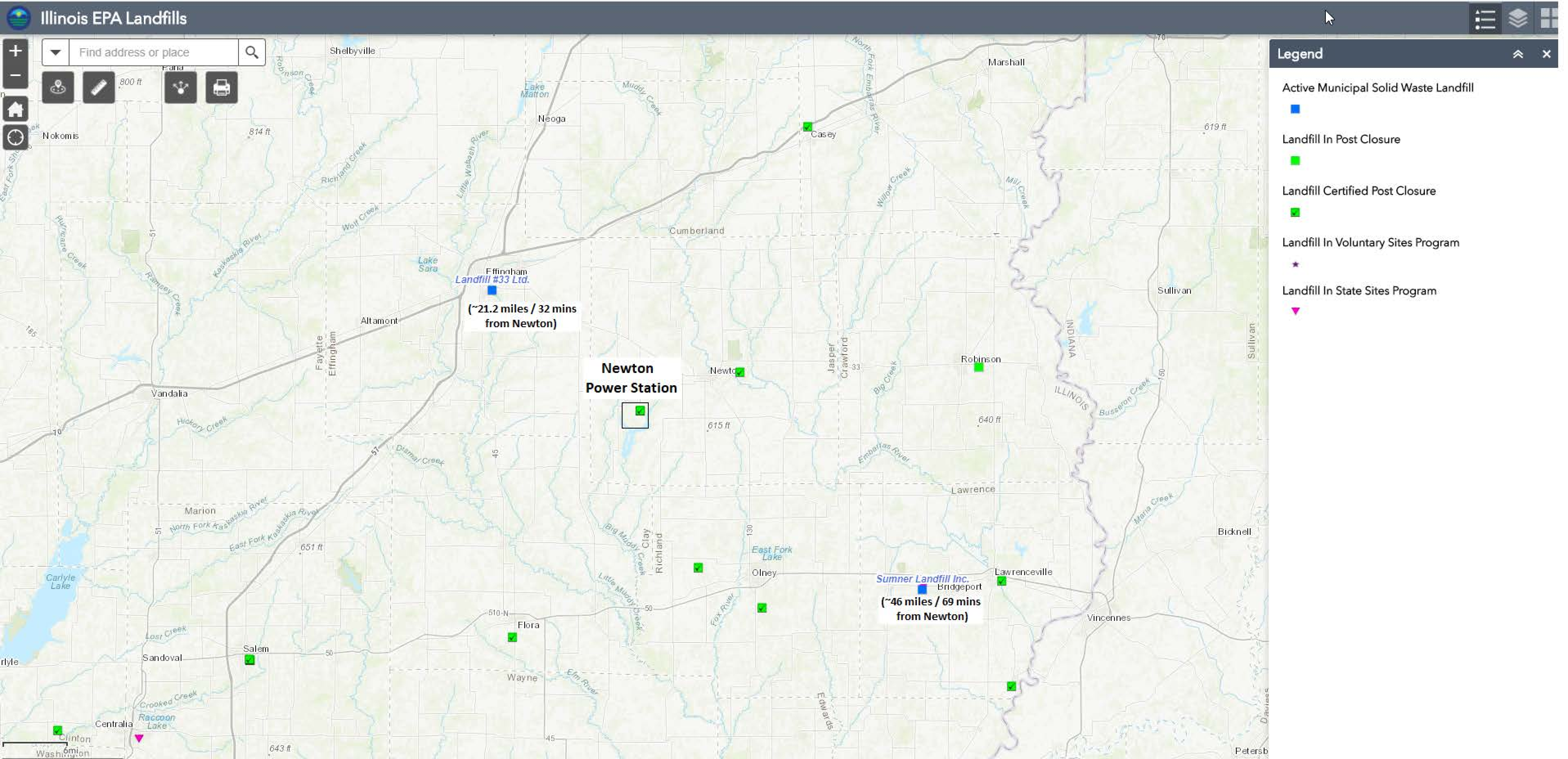
date 3/30/2020
designed A, MYERS

LUMINANT
NEWTON POWER STATION
SITE PLAN

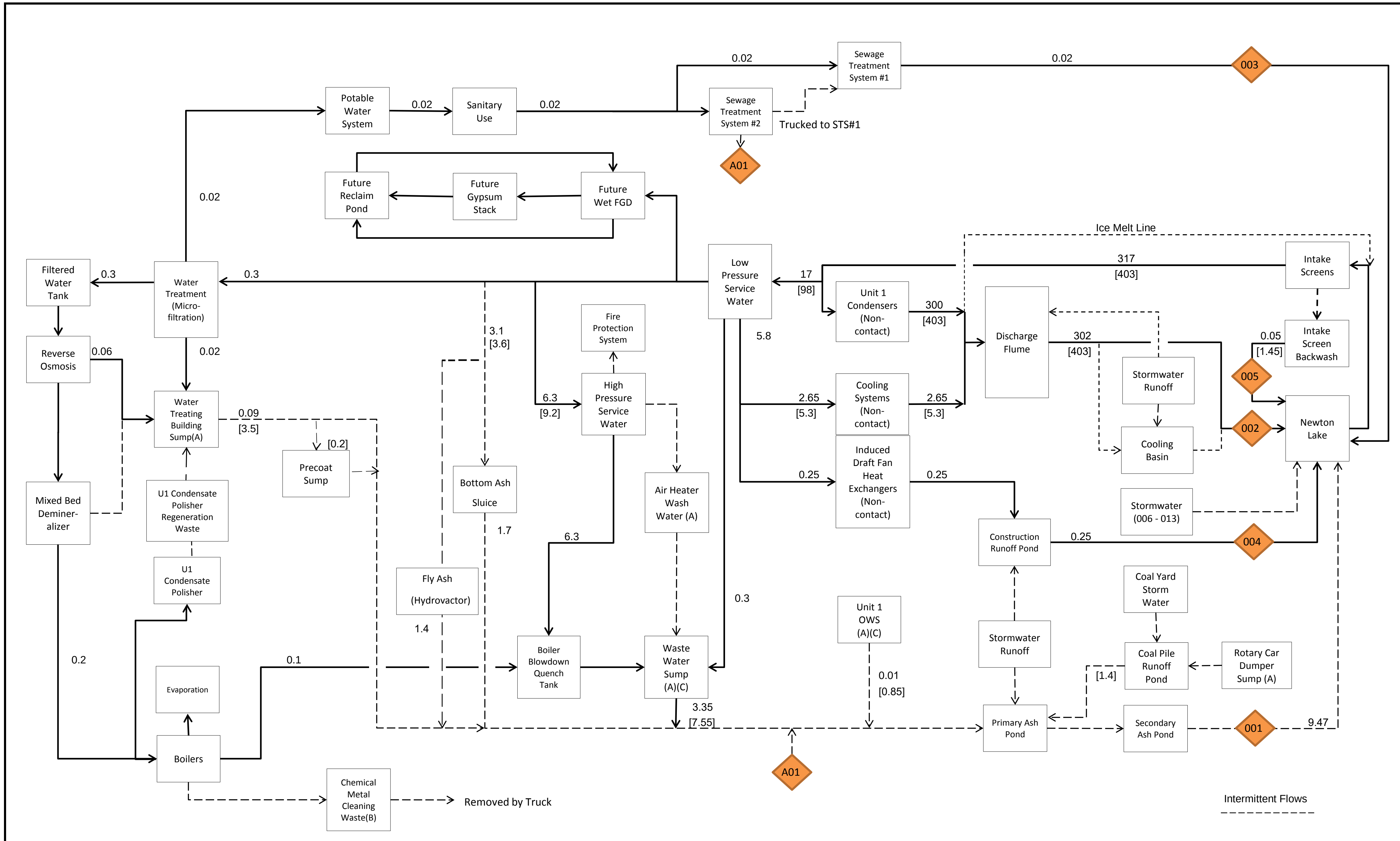
project 122702
contract -
dwg **FIGURE 1**

11/23/2020

\\bmcd\dfs\Clients\ENR\VistraEnergy\122702_ALTuseDisposal\Design\Civil\Dwgs\Sketches\Newton_Figure1.dgn


Illinois EPA Landfills
Find address or place
Legend
Active Municipal Solid Waste Landfill
Landfill In Post Closure
Landfill Certified Post Closure
Landfill In Voluntary Sites Program
Landfill In State Sites Program
Landfill #33 Ltd.
(~21.2 miles / 32 mins from Newton)
Newton Power Station
Sumner Landfill Inc.
(~46 miles / 69 mins from Newton)
Shelbyville
Neoga
Casey
Marshall
Nokomis
Cumberland
Effingham
Altamont
Vandalia
Newton
Robinson
Sullivan
Lawrence
Marion
Olney
Lawrenceville
Bridgeport
Vincennes
Bicknell
Flora
Salem
Sandoval
Wayne
Centralia
Clinton
Carlyle Lake
Lake Sara
Lake Mattoon
East Fork Lake
Raccoon Lake
INDIANA
ILLINOIS

APPENDIX B – WATER BALANCE DIAGRAM



Notes:

1 Flows shown as: Average [Maximum]

2 Flow units = Million Gallons per Day

3 20 hours maximum Ash Sluicing Flow from 1 x 3000 gpm Ash Sluicing Pump Capacity.

4 Average Fly Ash Sluicing Pump Flow 8 hours/day + bottom ash 8 hours/day Ash Sluicing Pump Capacity based on typical operation (2020)

5 Contributors to Maximum Circulating Water Flow from Engineering Data Book. Flow assumes that the 4 x 70,000 gpm pumps are shared.

6 CCW HX service water flow, Screen Wash Pumps, LP Service Water Pumps, HP Service Water Pumps, Vertical Coal Yard Pumps, Oil Separator Sump Pumps, Waste Water Sump Pumps, Water Treatment Building Sump Pumps, Precoat Sump Pumps, from Engineering Data Book.

7 Source of average flows not otherwise indicated is the Newton ICR Water Balance, effective January 1, 2015.

8 Average Outfall 001 & 002 flow from DMR data 10/2018 through 2/2020, and 2/2017 through 2/2020, respectively.

9 Components representing the Water Treatment Plant Sump, Precoat Sump, Waste Water Sump, and Rotary Car Dumper Sump have been added to clarify how waste water streams are collected before discharge to the Ash Pond.

(A) Non-Chemical Metal Cleaning Includes:
Precipitator Cleaning
Boiler Fireside Cleaning
Economizer Cleaning
Air Heater Cleaning
Boiler Water Side Rinse Water
Condenser Tube Cleaning
Misc. Non-Chemical Cleaning

(B) Chemical Metal Cleaning Wastewater Includes:
Boiler Tube Cleaning
Condenser Tube Cleaning
Misc. Chemical Metal Cleaning

(C) Includes:
Soot Blower Thermal Drains
Ash Hopper Overflow
Ash Pit Sumps
Boiler House Floor Drains
Strainer Backwash
Misc. Contributory Flows

OWS Oil/Water Separator
SCR Selective Catalytic Reduction
U1 Unit 1
U2 Unit 2

Drawing Release Record

Rev	Date	Prepared	Reviewed	Approved	Purpose
A0	4-Sep-15	M. Heermann	M. Rosen	A. Baker	Initial Issue
A1	12-Oct-15	M. Heermann	M. Rosen	A. Baker	Incorporated Client Comments
A2	10-Nov-15	M. Cruz	M. Heermann	A. Baker	Incorporated Plant Comments
A3	26-Mar-20	T. Herry, SD			Record Revision, Renewal Revisions - from A. Green

Project No: 12160-162

Owner: DYNEGY

Engineer: Sargent & Lundy LLC

Dynegy

Effluent Limitation Guidelines Compliance Planning Study
Preliminary Water Balance - Newton

MSK-NEW-WB-001

ATTACHMENT 1 – RISK MITIGATION PLAN

RISK MITIGATION PLAN - 40 C.F.R. § 257.103(f)(2)(v)(B)

INTRODUCTION

To demonstrate that the criteria in 40 C.F.R. § 257.103(f)(2)(ii) has been met, Illinois Power Generating Company (IPGC) has prepared this Risk Mitigation Plan for the Newton Primary Ash Pond located in Newton, Illinois.

- EPA is requiring a risk mitigation plan to "address the potential risk of continued operation of the CCR surface impoundment while the facility moves towards closure of their coal-fired boiler(s), to be consistent with the court's holding in *USWAG* that RCRA requires EPA to set minimum criteria for sanitary landfills that prevent harm to either human health or the environment." 85 Fed. Reg. at 53,516, 53,548 (Aug. 28, 2020).

As required by § 257.103(f)(2)(v)(B), the Risk Mitigation Plan must describe the "measures that will be taken to expedite any required corrective action," and contain the three following elements:

- First, "a discussion of any physical or chemical measures a facility can take to limit any future releases to groundwater during operation." § 257.103(f)(2)(v)(B)(1). In promulgating this requirement, EPA explained that this "might include stabilization of waste prior to disposition in the impoundment or adjusting the pH of the impoundment waters to minimize solubility of contaminants and that this discussion should take into account the potential impacts of these measures on Appendix IV constituents." 85 Fed. Reg. at 53,548.

- Second, "a discussion of the surface impoundment's groundwater monitoring data and any found exceedances; the delineation of the plume (if necessary based on the groundwater monitoring data); identification of any nearby receptors that might be exposed to current or future groundwater contamination; and how such exposures could be promptly mitigated." § 257.103(f)(2)(v)(B)(2).

- Third, "a plan to expedite and maintain the containment of any contaminant plume that is either present or identified during continued operation of the unit." § 257.103(f)(2)(v)(B)(3). In promulgating this final requirement, EPA explained that "the purpose of this plan is to demonstrate that a plume can be fully contained and to define how this could be accomplished in the most accelerated timeframe feasible to prevent further spread and eliminate any potential for exposures." 85 Fed. Reg. at 53,549. In addition, EPA stated that "this plan will be based on relevant site data, which may include groundwater chemistry, the variability of local hydrogeology, groundwater elevation and flow rates, and the presence of any surface water features that would influence rate and direction of contamination movement. For example, based on the rate and direction of groundwater flow and potential for diffusion of the plume, this plan could identify the design and spacing of extraction wells necessary to prevent further downgradient migration of contaminated groundwater." 85 Fed. Reg. at 53,549.

Consistent with these requirements and guidance, IPGC plans to continue to mitigate the risks to human health and the environment from the Newton Primary Ash Pond as detailed in this Risk Mitigation Plan.

1 OPERATIONAL MEASURES TO LIMIT FUTURE RELEASES TO GROUNDWATER– 40 C.F.R. § 257.101(F)(2)(V)(B)(1)

The Newton Primary Ash Pond is a 404-acre CCR surface impoundment. Consistent with the requirements of the CCR rule, compliance documents on Newton's CCR public website reflect the characterization of the Primary Ash Pond as a single unit for purposes of groundwater monitoring and closure activities.

The Newton CCR surface impoundment receives CCR transport waters from bottom ash and economizer ash plus non-CCR process waters onsite before discharging to the Newton Cooling Pond via Outfall 001 in accordance with NPDES Permit No. IL0049191.

At the Newton Primary Ash Pond, none of the Appendix IV parameter have reported statistically significant levels (SSLs) above their respective Ground Water Protection Standards (GWPSs), as sampled and analyzed per the CCR surface impoundment's groundwater monitoring program. Therefore, Newton's current physical treatment operation adequately limits potential risks to human health and the environment during operation. Newton will continue this treatment process for the CCR surface impoundment until such time as closure is required per 40 CFR 257. The facility's current physical treatment process is discussed below, followed by a discussion of other treatment processes that could be implemented, as required per § 257.103(f)(2)(v)(B)(1).

1.1 CURRENT OPERATION OF PHYSICAL TREATMENT

Fly ash and economizer ash are normally captured dry and either hauled offsite for beneficial use or disposed of in the CCR surface impoundment. Therefore, during normal operations, fly ash transport waters are not conveyed to the CCR surface impoundment.

Also, as part of normal operations, bottom ash and economizer ash are transported through the sluice lines into the CCR surface impoundment where some of the bottom ash goes offsite for beneficial reuse. The CCR surface impoundment is also a wastewater treatment settling system which allows the solids to settle.

Therefore, since fly ash transport water is not normally conveyed to the CCR surface impoundment and some of the bottom ash solids are removed from the CCR surface impoundment, the current operation of Newton's CCR surface impoundment limits future releases to groundwater during operation, and consequently no potential safety impacts or exposure to human health or environmental receptors are expected to result.

If Appendix IV releases are discovered per the facility's groundwater monitoring program, IPGC will test, evaluate, and implement a chemical treatment method (i.e. pH adjustment, coagulation, precipitation, or other method as determined) for the Newton CCR Impoundment to limit potential risks to human health and the environment during operation.

2 GROUNDWATER IMPACTS, RECEPTORS, AND POTENTIAL EXPOSURE MITIGATION - 40 C.F.R. § 257.101(F)(2)(V)(B)(2)

The Newton Primary Ash Pond, with a footprint of approximately 404 acres (Figure 1), currently remains in detection monitoring. Any SSIs of Appendix III parameter concentrations have previously been addressed through alternate source demonstrations (ASDs) (see Attachment 1, 2019 Annual Groundwater Monitoring and Corrective Action Report, Newton Primary Ash Pond, Newton Power Station [Ramboll, 2020]. The latest ASD was completed in October 13, 2020, is attached to this risk mitigation plan; and, will be included in the 2020 Annual Groundwater Monitoring and Corrective Action Report, due in January 2021 (see Attachment 2). A summary of the detection monitoring program, including constituents with reported SSIs and ASD completions, are provided in Table 1.

Since there have been no SSL exceedances of GWPS(s) for any Appendix IV constituents attributable to the Primary Ash Pond to date, plume delineation has not been required. However, if one or more Appendix IV constituents are detected at SSLs above the GWPS(s), the nature and extent of the release would be characterized to delineate the contaminant plume. The existing conceptual site model and description of site hydrogeology provides site characterization data that will be used as the basis for executing supplemental plume delineation activities. A demonstration may also be made that a source other than the CCR unit caused the contamination, or that the SSL resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality (§257.95(g)(3)(ii)).

Receptors

For constituents of potential concern (COPCs) found in groundwater to pose a risk to human health or the environment, a complete exposure pathway must be present to a receptor with elevated concentrations of COPCs via that pathway.

Should a release of one or more Appendix IV parameters from the Newton Primary Ash Pond to groundwater occur in the future, the two primary risks to human health and environmental receptors are via impacted groundwater and surface water. Groundwater exposure would be via ingestion or dermal contact, both of which are likely an incomplete exposure pathway for the reasons discussed below. Impacted groundwater potentially migrating to nearby surface water bodies – specifically Newton Lake located east, south and southwest – is another potential exposure pathway; however, this is also likely incomplete for the reasons discussed below.

Ambient groundwater flow beneath the Primary Ash Pond is generally south to southwest towards Newton Lake. Although there are localized variations in groundwater flow directions beneath different areas of the ash pond – west, east and south - the overall flow direction is towards Newton Lake. The Uppermost Aquifer is confined within thin to moderately thick (3 to 17 ft), moderate to high permeability sand, silty sand, and sandy silt/clay units of the Mulberry Grove Member of the Glasford Formation. The geometric mean of the hydraulic conductivity for tested monitoring wells in the Uppermost Aquifer, excluding one outlier, is 2.5 x 10-4 cm/s. The horizontal hydraulic gradient beneath the impoundment is typically 0.007 ft/ft. Groundwater flow velocity beneath the Primary Ash Pond was 0.12 ft/day based on January and June 2017 groundwater contours (refer to the description of hydrogeology attached to the alternative closure demonstration letter).

There are no industrial, commercial or domestic use water wells located in a downgradient or cross-gradient groundwater flow direction relative to the Primary Ash Pond that are at risk of impacts from a release. Impacted groundwater potentially migrating to nearby surface water bodies - specifically Newton Lake located east, south and southwest – could be an exposure pathway, but does not pose a risk to human health as there are no surface water intakes within 2,500 feet of the Newton property line.

Since there have been no SSLs above the GWPS, there is no risk to ecological receptors located near the Newton Primary Ash Pond. If a release to groundwater were to occur, ecological receptors could potentially be exposed to COPCs through ingestion or direct contact with impacted groundwater; however, should any surface water or sediment come into contact with impacted groundwater, the risk of exposure is likely low due to expected attenuation and dilution.

Although current conditions do not pose a risk concern to human health or the environment, measures presented in the Contaminant Plume Containment Plan (Section 3.1 of this RMP) would address any future potential exposures and risks by containing potential groundwater impacts and mitigating impacts to potential receptors.

If one or more Appendix IV parameters are detected and confirmed in groundwater at a SSL above GWPS(s), and the SSL is not attributed to an alternate source, via an alternate source demonstration (ASD), the first steps to mitigating risk will involve the immediate implementation of source control, which, if necessary, could include installation and operation of a groundwater extraction well or recovery trench system. This immediate source control would allow for capture of impacted groundwater and prevention of further plume migration towards the principal potential receptors. Furthermore, to characterize the nature and extent of the release, plume delineation wells will be installed as necessary to define the magnitude and limits of the groundwater impacts.

Exposure Mitigation

Mitigation of future potential exposures to groundwater contamination from continued operation of the Primary Ash Pond is discussed in detail in the following section.

3 CONTAMINANT PLUME CONTAINMENT: OPTIONS EVALUATION AND PLAN - 40 C.F.R. § 257.101(F)(2)(V)(B)(3)

Appropriate corrective measure(s) to address future potential impacted groundwater associated with the Newton Primary Ash Pond are based on impacts to the Uppermost Aquifer. The Uppermost Aquifer is the Mulberry Grove Member, which typically consists of fine to coarse sand with varying amounts of clay, silt, and fine to coarse gravel. The portion of the Mulberry Grove Member at the site that is defined as a sand layer ranges in thickness from 3 to 17 ft with an average thickness of 8 ft and with only a few exceptions occurs between depths of 55 to 88 ft below ground surface. Overlying units consist predominantly of low permeability clays and silts with occasional and discontinuous lenses of silt, sand, and gravel (refer to the description of hydrogeology attached to the alternative closure demonstration letter).

If one or more Appendix IV parameters are detected and confirmed in groundwater at a SSL above GWPS(s), and the SSL is not attributed to an alternate source, via an alternate source demonstration (ASD), the first steps to mitigating risk will involve the immediate implementation of source control, which, if necessary, could include installation and operation of a groundwater extraction well or recovery trench system. This immediate source control would allow for capture of impacted groundwater and prevention of further plume migration towards the principal potential receptors. Furthermore, to characterize the nature and extent of the release, plume delineation wells will be installed as necessary to define the magnitude and limits of the groundwater impacts. If applicable, notifications will be made to all persons who own the land or reside on the land that directly overlies any part of the groundwater plume. Additional soil and groundwater data will be collected as necessary to support a Corrective Measures Assessment (CMA), which will be initiated within 90 days of detecting the SSL. Further discussion of short-term and long-term corrective measures is further discussed in Section 3.1.

Since there has been no release of Appendix IV parameters to groundwater above GWPS(s), which would trigger a CMA under 40 C.F.R. § 257.96 based on specific parameter concentrations and contaminant plume dimensions, several options are evaluated to address potential future plume containments. The evaluation criteria for assessing remedial options are the following: performance; reliability; ease of implementation; potential impacts of the remedies (safety, cross-media, and control of exposure to residual contamination); time required to begin and complete the remedy; and, institutional requirements that may substantially affect implementation of the remedy(s), such as permitting, environmental or public health requirements.

Although future potential source control measures (e.g. closure in place, closure by removal to on-site or off-site landfill, in-situ solidification/stabilization) to mitigate groundwater impacts are typically considered as part of a CMA process upon closure of the Newton Primary Ash Pond, the shorter-term options considered for mitigating groundwater impacts relative to a potential future release of one or more Appendix IV parameters at Newton are as follows:

- Groundwater Extraction
- Groundwater Cutoff Wall
- Permeable Reactive Barrier
- In-Situ Chemical Treatment
- Monitored Natural Attenuation (MNA)

These same groundwater remedial corrective measures will be evaluated for all Appendix IV constituents that present a future risk to human health or the environment.

<u>Groundwater Extraction</u>

This corrective measure includes installation of one or more groundwater pumping wells or trenches to control and extract impacted groundwater. Groundwater extraction captures and contains impacted groundwater and can limit plume expansion and/or off-site migration. Construction of a groundwater extraction system typically includes, but is not limited to, the following primary project components:

- Designing and constructing a groundwater extraction system consisting of a series of extraction wells or trenches located around the perimeter of the contaminant plume and operating at a rate to allow capture of CCR impacted groundwater.
- Designing a system to manage extracted groundwater, which may include modification to the existing NPDES permit, including treatment prior to discharge, if necessary.
- Ongoing inspection and maintenance of the groundwater extraction system.

Installation of a groundwater extraction system, whether wells or trenches, can be expedited with the assumption that there is a good conceptual site model (CSM) of the hydrogeological system around the CCR unit, groundwater flow and transport model, and aquifer testing. Upon notification of an SSL exceedance of a GWPS for one or more Appendix IV constituents, an aquifer test will be conducted, and groundwater model developed for designing a groundwater extraction system for optimization of contaminant plume capture.

A schematic of a typical groundwater extraction well is shown on Figure 2. Based on site specific hydrogeology and future potential plume width and depth, a groundwater extraction system would likely consist of one to three extraction wells with pitless adapter's manifolded together with HDPE conveyance pipe to a common tank or lined collection vault prior to treatment at the on-site wastewater treatment plant and discharge via the NPDES permitted outfall.

Groundwater Cutoff Wall

Vertical cutoff walls are used to control and/or isolate impacted groundwater. Low permeability cutoff walls can be used to prevent horizontal off-site migration of potentially impacted groundwater. Cutoff walls act as barriers to migration of impacted groundwater and can isolate soils that have been impacted by CCR to prevent contact with unimpacted groundwater. Cutoff walls are often used in conjunction with an interior pumping system to establish a reverse gradient within the cutoff wall. The reverse gradient imparted by the pumping system maintains an inward flow through the wall, keeping it from acting as a groundwater dam and controlling potential end-around or breakout flow of contaminated groundwater.

A commonly used cutoff wall construction technology is the slurry trench method, which consists of excavating a trench and backfilling it with a soil-bentonite mixture, often created with the soils excavated from the trench. The trench is temporarily supported with bentonite slurry that is pumped into the trench as it is excavated. Excavation for cutoff walls is conducted with conventional hydraulic excavators, hydraulic excavators equipped with specialized booms to extend their reach (*i.e.*, long-stick excavators), or chisels and clamshells, depending upon the depth of the trench and the material to be excavated.

Permeable Reactive Barrier

Chemical treatment via a Permeable Reactive Barrier (PRB) is defined as an emplacement of reactive materials in the subsurface designed to intercept a contaminant plume, provide a flow path through the reactive media, and transform or otherwise render the contaminant(s) into environmentally acceptable forms to attain remediation concentration goals downgradient of the barrier (EPRI, 2006).

As groundwater passes through the PRB under natural gradients, dissolved constituents in the groundwater react with the media and are transformed or immobilized. A variety of media have been used or proposed for use in PRBs. Zero-valent iron has been shown to effectively immobilize CCR constituents, including arsenic, chromium, cobalt, molybdenum, selenium and sulfate. Zero-valent iron has not been proven effective for boron, antimony, or lithium (EPRI, 2006).

System configurations include continuous PRBs, in which the reactive media extends across the entire path of the contaminant plume; and funnel-and-gate systems, where barrier walls are installed to control groundwater flow through a permeable gate containing the reactive media. Continuous PRBs intersect the entire contaminant plume and do not materially impact the groundwater flow system. Design may or may not include keying the PRB into a low-permeability unit at depth. Funnel-and-gate systems utilize a system of barriers to groundwater flow (funnels) to direct the contaminant plume through the reactive gate. The barriers, typically some form of cutoff wall, are keyed into a low-permeability unit at depth to prevent short circuiting of the plume. Funnel-and-gate design must consider the residence time to allow chemical reactions to occur. Directing the contaminant plume through the reactive gate can significantly increase the flow velocity, thus reducing residence time.

Design of PRB systems requires rigorous site investigation to characterize the site hydrogeology and to delineate the contaminant plume. A thorough understanding of the geochemical and redox characteristics of the plume is critical to assess the feasibility of the process and select appropriate reactive media. Laboratory studies, including batch studies and column studies using samples of site groundwater, are needed to determine the effectiveness of the selected reactive media at the site (EPRI, 2006).

This is a potential viable option for groundwater corrective measures, to be evaluated further, but is not a short-term solution that can be implemented expeditiously.

In-Situ Chemical Treatment

In-situ chemical treatment for inorganics are being tested and applied with increasing frequency. In-situ chemical treatment includes the targeted injection of reactive media into the subsurface to mitigate groundwater impacts. Inorganic contaminants are typically remediated through immobilization by reduction or oxidation followed by precipitation or adsorption (EPRI, 2006). Chemical reactants that have been applied or are in development for application in treating inorganic contaminants include ferrous sulfate, nanoscale zero-valent iron, organo-phosphorus nutrient mixture (PrecipiPHOS™) and sodium dithionite (EPRI, 2006). Zero-valent iron has been shown to effectively immobilize cobalt and molybdenum. Implementation of in-situ chemical treatment requires detailed technical analysis of field hydrogeological and geochemical conditions along with laboratory studies.

This is a potential viable option for groundwater corrective measures, to be evaluated further, but is not a short-term solution that can be implemented expeditiously.

Monitored Natural Attenuation (MNA)

Upon notification of a release of one or more Appendix IV parameter(s) to groundwater, MNA will be evaluated with site-specific characterization data and geochemical analysis as a long term remedial option, combined with source control measures, through application of the USEPA's tiered approach to MNA (USEPA 1999, 2007 and 2015):

1. Demonstrate that the area of groundwater impacts is not expanding.
2. Determine the mechanisms and rates of attenuation.
3. Determine that the capacity of the aquifer is sufficient to attenuate the mass of constituents in groundwater and that the immobilized constituents are stable and will not remobilize.
4. Design a performance monitoring program based on the mechanisms of attenuation and establish contingency remedies (tailored to site-specific conditions) should MNA not perform adequately.

MNA is not regarded as a short-term remedial option for contaminant plume containment, but as a potential long- term option following implementation of shorter term control measures.

3.1 Containment Plan

Based on the options evaluated for containment of a future potential groundwater contaminant plume originating from the Newton Primary Ash Pond for one or more Appendix IV constituents exceeding their GWPS(s), the most viable short-term option of those evaluated is a groundwater extraction or recovery trench system, which would allow for capture of impacted groundwater and prevention of further plume migration towards the principal receptor, which has been identified as Newton Lake to the south.

In circumstances where there is not an immediate concern of endangerment to human health or the environment, other longer-term corrective measures may be more viable and will be further evaluated at the Newton Primary Ash Pond.

Depending on the location, depth, and plume geometry of any future potential Appendix IV exceedances of GWPSs, the specific parameter(s) with exceedances, and distance from potential receptors, the other groundwater corrective measures discussed as part of the corrective options evaluation – groundwater cutoff wall, permeable reactive barrier, in-situ chemical treatment, and MNA – are all secondary remedial alternatives available for consideration following the current primary option of groundwater extraction for short-term application.

4 REFERENCES

Electric Power Research Institute (EPRI), 2006. Groundwater Remediation of Inorganic Constituents at Coal Combustion Product Management Sites, Overview of Technologies, Focusing on Permeable Reactive Barriers. Electric Power Research Institute, Palo Alto, California. Final Report 1012584, October 2006.

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USEPA, 1999. Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites. Directive No. 9200.U-17P. Washington, D.C.: EPA, Office of Solid Waste and Emergency Response.

USEPA, 2007. Monitored Natural Attenuation of Inorganic Contaminants in Ground Water, Volume 1 – Technical Basis for Assessment. EPA/600/R-07/139. National Risk Management Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, Ohio. October 2007.

USEPA, 2015. Use of Monitored Natural Attenuation for Inorganic Contaminants in Groundwater at Superfund Sites. Directive No. 9283.1-36. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. August 2015.

TABLES

Table 1 - Detection Monitoring Program Summary, Newton Primary Ash Ponc

Sampling Dates	Analytical Data Receipt Date	Parameters Collected	SSI(s) Appendix III	SSI(s) Determination Date	ASD Completion Date	CMA Completion / Status
November 17-18, 2017	December 5, 2017	Appendix III	Calcium (APW7, APW8, APW9, APW10) Chloride (APW7, APW9) Sulfate (APW8, APW10)	January 9, 2018	April 9, 2018	NA
May 18, 2018	July 9, 2018	Appendix III	Calcium (APW7, APW8, APW9, APW10) Chloride (APW7, APW9) Sulfate (APW8, APW10)	October 7, 2018	January 7, 2019	NA
August 17-18, 2018	October 8, 2018	Appendix III Greater than Background[1]	above confirmed	NA	NA	NA
November 9, 2018	January 16, 2019	Appendix III	Calcium (APW8, APW10) Fluoride (APW9) Sulfate (APW8, APW9, APW10)	April 15, 2019	July 15, 2019	NA
February 22, 2019	April 15, 2019	Appendix III	Calcium (APW8, APW10) Fluoride (APW7, APW9) Sulfate (APW7, APW8, APW9, APW10)	July 15, 2019	October 14, 2019	NA
August 22-23, 2019	October 28, 2019	Appendix III	Calcium (APW8, APW10) Chloride (APW8) Sulfate (APW7, APW8, APW9, APW10)	January 27, 2020	April 27, 2020	NA
February 4-5, 19, 2020	April 16, 2020	Appendix III	Calcium (APW7, APW8, APW9, APW10) Chloride (APW7, APW9) Sulfate (APW8, APW10)	July 14, 2020	TBD (October 2020)	NA
June 11, 2020	June 19, 2020	Appendix III Greater than Background[1]	Chloride (APW7, APW9)	NA	NA	NA

[O: RAB 9/11/20; C: EJT 9/16/20]

Notes:

CMA = Corrective Measures Assessment
NA = Not Applicable
TBD = To Be Determined
1. To confirm SSIs, as allowed by the Statistical Analysis Plan, groundwater samples were collected and analyzed for Appendix III parameters initially detected at concentrations greater than statistical background values in the preceding sampling event.

FIGURES

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

SITE AND WELL LOCATION MAP
NEWTON PRIMARY ASH POND
UNIT ID: 501

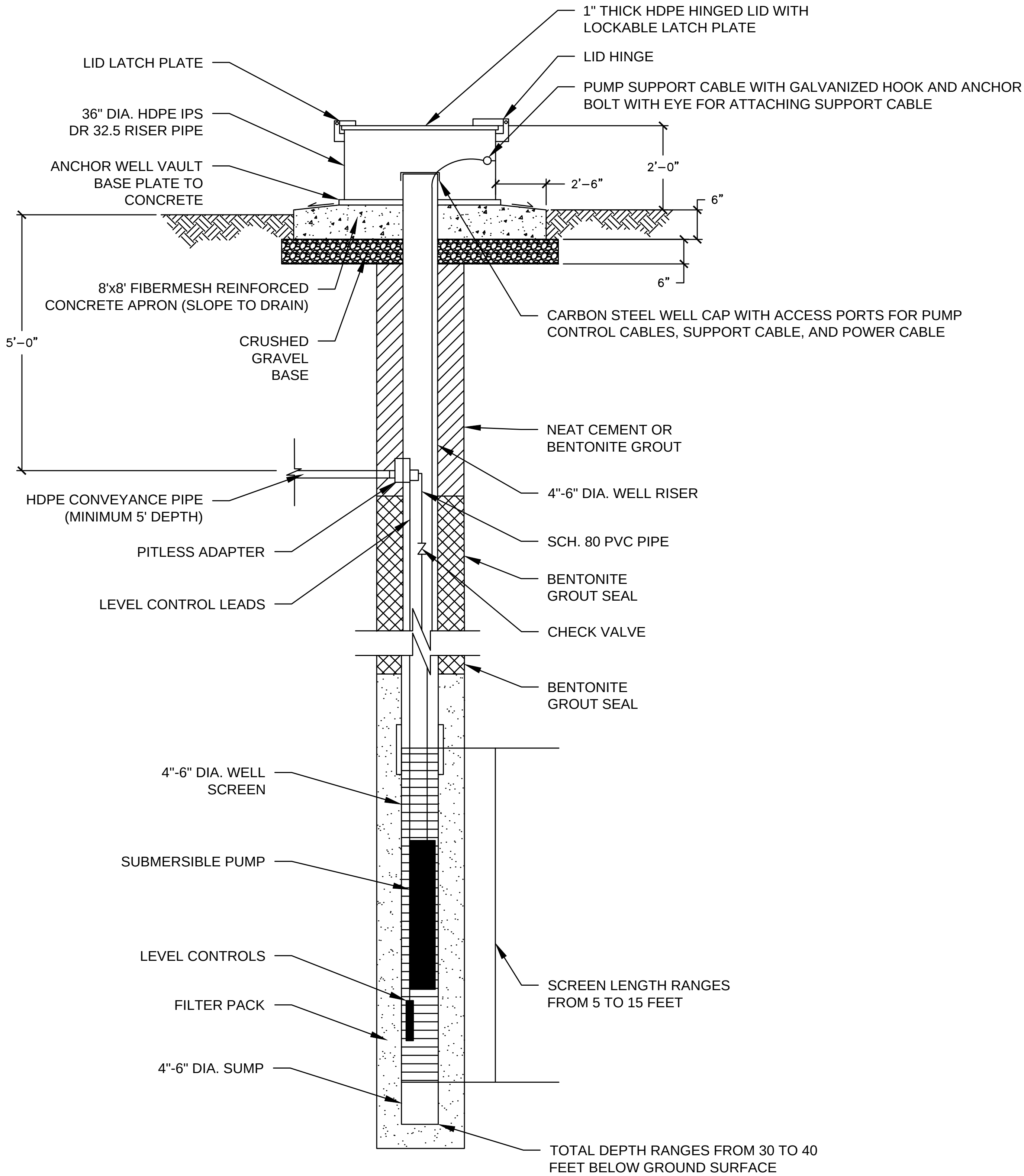
SAMPLING AND ANALYSIS PLAN
DYNEGY CCR RULE GROUNDWATER MONITORING
NEWTON POWER STATION
NEWTON, ILLINOIS

DRAWN BY/DATE: MDM 10/13/15
REVIEWED BY/DATE: YAD 10/14/15
APPROVED BY/DATE: SJC 10/16/15

PROJECT NO: 2285/4.3

FIGURE NO: 1

NATURAL RESOURCE TECHNOLOGY



NOTES

1. NOT TO SCALE

TYPICAL HYDRAULIC GRADIENT CONTROL WELL DETAIL

FIGURE 2

ILLINOIS POWER GENERATING COMPANY

NEWTON PRIMARY ASH POND
NEWTON, ILLINOIS

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

ATTACHMENT 1
2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT

Prepared for

Illinois Power Generating Company

Document type

2019 Annual Groundwater Monitoring and Corrective Action Report

Date

January 31, 2020

2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT

NEWTON PRIMARY ASH POND, NEWTON POWER STATION

Bright ideas. Sustainable change.

2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT NEWTON PRIMARY ASH POND, NEWTON POWER STATION

Project name	**Newton Power Station**
Project no.	**72760**
Recipient	**Illinois Power Generating Company**
Document type	**Annual Groundwater Monitoring and Corrective Action Report**
Version	**FINAL**
Date	**January 31, 2020**
Prepared by	**Kristen L. Theesfeld**
Checked by	**Nicole M. Pagano**
Approved by	**Eric J. Tlachac**
Description	**Annual Report in Support of the CCR Rule Groundwater Monitoring Program**

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ACRONYMS AND ABBREVIATIONS

ASD	Alternate Source Demonstration
CCR	Coal Combustion Residuals
PAP	Primary Ash Pond
SAP	Sampling and Analysis Plan
SSI	Statistically Significant Increase

EXECUTIVE SUMMARY

This report has been prepared to provide the information required by Title 40 of the Code of Federal Regulations (40 C.F.R.) § 257.90(e) for the Newton Primary Ash Pond (PAP) located at Newton Power Station near Newton, Illinois.

Groundwater is being monitored at Newton PAP in accordance with the Detection Monitoring Program requirements specified in 40 C.F.R. § 257.94.

No changes were made to the monitoring system in 2019 (no wells were installed or decommissioned).

The following Statistically Significant Increases (SSIs) of 40 C.F.R. Part 257 Appendix III parameter concentrations greater than background concentrations were determined during one or more sampling events in 2019:

- Calcium at wells APW7, APW8, APW9, and APW10
- Chloride at wells APW7 and APW9
- Fluoride at wells APW7 and APW9
- Sulfate at wells APW7, APW8, APW9, and APW10

Alternate Source Demonstrations (ASDs) were completed for the SSIs referenced above and Newton PAP remains in the Detection Monitoring Program.

1. INTRODUCTION

This report has been prepared by Ramboll on behalf of Illinois Power Generating Company, to provide the information required by 40 C.F.R. § 257.90(e) for Newton PAP located at Newton Power Station near Newton, Illinois.

In accordance with 40 C.F.R. § 257.90(e), the owner or operator of a Coal Combustion Residuals (CCR) unit must prepare an Annual Groundwater Monitoring and Corrective Action Report for the preceding calendar year that documents the status of the Groundwater Monitoring and Corrective Action Program for the CCR unit, summarizes key actions completed, describes any problems encountered, discusses actions to resolve the problems, and projects key activities for the upcoming year. At a minimum, the Annual Report must contain the following information, to the extent available:

1. A map, aerial image, or diagram showing the CCR unit and all background (or upgradient) and downgradient monitoring wells, to include the well identification numbers, that are part of the groundwater monitoring program for the CCR unit.
2. Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a narrative description of why those actions were taken.
3. In addition to all the monitoring data obtained under §§ 257.90 through 257.98, a summary including the number of groundwater samples that were collected for analysis for each background and downgradient well, the dates the samples were collected, and whether the sample was required by the Detection Monitoring or Assessment Monitoring Programs.
4. A narrative discussion of any transition between monitoring programs (e.g., the date and circumstances for transitioning from Detection Monitoring to Assessment Monitoring in addition to identifying the constituent(s) detected at a Statistically Significant Increase relative to background levels).
5. Other information required to be included in the Annual Report as specified in §§ 257.90 through 257.98.

This report provides the required information for Newton PAP for calendar year 2019.

2. MONITORING AND CORRECTIVE ACTION PROGRAM STATUS

No changes have occurred to the monitoring program status in calendar year 2019, and Newton PAP remains in the Detection Monitoring Program in accordance with 40 C.F.R. § 257.94.

3. KEY ACTIONS COMPLETED IN 2019

The Detection Monitoring Program is summarized in Table A. The groundwater monitoring system, including the CCR unit and all background and downgradient monitoring wells, is presented in Figure 1. No changes were made to the monitoring system in 2019 (no wells were installed or decommissioned). In general, one groundwater sample was collected from each background and downgradient well during each monitoring event.[1] All samples were collected and analyzed in accordance with the Sampling and Analysis Plan (SAP) (NRT/OBG, 2017a). All monitoring data obtained under 40 C.F.R. §§ 257.90 through 257.98 (as applicable) in 2019 are presented in Table 1. Analytical data were evaluated in accordance with the Statistical Analysis Plan (NRT/OBG, 2017b) to determine any SSIs of Appendix III parameters relative to background concentrations.

Statistical background values are provided in Table 2.

Analytical results for the May, August, and November 2018 sampling events were provided in the 2018 Annual Groundwater Monitoring and Corrective Action Report.

Potential alternate sources were evaluated as outlined in the 40 C.F.R. § 257.94(e)(2). ASDs were completed and certified by a qualified professional engineer. The dates the ASDs were completed are provided in Table A. The ASDs completed in 2019 are included in Appendix A.

[1] Sampling was limited to APW7, APW8, APW9, and APW10 during the August 2018 sampling event to confirm Appendix III parameters initially detected at concentrations greater than statistical background values in the preceding sampling event to confirm SSIs, as allowed by the Statistical Analysis Plan.

Table A – 2018–2019 Detection Monitoring Program Summary

Sampling Date	Analytical Data Receipt Date	Parameters Collected	SSI(s)	SSI(s) Determination Date	ASD Completion Date
May 18, 2018	July 9, 2018	Appendix III	Calcium (APW7, APW8, APW9, APW10) Chloride (APW7, APW9) Sulfate (APW8, APW10)	October 7, 2018	January 7, 2019
August 17-18, 2018	July 9, 2018	Appendix III Greater than Background [1]	NA	NA	NA
November 9, 2018	January 16, 2019	Appendix III	Calcium (APW8, APW10) Fluoride (APW9) Sulfate (APW8, APW9, APW10)	April 15, 2019	July 15, 2019
February 22, 2019	April 15, 2019	Appendix III	Calcium (APW8, APW10) Fluoride (APW7, APW9) Sulfate (APW7, APW8, APW9, APW10)	July 15, 2019	October 14, 2019
August 22-23, 2019	October 28, 2019	Appendix III	TBD	TBD	TBD

Notes:

NA: Not Applicable
TBD: To Be Determined
1. To confirm SSIs, as allowed by the Statistical Analysis Plan, groundwater samples were collected and analyzed for Appendix III parameters initially detected at concentrations greater than statistical background values in the preceding sampling event.

4. PROBLEMS ENCOUNTERED AND ACTIONS TO RESOLVE THE PROBLEMS

No problems were encountered with the Groundwater Monitoring Program during 2019. Groundwater samples were collected and analyzed in accordance with the SAP (NRT/OBG, 2017a), and all data were accepted.

5. KEY ACTIVITIES PLANNED FOR 2020

The following key activities are planned for 2020:

- Continuation of the Detection Monitoring Program with semi-annual sampling scheduled for the first and third quarters of 2020.
- Complete evaluation of analytical data from the downgradient wells, using background data to determine whether an SSI of Appendix III parameters detected at concentrations greater than background concentrations has occurred.
- If an SSI is identified, potential alternate sources (i.e., a source other than the CCR unit caused the SSI or that that SSI resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality) will be evaluated.
  - If an alternate source is demonstrated to be the cause of the SSI, a written demonstration will be completed within 90 days of SSI determination and included in the 2020 Annual Groundwater Monitoring and Corrective Action Report.
  - If an alternate source(s) is not identified to be the cause of the SSI, the applicable requirements of 40 C.F.R. §§ 257.94 through 257.98 as may apply in 2020 (e.g., Assessment Monitoring) will be met, including associated recordkeeping/notifications required by 40 C.F.R. §§ 257.105 through 257.108.

6. REFERENCES

Natural Resource Technology, an OBG Company (NRT/OBG), 2017a. Sampling and Analysis Plan, Newton Primary Ash Pond, Newton Power Station, Newton, Illinois, Project No. 2285, Revision 0, October 17, 2017.

Natural Resource Technology, an OBG Company (NRT/OBG), 2017b. Statistical Analysis Plan, Coffeen Power Station, Newton Power Station, Illinois Power Generating Company, October 17, 2017.

TABLES

TABLE 1.

2019 ANALYTICAL RESULTS - GROUNDWATER ELEVATION AND APPENDIX III PARAMETERS

2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT

NEWTON POWER STATION

UNIT ID 501 - NEWTON PRIMARY ASH POND

NEWTON, ILLINOIS

DETECTION MONITORING PROGRAM

Well Identification Number	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Date & Time Sampled	Depth to Groundwater (ft)[1]	Groundwater Elevation (ft NAVD88)	40 C.F.R. Part 257 Appendix III						
						Boron, total (mg/L) 6020A[2]	Calcium, total (mg/L) 6020A[2]	Chloride, total (mg/L) 9251[2]	Fluoride, total (mg/L) 9214[2]	pH (field) (S.U.) SM 4500 H+B[2]	Sulfate, total (mg/L) 9036[2]	Total Dissolved Solids (mg/L) SM 2540C[2]
Background / Upgradient Monitoring Wells												
APW5	38.933964	-88.280989	2/22/2019 10:00	15.00	529.07	0.11	50	48	0.374	6.9	3.5	600
			8/22/2019 16:46	16.04	528.03	0.12	49	50	<0.250	7.0	2.3	530
APW6	38.933753	-88.286281	2/22/2019 11:07	15.49	530.58	0.09	45	24	0.386	7.3	1.7	480
			8/23/2019 8:14	16.39	529.68	0.11	55	26	0.314	7.3	5.8	500
Downgradient Monitoring Wells												
APW7	38.928239	-88.292081	2/22/2019 15:38	42.18	496.19	0.060	45	43	0.734	7.2	66	340
			8/23/2019 11:30	43.00	495.37	0.075	58	46	0.632	7.1	62	350
APW8	38.923161	-88.292292	2/22/2019 13:12	35.06	493.91	0.10	80	56	0.393	7.2	46	600
			8/23/2019 9:01	34.20	494.77	0.10	82	59	0.337	7.2	48	570
APW9	38.922325	-88.281036	2/22/2019 13:56	20.77	510.75	0.054	38	47	0.714	7.5	61	320
			8/23/2019 9:50	22.09	509.43	0.055	41	51	0.621	7.4	51	360
APW10	38.927442	-88.273133	2/22/2019 14:42	14.85	509.40	0.079	110	50	0.276	6.9	420	990
			8/23/2019 10:42	16.08	508.17	0.10	130	50	0.359	7.0	390	1000

[O: RAB 12/23/19, C: KLT 12/26/19]

Notes:

40 C.F.R. = Title 40 of the Code of Federal Regulations

ft = foot/feet

mg/L = milligrams per liter

NAVD88 = North American Vertical Datum of 1988

S.U. = Standard Units

< = concentration is less than the concentration shown, which corresponds to the reporting limit for the method; estimated concentrations below the reporting limit and associated qualifiers are not provided since not utilized in statistics to determine Statistically Significant Increases (SSIs) over background.

[1]All depths to groundwater were measured on the first day of the sampling event.

[2]4-digit numbers represent SW-846 analytical methods.

TABLE 2.
STATISTICAL BACKGROUND VALUES
2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
NEWTON POWER STATION
UNIT ID 501 - NEWTON PRIMARY ASH POND
NEWTON, ILLINOIS
DETECTION MONITORING PROGRAM

Parameter	Statistical Background Value (UPL)
40 C.F.R. Part 257 Appendix III	
Boron (mg/L)	0.14
Calcium (mg/L)	65
Chloride (mg/L)	58
Fluoride (mg/L)	0.692
pH (S.U.)	6.6 / 8.0
Sulfate (mg/L)	15
Total Dissolved Solids (mg/L)	1000

[O: RAB 12/23/19, C: KLT 12/26/19]

Notes:
40 C.F.R. = Title 40 of the Code of Federal Regulations
mg/L = milligrams per liter
S.U. = Standard Units
UPL = Upper Prediction Limit

FIGURES

UPGRADIENT MONITORING WELL LOCATION
DOWNGRADIENT MONITORING WELL LOCATION
CCR MONITORED UNIT

0 500 1,000 Feet

MONITORING WELL LOCATION MAP
NEWTON PRIMARY ASH POND
UNIT ID:501

2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
VISTRA CCR RULE GROUNDWATER MONITORING
NEWTON POWER STATION
NEWTON, ILLINOIS

FIGURE 1

O'BRIEN & GERE ENGINEERS, INC.
A RAMBOLL COMPANY

PROJECT: 169000XXXX | DATED: 1/14/2020 | DESIGNER: GALARNMC

APPENDIX A
ALTERNATE SOURCE DEMONSTRATIONS

40 C.F.R. § 257.94(e)(2): ALTERNATE SOURCE DEMONSTRATION
NEWTON PRIMARY ASH POND
JANUARY 7, 2019

January 7, 2019

Title 40 of the Code of Federal Regulations (C.F.R.) § 257.94(e)(2) allows the owner or operator of a coal combustion residuals (CCR) unit 90 days from the date of determination of statistically significant increases (SSIs) over background for groundwater constituents listed in Appendix III of 40 C.F.R. Part 257 to complete a written demonstration that a source other than the CCR unit being monitored caused the SSI(s), or that the SSI(s) resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality (alternate source demonstration [ASD]).

This ASD has been prepared on behalf of Illinois Power Generating Company by O'Brien & Gere Engineers, Inc., part of Ramboll (OBG) to provide pertinent information pursuant to 40 C.F.R. § 257.94(e)(2) for the Newton Primary Ash Pond (PAP) located near Newton, Illinois.

The second semi-annual detection monitoring samples (Detection Monitoring Round 2 [D2]) were collected on May 18, 2018 and analytical data were received on July 9, 2018. In accordance with 40 C.F.R. § 257.93(h)(2), statistical analysis of the data to identify SSIs of 40 C.F.R. Part 257 Appendix III parameters over background concentrations was completed by October 7, 2018, within 90 days of receipt of the analytical data. The statistical determination identified the following SSIs at downgradient monitoring wells:

- Calcium at wells APW7, APW8, APW9, and APW10
- Chloride at wells APW7 and APW9
- Sulfate at wells APW8 and APW10

In accordance with the Statistical Analysis Plan[1], to confirm the SSIs, wells APW7, APW8, APW9, and APW10 were resampled on August 17-18, 2018 and analyzed only for the SSI parameters at each well. Following evaluation of analytical data from the resample, the following SSIs were confirmed:

- Calcium at wells APW7, APW8, APW9, and APW10
- Chloride at wells APW7 and APW9
- Sulfate at wells APW8 and APW10

Pursuant to 40 C.F.R. § 257.94(e)(2), the following demonstrates that sources other than the Newton PAP were the cause of the SSIs listed above. This ASD was completed by January 7, 2019, within 90 days of determination of the SSIs, as required by 40 C.F.R. § 257.94(e)(2).

ALTERNATE SOURCE DEMONSTRATION: LINES OF EVIDENCE

Lines of evidence supporting these ASDs include the following:

1. The ionic composition of Newton PAP water is different from the ionic composition of groundwater.
2. Concentrations of calcium in the Newton PAP are lower than those observed in the groundwater.
3. Concentrations of chloride in the Newton PAP are lower than those observed in the groundwater.

[1] Natural Resource Technology, an OBG Company, 2017, *Statistical Analysis Plan, Coffeen Power Station, Newton Power Station*, Illinois Power Generating Company, October 17, 2017.

4. Concentrations of sulfate in the Newton PAP are lower than those observed in the groundwater.
5. Concentrations of boron, a common indicator for CCR impacts to groundwater, in downgradient wells are stable and at or below concentrations in the background wells.

These lines of evidence are described and supported in greater detail below. Monitoring wells and leachate sample locations are shown on Figure 1.

LINE OF EVIDENCE #1: THE IONIC COMPOSITION OF NEWTON PAP WATER IS DIFFERENT FROM THE IONIC COMPOSITION OF GROUNDWATER

Piper diagrams graphically represent ionic composition of aqueous solutions. A Piper diagram displays the position of water samples relative to their major cation and anion content, providing the information needed to identify compositional categories or groupings. Figure 2 is a Piper diagram that displays the ionic composition of groundwater samples from the background and downgradient monitoring wells associated with the Phase I Landfill (LF1), Phase II Landfill (LF2), and Primary Ash Pond (PAP) and LF1 leachate and PAP water based on Quarter 2 2017 and Quarter 3 2018 samples. The ionic compositional groupings identified are shown in the green, blue, purple, brown, and turquoise ellipses on the diamond portion of the Piper diagram. These are discussed in more detail below.

The results show that there are three distinct groups. Groundwater samples from the PAP background and downgradient wells (enclosed within a green ellipse) and LF2 groundwater samples (enclosed within a blue ellipse) have a very high percentage of carbonate-bicarbonate cations and no dominant cation. Groundwater samples from the LF1 wells (enclosed within a turquoise ellipse) also have no dominant cation, but these waters have a high percentage of sulfate. Surface water samples from the PAP (enclosed within a purple ellipse) and the landfill leachate (enclosed within a brown ellipse) have a very high percentage of sodium-potassium and no dominant anion and a high percentage of sulfate, respectively.

The groundwater samples for both the PAP and LF2 (enclosed within the green and blue ellipses, respectively) are tightly clustered on the Piper diagram. This tight grouping indicates either an apparent lack of outside influences on the groundwater or the apparent influence of a constant, steady-state source, such as LF1, that is influencing all the wells equally and simultaneously.

The potential presence of a mixing zone between LF2 groundwater, PAP groundwater, and LF1 groundwater suggests that LF1 is an alternate source of the elevated major anion chloride.

Neither PAP groundwater nor LF2 groundwater is trending towards, or mixing with, the PAP leachate. The apparent lack of mixing between the PAP leachate and underlying groundwater in the Uppermost Aquifer demonstrates that there is no impact to groundwater from the PAP. However, the presence of a potential mixing zone between PAP groundwater and LF1 groundwater suggests that LF1 is a source of the elevated major cation calcium and elevated major anions chloride and sulfate.

The ionic characteristics of these samples are provided in Table 1 below.

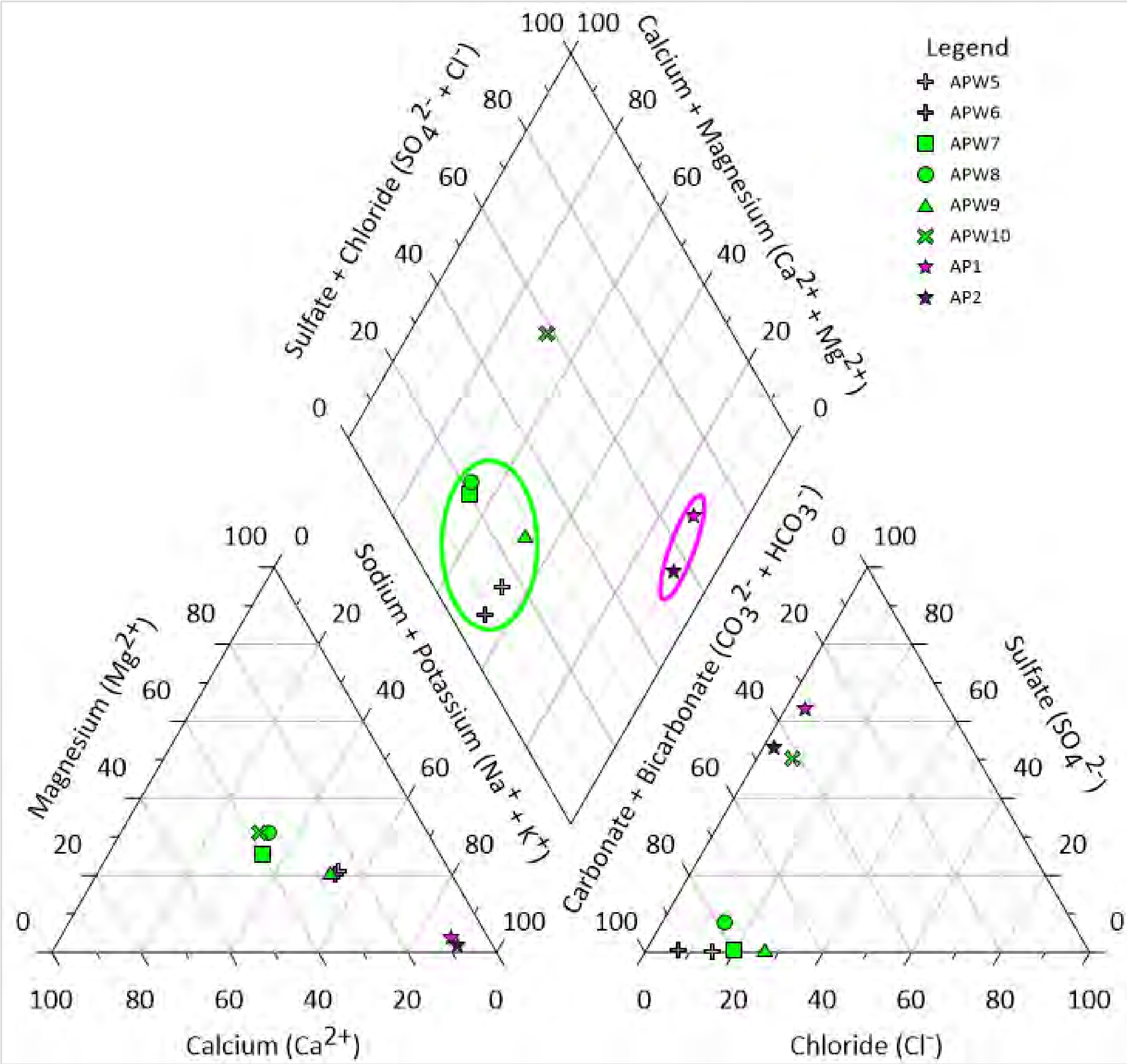

Figure 2 Piper Diagram Showing Ionic Composition of Samples of Background and Downgradient Groundwater Associated with LF1, LF2, and PAP.

Grouping	Green	Blue	Purple	Brown	Turquoise
Locations	PAP Wells Groundwater	LF2 Wells Groundwater	PAP Surface Water	LF1 Leachate	LF1 Wells Groundwater
Dominant Cation	No dominant cation	No dominant cation	**Very High Sodium-Potassium**	**Very High Sodium-Potassium**	No dominant cation
Dominant Anion	**Very High Carbonate-Bicarbonate**	**Very High Carbonate-Bicarbonate**	**No dominant anion**	**High Sulfate**	**High Sulfate**

Table 1. Summary of Ionic Classification

LINE OF EVIDENCE #2: CONCENTRATIONS OF CALCIUM IN THE NEWTON PRIMARY ASH POND ARE LOWER THAN THOSE OBSERVED IN THE GROUNDWATER

Calcium concentrations in water sampled from the PAP are lower than calcium concentrations in all groundwater samples from downgradient ash pond wells from 2015 through 2018. A time series for calcium concentrations is provided in Figure 3 below.

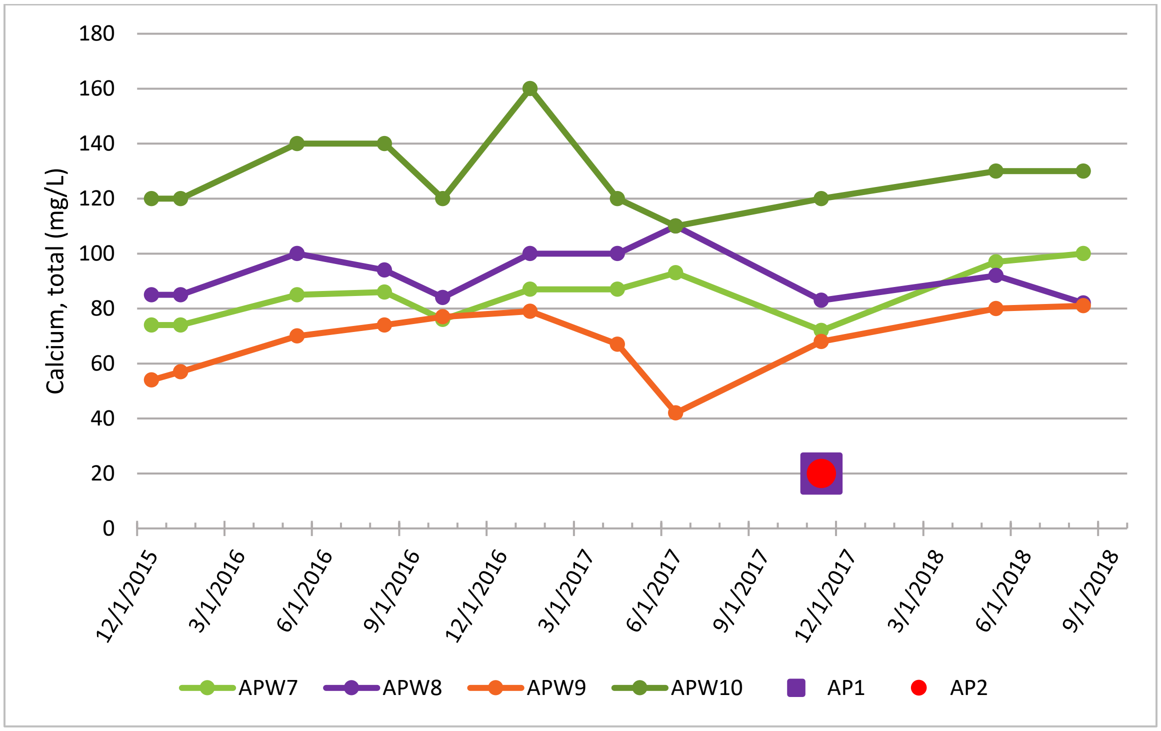

Figure 3. Calcium time series

The following observations can be made from Figure 3:

- PAP water samples AP1 and AP2 each contain 20 mg/L of calcium.
- Groundwater samples from wells APW7, APW8, APW9, and APW10 have two to eight times greater concentrations than the PAP water.

If the PAP were the source of calcium in groundwater, calcium concentrations in downgradient monitoring wells would be lower than calcium concentrations in the water in the pond; therefore, the PAP is not the source of the calcium observed in the Uppermost Aquifer. Elevated concentrations of calcium are most likely naturally occurring due to geochemical variations within the Uppermost Aquifer, although some level of impacts from upgradient anthropogenic sources (i.e. Phase I Landfill) may also be present.

LINE OF EVIDENCE #3: CONCENTRATIONS OF CHLORIDE IN THE NEWTON PRIMARY ASH POND ARE LOWER THAN THOSE OBSERVED IN THE GROUNDWATER

Chloride concentrations in water sampled from the PAP are lower than chloride concentrations in all groundwater samples from downgradient ash pond wells from 2015 through 2018, inclusive of wells APW7 and APW9. A time series for chloride concentrations is provided in Figure 4 below.

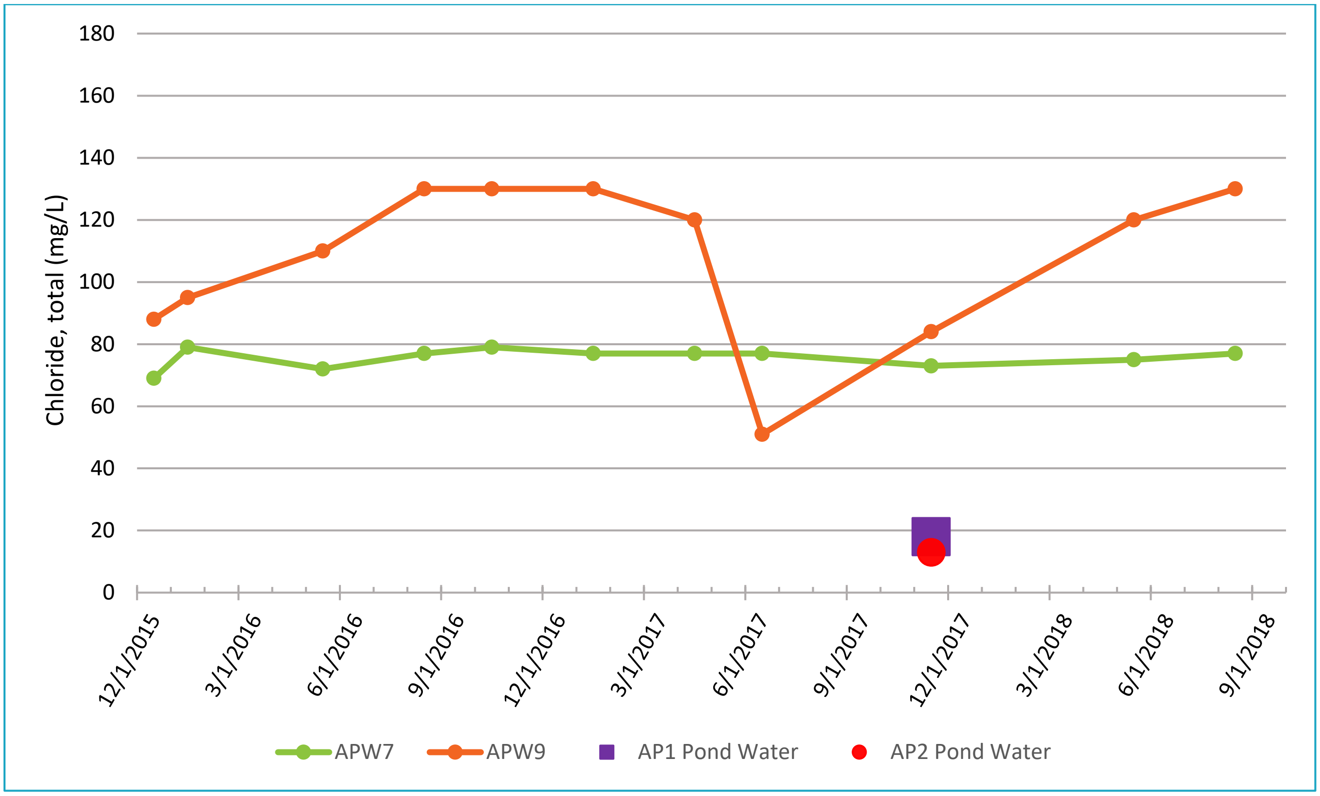

Figure 4. Chloride time series

The following observations can be made from Figure 4:

- PAP water samples AP1 and AP2 contain 18 and 13 mg/L of chloride, respectively.
- Groundwater samples from wells APW7 and APW9 have two-and-a-half to seven times greater concentrations than the PAP water.

If the PAP was the source of chloride observed in groundwater, chloride concentrations in downgradient monitoring wells APW7 and APW9 would be lower than chloride concentrations in the water in the pond; therefore, the PAP is not the source of the chloride observed in the Uppermost Aquifer. Elevated chloride concentrations are most likely naturally occurring due to geochemical variations within the Uppermost Aquifer, although some level of impacts from upgradient anthropogenic sources (i.e. Phase I Landfill) may also be present.

LINE OF EVIDENCE #4: CONCENTRATIONS OF SULFATE IN THE NEWTON PRIMARY ASH POND ARE LOWER THAN THOSE OBSERVED IN THE GROUNDWATER

Sulfate concentrations in water sampled from the PAP are lower than sulfate concentrations in all groundwater samples from downgradient ash pond well APW10 from 2015 through 2018. A time series for sulfate concentrations is provided in Figure 5 below.

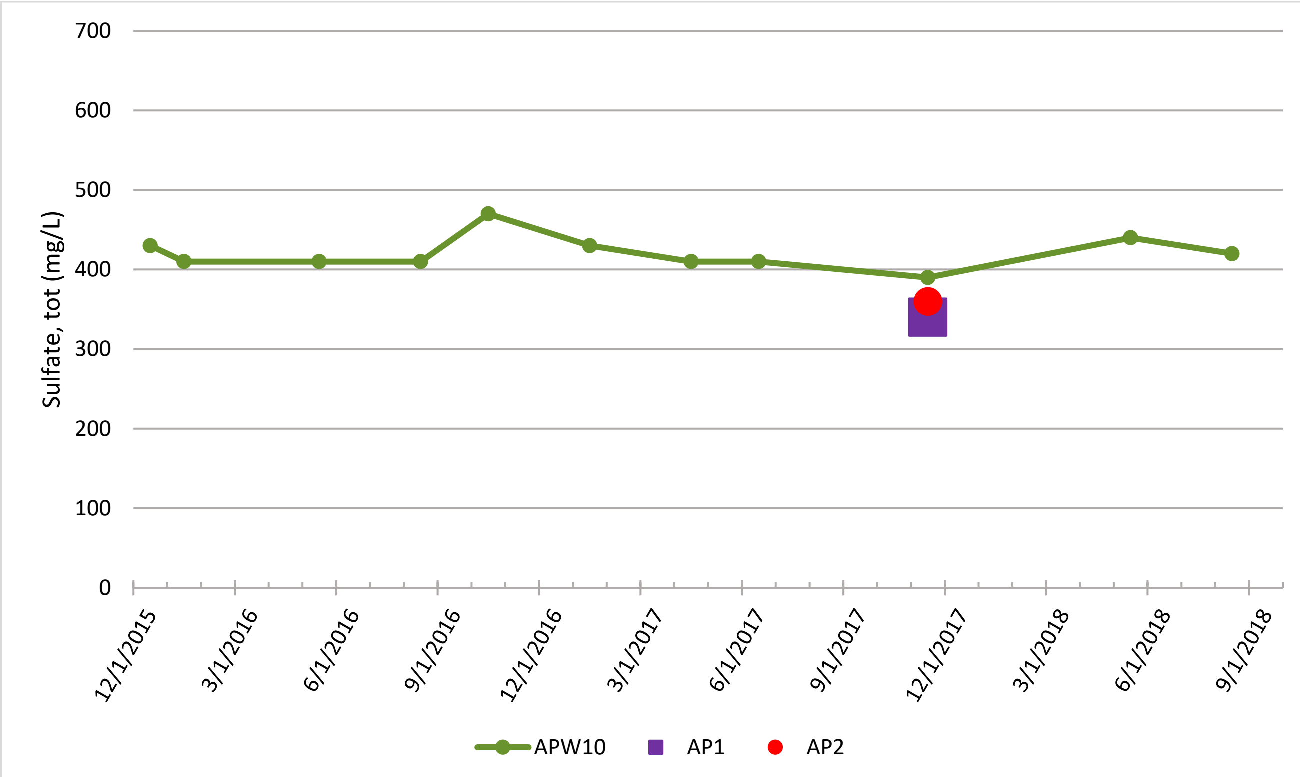

Figure 5. Sulfate time series

The following observations can be made from Figure 5:

- PAP water samples AP1 and AP2 contain 340 and 360 mg/L of sulfate, respectively.
- Groundwater samples from well APW10 have higher sulfate concentrations than the PAP water, ranging from 390 to 470 mg/L from 2015 through 2018.

If the PAP were the source of sulfate observed in groundwater samples from APW10, the sulfate concentrations in downgradient monitoring well APW10 would be lower than sulfate concentrations in the water in the pond; therefore, the PAP is not the source of the sulfate observed in the Uppermost Aquifer. Alternate sources of sulfate are most likely present from upgradient anthropogenic sources, principally the Phase I Landfill, although naturally occurring geochemical variations within the Uppermost Aquifer may also be affecting sulfate concentrations.

LINE OF EVIDENCE #5: CONCENTRATIONS OF BORON, A COMMON INDICATOR FOR CCR IMPACTS TO GROUNDWATER, IN DOWNGRADIENT WELLS ARE STABLE AND AT OR BELOW CONCENTRATIONS IN THE BACKGROUND WELLS

Boron is a primary indicator of CCR impacts to groundwater. Concentrations of boron in all downgradient monitoring wells are below upper prediction limits established using background monitoring wells (i.e. thresholds for SSIs) and are lower than median concentrations observed in background wells APW5 and APW6 from 2015 through 2018, as shown on Figure 6.

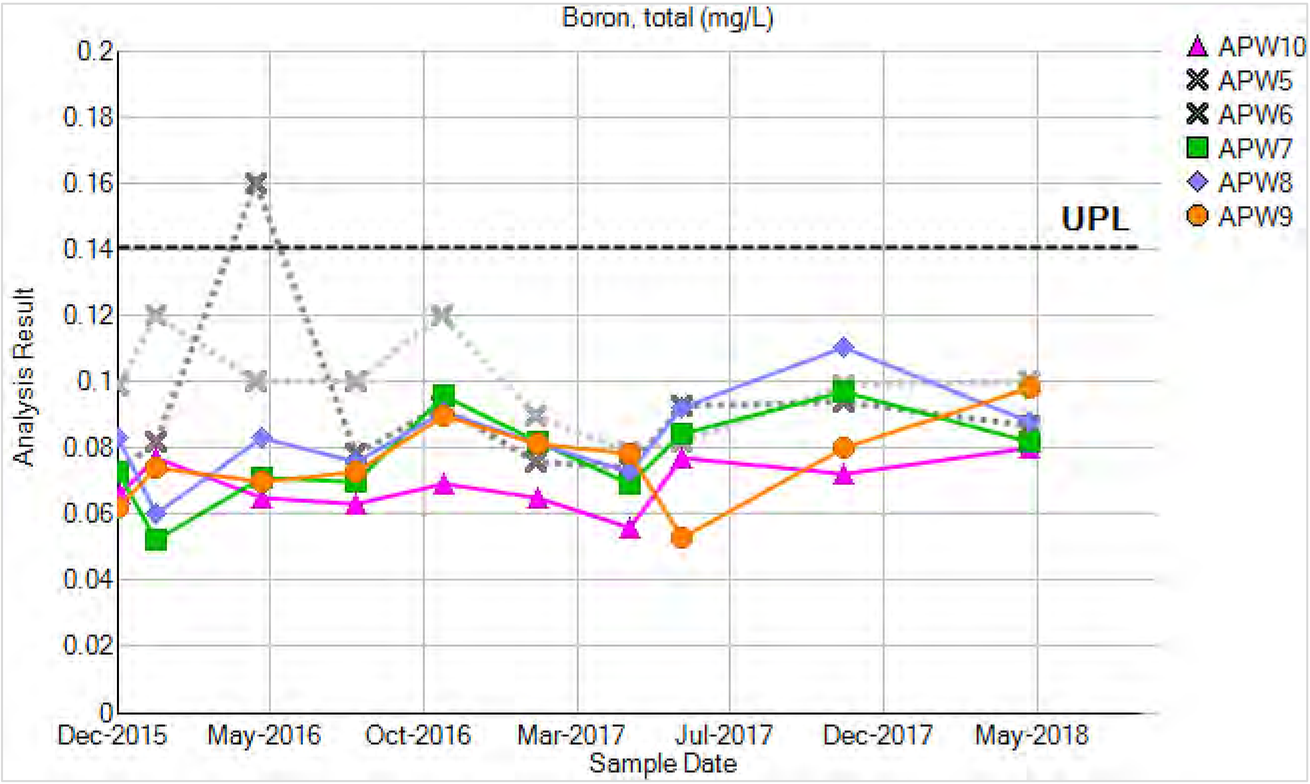

Figure 6. Boron time series showing boron concentrations in groundwater samples from background wells (gray "X"s) are higher or similar to concentrations in groundwater samples from downgradient wells.

From Figure 6 the following observations can be made:

- Boron is stable. A Mann-Kendall trend analysis (Attachment A) was performed to determine whether the concentration trend for each downgradient well is statistically significant. None were determined to be statistically significant using the Mann-Kendall test.
  - If a Mann-Kendall test did not identify a trend, the coefficient of variation (CV) was calculated (Attachment B) to determine if the concentrations are stable (i.e., CV less than or equal to 1), or if there is too much data variability to draw a conclusion. All calculated CVs were less than 1, indicating concentrations are stable.
- Boron concentrations in groundwater samples from downgradient monitoring wells range from 0.052 to 0.11 mg/L and 0.073 to 0.16 mg/L in groundwater samples from background wells. The overall median boron concentration in groundwater samples collected from downgradient wells from 2015 through 2018 is 0.077 mg/L and 0.093 mg/L in groundwater samples collected from background wells.

Elevated boron concentrations are most likely naturally occurring due to geochemical variations within the Uppermost Aquifer, although some level of impacts from upgradient anthropogenic sources may also be present.

Based on these five lines of evidence, it has been demonstrated that the Newton Primary Ash Pond has not caused the SSIs in APW7, APW8, APW9, and APW10.

This information serves as the written alternate source demonstration prepared in accordance with 40 C.F.R. § 257.94(e)(2) that SSIs observed during the detection monitoring program were not due to the CCR unit but were from a combination of naturally occurring conditions and potential anthropogenic impacts from the closed Phase I Landfill. Therefore, an assessment monitoring program is not required and the Newton Primary Ash Pond will remain in detection monitoring.

Attachments:

Figure 1	Monitoring Well and Source Water Location Map Newton Primary Ash Pond
Attachment A	Boron Mann-Kendall Trend Analyses
Attachment B	Coefficient of Variation Evaluation

I, Eric J. Tlachac, a qualified professional engineer in good standing in the State of Illinois, certify that the information in this report is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

Eric J. Tlachac
Qualified Professional Engineer
062-063091
Illinois
O'Brien & Gere Engineers, Inc., part of Ramboll
Date: January 7, 2019

I, Nicole M. Pagano, a professional geologist in good standing in the State of Illinois, certify that the information in this report is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

Nicole M. Pagano
Professional Geologist
196-000750
O'Brien & Gere Engineers, Inc., part of Ramboll
Date: January 7, 2019

Attachments

Figures

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

DRAWN BY/DATE: SDS 3/28/18
REVIEWED BY/DATE: JJW 3/28/18
APPROVED BY/DATE: NMP 3/30/18

MONITORING WELL AND SOURCE WATER LOCATION MAP
NEWTON PRIMARY ASH POND

ALTERNATE SOURCE DEMONSTRATION
NEWTON POWER STATION
NEWTON, ILLINOIS

PROJECT NO: 67719

FIGURE NO: 1

Y:\Mapping\Projects\22\2285\MXD\Alt_Source_Dem\Figure 1_Newton Landfill Phases_PAP.mxd Author: stolzsd

Attachment A

Boron Mann-Kendall Trend Analyses

Newton
Mann-Kendall Trend Analysis

User Supplied Information

Location ID:	**APW7**	**Parameter Code:**	**01022**
Location Class:		**Parameter:**	**B, tot**
Location Type:		**Units:**	**mg/L**
Confidence Level:	**95.00%**	**Period Length:**	**1 month(s)**
Date Range: 12/14/2015 to 08/31/2018		**Limit Name:**	
		Averaged:	**No**

Trend Analysis

Trend of the least squares straight line

Slope (fitted to data):	0.000028	mg/L per day
R-Squared error of fit:	0.350024	

Sen's Non-parametric estimate of the slope (One-Sided Test)

Median Slope:	0.000032	mg/L per day
Lower Confidence Limit of Slope, M1:	-0.000005	mg/L per day
Upper Confidence Limit of Slope, M2+1:	0.000061	mg/L per day

Non-parametric Mann-Kendall Test for Trend

S Statistic:	1.347
Z test:	1.645
At the 95.0 % Confidence Level (One-Sided Test):	None

Newton
Mann-Kendall Trend Analysis

User Supplied Information

Location ID:	**APW8**	**Parameter Code:**	**01022**
Location Class:		**Parameter:**	**B, tot**
Location Type:		**Units:**	**mg/L**
Confidence Level:	**95.00%**	**Period Length:**	**1 month(s)**
Date Range: 12/14/2015 to 08/31/2018		**Limit Name:**	
		Averaged:	**No**

Trend Analysis

Trend of the least squares straight line		
Slope (fitted to data):	0.000027	mg/L per day
R-Squared error of fit:	0.338419	
Sen's Non-parametric estimate of the slope (One-Sided Test)		
Median Slope:	0.000025	mg/L per day
Lower Confidence Limit of Slope, M1:	-0.000005	mg/L per day
Upper Confidence Limit of Slope, M2+1:	0.000055	mg/L per day
Non-parametric Mann-Kendall Test for Trend		
S Statistic:	1.347	
Z test:	1.645	
At the 95.0 % Confidence Level (One-Sided Test):	None	

Newton
Mann-Kendall Trend Analysis

User Supplied Information

Location ID:	**APW9**	**Parameter Code:**	**01022**
Location Class:		**Parameter:**	**B, tot**
Location Type:		**Units:**	**mg/L**
Confidence Level:	**95.00%**	**Period Length:**	**1 month(s)**
Date Range: 12/14/2015 to 08/31/2018		**Limit Name:**	
		Averaged:	**No**

Trend Analysis

Trend of the least squares straight line

Slope (fitted to data):	0.000021	mg/L per day
R-Squared error of fit:	0.226829	

Sen's Non-parametric estimate of the slope (One-Sided Test)

Median Slope:	0.000022	mg/L per day
Lower Confidence Limit of Slope, M1:	-0.000005	mg/L per day
Upper Confidence Limit of Slope, M2+1:	0.000044	mg/L per day

Non-parametric Mann-Kendall Test for Trend

S Statistic:	1.431
Z test:	1.645
At the 95.0 % Confidence Level (One-Sided Test):	None

Newton
Mann-Kendall Trend Analysis

User Supplied Information

Location ID:	**APW10**	**Parameter Code:**	**01022**
Location Class:		**Parameter:**	**B, tot**
Location Type:		**Units:**	**mg/L**
Confidence Level:	**95.00%**	**Period Length:**	**1 month(s)**
Date Range: 12/14/2015 to 08/31/2018		**Limit Name:**	
		Averaged:	**No**

Trend Analysis

Trend of the least squares straight line

Slope (fitted to data):	0.000009	mg/L per day
R-Squared error of fit:	0.110910	

Sen's Non-parametric estimate of the slope (One-Sided Test)

Median Slope:	0.000009	mg/L per day
Lower Confidence Limit of Slope, M1:	-0.000017	mg/L per day
Upper Confidence Limit of Slope, M2+1:	0.000023	mg/L per day

Non-parametric Mann-Kendall Test for Trend

S Statistic:	0.721
Z test:	1.645
At the 95.0 % Confidence Level (One-Sided Test):	None

Attachment B

Coefficient of Variation Evaluation

Newton

Coefficient of Variation
Date Range: 12/14/2015 to 8/31/2018

Boron, total (mg/L)

Location	Count	Mean	Std Dev	% Non-Detects	CV
APW5	10	0.099	0.014	0.00	0.14
APW6	10	0.091	0.026	0.00	0.29
APW7	10	0.078	0.014	0.00	0.18
APW8	10	0.084	0.013	0.00	0.15
APW9	10	0.076	0.013	0.00	0.17
APW10	10	0.069	0.007	0.00	0.10

CV=Std Dev/ Mean

Newton

Coefficient of Variation
Date Range: 12/14/2015 to 8/31/2018

Boron, total (mg/L)

Location	Count	Mean	Std Dev	% Non-Detects	CV
APW5	10	0.099	0.014	0.00	0.14
APW6	10	0.091	0.026	0.00	0.29
APW7	10	0.078	0.014	0.00	0.18
APW8	10	0.084	0.013	0.00	0.15
APW9	10	0.076	0.013	0.00	0.17
APW10	10	0.069	0.007	0.00	0.10

CV=Std Dev/ Mean

40 C.F.R. § 257.94(e)(2): ALTERNATE SOURCE DEMONSTRATION
NEWTON PRIMARY ASH POND
JULY 15, 2019

July 15, 2019

Title 40 of the Code of Federal Regulations (C.F.R.) § 257.94(e)(2) allows the owner or operator of a Coal Combustion Residuals (CCR) unit 90 days from the date of determination of Statistically Significant Increases (SSIs) over background for groundwater constituents listed in Appendix III of 40 C.F.R. Part 257 to complete a written demonstration that a source other than the CCR unit being monitored caused the SSI(s), or that the SSI(s) resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality (Alternate Source Demonstration [ASD]).

This ASD has been prepared on behalf of Illinois Power Generating Company by O'Brien & Gere Engineers, Inc., part of Ramboll (OBG), to provide pertinent information pursuant to 40 C.F.R. § 257.94(e)(2) for the Newton Primary Ash Pond (PAP) located near Newton, Illinois.

The third round of semi-annual detection monitoring samples (Detection Monitoring Round 3 [D3]) were collected on November 9, 2018 and analytical data were received on January 16, 2019. In accordance with 40 C.F.R. Section 257.93(h)(2), statistical analysis of the data to identify SSIs of 40 C.F.R. Part 257 Appendix III parameters over background concentrations was completed by April 16, 2019 within 90 days of receipt of the analytical data. The statistical determination identified the following SSIs at downgradient monitoring wells:

- Calcium at wells APW7, APW8, and APW10
- Chloride at APW7
- Fluoride at well APW9
- Sulfate at wells APW8, APW9, and APW10

Because the Detection Monitoring Round 4 (D4) was completed on February 22, 2019, prior to SSIs referenced above being determined for D3, results from D4 were used to verify the D3 SSIs in accordance with the Statistical Analysis Plan[1]. Following evaluation of analytical data from D4, the following SSIs were confirmed:

- Calcium at wells APW8 and APW10
- Fluoride at well APW9
- Sulfate at wells APW8, APW9, and APW10

Pursuant to 40 C.F.R. § 257.94(e)(2), the following demonstrates that sources other than the PAP were the cause of the SSIs listed above. This ASD was completed by July 15, 2019, within 90 days of determination of the SSIs, as required by 40 C.F.R. § 257.94(e)(2).

SITE LOCATION AND DESCRIPTION

The Newton Power Station (Site) is located in Jasper County, in the southeastern part of central Illinois, approximately 7 miles southwest of the town of Newton. The area is surrounded by Newton Lake. Beyond the lake is agricultural land.

GEOLOGY AND HYDROGEOLOGY

The site geology and hydrogeology are summarized below from the Hydrogeologic Monitoring Plan (NRT/OBG, 2017a)[2].

[1] Natural Resource Technology, an OBG Company, *Statistical Analysis Plan, Coffeen Power Station, Newton Power Station*, Illinois Power Generating Company, October 17, 2017.

GEOLOGY

Quaternary deposits in the Newton area consist mainly of diamictons and outwash deposits that were deposited during Illinoian and Pre-Illinoian glaciations. The unconsolidated deposits occurring at Newton Power Station include the following units (beginning at the ground surface):

- Ash/Fill Units – CCR and fill within the various CCR Units
- Upper Confining Unit – Low permeability clays and silts, including: the Peoria Silt (Loess Unit) in upland areas and the Cahokia Formation in the flood plain and channel areas to the south and east; underlain by the Sangamon Soil, and the predominantly clay diamictons of the Hagarstown (Till) and Vandalia (Till) Members of the Glasford Formation
- Uppermost Aquifer (Groundwater Monitoring Zone) – Thin to moderately thick (3 to 17 ft), moderate to high permeability sand, silty sand, and sandy silt/clay units of the Mulberry Grove Member of the Glasford Formation
- Lower Confining Unit – Thick, very low permeability silty clay diamictons of the Smithboro (Till) Member of the Glasford Formation and the silty clay diamictons of the Banner Formation

The bedrock beneath the unconsolidated deposits consists of Pennsylvanian-age Mattoon Formation that is mostly shale near the bedrock surface, but is characterized at depth by a complex sequence of shales, thin limestones, coals, underclays, and several sandstones. The erosional surface of the Pennsylvanian-age Mattoon Formation bedrock ranges widely in depth in the vicinity of the site, but is typically encountered at 90 to 120 ft below ground surface (bgs).

HYDROGEOLOGY

The information used to describe the hydrogeology is based on the local geology obtained from published sources, hydrogeologic investigation data, and boring data collected during monitoring well installation. CCR monitoring well locations are shown in Figure 1.

Uppermost Aquifer

The Uppermost Aquifer, the Mulberry Grove Member, typically consists of fine to coarse sand with varying amounts of clay, silt, and fine to coarse gravel. The portion of the Mulberry Grove Member at the site that is defined as a sand layer ranges in thickness from 3 to 17 ft with an average thickness of 8 ft. With only a few exceptions, the sand layer occurs between depths of 55 to 88 ft bgs.

Lower Limit of Aquifer

The lower hydrostratigaphic units, which comprise the lower limit of the Uppermost Aquifer, consist of the Smithboro Member and the Banner Formation, both of which are predominantly low permeability clay diamictons with varying amounts of silt, sand, and gravel. The lower hydrostratigraphic units are 30 ft to more than 50 ft thick above the underlying bedrock.

Groundwater Elevation and Flow Direction

Groundwater elevations across PAP ranged from approximately 495 to 530 ft MSL (NAVD88) during D3 (Figure 2). The groundwater elevation contours shown on Figure 2 were measured on November 8, 2018, the first day of a combined sampling event at the Site for LF2 and the Primary Ash Pond and for multiple monitoring programs required by both federal and state regulatory agencies. Overall groundwater flow within the Uppermost Aquifer in this area is southward toward Newton Lake, but with a predominantly southwesterly flow under the PAP.

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[2] Natural Resource Technology, an OBG Company (NRT), October 17, 2017. *Hydrogeologic Monitoring Plan. Newton Primary Ash Pond – CCR Unit ID 501, Newton Landfill 2 – CCR Unit ID 502*. Newton Power Station, Canton, Illinois. Illinois Power Generating Company.

GROUNDWATER AND PAP WATER MONITORING

The Uppermost Aquifer monitoring system for the PAP is shown on Figure 1. Monitoring wells APW5 and APW6 are used to monitor background water quality for the PAP. These wells are located north of the PAP. The downgradient monitoring wells are APW7, APW8, APW9, and APW10.

PAP water samples have been collected from locations AP1 in the southwest corner of the PAP and AP2 in the southeast corner of the PAP.

ALTERNATE SOURCE DEMONSTRATION: LINES OF EVIDENCE

As allowed by 40 C.F.R. § 257.94(e)(2), this ASD demonstrates that sources other than the PAP caused the SSIs, or that the SSIs were a result of natural variation in groundwater quality. Lines of evidence supporting this ASD include the following:

1. The ionic composition of Newton PAP water is different from the ionic composition of groundwater.
2. The Newton PAP is not hydraulically connected to the Uppermost Aquifer.
3. Concentrations of calcium in the Newton PAP are lower than those observed in the groundwater.
4. Boron, a primary indicator parameter for CCR impacts to groundwater, has concentrations in downgradient wells that are near, or below, concentrations observed in background monitoring wells.

These lines of evidence are described and supported in greater detail below. Monitoring wells and leachate sample locations are shown on Figure 1.

LINE OF EVIDENCE #1: THE IONIC COMPOSITION OF NEWTON PAP WATER IS DIFFERENT FROM THE IONIC COMPOSITION OF GROUNDWATER

Piper diagrams graphically represent ionic composition of aqueous solutions. A Piper diagram displays the position of water samples relative to their major cation and anion content, providing the information needed to identify compositional categories or groupings. Figure 2, below, is a Piper diagram that displays the ionic composition of groundwater samples from the background and downgradient monitoring wells associated with the PAP and PAP water based on Quarter 2 2017 and Quarter 3 2018 samples.

Groundwater samples from the PAP downgradient wells (enclosed within a green ellipse) have a very high percentage of carbonate-bicarbonate anions and no dominant cation. Surface water samples from the PAP (enclosed within a purple ellipse) have a very high percentage of sodium-potassium cations and no dominant anion. The dissimilar ionic compositions of the PAP downgradient groundwater and the PAP surface water indicates that the PAP is not the source of CCR constituents detected in PAP groundwater.

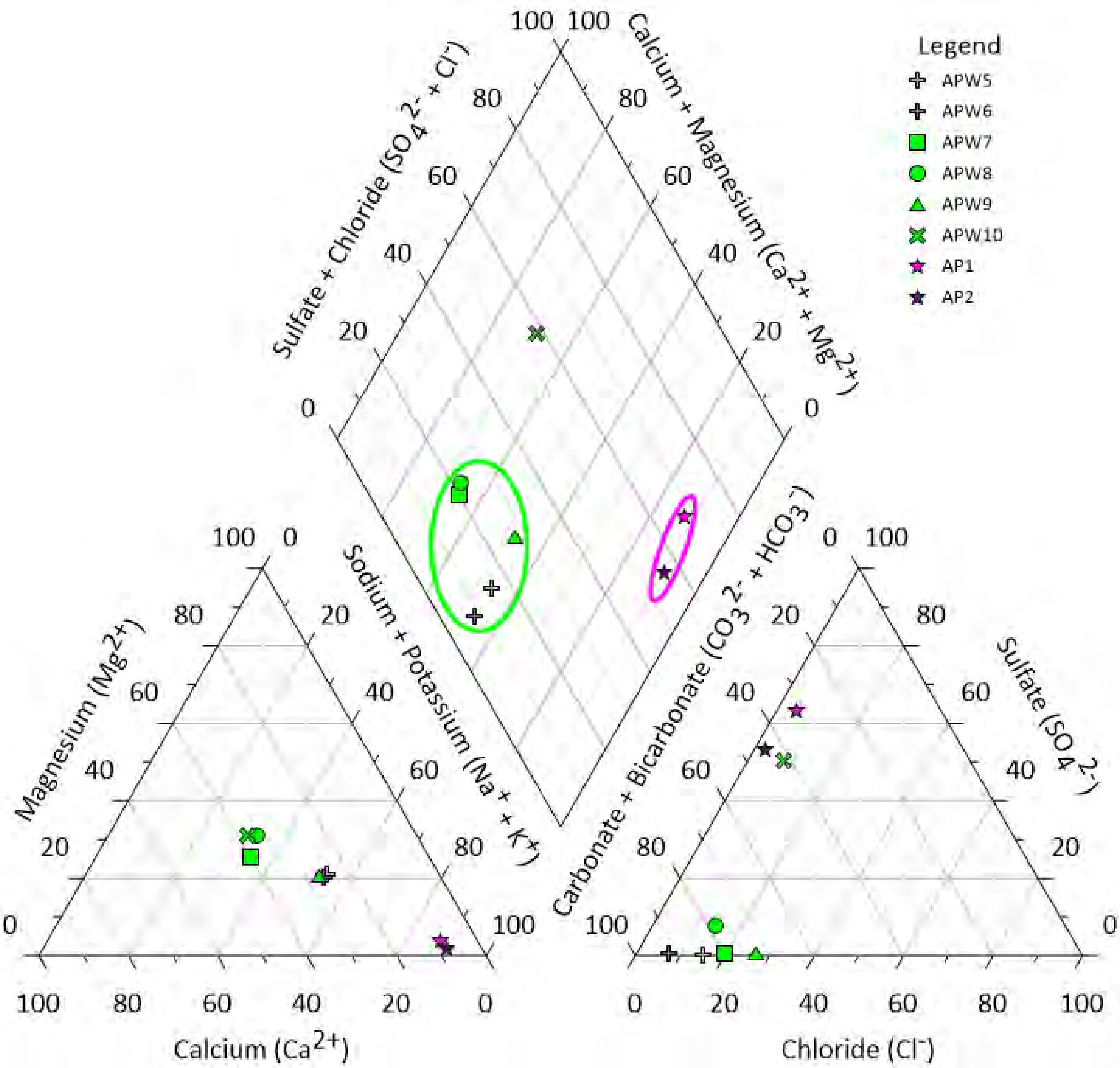


Figure 2 Piper Diagram Showing Ionic Composition of Samples of Background and Downgradient Groundwater Associated with PAP and Samples of PAP Surface Water.

LINE OF EVIDENCE #2: THE NEWTON PRIMARY ASH POND IS NOT HYDRAULICALLY CONNECTED TO THE UPPERMOST AQUIFER

As noted above, the Uppermost Aquifer at the Site is the Mulberry Grove Member of the Glasford Formation. Based on boring logs for monitoring wells installed around the perimeter of the site, the Uppermost Aquifer is confined and the top of this unit ranges from 461.8 ft msl in APW-8 to 482.8 ft msl in APW-10 (Attachment A). The bottom elevation of the PAP is within the Hagarstown Member of the Glasford Formation at 508 ft msl, approximately 25 ft above the top of the Uppermost Aquifer (Attachment B). The Hagarstown Member functions as an aquitard, with hydraulic conductivity ranging from 2.4×10^{-6} to 6.1×10^{-5} centimeters per second (cm/s). Based upon these hydraulic conductivity values and the fact that the Uppermost Aquifer is confined, the PAP is not hydraulically connected to the Uppermost Aquifer. The lack of connection between the PAP and the

Uppermost Aquifer demonstrates that there is no complete pathway for transport of CCR constituents in groundwater beneath the PAP, thus the PAP is not the source of CCR constituents in the Uppermost Aquifer.

LINE OF EVIDENCE #3: CONCENTRATIONS OF CALCIUM IN THE NEWTON PRIMARY ASH POND ARE LOWER THAN THOSE OBSERVED IN THE GROUNDWATER

Calcium concentrations are lower in PAP water samples than in all downgradient groundwater samples collected between 2015 and 2019. A time series for calcium concentrations is provided in Figure 3 below.

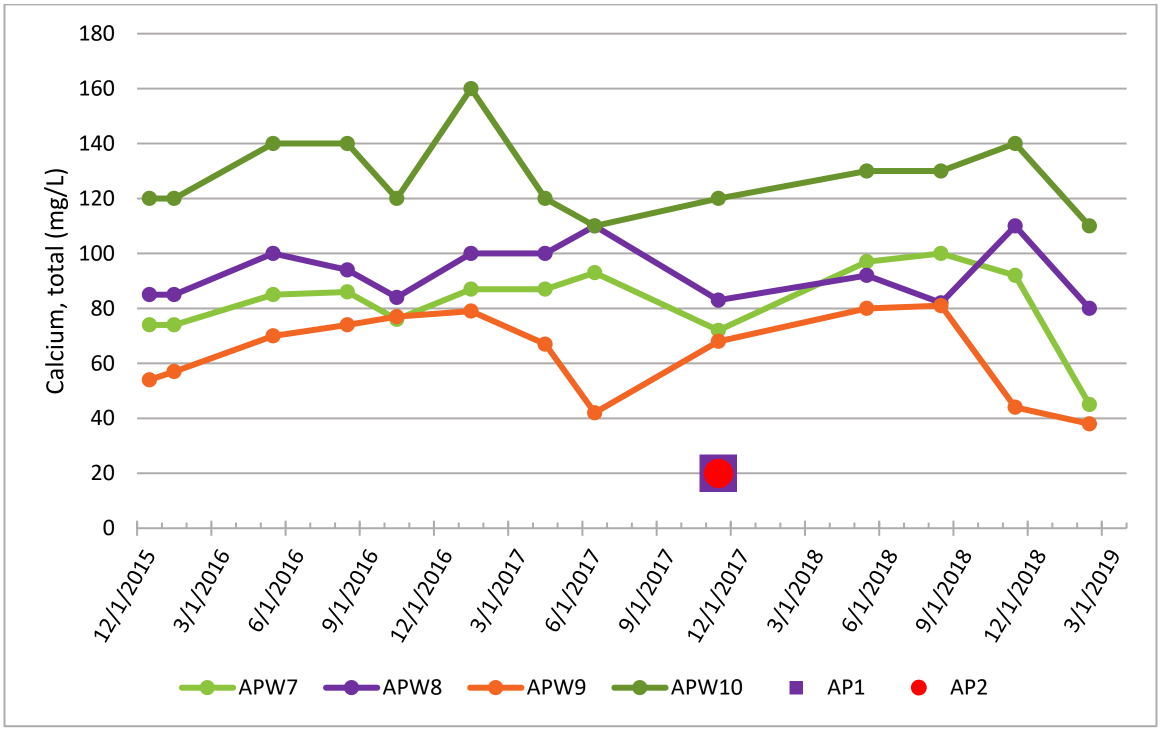


Figure 3. Calcium time series

The following observations can be made from Figure 3:

- PAP water samples AP1 and AP2 each contained 20 mg/L of calcium.
- Groundwater from downgradient wells APW7, APW8, APW9, and APW10 had higher calcium concentrations than the PAP water.

If the PAP were the source of calcium in groundwater, groundwater concentrations in PAP water would be higher than the downgradient groundwater; therefore, the PAP is not likely the source of the calcium observed in the Uppermost Aquifer.

LINE OF EVIDENCE #4: BORON, A PRIMARY INDICATOR PARAMETER OF CCR IMPACTS TO GROUNDWATER, HAS CONCENTRATIONS IN DOWNGRADIENT WELLS THAT ARE STABLE AND NEAR, OR BELOW, CONCENTRATIONS OBSERVED IN BACKGROUND MONITORING WELLS

Boron is a primary indicator of CCR impacts to groundwater. If the source of the SSIs in the downgradient monitoring wells were the PAP, boron would be anticipated to be present at elevated concentrations, as well. Concentrations of boron in all downgradient monitoring wells are below upper prediction limits established using background monitoring wells (i.e. SSI limits) and are lower than median concentrations observed in background wells APW5 and APW6 from 2015 through 2019, as shown on Figure 4.

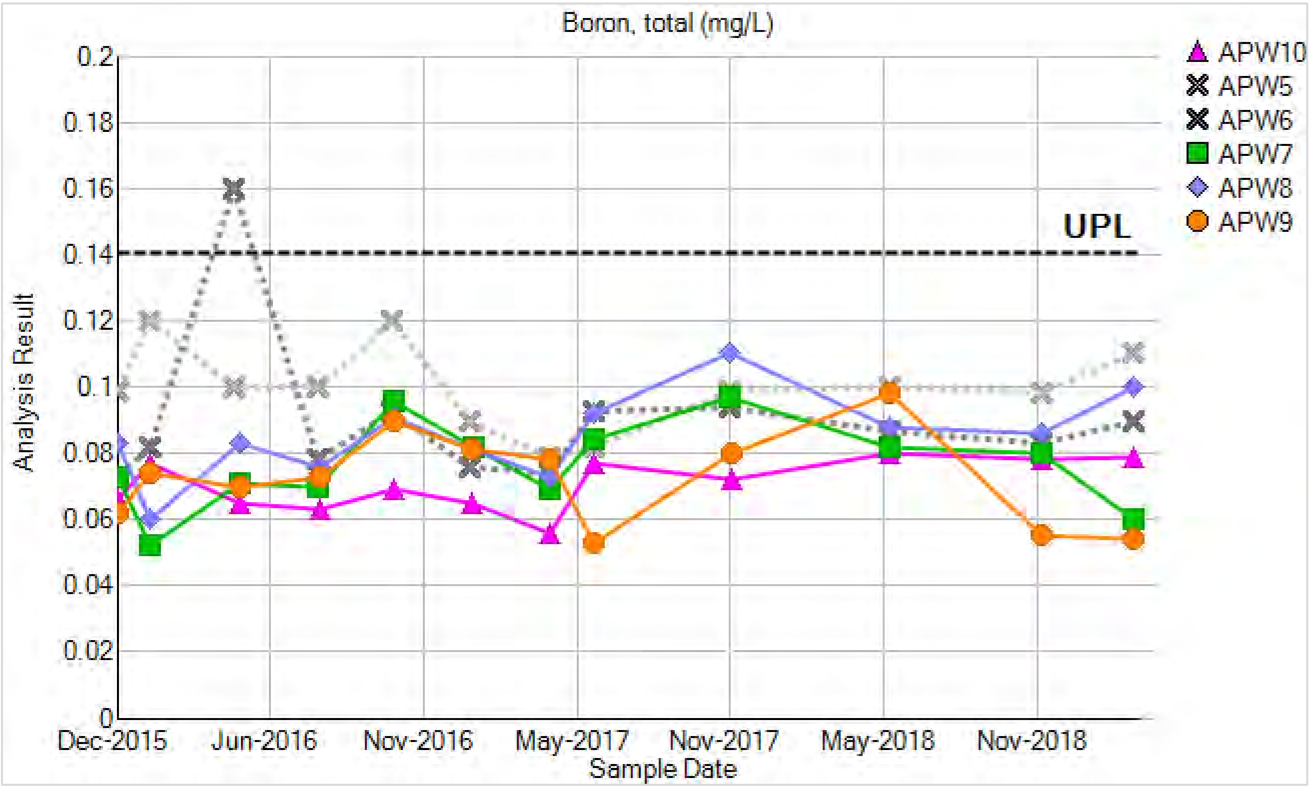


Figure 4. Boron time series showing boron concentrations in background wells (gray "X"s) are higher or similar to concentrations in downgradient wells.

From Figure 4 the following observations can be made:

- Boron concentrations in downgradient monitoring wells range from 0.052 mg/L to 0.11 mg/L, versus 0.073 mg/L to 0.16 mg/L in background wells.
- Overall median boron concentration in downgradient wells from 2015 through 2019 is 0.077 mg/L versus 0.093 mg/L in background wells.

Mann-Kendall trend analysis tests were performed (Attachment C) to determine if boron concentrations at each well were increasing, decreasing or stable (i.e., no statistically significant upward or downward trend). If the Mann-Kendall test did not identify a trend, the coefficient of variation (CV) was calculated (Attachment D) to determine if the concentrations were too variable to identify a trend (i.e. CV greater than or equal to 1). If a trend was identified, the CV was calculated to indicate whether data used to establish the trend were suggestive of a low or high magnitude trend. Data with a CV less than or equal to 1 suggest a lower magnitude trend. Boron concentrations are stable in background wells and downgradient wells APW7 and APW9. Upward trends were identified at APW8 and APW10, however, coefficient of variation evaluations identified minimal variation at all wells, suggesting a low-magnitude trend. Table 2 provides summary statistics, including variability and trend per well.

The low concentrations of boron in downgradient monitoring wells, relative to background concentrations, and the relatively stable boron concentrations in both background and downgradient monitoring wells suggests that the source of the of the SSIs in those wells is not the PAP.

Monitoring Well	Boron (mg/L)					
	Minimum	Maximum	Median	Standard Deviation	Trend	CV
APW5	0.079	0.12	0.100	0.0127	stable	0.13
APW6	0.073	0.16	0.085	0.0232	stable	0.26
APW7	0.052	0.097	0.077	0.0133	stable	0.17
APW8	0.060	0.11	0.085	0.0129	upward	0.15
APW9	0.053	0.098	0.074	0.0143	stable	0.20
APW10	0.056	0.08	0.071	0.0077	upward	0.11

Table 2. Minimum, maximum, median, standard deviation, trend, and coefficient of variation of boron concentrations in groundwater

Based on these four lines of evidence, it has been demonstrated that the Newton Primary Ash Pond has not caused the SSIs in APW7, APW8, APW9, and APW10.

This information serves as the written alternate source demonstration prepared in accordance with 40 C.F.R. § 257.94(e)(2) that SSIs observed during the detection monitoring program were not due to the PAP. Therefore, an assessment monitoring program is not required and the PAP will remain in detection monitoring.

Attachments

Figure 1 Monitoring Well and Source Water Location Map Newton Primary Ash Pond
Figure 2 Groundwater Elevation Contour Map – November 8, 2018
Attachment A Boring Logs for Monitoring Wells APW8 and APW10
Attachment B Geologic Cross Section B-B'
Attachment C Mann-Kendall Trend Analysis
Attachment D Coefficient of Variation Evaluation
.

I, Eric J. Tlachac, a qualified professional engineer in good standing in the State of Illinois, certify that the information in this report is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

Eric J. Tlachac
Qualified Professional Engineer
062-063091
Illinois
O'Brien & Gere Engineers, Inc., a Ramboll Company
Date: July 15, 2019

I, Nicole M. Pagano, a professional geologist in good standing in the State of Illinois, certify that the information in this report is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

Nicole M. Pagano
Professional Geologist
196-000750
O'Brien & Gere Engineers, Inc., a Ramboll Company
Date: July 15, 2019

Attachments

Figures

Y:\Mapping\Projects\22\2285\MXD\Alt_Source_Dem\Figure 1_Newton Landfill Phases_PAP.mxd Author: stolzsd

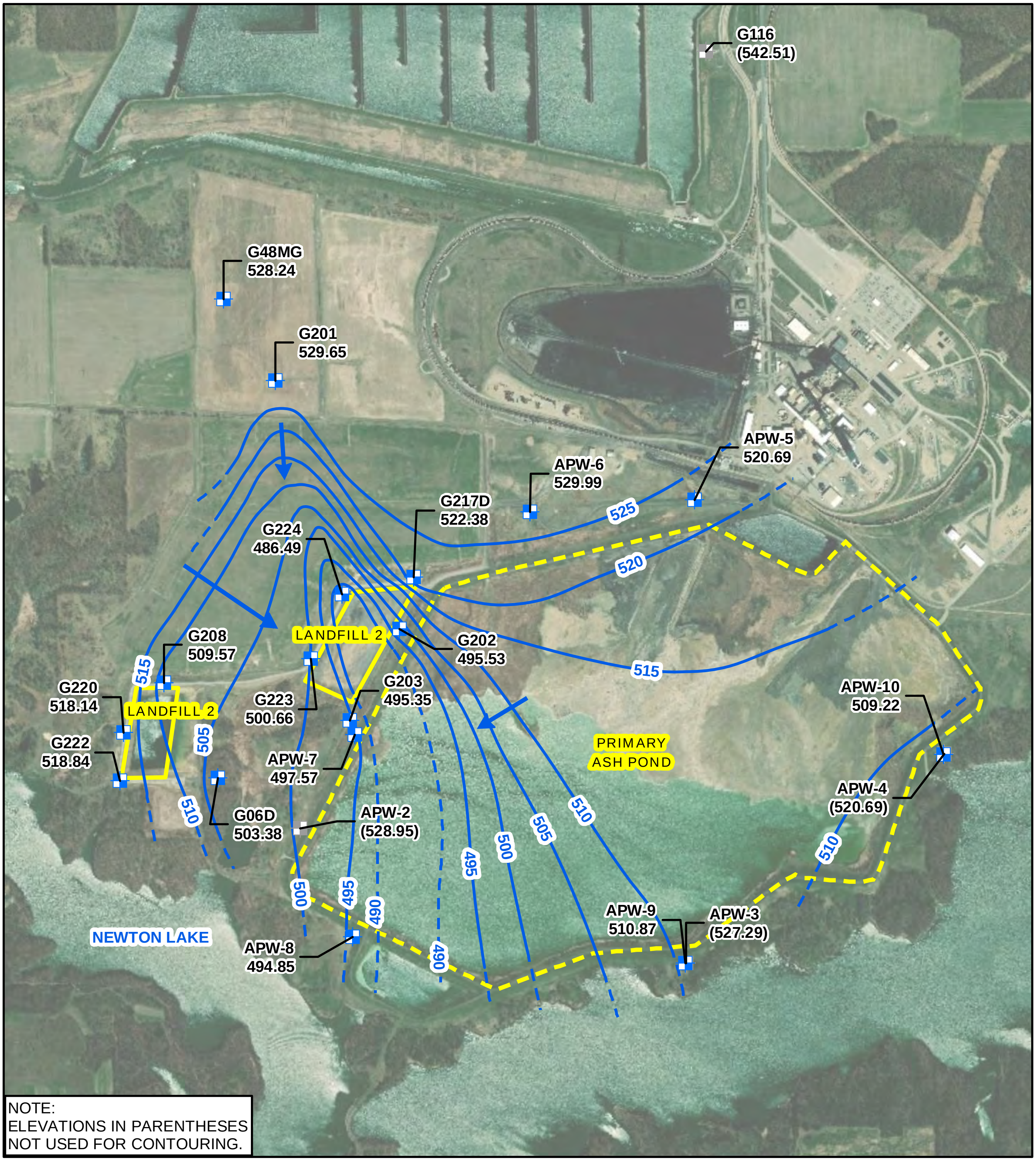
DRAWN BY/DATE:
SDS 3/28/18
REVIEWED BY/DATE:
JJW 3/28/18
APPROVED BY/DATE:
NMP 3/30/18

MONITORING WELL AND SOURCE WATER LOCATION MAP
NEWTON PRIMARY ASH POND

ALTERNATE SOURCE DEMONSTRATION
NEWTON POWER STATION
NEWTON, ILLINOIS

PROJECT NO: 67719

FIGURE NO: 1



CCR RULE MONITORING WELL LOCATION

NON-CCR RULE MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR (5-FOOT INTERVAL)

INFERRED GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW DIRECTION

LANDFILL 2 CCR MONITORED UNIT

PRIMARY ASH POND CCR MONITORED UNIT

NEWTON PRIMARY ASH POND (UNIT ID: 501)
GROUNDWATER ELEVATION CONTOUR MAP
NOVEMBER 8, 2018

ALTERNATE SOURCE DEMONSTRATION
NEWTON POWER STATION
NEWTON, ILLINOIS

0 325 650 1,300
Feet

N

O'BRIEN & GERE ENGINEERS, INC.

Y:\Mapping\Projects\22\2285\MXD\Alt_Source_Dem\Figure 2_D3 Newton GW Contours.mxd

Attachment A

Boring Logs for Monitoring Wells APW8 and APW10

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/27/2015
Finish: 10/28/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW8
Well ID: APW8
Surface Elev: 526.75 ft. MSL
Completion: 82.00 ft. BGS
Station: 3,839.59N
6,082.37E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 33.70 - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp (tsf)* Failure Type	Remarks
1A	60/60 *100%*	DP		13		*4.50*	
1B				21		*3.00*	
2A	60/60 *100%*	DP		18		*2.50*	
2B				28		*2.00*	
3A	20/24 *83%*	DP		8		*2.00*	
4A	0/17 *0%*	SS	*23-43 50/5"*				Rock in shoe of sampler.
5A	21/24 *88%*	SS	*13-20 24-28* N=44	10		*4.50*	
6A	24/24 *100%*	SS	*7-14 20-48* N=34	11		*4.50*	
7A	24/24 *100%*	SS	*14-21 26-32* N=47	10			

Depth ft. BGS: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20
Elevation ft. MSL: 526, 524, 522, 520, 518, 516, 514, 512, 510, 508

Lithologic Description

Black (10YR2/1), moist, very stiff, SILT with little clay and trace very fine- to medium-grained sand, roots.

Yellowish brown (10YR5/4) with 30% light gray (10YR7/2) mottles, dry, hard, SILT with little clay and trace very fine- to medium-grained sand.

Grayish brown (10YR5/2) with 15% dark yellowish brown (10YR4/6) and 10% black (10YR2/1) mottles, moist, very stiff, silty CLAY with few very fine- to coarse-grained sand and trace small gravel.

Grayish brown (10YR5/2) with 15% dark yellowish brown mottles, moist, stiff, silty CLAY with few very fine- to coarse-grained sand and trace small gravel.

Brown (10YR5/3) with 20% dark yellowish brown (10YR5/6) mottles, dry, stiff, SILT with little clay and trace very fine- to coarse-grained sand.

Dark gray (10YR4/1), moist, hard, SILT with little clay, trace very fine- to coarse-grained sand and small gravel.

NOTE(S): APW8 installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/27/2015
Finish: 10/28/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW8
Well ID: APW8
Surface Elev: 526.75 ft. MSL
Completion: 82.00 ft. BGS
Station: 3,839.59N
6,082.37E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 33.70 - During Drilling
▼ =
▽ =

SAMPLE: Number	SAMPLE: Recov / Total (in) *% Recovery*	SAMPLE: Type	TESTING: *Blows / 6 in* N - Value **RQD**	TESTING: Moisture (%)	TESTING: Dry Den. (lb/ft³)	TESTING: Qu (tsf) *Qp (tsf)* Failure Type
8A	24/24 *100%*	SS	*7-13 19-23* N=32	11		*4.50*
9A	24/24 *100%*	SS	*7-14 19-27* N=33	11		*4.50*
10A	24/24 *100%*	SS	*8-15 30-37* N=45	11		*4.50*
11A	24/24 *100%*	SS	*8-16 24-33* N=40	11		*4.50*
12A	24/24 *100%*	SS	*9-31 33-30* N=64	11		
12B				12		*4.50*
13A	24/24 *100%*	SS	*10-23 40-35* N=63	11		*4.50*
14A	21/24 *88%*	SS	*16-16 29-50* N=45	10		*4.50*
15A	20/24 *83%*	SS	*9-24 34-41* N=58	13		
	22/24 *92%*	SS	*16-18 29-35* N=47			
16A				11		*4.50*
17A	21/24 *88%*	SS	*10-17 21-31* N=38	11		*4.50*

Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
20.00–29.00	Dark gray (10YR4/1), moist, hard, SILT with little clay, trace very fine- to coarse-grained sand and small gravel. *[Continued from previous page]*	506, 504, 502, 500, 498	
29.00–29.70	Gray (10YR5/1), moist, dense, silty, very fine- to medium-grained SAND.		
29.70–33.70	Dark gray (10YR4/1), moist, hard SILT with little clay, few very fine- to coarse-grained sand, and trace small gravel.	496, 494	
33.70–36.30	Dark gray (10YR4/1), wet, very dense, silty, very fine- to coarse-grained SAND with trace small gravel.	492	
36.30–40.00	Dark gray (10YR4/1), moist, hard, SILT with little clay, few very fine- to coarse-grained sand, and trace small gravel.	490, 488	

Depth scale: 22, 24, 26, 28, 30, 32, 34, 36, 38, 40 (▼ at 33.70)

NOTE(S): APW8 installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/27/2015
Finish: 10/28/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW8
Well ID: APW8
Surface Elev: 526.75 ft. MSL
Completion: 82.00 ft. BGS
Station: 3,839.59N
6,082.37E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 33.70 - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Qp (tsf)* Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
18A	24/24 *100%*	SS	*9-16 26-32* N=42	11		*4.50*				486	
							42				
19A	24/24 *100%*	SS	*10-16 23-34* N=39	12		*4.50*				484	
							44				
20A	24/24 *100%*	SS	*10-15 26-44* N=41	13		*4.50*				482	
							46				
21A	24/24 *100%*	SS	*12-21 32-48* N=53	12		*4.50*				480	
							48				
22A	24/24 *100%*	SS	*11-17 22-31* N=39	13		*4.50*		Dark gray (10YR4/1), moist, hard, SILT with little clay, few very fine- to coarse-grained sand, and trace small gravel. *[Continued from previous page]*		478	
							50				
23A	24/24 *100%*	SS	*10-13 21-32* N=34	13		*4.50*				476	
							52				
24A	24/24 *100%*	SS	*8-13 50-26* N=63	13		*4.50*				474	
							54				
25A	24/24 *100%*	SS	*8-11 19-28* N=30	14		*4.25*				472	
							56				
26A	24/24 *100%*	SS	*10-12 18-26* N=30	13		*4.50*				470	
							58				
27A	22/24 *92%*	SS	*7-10 15-22* N=25	21		*4.50*		Olive gray (5Y4/2), moist, hard, silty CLAY with few very fine- to coarse-grained sand and trace small gravel.		468	
							60				

NOTE(S): APW8 installed in borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/27/2015
Finish: 10/28/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

HANSON

BOREHOLE ID: APW8
Well ID: APW8
Surface Elev: 526.75 ft. MSL
Completion: 82.00 ft. BGS
Station: 3,839.59N
6,082.37E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 33.70 - During Drilling
▼ =
▽ =

Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp (tsf)* Failure Type
28A	20/24 *83%*	ss	*7-15 19-20* N=34	14		*4.50*
29A	21/24 *88%*	ss	*7-8 11-16* N=19	11		*3.75*
30A	21/24 *88%*	ss	*6-13 14-11* N=27	14		*4.00*
30B				10		
31A	18/24 *75%*	ss	*4-3 4-3* N=7	28		
31B				15		*3.25*
32A	20/24 *83%*	ss	*1-3 3-2* N=6	17		
32B				28		
33A	15/24 *63%*	ss	*woh-2 6-6* N=8	17		
34A	16/24 *67%*	ss	*9-11 15-20* N=26	9		
35A	15/24 *63%*	ss	*16-21 23-24* N=44	9		
36A	14/24 *58%*	ss	*11-20 25-24* N=45	11		
37A	15/24 *63%*	ss	*20-25 24-25* N=49	10		

Depth ft. BGS (scale): 62, 64, 66, 68, 70, 72, 74, 76, 78, 80

Elevation ft. MSL (scale): 466, 464, 462, 460, 458, 456, 454, 452, 450, 448

Lithologic Description:

- Dark gray (10YR4/1), moist, hard, SILT with little clay, few very fine- to coarse-grained sand and trace small gravel.
- Dark gray (10YR4/1), moist, very stiff, SILT with little clay, few very fine- to coarse-grained sand and trace small gravel.
- Gray (10YR6/1), wet, medium dense, silty, very fine- to coarse-grained SAND with trace small to large gravel.
- Dark gray (10YR4/1), moist, very stiff, SILT with little clay and few very fine- to coarse-grained sand.
- Dark gray (10YR4/1), wet, loose, silty, very fine- to coarse-grained SAND with trace small gravel and trace wood fragments.
- Dark gray (10YR4/1), moist, very stiff, SILT with little clay, few very fine- to coarse-grained sand, and trace small gravel, trace wood fragments.
- Dark gray (10YR4/1), wet, loose, SILT with little very fine- to fine-grained sand.
- Dark gray (10YR4/1), wet, loose, silty, very fine- to coarse-grained SAND.
- Dark gray (10YR4/1), wet, loose, SILT with little very fine- to fine-grained sand, trace wood fragments.
- Dark gray (10YR4/1), wet, loose, silty, very fine- to coarse-grained SAND, trace wood fragments.
- Dark gray (10YR4/1), wet, medium dense, silty, very fine- to coarse-grained SAND with trace small gravel.
- Dark gray (10YR4/1), wet, medium dense, silty, very fine- to coarse-grained SAND with few small to large gravel.
- Dark gray (10YR4/1), wet, dense, silty, very fine- to coarse-grained SAND with few small to large gravel.
- Dark gray (10YR4/1), wet, dense, silty, very fine- to coarse-grained SAND with trace small gravel.

Borehole Detail | Remarks

NOTE(S): APW8 installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/27/2015
Finish: 10/28/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW8
Well ID: APW8
Surface Elev: 526.75 ft. MSL
Completion: 82.00 ft. BGS
Station: 3,839.59N
6,082.37E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 33.70 - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) / *% Recovery*	Type	*Blows / 6 in* / N - Value / **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp (tsf)* / Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
38A	18/24 *75%*	SS	*26-26* *26-31* N=52	8				Dark gray (10YR4/1), wet, dense, silty, very fine- to coarse-grained SAND with trace small gravel. *[Continued from previous page]*		446	
38B				11		*4.50*	82	Dark gray (10YR4/1), moist, hard, SILT with little clay and few very fine- to coarse-grained sand.			

End of boring = 82.0 feet

NOTE(S): APW8 installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/27/2015
Finish: 10/27/2015
WEATHER: Cool, rainy, lo-50s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA

FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW10a
Well ID: APW10
Surface Elev: 521.98 ft. MSL
Completion: 45.94 ft. BGS
Station: 5,371.32N
11,541.23E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 25, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 36.00 - During Drilling
▼ =
▽ =

SAMPLE			TESTING								
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							2			520	
							4			518	
							6			516	
							8			514	
							10	Blind drill - see APW4 boring log for lithology, sample, and testing data		512	
							12			510	
							14			508	
							16			506	
							18			504	
							20			502	

NOTE(S): APW10 installed in borehole.
Lithology, sample, and testing data can be found on APW-4 Field Boring Log.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/27/2015
Finish: 10/27/2015
WEATHER: Cool, rainy, lo-50s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA

FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW10a
Well ID: APW10
Surface Elev: 521.98 ft. MSL
Completion: 45.94 ft. BGS
Station: 5,371.32N
11,541.23E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 25, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 36.00 - During Drilling
▼ =
▽ =

SAMPLE: Number	Recov / Total (in) / % Recovery	Type	TESTING: Blows / 6 in / N - Value / RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) / Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							22	Yellowish brown (10YR5/6) with 5% gray (N6/1) mottles, moist, hard, SILT with little clay, few very fine-grained sand, and trace small gravel.		500	
							24, 26, 28, 30	Yellowish brown (10YR5/4) with 5% dark yellowish brown (10YR4/6) and 5% gray (N6/1) mottles, moist, hard, SILT with little clay, few very fine-grained sand, and trace small gravel.		498, 496, 494, 492	
							32, 34, ▼ 36, 38	Brown (10YR5/3) with 5% gray (N6/1) mottles, moist, hard, SILT with little clay, few very fine-grained sand, and trace small gravel.		490, 488, 486, 484	
							40	Brown (10YR5/3), wet, very dense, silty, very fine- to medium-grained SAND with trace small gravel.		482	

NOTE(S): APW10 installed in borehole.
Lithology, sample, and testing data can be found on APW-4 Field Boring Log.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/27/2015
Finish: 10/27/2015
WEATHER: Cool, rainy, lo-50s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA

FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW10a
Well ID: APW10
Surface Elev: 521.98 ft. MSL
Completion: 45.94 ft. BGS
Station: 5,371.32N
11,541.23E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 25, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 36.00 - During Drilling
▼ =
▽ =

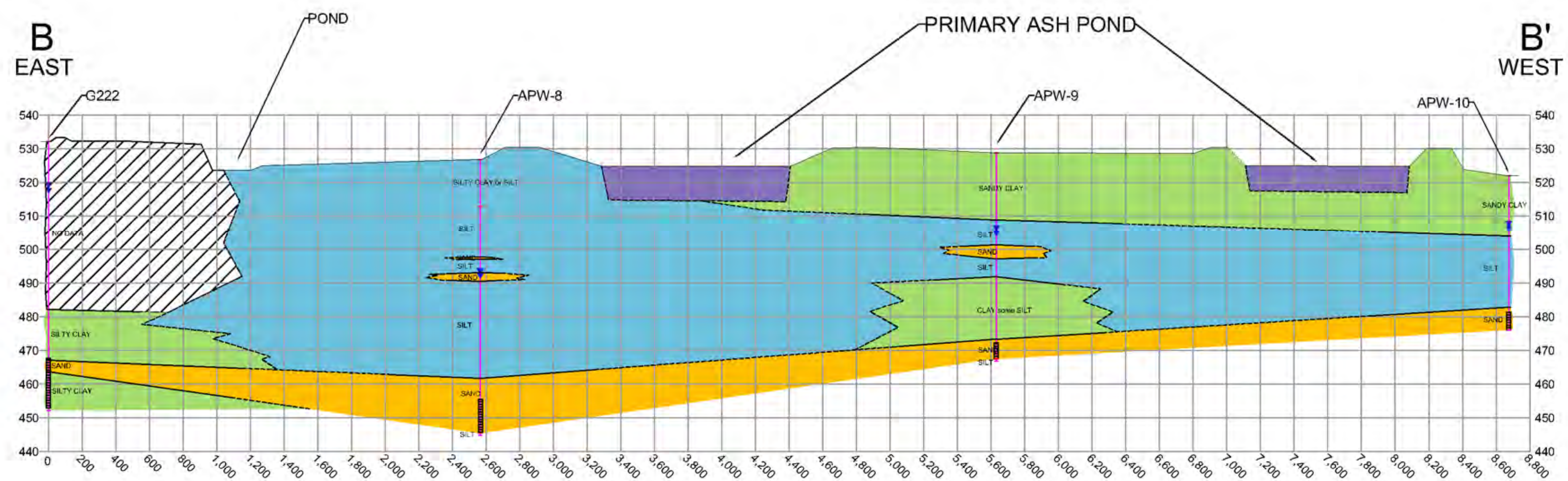
SAMPLE: Number	Recov / Total (in) *% Recovery*	Type	TESTING: *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							42 44	Brown (10YR5/3), wet, very dense, silty, very fine- to medium-grained SAND with trace small gravel. *[Continued from previous page]*		480 478	

End of boring = 45.94 feet

NOTE(S): APW10 installed in borehole.
Lithology, sample, and testing data can be found on APW-4 Field Boring Log.

Attachment B

Geologic Cross Section B-B'



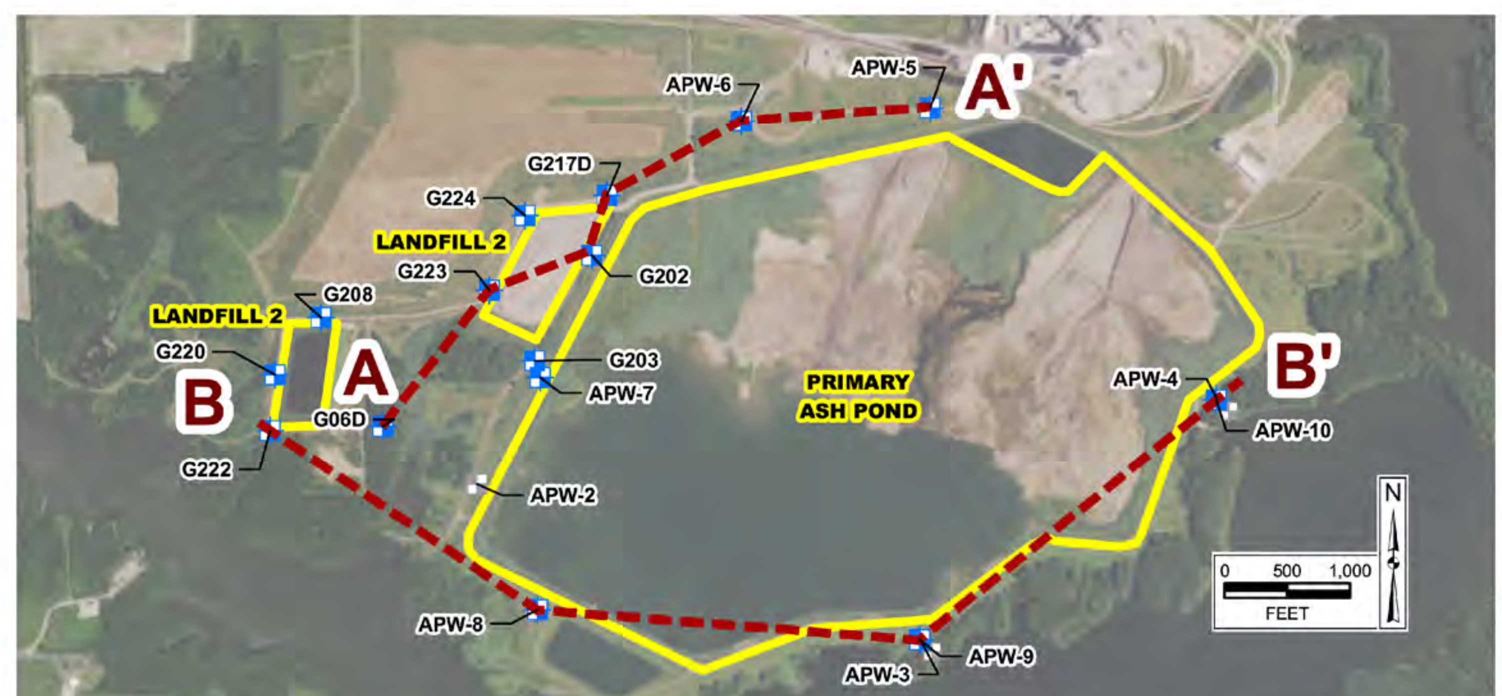
NO DATA	WELL SCREEN
ASH	GROUNDWATER ELEVATION
CLAY	
SILT	
SAND	

NOTE THAT THE DEPTH OF THE ASH IN THE ASH POND IS APPROXIMATE.

VERTICAL SCALE IN FEET: 40

HORIZONTAL SCALE IN FEET: 800

VERTICAL EXAGGERATION =20



DRAWN BY: JMO DATE: 08/29/2017

CHECKED BY: TBN DATE: 10/2/2017

APPROVED BY: SJC DATE: 10/2/2017

DRAWING NO: Fig X_Geologic Cross-Section A-A'

REFERENCE:

GEOLOGIC CROSS-SECTION B-B'

HYDROGEOLOGIC MONITORING PLAN

NEWTON POWER STATION
NEWTON, ILLINOIS

Natural Resource Technology
AN OBG COMPANY

PROJECT NO.
2285

FIGURE NO.
APPENDIX A-2

Attachment C

Mann-Kendall Trend Analysis

Newton
Mann-Kendall Trend Analysis

User Supplied Information

Location ID:	**APW5**	**Parameter Code:**	**01022**
Location Class:		**Parameter:**	**B, tot**
Location Type:		**Units:**	**mg/L**
Confidence Level:	**95.00%**	**Period Length:**	**1 month(s)**
Date Range: 12/14/2015 to 03/31/2019		**Limit Name:**	
		Averaged:	**No**

Trend Analysis

Trend of the least squares straight line

Slope (fitted to data):	-0.000004	mg/L per day
R-Squared error of fit:	0.016425	

Sen's Non-parametric estimate of the slope (One-Sided Test)

Median Slope:	-0.000001	mg/L per day
Lower Confidence Limit of Slope, M1:	-0.000031	mg/L per day
Upper Confidence Limit of Slope, M2+1:	0.000011	mg/L per day

Non-parametric Mann-Kendall Test for Trend

S Statistic:	-0.417
Z test:	1.645
At the 95.0 % Confidence Level (One-Sided Test):	None

Newton
Mann-Kendall Trend Analysis

User Supplied Information

Location ID:	**APW6**	**Parameter Code:**	**01022**
Location Class:		**Parameter:**	**B, tot**
Location Type:		**Units:**	**mg/L**
Confidence Level:	**95.00%**	**Period Length:**	**1 month(s)**
Date Range: 12/14/2015 to 03/31/2019		**Limit Name:**	
		Averaged:	**No**

Trend Analysis

Trend of the least squares straight line

Slope (fitted to data):	-0.000008	mg/L per day
R-Squared error of fit:	0.018309	

Sen's Non-parametric estimate of the slope (One-Sided Test)

Median Slope:	0.000006	mg/L per day
Lower Confidence Limit of Slope, M1:	-0.000015	mg/L per day
Upper Confidence Limit of Slope, M2+1:	0.000018	mg/L per day

Non-parametric Mann-Kendall Test for Trend

S Statistic:	0.687
Z test:	1.645
At the 95.0 % Confidence Level (One-Sided Test):	None

Newton
Mann-Kendall Trend Analysis

User Supplied Information

Location ID:	**APW7**	**Parameter Code:**	**01022**
Location Class:		**Parameter:**	**B, tot**
Location Type:		**Units:**	**mg/L**
Confidence Level:	**95.00%**	**Period Length:**	**1 month(s)**
Date Range: 12/14/2015 to 03/31/2019		**Limit Name:**	
		Averaged:	**No**

Trend Analysis

Trend of the least squares straight line

Slope (fitted to data):	0.000006	mg/L per day
R-Squared error of fit:	0.033439	

Sen's Non-parametric estimate of the slope (One-Sided Test)

Median Slope:	0.000008	mg/L per day
Lower Confidence Limit of Slope, M1:	-0.000011	mg/L per day
Upper Confidence Limit of Slope, M2+1:	0.000034	mg/L per day

Non-parametric Mann-Kendall Test for Trend

S Statistic:	0.412
Z test:	1.645
At the 95.0 % Confidence Level (One-Sided Test):	None

Newton
Mann-Kendall Trend Analysis

User Supplied Information

Location ID:	**APW8**	**Parameter Code:**	**01022**
Location Class:		**Parameter:**	**B, tot**
Location Type:		**Units:**	**mg/L**
Confidence Level:	**95.00%**	**Period Length:**	**1 month(s)**
Date Range: 12/14/2015 to 03/31/2019		**Limit Name:**	
		Averaged:	**No**

Trend Analysis

Trend of the least squares straight line

Slope (fitted to data):	0.000019	mg/L per day
R-Squared error of fit:	0.342389	

Sen's Non-parametric estimate of the slope (One-Sided Test)

Median Slope:	0.000017	mg/L per day
Lower Confidence Limit of Slope, M1:	0.000003	mg/L per day
Upper Confidence Limit of Slope, M2+1:	0.000039	mg/L per day

Non-parametric Mann-Kendall Test for Trend

S Statistic:	1.787
Z test:	1.645
At the 95.0 % Confidence Level (One-Sided Test):	Upward

Newton
Mann-Kendall Trend Analysis

User Supplied Information

Location ID:	**APW9**	**Parameter Code:**	**01022**
Location Class:		**Parameter:**	**B, tot**
Location Type:		**Units:**	**mg/L**
Confidence Level:	**95.00%**	**Period Length:**	**1 month(s)**
Date Range: 12/14/2015 to 03/31/2019		**Limit Name:**	
		Averaged:	**No**

Trend Analysis

Trend of the least squares straight line		
Slope (fitted to data):	-0.000006	mg/L per day
R-Squared error of fit:	0.028627	
Sen's Non-parametric estimate of the slope (One-Sided Test)		
Median Slope:	-0.000001	mg/L per day
Lower Confidence Limit of Slope, M1:	-0.000026	mg/L per day
Upper Confidence Limit of Slope, M2+1:	0.000028	mg/L per day
Non-parametric Mann-Kendall Test for Trend		
S Statistic:	0.000	
Z test:	1.645	
At the 95.0 % Confidence Level (One-Sided Test):	None	

Newton
Mann-Kendall Trend Analysis

User Supplied Information

Location ID:	**APW10**	**Parameter Code:**	**01022**
Location Class:		**Parameter:**	**B, tot**
Location Type:		**Units:**	**mg/L**
Confidence Level:	**95.00%**	**Period Length:**	**1 month(s)**
Date Range: 12/14/2015 to 03/31/2019		**Limit Name:**	
		Averaged:	**No**

Trend Analysis

Trend of the least squares straight line

Slope (fitted to data):	0.000011	mg/L per day
R-Squared error of fit:	0.304448	

Sen's Non-parametric estimate of the slope (One-Sided Test)

Median Slope:	0.000011	mg/L per day
Lower Confidence Limit of Slope, M1:	0.000000	mg/L per day
Upper Confidence Limit of Slope, M2+1:	0.000019	mg/L per day

Non-parametric Mann-Kendall Test for Trend

S Statistic:	1.722
Z test:	1.645
At the 95.0 % Confidence Level (One-Sided Test):	Upward

Attachment D

Coefficient of Variation Evaluation

Newton

Coefficient of Variation
Date Range: 12/14/2015 to 3/31/2019

Boron, total (mg/L)

Location	Count	Mean	Std Dev	% Non-Detects	CV
APW5	12	0.100	0.013	0.00	0.13
APW6	12	0.090	0.023	0.00	0.26
APW7	12	0.076	0.013	0.00	0.17
APW8	12	0.085	0.013	0.00	0.15
APW9	12	0.072	0.014	0.00	0.20
APW10	12	0.071	0.008	0.00	0.11

CV=Std Dev/ Mean

40 C.F.R. § 257.94(e)(2): ALTERNATE SOURCE DEMONSTRATION
NEWTON PRIMARY ASH POND
OCTOBER 14, 2019

October 14, 2019

Title 40 of the Code of Federal Regulations (C.F.R.) § 257.94(e)(2) allows the owner or operator of a Coal Combustion Residuals (CCR) unit 90 days from the date of determination of Statistically Significant Increases (SSIs) over background for groundwater constituents listed in Appendix III of 40 C.F.R. Part 257 to complete a written demonstration that a source other than the CCR unit being monitored caused the SSI(s), or that the SSI(s) resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality (Alternate Source Demonstration [ASD]).

This ASD has been prepared on behalf of Illinois Power Generating Company by O'Brien & Gere Engineers, Inc., part of Ramboll (OBG) to provide pertinent information pursuant to 40 C.F.R. § 257.94(e)(2) for the Newton Primary Ash Pond (PAP) located near Newton, Illinois.

The fourth semi-annual detection monitoring samples (Detection Monitoring Round 4 [D4]) were collected on February 22, 2019 and analytical data were received on April 15, 2019. In accordance with 40 C.F.R. § 257.93(h)(2), statistical analysis of the data to identify SSIs of 40 C.F.R. Part 257 Appendix III parameters over background concentrations was completed by July 15, 2019, within 90 days of receipt of the analytical data. The statistical determination identified the following SSIs at downgradient monitoring wells:

- Calcium at wells APW8 and APW10
- Fluoride at wells APW7 and APW9
- Sulfate at wells APW7, APW8, APW9, and APW10

Pursuant to 40 C.F.R. § 257.94(e)(2), the following demonstrates that sources other than the Newton PAP were the cause of the SSIs listed above. This ASD was completed by October 14, 2019, within 90 days of determination of the SSIs, as required by 40 C.F.R. § 257.94(e)(2).

SITE LOCATION AND DESCRIPTION

The Newton Power Station (Site) is located in Jasper County, in the southeastern part of central Illinois, approximately 7 miles southwest of the town of Newton. The area is surrounded by Newton Lake. Beyond the lake is agricultural land.

GEOLOGY AND HYDROGEOLOGY

The site geology and hydrogeology are summarized below from the Hydrogeologic Monitoring Plan (NRT/OBG, 2017a)[1].

GEOLOGY

Quaternary deposits in the Newton area consist mainly of diamictons and outwash deposits that were deposited during Illinoian and Pre-Illinoian glaciations. The unconsolidated deposits occurring at Newton Power Station include the following units (beginning at the ground surface):

- Ash/Fill Units – CCR and fill within the various CCR Units

[1] Natural Resource Technology, an OBG Company (NRT), October 17, 2017. *Hydrogeologic Monitoring Plan. Newton Primary Ash Pond – CCR Unit ID 501, Newton Landfill 2 – CCR Unit ID 502*. Newton Power Station, Canton, Illinois. Illinois Power Generating Company.

- Upper Confining Unit – Low permeability clays and silts, including: the Peoria Silt (Loess Unit) in upland areas and the Cahokia Formation in the flood plain and channel areas to the south and east; underlain by the Sangamon Soil, and the predominantly clay diamictons of the Hagarstown (Till) and Vandalia (Till) Members of the Glasford Formation
- Uppermost Aquifer (Groundwater Monitoring Zone) – Thin to moderately thick (3 to 17 ft), moderate to high permeability sand, silty sand, and sandy silt/clay units of the Mulberry Grove Member of the Glasford Formation
- Lower Confining Unit – Thick, very low permeability silty clay diamicton of the Smithboro (Till) Member of the Glasford Formation and the silty clay diamictons of the Banner Formation

The bedrock beneath the unconsolidated deposits consists of Pennsylvanian-age Mattoon Formation that is mostly shale near the bedrock surface, but is characterized at depth by a complex sequence of shales, thin limestones, coals, underclays, and several sandstones. The erosional surface of the Pennsylvanian-age Mattoon Formation bedrock ranges widely in depth in the vicinity of the site, but is typically encountered at 90 to 120 ft below ground surface (bgs).

HYDROGEOLOGY

The information used to describe the hydrogeology is based on the local geology obtained from published sources, hydrogeologic investigation data, and boring data collected during monitoring well installation. CCR monitoring well locations are shown in Figure 1.

Uppermost Aquifer

The Uppermost Aquifer is the Mulberry Grove Member, typically consisting of fine to coarse sand with varying amounts of clay, silt, and fine to coarse gravel. The portion of the Mulberry Grove Member at the site that is defined as a sand layer ranges in thickness from 3 to 17 ft with an average thickness of 8 ft. With only a few exceptions, the sand layer occurs between depths of 55 to 88 ft bgs.

Lower Limit of Aquifer

The lower hydrostratigraphic units, which comprise the lower limit of the Uppermost Aquifer, consist of the Smithboro Member and the Banner Formation, both of which are predominantly low permeability clay diamictons with varying amounts of silt, sand, and gravel. The lower hydrostratigraphic units are 30 to more than 50 ft thick above the underlying bedrock.

Groundwater Elevation and Flow Direction

Groundwater elevations across PAP ranged from approximately 494 to 531 ft MSL (NAVD88) during D4 (Figure 2). The groundwater elevation contours shown on Figure 2 were measured on February 18, 2019, the first day of a combined sampling event at the Site for LF2 and the Primary Ash Pond and for multiple monitoring programs required by both federal and state regulatory agencies. Overall groundwater flow within the Uppermost Aquifer in this area is southward toward Newton Lake, but with a predominantly southwesterly flow under the PAP.

GROUNDWATER AND PAP WATER MONITORING

The Uppermost Aquifer monitoring system for the PAP is shown on Figure 1. Monitoring wells APW5 and APW6 are used to monitor background water quality for the PAP. These wells are located north of the PAP. The downgradient monitoring wells are APW7, APW8, APW9, and APW10.

PAP water samples have been collected from locations AP1 in the southwest corner of the PAP and AP2 in the southeast corner of the PAP.

ALTERNATE SOURCE DEMONSTRATION: LINES OF EVIDENCE

Lines of evidence supporting these ASDs include the following:

1. The ionic composition of Newton PAP water is different from the ionic composition of groundwater.
2. The Newton PAP is not hydraulically connected to the Uppermost Aquifer.
3. Concentrations of calcium in the Newton PAP are lower than those observed in the groundwater.
4. Boron, a primary indicator parameter for CCR impacts to groundwater, has concentrations in downgradient wells that are near, or below, concentrations observed in background monitoring wells.

These lines of evidence are described and supported in greater detail below. Monitoring wells and leachate sample locations are shown on Figure 1.

LINE OF EVIDENCE #1: THE IONIC COMPOSITION OF NEWTON PAP WATER IS DIFFERENT FROM THE IONIC COMPOSITION OF GROUNDWATER

Piper diagrams graphically represent ionic composition of aqueous solutions. A Piper diagram displays the position of water samples relative to their major cation and anion content, providing the information needed to identify compositional categories or groupings. Figure 2 is a Piper diagram that displays the ionic composition of groundwater samples from the background and downgradient monitoring wells associated with the Phase I Landfill (LF1), Phase II Landfill (LF2), and Primary Ash Pond (PAP) and LF1 leachate and PAP water based on Quarter 2 2017 and Quarter 3 2018 samples.

Groundwater samples from the PAP downgradient wells (enclosed within a green ellipse) have a very high percentage of carbonate-bicarbonate cations and no dominant cation. Surface water samples from the PAP (enclosed within a purple ellipse) have a very high percentage of sodium-potassium cations and no dominant anion. The dissimilar ionic compositions of the PAP downgradient groundwater and the PAP surface water indicates that the PAP is not the source of CCR constituents detected in PAP groundwater.

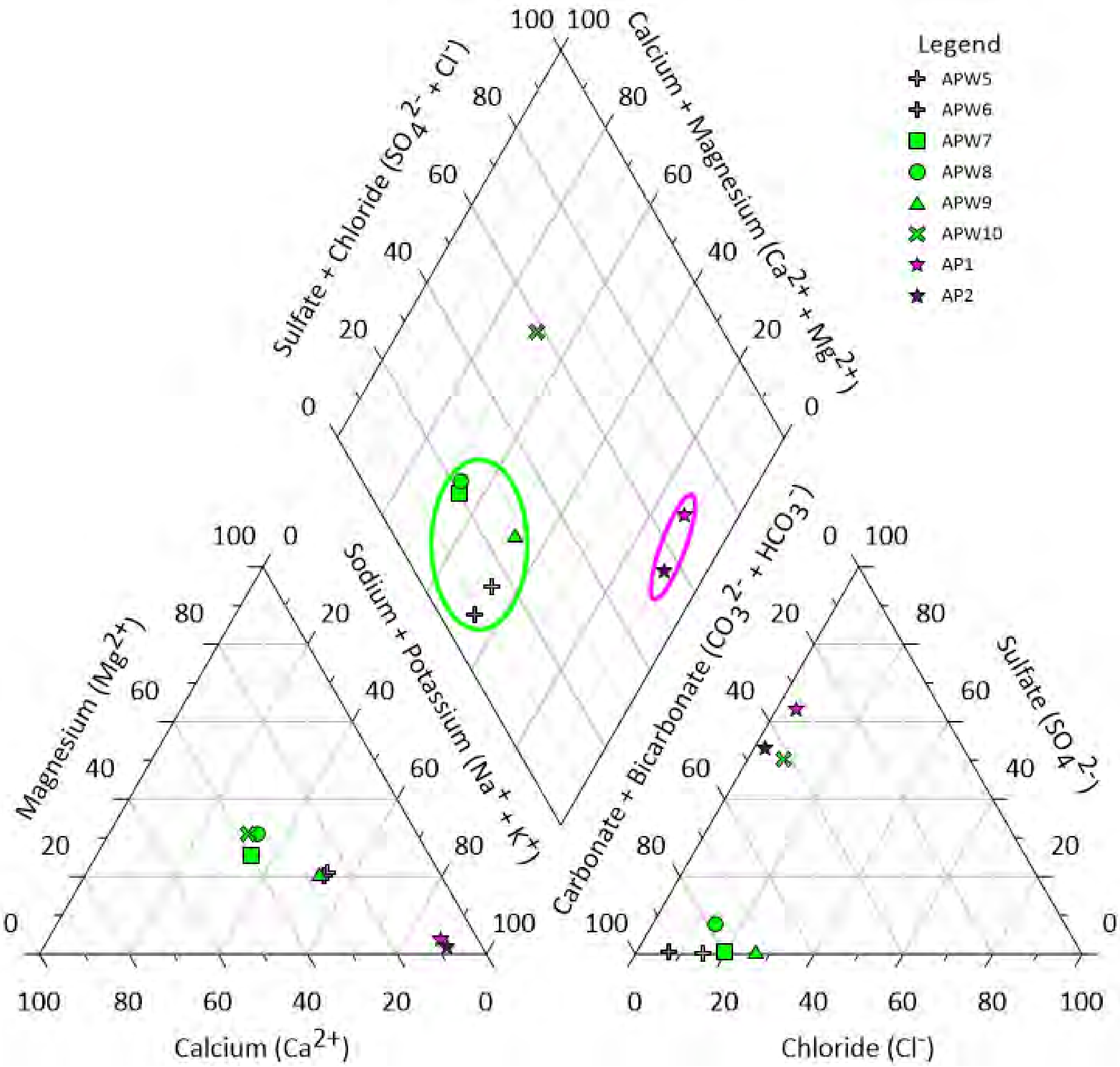


Figure 2 Piper Diagram Showing Ionic Composition of Samples of Background and Downgradient Groundwater Associated with LF1, LF2, and PAP and Samples of LF1 Leachate and PAP Surface Water.

LINE OF EVIDENCE #2: THE NEWTON PRIMARY ASH POND IS NOT HYDRAULICALLY CONNECTED TO THE UPPERMOST AQUIFER

As noted above, the Uppermost Aquifer at the Site is the Mulberry Grove Member of the Glasford Formation. Based on boring logs for monitoring wells installed around the perimeter of the site, the Uppermost Aquifer is confined and the top of this unit ranges from 461.8 ft msl in APW-8 to 482.8 ft msl in APW-10 (Attachment A). The bottom elevation of the PAP is, situated within the Hagarstown Member of the Glasford Formation at 508 ft msl, approximately 25 ft above the top of the Uppermost Aquifer (Attachment B). The Hagarstown Member functions as an aquitard with hydraulic conductivities ranging from 2.4 x 10^{-6} to 6.1 x 10^{-5} centimeters per second (cm/s)[2]. Based upon these hydraulic conductivity values and the fact that the Uppermost Aquifer is confined, the PAP is not hydraulically connected to the Uppermost Aquifer. The lack of connection between the PAP and the Uppermost Aquifer demonstrates that there is no complete pathway for transport of CCR constituents in groundwater beneath the PAP, thus the PAP is not the source of CCR constituents in the Uppermost Aquifer.

LINE OF EVIDENCE #3: CONCENTRATIONS OF CALCIUM IN THE NEWTON PRIMARY ASH POND ARE LOWER THAN THOSE OBSERVED IN THE GROUNDWATER

Calcium concentrations are lower in PAP water samples than in all downgradient groundwater samples collected between 2015 and 2019. A time series for calcium concentrations is provided in Figure 3 below.

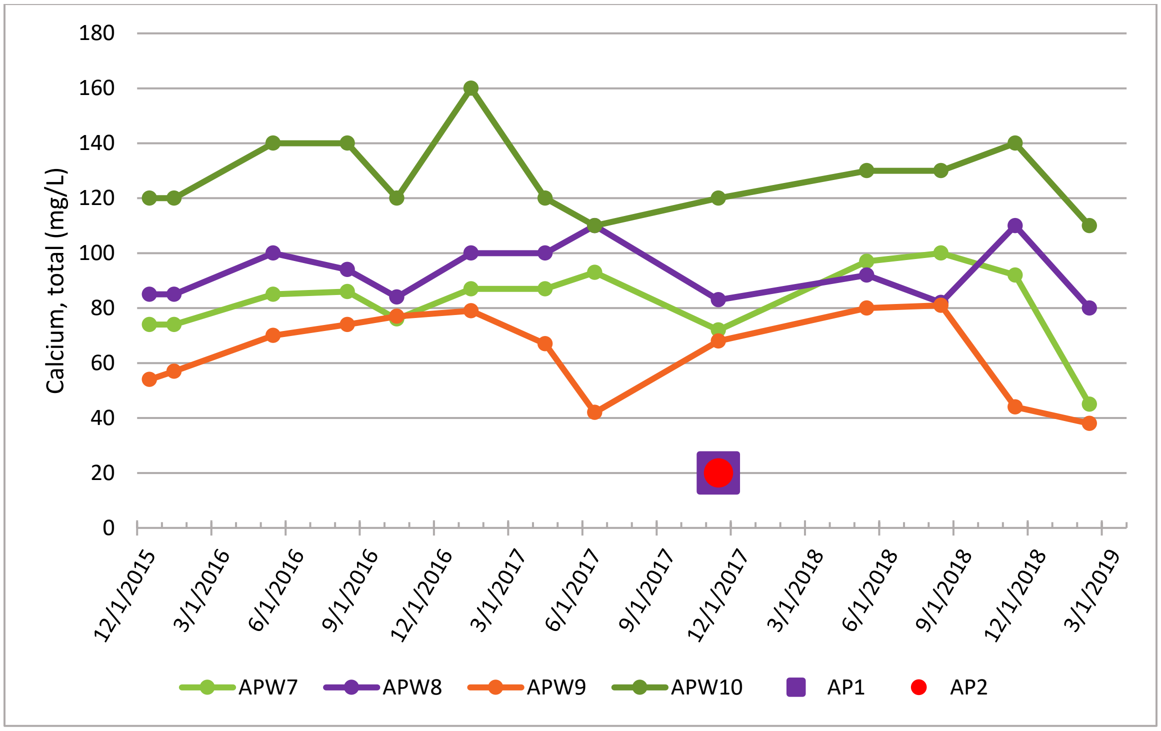


Figure 3. Calcium time series

The following observations can be made from Figure 3:

- PAP water samples AP1 and AP2 each contained 20 mg/L of calcium.
- Groundwater from downgradient wells APW7, APW8, APW9, and APW10 had higher calcium concentrations than the PAP water.

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[2] Natural Resource Technology, an OBG Company (NRT), October 17, 2017. *Hydrogeologic Monitoring Plan. Newton Primary Ash Pond – CCR Unit ID 501, Newton Landfill 2 – CCR Unit ID 502*. Newton Power Station, Canton, Illinois. Illinois Power Generating Company.

If the PAP were the source of calcium in groundwater, groundwater concentrations in PAP water would be higher than the downgradient groundwater; therefore, the PAP is not likely the source of the calcium observed in the Uppermost Aquifer.

LINE OF EVIDENCE #4: BORON, A PRIMARY INDICATOR PARAMETER OF CCR IMPACTS TO GROUNDWATER, HAS CONCENTRATIONS IN DOWNGRADIENT WELLS THAT ARE STABLE AND NEAR, OR BELOW, CONCENTRATIONS OBSERVED IN BACKGROUND MONITORING WELLS

Boron is a primary indicator of CCR impacts to groundwater. If the source of the SSIs in the downgradient monitoring wells were the PAP, boron would be anticipated to be present at elevated concentrations, as well. Concentrations of boron in all downgradient monitoring wells are below upper prediction limits established using background monitoring wells (i.e. SSI limits) and are lower than median concentrations observed in background wells APW5 and APW6 from 2015 through 2019, as shown on Figure 4.

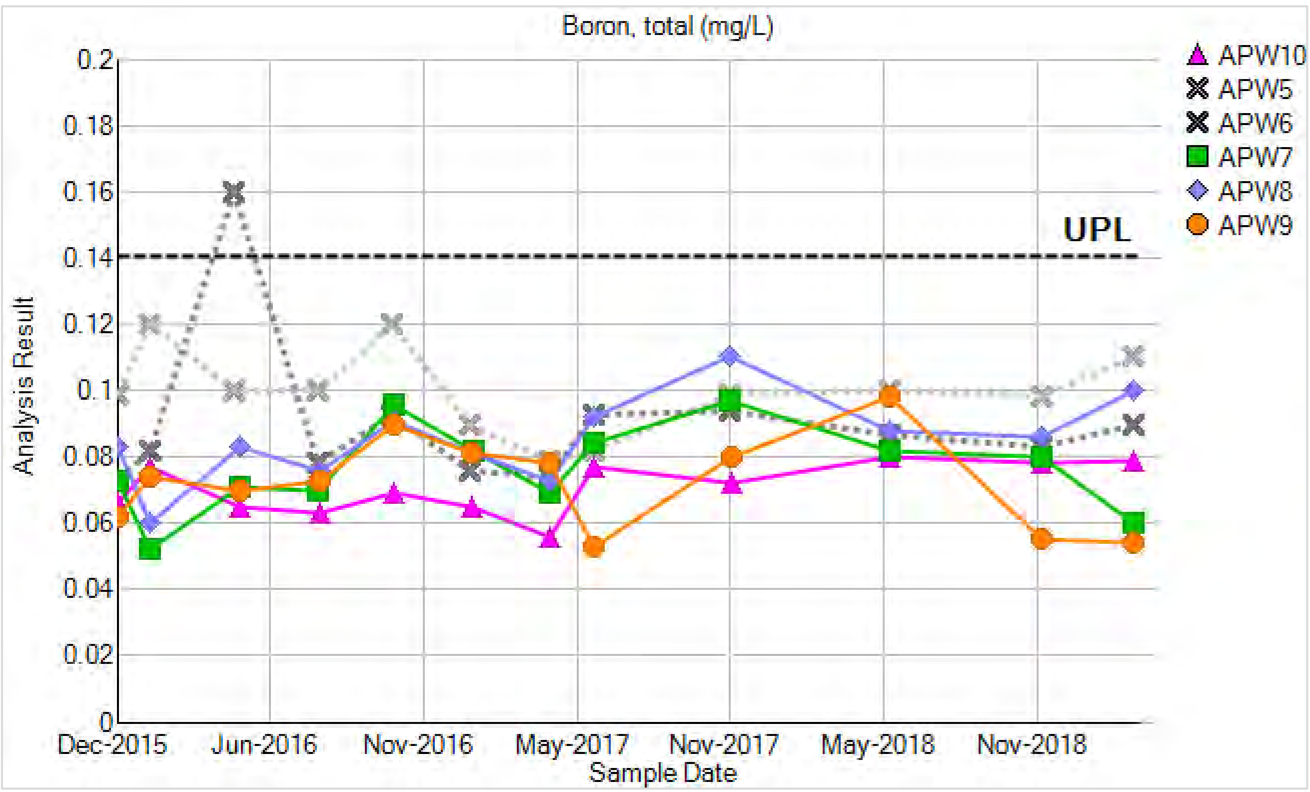

Figure 4. Boron time series showing boron concentrations in background wells (gray "X"s) are higher or similar to concentrations in downgradient wells.

From Figure 6 the following observations can be made:

- Boron concentrations in downgradient monitoring wells range from 0.052 to 0.11 mg/L versus 0.073 to 0.16 mg/L in background wells.
- Overall median boron concentration in downgradient wells from 2015 through 2019 is 0.077 mg/L versus 0.093 mg/L in background wells.

Mann-Kendall trend analysis tests were performed (Attachment D) to determine if concentrations at each well were increasing, decreasing or stable (i.e., no statistically significant upward or downward trend). If the Mann-Kendall test did not identify a trend the coefficient of variation (CV) was calculated (Attachment E) to determine if the concentrations are too variable to identify a trend (i.e. CV greater than or equal to 1). If a trend was identified, the CV was calculated to indicate whether data used to establish the trend are suggestive of a low or high magnitude trend. Data with a CV less than or equal to 1 suggest a lower magnitude trend. Boron concentrations are stable in background wells and downgradient wells APW7 and APW9. Upward trends were identified at APW8 and APW10, however, coefficient of variation evaluations identified minimal variation at all wells, suggesting a low-magnitude trend. Table 2 provides summary statistics, including variability and trend per well.

Monitoring Well	Boron (mg/L)					
	Minimum	Maximum	Median	Standard Deviation	Trend	CV
APW5	0.079	0.12	0.100	0.0127	stable	0.13
APW6	0.073	0.16	0.085	0.0232	stable	0.26
APW7	0.052	0.097	0.077	0.0133	stable	0.17
APW8	0.060	0.11	0.085	0.0129	upward	0.15
APW9	0.053	0.098	0.074	0.0143	stable	0.20
APW10	0.056	0.08	0.071	0.0077	upward	0.11

Table 2. Maximum, minimum, median, variance and trend of boron in groundwater

The low concentrations of boron in downgradient monitoring wells, relative to background concentrations, and the relatively stable boron concentrations in both background and downgradient monitoring wells suggests that the source of the of the SSIs in those wells is not the PAP.

Based on these four lines of evidence, it has been demonstrated that the Newton Primary Ash Pond has not caused the SSIs in APW7, APW8, APW9, and APW10.

This information serves as the written alternate source demonstration prepared in accordance with 40 C.F.R. § 257.94(e)(2) that SSIs observed during the detection monitoring program were not due to the PAP. Therefore, an assessment monitoring program is not required and the Newton Primary Ash Pond will remain in detection monitoring.

Attachments

Figure 1	Monitoring Well and Source Water Location Map Newton Primary Ash Pond
Figure 2	Groundwater Elevation Contour Map – February 18, 2019
Attachment A	Boring Logs for Monitoring Wells APW8 and APW10
Attachment B	Geologic Cross Section B-B'
Attachment C	Boron Trend Analysis for APW7, APW8, APW9, and APW10
Attachment D	Coefficient of Variation Evaluation

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I, Eric J. Tlachac, a qualified professional engineer in good standing in the State of Illinois, certify that the information in this report is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

Eric J. Tlachac
Qualified Professional Engineer
062-063091
Illinois
O'Brien & Gere Engineers, Inc., a Ramboll Company
Date: October 14, 2019

I, Nicole M. Pagano, a professional geologist in good standing in the State of Illinois, certify that the information in this report is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

Nicole M. Pagano
Professional Geologist
196-000750
O'Brien & Gere Engineers, Inc., a Ramboll Company
Date: October 14, 2019

Attachments

Figures

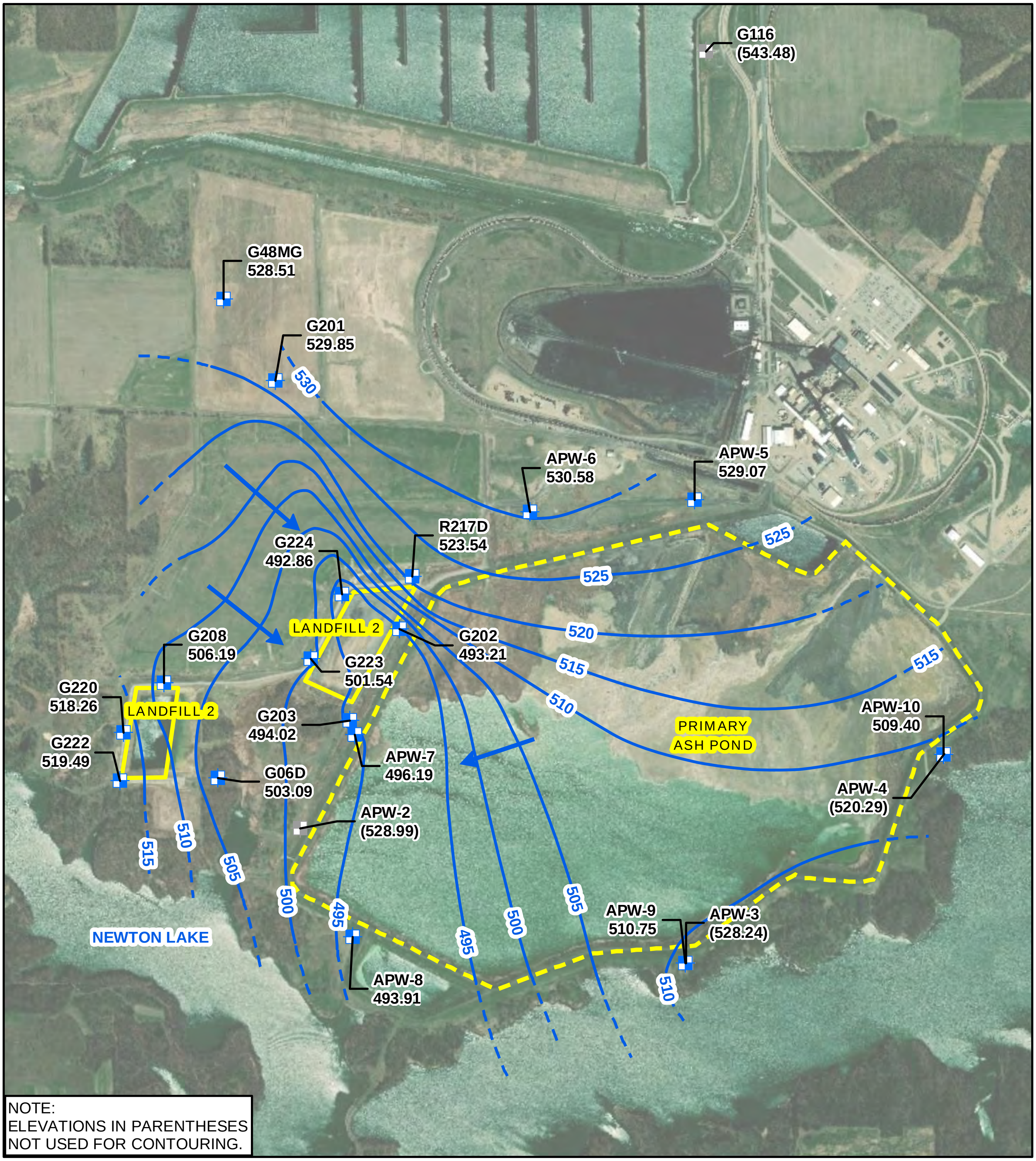
DRAWN BY/DATE:
SDS 3/28/18
REVIEWED BY/DATE:
JJW 3/28/18
APPROVED BY/DATE:
NMP 3/30/18

MONITORING WELL AND SOURCE WATER LOCATION MAP
NEWTON PRIMARY ASH POND

ALTERNATE SOURCE DEMONSTRATION
NEWTON POWER STATION
NEWTON, ILLINOIS

PROJECT NO: 67719

FIGURE NO: 1



CCR RULE MONITORING WELL LOCATION

NON-CCR RULE MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR (5-FOOT INTERVAL)

INFERRED GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW DIRECTION

LANDFILL 2 CCR MONITORED UNIT

PRIMARY ASH POND CCR MONITORED UNIT

NEWTON PRIMARY ASH POND (UNIT ID: 501)
GROUNDWATER ELEVATION CONTOUR MAP
FEBRUARY 18, 2019

ALTERNATE SOURCE DEMONSTRATION
NEWTON POWER STATION
NEWTON, ILLINOIS

0 325 650 1,300
Feet

N

O'BRIEN & GERE ENGINEERS, INC.

Y:\Mapping\Projects\22\2285\MXD\Alt_Source_Dem\Figure 2_D4 Newton GW Contours.mxd

Attachment A

Boring Logs for Monitoring Wells APW8 and APW10

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/27/2015
Finish: 10/28/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW8
Well ID: APW8
Surface Elev: 526.75 ft. MSL
Completion: 82.00 ft. BGS
Station: 3,839.59N 6,082.37E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 33.70 - During Drilling
▼ =
▽ =

Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp (tsf)* Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
							0–0.6	Black (10YR2/1), moist, very stiff, SILT with little clay and trace very fine- to medium-grained sand, roots.		
1A				13		*4.50*	0.6–2.5	Yellowish brown (10YR5/4) with 30% light gray (10YR7/2) mottles, dry, hard, SILT with little clay and trace very fine- to medium-grained sand.	526	
	60/60 *100%*	DP								
1B				21		*3.00*	2.5–8.2	Grayish brown (10YR5/2) with 15% dark yellowish brown (10YR4/6) and 10% black (10YR2/1) mottles, moist, very stiff, silty CLAY with few very fine- to coarse-grained sand and trace small gravel.	524, 522, 520	
2A				18		*2.50*				
	60/60 *100%*	DP								
2B				28		*2.00*	8.2–10	Grayish brown (10YR5/2) with 15% dark yellowish brown mottles, moist, stiff, silty CLAY with few very fine- to coarse-grained sand and trace small gravel.	518	
	20/24 *83%*	DP								
3A				8		*2.00*	10–14	Brown (10YR5/3) with 20% dark yellowish brown (10YR5/6) mottles, dry, stiff, SILT with little clay and trace very fine- to coarse-grained sand.	516, 514	
4A	0/17 *0%*	SS	*23-43* *50/5"*							Rock in shoe of sampler.
5A	21/24 *88%*	SS	*13-20* *24-28* N=44	10		*4.50*	14–20	Dark gray (10YR4/1), moist, hard, SILT with little clay, trace very fine- to coarse-grained sand and small gravel.	512	
6A	24/24 *100%*	SS	*7-14* *20-48* N=34	11		*4.50*			510	
7A	24/24 *100%*	SS	*14-21* *26-32* N=47	10					508	

NOTE(S): APW8 installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/27/2015
Finish: 10/28/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW8
Well ID: APW8
Surface Elev: 526.75 ft. MSL
Completion: 82.00 ft. BGS
Station: 3,839.59N 6,082.37E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 33.70 - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp (tsf)* Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
8A	24/24 *100%*	SS	*7-13 19-23* N=32	11		*4.50*	20–29	Dark gray (10YR4/1), moist, hard, SILT with little clay, trace very fine- to coarse-grained sand and small gravel. *[Continued from previous page]*	506	
9A	24/24 *100%*	SS	*7-14 19-27* N=33	11		*4.50*	22		504	
10A	24/24 *100%*	SS	*8-15 30-37* N=45	11		*4.50*	24		502	
11A	24/24 *100%*	SS	*8-16 24-33* N=40	11		*4.50*	26		500	
12A	24/24 *100%*	SS	*9-31 33-30* N=64	11			28		498	
12B				12		*4.50*	29–29.7	Gray (10YR5/1), moist, dense, silty, very fine- to medium-grained SAND.		
13A	24/24 *100%*	SS	*10-23 40-35* N=63	11		*4.50*	30–33.7	Dark gray (10YR4/1), moist, hard SILT with little clay, few very fine- to coarse-grained sand, and trace small gravel.	496	
14A	21/24 *88%*	SS	*16-16 29-50* N=45	10		*4.50*	32		494	
15A	20/24 *83%*	SS	*9-24 34-41* N=58	13			33.7–36.3 ▼	Dark gray (10YR4/1), wet, very dense, silty, very fine- to coarse-grained SAND with trace small gravel.	492	
	22/24 *92%*	SS	*16-18 29-35* N=47				36		490	
16A				11		*4.50*	36.3–40	Dark gray (10YR4/1), moist, hard, SILT with little clay, few very fine- to coarse-grained sand, and trace small gravel.		
17A	21/24 *88%*	SS	*10-17 21-31* N=38	11		*4.50*	38–40		488	

NOTE(S): APW8 installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/27/2015
Finish: 10/28/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW8
Well ID: APW8
Surface Elev: 526.75 ft. MSL
Completion: 82.00 ft. BGS
Station: 3,839.59N
6,082.37E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 33.70 - During Drilling
▼ =
▽ =

Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp (tsf)* Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
18A	24/24 *100%*	SS	*9-16 26-32* N=42	11		*4.50*		Dark gray (10YR4/1), moist, hard, SILT with little clay, few very fine- to coarse-grained sand, and trace small gravel. *[Continued from previous page]*	486	
19A	24/24 *100%*	SS	*10-16 23-34* N=39	12		*4.50*	42		484	
20A	24/24 *100%*	SS	*10-15 26-44* N=41	13		*4.50*	44		482	
21A	24/24 *100%*	SS	*12-21 32-48* N=53	12		*4.50*	46		480	
22A	24/24 *100%*	SS	*11-17 22-31* N=39	13		*4.50*	48		478	
23A	24/24 *100%*	SS	*10-13 21-32* N=34	13		*4.50*	50		476	
24A	24/24 *100%*	SS	*8-13 50-26* N=63	13		*4.50*	52		474	
25A	24/24 *100%*	SS	*8-11 19-28* N=30	14		*4.25*	54		472	
26A	24/24 *100%*	SS	*10-12 18-26* N=30	13		*4.50*	56		470	
27A	22/24 *92%*	SS	*7-10 15-22* N=25	21		*4.50*	58	Olive gray (5Y4/2), moist, hard, silty CLAY with few very fine- to coarse-grained sand and trace small gravel.	468	
							60			

NOTE(S): APW8 installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/27/2015
Finish: 10/28/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW8
Well ID: APW8
Surface Elev: 526.75 ft. MSL
Completion: 82.00 ft. BGS
Station: 3,839.59N
6,082.37E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 33.70 - During Drilling
▼ =
▽ =

SAMPLE: Number	Recov / Total (in) *% Recovery*	Type	TESTING: *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp (tsf)* Failure Type
28A	20/24 *83%*	ss	*7-15 19-20* N=34	14		*4.50*
29A	21/24 *88%*	ss	*7-8 11-16* N=19	11		*3.75*
30A	21/24 *88%*	ss	*6-13 14-11* N=27	14		*4.00*
30B				10		
31A	18/24 *75%*	ss	*4-3 4-3* N=7	28		
31B				15		*3.25*
32A	20/24 *83%*	ss	*1-3 3-2* N=6	17		
32B				28		
33A	15/24 *63%*	ss	*woh-2 6-6* N=8	17		
34A	16/24 *67%*	ss	*9-11 15-20* N=26	9		
35A	15/24 *63%*	ss	*16-21 23-24* N=44	9		
36A	14/24 *58%*	ss	*11-20 25-24* N=45	11		
37A	15/24 *63%*	ss	*20-25 24-25* N=49	10		

Depth ft. BGS	Lithologic Description
to 62	Dark gray (10YR4/1), moist, hard, SILT with little clay, few very fine- to coarse-grained sand and trace small gravel.
62 – 65	Dark gray (10YR4/1), moist, very stiff, SILT with little clay, few very fine- to coarse-grained sand and trace small gravel.
65 – 66	Gray (10YR6/1), wet, medium dense, silty, very fine- to coarse-grained SAND with trace small to large gravel.
	Dark gray (10YR4/1), moist, very stiff, SILT with little clay and few very fine- to coarse-grained sand.
	Dark gray (10YR4/1), wet, loose, silty, very fine- to coarse-grained SAND with trace small gravel and trace wood fragments.
	Dark gray (10YR4/1), moist, very stiff, SILT with little clay, few very fine- to coarse-grained sand, and trace small gravel, trace wood fragments.
	Dark gray (10YR4/1), wet, loose, SILT with little very fine- to fine-grained sand.
	Dark gray (10YR4/1), wet, loose, silty, very fine- to coarse-grained SAND.
	Dark gray (10YR4/1), wet, loose, SILT with little very fine- to fine-grained sand, trace wood fragments.
– 72	Dark gray (10YR4/1), wet, loose, silty, very fine- to coarse-grained SAND, trace wood fragments.
72 –	Dark gray (10YR4/1), wet, medium dense, silty, very fine- to coarse-grained SAND with trace small gravel.
– 74	Dark gray (10YR4/1), wet, medium dense, silty, very fine- to coarse-grained SAND with few small to large gravel.
74 – 76	Dark gray (10YR4/1), wet, dense, silty, very fine- to coarse-grained SAND with few small to large gravel.
76 – 80	Dark gray (10YR4/1), wet, dense, silty, very fine- to coarse-grained SAND with trace small gravel.

Elevation ft. MSL: 466, 464, 462, 460, 458, 456, 454, 452, 450, 448

Remarks:

NOTE(S): APW8 installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/27/2015
Finish: 10/28/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW8
Well ID: APW8
Surface Elev: 526.75 ft. MSL
Completion: 82.00 ft. BGS
Station: 3,839.59N
6,082.37E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 33.70 - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Qp (tsf)* Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
38A	18/24 *75%*	SS	*26-26 26-31* N=52	8				Dark gray (10YR4/1), wet, dense, silty, very fine- to coarse-grained SAND with trace small gravel. *[Continued from previous page]*		446	
38B				11		*4.50*	82	Dark gray (10YR4/1), moist, hard, SILT with little clay and few very fine- to coarse-grained sand.			

End of boring = 82.0 feet

NOTE(S): APW8 installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/27/2015
Finish: 10/27/2015
WEATHER: Cool, rainy, lo-50s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA

FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW10a
Well ID: APW10
Surface Elev: 521.98 ft. MSL
Completion: 45.94 ft. BGS
Station: 5,371.32N
11,541.23E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 25, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 36.00 - During Drilling
▼ =
▽ =

SAMPLE			TESTING								
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							2			520	
							4			518	
							6			516	
							8			514	
							10	Blind drill - see APW4 boring log for lithology, sample, and testing data		512	
							12			510	
							14			508	
							16			506	
							18			504	
							20			502	

NOTE(S): APW10 installed in borehole.
Lithology, sample, and testing data can be found on APW-4 Field Boring Log.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.	**CONTRACTOR:** Bulldog Drilling, Inc.		
Site: Newton Energy Center	**Rig mfg/model:** CME-550X ATV Drill	**BOREHOLE ID:** APW10a	
Location: Newton, Illinois	**Drilling Method:** 4¼" HSA	**Well ID:** APW10	
Project: 15E0030		**Surface Elev:** 521.98 ft. MSL	
DATES: Start: 10/27/2015	**FIELD STAFF: Driller:** C. Dutton	**Completion:** 45.94 ft. BGS	
Finish: 10/27/2015	**Helper:** C. Jones	**Station:** 5,371.32N	
WEATHER: Cool, rainy, lo-50s	**Eng/Geo:** S. Keim	11,541.23E	

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 25, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 36.00 - During Drilling
▼ =
▽ =

SAMPLE: Number	Recov / Total (in) % Recovery	Type	TESTING: Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							22	Yellowish brown (10YR5/6) with 5% gray (N6/1) mottles, moist, hard, SILT with little clay, few very fine-grained sand, and trace small gravel.		500	
							24–32	Yellowish brown (10YR5/4) with 5% dark yellowish brown (10YR4/6) and 5% gray (N6/1) mottles, moist, hard, SILT with little clay, few very fine-grained sand, and trace small gravel.		498–490	
							32–39.2 (▼ 36)	Brown (10YR5/3) with 5% gray (N6/1) mottles, moist, hard, SILT with little clay, few very fine-grained sand, and trace small gravel.		490–484	
							40	Brown (10YR5/3), wet, very dense, silty, very fine- to medium-grained SAND with trace small gravel.		482	

NOTE(S): APW10 installed in borehole.
Lithology, sample, and testing data can be found on APW-4 Field Boring Log.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/27/2015
Finish: 10/27/2015
WEATHER: Cool, rainy, lo-50s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA

FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW10a
Well ID: APW10
Surface Elev: 521.98 ft. MSL
Completion: 45.94 ft. BGS
Station: 5,371.32N
11,541.23E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 25, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 36.00 - During Drilling
▼ =
▽ =

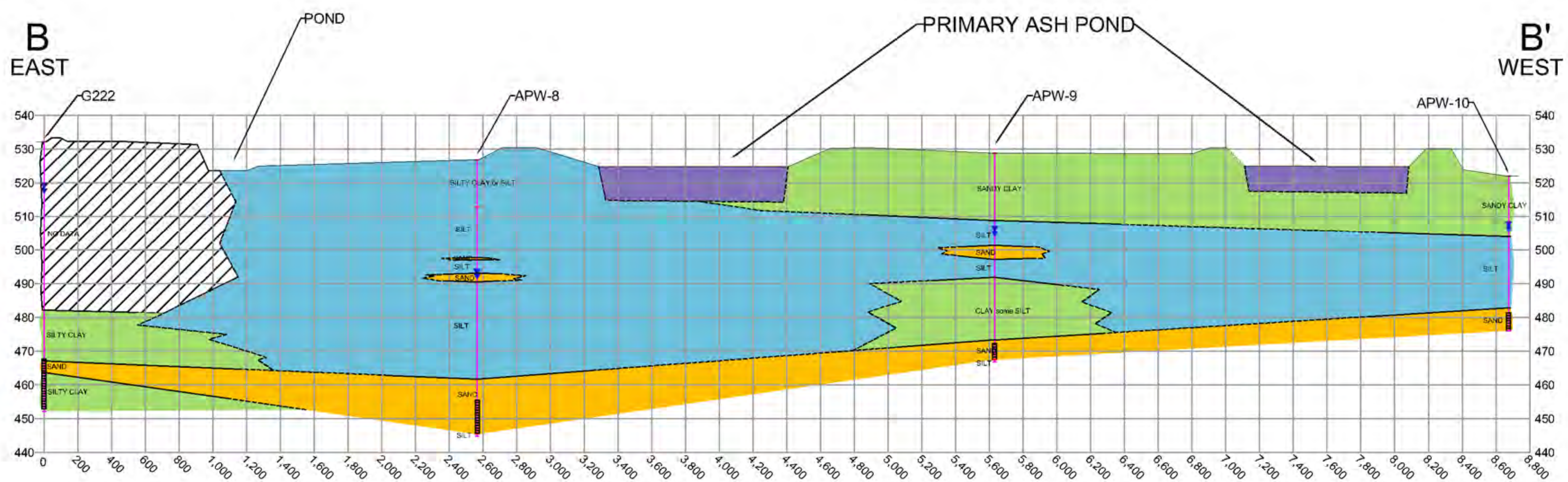
SAMPLE			TESTING									
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							42			480	
								Brown (10YR5/3), wet, very dense, silty, very fine- to medium-grained SAND with trace small gravel. *[Continued from previous page]*			
							44			478	

End of boring = 45.94 feet

NOTE(S): APW10 installed in borehole.
Lithology, sample, and testing data can be found on APW-4 Field Boring Log.

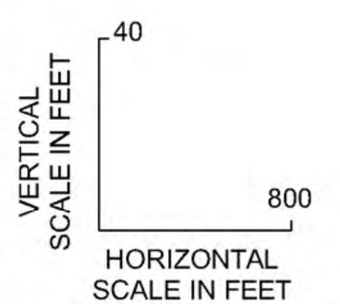
Attachment B

Geologic Cross Section B-B’

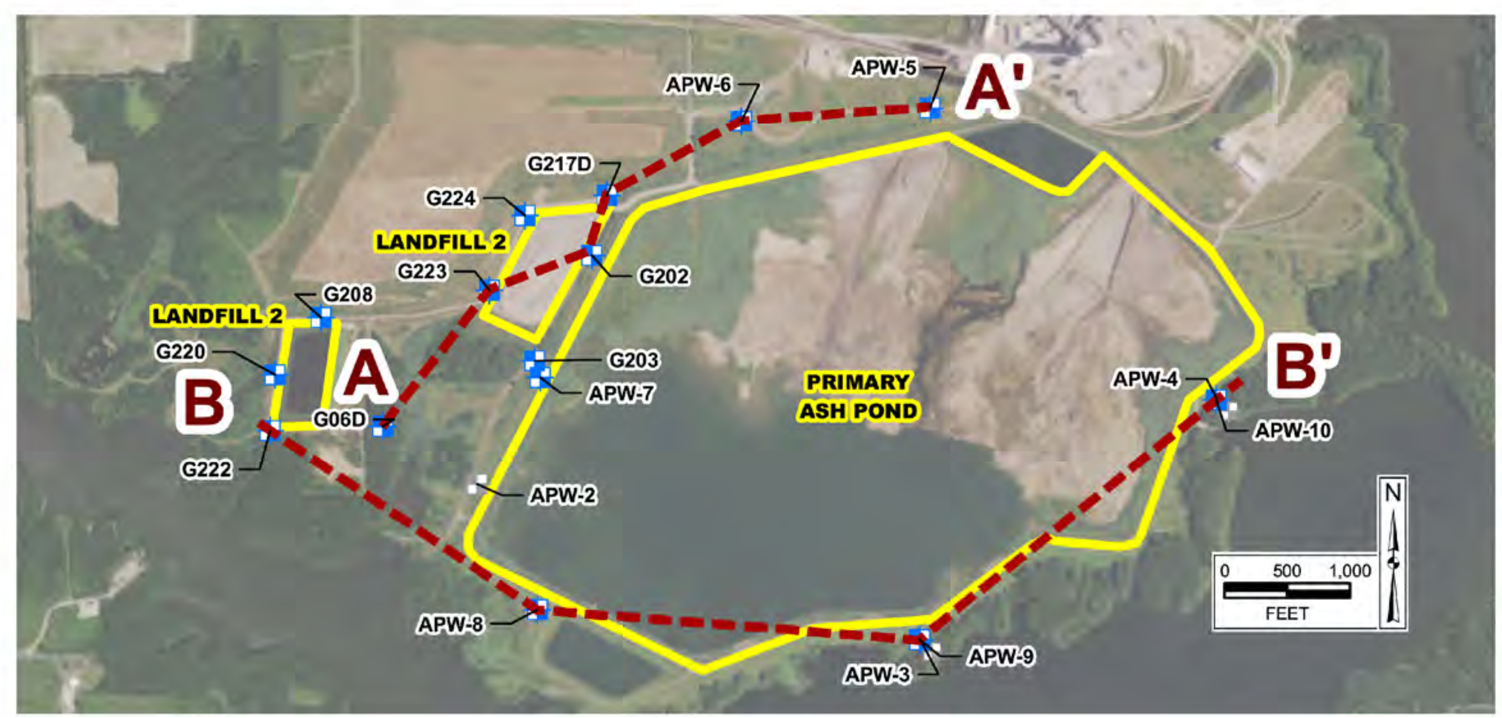


(hatched)	NO DATA	(well screen symbol)	WELL SCREEN
(purple)	ASH	(triangle symbol)	GROUNDWATER ELEVATION
(green)	CLAY		
(blue)	SILT		
(orange)	SAND		

NOTE THAT THE DEPTH OF THE ASH IN THE ASH POND IS APPROXIMATE.



VERTICAL EXAGGERATION =20



DRAWN BY: JMO DATE: 08/29/2017
CHECKED BY: TBN DATE: 10/2/2017
APPROVED BY: SJC DATE: 10/2/2017
DRAWING NO: Fig X_Geologic Cross-Section A-A'
REFERENCE:

GEOLOGIC CROSS-SECTION B-B'

HYDROGEOLOGIC MONITORING PLAN

NEWTON POWER STATION
NEWTON, ILLINOIS

Natural Resource Technology
AN OBG COMPANY

PROJECT NO.
2285

FIGURE NO.
APPENDIX A-2

Attachment C

Mann-Kendall Trend Analysis

Newton
Mann-Kendall Trend Analysis

User Supplied Information

Location ID:	**APW5**	**Parameter Code:**	**01022**
Location Class:		**Parameter:**	**B, tot**
Location Type:		**Units:**	**mg/L**
Confidence Level:	**95.00%**	**Period Length:**	**1 month(s)**
Date Range: 12/14/2015 to 03/31/2019		**Limit Name:**	
		Averaged:	**No**

Trend Analysis

Trend of the least squares straight line

Slope (fitted to data):	-0.000004	mg/L per day
R-Squared error of fit:	0.016425	

Sen's Non-parametric estimate of the slope (One-Sided Test)

Median Slope:	-0.000001	mg/L per day
Lower Confidence Limit of Slope, M1:	-0.000031	mg/L per day
Upper Confidence Limit of Slope, M2+1:	0.000011	mg/L per day

Non-parametric Mann-Kendall Test for Trend

S Statistic:	-0.417
Z test:	1.645
At the 95.0 % Confidence Level (One-Sided Test):	None

Newton
Mann-Kendall Trend Analysis

User Supplied Information

Location ID:	**APW6**	**Parameter Code:**	**01022**
Location Class:		**Parameter:**	**B, tot**
Location Type:		**Units:**	**mg/L**
Confidence Level:	**95.00%**	**Period Length:**	**1 month(s)**
Date Range: 12/14/2015 to 03/31/2019		**Limit Name:**	
		Averaged:	**No**

Trend Analysis

Trend of the least squares straight line

Slope (fitted to data):	-0.000008	mg/L per day
R-Squared error of fit:	0.018309	

Sen's Non-parametric estimate of the slope (One-Sided Test)

Median Slope:	0.000006	mg/L per day
Lower Confidence Limit of Slope, M1:	-0.000015	mg/L per day
Upper Confidence Limit of Slope, M2+1:	0.000018	mg/L per day

Non-parametric Mann-Kendall Test for Trend

S Statistic:	0.687
Z test:	1.645
At the 95.0 % Confidence Level (One-Sided Test):	None

Newton
Mann-Kendall Trend Analysis

User Supplied Information

Location ID:	**APW7**	**Parameter Code:**	**01022**
Location Class:		**Parameter:**	**B, tot**
Location Type:		**Units:**	**mg/L**
Confidence Level:	**95.00%**	**Period Length:**	**1 month(s)**
Date Range: 12/14/2015 to 03/31/2019		**Limit Name:**	
		Averaged:	**No**

Trend Analysis

Trend of the least squares straight line

Slope (fitted to data):	0.000006	mg/L per day
R-Squared error of fit:	0.033439	

Sen's Non-parametric estimate of the slope (One-Sided Test)

Median Slope:	0.000008	mg/L per day
Lower Confidence Limit of Slope, M1:	-0.000011	mg/L per day
Upper Confidence Limit of Slope, M2+1:	0.000034	mg/L per day

Non-parametric Mann-Kendall Test for Trend

S Statistic:	0.412
Z test:	1.645
At the 95.0 % Confidence Level (One-Sided Test):	None

Newton
Mann-Kendall Trend Analysis

User Supplied Information

Location ID:	**APW8**	**Parameter Code:**	**01022**
Location Class:		**Parameter:**	**B, tot**
Location Type:		**Units:**	**mg/L**
Confidence Level:	**95.00%**	**Period Length:**	**1 month(s)**
Date Range: 12/14/2015 to 03/31/2019		**Limit Name:**	
		Averaged:	**No**

Trend Analysis

Trend of the least squares straight line

Slope (fitted to data):	0.000019	mg/L per day
R-Squared error of fit:	0.342389	

Sen's Non-parametric estimate of the slope (One-Sided Test)

Median Slope:	0.000017	mg/L per day
Lower Confidence Limit of Slope, M1:	0.000003	mg/L per day
Upper Confidence Limit of Slope, M2+1:	0.000039	mg/L per day

Non-parametric Mann-Kendall Test for Trend

S Statistic:	1.787
Z test:	1.645
At the 95.0 % Confidence Level (One-Sided Test):	Upward

Newton
Mann-Kendall Trend Analysis

User Supplied Information

Location ID:	**APW9**	**Parameter Code:**	**01022**
Location Class:		**Parameter:**	**B, tot**
Location Type:		**Units:**	**mg/L**
Confidence Level:	**95.00%**	**Period Length:**	**1 month(s)**
Date Range: 12/14/2015 to 03/31/2019		**Limit Name:**	
		Averaged:	**No**

Trend Analysis

Trend of the least squares straight line

Slope (fitted to data):	-0.000006	mg/L per day
R-Squared error of fit:	0.028627	

Sen's Non-parametric estimate of the slope (One-Sided Test)

Median Slope:	-0.000001	mg/L per day
Lower Confidence Limit of Slope, M1:	-0.000026	mg/L per day
Upper Confidence Limit of Slope, M2+1:	0.000028	mg/L per day

Non-parametric Mann-Kendall Test for Trend

S Statistic:	0.000
Z test:	1.645
At the 95.0 % Confidence Level (One-Sided Test):	None

Newton
Mann-Kendall Trend Analysis

User Supplied Information

Location ID:	**APW10**	**Parameter Code:**	**01022**
Location Class:		**Parameter:**	**B, tot**
Location Type:		**Units:**	**mg/L**
Confidence Level:	**95.00%**	**Period Length:**	**1 month(s)**
Date Range: 12/14/2015 to 03/31/2019		**Limit Name:**	
		Averaged:	**No**

Trend Analysis

Trend of the least squares straight line

Slope (fitted to data):	0.000011	mg/L per day
R-Squared error of fit:	0.304448	

Sen's Non-parametric estimate of the slope (One-Sided Test)

Median Slope:	0.000011	mg/L per day
Lower Confidence Limit of Slope, M1:	0.000000	mg/L per day
Upper Confidence Limit of Slope, M2+1:	0.000019	mg/L per day

Non-parametric Mann-Kendall Test for Trend

S Statistic:	1.722
Z test:	1.645
At the 95.0 % Confidence Level (One-Sided Test):	Upward

Attachment D

Coefficient of Variation Evaluation

Newton

Coefficient of Variation
Date Range: 12/14/2015 to 3/31/2019

Boron, total (mg/L)

Location	Count	Mean	Std Dev	% Non-Detects	CV
APW5	12	0.100	0.013	0.00	0.13
APW6	12	0.090	0.023	0.00	0.26
APW7	12	0.076	0.013	0.00	0.17
APW8	12	0.085	0.013	0.00	0.15
APW9	12	0.072	0.014	0.00	0.20
APW10	12	0.071	0.008	0.00	0.11

CV=Std Dev/ Mean

ATTACHMENT 2
APRIL 27, 2020 AND OCT 13, 2020 ALTERNATE SOURCE DEMONSTRATIONS

Intended for
Illinois Power Generating Company

Date
April 27, 2020

Project No.
74923

40 C.F.R. § 257.94(e)(2): ALTERNATE SOURCE DEMONSTRATION

NEWTON PRIMARY ASH POND

RAMBOLL Bright ideas. Sustainable change.

CERTIFICATIONS

I, Nicole M. Pagano, a professional geologist in good standing in the State of Illinois, certify that the information in this report is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

____

Nicole M. Pagano
Professional Geologist
196-000750
Illinois
O'Brien & Gere Engineers, Inc., a Ramboll Company
Date: April 27, 2020

LICENSED PROFESSIONAL GEOLOGIST
NICOLE M. PAGANO
196-000750
ILLINOIS

I, Eric J. Tlachac, a qualified professional engineer in good standing in the State of Illinois, certify that the information in this report is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

____

Eric J. Tlachac
Qualified Professional Engineer
062-063091
Illinois
O'Brien & Gere Engineers, Inc., a Ramboll Company
Date: April 27, 2020

LICENSED PROFESSIONAL ENGINEER
ERIC J. TLACHAC
062-063091
STATE OF ILLINOIS

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234 W. Florida Street
Fifth Floor
Milwaukee, WI 53204
USA
T 414-837-3607
F 414-837-3608
https://ramboll.com

CONTENTS

TABLES (IN TEXT)

FIGURES (IN TEXT)

FIGURES (ATTACHED)

ACRONYMS AND ABBREVIATIONS

40 C.F.R.	Title 40 of the Code of Federal Regulations
ASD	Alternate Source Demonstration
bgs	below ground surface
CCR	Coal Combustion Residuals
ft	foot/feet
LF2	Phase II Landfill 2
msl	mean sea level
NRT/OBG	Natural Resource Technology, an OBG Company
PAP	Primary Ash Pond
Site	Newton Power Station
SSIs	Statistically Significant Increases
UPL	Upper Prediction Limit

1. INTRODUCTION

Title 40 of the Code of Federal Regulations (40 C.F.R.) § 257.94(e)(2) allows the owner or operator of a Coal Combustion Residuals (CCR) unit 90 days from the date of determination of a Statistically Significant Increase (SSI) over background for groundwater constituents listed in Appendix III of 40 C.F.R. Part 257 to complete a written demonstration that a source other than the CCR unit being monitored caused the SSI(s), or that the SSI(s) resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality (Alternate Source Demonstration [ASD]).

This ASD has been prepared on behalf of Illinois Power Generating Company, by O'Brien & Gere Engineers, Inc., a Ramboll Company (Ramboll), to provide pertinent information pursuant to 40 C.F.R. § 257.94(e)(2) for the Newton Primary Ash Pond (PAP) located near Newton, Illinois.

The most recent Detection Monitoring sampling event (Detection Monitoring Round 5 [D5]) was completed on August 22 and 23, 2019, and analytical data were received on October 28, 2019. Analytical data from D5 were evaluated in accordance with the Statistical Analysis Plan (NRT/OBG 2017a) to determine any SSIs of Appendix III parameters over background concentrations. That evaluation identified SSIs at downgradient monitoring wells as follows:

- Calcium at wells APW8 and APW10
- Sulfate at wells APW7, APW8, APW9, and APW10
- Chloride at APW8

Pursuant to 40 C.F.R. § 257.94(e)(2), the following lines of evidence (LOE) demonstrate that sources other than the Newton PAP were the cause of the calcium, sulfate, and chloride SSIs listed above. This ASD was completed by April 27, 2020, within 90 days of determination of the SSIs (January 27, 2020), as required by 40 C.F.R. § 257.94(e)(2).

2. BACKGROUND

2.1 Site Location and Description

The Newton Power Station (Site) is located in Jasper County in the southeastern part of central Illinois, approximately 7 miles southwest of the town of Newton. The plant is located on the north side of Newton Lake. The area is bounded by Newton Lake and agricultural land to the west, south, and east, and agricultural land to the north. Beyond the lake is additional agricultural land.

2.2 Description of Primary Ash Pond CCR Unit

The Newton Power Station's sole CCR surface impoundment, the Primary Ash Pond (PAP), was constructed in 1977 and has a design capacity of approximately 9,715 acre-feet. The PAP has a surface area of 400 acres and a height of approximately 71 feet above grade. The PAP currently receives bottom ash, fly ash, and low-volume wastewater from the plant's two coal-fired boilers, and is operated per NPDES Permit IL0049191, Outfall 001. The PAP was not excavated during construction, except for native materials used to build the containment berms.

2.3 Geology and Hydrogeology

The information used to describe the hydrogeology is based on the local geology obtained from published sources, hydrogeologic investigation data, and boring data collected during monitoring well installation.

Quaternary deposits in the Newton area consist mainly of diamictons and outwash deposits that were deposited during Illinoian and Pre-Illinoian glaciations (Lineback, 1979; Willman et al., 1975). The unconsolidated deposits occurring at Newton Power Station include the following units (beginning at the ground surface):

- Ash/Fill Units – CCR and fill within the various CCR Units.
- Upper Confining Unit – Low permeability clays and silts, including the Peoria Silt (Loess Unit) in upland areas and the Cahokia Formation in the flood plain and channel areas to the south and east, underlain by the Sangamon Soil, and the predominantly clay diamictons of the Hagarstown (Till) and Vandalia (Till) Members of the Glasford Formation.
- Uppermost Aquifer – Thin to moderately thick (3 to 17 feet [ft]), moderate to high permeability sand, silty sand, and sandy silt/clay units of the Mulberry Grove Member of the Glasford Formation.
- Lower Confining Unit – Thick, very low permeability silty clay diamictons of the Smithboro (Till) Member of the Glasford Formation and the silty clay diamictons of the Banner Formation.

The bedrock beneath the unconsolidated deposits consists of Pennsylvanian-age Mattoon Formation (Willman et al., 1967) that is mostly shale near the bedrock surface but is characterized at depth by a complex sequence of shales, thin limestones, coals, underclays, and several sandstones (Willman et al., 1975). The erosional surface of the Pennsylvanian-age Mattoon Formation bedrock ranges widely in depth in the vicinity of the Site but is typically encountered at 90 to 120 ft below ground surface (bgs).

Groundwater elevations across the PAP ranged from approximately 495 to 525 ft msl (mean sea level) during D5 (Figure 1). Depths to groundwater used to generate the groundwater elevation contours shown on Figure 1 were measured on August 21, 2019. Groundwater flow in the Uppermost Aquifer beneath the eastern portion of PAP is generally to the south toward Newton Lake. The flow direction diverges to the southwest beneath the western portion of the PAP, toward LF2, where groundwater flow in the area is converging along the major axis of LF2 Cells 1 and 2.

2.4 Groundwater and PAP Monitoring

The Uppermost Aquifer monitoring system for the PAP is shown on Figure 1. Monitoring wells APW5 and APW6 are used to monitor background water quality for the PAP. These wells are located north of the PAP. The downgradient monitoring wells are APW7, APW8, APW9, and APW10. PAP surface water samples were collected from locations AP1 in the southwest corner of the PAP and AP2 in the southeast corner of the PAP.

3. ALTERNATE SOURCE DEMONSTRATION: LINES OF EVIDENCE

As allowed by 40 C.F.R. § 257.94(e)(2), this ASD demonstrates that sources other than Newton PAP (the CCR unit) caused the SSIs. Lines of evidence supporting this ASD include the following:

1. The PAP is separated from the uppermost aquifer by a thick, low-permeability glacial till.
2. Concentrations of calcium and chloride in the PAP are lower than those observed in the groundwater.
3. Boron, a primary indicator parameter for CCR impacts to groundwater, has concentrations in downgradient wells that are near or below concentrations observed in background monitoring wells.

3.1 LOE #1: The PAP Is Separated from the Uppermost Aquifer by a Thick, Low-Permeability Glacial Till

As noted above, the Uppermost Aquifer at the Site is the Mulberry Grove Member of the Glasford Formation. Based on boring logs for monitoring wells installed around the perimeter of the Site, the Uppermost Aquifer is confined and the top of the Mulberry Grove Member ranges from 461.8 ft msl in APW-8 to 482.8 ft msl in APW-10 (Figure 2). The bottom elevation of the PAP is situated within the Hagarstown Member of the Glasford Formation at 508 ft msl, approximately 25 ft above the top of the Uppermost Aquifer (Figure 2). The Hagarstown Member, a thick, low-permeability glacial till, with hydraulic conductivities ranging from 2.4×10^{-6} to 6.1×10^{-5} centimeters per second (cm/s), separates the PAP from the uppermost aquifer. The lack of connection between the PAP and the Uppermost Aquifer demonstrates that there is no complete pathway for transport of CCR constituents in groundwater beneath the PAP, thus the PAP is not the source of CCR constituents in the Uppermost Aquifer.

3.2 LOE #2: Concentrations of Calcium and Chloride in the PAP Are Lower Than Those Observed in the Groundwater

Box plots graphically represent the first quartile, median, and third quartile of a given dataset using lines to construct a box where the lower line, midline and upper line of the box represent the values of the first quartile, median, and third quartile, respectively. The minimum and maximum values of the dataset (excluding outliers) are illustrated by whisker lines extending beyond the first and third quartiles of the box plot.

A box plot of calcium concentrations in downgradient monitoring wells and surface water samples is provided in Figure A. Calcium concentrations are lower in PAP surface water samples (collected in November 2017 and November 2019) than in all downgradient groundwater samples collected between 2015 and 2019. The maximum concentration of calcium detected in PAP surface water (36 milligrams per liter [mg/L]) is lower than the minimum concentration of calcium in a downgradient well (38 mg/L at APW10).

If the PAP were the source of calcium detected in groundwater, calcium concentrations in PAP surface water would be higher than the calcium concentrations detected in downgradient monitoring wells. Because the reverse is true (i.e., PAP calcium concentrations are lower than in the groundwater), the PAP is not likely the source of the calcium observed in downgradient wells.

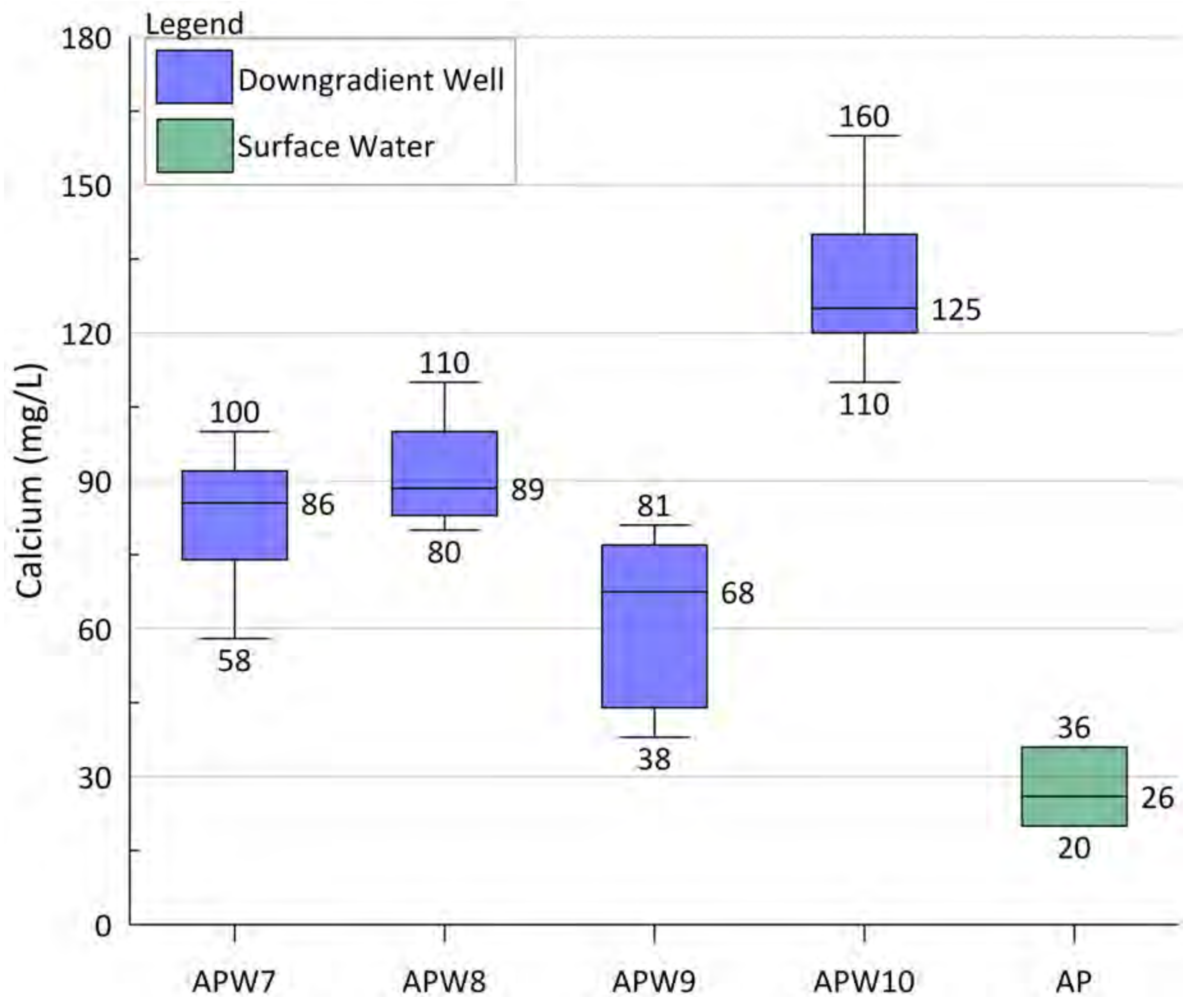


Figure A. Calcium Box Plot. The maximum, minimum, and median values are noted.

Similarly, chloride concentrations are lower in PAP water samples (collected in November 2017 and November 2019) than in all downgradient groundwater samples collected between 2015 and 2019. A box plot of chloride concentrations is provided in Figure B. The maximum concentration of chloride detected in PAP surface water (18 mg/L) is lower than the minimum concentration of calcium in a downgradient well (44 mg/L at APW9 and APW10).

If the PAP were the source of chloride detected in groundwater, chloride concentrations in PAP water would be higher than the chloride concentrations detected in downgradient groundwater. Because the reverse is true, the PAP is not likely the source of the chloride observed in downgradient wells.

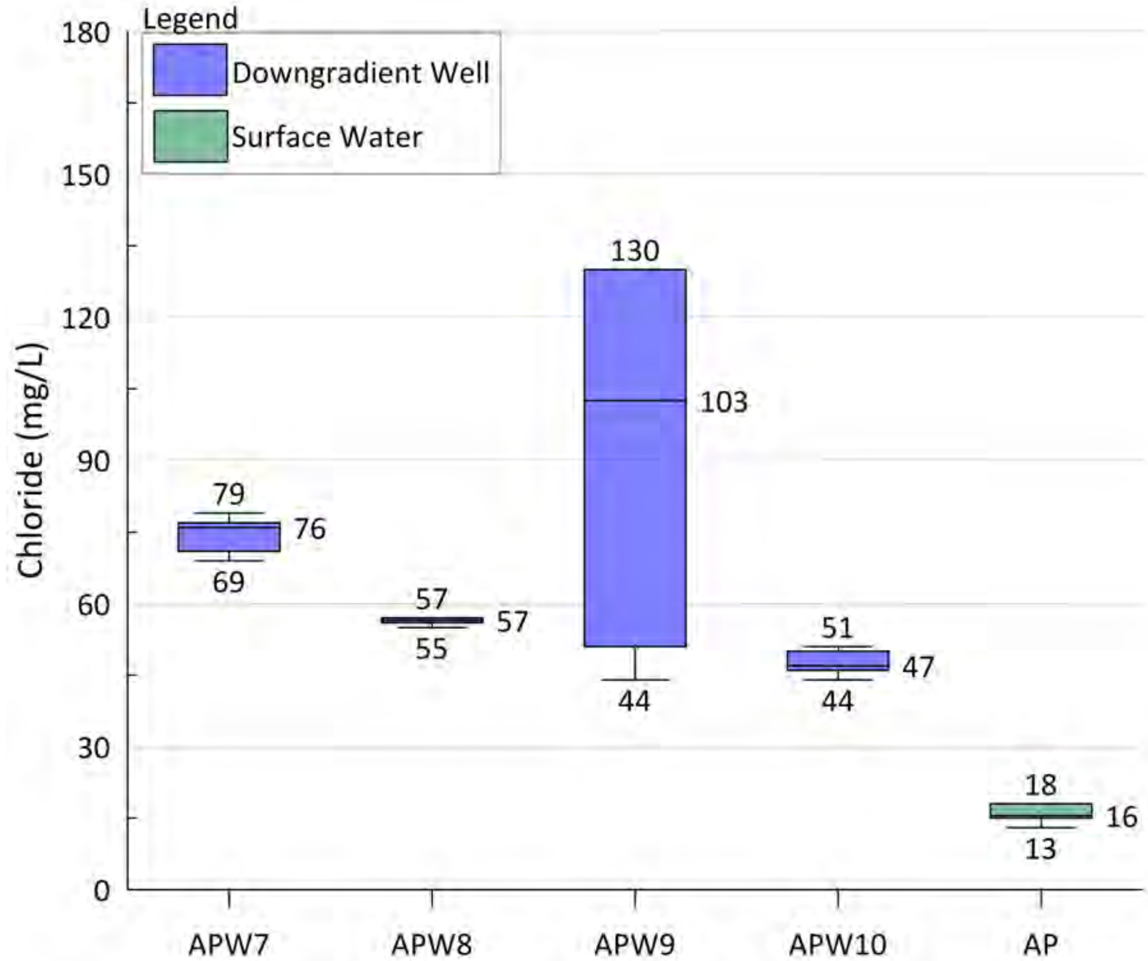


Figure B. Chloride Box Plot. The maximum, minimum, and median values are noted.

3.3 LOE #3: Boron, a Primary Indicator Parameter for CCR Impacts to Groundwater, Has Concentrations in Downgradient Wells That Are Near or Below Concentrations Observed in Background Monitoring Wells

Boron is a primary indicator of CCR impacts to groundwater. If the source of the SSIs in the downgradient monitoring wells were the PAP, boron would be anticipated to be elevated above background concentrations. Concentrations of boron in all downgradient monitoring wells are below the boron Upper Prediction Limit (UPL) (0.141 milligrams per liter [mg/L]) established using background monitoring wells (i.e. SSI limits) (Figure C).

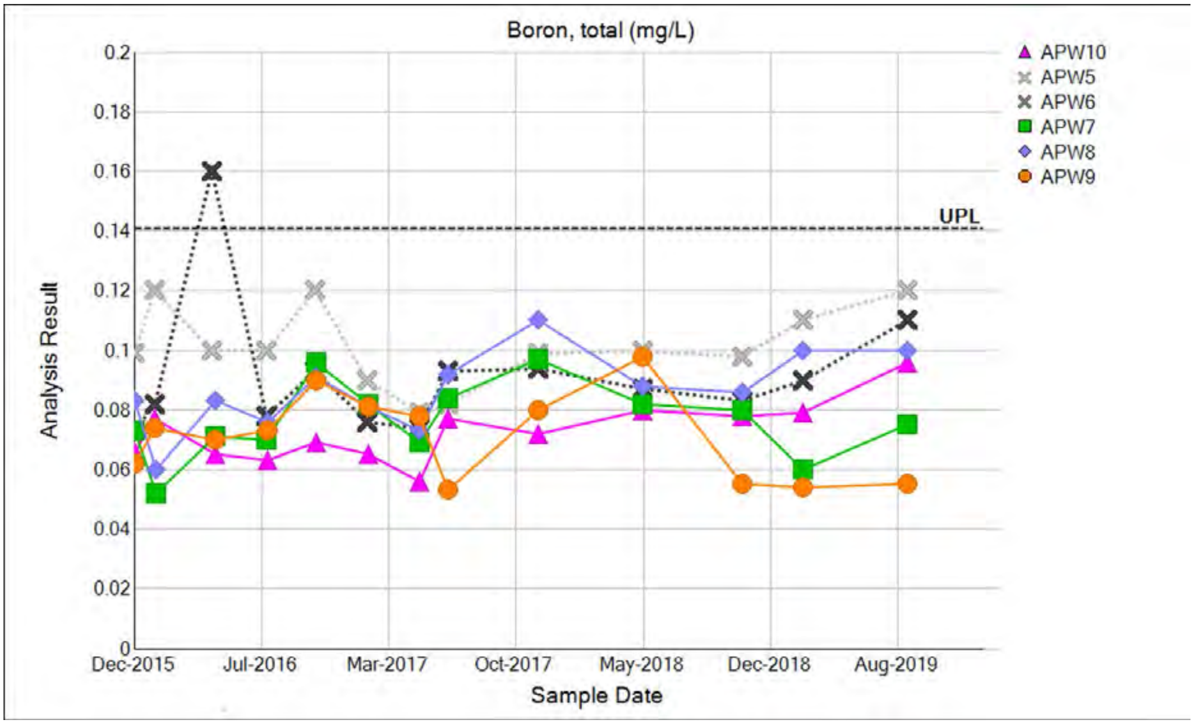


Figure C. Boron Time Series. The time series shows boron concentrations in background wells (represented by gray "X"s) are greater or similar to concentrations in downgradient wells.

Mann-Kendall (M-K) trend analysis tests were performed to determine the boron concentration trend in each well, if there was a trend. If the Mann-Kendall test identified a trend, the coefficient of variation (CV) was used to determine if the trend was of high or low magnitude. The CV is a measure of data spread calculated by dividing the standard deviation by the mean. CV values less than 1 indicate that the data is grouped closely around the mean and that is there is little variation in the data. Thus, a M-K analysis result of a trend with a CV less than 1 indicates that the data varies only slightly, and that the magnitude of the slope is low. No trends in boron concentrations were identified in background wells APW5 and APW6 and downgradient wells APW7 and APW9; and upward trends were identified at APW8 and APW10. However, the CV values for upward trends in APW8 and APW10 are well below 1, indicating that there is little variation in the data and that the trends are low magnitude. Table A provides summary statistics, including the CV and trend per well.

Table A – Summary Statistics and Trend Analysis of Boron in Groundwater.

Monitoring Well	Boron (mg/L)					
	Minimum	Maximum	Median	Standard Deviation	Trend	CV
APW5	0.079	0.12	0.10	0.013	None	0.13
APW6	0.073	0.16	0.087	0.023	None	0.25
APW7	0.052	0.097	0.075	0.013	None	0.17
APW8	0.060	0.11	0.086	0.013	Upward	0.15
APW9	0.053	0.098	0.073	0.015	None	0.20
APW10	0.056	0.096	0.072	0.010	Upward	0.14

The low concentrations of boron in downgradient monitoring wells relative to the UPL suggests that the source of the of the SSIs is not the PAP.

4. CONCLUSIONS

Based on the three lines of evidence below, it has been demonstrated that the Newton PAP is not the source of SSIs of calcium at APW8 and APW10; chloride at APW8; and sulfate at APW7, APW8, APW9, and APW10.

1. The PAP is separated from the uppermost aquifer by a thick, low-permeability glacial till.
2. Concentrations of calcium and chloride in the PAP are lower than those observed in the groundwater.
3. Boron, a primary indicator parameter for CCR impacts to groundwater, has concentrations in downgradient wells that are near or below concentrations observed in background monitoring wells.

This information serves as the written ASD prepared in accordance with 40 CFR § 257.94(e)(2) that the SSIs observed during the D5 sampling event were not due to the Newton PAP. Therefore, an assessment monitoring program is not required, and the Newton PAP will remain in detection monitoring.

5. REFERENCES

Lineback, J., 1979, Quaternary Deposits of Illinois: Illinois State Geological Survey map, scale 1:500,000.

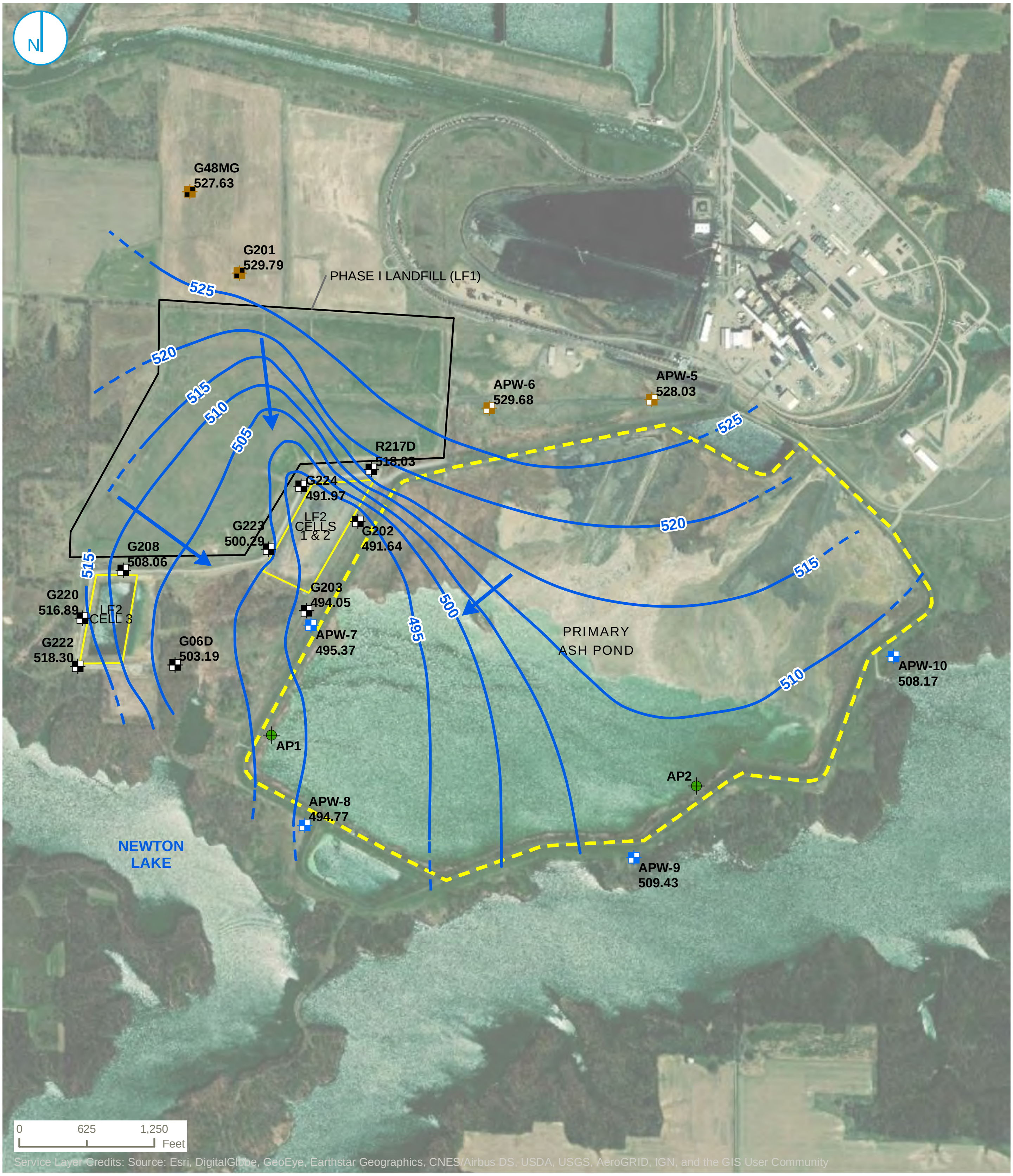
Natural Resource Technology, an OBG Company (NRT/OBG), 2017a, Statistical Analysis Plan, Coffeen Power Station, Newton Power Station, Illinois Power Generating Company, October 17, 2017.

Natural Resource Technology, an OBG Company (NRT/OBG), 2017b, Hydrogeologic Monitoring Plan, Newton Primary Ash Pond – CCR Unit ID 501, Newton Landfill 2 – CCR Unit ID 502, Newton Power Station, Canton, Illinois, Illinois Power Generating Company, October 17, 2017.

Willman, H.B., J.C. Frye, J.A. Simon, K.E. Clegg, D.H. Swann, E. Atherton, C. Collinson, J.A. Lineback, T.C. Buschbach, and H.B. Willman, 1967, Geologic Map of Illinois: Illinois State Geological Survey map, scale 1:500,000.

Willman, H.B., E. Atherton, T.C. Buschbach, C. Collinson, J.C. Frye, M.E. Hopkins, J.A. Lineback, and J.A. Simon, 1975, Handbook of Illinois Stratigraphy: Illinois State Geological Survey, Bulletin 95, 261 p.

FIGURES



Y:\Mapping\Projects\22\2285\MXD\Alt_Source_Dem\Newton\Figure 1_SampLoc and GWC PAP_D5.mxd

PROJECT: 169000XXXX | DATED: 4/3/2020 | DESIGNER: STOLZSD

- PRIMARY ASH POND CCR MONITORING WELL
- PRIMARY ASH POND BACKGROUND CCR MONITORING WELL
- LF2 CCR MONITORING WELL
- LF2 BACKGROUND CCR MONITORING WELL
- SOURCE WATER LOCATION
- GROUNDWATER ELEVATION CONTOUR (5-FOOT INTERVAL)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- PRIMARY ASH POND CCR UNIT BOUNDARY
- LF2 CCR UNIT BOUNDARY
- LF1 UNIT BOUNDARY

SAMPLING LOCATION AND GROUNDWATER ELEVATION CONTOUR MAP AUGUST 21, 2019

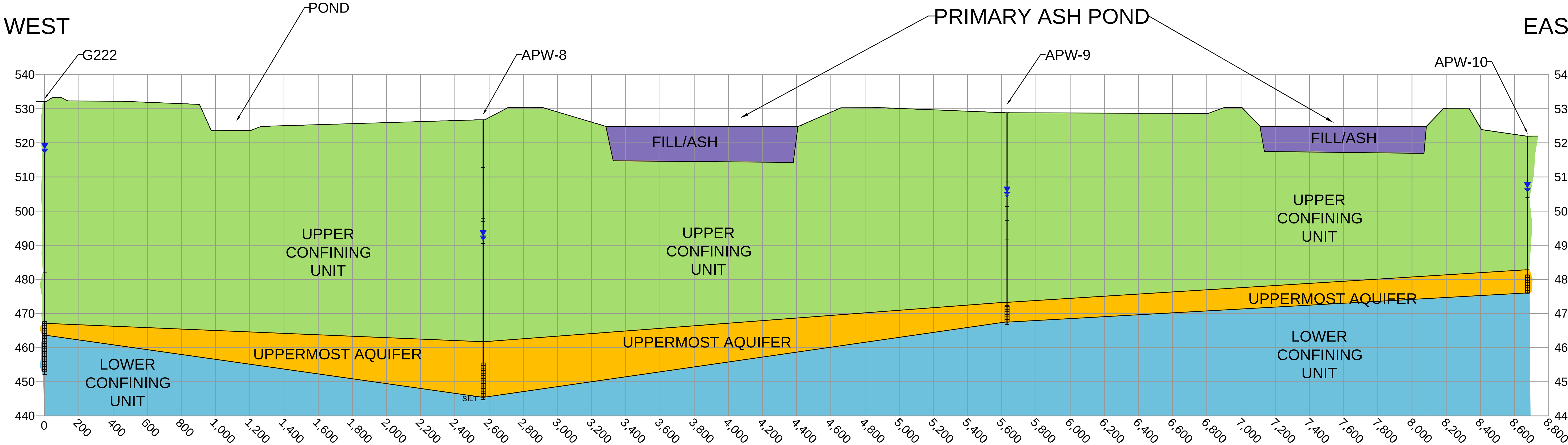
NEWTON PRIMARY ASH POND (UNIT ID: 501)
ALTERNATE SOURCE DEMONSTRATION
VISTRA ENERGY
NEWTON POWER STATION
NEWTON, ILLINOIS

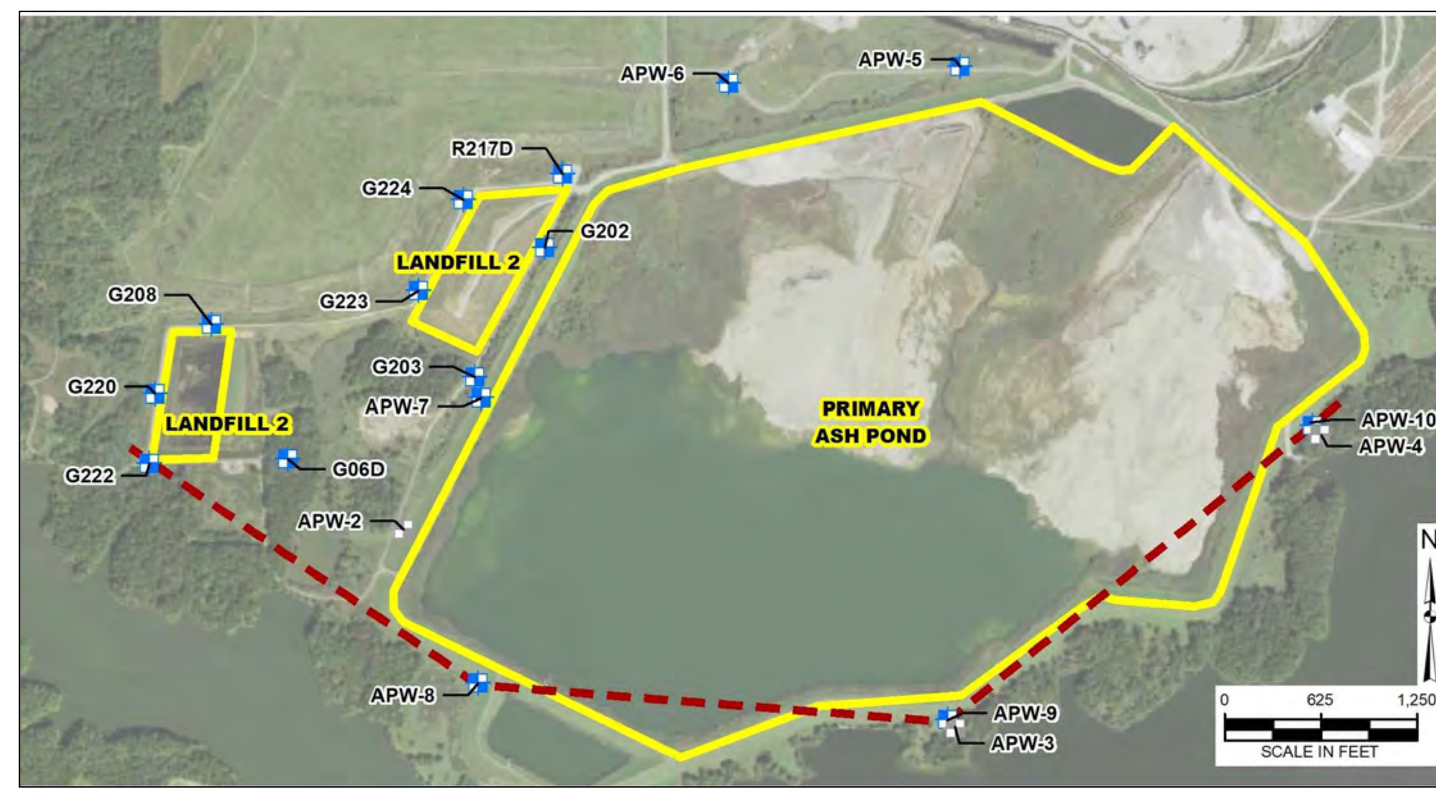
FIGURE 1

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

\\server27-01\Y Drive\Mapping\Projects\22\2285\CAD\Newton\PAP Cross Section Updates\Geologic Cross-Sections A&B.dwg

PROJECT: 74923 DATED: 4/3/2020 1:44 PM DESIGNER: ENGELHSA





LEGEND

- FILL / ASH
- UPPER CONFINING UNIT
- UPPERMOST AQUIFER
- LOWER CONFINING UNIT
- WELL SCREEN
- GROUNDWATER ELEVATION

VERTICAL SCALE IN FEET 30

HORIZONTAL SCALE IN FEET 600

VERTICAL EXAGGERATION =20

GEOLOGIC CROSS SECTION

NEWTON PRIMARY ASH POND (UNIT ID: 501)
40 C.F.R § 257.94(e)(2): ALTERNATE SOURCE DEMONSTRATION
NEWTON POWER STATION
NEWTON, ILLINOIS

FIGURE 2

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

RAMBOLL

Intended for
Illinois Power Generating Company

Date
October 13, 2020

Project No.
1940074923

40 C.F.R. § 257.94(e)(2): ALTERNATE SOURCE DEMONSTRATION

NEWTON PRIMARY ASH POND

RAMBOLL Bright ideas. Sustainable change.

CERTIFICATIONS

I, Nicole M. Pagano, a professional geologist in good standing in the State of Illinois, certify that the information in this report is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

Nicole M. Pagano
Professional Geologist
196-000750
Illinois
Ramboll Americas Engineering Solutions, Inc., f/k/a O'Brien & Gere Engineers, Inc.
Date: October 13, 2020

I, Anne Frances Ackerman, a qualified professional engineer in good standing in the State of Illinois, certify that the information in this report is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

Anne Frances Ackerman
Qualified Professional Engineer
062-060586
Illinois
Ramboll Americas Engineering Solutions, Inc., f/k/a O'Brien & Gere Engineers, Inc.
Date: October 13, 2020

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CONTENTS

TABLES (IN TEXT)

FIGURES (IN TEXT)

FIGURES (ATTACHED)

ACRONYMS AND ABBREVIATIONS

40 C.F.R.	Title 40 of the Code of Federal Regulations
ASD	Alternate Source Demonstration
bgs	below ground surface
CCR	Coal Combustion Residuals
f/k/a	formerly known as
ft	foot/feet
LF2	Phase II Landfill 2
M-K	Mann-Kendall
msl	mean sea level
NRT/OBG	Natural Resource Technology, an OBG Company
PAP	Newton Primary Ash Pond
Site	Newton Power Station
SSIs	Statistically Significant Increases
UPL	Upper Prediction Limit

1. INTRODUCTION

Title 40 of the Code of Federal Regulations (40 C.F.R.) § 257.94(e)(2) allows the owner or operator of a Coal Combustion Residuals (CCR) unit 90 days from the date of determination of a Statistically Significant Increase (SSI) over background for groundwater constituents listed in Appendix III of 40 C.F.R. Part 257 to complete a written demonstration that a source other than the CCR unit being monitored caused the SSI(s), or that the SSI(s) resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality (Alternate Source Demonstration [ASD]).

This ASD has been prepared on behalf of Illinois Power Generating Company, by Ramboll Americas Engineering Solutions, Inc., formerly known as (f/k/a) O'Brien & Gere Engineers, Inc., to provide pertinent information pursuant to 40 C.F.R. § 257.94(e)(2) for the Newton Primary Ash Pond (PAP) located near Newton, Illinois.

The most recent Detection Monitoring sampling event (Detection Monitoring Round 6 [D6]) was completed on February 5, 6, and 19, 2020, and analytical data were received on April 15, 2020. Analytical data from D6 were evaluated in accordance with the Statistical Analysis Plan (Natural Resource Technology, an OBG Company [NRT/OBG] 2017a) to determine any SSIs of Appendix III parameters over background concentrations. That evaluation identified SSIs at downgradient monitoring wells as follows:

- Calcium at wells APW7, APW8, APW9, and APW10
- Chloride at APW7 and APW9
- Sulfate at wells APW8 and APW10
- TDS at APW10

In accordance with the Statistical Analysis Plan, APW7, APW9, and APW10 were resampled on June 11, 2020 and analyzed only for chloride (APW7 and APW9) and TDS (APW10) to confirm the SSIs. Following evaluation of analytical data from the resample event, the following SSIs remained:

- Calcium at wells APW7, APW8, APW9, and APW10
- Chloride at APW7 and APW9
- Sulfate at wells APW8 and APW10

Pursuant to 40 C.F.R. § 257.94(e)(2), the following lines of evidence (LOE) demonstrate that sources other than the PAP were the cause of the calcium, chloride, and sulfate SSIs listed above. This ASD was completed by October 13, 2020, within 90 days of determination of the SSIs (July 15, 2020), as required by 40 C.F.R. § 257.94(e)(2).

2. BACKGROUND

2.1 Site Location and Description

The Newton Power Station (Site) is located in Jasper County in the southeastern part of central Illinois, approximately 7 miles southwest of the town of Newton. The plant is located on the north side of Newton Lake. The area is bounded by Newton Lake and agricultural land to the west, south, and east, and agricultural land to the north. Beyond the lake is additional agricultural land.

2.2 Description of Primary Ash Pond CCR Unit

The Newton Power Station's sole CCR surface impoundment, the PAP, was constructed in 1977 and has a design capacity of approximately 9,715 acre-feet. The PAP has a surface area of 400 acres and a height of approximately 71 feet (ft) above grade. The PAP currently receives bottom ash, fly ash, and low-volume wastewater from the plant's two coal-fired boilers, and is operated per NPDES Permit IL0049191, Outfall 001. The PAP was not excavated during construction, except for native materials used to build the containment berms.

2.3 Geology and Hydrogeology

The information used to describe the hydrogeology is based on the local geology obtained from published sources, hydrogeologic investigation data, and boring data collected during monitoring well installation.

Quaternary deposits in the Newton area consist mainly of diamictons and outwash deposits that were deposited during Illinoian and Pre-Illinoian glaciations (Lineback, 1979; Willman et al., 1975). The unconsolidated deposits occurring at Newton Power Station include the following units (beginning at the ground surface):

- Upper Confining Unit – Low permeability clays and silts, including the Peoria Silt (Loess Unit) in upland areas and the Cahokia Formation in the flood plain and channel areas to the south and east, underlain by the Sangamon Soil, and the predominantly clay diamictons of the Hagarstown (Till) and Vandalia (Till) Members of the Glasford Formation. The Hagarstown Member till have low hydraulic conductivities, ranging from 2.4×10^{-6} to 6.1×10^{-5} centimeters per second (cm/s) (OBG/NRT 2017b).
- Uppermost Aquifer – Thin to moderately thick (3 to 17 ft), moderate to high permeability sand, silty sand, and sandy silt/clay units of the Mulberry Grove Member of the Glasford Formation.
- Lower Confining Unit – Thick, very low permeability silty clay diamictons of the Smithboro (Till) Member of the Glasford Formation and the silty clay diamictons of the Banner Formation.

The bedrock beneath the unconsolidated deposits consists of Pennsylvanian-age Mattoon Formation (Willman et al., 1967) that is mostly shale near the bedrock surface but is characterized at depth by a complex sequence of shales, thin limestones, coals, underclays, and several sandstones (Willman et al., 1975). The erosional surface of the Pennsylvanian-age Mattoon Formation bedrock ranges widely in depth in the vicinity of the Site but is typically encountered at 90 to 120 ft below ground surface (bgs).

Groundwater elevations across the PAP ranged from approximately 492 to 530 ft mean sea level (msl) during D6 (Figure 1). Depth to groundwater measurements used to generate the groundwater elevation contours shown on Figure 1 were collected on February 3, 2020. Groundwater flow in the Uppermost Aquifer beneath the eastern portion of PAP is generally to the south toward Newton Lake. The flow direction diverges to the southwest beneath the western portion of the PAP, toward Phase II Landfill 2 (LF2), where groundwater flow in the area is converging along the major axis of LF2 Cells 1 and 2.

2.4 Groundwater and PAP Monitoring

The Uppermost Aquifer monitoring system for the PAP is shown on Figure 1. Monitoring wells APW5 and APW6 are used to monitor background water quality for the PAP. These wells are located north of the PAP. The downgradient monitoring wells are APW7, APW8, APW9, and APW10. PAP surface water samples were collected from locations AP1 in the southwest corner of the PAP and AP2 in the southeast corner of the PAP.

3. ALTERNATE SOURCE DEMONSTRATION: LINES OF EVIDENCE

As allowed by 40 C.F.R. § 257.94(e)(2), this ASD demonstrates that sources other than the PAP (the CCR unit) caused the SSIs. LOE supporting this ASD include the following:

1. The PAP is separated from the uppermost aquifer by a thick, low-permeability glacial till.
2. Concentrations of calcium and chloride in the PAP are lower than those observed in the groundwater.
3. Boron, a primary indicator parameter for CCR impacts to groundwater, has concentrations in downgradient wells that are below concentrations observed in background monitoring wells.

These LOEs are described and supported in greater detail below.

3.1 LOE #1: The PAP Is Separated from the Uppermost Aquifer by a Thick, Low-Permeability Glacial Till

Based on groundwater elevations and information on the boring logs for monitoring wells installed around the perimeter of the Site, the Uppermost Aquifer ranges from 461.8 ft msl in APW-8 to 482.8 ft msl in APW-10 and is overlain by a low-permeability unit (Figure 2). The bottom elevation of the PAP is situated within the Upper Confining Unit at 508 ft msl, approximately 25 ft above the top of the Uppermost Aquifer (Figure 2). Thus, a low-permeability glacial till layer separates the PAP from the uppermost aquifer. The lack of connection between the PAP and the Uppermost Aquifer demonstrates that there is no complete pathway for transport of CCR constituents in groundwater beneath the PAP, thus the PAP is not the source of CCR constituents in the Uppermost Aquifer.

3.2 LOE #2: Concentrations of Calcium and Chloride in the PAP Are Lower Than Those Observed in the Groundwater

A box plot of calcium concentrations in downgradient monitoring wells and surface water samples is provided in Figure A. Box plots graphically represent the range of a given dataset using lines to construct a box where the lower line, midline, and upper line of the box represent the values of the first quartile, median, and third quartile values, respectively. The minimum and maximum values of the dataset (excluding outliers) are illustrated by whisker lines extending beyond the first and third quartiles of (*i.e.*, below and above) the box plot. The interquartile range (IQR) is the distance between the first and third quartiles. Outliers (values that are at least 1.5 times the IQR away from the edges of the box) are represented by single points plotted outside of the range of the whiskers.

Calcium concentrations are lower in all PAP surface water samples (collected in November 2017, November 2019, and February 2020) than in all downgradient groundwater samples collected between 2015 and 2020. The maximum concentration of calcium detected in PAP surface water (36 milligrams per liter [mg/L]) is lower than the minimum concentration of calcium in any downgradient well (38 mg/L at APW10).

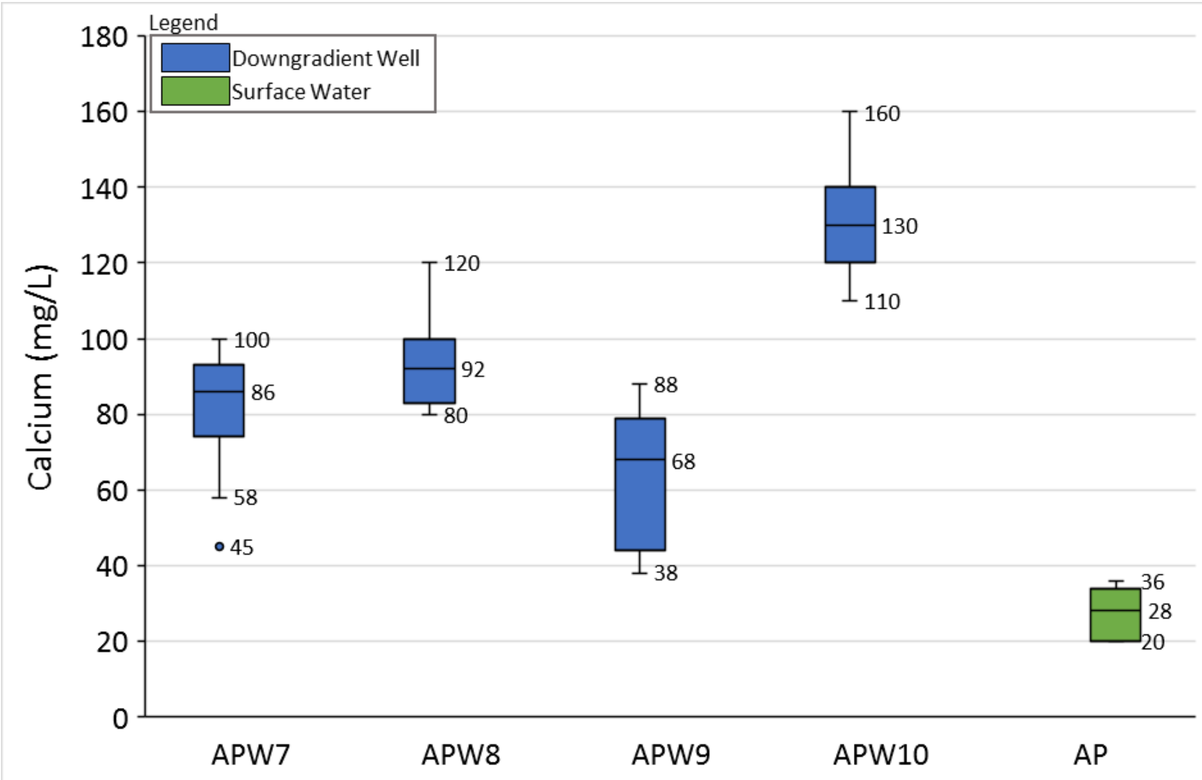


Figure A. Calcium Box Plot. The maximum, minimum, and median values are noted. AP includes data from both AP1 and AP2.

Similarly, chloride concentrations are lower in all PAP surface water samples (collected in November 2017, November 2019, and February 2020) than in all downgradient groundwater samples collected between 2015 and 2020. A box plot of chloride concentrations is provided in Figure B. The maximum concentration of chloride detected in PAP surface water (18 mg/L) is lower than the minimum concentration of calcium in any downgradient well (43 mg/L at APW9).

The concentrations of calcium and chloride in the PAP surface water are lower than those observed in the groundwater, indicating that the PAP is not the source of calcium and chloride to groundwater in the vicinity of the PAP. If the PAP were the source of calcium and chloride detected in groundwater, concentrations in PAP water would be higher than concentrations detected in groundwater.

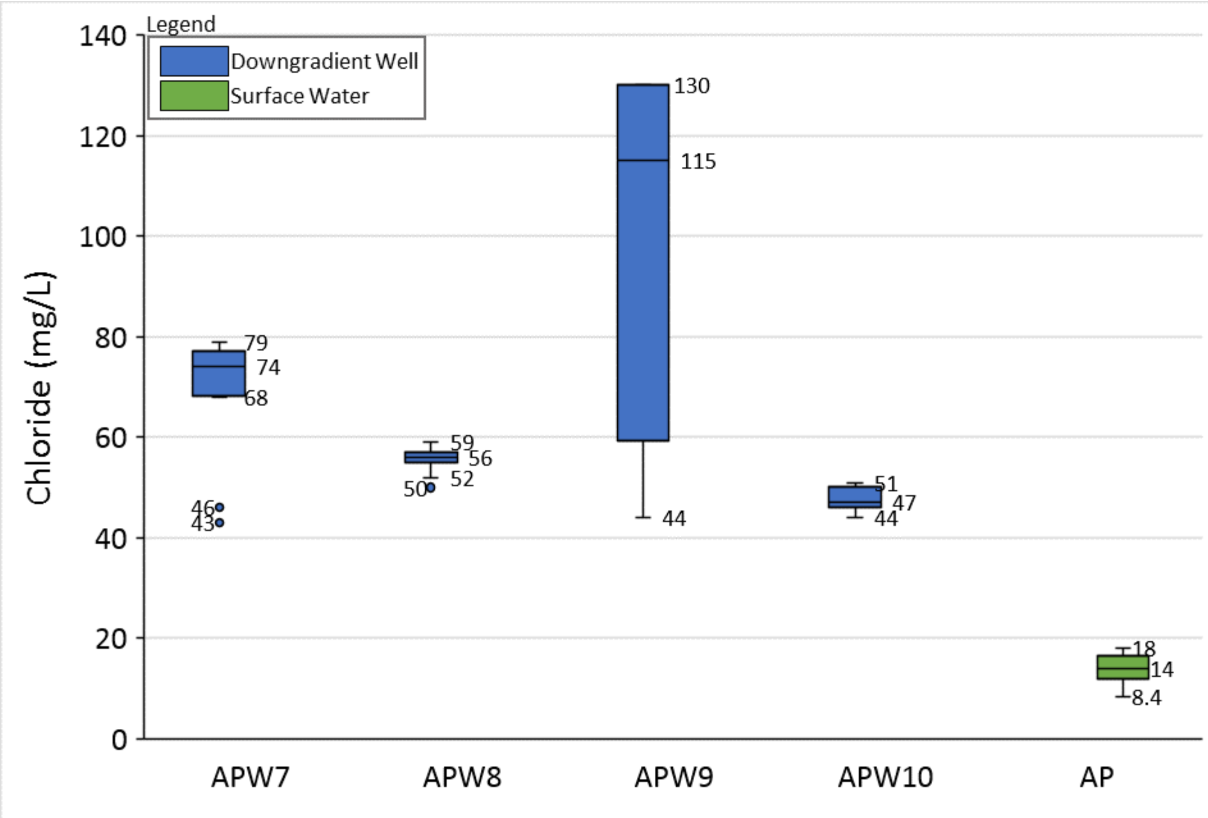


Figure B. Chloride Box Plot. The maximum, minimum, and median values are noted. AP includes data from both AP1 and AP2.

3.3 LOE #3: Boron, a Primary Indicator Parameter for CCR Impacts to Groundwater, Has Concentrations in Downgradient Wells That Are Below Concentrations Observed in Background Monitoring Wells

Boron is a primary indicator of CCR impacts to groundwater. If the groundwater downgradient of the PAP had been impacted by discharge of CCR from the PAP, boron would be expected to be elevated above background concentrations. Concentrations of boron in all downgradient monitoring wells are below the boron Upper Prediction Limit (UPL) (0.141 mg/L) established using background monitoring wells (i.e. SSI limits) (Figure C). Therefore, the PAP is not the source of the SSIs detected in groundwater.

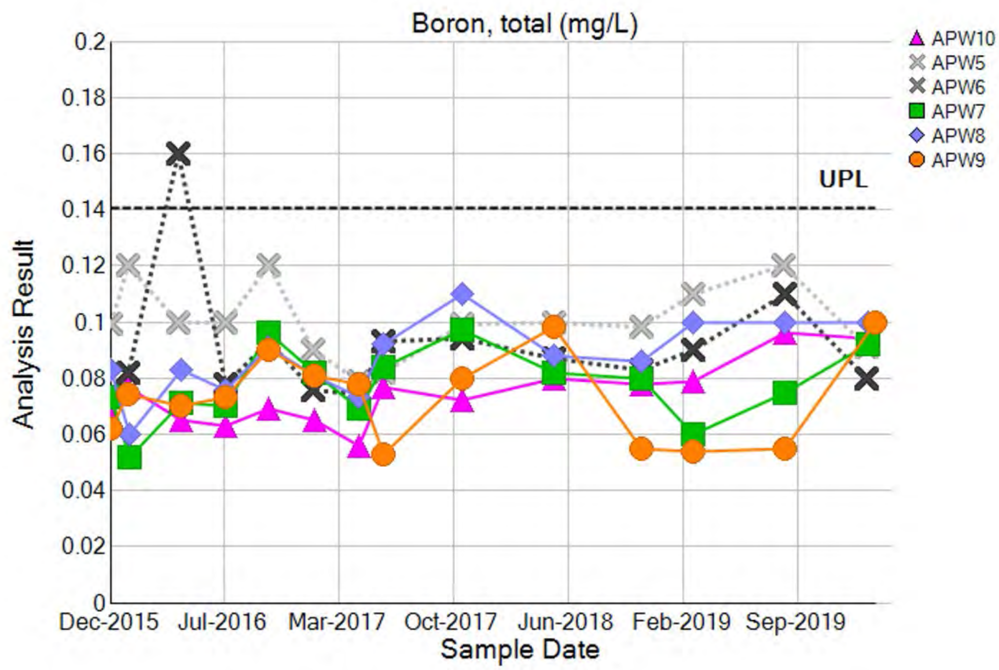


Figure C. Boron Time Series. The time series shows boron concentrations in downgradient wells are less than concentrations in background wells (represented by gray "X"s).

Mann-Kendall (M-K) trend analysis tests were performed to determine the boron concentration trend in each well, if there was a trend. If the M-K test identified a trend, the coefficient of variation (CV) was used to determine if the trend was of high or low magnitude. The CV is a measure of data spread calculated by dividing the standard deviation by the mean. CV values less than 1 indicate that the data is grouped closely around the mean and that is there is little variation in the data. Thus, a M-K analysis result of a trend with a CV less than 1 indicates that the data varies only slightly, and that the magnitude of the slope is low. No trends in boron concentrations were identified in background wells APW5 and APW6 and downgradient wells APW7 and APW9; and upward trends were identified at APW8 and APW10. However, the CV values for upward trends in APW8 and APW10 are well below 1, indicating that there is little variation in the data and that the trends are low magnitude. Table A provides summary statistics, including the CV and trend per well.

Table A – Summary Statistics and Trend Analysis of Boron in Groundwater.

Monitoring Well	Boron (mg/L)					
	Minimum	Maximum	Median	Standard Deviation	Trend	CV
APW5	0.079	0.12	0.10	0.013	None	0.13
APW6	0.073	0.16	0.085	0.022	None	0.24
APW7	0.052	0.097	0.078	0.013	None	0.17
APW8	0.060	0.11	0.087	0.013	Upward	0.15
APW9	0.053	0.10	0.074	0.016	None	0.22
APW10	0.056	0.096	0.074	0.011	Upward	0.15

The low concentrations of boron in downgradient monitoring wells relative to the UPL suggests that the source of the of the SSIs is not the PAP.

4. CONCLUSIONS

Based on these three LOEs, it has been demonstrated that the SSLs at APW7, APW8, APW9, and APW10 are not due to the PAP but are from a source other than the CCR unit being monitored.

1. The PAP is separated from the uppermost aquifer by a thick, low-permeability glacial till.
2. Concentrations of calcium and chloride in the PAP are lower than those observed in the groundwater.
3. Boron, a primary indicator parameter for CCR impacts to groundwater, has concentrations in downgradient wells that are below concentrations observed in background monitoring wells.

This information serves as the written ASD prepared in accordance with 40 CFR § 257.94(e)(2) that the SSIs observed during the D6 sampling event were not due to the PAP. Therefore, an assessment monitoring program is not required, and the PAP will remain in detection monitoring.

5. REFERENCES

Lineback, J., 1979, Quaternary Deposits of Illinois: Illinois State Geological Survey map, scale 1:500,000.

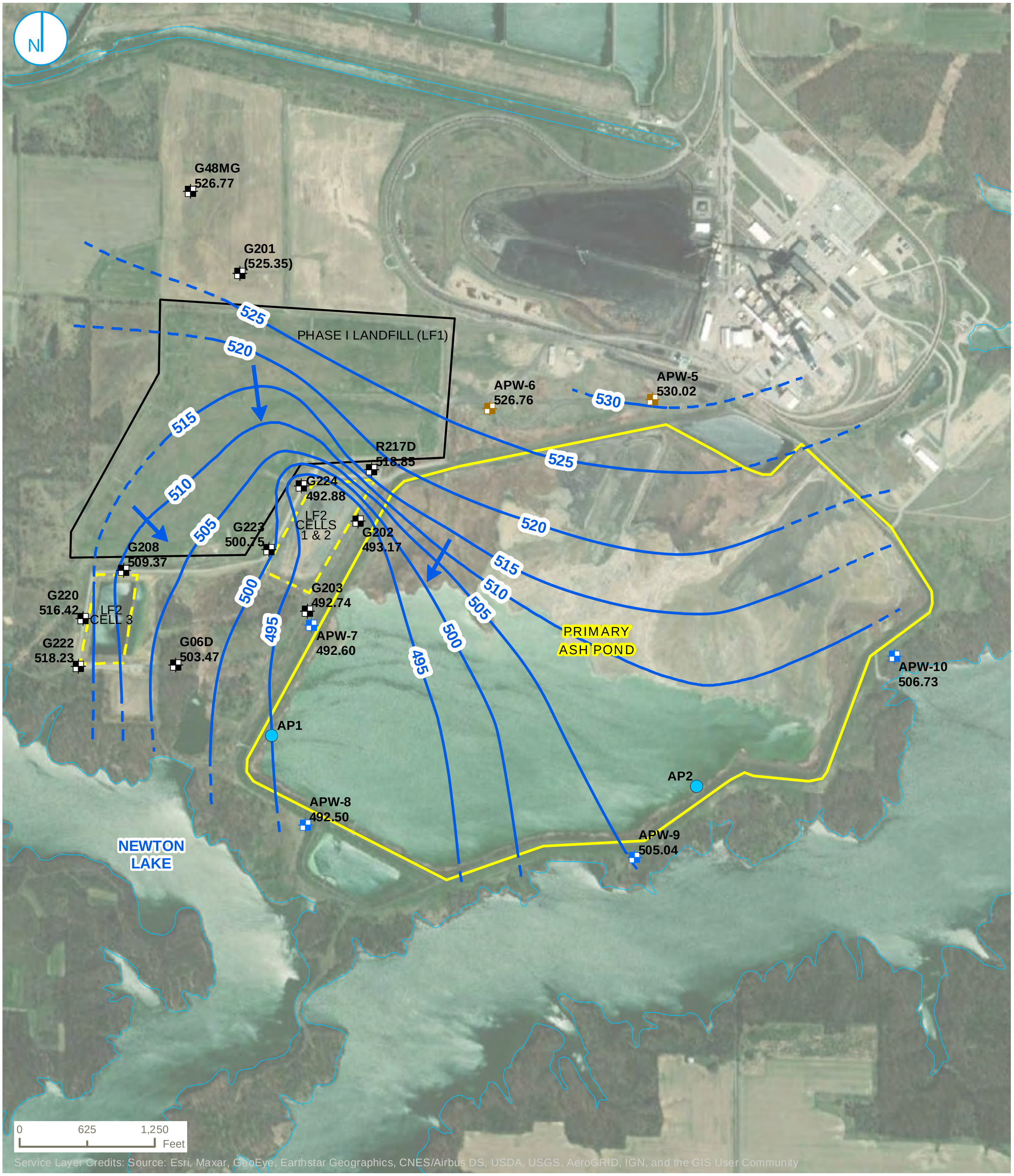
Natural Resource Technology, an OBG Company (NRT/OBG), 2017a, Statistical Analysis Plan, Coffeen Power Station, Newton Power Station, Illinois Power Generating Company, October 17, 2017.

Natural Resource Technology, an OBG Company (NRT/OBG), 2017b, Hydrogeologic Monitoring Plan, Newton Primary Ash Pond – CCR Unit ID 501, Newton Landfill 2 – CCR Unit ID 502, Newton Power Station, Canton, Illinois, Illinois Power Generating Company, October 17, 2017.

Willman, H.B., J.C. Frye, J.A. Simon, K.E. Clegg, D.H. Swann, E. Atherton, C. Collinson, J.A. Lineback, T.C. Buschbach, and H.B. Willman, 1967, Geologic Map of Illinois: Illinois State Geological Survey map, scale 1:500,000.

Willman, H.B., E. Atherton, T.C. Buschbach, C. Collinson, J.C. Frye, M.E. Hopkins, J.A. Lineback, and J.A. Simon, 1975, Handbook of Illinois Stratigraphy: Illinois State Geological Survey, Bulletin 95, 261 p.

FIGURES



Y:\Mapping\Projects\22\2285\MXD\Alt_Source_Dem\Newton\Figure 1_SampLoc and GWC PAP_D6.mxd

PROJECT: 169000XXXX | DATED: 7/6/2020 | DESIGNER: galarnmc

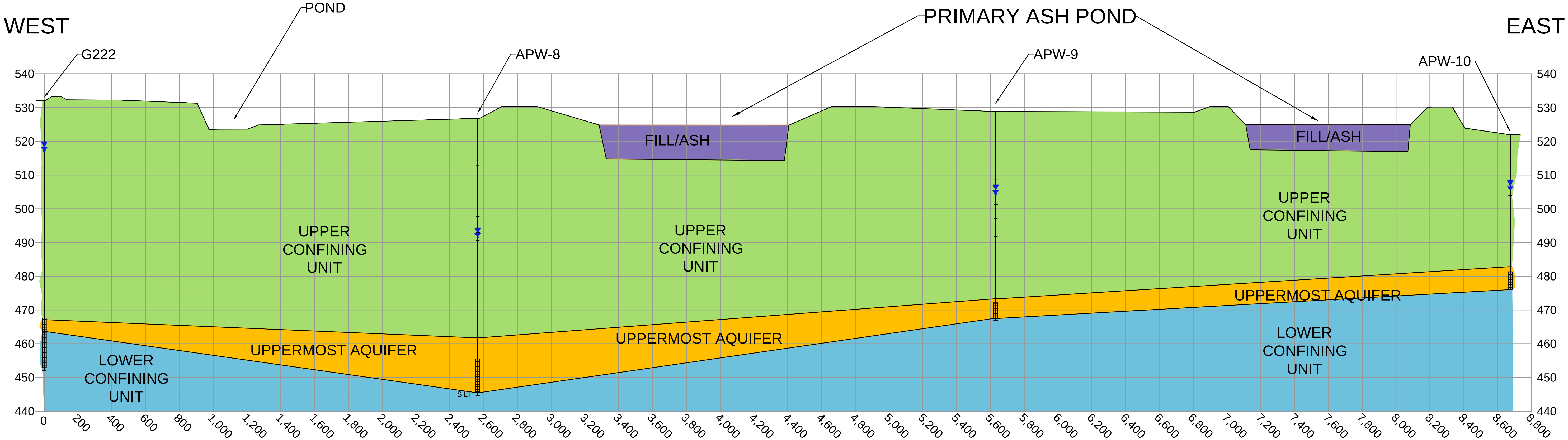
PRIMARY ASH POND DOWNGRADIENT MONITORING WELL
PRIMARY ASH POND UPGRADIENT MONITORING WELL
LF2 CCR RULE MONITORING WELL
SOURCE WATER LOCATION
GROUNDWATER ELEVATION CONTOUR (5-FT CONTOUR INTERVAL, NAVD 88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
SURFACE WATER FEATURE
PRIMARY ASH POND CCR UNIT BOUNDARY
LF2 CCR UNIT BOUNDARY
LF1 UNIT BOUNDARY

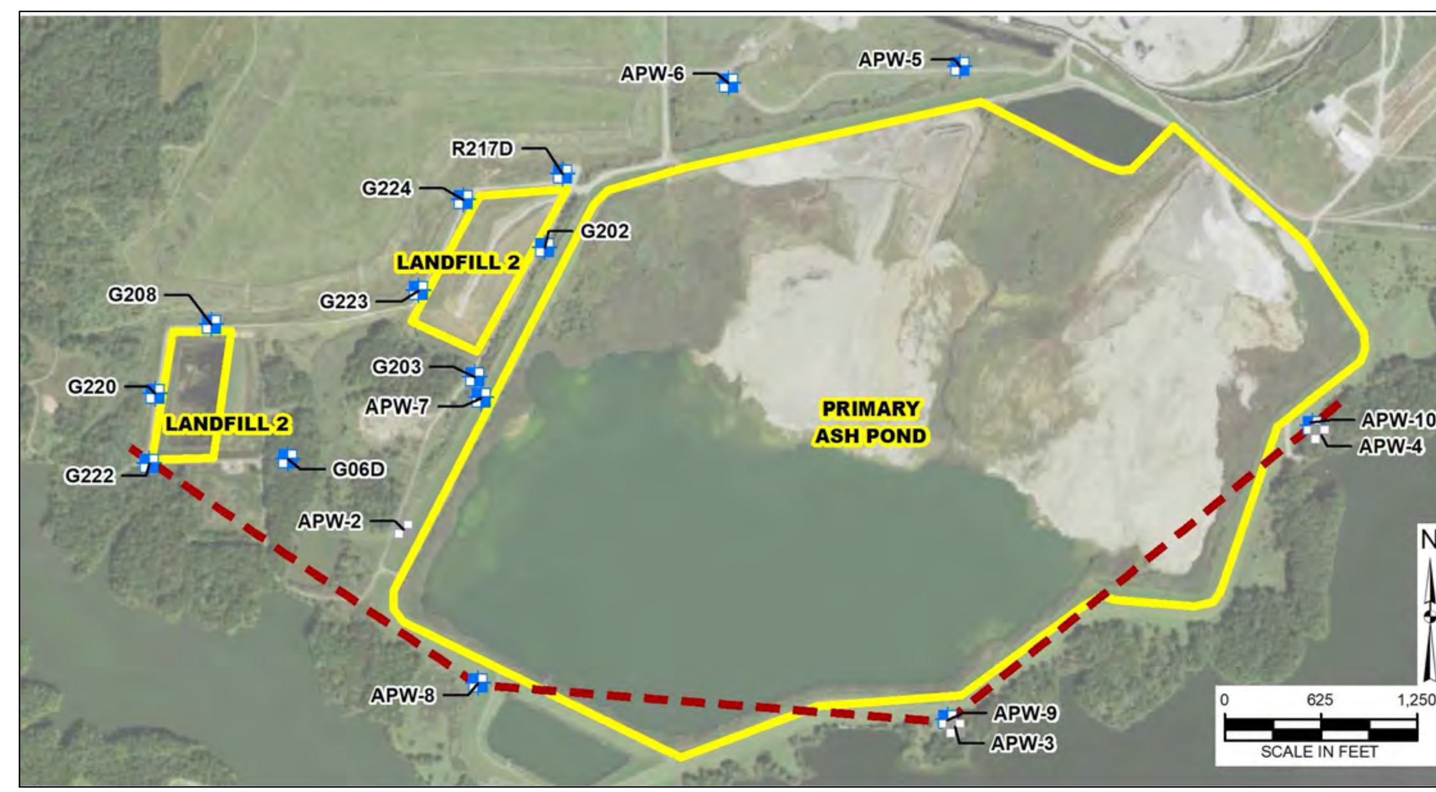
SAMPLING LOCATION AND GROUNDWATER ELEVATION CONTOUR MAP
FEBRUARY 3, 2020

NEWTON PRIMARY ASH POND (UNIT ID: 501)
ALTERNATE SOURCE DEMONSTRATION
VISTRA ENERGY
NEWTON POWER STATION
NEWTON, ILLINOIS

FIGURE 1

RAMBOLL US CORPORATION
A RAMBOLL COMPANY





LEGEND

- FILL / ASH
- UPPER CONFINING UNIT
- UPPERMOST AQUIFER
- LOWER CONFINING UNIT
- WELL SCREEN
- GROUNDWATER ELEVATION

VERTICAL SCALE IN FEET 30

HORIZONTAL SCALE IN FEET 600

VERTICAL EXAGGERATION =20

GEOLOGIC CROSS SECTION

NEWTON PRIMARY ASH POND (UNIT ID: 501)

40 C.F.R § 257.94(e)(2): ALTERNATE SOURCE DEMONSTRATION

NEWTON POWER STATION

NEWTON, ILLINOIS

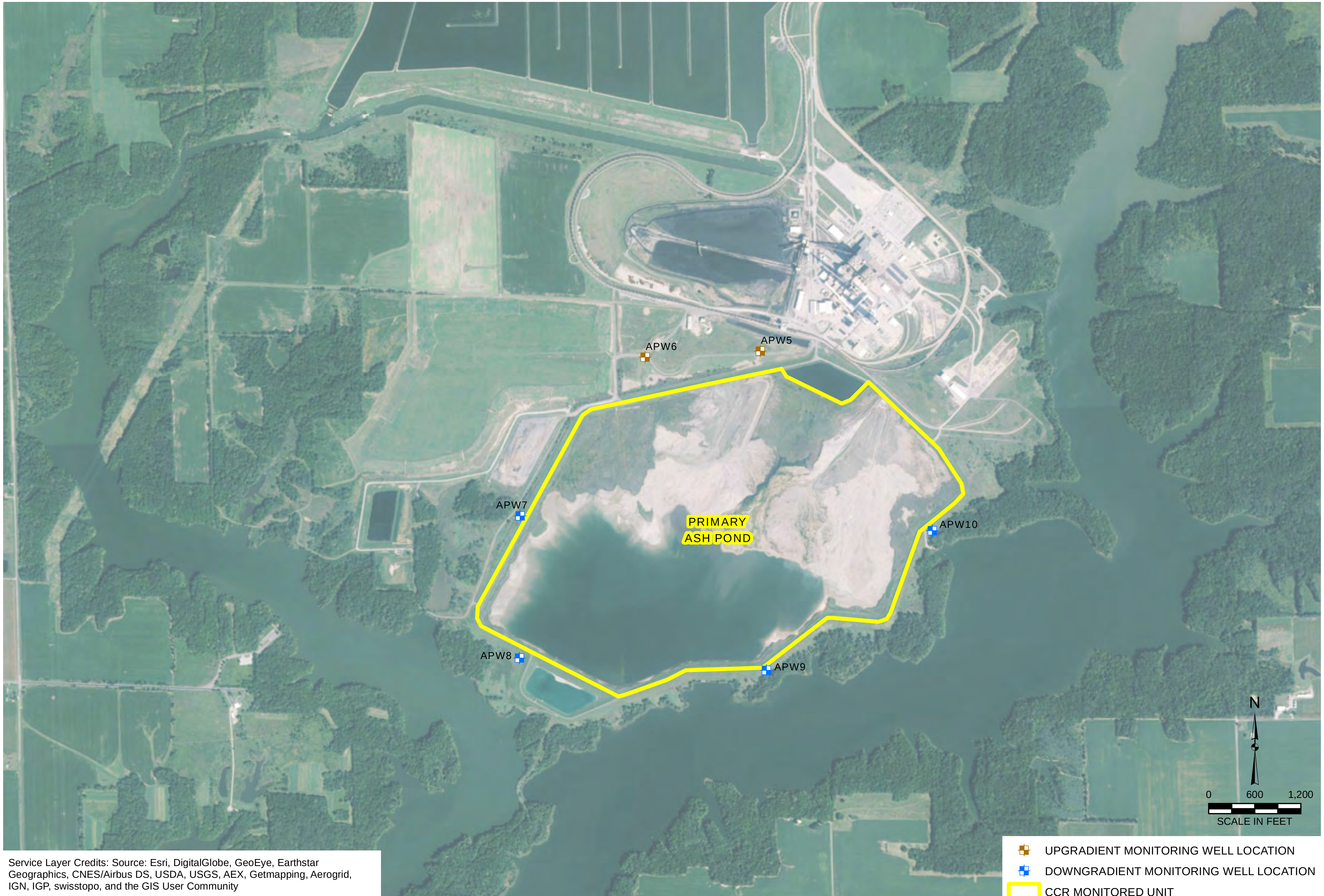
FIGURE 2

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

PROJECT: 74923 DATED: 4/3/2020 1:44 PM DESIGNER: ENGELHSA

\\server27-01\Y Drive\Mapping\Projects\22\2285\CAD\Newton\PAP Cross Section Updates\Geologic Cross-Sections A&B.dwg

ATTACHMENT 2 – MAP OF GROUNDWATER MONITORING WELL LOCATIONS



UPGRADIENT MONITORING WELL LOCATION

DOWNGRADIENT MONITORING WELL LOCATION

CCR MONITORED UNIT

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

DRAWN BY/DATE:
MDM 10/13/15
REVIEWED BY/DATE:
YAD 10/14/15
APPROVED BY/DATE:
SJC 10/16/15

SITE AND WELL LOCATION MAP
NEWTON PRIMARY ASH POND
UNIT ID: 501

SAMPLING AND ANALYSIS PLAN
DYNEGY CCR RULE GROUNDWATER MONITORING
NEWTON POWER STATION
NEWTON, ILLINOIS

PROJECT NO: 2285/4.3

FIGURE NO: 1

NATURAL RESOURCE TECHNOLOGY

Y:\Mapping\Projects\22\2285\MXD\SAP\Figure 1_Site and Well Location Map - Newton Primary Ash Pond.mxd Author: mmejac; Date/Time: 10/16/2015, 9:32:33 AM

ATTACHMENT 3 – WELL CONSTRUCTION DIAGRAMS AND DRILLING LOGS

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/22/2015
Finish: 10/22/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW5
Well ID: APW5
Surface Elev: 541.57 ft. MSL
Completion: 68.00 ft. BGS
Station: 7,758.02N 9,318.19E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 58.00 - During Drilling
▼ =
▽ =

Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp (tsf)* Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
							0	Very dark grayish brown (10YR3/2), dry, very stiff, SILT with little clay and trace very fine- to medium-grained sand, roots.		
1A	60/60 *100%*	DP		7		*3.00*	2	Yellowish brown (10YR5/6), dry, very stiff, SILT with little clay and few very fine- to medium-grained sand.	540	
1B				13		*2.50*	4	Yellowish brown (10YR5/6) with 10% gray (10YR6/1) mottles, moist, very stiff, silty CLAY with few very fine- to medium-grained sand and trace small gravel.	538, 536	
2A	60/60 *100%*	DP		25		*3.25*	6–8	Gray (10YR5/1) with 20% dark yellowish brown (10YR4/6) mottles, moist, very stiff, CLAY with some silt, trace very fine- to fine-grained sand.	534	
2B				22		*2.25*	10	Dark grayish brown (10YR4/2), moist, stiff, CLAY with little silt and trace very fine- to fine-grained sand.	532	
								Gray (10YR6/1), moist, medium dense, very fine- to fine-grained SAND and SILT with little clay.	530	
3A	60/60 *100%*	DP		19		*1.50*	12			
3B				19		*3.00*	14	Gray (10YR5/1) with 5% yellowish brown (10YR5/6) mottles, moist, very stiff, silty CLAY with few fine- to coarse-grained sand and trace small gravel.	528, 526	
4A	36/36 *100%*	DP		9		*2.00*	16	Yellowish brown (10YR5/6) with 15% grayish brown (10YR5/2) mottles, moist, stiff, SILT with little clay and trace fine- to coarse-grained sand and small gravel.	524	
5A	23/24 *96%*	SS	*14-28 40-50* N=68	9		*4.50*	18–20	Brown (10YR5/3), moist, hard, SILT with little clay, few very fine- to coarse-grained sand, and trace small gravel.	522	

NOTE(S): APW5 installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/22/2015
Finish: 10/22/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW5
Well ID: APW5
Surface Elev: 541.57 ft. MSL
Completion: 68.00 ft. BGS
Station: 7,758.02N 9,318.19E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 58.00 - During Drilling
▼ =
▽ =

Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp (tsf)* Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
6A	21/24 *88%*	SS	*11-26 21-14* N=47	9		*4.50*	to 22	Brown (10YR5/3), moist, hard, SILT with little clay, few very fine- to coarse-grained sand, and trace small gravel. *[Continued from previous page]*		
7A	24/24 *100%*	SS	*5-5 8-13* N=13	16		*4.25*	22–23.8	Brown (10YR5/3) with 5% gray (10YR6/1) and 5% yellowish brown (10YR5/6) mottles, moist, hard, SILT with some clay and trace very fine- to fine-grained sand and small gravel.		
8A	22/24 *92%*	SS	*18-31 43-27* N=74	9		*4.50*	23.8–26.4	Brown (10YR5/3), moist, hard, SILT with little clay, few very fine- to coarse-grained sand, and trace small gravel.		
9A	21/24 *88%*	SS	*4-5 11-11* N=16	14		*2.75*	26.4–30.4	Brown (10YR5/3) with 5% gray (10YR6/1) and 5% yellowish brown (10YR5/6) mottles, moist, hard, SILT with some clay and trace very fine- to fine-grained sand and small gravel.		
10A	22/24 *92%*	SS	*3-6 9-12* N=15	15		*3.75*				
11A	24/24 *100%*	SS	*4-7 13-16* N=20	14		*4.50*	30.4–34.2	Dark gray (10YR4/1), moist, hard, SILT with some clay, few very fine- to coarse-grained sand and trace small gravel.		
12A	24/24 *100%*	SS	*4-7 11-17* N=18	16		*4.50*				
13A	24/24 *100%*	SS	*5-9 12-15* N=21	18		*4.50*	34.2–36.7	Light olive brown (2.5Y5/3) with 5% gray (10YR5/1) mottles, moist, hard, SILT with little clay and trace very fine- to medium-grained sand.		
14A	24/24 *100%*	SS	*4-8 11-14* N=19	16		*4.50*	36.7–40	Olive brown (2.5Y4/3) with 10% gray (N6/1) mottles, moist, hard, silty CLAY with little fine- to coarse-grained sand and trace small gravel.		
15A	24/24 *100%*	SS	*5-13 16-23* N=29	12		*4.50*				

Depth scale: 22, 24, 26, 28, 30, 32, 34, 36, 38, 40 ft. BGS. Elevation scale: 520, 518, 516, 514, 512, 510, 508, 506, 504, 502 ft. MSL.

NOTE(S): APW5 installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/22/2015
Finish: 10/22/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW5
Well ID: APW5
Surface Elev: 541.57 ft. MSL
Completion: 68.00 ft. BGS
Station: 7,758.02N
9,318.19E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 58.00 - During Drilling
▼ =
▽ =

Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp (tsf)* Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL
16A	24/24 *100%*	SS	*6-13 16-30* N=29	12		*4.50*	42	Olive brown (2.5Y4/3) with 10% gray (N6/1) mottles, moist, hard, silty CLAY with little fine- to coarse-grained sand and trace small gravel. *[Continued from previous page]*	500
17A	24/24 *100%*	SS	*5-10 13-22* N=23	15		*4.50*	44		498
18A	24/24 *100%*	SS	*7-13 17-25* N=30	13		*4.50*	46	Olive brown (2.5Y4/3) with 10% gray (N6/1) mottles, moist, hard, SILT with little clay, few very fine- to coarse-grained sand and trace small gravel.	496
19A	24/24 *100%*	SS	*6-13 20-28* N=33	13		*4.50*	48		494
20A	24/24 *100%*	SS	*5-10 16-21* N=26	13		*4.50*	50		492
21A	24/24 *100%*	SS	*6-10 18-21* N=28	13		*4.50*	52		490
22A	24/24 *100%*	SS	*7-14 19-26* N=33	13		*4.50*	54		488
23A	24/24 *100%*	SS	*6-10 17-24* N=27	13		*4.50*	56		486
24A	24/24 *100%*	SS	*12-16 28-36* N=44	11		*4.50*	▼ 58	Olive gray (5Y5/2) with 40% olive brown (2.5Y4/4) mottles, moist, hard, SILT with little clay, few very fine- to coarse-grained sand and trace small gravel.	484
25A	24/24 *100%*	SS	*2-6 12-15* N=18	23				Greenish gray (10G5/1) with 40% olive gray (5Y4/2) mottles, moist, medium dense, SILT with few clay and trace very fine- to fine-grained sand.	
25B				15			60	Very dark gray (10YR3/1), wet, medium dense, very fine- to coarse-grained SAND with few silt.	482

NOTE(S): APW5 installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/22/2015
Finish: 10/22/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW5
Well ID: APW5
Surface Elev: 541.57 ft. MSL
Completion: 68.00 ft. BGS
Station: 7,758.02N
9,318.19E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 58.00 - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Qp (tsf)* Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
26A	19/24 *79%*	SS	*3-19 34-48* N=53	13				Very dark gray (10YR3/1), wet, very dense, very fine- to coarse-grained SAND with few silt.		480	
27A	20/24 *83%*	SS	*22-38 33-34* N=71	16			62			478	
28A	22/24 *92%*	SS	*18-28 31-33* N=59	14			64			476	
29A	24/24 *100%*	SS	*21-27 24-23* N=51	16			66				
29B				14		*4.50*	68	Dark gray (10YR4/1), moist, hard, SILT with little clay and few very fine- to coarse-grained sand.		474	

End of boring = 68.0 feet

NOTE(S): APW5 installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/20/2015
Finish: 10/21/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW6
Well ID: APW6
Surface Elev: 543.38 ft. MSL
Completion: 74.00 ft. BGS
Station: 7,688.54N
7,811.93E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 14.00 - During Drilling
▼ =
▽ =

Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp (tsf)* Failure Type
1A	60/60 *100%*	DP		15		*4.00*
1B				26		*3.00*
2A	60/60 *100%*	DP		18		*2.50*
2B				18		*1.00*
3A	60/60 *100%*	DP		27		*1.50*
3B				21		*1.50*
4A	12/12 *100%*	DP		10		
5A	22/24 *92%*	SS	*15-29 41-50* N=70	8		*4.50*
6A	21/24 *88%*	SS	*14-30 40-50* N=70	8		*4.50*

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
0	Gray (10YR6/1), dry, very stiff, SILT with few clay and trace very fine- to coarse- grained sand, trace roots.	
	Brown (10YR5/3) with 5% dark yellowish brown (10YR4/6) and 5% gray (10YR6/1) mottles, dry, very stiff, SILT with few clay and very fine- to coarse-grained sand, trace small gravel, trace roots.	542
2		
	Gray (10YR5/1) with 35% dark yellowish brown (10YR4/6) mottles, moist, very stiff, CLAY with little silt and trace very fine- to fine-grained sand.	540
4		
6	Gray (10YR5/1) with 40% dark yellowish brown (10YR3/6) mottles, moist, very stiff, SILT with little clay and trace very fine- to medium-grained sand.	538
		536
8	Gray (10YR5/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, stiff, SILT with some clay and few very fine- to medium-grained sand.	534
10		
12	Dark yellowish brown (10YR4/6) with 25% gray (10YR5/1) mottles, moist, stiff, CLAY with some silt and few very fine- to medium-sand.	532
		530
▼ 14	Dark yellowish brown (10YR3/4), wet, soft, fine- to coarse grained sandy CLAY with little silt.	
	Brown (10YR4/3), moist, stiff, SILT with little clay and few very fine- to coarse-grained sand.	528
16		
18	Grayish brown (10YR5/2) with 15% dark gray (10YR4/1) mottles, dry, hard, SILT with little clay, few very fine- to coarse-grained sand and trace small gravel.	526
		524
20		

Borehole Detail | Remarks

NOTE(S): APW6 installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/20/2015
Finish: 10/21/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW6
Well ID: APW6
Surface Elev: 543.38 ft. MSL
Completion: 74.00 ft. BGS
Station: 7,688.54N
7,811.93E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 14.00 - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	TESTING *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Qp (tsf)* Failure Type
7A	15/17 *88%*	SS	*16-46 50/5"*	9		*4.50*
8A	12/24 *50%*	SS	*14-37 45-50* N=82	7		*4.50*
9A	24/24 *100%*	SS	*8-17 23-32* N=40	10		*4.50*
10A	24/24 *100%*	SS	*10-22 26-36* N=48	11		*4.50*
11A	24/24 *100%*	SS	*10-18 23-26* N=41	10		*4.50*
12A	24/24 *100%*	SS	*6-13 17-23* N=30	13		*4.50*
13A	24/24 *100%*	SS	*5-7 12-19* N=19	17		*4.50*
14A	24/24 *100%*	SS	*5-9 13-19* N=22	16		*4.50*
15A	24/24 *100%*	SS	*5-10 15-22* N=25	15		*4.50*
16A	24/24 *100%*	SS	*5-9 15-22* N=24	15		*4.50*

Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
~20–21	Brown (10YR5/3), moist, very dense, silty, very fine- to medium-grained SAND with trace small gravel.			
22, 24	Brown (10YR5/3), dry, hard, SILT with little clay and few very fine- to coarse-grained sand.		522, 520	
26, 28, 30, 32	Dark gray (10YR4/1), moist, hard, SILT with little clay, few very fine- to coarse-grained sand and trace small gravel.		518, 516, 514, 512	
34	Dark gray (10YR4/1) with 30% dark greenish gray (10Y4/1) mottles, moist, hard, SILT with some clay, few very fine- to coarse-grained sand and trace small gravel.		510	
36, 38, 40	Dark gray (10YR4/1), moist, hard, SILT with little clay, few very fine- to coarse-grained sand and trace small to large gravel.		508, 506, 504	

NOTE(S): APW6 installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/20/2015
Finish: 10/21/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW6
Well ID: APW6
Surface Elev: 543.38 ft. MSL
Completion: 74.00 ft. BGS
Station: 7,688.54N 7,811.93E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 14.00 - During Drilling
▼ =
▽ =

Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp (tsf)* Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL
17A	21/24 *88%*	SS	*4-14 18-25* N=32	12		*4.25*	41–46.3	Dark gray (10YR4/1), moist, hard, SILT with little clay, few very fine- to coarse-grained sand and trace small to large gravel. *[Continued from previous page]*	502
18A	24/24 *100%*	SS	*8-12 16-22* N=28	15		*4.50*			500
19A	22/24 *92%*	SS	*7-11 15-18* N=26	16		*4.25*			498
20A	22/24 *92%*	SS	*7-16 26-45* N=42	13		*4.50*	46.3–54.6	Olive gray (5Y4/2) with 20% dark gray (10YR4/1) mottles, moist, hard, SILT with little clay and trace very fine- to coarse- grained sand and small gravel.	496
21A	21/24 *88%*	SS	*11-19 30-37* N=49	13		*4.50*			494
22A	19/24 *79%*	SS	*5-13 26-38* N=39	14					492
23A	24/24 *100%*	SS	*12-18 29-40* N=47	13		*4.50*			490
24A	24/24 *100%*	SS	*7-18 30-37* N=48	13			54.6–56.7	Dark gray brown (2.5Y4/2) with 15% dark gray (10YR4/1) mottles, moist, hard, SILT with little clay and trace very fine- to coarse-grained sand.	488
25A	24/24 *100%*	SS	*11-18 27-38* N=45	14		*4.50*	56.7–58	Olive brown (2.5Y4/3) with 5% gray (N6/1) mottles, moist, hard, SILT with little clay and trace very fine- to medium-grained sand.	486
26A	24/24 *100%*	SS	*10-15 23-33* N=38	17		*4.50*	58–60	Olive brown (2.5Y4/3) with 5% gray (N6/1) mottles, moist, hard, SILT with little clay and trace very fine- to coarse-grained sand and small gravel.	484

NOTE(S): APW6 installed in borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/20/2015
Finish: 10/21/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

HANSON

BOREHOLE ID: APW6
Well ID: APW6
Surface Elev: 543.38 ft. MSL
Completion: 74.00 ft. BGS
Station: 7,688.54N
7,811.93E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 14.00 - During Drilling
▼ =
▽ =

SAMPLE: Number	Recov / Total (in) *% Recovery*	Type	TESTING: *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Qp (tsf)* Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
27A	24/24 *100%*	SS	*5-4 21-32* N=25	13		*4.50*	62	Olive brown (2.5Y4/3) with 5% gray (N6/1) mottles, moist, hard, SILT with little clay and trace very fine- to coarse-grained sand and small gravel. *[Continued from previous page]*		482	
28A	24/24 *100%*	SS	*7-18 23-31* N=41	12		*4.50*	64	Dark gray (10YR4/1) with 5% dark olive brown (2.5Y3/3) mottles, moist, hard, SILT with little clay and trace very fine- to coarse-grained sand and small gravel.		480	
29A	24/24 *100%*	SS	*7-14 18-30* N=32	13		*4.25*	66	Dark gray (10YR4/1), moist, hard, SILT with little clay and trace very fine- to coarse-grained sand and small gravel.		478	
30A	24/24 *100%*	SS	*13-21 33-33* N=54	14			68	Dark gray (10YR4/1), wet, very dense, silty, very fine- to coarse-grained SAND with trace small gravel.		476	
31A	16/23 *70%*	SS	*3-27 49-50/5"* N=76	13			70			474	
32A	20/23 *87%*	SS	*6-29 38-50/5"* N=67	22			72	Gray (10YR5/1), wet, very dense, SILT with few very fine- to fine-grained sand.		472	
								Dark gray (10YR4/1), wet, very dense, silty, very fine- to medium-grained SAND with trace small gravel.			
33A	20/24 *83%*	SS	*26-28 34-37* N=62	12		*4.50*	74	Dark gray (10YR4/1), moist, hard, SILT with little clay and few very fine- to coarse-grained sand.		470	

End of boring = 74.0 feet

NOTE(S): APW6 installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 11/3/2015
Finish: 11/5/2015
WEATHER: Sunny, warm, lo-70s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA

FIELD STAFF: Driller: J. Gates
Helper: C. Clines
Eng/Geo: R. Hasenyager

BOREHOLE ID: APW7a
Well ID: APW7
Surface Elev: 536.21 ft. MSL
Completion: 83.10 ft. BGS
Station: 5,688.85N
6,151.60E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = Dry - During Drilling
▼ =
▽ =

SAMPLE: Number	Recov / Total (in) *% Recovery*	Type	TESTING: *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							0–2.9	Yellowish brown (10YR5/6), moist, medium, CLAY with some silt and trace very fine- to fine-grained sand, roots.		536, 534	
							2.9–4.1	Light gray (10YR7/2), moist, medium, SILT with few very fine-grained sand and trace roots.			
							4.1–7.0	Gray (10YR5/1) with 30% yellowish brown (10YR5/8) mottles, moist, medium, CLAY with some silt, trace very fine-grained sand, and trace roots.		532, 530	
							7.0–13.1	Gray (10YR5/1) with 30% yellowish brown (10YR5/8) mottles, moist, medium, CLAY with some silt and trace very fine- to medium-grained sand, trace small gravel, and trace roots.		528, 526, 524	
							13.1–16.2	Yellowish brown (10YR5/4), moist, hard, SILT with few clay, little very fine- to coarse-grained sand, and trace small to medium gravel.		522	
							16.2–17.0	Yellowish brown (10YR5/6), wet, dense, fine- to coarse-grained SAND with little silt.		520	
							17.0–18.0	Gray (10YR5/1), moist, hard, SILT with few clay, little very fine- to very coarse-grained sand, and trace small to medium gravel.			
							18.0–20	Yellowish brown (10YR5/6) with 20% gray (10YR5/1) mottles, dry, hard, SILT with few clay, little very fine- to very coarse-grained sand, and trace small to medium gravel.		518	

NOTE(S): APW7 installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 11/3/2015
Finish: 11/5/2015
WEATHER: Sunny, warm, lo-70s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA

FIELD STAFF: Driller: J. Gates
Helper: C. Clines
Eng/Geo: R. Hasenyager

BOREHOLE ID: APW7a
Well ID: APW7
Surface Elev: 536.21 ft. MSL
Completion: 83.10 ft. BGS
Station: 5,688.85N
6,151.60E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = Dry - During Drilling
▼ =
▽ =

SAMPLE: Number	Recov / Total (in) *% Recovery*	Type	TESTING: *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
								Yellowish brown (10YR5/6) with 20% gray (10YR5/1) mottles, dry, hard, SILT with few clay, little very fine- to very coarse-grained sand, and trace small to medium gravel. *[Continued from previous page]*		516	
							22	Yellowish brown (10YR5/6) with 20% gray (10YR5/1) mottles, dry, hard, SILT with few clay, little very fine- to very coarse-grained sand, and trace small to medium gravel, horizontal and vertical fractures with dark brown (10YR3/3) oxidized faces.		514	
							24	Gray (10YR5/1), moist, hard, SILT with few clay, little very fine- to very coarse-grained sand, and trace small to medium gravel, horizontal and vertical fractures with dark brown (10YR3/3) oxidized faces.		512, 510, 508, 506	
							32	Gray (10YR5/1), moist, hard, SILT with few clay, little very fine- to very coarse-grained sand, and trace small to medium gravel.		504, 502, 500	
								Gray (10YR5/1), moist, dense, very fine- to fine-grained SAND with trace silt.			
								Gray (10YR5/1), moist, dense, very fine- to very coarse-grained SAND with trace silt and small gravel.		498	
								Gray (10YR5/1), moist, dense, very fine- to fine-grained SAND with trace silt.			
							40				

Depth scale: 22, 24, 26, 28, 30, 32, 34, 36, 38, 40

NOTE(S): APW7 installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 11/3/2015
Finish: 11/5/2015
WEATHER: Sunny, warm, lo-70s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA
FIELD STAFF: Driller: J. Gates
Helper: C. Clines
Eng/Geo: R. Hasenyager

BOREHOLE ID: APW7a
Well ID: APW7
Surface Elev: 536.21 ft. MSL
Completion: 83.10 ft. BGS
Station: 5,688.85N
6,151.60E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = Dry - During Drilling
▼ =
▽ =

SAMPLE: Number	Recov / Total (in) % Recovery	Type	TESTING: Blows / 6 in N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							40–46.7	Gray (10YR5/1), moist, hard, CLAY with some silt, little very fine- to very coarse-grained sand, trace small gravel, and trace wood fragments.			
							46.7–60	Gray (10YR5/1), moist, hard, CLAY with some silt, little very fine- to very coarse-grained sand, and trace small gravel, trace wood fragments.			

Depth scale (ft. BGS): 42, 44, 46, 48, 50, 52, 54, 56, 58, 60

Elevation scale (ft. MSL): 496, 494, 492, 490, 488, 486, 484, 482, 480, 478

NOTE(S): APW7 installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 11/3/2015
Finish: 11/5/2015
WEATHER: Sunny, warm, lo-70s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA
FIELD STAFF: Driller: J. Gates
Helper: C. Clines
Eng/Geo: R. Hasenyager

BOREHOLE ID: APW7a
Well ID: APW7
Surface Elev: 536.21 ft. MSL
Completion: 83.10 ft. BGS
Station: 5,688.85N
6,151.60E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = Dry - During Drilling
▼ =
▽ =

SAMPLE: Number	Recov / Total (in) % Recovery	Type	TESTING: Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							60–71.1	Gray (10YR5/1), moist, hard, CLAY with some silt, little very fine- to very coarse-grained sand, and trace small gravel, trace wood fragments. *[Continued from previous page]*			
							71.1–71.6	Gray (10YR5/1), moist, dense, very fine- to very coarse-grained SAND with some clay and silt.			
							71.6–76	Gray (10YR5/1), moist, hard, CLAY with some silt, little very fine- to very coarse-grained sand, trace small gravel, and trace wood fragments.			
							76–80	Gray (10YR5/1), wet, loose, very fine- to very coarse-grained SAND with trace small gravel.			

Depth scale: 62, 64, 66, 68, 70, 72, 74, 76, 78, 80
Elevation scale: 476, 474, 472, 470, 468, 466, 464, 462, 460, 458

NOTE(S): APW7 installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 11/3/2015
Finish: 11/5/2015
WEATHER: Sunny, warm, lo-70s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA
FIELD STAFF: Driller: J. Gates
Helper: C. Clines
Eng/Geo: R. Hasenyager

BOREHOLE ID: APW7a
Well ID: APW7
Surface Elev: 536.21 ft. MSL
Completion: 83.10 ft. BGS
Station: 5,688.85N
6,151.60E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = Dry - During Drilling
▼ =
▽ =

SAMPLE			TESTING								
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							82	Gray (10YR5/1), wet, loose, very fine- to very coarse-grained SAND with trace small gravel. *[Continued from previous page]*		456, 454	
								Bluish black (10B2.5/1), wet dense, very fine- to very coarse-grained SAND with little silt and trace small gravel.			

End of boring = 83.1 feet

NOTE(S): APW7 installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/27/2015
Finish: 10/28/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW8
Well ID: APW8
Surface Elev: 526.75 ft. MSL
Completion: 82.00 ft. BGS
Station: 3,839.59N
6,082.37E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 33.70 - During Drilling
▼ =
▽ =

Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp (tsf)* Failure Type	Remarks
1A	60/60 *100%*	DP		13		*4.50*	
1B				21		*3.00*	
2A	60/60 *100%*	DP		18		*2.50*	
2B				28		*2.00*	
3A	20/24 *83%*	DP		8		*2.00*	
4A	0/17 *0%*	SS	*23-43 50/5"*				Rock in shoe of sampler.
5A	21/24 *88%*	SS	*13-20 24-28* N=44	10		*4.50*	
6A	24/24 *100%*	SS	*7-14 20-48* N=34	11		*4.50*	
7A	24/24 *100%*	SS	*14-21 26-32* N=47	10			

Depth ft. BGS	Lithologic Description
	Black (10YR2/1), moist, very stiff, SILT with little clay and trace very fine- to medium-grained sand, roots.
	Yellowish brown (10YR5/4) with 30% light gray (10YR7/2) mottles, dry, hard, SILT with little clay and trace very fine- to medium-grained sand.
	Grayish brown (10YR5/2) with 15% dark yellowish brown (10YR4/6) and 10% black (10YR2/1) mottles, moist, very stiff, silty CLAY with few very fine- to coarse-grained sand and trace small gravel.
	Grayish brown (10YR5/2) with 15% dark yellowish brown mottles, moist, stiff, silty CLAY with few very fine- to coarse-grained sand and trace small gravel.
	Brown (10YR5/3) with 20% dark yellowish brown (10YR5/6) mottles, dry, stiff, SILT with little clay and trace very fine- to coarse-grained sand.
	Dark gray (10YR4/1), moist, hard, SILT with little clay, trace very fine- to coarse-grained sand and small gravel.

Depth scale (ft. BGS): 2, 4, 6, 8, 10, 12, 14, 16, 18, 20
Elevation scale (ft. MSL): 526, 524, 522, 520, 518, 516, 514, 512, 510, 508

NOTE(S): APW8 installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/27/2015
Finish: 10/28/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW8
Well ID: APW8
Surface Elev: 526.75 ft. MSL
Completion: 82.00 ft. BGS
Station: 3,839.59N 6,082.37E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 33.70 - During Drilling
▼ =
▽ =

Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp (tsf)* Failure Type
8A	24/24 *100%*	SS	*7-13 19-23* N=32	11		*4.50*
9A	24/24 *100%*	SS	*7-14 19-27* N=33	11		*4.50*
10A	24/24 *100%*	SS	*8-15 30-37* N=45	11		*4.50*
11A	24/24 *100%*	SS	*8-16 24-33* N=40	11		*4.50*
12A	24/24 *100%*	SS	*9-31 33-30* N=64	11		
12B				12		*4.50*
13A	24/24 *100%*	SS	*10-23 40-35* N=63	11		*4.50*
14A	21/24 *88%*	SS	*16-16 29-50* N=45	10		*4.50*
15A	20/24 *83%*	SS	*9-24 34-41* N=58	13		
	22/24 *92%*	SS	*16-18 29-35* N=47			
16A				11		*4.50*
17A	21/24 *88%*	SS	*10-17 21-31* N=38	11		*4.50*

Depth ft. BGS: 22, 24, 26, 28, 30, 32, 34, 36, 38, 40

Elevation ft. MSL: 506, 504, 502, 500, 498, 496, 494, 492, 490, 488

Lithologic Description

Dark gray (10YR4/1), moist, hard, SILT with little clay, trace very fine- to coarse-grained sand and small gravel.
[Continued from previous page]

Gray (10YR5/1), moist, dense, silty, very fine- to medium-grained SAND.

Dark gray (10YR4/1), moist, hard SILT with little clay, few very fine- to coarse-grained sand, and trace small gravel.

Dark gray (10YR4/1), wet, very dense, silty, very fine- to coarse-grained SAND with trace small gravel.

Dark gray (10YR4/1), moist, hard, SILT with little clay, few very fine- to coarse-grained sand, and trace small gravel.

Borehole Detail | Remarks

NOTE(S): APW8 installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/27/2015
Finish: 10/28/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW8
Well ID: APW8
Surface Elev: 526.75 ft. MSL
Completion: 82.00 ft. BGS
Station: 3,839.59N
6,082.37E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 33.70 - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp (tsf)* Failure Type
18A	24/24 *100%*	ss	*9-16 26-32* N=42	11		*4.50*
19A	24/24 *100%*	ss	*10-16 23-34* N=39	12		*4.50*
20A	24/24 *100%*	ss	*10-15 26-44* N=41	13		*4.50*
21A	24/24 *100%*	ss	*12-21 32-48* N=53	12		*4.50*
22A	24/24 *100%*	ss	*11-17 22-31* N=39	13		*4.50*
23A	24/24 *100%*	ss	*10-13 21-32* N=34	13		*4.50*
24A	24/24 *100%*	ss	*8-13 50-26* N=63	13		*4.50*
25A	24/24 *100%*	ss	*8-11 19-28* N=30	14		*4.25*
26A	24/24 *100%*	ss	*10-12 18-26* N=30	13		*4.50*
27A	22/24 *92%*	ss	*7-10 15-22* N=25	21		*4.50*

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
40–59.4	Dark gray (10YR4/1), moist, hard, SILT with little clay, few very fine- to coarse-grained sand, and trace small gravel. *[Continued from previous page]*	
59.4–60	Olive gray (5Y4/2), moist, hard, silty CLAY with few very fine- to coarse-grained sand and trace small gravel.	

Depth scale: 42, 44, 46, 48, 50, 52, 54, 56, 58, 60
Elevation scale: 486, 484, 482, 480, 478, 476, 474, 472, 470, 468

Remarks

NOTE(S): APW8 installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/27/2015
Finish: 10/28/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW8
Well ID: APW8
Surface Elev: 526.75 ft. MSL
Completion: 82.00 ft. BGS
Station: 3,839.59N 6,082.37E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 33.70 - During Drilling
▼ =
▽ =

Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp (tsf)* Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
28A	20/24 *83%*	SS	*7-15 19-20* N=34	14		*4.50*		Dark gray (10YR4/1), moist, hard, SILT with little clay, few very fine- to coarse-grained sand and trace small gravel.	466	
							62			
29A	21/24 *88%*	SS	*7-8 11-16* N=19	11		*3.75*		Dark gray (10YR4/1), moist, very stiff, SILT with little clay, few very fine- to coarse-grained sand and trace small gravel.	464	
							64			
30A	21/24 *88%*	SS	*6-13 14-11* N=27	14		*4.00*			462	
30B				10				Gray (10YR6/1), wet, medium dense, silty, very fine- to coarse-grained SAND with trace small to large gravel.		
							66	Dark gray (10YR4/1), moist, very stiff, SILT with little clay and few very fine- to coarse-grained sand.		
31A	18/24 *75%*	SS	*4-3 4-3* N=7	28				Dark gray (10YR4/1), wet, loose, silty, very fine- to coarse-grained SAND with trace small gravel and trace wood fragments.	460	
31B				15		*3.25*		Dark gray (10YR4/1), moist, very stiff, SILT with little clay, few very fine- to coarse-grained sand, and trace small gravel, trace wood fragments.		
							68			
32A	20/24 *83%*	SS	*1-3 3-2* N=6	17				Dark gray (10YR4/1), wet, loose, SILT with little very fine- to fine-grained sand.	458	
32B				28				Dark gray (10YR4/1), wet, loose, silty, very fine- to coarse-grained SAND.		
							70	Dark gray (10YR4/1), wet, loose, SILT with little very fine- to fine-grained sand, trace wood fragments.		
33A	15/24 *63%*	SS	*woh-2 6-6* N=8	17				Dark gray (10YR4/1), wet, loose, silty, very fine- to coarse-grained SAND, trace wood fragments.	456	
							72			
34A	16/24 *67%*	SS	*9-11 15-20* N=26	9				Dark gray (10YR4/1), wet, medium dense, silty, very fine- to coarse-grained SAND with trace small gravel.	454	
								Dark gray (10YR4/1), wet, medium dense, silty, very fine- to coarse-grained SAND with few small to large gravel.		
							74			
35A	15/24 *63%*	SS	*16-21 23-24* N=44	9				Dark gray (10YR4/1), wet, dense, silty, very fine- to coarse-grained SAND with few small to large gravel.	452	
							76			
36A	14/24 *58%*	SS	*11-20 25-24* N=45	11					450	
							78	Dark gray (10YR4/1), wet, dense, silty, very fine- to coarse-grained SAND with trace small gravel.		
37A	15/24 *63%*	SS	*20-25 24-25* N=49	10					448	
							80			

NOTE(S): APW8 installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/27/2015
Finish: 10/28/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW8
Well ID: APW8
Surface Elev: 526.75 ft. MSL
Completion: 82.00 ft. BGS
Station: 3,839.59N 6,082.37E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 33.70 - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Qp (tsf)* Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
38A	18/24 *75%*	SS	*26-26 26-31* N=52	8				Dark gray (10YR4/1), wet, dense, silty, very fine- to coarse-grained SAND with trace small gravel. *[Continued from previous page]*		446	
38B				11		*4.50*	82	Dark gray (10YR4/1), moist, hard, SILT with little clay and few very fine- to coarse-grained sand.			

End of boring = 82.0 feet

NOTE(S): APW8 installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 11/2/2015
Finish: 11/3/2015
WEATHER: Foggy, mild, lo-50s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, split spoon sampler
FIELD STAFF: Driller: J. Gates
Helper: C. Clines
Eng/Geo: R. Hasenyager

BOREHOLE ID: APW9
Well ID: APW9
Surface Elev: 528.82 ft. MSL
Completion: 62.00 ft. BGS
Station: 3,519.59N
9,125.33E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 27.00 - During Drilling
▼ = 26.10 - 11/3/15
▽ =

SAMPLE: Number	Recov / Total (in) *% Recovery*	Type	TESTING: *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
1	0/60 *0%*	BD					0–5	Blind drill - see APW3 boring log for lithology, sample, and testing data		528–524	
2	0/60 *0%*	BD					5–10			524–519	
3	0/60 *0%*	BD					10–15			519–514	
4	0/60 *0%*	BD					15–20			514–509	

NOTE(S): APW9 installed in borehole.
Lithology, sample, and testing data can be found on APW-3 Field Boring Log.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 11/2/2015
Finish: 11/3/2015
WEATHER: Foggy, mild, lo-50s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, split spoon sampler

FIELD STAFF: Driller: J. Gates
Helper: C. Clines
Eng/Geo: R. Hasenyager

HANSON

BOREHOLE ID: APW9
Well ID: APW9
Surface Elev: 528.82 ft. MSL
Completion: 62.00 ft. BGS
Station: 3,519.59N
9,125.33E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 27.00 - During Drilling
▼ = 26.10 - 11/3/15
▽ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp (tsf)* Failure Type	Remarks
5A	24/24 *100%*	SS	*10-13 21-28* N=34	10		*4.25*	
6A	24/24 *100%*	SS	*13-15 21-29* N=36	10		*4.50*	
7A	2/24 *8%*	SS	*15-28 33-39* N=61	11		*4.50*	Rock in shoe of sampler.
8A	23/23 *100%*	SS	*9-15 39-50/5"* N=54	11			
8B				11			
9A	24/24 *100%*	SS	*12-22 28-27* N=50	11			
9B				12		*4.50*	
10A	24/24 *100%*	SS	*14-22 32-44* N=54	11		*4.50*	
11A	23/24 *96%*	SS	*8-16 24-35* N=40	11		*4.50*	
12A	16/24 *67%*	SS	*12-25 35-32* N=60	12		*4.50*	
13A	24/24 *100%*	SS	*6-12 24-25* N=36	11		*4.50*	
14A	24/24 *100%*	SS	*4-7 16-32* N=23	14		*4.50*	

Depth ft. BGS: 22, 24, 26, 28, 30, 32, 34, 36, 38, 40
Elevation ft. MSL: 508, 506, 504, 502, 500, 498, 496, 494, 492, 490

Lithologic Description

Gray (10YR5/1), moist, hard, SILT with some very fine-grained sand, little clay, and trace small to medium gravel. Vertical and horizontal fractures with yellowish brown (10YR5/8) faces.

Gray (10YR5/1), moist, hard, SILT with some very fine-grained sand, little clay, and trace small to medium gravel.

Gray (10YR5/1), wet, dense, very fine- to very coarse-grained SAND with some silt, few clay and trace small to medium gravel.

Gray (10YR5/1), moist, hard, SILT with little clay and very fine-grained sand and trace small gravel.

Gray (10YR5/1) moist, stiff, CLAY with some silt, little very fine-grained sand and trace small gravel.

NOTE(S): APW9 installed in borehole.
Lithology, sample, and testing data can be found on APW-3 Field Boring Log.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 11/2/2015
Finish: 11/3/2015
WEATHER: Foggy, mild, lo-50s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, split spoon sampler
FIELD STAFF: Driller: J. Gates
Helper: C. Clines
Eng/Geo: R. Hasenyager

BOREHOLE ID: APW9
Well ID: APW9
Surface Elev: 528.82 ft. MSL
Completion: 62.00 ft. BGS
Station: 3,519.59N
9,125.33E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 27.00 - During Drilling
▼ = 26.10 - 11/3/15
▽ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type
15A	24/24 *100%*	SS	*5-11 19-23* N=30	14		*4.50*
16A	24/24 *100%*	SS	*4-8 14-29* N=22	15		*4.50*
16B				12		
17A	24/24 *100%*	SS	*8-17 24-34* N=41	11		*4.50*
18A	24/24 *100%*	SS	*7-13 20-29* N=33	12		*4.50*
19A	24/24 *100%*	SS	*6-12 18-24* N=30	12		*4.50*
20A	24/24 *100%*	SS	*7-12 17-22* N=29	15		*4.50*
21A	24/24 *100%*	SS	*5-11 12-18* N=23	14		*4.25*
22A	23/23 *100%*	SS	*6-14 24-50/5"* N=38	13		*4.50*
22B				13		
23A	24/24 *100%*	SS	*7-15 21-30* N=36	13		
24A	18/24 *75%*	SS	*13-38 43-40* N=81	15		

Depth ft. BGS: 42, 44, 46, 48, 50, 52, 54, 56, 58, 60

Elevation ft. MSL: 488, 486, 484, 482, 480, 478, 476, 474, 472, 470

Lithologic Description

Gray (10YR5/1) moist, stiff, CLAY with some silt, little very fine-grained sand and trace small gravel, trace wood fragments.

Light olive brown (2.5Y5/3), moist, stiff, CLAY with some silt, few very fine- to very coarse-grained sand, and trace small gravel.

Light olive brown (2.5Y5/3) with 30% yellowish brown (10YR5/8) mottles, moist, stiff, CLAY with some silt, few very fine- to very coarse-grained sand, and trace small gravel.

Grayish brown (2.5Y5/2) with 10% gray (2.5Y5/3) mottles, moist, hard, SILT with little very fine- to very coarse-grained sand, few clay and trace small to large gravel.

Yellowish brown (10YR5/6) with 25% gray (10YR6/1) mottles, moist, stiff, CLAY with some silt, little very fine-medium-grained sand, and trace small gravel.

Dark gray (10YR4/1), moist, dense, very fine- to fine-grained SAND with few silt.

Gray (10YR5/1), wet, loose, very fine- to very coarse-grained SAND with trace small gravel.

Gray (10YR5/1), wet, loose, very fine- to coarse-grained SAND.

NOTE(S): APW9 installed in borehole.
Lithology, sample, and testing data can be found on APW-3 Field Boring Log.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 11/2/2015
Finish: 11/3/2015
WEATHER: Foggy, mild, lo-50s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, split spoon sampler
FIELD STAFF: Driller: J. Gates
Helper: C. Clines
Eng/Geo: R. Hasenyager

BOREHOLE ID: APW9
Well ID: APW9
Surface Elev: 528.82 ft. MSL
Completion: 62.00 ft. BGS
Station: 3,519.59N
9,125.33E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 27.00 - During Drilling
▼ = 26.10 - 11/3/15
▽ =

SAMPLE: Number	Recov / Total (in) *% Recovery*	Type	TESTING: *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
25A	24/24 *100%*	SS	*4-18* *25-30* N=43	21				Gray (10YR5/1), wet, loose, very fine- to coarse-grained SAND. *[Continued from previous page]*		468	
								Gray (10YR5/1), moist, stiff, CLAY with some silt and trace very fine-grained sand.			
25B				16			62	Gray (10YR5/1), wet, dense, SILT and very fine-grained SAND.			

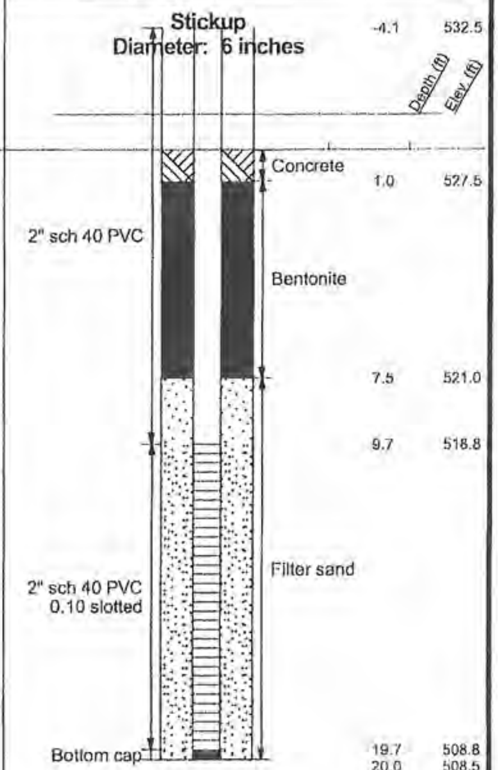
End of boring = 62.0 feet

NOTE(S): APW9 installed in borehole.
Lithology, sample, and testing data can be found on APW-3 Field Boring Log.

Surface Elevation: 528.47 | Datum: msl | Completion Date: 6/18/10 | Northing: 821379.76 | Easting: 998975.74

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0	Soft, brown, silty CLAY - CL			
6	Soft, brown, sandy CLAY with gravel - CL			
9	Hard, brown, sandy CLAY with gravel - CL			
13	Hard, brownish-gray, sandy CLAY with gravel - CL			
20	Boring terminated at 20 feet.			

WELL DIAGRAM



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

4 1/4" AUGER __ HOLLOW STEM

WASHBORING FROM __ FEET

MVU DRILLER KCR LOGGER

CME 750X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: RSP	App'vd. by: DTK
Date: 6/29/10	Date: 2/7/11	Date: 2-7-11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ameren Power Plant
Newton, Illinois

LOG OF BORING: APW-3

Project No. J017150.01

LOG OF BORING 2002 WL J017150.01ENV - AMEREN-NEWTON.GPJ GTINC 0638301.GPJ 2/22/11

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/27/2015
Finish: 10/27/2015
WEATHER: Cool, rainy, lo-50s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA

FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW10a
Well ID: APW10
Surface Elev: 521.98 ft. MSL
Completion: 45.94 ft. BGS
Station: 5,371.32N
11,541.23E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 25, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 36.00 - During Drilling
▼ =
▽ =

SAMPLE			TESTING								
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							2			520	
							4			518	
							6			516	
							8			514	
							10	Blind drill - see APW4 boring log for lithology, sample, and testing data		512	
							12			510	
							14			508	
							16			506	
							18			504	
							20			502	

NOTE(S): APW10 installed in borehole.
Lithology, sample, and testing data can be found on APW-4 Field Boring Log.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/27/2015
Finish: 10/27/2015
WEATHER: Cool, rainy, lo-50s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA

FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW10a
Well ID: APW10
Surface Elev: 521.98 ft. MSL
Completion: 45.94 ft. BGS
Station: 5,371.32N
11,541.23E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 25, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 36.00 - During Drilling
▼ =
▽ =

SAMPLE: Number	Recov / Total (in) % Recovery	Type	TESTING: Blows / 6 in N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							22	Yellowish brown (10YR5/6) with 5% gray (N6/1) mottles, moist, hard, SILT with little clay, few very fine-grained sand, and trace small gravel.		500	
							24, 26, 28, 30	Yellowish brown (10YR5/4) with 5% dark yellowish brown (10YR4/6) and 5% gray (N6/1) mottles, moist, hard, SILT with little clay, few very fine-grained sand, and trace small gravel.		498, 496, 494, 492	
							32, 34, ▼ 36, 38	Brown (10YR5/3) with 5% gray (N6/1) mottles, moist, hard, SILT with little clay, few very fine-grained sand, and trace small gravel.		490, 488, 486, 484	
							40	Brown (10YR5/3), wet, very dense, silty, very fine- to medium-grained SAND with trace small gravel.		482	

NOTE(S): APW10 installed in borehole.
Lithology, sample, and testing data can be found on APW-4 Field Boring Log.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/27/2015
Finish: 10/27/2015
WEATHER: Cool, rainy, lo-50s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW10a
Well ID: APW10
Surface Elev: 521.98 ft. MSL
Completion: 45.94 ft. BGS
Station: 5,371.32N
11,541.23E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 25, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 36.00 - During Drilling
▼ =
▽ =

SAMPLE			TESTING								
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							42			480	
								Brown (10YR5/3), wet, very dense, silty, very fine- to medium-grained SAND with trace small gravel. *[Continued from previous page]*			
							44			478	

End of boring = 45.94 feet

NOTE(S): APW10 installed in borehole.
Lithology, sample, and testing data can be found on APW-4 Field Boring Log.

Surface Elevation: 521.56

Datum: msl

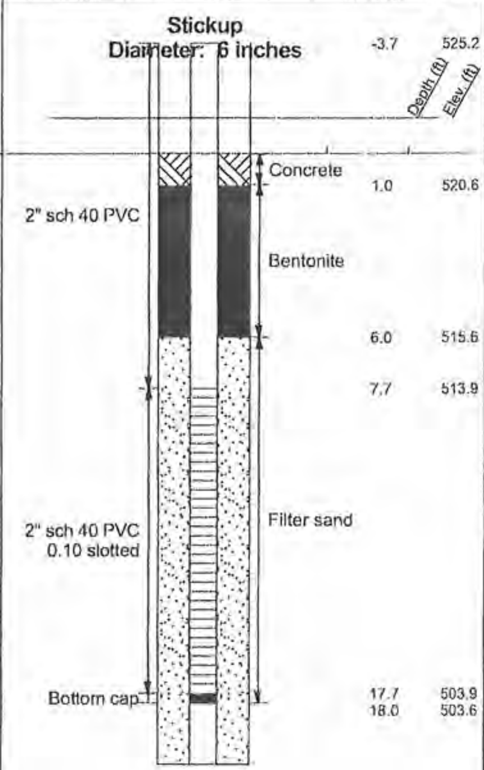
Completion Date: 6/19/10

Northing: 823246.45

Easting: 1001379.56

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0	Soft, brown, silty CLAY - CL			
7	Soft, brown, sandy CLAY - CL ▽			
12	Stiff, brown, sandy CLAY with gravel - CL			
18	Boring terminated at 18 feet.			

WELL DIAGRAM



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150.01ENV - AMEREN-NEWTON.GPJ GTINC 0638301.GPJ 2/22/11

GROUNDWATER DATA

ENCOUNTERED AT 8 FEET ▽

DRILLING DATA

4 1/4" AUGER __ HOLLOW STEM

WASHBORING FROM __ FEET

MVU DRILLER KCR LOGGER

CME 750X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: RJP	App'vd. by: DRK
Date: 6/29/10	Date: 2-7-11	Date: 2-7-11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ameren Power Plant
Newton, Illinois

LOG OF BORING: APW-4

Project No. J017150.01

Illinois Environmental Protection Agency — Well Completion Report

Site #: ______ County: Jasper County Well #: APW5

Site Name: Newton Energy Center Borehole #: APW5

~~State~~ Plant ~~Plane~~ Coordinate: X 9,318.2 Y 7,758.0 (or) Latitude: 38° 56' 2.270" Longitude: -88° 16' 51.560"

Surveyed By: Michael J. Graminski IL Registration #: 035-002901

Drilling Contractor: Bulldog Drilling, Inc. Driller: C. Dutton

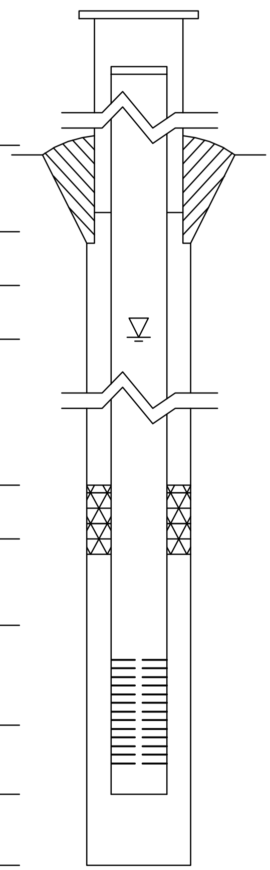
Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: Hollow Stem Auger Drilling Fluid (Type): Water

Logged By: Suzanna L. Keim Date Started: 10/22/2015 Date Finished: 10/22/2015

Report Form Completed By: Suzanna L. Keim Date: 11/6/2015

ANNULAR SPACE DETAILS



Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: >48 hours

Type of Bentonite Seal -- Granular **Pellet** (circled) Slurry (choose one)

Installation Method: Gravity

Setting Time: 45 minutes

Type of Sand Pack: Quartz Sand

Grain Size: 10-20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: n/a (if applicable)

Installation Method: ______

Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
545.00	-3.43	Top of Protective Casing
544.56	-2.99	Top of Riser Pipe
541.57	0.00	Ground Surface
539.57	2.00	Top of Annular Sealant
527.06	14.51	Static Water Level (After Completion) 12/15/2015
484.39	57.18	Top of Seal
480.62	60.95	Top of Sand Pack
478.93	62.64	Top of Screen
474.13	67.44	Bottom of Screen
473.73	67.84	Bottom of Well
473.57	68.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	65.63
Bottom of Screen to End Cap	(feet)	0.40
Screen Length (1st slot to last slot)	(feet)	4.80
Total Length of Casing	(feet)	70.83
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: **Steel** (circled)
Riser Pipe Above W.T.	SS304	SS316	PTFE	**PVC** (circled)	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	**PVC** (circled)	OTHER:
Screen	SS304	SS316	PTFE	**PVC** (circled)	OTHER:

Illinois Environmental Protection Agency — Well Completion Report

Site #: ______ County: Jasper County Well #: APW6

Site Name: Newton Energy Center Borehole #: APW6

~~State~~ Plant ~~Plane~~ Coordinate: X 7,811.9 Y 7,688.5 (or) Latitude: 38° 56' 1.510" Longitude: -88° 17' 10.610"

Surveyed By: Michael J. Graminski IL Registration #: 035-002901

Drilling Contractor: Bulldog Drilling, Inc. Driller: C. Dutton

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: Hollow Stem Auger Drilling Fluid (Type): Water

Logged By: Suzanna L. Keim Date Started: 10/20/2015 Date Finished: 10/21/2015

Report Form Completed By: Suzanna L. Keim Date: 11/6/2015

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: >48 hours

Type of Bentonite Seal -- Granular **Pellet** Slurry (choose one)

Installation Method: Gravity

Setting Time: 30 minutes

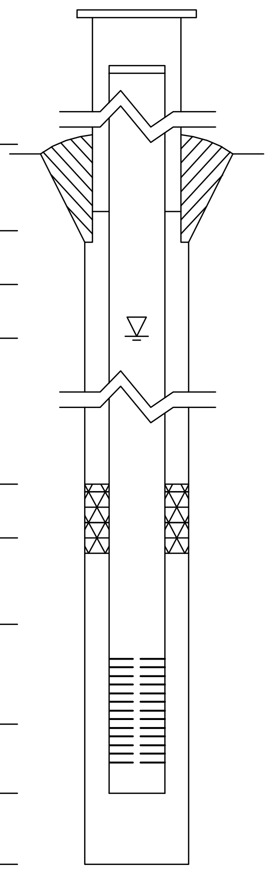
Type of Sand Pack: Quartz Sand

Grain Size: 10-20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: Quartz Sand (if applicable)

Installation Method: gravity



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
546.88	-3.50	Top of Protective Casing
546.56	-3.18	Top of Riser Pipe
543.38	0.00	Ground Surface
541.38	2.00	Top of Annular Sealant
523.45	19.93	Static Water Level (After Completion) 12/15/2015
478.48	64.90	Top of Seal
477.28	66.10	Top of Sand Pack
475.71	67.67	Top of Screen
470.90	72.48	Bottom of Screen
470.50	72.88	Bottom of Well
469.38	74.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	70.85
Bottom of Screen to End Cap	(feet)	0.40
Screen Length (1st slot to last slot)	(feet)	4.81
Total Length of Casing	(feet)	76.06
Screen Slot Size **	(inches)	0.010

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: **Steel**
Riser Pipe Above W.T.	SS304	SS316	PTFE	**PVC**	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	**PVC**	OTHER:
Screen	SS304	SS316	PTFE	**PVC**	OTHER:

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: ______ County: Jasper County Well #: APW7

Site Name: Newton Energy Center Borehole #: APW7a

~~State~~ Plant ~~Plane~~ Coordinate: X 6,151.6 Y 5,688.8 (or) Latitude: 38° 55' 41.660" Longitude: -88° 17' 31.490"

Surveyed By: Michael J. Graminski IL Registration #: 035-002901

Drilling Contractor: Bulldog Drilling, Inc. Driller: J. Gates

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: Hollow Stem Auger Drilling Fluid (Type): Water

Logged By: Rhonald W. Hasenyager Date Started: 11/3/2015 Date Finished: 11/5/2015

Report Form Completed By: Suzanna L. Keim Date: 11/9/2015

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: >48 hours

Type of Bentonite Seal -- Granular (Pellet) Slurry (choose one)

Installation Method: Gravity

Setting Time: 120 minutes

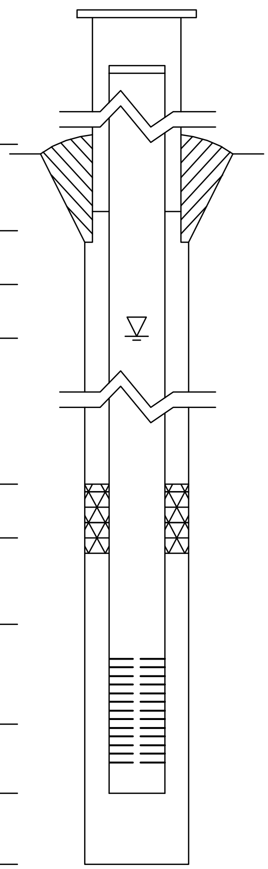
Type of Sand Pack: Quartz Sand

Grain Size: 10-20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: Quartz Sand (if applicable)

Installation Method: gravity



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
539.24	-3.03	Top of Protective Casing
538.86	-2.65	Top of Riser Pipe
536.21	0.00	Ground Surface
534.21	2.00	Top of Annular Sealant
490.68	45.53	Static Water Level (After Completion) 12/15/2015
462.06	74.15	Top of Seal
460.21	76.00	Top of Sand Pack
458.32	77.89	Top of Screen
453.51	82.70	Bottom of Screen
453.11	83.10	Bottom of Well
453.11	83.10	Bottom of Borehole

* Referenced to a National Geodetic Datum

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	80.54
Bottom of Screen to End Cap	(feet)	0.40
Screen Length (1st slot to last slot)	(feet)	4.81
Total Length of Casing	(feet)	85.75
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: (Steel)
Riser Pipe Above W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Screen	SS304	SS316	PTFE	(PVC)	OTHER:

Illinois Environmental Protection Agency — Well Completion Report

Site #: ______ County: Jasper County Well #: APW8

Site Name: Newton Energy Center Borehole #: APW8

~~State~~ Plant ~~Plane~~ Coordinate: X 6,082.4 Y 3,839.6 (or) Latitude: 38° 55' 23.380" Longitude: -88° 17' 32.250"

Surveyed By: Michael J. Graminski IL Registration #: 035-002901

Drilling Contractor: Bulldog Drilling, Inc. Driller: C. Dutton

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: Hollow Stem Auger Drilling Fluid (Type): Water

Logged By: Suzanna L. Keim Date Started: 10/27/2015 Date Finished: 10/28/2015

Report Form Completed By: Suzanna L. Keim Date: 11/6/2015

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: >48 hours

Type of Bentonite Seal -- Granular **[Pellet]** Slurry (choose one)

Installation Method: Gravity

Setting Time: 55 minutes

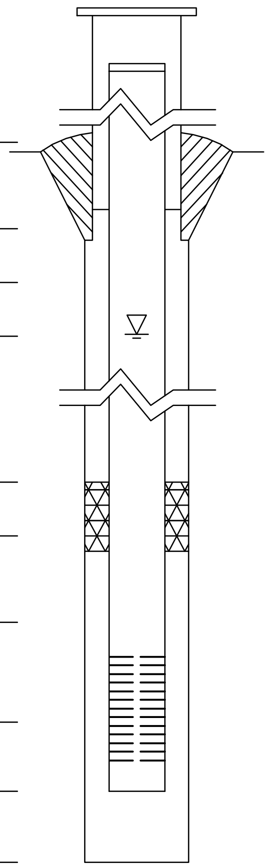
Type of Sand Pack: Quartz Sand

Grain Size: 10-20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: n/a (if applicable)

Installation Method: ______



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
529.86	-3.11	Top of Protective Casing
529.46	-2.71	Top of Riser Pipe
526.75	0.00	Ground Surface
524.75	2.00	Top of Annular Sealant
490.50	36.25	Static Water Level (After Completion) 12/15/2015
462.45	64.30	Top of Seal
458.70	68.05	Top of Sand Pack
455.35	71.40	Top of Screen
445.69	81.06	Bottom of Screen
445.22	81.53	Bottom of Well
444.75	82.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	74.11
Bottom of Screen to End Cap	(feet)	0.47
Screen Length (1st slot to last slot)	(feet)	9.66
Total Length of Casing	(feet)	84.24
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: **[Steel]**
Riser Pipe Above W.T.	SS304	SS316	PTFE	**[PVC]**	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	**[PVC]**	OTHER:
Screen	SS304	SS316	PTFE	**[PVC]**	OTHER:

Illinois Environmental Protection Agency — Well Completion Report

Site #: ______ County: Jasper County Well #: APW9

Site Name: Newton Energy Center Borehole #: APW9

~~State~~ Plant ~~Plane~~ Coordinate: X 9,125.3 Y 3,519.6 (or) Latitude: 38° 55' 20.370" Longitude: -88° 16' 53.730"

Surveyed By: Michael J. Graminski IL Registration #: 035-002901

Drilling Contractor: Bulldog Drilling, Inc. Driller: J. Gates

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: Hollow Stem Auger Drilling Fluid (Type): Water

Logged By: Rhonald W. Hasenyager Date Started: 11/2/2015 Date Finished: 11/3/2015

Report Form Completed By: Suzanna L. Keim Date: 11/9/2015

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: >48 hours

Type of Bentonite Seal -- Granular [Pellet] Slurry (choose one)

Installation Method: Gravity

Setting Time: 65 minutes

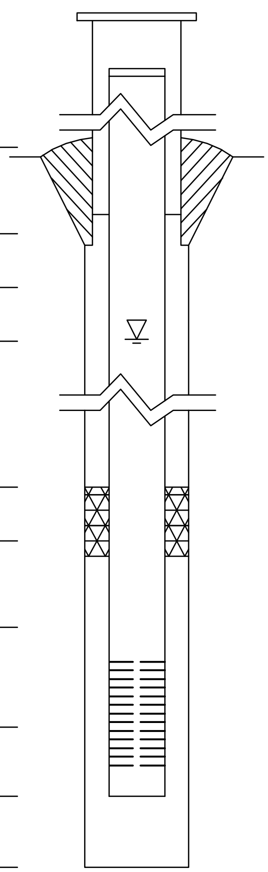
Type of Sand Pack: Quartz Sand

Grain Size: 10-20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: n/a (if applicable)

Installation Method: ______



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
532.43	-3.61	Top of Protective Casing
532.01	-3.19	Top of Riser Pipe
528.82	0.00	Ground Surface
526.82	2.00	Top of Annular Sealant
502.18	26.64	Static Water Level (After Completion) 12/15/2015
475.91	52.91	Top of Seal
474.20	54.62	Top of Sand Pack
472.16	56.66	Top of Screen
467.36	61.46	Bottom of Screen
466.97	61.85	Bottom of Well
466.82	62.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	59.85
Bottom of Screen to End Cap	(feet)	0.39
Screen Length (1st slot to last slot)	(feet)	4.80
Total Length of Casing	(feet)	65.04
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

WELL CONSTRUCTION MATERIALS
(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: [Steel]
Riser Pipe Above W.T.	SS304	SS316	PTFE	[PVC]	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	[PVC]	OTHER:
Screen	SS304	SS316	PTFE	[PVC]	OTHER:

Illinois Environmental Protection Agency — Well Completion Report

Site #: ______ County: Jasper County Well #: APW10

Site Name: Newton Energy Center Borehole #: APW10a

~~State~~ Plant ~~Plane~~ Coordinate: X 11,541.2 Y 5,371.3 (or) Latitude: 38° 55' 38.790" Longitude: -88° 16' 23.280"

Surveyed By: Michael J. Graminski IL Registration #: 035-002901

Drilling Contractor: Bulldog Drilling, Inc. Driller: C. Dutton

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: Hollow Stem Auger Drilling Fluid (Type): Water

Logged By: Suzanna L. Keim Date Started: 10/27/2015 Date Finished: 10/27/2015

Report Form Completed By: Suzanna L. Keim Date: 11/6/2015

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: >48 hours

Type of Bentonite Seal -- Granular [Pellet] Slurry (choose one)

Installation Method: Gravity

Setting Time: 50 minutes

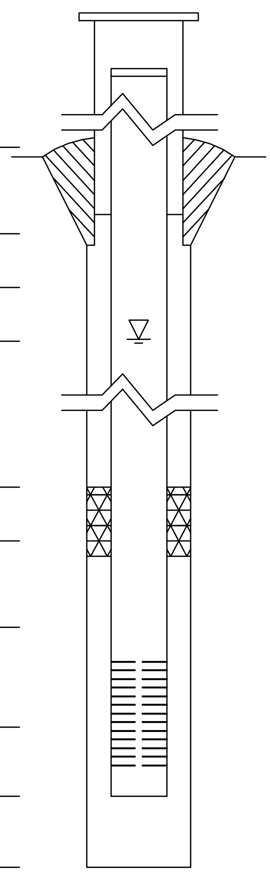
Type of Sand Pack: Quartz Sand

Grain Size: 10-20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: n/a (if applicable)

Installation Method: ______



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
525.12	-3.14	Top of Protective Casing
524.74	-2.76	Top of Riser Pipe
521.98	0.00	Ground Surface
519.98	2.00	Top of Annular Sealant
504.12	17.86	Static Water Level (After Completion) 12/15/2015
484.66	37.32	Top of Seal
483.22	38.76	Top of Sand Pack
481.24	40.74	Top of Screen
476.44	45.54	Bottom of Screen
476.04	45.94	Bottom of Well
476.04	45.94	Bottom of Borehole

* Referenced to a National Geodetic Datum

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	43.50
Bottom of Screen to End Cap	(feet)	0.40
Screen Length (1st slot to last slot)	(feet)	4.80
Total Length of Casing	(feet)	48.70
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

WELL CONSTRUCTION MATERIALS
(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: [Steel]
Riser Pipe Above W.T.	SS304	SS316	PTFE	[PVC]	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	[PVC]	OTHER:
Screen	SS304	SS316	PTFE	[PVC]	OTHER:

Monitoring Well Boring Logs – Landfill 2

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 11/9/2015
Finish: 11/10/2015
WEATHER: Sunny, mild, lo-60s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 4¼" HSA, split spoon sampler
FIELD STAFF: Driller: J. Gates
Helper: C. Clines
Eng/Geo: R. Hasenyager

BOREHOLE ID: G06D
Well ID: G06D
Surface Elev: 529.69 ft. MSL
Completion: 96.00 ft. BGS
Station: 5,328.80N
4,925.99E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = Dry - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
1	0/60 *0%*	BD					0–5	Blind drill - see G106 boring log for lithology, sample, and testing data		528	
2	0/60 *0%*	BD					5–10			526, 524, 522	
3	0/60 *0%*	BD					10–15			520, 518, 516	
4	0/60 *0%*	BD					15–20			514, 512, 510	

NOTE(S): G06D installed in borehole.
Lithology, sample, and testing data can be found on G106 Field Boring Log.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.	**CONTRACTOR:** Bulldog Drilling, Inc.		
Site: Newton Energy Center	**Rig mfg/model:** CME-550 ATV Drill	**BOREHOLE ID:** G06D	
Location: Newton, Illinois	**Drilling Method:** 4¼" HSA, split spoon sampler	**Well ID:** G06D	
Project: 15E0030		**Surface Elev:** 529.69 ft. MSL	
DATES: Start: 11/9/2015	**FIELD STAFF: Driller:** J. Gates	**Completion:** 96.00 ft. BGS	
Finish: 11/10/2015	**Helper:** C. Clines	**Station:** 5,328.80N	
WEATHER: Sunny, mild, lo-60s	**Eng/Geo:** R. Hasenyager	4,925.99E	

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = Dry - During Drilling
▼ =
▽ =

Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp (tsf)* Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
	0/60 *0%*	BD					20–25	Blind drill - see G106 boring log for lithology, sample, and testing data *[Continued from previous page]*		
5	0/60 *0%*	BD					25–30			
6	0/60 *0%*	BD					30–35			
7	0/12 *0%*	BD					35–36			
8							36		493.69	
9A	24/24 *100%*	SS	*3-8 12-15* N=20	13		*3.75*	36–37.5	Gray (10YR5/1), moist, stiff, CLAY with some silt, little very fine- to very coarse-grained sand, and trace small gravel.		
							37.5–38	Gray (10YR5/1), wet, loose, very fine- to medium-grained SAND.		
10A	14/24 *58%*	SS	*6-11 19-22* N=30	14		*4.00*	38–40	Gray (10YR5/1), moist, stiff, CLAY with some silt, little very fine- to very coarse-grained sand, and trace small gravel.		

NOTE(S): G06D installed in borehole.
Lithology, sample, and testing data can be found on G106 Field Boring Log.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 11/9/2015
Finish: 11/10/2015
WEATHER: Sunny, mild, lo-60s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 4¼" HSA, split spoon sampler

FIELD STAFF: Driller: J. Gates
Helper: C. Clines
Eng/Geo: R. Hasenyager

HANSON

BOREHOLE ID: G06D
Well ID: G06D
Surface Elev: 529.69 ft. MSL
Completion: 96.00 ft. BGS
Station: 5,328.80N
4,925.99E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = Dry - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) / % Recovery	Type	Blows / 6 in / N - Value / RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) / Qp (tsf) / Failure Type
11A	24/24 100%	SS	3-7 13-16 N=20	12		4.50
12A	24/24 100%	SS	3-7 11-12 N=18	13		4.50
13A	24/24 100%	SS	6-8 12-14 N=20	14		4.50
14A	3/24 13%	SS	13-14 16-20 N=30	13		
15A	23/24 96%	SS	3-7 11-14 N=18	13		4.50
16A	24/24 100%	SS	5-9 11-15 N=20	15		4.00
17A	21/24 88%	SS	10-14 12-15 N=26	13		3.75
18A	23/24 96%	SS	4-7 10-14 N=17	14		3.25
19A	24/24 100%	SS	2-4 9-12 N=13	15		3.25
20A	24/24 100%	SS	3-7 10-14 N=17	13		3.50

Depth ft. BGS	Lithologic Description	Elevation ft. MSL
40.0 – 43.5	Gray (10YR5/1), moist, hard, CLAY with some silt, few very fine- to medium-grained sand, and trace small gravel.	
43.5 – 52.0	Gray (10YR5/1), moist, hard, SILT with some clay, little very fine- to very coarse-grained sand, and trace small gravel, trace wood fragments.	
52.0 – 60.0	Gray (10YR5/1), moist, hard, SILT with some clay, little very fine- to very coarse-grained sand, and trace small to medium gravel, trace wood fragments.	

Depth scale (ft. BGS): 42, 44, 46, 48, 50, 52, 54, 56, 58, 60
Elevation scale (ft. MSL): 488, 486, 484, 482, 480, 478, 476, 474, 472, 470

Borehole Detail | Remarks

NOTE(S): G06D installed in borehole.
Lithology, sample, and testing data can be found on G106 Field Boring Log.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 11/9/2015
Finish: 11/10/2015
WEATHER: Sunny, mild, lo-60s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 4¼" HSA, split spoon sampler
FIELD STAFF: Driller: J. Gates
Helper: C. Clines
Eng/Geo: R. Hasenyager

BOREHOLE ID: G06D
Well ID: G06D
Surface Elev: 529.69 ft. MSL
Completion: 96.00 ft. BGS
Station: 5,328.80N
4,925.99E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = Dry - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp (tsf)* Failure Type
21A	24/24 *100%*	SS	*4-8 11-16* N=19	13		*4.25*
22A	24/24 *100%*	SS	*2-6 10-14* N=16	14		*3.75*
23A	24/24 *100%*	SS	*6-10 16-21* N=26	13		*4.50*
24A	24/24 *100%*	SS	*4-8 11-14* N=19	13		*4.50*
25A	24/24 *100%*	SS	*2-6 8-9* N=14	15		*3.60*
26A	24/24 *100%*	SS	*1-4 8-9* N=12	17		*2.75*
27A	24/24 *100%*	SS	*woh-4 5-8* N=9	18		*2.25*
28A	24/24 *100%*	SS	*woh-3 5-8* N=8	17		*1.50*
29A	24/24 *100%*	SS	*wor-1 5-7* N=6	18		*1.50*
30A	24/24 *100%*	SS	*1-4 5-8* N=9	19		*1.00*

Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
to 62	Gray (10YR5/1), moist, hard, SILT with some clay, little very fine- to very coarse-grained sand, and trace small to medium gravel, trace wood fragments. *[Continued from previous page]*		468	
62–64	Gray (10YR5/1), moist, hard, CLAY with some silt, little very fine- to very coarse-grained sand, and trace small to medium gravel, trace wood fragments.		466	
64–68.4	Gray (10YR5/1), moist, hard, SILT with some clay, little very fine- to very coarse-grained sand, and trace small to medium gravel, trace wood fragments.		464, 462	
68.4–73	Gray (10YR5/1), moist, stiff, CLAY with some silt, little very fine- to very coarse-grained sand, and trace small gravel, trace wood fragments.		460, 458	
73–78	Gray (10YR5/1), moist, medium, CLAY with some silt, little very fine- to very coarse-grained sand, and trace small gravel, trace wood fragments.		456, 454, 452	
78–80	Gray (10YR5/1), moist, soft, CLAY with some silt, little very fine- to very coarse-grained sand, and trace small gravel, trace wood fragments.		450	

NOTE(S): G06D installed in borehole.
Lithology, sample, and testing data can be found on G106 Field Boring Log.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 11/9/2015
Finish: 11/10/2015
WEATHER: Sunny, mild, lo-60s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550 ATV Drill
Drilling Method: 4¼" HSA, split spoon sampler
FIELD STAFF: Driller: J. Gates
Helper: C. Clines
Eng/Geo: R. Hasenyager

BOREHOLE ID: G06D
Well ID: G06D
Surface Elev: 529.69 ft. MSL
Completion: 96.00 ft. BGS
Station: 5,328.80N
4,925.99E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = Dry - During Drilling
▼ =
▽ =

Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp (tsf)* Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
31A	24/24 *100%*	SS	*woh-3 5-8* N=8	19		*0.75*	80–87	Gray (10YR5/1), moist, soft, CLAY with some silt, little very fine- to very coarse-grained sand, and trace small gravel, trace wood fragments. *[Continued from previous page]*		
32A	24/24 *100%*	SS	*1-4 6-8* N=10	18		*1.25*				
33A	24/24 *100%*	SS	*woh-4 6-8* N=10	19		*1.00*				
34A	24/24 *100%*	SS	*woh-4 9-10* N=13	16		*1.00*	87–87.6	Gray (10YR5/1), moist, dense, SILT and very fine-grained SAND with trace very coarse-grained sand.		
34B				18			87.6–90	Gray (10YR5/1), moist, soft, CLAY with some silt, little very fine- to coarse-grained sand, and trace small gravel, trace wood fragments.		
35A	24/24 *100%*	SS	*4-9 7-8* N=16	19		*1.25*				
36A	24/24 *100%*	SS	*woh-2 5-6* N=7	20		*0.75*	90–96	Gray (10YR5/1), moist, soft, CLAY with some silt, trace very fine- to coarse-grained sand, and trace small gravel, trace wood fragments.		
37A	24/24 *100%*	SS	*woh-2 5-7* N=7	19		*0.75*				
38A	24/24 *100%*	SS	*woh-3 5-8* N=8	19		*0.75*				

Depth scale (ft. BGS): 82, 84, 86, 88, 90, 92, 94, 96
Elevation scale (ft. MSL): 448, 446, 444, 442, 440, 438, 436, 434

End of boring = 96.0 feet

NOTE(S): G06D installed in borehole.
Lithology, sample, and testing data can be found on G106 Field Boring Log.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/19/2015
Finish: 10/20/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA

FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: G48MG
Well ID: G48MG
Surface Elev: 543.17 ft. MSL
Completion: 77.06 ft. BGS
Station: 9,706.71N
5,052.58E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 23, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = Dry - During Drilling
▼ =
▽ =

SAMPLE			TESTING								
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							0	Grayish brown (10YR5/2), moist, very soft, silty CLAY, trace roots.			
								Grayish brown (10YR5/2) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY, slight trace roots.		542	
							2				
										540	
							4	Brown (10YR5/3) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with trace sand and slight trace gravel.			
										538	
							6				
								Gray (10YR5/1) with 20% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with trace sand and slight trace gravel.		536	
							8	Gray (10YR5/1) with 40% dark yellowish brown (10YR4/6) mottles, very moist, soft, silty CLAY with trace sand and slight trace gravel.		534	
							10	Yellowish brown (10YR5/4) with 10% gray (10YR6/1) mottles, soft, wet, sandy CLAY with slight trace gravel.			
								Yellowish brown (10YR5/4) with 10% gray (10YR5/1) mottles, moist, firm, silty CLAY with trace sand and slight trace gravel.		532	
							12	Dark gray (10YR4/1) with 30% brown (10YR4/3) mottles, slightly moist, hard, clayey SILT with trace sand and slight trace gravel.		530	
							14	Dark gray (10YR4/1) with 20% dark grayish brown (10YR4/2) mottles, slightly moist, hard, clayey SILT with trace sand and slight trace gravel.		528	
							16				
								Dark gray (10YR4/1), slightly moist, hard, clayey SILT with trace sand and slight trace gravel.		526	
							18				
										524	
							20				

NOTE(S): G48MG installed in borehole.
Sample and testing data can be found on B-48 Field Boring Log.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/19/2015
Finish: 10/20/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA

FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: G48MG
Well ID: G48MG
Surface Elev: 543.17 ft. MSL
Completion: 77.06 ft. BGS
Station: 9,706.71N
5,052.58E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 23, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = Dry - During Drilling
▼ =
▽ =

SAMPLE: Number	Recov / Total (in) *% Recovery*	Type	TESTING: *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							21–25.8	Dark gray (10YR4/1), slightly moist, hard, clayey SILT with trace sand and slight trace gravel. *[Continued from previous page]*			
						25.8–26.4	Dark gray (10YR4/1), moist, firm, silty CLAY with slight trace sand and gravel.			
						26.4–27	Dark gray (10YR4/1), slightly moist, hard, clayey SILT with trace sand and slight trace gravel.			
						27–30.5	Dark gray (10YR4/1), slightly moist, firm, clayey SILT with trace sand and slight trace gravel.			
						30.5–37.3	Dark gray (10YR4/1), slightly moist, hard, clayey SILT with trace sand and slight trace gravel.			
						37.3–40	Dark gray (10YR4/1), slightly moist, hard, silty CLAY with slight trace sand and gravel.			

Depth scale (ft. BGS): 22, 24, 26, 28, 30, 32, 34, 36, 38, 40
Elevation scale (ft. MSL): 522, 520, 518, 516, 514, 512, 510, 508, 506, 504

NOTE(S): G48MG installed in borehole.
Sample and testing data can be found on B-48 Field Boring Log.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/19/2015
Finish: 10/20/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA

FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: G48MG
Well ID: G48MG
Surface Elev: 543.17 ft. MSL
Completion: 77.06 ft. BGS
Station: 9,706.71N
5,052.58E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 23, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = Dry - During Drilling
▼ =
▽ =

SAMPLE: Number	Recov / Total (in) *% Recovery*	Type	TESTING: *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							40–44	Dark gray (10YR4/1), slightly moist, hard, silty CLAY with slight trace sand and gravel. *[Continued from previous page]*		502, 500	
							44	Dark gray (10YR4/1), slightly moist, firm, SILT with slight trace sand.			
							46, 48, 50	Dark gray (10YR4/1), slightly moist, hard, silty CLAY with slight trace sand and gravel.		498, 496, 494, 492	
							52	Olive gray (5Y4/2), slightly moist, firm, silty CLAY with slight trace sand and gravel.			
							54	Dark greenish gray (10Y4/1) with 20% greenish gray (10Y6/1) mottles, slightly moist, hard, silty CLAY with trace sand and slight trace gravel.		490	
							56	Olive gray (5Y4/2) with 15% dark gray (N4/1) mottles, slightly moist, hard, silty CLAY with slight trace sand and gravel.		488	
							58, 60	Olive gray (5Y4/2) with 15% dark gray (N4/1) mottles, slightly moist, firm, silty CLAY with slight trace sand and gravel.		486, 484	

NOTE(S): G48MG installed in borehole.
Sample and testing data can be found on B-48 Field Boring Log.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/19/2015
Finish: 10/20/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA

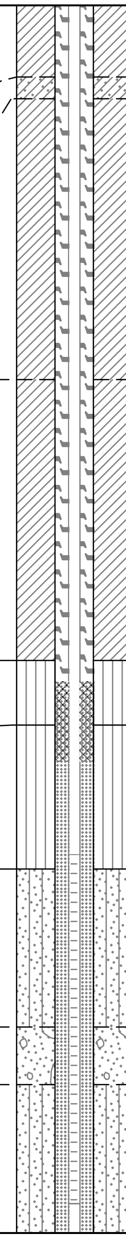
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: G48MG
Well ID: G48MG
Surface Elev: 543.17 ft. MSL
Completion: 77.06 ft. BGS
Station: 9,706.71N
5,052.58E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 23, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = Dry - During Drilling
▼ =
▽ =

SAMPLE			TESTING								
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
								Olive gray (5Y4/2) with 15% dark gray (N4/1) mottles, slightly moist, firm, silty CLAY with slight trace sand and gravel.			
								[Continued from previous page]		482	
								Light olive gray (5Y5/2), very moist, very soft, sandy CLAY with slight trace gravel.			
							62				
								Light olive gray (5Y5/2) with 10% greenish gray (5GY5/1) mottles, slightly moist, firm, silty CLAY with trace sand and slight trace gravel.		480	
							64				
										478	
							66				
								Greenish gray (10Y5/1) with 10% olive gray (5Y4/2) mottles, slightly moist, firm, silty CLAY with slight trace sand and gravel.		476	
							68				
								Greenish gray (10G5/1) with 5% dark yellowish brown (10YR4/6) mottles, moist, dense, SILT with slight trace sand.		474	
							70				
								Dark greenish gray (10GY4/1), slightly moist, very hard, clayey SILT with trace sand and slight trace gravel.		472	
							72				
								Dark greenish gray (10GY4/1), wet, very dense, silty, medium- to coarse-grained SAND with slight trace gravel.		470	
							74				
								Dark greenish gray (10GY4/1), wet, very dense, silty, coarse-grained SAND and gravel.		468	
							76	Dark gray (10YR4/1), wet, very dense, silty, medium- to coarse-grained SAND with slight trace gravel.			



End of boring = 77.06 feet

NOTE(S): G48MG installed in borehole.
Sample and testing data can be found on B-48 Field Boring Log.

RAPPS

BORING LOG

ENGINEERING and APPLIED SCIENCE — 2387 WEST MONROE - SPRINGFIELD IL 62704 - (217)787-2118

Client: CIPS-NEWTON Project: WELL INSTALLATION Boring No: G201

Drilling Firm: PROFESSIONAL SERVICE IND. Drilling Method: 4-1/4 ID HSA Surface Elev. 542.45

Logged By: MSS Checked By: ______ Date Started: 10-8-96 Completed: 10-10-96

Classification System: UNIFIED

Depth	Material Description	Tube No.	Type	% Rec.	OVM (ppm)	Qu t/sf PEN	Moist	Comments	Well
0–4.5	Brown, mottled gray silty CLAY (OH) w/trace pebbles — 4.5	1	5.0' CME continuous sampler	80		1.5, 1.5, 3.25, 3.75	dry	Fractured	
4.5–5.0	Gray to tan clayey SILT (MH) — 5.0	2		100		1.75, 1.25, 1.50, 1.50, 1.75	dry, moist		
5.0–6.7	Brown, w/reddish streaking silty CLAY (CH) — 6.7								
6.7–10.2	Gray, mottled brown silty CLAY (CH) w/trace sand & pebbles — 10.2								
10.2–13.0	Reddish brown, silty CLAY (CL) w/pebbles — 13.0	3		95		1.75, 2.25, 2.75, 0.75, 0.75	wet, moist, wet		
13.0–15.0	Reddish brown silty SAND (SP-SM) w/pebbles — 15.0							Blocky Structure 527.5	
15.0–27.5	Gray silty CLAY (ML-CL) w/pebbles — 27.5	4		100		4.5+, 4.5+, 4.5+, 4.5+, 4.5+	dry, dry		
		5		100		4.5+, 4.5+, 4.5+, 4.5+, 4.5+	dry, dry		
		6		50		4.5+, 4.5+	dry	515	
27.5–30	Gray SAND (SM) fine to coarse grain w/silt & trace pebbles					NA, NA	wet	Blow-in: Tried to flush hole. Redrilled w/plug.	

Water Level NA of NA hrs.
Water Level NA of NA hrs.

N 8947.43, E 5499.92

Sheet 1 of 3

RAPPS

ENGINEERING and APPLIED SCIENCE

2357 WEST MONROE - SPRINGFIELD IL 62704 - (217)787-2118

BORING LOG

Client: CIPS-NEWTON Project: WELL INSTALLATION Boring No: G201

Drilling Firm: PROFESSIONAL SERVICE IND. Drilling Method: 4-1/4 ID HSA Surface Elev. 542.45

Logged By: MSS Checked By: Date Started: 10-8-96 Completed: 10-8-96

Classification System: UNIFIED

DEPTH	Material Description	Sampling: Tube No.	Sampling: Type	Sampling: % Rec.	Tests: OVM (ppm)	Tests: Qu t/sf PEN	Tests: Moist	Comments	Well
30–33.0	Gray SAND (SM) fine to coarse grain w/silt & trace pebbles (33.0)	7	5.0' CME continuous sampler	40		NA, NA, NA	wet		
33.0–33.4	Gray GRAVEL (GL) w/sand & silt (33.4)					4.5+	wet		
33.4–40.0	Gray silty CLAY (ML-CL) w/pebbles (40.0)	8		60		4.5+, 4.5+, 4.5+	moist, moist		
40.0–45.0	No recovery (45.0)	9		00		NA		Very hard Firm.	
45.0–54.1	Gray silty CLAY (ML-CL) w/pebbles (54.1)	10		90		4.5+, 4.5+, 4.5+, 4.5+, 4.5+	moist, moist		
		11		100		4.5+, 3.0, 3.0, 3.0, 3.0	moist, moist		
54.1–55.0	Gray-brown silty CLAY (ML-CL) w/pebbles (55.0)								
55.0–60	Gray-brown silty CLAY (ML-CL) w/pebbles	12		100		4.0, 4.5, 4.0, 4.0, 4.5+	moist, moist		

Water Level NA of NA hrs.
Water Level NA of NA hrs.

N 8947.43, E 5499.92

RAPPS

ENGINEERING and APPLIED SCIENCE

BORING LOG

2387 WEST MONROE - SPRINGFIELD IL 62704 - (217)787-2118

Client: CIPS-NEWTON Project: WELL INSTALLATION Boring No: G201

Drilling Firm: PROFESSIONAL SERVICE IND. Drilling Method: 4-1/4 ID HSA Surface Elev. 542.45

Logged By: MSS Checked By: ____ Date Started: 10-8-96 Completed: 10-8-96

DEPTH	Material Description Classification System UNIFIED	Sampling: Tube No.	Sampling: Type	Sampling: % Rec.	Tests: OVM (ppm)	Tests: Qu t/sf PEN	Tests: Moist	Comments	Well
60	Gray silty CLAY (ML-CL) w/pebbles		5.0' CME continuous sampler			4.5			
						4.5	moist		
	63.0	13		75		4.5			
	Gray fine grain sandy SILT (SM-ML) w/trace pebbles					3.0	wet		
65	65.5							Note: 63.5' to 65.0' split spoon to open augers 30/120/150 blow count.	
	Gray fine grain SAND-SILT (SM) w/trace pebbles					3.0			
		14		90		3.0	wet		
						3.0	wet		
						3.0			
70	End Of Boring @70.0'								
75									
80									
85									
90									

Water Level NA of NA hrs.
Water Level NA of NA hrs.

N 8947.43, E 5499.92

RAPPS

ENGINEERING and APPLIED SCIENCE

2387 WEST MONROE - SPRINGFIELD IL 62704 - (217)787-2118

BORING LOG

Client: CIPS-NEWTON Project: WELL INSTALLATION Boring No: G202

Drilling Firm: PROFESSIONAL SERVICE IND. Drilling Method: 4-1/4 ID HSA Surface Elev. 537.24

Logged By: MSS Checked By: ______ Date Started: 10-16-96 Completed: 10-16-96

DEPTH	Material Description (Classification System UNIFIED)	Sampling: Tube No.	Sampling: Type	Sampling: % Rec.	Tests: OVM (ppm)	Tests: Qu t/sf PEN	Tests: Moist	Comments	Well
0–10.0	Fill Material: Drilled through built drilling pad (10.0)	1	5.0' CME continuous sampler	0		NA	NA		
		2		0		NA	NA		
10.0–12.5	Brown-gray silty SAND (SM) w/clay & trace pebbles (12.5)	3		30		NA	moist		
12.5–16.5	Brown-clayey SILT (ML) w/ sand & pebbles (16.5)					0.25	wet		
						NA			
16.5–18.0	Gray silty CLAY (ML-CL) w/pebbles (18.0)	4		30		NA		Very weathered	
						NA	moist		
18.0–20.8	Brown coarse SAND (SM) w/silt (20.8)					NA	moist		
						NA			
20.8–30	Gray silty CLAY (ML-CL) w/pebbles	5		60		4.5+			
						4.5+	dry		
						4.5+			
		6		100		4.5+	moist		
						4.5+			
						4.5+	moist		
						4.5+			

Water Level NA of NA hrs.
Water Level NA of NA hrs.

N 6649.68, E 6587.20

RAPPS

ENGINEERING and APPLIED SCIENCE

BORING LOG

2387 WEST MONROE - SPRINGFIELD IL 62704 - (217)787-2118

Client: CIPS-NEWTON Project: WELL INSTALLATION Boring No: G202
Drilling Firm: PROFESSIONAL SERVICE IND. Drilling Method: 4-1/4 ID HSA Surface Elev. 537.24
Logged By: MSS Checked By: ______ Date Started: 10-8-96 Completed: 10-8-96

DEPTH	Material Description Classification System UNIFIED	Sampling Tube No.	Sampling Type	Sampling % Rec.	Tests OVM (ppm)	Tests Qu t/sf PEN	Tests Moist	Comments	Well	DEPTH
30	Gray silty CLAY (ML-CL) w/pebbles 31.3	7	5.0' CME continuous sampler	100		4.5+				30
	Brownish Gray CLAY (CH) w/silt 32.3					4.5+	moist			
	Gray silty CLAY (ML-CL) w/pebbles					3.0	wet			
						4.5+	moist			
						4.5+				
35	36.0	8		100		4.5+				35
	Gray silty SAND (SM) 36.5					NA	wet			
						4.5+				
						4.5+	moist			
						4.5+				
40	Gray silty CLAY (ML-CL) w/pebbles	9		90		4.5+				40
						4.5+	moist			
						4.5+				
						4.5+	moist			
						4.5+				
45		10		100		4.5+				45
						3.75	moist			
						4.5+				
						4.5+	moist			
						4.5+				
50		11		100		4.5+				50
						4.5+	moist			
						4.5+				
						4.5+	moist			
						4.5+				
55		12		100		4.5+				55
						4.5+	moist			
						4.5+				
						4.5+	moist			
60						4.5+				60

Water Level NA of NA hrs.
Water Level NA of NA hrs.

N 6649.68, E 6587.20

RAPPS

ENGINEERING and APPLIED SCIENCE

2387 WEST MONROE - SPRINGFIELD IL 62704 - (217)787-2118

BORING LOG

Client: CIPS-NEWTON Project: WELL INSTALLATION Boring No: G202

Drilling Firm: PROFESSIONAL SERVICE IND. Drilling Method: 4-1/4 ID HSA Surface Elev. 537.24

Logged By: MSS Checked By: ______ Date Started: 10-16-96 Completed: 10-16-96

DEPTH	Material Description (Classification System UNIFIED)	Sampling: Tube No.	Sampling: Type	Sampling: % Rec.	Tests: OVM (ppm)	Tests: Qu t/sf PEN	Tests: Moist	Comments	Well
60	Gray silty CLAY (ML-CL) w/pebbles 61.4		5.0' CME continuous sampler			4.5+			
	Gray GRAVEL (GM) w/silt 62.0					4.5+	wet		
	Gray silty CLAY (ML-CL) w/pebbles	13		100		4.5+			
						4.5+	wet		
						4.5+			
65		14		100		4.5+			
						4.5+	wet		
						4.5+			
						4.5+	wet		
	69.5								
70	Gray fine sandy SILT (SM)					NA		Blind drill: Augers plugged w/SILT-SAND	
	End Of Boring @70.0'								
75									
80									
85									
90									

Water Level NA of NA hrs.
Water Level NA of NA hrs.

N 6649.68, E 6587.20

RAPPS

BORING LOG

ENGINEERING and APPLIED SCIENCE — 2387 WEST MONROE - SPRINGFIELD IL 62704 - (217)787-2118

Client: CIPS-NEWTON Project: WELL INSTALLATION Boring No: G203

Drilling Firm: PROFESSIONAL SERVICE IND. Drilling Method: 4-1/4 ID HSA Surface Elev. 530.97

Logged By: MSS Checked By: ____ Date Started: 10-15-96 Completed: 10-15-96

Depth (ft)	Material Description (Classification System: UNIFIED)	Tube No.	Type	% Rec.	OVM (ppm)	Qu t/sf PEN	Moist	Comments
0–3.5	Tan, mottled reddish clayey SILT (MH) — 3.5	1	5.0' CME continuous sampler	75		4.5+, 4.5+, 4.0, 2.75	dry, moist	Very soft
3.5–11.5	Gray, mottled brown silty CLAY (MH-CH) w/trace coarse sand & pebbles — 11.5	2		100		1.75, 1.0, 0.75, 1.75, 2.5	moist, moist	
11.5–21.5	Brown silty clay (CL-ML) w/coarse sand & pebbles — 21.5	3		60		NA, NA, 2.5, 2.75	dry, dry	
		4		70		NA, NA, NA, NA	dry, dry	
21.5–23.0	Brown SAND (SM) w/silt, poorly sorted — 23.0	5		70		4.0, 4.0, NA, 4.5+	dry, dry	
23.0–28.0	Gray, mottled brown silty CLAY (CL) w/pebbles — 28.0	6		95		4.5+, 4.5+, 4.25, 4.5, 4.5+	moist, dry	
28.0–30	Gray silty CLAY (CL-ML) w/pebbles							

Water Level NA of NA hrs.
Water Level NA of NA hrs.

N 5821.29, E 6113.10

RAPPS

ENGINEERING and APPLIED SCIENCE

2387 WEST MONROE - SPRINGFIELD IL 62704 - (217)787-2118

BORING LOG

Client: CIPS–NEWTON | Project: WELL INSTALLATION | Boring No: G203

Drilling Firm: PROFESSIONAL SERVICE IND. | Drilling Method: 4–1/4 ID HSA | Surface Elev. 530.97

Logged By: MSS | Checked By: | Date Started: 10–15–96 | Completed: 10–15–96

Material Description — Classification System: UNIFIED

Depth (ft)	Material Description
30 – 33.2	Gray silty CLAY (ML–CL) w/pebbles
33.2 – 34.5	Gray fine grain SAND (SM) w/silt
34.5 – 36.5	Brownish gray silty CLAY (CL) w/pebbles
36.5 – 57.5	Gray silty CLAY (ML–CL) w/pebbles
57.5 – 58.0	Gray fine SAND (SM) w/silt
58.0 – 60	Gray silty CLAY (ML–CL) w/pebbles

Sampling: Type 5.0' CME continuous sampler

Depth (ft)	Tube No.	% Rec.	Qu t/sf PEN	Moist
30 – 35	7	100	4.5+, 4.5+, 4.5+, 4.5	dry, dry
35 – 40	8	100	4.0, 4.5, 4.5+, 4.5	dry, dry
40 – 45	9	100	4.5+, 4.5+, 4.5+, 4.5+	dry, dry
45 – 50	10	100	4.5+, 4.5+, 4.5+, 4.5+	dry, dry
50 – 55	11	100	4.5+, 4.5+, 4.5+, 4.5+, 4.5+	moist, moist
55 – 60	12	100	4.5+, 4.5+, 4.5+, 4.5+, 4.5+	moist, moist

Water Level NA of NA hrs.
Water Level NA of NA hrs.

N 5821.29, E 6113.10

RAPPS

BORING LOG

ENGINEERING and APPLIED SCIENCE
2387 WEST MONROE - SPRINGFIELD IL 62704 - (217)787-2118

Client: CIPS-NEWTON
Project: WELL INSTALLATION
Boring No: G203
Drilling Firm: PROFESSIONAL SERVICE IND.
Drilling Method: 4-1/4 ID HSA
Surface Elev. 530.97
Logged By: MSS
Checked By:
Date Started: 10-15-96
Completed: 10-15-96

DEPTH	Material Description (Classification System UNIFIED)	Tube No.	Type	% Rec.	OVM (ppm)	Qu t/sf PEN	Moist	Comments	Well	DEPTH
60	Gray silty CLAY (ML-CL) w/pebbles	13	5.0' CME continuous sampler	100		4.5+, 4.5+, 4.0, 4.5, 4.5+	moist, moist			60
65	65.6									65
	Gray fine SAND (SM) w/silt 66.4									
	Gray fine SAND-SILT (SM) w/trace gravel 70.0	14		80		3.0, 4.0, NA	wet, wet			
70	Blind Drill: Auger plugged & redrilled to 73.0'									70
	End Of Boring @73.0'									
75										75
80										80
85										85
90										90

Water Level NA of NA hrs.
Water Level NA of NA hrs.

N 5821.29, E 6113.10

Illinois Environmental Protection Agency

Field Boring Log

Site ID No. 0798085001 Federal ID No. ______

Site Name: Newton Power Station Landfill Phase II

Quadrangle: Latona Sec. 27 T. 6N R. 8E

~~UTM (or State Plane)~~ Plant Coord. N. (X) 6208.18 E. (Y) 4417.18

Latitude: ___° ___' ___" Longitude: ___° ___' ___"

Boring Location: South side of Area 3

Drilling Equipment: CME 550

County: Jasper

Boring No. B208 Monitoring Well No. G208

Surface Elevation: 533.06 Completion Depth: 95'

Auger Depth: 95' Rotary Depth: NA

Date: Start: 10/11/11 Finish: 10/13/11

Personnel

G - Ken Miller
D - Todd Skinner
H - Justin Lance
H - Scott Walsh

Elev.	Description of Material	Graphic Log	Depth In Feet	Sample No.	Sample Type	Sample Recovery (X)	Penetrometer	N Values (Blow Counts)	OVA or HNU Readings	REMARKS
	Clayey fill									
	Brown mottled gray silty clay (ML-CL); Trace sand & gravel; Moist; Firm			1	5' CS	100 %				
528.06			5	2	5' CS	100 %				
523.06			10	3	5' CS	100 %				
518.06	Gray silty clay (ML-CL); Trace sand & gravel; Dry; Very firm to hard		15	4	5' CS	100 %				
513.06	Brown silty sand (SM) to sand (SW); Some gravel; Moist		20							
	Med. gray silty clay (ML-CL) w/ gravel; Trace sand; Moist; Very firm to hard			5	5' CS	100 %				
508.06			25	6	5' CS	100 %				
503.06			30	7	5' CS	60 %				
498.06			35	8	5' CS	80 %				Fe staining
493.06			40	9	2' SS	100 %				Drove split spoon to remove obstruction
	Gray fine sand (SP); Wet			10	5' CS	30 %				
488.06			45	11	5' CS	100 %				

Illinois Environmental Protection Agency

Field Boring Log

Site ID No. 0798085001 Federal ID No. ______

Site Name: Newton Power Station Landfill Phase II

Quadrangle: Latona Sec. 27 T. 6N R. 8E

~~UTM (or State~~ Plant ~~Plane)~~ Coord. N. (X) 6208.18 E. (Y) 4417.18

Latitude: ° ' " Longitude: ° ' "

Boring Location: South side of Area 3

Drilling Equipment: CME 550

County: Jasper

Boring No. B208 Monitoring Well No. G208

Surface Elevation: 533.06 Completion Depth: 95'

Auger Depth: 95' Rotary Depth: NA

Date: Start: 10/11/11 Finish: 10/13/11

Personnel

G - Ken Miller
D - Todd Skinner
H - Justin Lance
H - Scott Walsh

Elev.	Description of Material	Graphic Log	Depth In Feet	Sample No.	Sample Type	Sample Recovery (X)	Penetrometer	N Values (Blow Counts)	OVA or HNU Readings	REMARKS
	Med. gray silty clay (ML-CL) w/ gravel; Trace sand; Moist; Very firm to hard			12	5' CS	100 %				
478.06			55	13	5' CS	100 %				
473.06			60	14	5' CS	60 %				
468.06			65	15	5' CS	100 %				
463.06	*Softer		70	16	2' SS	100 %				Drove split spoon to remove obstruction
				17	5' CS	100 %				
458.06			75	18	5' CS	100 %				
453.06			80	19	5' CS	100 %				
448.06	Large wood pieces & plant debris		85	20	5' CS	100 %				
443.06			90	21	5' CS	100 %				
438.06	EOB @ 95' BGS		95							

FIELD BORING LOG

HANSON

CLIENT: Illinois Power Generating Co.
Site: Newton Power Station
Location: 6725 N 500th St, Newton, IL 62448
Project: 16E0044A
DATES: Start: 9/25/2017
Finish: 9/26/2017
WEATHER: Sunny, warm (lo-80's)

CONTRACTOR: Bulldog Drilling
Rig mfg/model: CME-750 ATV Drill
Drilling Method: Mud Rotary w/split spoon
FIELD STAFF: Driller: J. Dittmaier
Helper: M. Hill
Eng/Geo: R. Hasenyager

BOREHOLE ID: R217D
Well ID: R217D
Surface Elev: 535.91 ft. MSL
Completion: 65.24 ft. BGS
Station: 7,126.90N
6,712.16E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Qp (tsf)* Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
1	0/60 *0%*	BD					0–3	FILL - Brown, silty CLAY.			
							3–8.2	Gray-brown, silty CLAY with coarse sand.			
2	0/60 *0%*	BD					8.2–8.6	Gray, medium SAND with silt.			
3	0/60 *0%*	BD					8.6–14	Gray, mottled brown, CLAY with silt.			
							14–15	Brown, silty CLAY with pebbles.			
4	0/60 *0%*	BD					15–20	Gray, mottles brown, silty CLAY with pebbles.			6"Ø permanent, PVC casing set to 20'

Depth scale: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20
Elevation scale: 534, 532, 530, 528, 526, 524, 522, 520, 518, 516

NOTE(S): R217D drilled 15.5 feet west of G217D.
Borehole reamed to 6" diameter to set well.
Lithology description to 25 ft. taken from G217 boring log as prepared by Rapps Engineering & Applied Science (1997).

FIELD BORING LOG

HANSON

CLIENT: Illinois Power Generating Co.
Site: Newton Power Station
Location: 6725 N 500th St, Newton, IL 62448
Project: 16E0044A
DATES: Start: 9/25/2017
Finish: 9/26/2017
WEATHER: Sunny, warm (lo-80's)

CONTRACTOR: Bulldog Drilling
Rig mfg/model: CME-750 ATV Drill
Drilling Method: Mud Rotary w/split spoon
FIELD STAFF: Driller: J. Dittmaier
Helper: M. Hill
Eng/Geo: R. Hasenyager

BOREHOLE ID: R217D
Well ID: R217D
Surface Elev: 535.91 ft. MSL
Completion: 65.24 ft. BGS
Station: 7,126.90N
6,712.16E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

SAMPLE			TESTING							
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Qp (tsf)* Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
5	0/60 *0%*	BD					22–25	Gray, mottles brown, silty CLAY with pebbles. *[Continued from previous page]*	514–511	
6A	24/24 *100%*	SS	*12-19 27-34* N=46	11.2			25–32	Gray (10YR5/1), moist, hard, SILT with some clay, few very fine- to very coarse-grained sand, and trace small gravel.	510	
7A	22/24 *92%*	SS	*10-24 31-35* N=55	9.8			28		508	
8A	24/24 *100%*	SS	*9-16 24-25* N=40	11.2			30		506	
9A	24/24 *100%*	SS	*11-16 28-28* N=44	11.0			32–39	Gray (10YR5/1), moist, hard, SILT with some clay, few very fine- to very coarse-grained sand, and trace small to medium gravel.	504	
10A	24/24 *100%*	SS	*11-16 24-32* N=40	11.5			34		502	
11A	24/24 *100%*	SS	*11-17 26-34* N=43	15.0			36		500	
12A	24/24 *100%*	SS	*10-17 27-34* N=44	11.8			38		498	
	24/24		*9-23*				39–40	Gray (10YR5/1), moist, hard, CLAY, with some silt, few very fine- to very coarse-grained sand, and trace small to medium gravel.	496	

NOTE(S): R217D drilled 15.5 feet west of G217D.
Borehole reamed to 6" diameter to set well.
Lithology description to 25 ft. taken from G217 boring log as prepared by Rapps Engineering & Applied Science (1997).

FIELD BORING LOG

HANSON

CLIENT: Illinois Power Generating Co.
Site: Newton Power Station
Location: 6725 N 500th St, Newton, IL 62448
Project: 16E0044A
DATES: Start: 9/25/2017
Finish: 9/26/2017
WEATHER: Sunny, warm (lo-80's)

CONTRACTOR: Bulldog Drilling
Rig mfg/model: CME-750 ATV Drill
Drilling Method: Mud Rotary w/split spoon

FIELD STAFF: Driller: J. Dittmaier
Helper: M. Hill
Eng/Geo: R. Hasenyager

BOREHOLE ID: R217D
Well ID: R217D
Surface Elev: 535.91 ft. MSL
Completion: 65.24 ft. BGS
Station: 7,126.90N
6,712.16E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

SAMPLE			TESTING								
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
13A	*100%*	SS	*33-35* N=56	10.9							
14A	24/24 *100%*	SS	*8-18 22-29* N=40	13.1			42			494	
15A	24/24 *100%*	SS	*9-15 17-22* N=32	14.1			44	Gray (10YR5/1), moist, hard, CLAY, with some silt, few very fine- to very coarse-grained sand, and trace small to medium gravel. *[Continued from previous page]*		492	
16A	24/24 *100%*	SS	*6-15 20-30* N=35	13.2			46			490	
17A	24/24 *100%*	SS	*8-14 20-25* N=34	14.8			48			488	
18A	24/24 *100%*	SS	*5-12 17-20* N=29	14.9			50			486	
19A	6/24 *25%*	SS	*9-14 19-24* N=33	23.3			52	Gray (10YR5/1), moist, hard, CLAY, with some silt, few very fine- to very coarse-grained sand, and trace small to medium gravel, trace wood fragments.		484	
20A	24/24 *100%*	SS	*5-11 15-20* N=26	16.6			54			482	
21A	24/24 *100%*	SS	*6-10 14-20* N=24	19.7			56	Olive gray (5Y4/2) with 10% gray (10YR5/1) mottles, moist, hard, CLAY with some silt, little very fine- to very coarse-grained sand, and trace small to medium gravel.		480	
22A	24/24 *100%*	SS	*7-10 12-14* N=22	19.3			58			478	
23A	24/24		*5-8*	22.1			60			476	

NOTE(S): R217D drilled 15.5 feet west of G217D.
Borehole reamed to 6" diameter to set well.
Lithology description to 25 ft. taken from G217 boring log as prepared by Rapps Engineering & Applied Science (1997).

FIELD BORING LOG

HANSON

CLIENT: Illinois Power Generating Co.
Site: Newton Power Station
Location: 6725 N 500th St, Newton, IL 62448
Project: 16E0044A
DATES: Start: 9/25/2017
Finish: 9/26/2017
WEATHER: Sunny, warm (lo-80's)

CONTRACTOR: Bulldog Drilling
Rig mfg/model: CME-750 ATV Drill
Drilling Method: Mud Rotary w/split spoon
FIELD STAFF: Driller: J. Dittmaier
Helper: M. Hill
Eng/Geo: R. Hasenyager

BOREHOLE ID: R217D
Well ID: R217D
Surface Elev: 535.91 ft. MSL
Completion: 65.24 ft. BGS
Station: 7,126.90N
6,712.16E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

SAMPLE			TESTING								
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Qp (tsf)* Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
23B	*100%*	SS	*16-20* N=24	18.8				Gray (10YR5/1), wet, dense, very fine- to very coarse-grained SAND, with little silt and trace small gravel.			
24A	24/24 *100%*	SS	*8-9* *22-27* N=31	19.5			62	Yellowish brown (10YR5/6), moist, hard, SILT with some clay, little very fine- to very coarse-grained sand, and trace small gravel.		474	
24B				14.6							
25A	24/24 *100%*	SS	*13-19* *27-35* N=46	13.2			64	Gray (10YR5/1), moist, hard, SILT with some clay, little very fine- to very coarse-grained sand, and trace small gravel.		472	
	0/3 *0%*	BD									

End of Boring = 65.24 feet

NOTE(S): R217D drilled 15.5 feet west of G217D.
Borehole reamed to 6" diameter to set well.
Lithology description to 25 ft. taken from G217 boring log as prepared by Rapps Engineering & Applied Science (1997).

Illinois Environmental Protection Agency

Field Boring Log

Site ID No. 0798085001 Federal ID No.

Site Name: Newton Power Station Landfill Phase II

Quadrangle: Latona Sec. 27 T. 6N R. 8E

~~UTM (or State Plane)~~ Plant Coord. N. (X) 5765.30 E. (Y) 4036.52

Latitude: ° ' " Longitude: ° ' "

Boring Location: South side of Area 3

Drilling Equipment: CME 550

County: Jasper

Boring No. B220 Monitoring Well No. G220

Surface Elevation: 532.46 Completion Depth: 87'

Auger Depth: 85' Rotary Depth: NA

Date: Start: 10/14/11 Finish: 10/17/11

Personnel

G - Ken Miller
D - Todd Skinner
H - Justin Lance
H - Tim Skinner

Elev.	Description of Material	Graphic Log	Depth In Feet	Sample No.	Sample Type	Sample Recovery (X)	Penetrometer	N Values (Blow Counts)	OVA or HNU Readings	REMARKS
527.46			5							
522.46			10							
517.46			15							
512.46			20							
507.46	Blind drill to 55'		25							
502.46			30							
497.46			35							
492.46			40							
487.46			45							

Illinois Environmental Protection Agency

Field Boring Log

Site ID No. 0798085001 Federal ID No. ____

Site Name: Newton Power Station Landfill Phase II

Quadrangle: Latona Sec. 27 T. 6N R. 8E

~~UTM (or State~~ Plant ~~Plane)~~ Coord. N. (X) 5765.30 E. (Y) 4036.52

Latitude: ° ' " Longitude: ° ' "

Boring Location: South side of Area 3

Drilling Equipment: CME 550

County: Jasper

Boring No. B220 Monitoring Well No. G220

Surface Elevation: 532.46 Completion Depth: 87'

Auger Depth: 85' Rotary Depth: NA

Date: Start: 10/14/11 Finish: 10/17/11

Personnel:
G - Ken Miller
D - Todd Skinner
H - Justin Lance
H - Tim Skinner

Elev.	Description of Material	Graphic Log	Depth In Feet	Sample No.	Sample Type	Sample Recovery (X)	Penetrometer	N Values (Blow Counts)	OVA or HNU Readings	REMARKS
	Blind drill to 55'									
477.46	Fine gray sand (SP); Moist		55							
	Med. gray silty clay (ML-CL) w/ gravel; Trace sand; Moist; Very firm to hard			1	5' CS	100 %				
472.46	*Siltier		60	2	5' CS	100 %				
467.46	2 x 2" gray silt lenses (ML)		65	3	5' CS	100 %				
462.46	6" gray silt lens (ML)		70	4	5' CS	100 %				
457.46	Gray silt (ML) to silty sand (SM); Moist		75							
	Dirty gravel (GC-GM)			5	5' CS	100 %				
452.46	*Wetter		80	6	5' CS	100 %				
447.46	EOB @ 85' BGS *Augers dropped ~2' after completion, increasing depth to 87'		85							

Illinois Environmental Protection Agency

Field Boring Log

Site ID No. 0798085001 Federal ID No. ______

Site Name: Newton Power Station Landfill Phase II

Quadrangle: Latona Sec. 27 T. 6N R. 8E

~~UTM (or State~~ Plant ~~Plane)~~ Coord. N. (X) 5322.24 E. (Y) 3989.08

Latitude: ___° ___' ___" Longitude: ___° ___' ___"

Boring Location: South side of Area 3

Drilling Equipment: CME 550

County: Jasper

Boring No. B222 Monitoring Well No. G222

Surface Elevation: 532.12 Completion Depth: 80'

Auger Depth: 80' Rotary Depth: NA

Date: Start: 10/24/11 Finish: 10/25/11

Personnel

G - Ken Miller
D - Todd Skinner
H - Justin Lance
H - Tim Skinner

Elev.	Description of Material	Graphic Log	Depth In Feet	Sample No.	Sample Type	Sample Recovery (X)	Penetrometer	N Values (Blow Counts)	OVA or HNU Readings	REMARKS
527.12			5							
522.12			10							
517.12			15							
512.12			20							
507.12	Blind drill to 50'		25							
502.12			30							
497.12			35							
492.12			40							
487.12			45							

Illinois Environmental Protection Agency

Field Boring Log

Site ID No. 0798085001 Federal ID No. ________

Site Name: Newton Power Station Landfill Phase II

Quadrangle: Latona Sec. 27 T. 6N R. 8E

~~UTM (or State~~ Plant ~~Plane)~~ Coord. N. (X) 5322.24 E. (Y) 3989.08

Latitude: ___° ___' ___" Longitude: ___° ___' ___"

Boring Location: South side of Area 3

Drilling Equipment: CME 550

County: Jasper

Boring No. B222 Monitoring Well No. G222

Surface Elevation: 532.12 Completion Depth: 80'

Auger Depth: 80' Rotary Depth: NA

Date: Start: 10/24/11 Finish: 10/25/11

Personnel

G - Ken Miller
D - Todd Skinner
H - Justin Lance
H - Tim Skinner

Elev.	Description of Material	Graphic Log	Depth In Feet	Sample No.	Sample Type	Sample Recovery (X)	Penetrometer	N Values (Blow Counts)	OVA or HNU Readings	REMARKS
	Dk. gray to black silt (ML); Thinly laminated; Fissile; Hard									
	Med. gray silty clay (ML-CL) w/ gravel; Trace sand; Moist; Firm to hard			1	5' CS	100 %				
477.12			55							
				2	5' CS	100 %				
472.12			60							
				3	5' CS	100 %				
467.12			65							
	Coarse sand (SP) w/ gravel; Wet			4	5' CS	30 %				Poor recovery
	Med. gray silty clay (ML-CL) w/ gravel; Trace sand; Moist; Firm to hard									
462.12			70							
				5	2' SS	100 %				Drove split spoon to remove obstruction
				6	5' CS	100 %				
457.12			75							
				7	5' CS	100 %				
452.12	EOB @ 80' BGS		80							

Illinois Environmental Protection Agency

Field Boring Log

County: Jasper

Site ID No. 0798085001 Federal ID No. ______

Boring No. B223 Monitoring Well No. G223

Site Name: Newton Power Station Landfill Phase II

Surface Elevation: 531.52 Completion Depth: 89'

Quadrangle: Latona Sec. 26 T. 6N R. 8E

Auger Depth: 89' Rotary Depth: NA

~~UTM (or State~~ Plant ~~Plane)~~ Coord. N. (X) 6393.02 E. (Y) 5763.68

Date: Start: 10/10/11 Finish: 10/11/11

Latitude: ° ' " Longitude: ° ' "

Boring Location: South side of Area 3

Drilling Equipment: CME 550

Personnel: G - Ken Miller; D - Todd Skinner; H - Justin Lance; H - Scott Walsh

Elev.	Description of Material	Graphic Log	Depth In Feet	Sample No.	Sample Type	Sample Recovery (X)	Penetrometer	N Values (Blow Counts)	OVA or HNU Readings	REMARKS
	Blind drill to 5'									Bottom ash road base
526.52	Brown mottled gray silty clay (ML-CL); Trace sand & gravel; Moist; Firm		5	1	5' CS	40 %				
521.52	*Softer		10	2	5' CS	80 %				
516.52	Gray silty clay (ML-CL); Trace sand & gravel; Moist to wet; Soft to Firm		15	3	5' CS	50 %				
	Silty sand (SM)									Plant debris
511.52	Coarse sand (SP) w/ gravel; Wet		20	4	5' CS	100 %				
	Med. gray silty clay (ML-CL) w/ gravel; Trace sand; Moist; Very firm to hard									Upper 2.5' mottled
506.52			25	5	5' CS	100 %				
501.52			30	6	5' CS	100 %				
496.52	*Slightly softer		35	7	5' CS	100 %				
491.52			40	8	5' CS	100 %				
486.52			45	9	5' CS	100 %				

Illinois Environmental Protection Agency

Field Boring Log

Site ID No. 0798085001 Federal ID No. ______

Site Name: Newton Power Station Landfill Phase II

Quadrangle: Latona Sec. 26 T. 6N R. 8E

~~UTM (or State~~ Plant ~~Plane)~~ Coord. N. (X) 6393.02 E. (Y) 5763.68

Latitude: ___° ___' ___" Longitude: ___° ___' ___"

Boring Location: South side of Area 3

Drilling Equipment: CME 550

County: Jasper

Boring No. B223 Monitoring Well No. G223

Surface Elevation: 531.52 Completion Depth: 89'

Auger Depth: 89' Rotary Depth: NA

Date: Start: 10/10/11 Finish: 10/11/11

Personnel

G - Ken Miller
D - Todd Skinner
H - Justin Lance
H - Scott Walsh

Elev.	Description of Material	Graphic Log	Depth In Feet	Sample No.	Sample Type	Sample Recovery (X)	Penetrometer	N Values (Blow Counts)	OVA or HNU Readings	REMARKS
	Med. gray silty clay (ML-CL) w/ gravel; Trace sand; Moist; Very firm to hard			10	5' CS	100 %				
476.52			55	11	5' CS	100 %				
471.52			60	12	5' CS	100 %				
466.52			65	13	5' CS	100 %				
461.52			70	14	5' CS	100 %				
456.52			75	15	5' CS	100 %				
451.52			80	16	5' CS	100 %				
446.52	Gray, medium to coarse silty sand (SM) w/ gravel; Moist to wet		85							Large wood pieces
	Med. gray silty clay (ML-CL) w/ gravel			17	5' CS	100 %				
441.52	EOB @ 89' BGS		90							

Illinois Environmental Protection Agency

Field Boring Log

Site ID No. 0798085001 Federal ID No. ______

Site Name: Newton Power Station Landfill Phase II

Quadrangle: Latona Sec. 26 T. 6N R. 8E

~~UTM (or State~~ Plant ~~Plane)~~ Coord. N. (X) 6976.66 E. (Y) 6067.30

Latitude: ° ' " Longitude: ° ' "

Boring Location: South side of Area 3

Drilling Equipment: Diedrich D-50

County: Jasper

Boring No. B224 Monitoring Well No. G224

Surface Elevation: 532.26 Completion Depth: 74'

Auger Depth: 74' Rotary Depth: NA

Date: Start: 10/04/11 Finish: 10/04/11

Personnel:
G - Ken Miller
D - Tim Fuhl
H - Eric Sievers
H - Clifford Ohman

Elev.	Description of Material	Graphic Log	Depth In Feet	Sample No.	Sample Type	Sample Recovery (X)	Penetrometer	N Values (Blow Counts)	OVA or HNU Readings	REMARKS
	Brown silty clay (ML-CL); Moist; Firm			1	5' CS	10 %				
527.26	Reddish brown mottled gray silty clay (ML-CL); Trace sand & gravel; Moist; Firm		5	2	5' CS	90 %				
522.26	*Softer, less mottling		10	3	5' CS	10 %				
517.26	Dark gray silty clay (ML-CL) w/ sand; Moist to wet; Soft		15	4	5' CS	60 %				Plant debris
	Medium to coarse sand (SP); Wet									
512.26	Brown mottled gray silty clay (ML-CL) w/ sand & gravel; Dry; Hard		20	5	5' CS	100 %				
	Med. gray silty clay (ML-CL) w/ gravel; Trace sand; Dry to moist; Hard									
507.26			25	6	5' CS	60 %				
502.26	No recovery		30	7	5' CS	0 %				
497.26			35	8	5' CS	0 %				Hard drilling
492.26			40	9	5' CS	0 %				
487.26			45	10	2' SS	0 %				Drove split spoons to remove possible obstruction
				11	2' SS	0 %				
				12	2' SS	100 %				

Illinois Environmental Protection Agency

Field Boring Log

Site ID No. 0798085001 Federal ID No. ______

Site Name: Newton Power Station Landfill Phase II

Quadrangle: Latona Sec. 26 T. 6N R. 8E

~~UTM (or State~~ Plant ~~Plane)~~ Coord. N. (X) 6976.66 E. (Y) 6067.30

Latitude: ° ' " Longitude: ° ' "

Boring Location: South side of Area 3

Drilling Equipment: CME 550

County: Jasper

Boring No. B224 Monitoring Well No. G224

Surface Elevation: 532.26 Completion Depth: 74'

Auger Depth: 74' Rotary Depth: NA

Date: Start: 10/04/11 Finish: 10/04/11

Personnel:
G - Ken Miller
D - Tim Fuhl
H - Eric Sievers
H - Clifford Ohman

Elev.	Description of Material	Graphic Log	Depth In Feet	Sample No.	Sample Type	Sample Recovery (X)	Penetrometer	N Values (Blow Counts)	OVA or HNU Readings	REMARKS
	Med. gray silty clay (ML-CL) w/ gravel; Trace sand; Moist; Very firm to hard			13	5' CS	100 %				
477.26			55	14	5' CS	100 %				
472.26			60	15	5' CS	100 %				
467.26	Gray silt (ML), silty sand (SM) and sand (SP); Wet *w/ gravel		65	16	5' CS	60 %				Large wood pieces
462.26	No recovery		70	17	5' CS	0 %				Trace sand & gravel in tube; Harder drilling @ 72.5'
457.26	EOB @ 74' BGS		75							

Monitoring Well Construction Forms – Landfill 2

Illinois Environmental Protection Agency — Well Completion Report

Site #: ______ County: Jasper County Well #: G06D

Site Name: Newton Energy Center Borehole #: G06D

~~State~~ Plant ~~Plane~~ Coordinate: X 4,926.0 Y 5,328.8 (or) Latitude: 38° 55' 38.040" Longitude: -88° 17' 46.980"

Surveyed By: Michael J. Graminski IL Registration #: 035-002901

Drilling Contractor: Bulldog Drilling, Inc. Driller: J. Gates

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: Hollow Stem Auger Drilling Fluid (Type): Water

Logged By: Rhonald W. Hasenyager Date Started: 11/9/2015 Date Finished: 11/10/2015

Report Form Completed By: Suzanna L. Keim Date: 11/16/2015

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: >48 hours

Type of Bentonite Seal -- Granular **Pellet** Slurry (choose one)

Installation Method: Gravity

Setting Time: 45 minutes

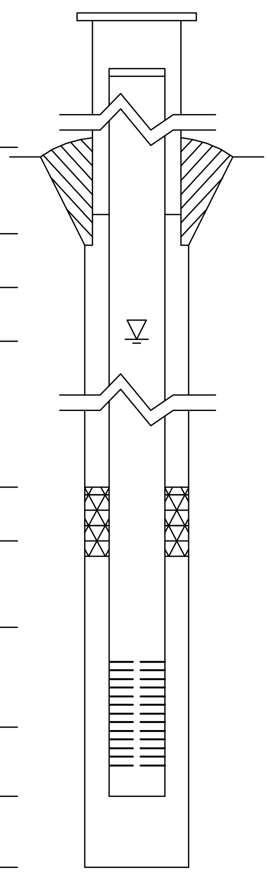
Type of Sand Pack: Quartz Sand

Grain Size: 10-20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: Quartz Sand (if applicable)

Installation Method: gravity



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
532.59	-2.90	Top of Protective Casing
532.18	-2.49	Top of Riser Pipe
529.69	0.00	Ground Surface
527.69	2.00	Top of Annular Sealant
439.57	90.12	Static Water Level (After Completion) 12/16/2016
459.39	70.30	Top of Seal
457.58	72.11	Top of Sand Pack
455.46	74.23	Top of Screen
435.80	93.89	Bottom of Screen
435.36	94.33	Bottom of Well
433.69	96.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	76.72
Bottom of Screen to End Cap	(feet)	0.44
Screen Length (1st slot to last slot)	(feet)	19.66
Total Length of Casing	(feet)	96.82
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: **Steel**
Riser Pipe Above W.T.	SS304	SS316	PTFE	**PVC**	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	**PVC**	OTHER:
Screen	SS304	SS316	PTFE	**PVC**	OTHER:

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/19/2015
Finish: 10/20/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA

FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: G48MG
Well ID: G48MG
Surface Elev: 543.17 ft. MSL
Completion: 77.06 ft. BGS
Station: 9,706.71N
5,052.58E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 23, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = Dry - During Drilling
▼ =
▽ =

SAMPLE			TESTING								
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
								Grayish brown (10YR5/2), moist, very soft, silty CLAY, trace roots.			
								Grayish brown (10YR5/2) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY, slight trace roots.		542	
							2				
								Brown (10YR5/3) with 30% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with trace sand and slight trace gravel.		540	
							4			538	
							6				
								Gray (10YR5/1) with 20% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with trace sand and slight trace gravel.		536	
							8	Gray (10YR5/1) with 40% dark yellowish brown (10YR4/6) mottles, very moist, soft, silty CLAY with trace sand and slight trace gravel.		534	
							10	Yellowish brown (10YR5/4) with 10% gray (10YR6/1) mottles, soft, wet, sandy CLAY with slight trace gravel.			
								Yellowish brown (10YR5/4) with 10% gray (10YR5/1) mottles, moist, firm, silty CLAY with trace sand and slight trace gravel.		532	
							12	Dark gray (10YR4/1) with 30% brown (10YR4/3) mottles, slightly moist, hard, clayey SILT with trace sand and slight trace gravel.		530	
							14	Dark gray (10YR4/1) with 20% dark grayish brown (10YR4/2) mottles, slightly moist, hard, clayey SILT with trace sand and slight trace gravel.		528	
							16				
								Dark gray (10YR4/1), slightly moist, hard, clayey SILT with trace sand and slight trace gravel.		526	
							18			524	
							20				

NOTE(S): G48MG installed in borehole.
Sample and testing data can be found on B-48 Field Boring Log.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/19/2015
Finish: 10/20/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA

FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: G48MG
Well ID: G48MG
Surface Elev: 543.17 ft. MSL
Completion: 77.06 ft. BGS
Station: 9,706.71N
5,052.58E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 23, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = Dry - During Drilling
▼ =
▽ =

SAMPLE: Number	Recov / Total (in) *% Recovery*	Type	TESTING: *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							20–25.8	Dark gray (10YR4/1), slightly moist, hard, clayey SILT with trace sand and slight trace gravel. *[Continued from previous page]*			
							25.8–26.4	Dark gray (10YR4/1), moist, firm, silty CLAY with slight trace sand and gravel.			
							26.4–27.0	Dark gray (10YR4/1), slightly moist, hard, clayey SILT with trace sand and slight trace gravel.			
							27.0–30.5	Dark gray (10YR4/1), slightly moist, firm, clayey SILT with trace sand and slight trace gravel.			
							30.5–37.3	Dark gray (10YR4/1), slightly moist, hard, clayey SILT with trace sand and slight trace gravel.			
							37.3–40	Dark gray (10YR4/1), slightly moist, hard, silty CLAY with slight trace sand and gravel.			

Depth scale (ft. BGS): 22, 24, 26, 28, 30, 32, 34, 36, 38, 40
Elevation scale (ft. MSL): 522, 520, 518, 516, 514, 512, 510, 508, 506, 504

NOTE(S): G48MG installed in borehole.
Sample and testing data can be found on B-48 Field Boring Log.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/19/2015
Finish: 10/20/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA

FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: G48MG
Well ID: G48MG
Surface Elev: 543.17 ft. MSL
Completion: 77.06 ft. BGS
Station: 9,706.71N
5,052.58E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 23, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = Dry - During Drilling
▼ =
▽ =

SAMPLE			TESTING								
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft^3)	Qu (tsf) *Qp (tsf)* Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							40–44	Dark gray (10YR4/1), slightly moist, hard, silty CLAY with slight trace sand and gravel. *[Continued from previous page]*		502, 500	
							44–44.4	Dark gray (10YR4/1), slightly moist, firm, SILT with slight trace sand.			
							44.4–52	Dark gray (10YR4/1), slightly moist, hard, silty CLAY with slight trace sand and gravel.		498, 496, 494, 492	
							52–52.6	Olive gray (5Y4/2), slightly moist, firm, silty CLAY with slight trace sand and gravel.			
							52.6–54.4	Dark greenish gray (10Y4/1) with 20% greenish gray (10Y6/1) mottles, slightly moist, hard, silty CLAY with trace sand and slight trace gravel.		490	
							54.4–57	Olive gray (5Y4/2) with 15% dark gray (N4/1) mottles, slightly moist, hard, silty CLAY with slight trace sand and gravel.		488	
							57–60	Olive gray (5Y4/2) with 15% dark gray (N4/1) mottles, slightly moist, firm, silty CLAY with slight trace sand and gravel.		486, 484	

Depth scale: 42, 44, 46, 48, 50, 52, 54, 56, 58, 60

NOTE(S): G48MG installed in borehole.
Sample and testing data can be found on B-48 Field Boring Log.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: Start: 10/19/2015
Finish: 10/20/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA
FIELD STAFF: Driller: C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: G48MG
Well ID: G48MG
Surface Elev: 543.17 ft. MSL
Completion: 77.06 ft. BGS
Station: 9,706.71N
5,052.58E

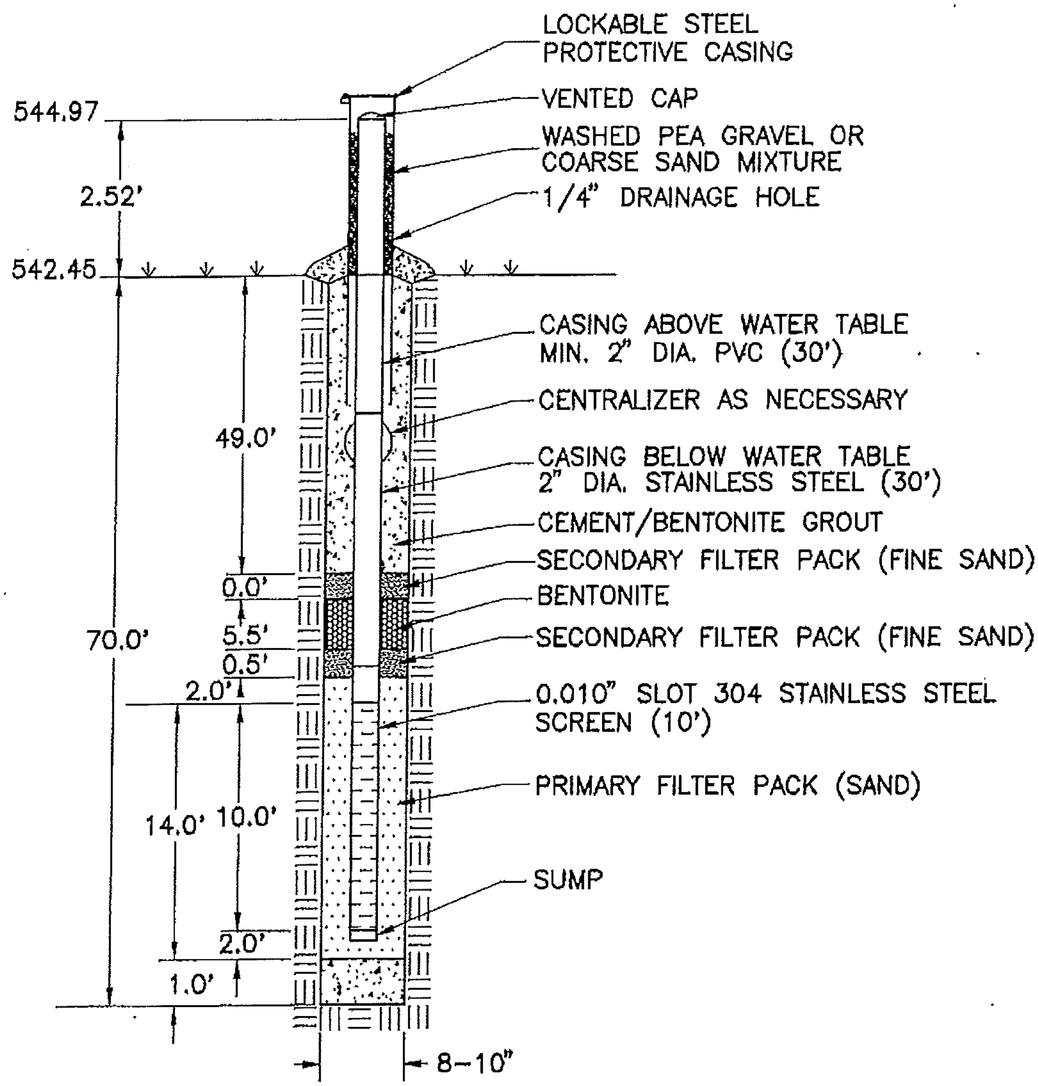
TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 23, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = Dry - During Drilling
▼ =
∇ =

SAMPLE: Number	Recov / Total (in) *% Recovery*	Type	TESTING: *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
								Olive gray (5Y4/2) with 15% dark gray (N4/1) mottles, slightly moist, firm, silty CLAY with slight trace sand and gravel. *[Continued from previous page]*		482	
							62	Light olive gray (5Y5/2), very moist, very soft, sandy CLAY with slight trace gravel.			
							64	Light olive gray (5Y5/2) with 10% greenish gray (5GY5/1) mottles, slightly moist, firm, silty CLAY with trace sand and slight trace gravel.		480	
							66, 68	Greenish gray (10Y5/1) with 10% olive gray (5Y4/2) mottles, slightly moist, firm, silty CLAY with slight trace sand and gravel.		478, 476	
							70	Greenish gray (10G5/1) with 5% dark yellowish brown (10YR4/6) mottles, moist, dense, SILT with slight trace sand.		474	
							72	Dark greenish gray (10GY4/1), slightly moist, very hard, clayey SILT with trace sand and slight trace gravel.		472	
							74	Dark greenish gray (10GY4/1), wet, very dense, silty, medium- to coarse-grained SAND with slight trace gravel.		470	
								Dark greenish gray (10GY4/1), wet, very dense, silty, coarse-grained SAND and gravel.		468	
							76	Dark gray (10YR4/1), wet, very dense, silty, medium- to coarse-grained SAND with slight trace gravel.			

End of boring = 77.06 feet

NOTE(S): G48MG installed in borehole.
Sample and testing data can be found on B-48 Field Boring Log.



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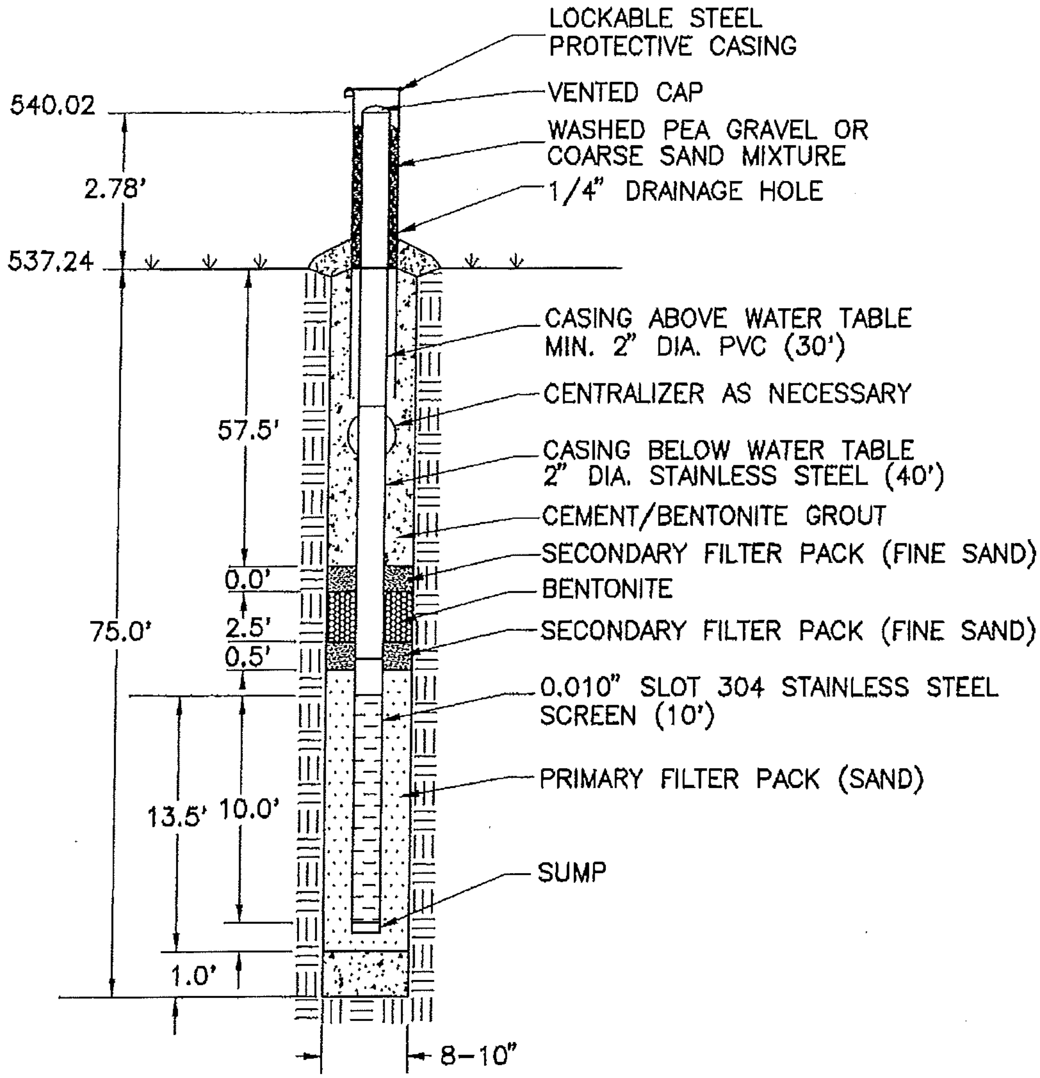
1601 BROADWAY • MT. VERNON, IL 62864 • (618) 244-2611

G201
MONITORING WELL AS-BUILT DIAGRAM

CIPS-NEWTON LANDFILL
JASPER COUNTY, ILLINOIS



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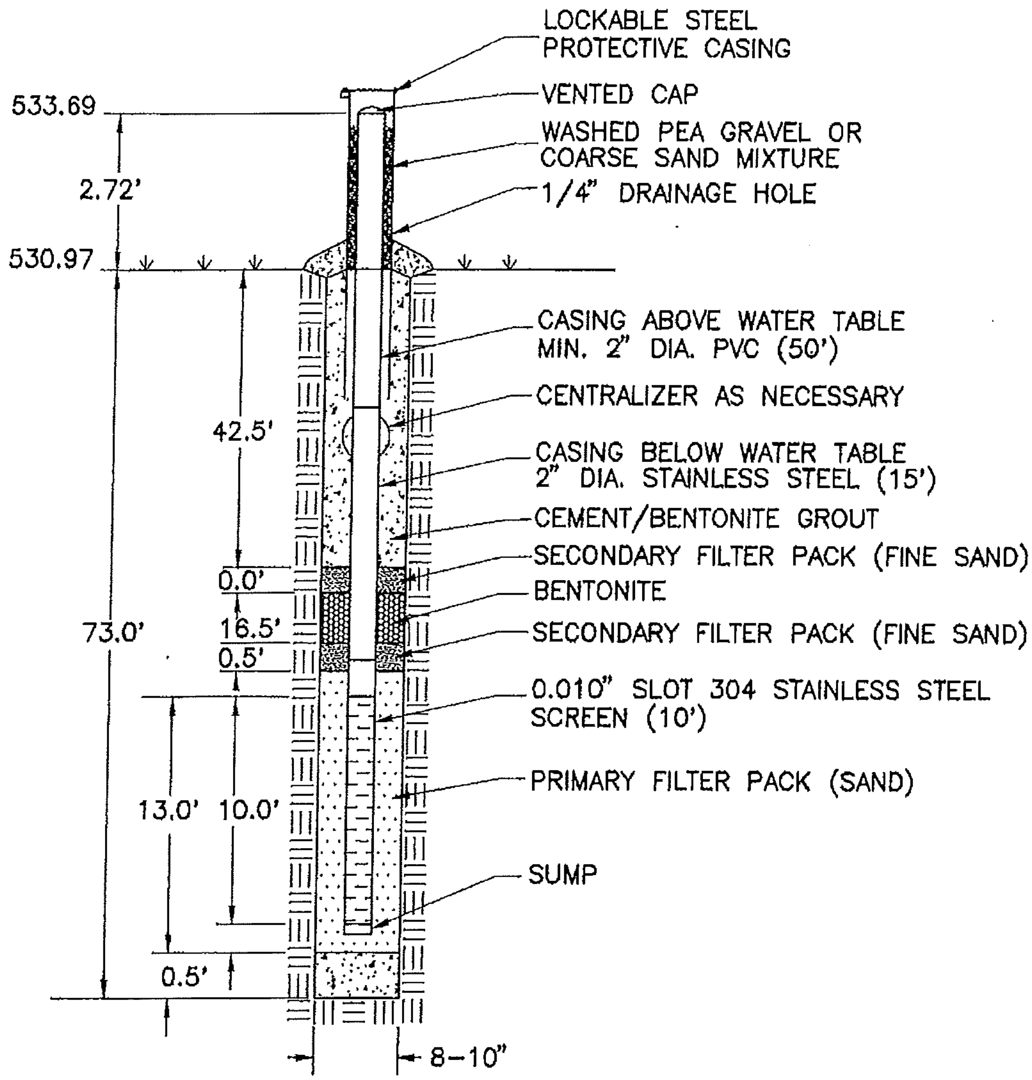
G202
MONITORING WELL AS-BUILT DIAGRAM

CIPS-NEWTON LANDFILL
JASPER COUNTY, ILLINOIS



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RAPPS ENGINEERING & APPLIED SCIENCE 821 S. DURKIN DR. • SPRINGFIELD, IL 62704 • (217) 787-2118 1601 BROADWAY • MT. VERNON, IL 62864 • (618) 244-2611	**G203** **MONITORING WELL AS-BUILT DIAGRAM** CIPS-NEWTON LANDFILL JASPER COUNTY, LANDFILL

Illinois Environmental Protection Agency — **Well Completion Report**

Site Number: 0798085001 County: Jasper

Site Name: Newton Power Station Landfill Phase II — Well #: G208

State Plane Coordinate: X ____ Y ____ (or) Latitude: ___° ___' ___" Longitude: ___° ___' ___" — Borehole #: B208

Plant Coordinates: Northing 6208.18 Easting 4417.18

Surveyed by: Ken Miller — IL Registration #: 196-001263

Drilling Contractor: Skinner Ltd. — Driller: Todd Skinner

Consulting Firm: Rapps Engineering — Geologist: Ken Miller

Drilling Method: HSA — Drilling Fluid (Type): None

Logged By: Ken Miller — Date Started: 10/11/11 Date Finished: 10/13/11

Report Form Completed By: Ken Miller — Date: 11/30/11

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: Bentonite Slurry

Installation Method: Tremi

Setting Time: ____

Type of Bentonite Seal -- Granular, (Pellet), Slurry (Choose One)

Installation Method: Poured

Setting Time: ____

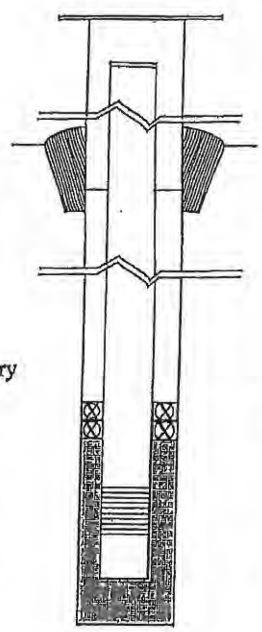
Type of Sand Pack: Silica Sand

Grain Size: 20/40 (Sieve Size)

Installation Method: Poured

Type of Backfill Material: NA (if applicable)

Installation Method: ____



Elevations (MSL)*	Depths (BGS)	(.01ft.)
535.89	-2.83	Top of Protective Casing
535.52	-2.46	Top of Riser Pipe
533.06	0.00	Ground Surface
530.06	3.00	Top of Annular Sealant
____	____	Static Water Level (After Completion)
463.13	69.93	Top of Seal
460.13	72.93	Top of Sand Pack
458.13	74.93	Top of Screen
438.35	94.71	Bottom of Screen
438.29	94.77	Bottom of Well
438.06	95.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIAL

(Choose one type of material for each area)

Protective Casing	SS304, SS316, PTFE, PVC, or (Other)
Riser Pipe Above W.T.	SS304, SS316, PTFE, (PVC) or Other
Riser Pipe Below W.T.	(SS304) SS316, PTFE, PVC, or Other
Screen	(SS304) SS316, PTFE, PVC, or Other

CASING MEASURMENTS

Diameter of Borehole (inches)	9
ID of Riser Pipe (inches)	2
Protective Casing Length (feet)	5
Riser Pipe Length (feet)	77.39
Bottom of Screen to End Cap (feet)	0.06
Screen Length (1st slot to last slot) (feet)	19.78
Total Length of Casing (feet)	97.23
Screen Slot Size **	0.010

**Hand-Slotted Well Screens are Unacceptable

Well Completion Form (revised 02/06/02)

Illinois Environmental Protection Agency — Well Completion Report

Site #: 0798085001 County: Jasper Well #: R217D

Site Name: Newton Power Station Borehole #: R217D

~~State~~ Plant ~~Plane~~ Coordinate: X 6,712.2 Y 7,126.9 (or) Latitude: 38° 55' 55.889" Longitude: -88° 17' 24.426"

Surveyed By: Matthew H. Schrader IL Registration #: 035-003487

Drilling Contractor: Bulldog Drilling Driller: J. Dittmaier

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: Mud Rotary Drilling Fluid (Type): Bentonite mud

Logged By: Rhonald W. Hasenyager Date Started: 9/25/2017 Date Finished: 9/26/2017

Report Form Completed By: Suzanna L. Keim Date: 10/16/2017

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: high-solids bentonite

Installation Method: Tremie

Setting Time: +24 hours

Type of Bentonite Seal -- (Granular) Pellet Slurry (choose one)

Installation Method: Gravity

Setting Time: 10 minutes

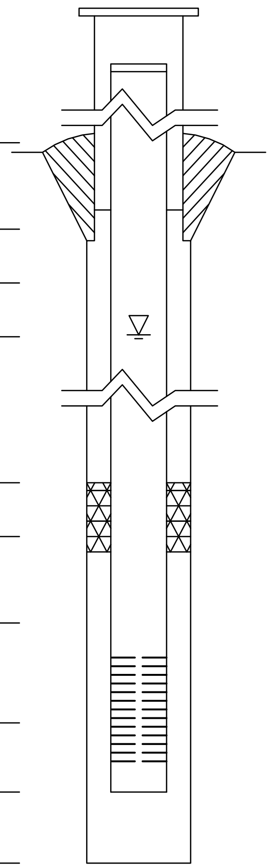
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: none (if applicable)

Installation Method:



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
538.85	-2.94	Top of Protective Casing
538.55	-2.64	Top of Riser Pipe
535.91	0.00	Ground Surface
533.41	2.50	Top of Annular Sealant
		Static Water Level (After Completion)
479.39	56.52	Top of Seal
478.01	57.90	Top of Sand Pack
475.81	60.10	Top of Screen
470.88	65.03	Bottom of Screen
470.67	65.24	Bottom of Well
470.67	65.24	Bottom of Borehole

* Referenced to a National Geodetic Datum

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	62.64
Bottom of Screen to End Cap	(feet)	0.31
Screen Length (1st slot to last slot)	(feet)	4.93
Total Length of Casing	(feet)	67.88
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

WELL CONSTRUCTION MATERIALS
(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: (Steel)
Riser Pipe Above W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Screen	SS304	SS316	PTFE	(PVC)	OTHER:

Illinois Environmental Protection Agency | **Well Completion Report**

Site Number: 0798085001 County: Jasper

Site Name: Newton Power Station Landfill Phase II Well #: G220

State Plane Coordinate: X ____ Y ____ (or) Latitude: ___° ___' ___" Longitude: ___° ___' ___" Borehole #: B220

Plant Coordinates: Northing 5765.30 Easting 4036.52

Surveyed by: Ken Miller IL Registration #: 196-001263

Drilling Contractor: Skinner Ltd. Driller: Todd Skinner

Consulting Firm: Rapps Engineering Geologist: Ken Miller

Drilling Method: HSA Drilling Fluid (Type): None

Logged By: Ken Miller Date Started: 10/14/11 Date Finished: 10/17/11

Report Form Completed By: Ken Miller Date: 11/30/11

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: Bentonite Slurry

Installation Method: Tremi

Setting Time: ____

Type of Bentonite Seal - - Granular, Pellet (circled), Slurry (Choose One)

Installation Method: Poured

Setting Time: ____

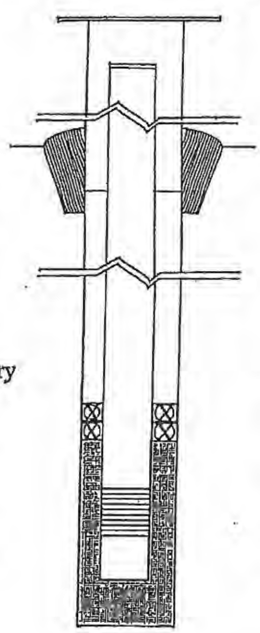
Type of Sand Pack: Quartz Sand

Grain Size: 20/40 (Sieve Size)

Installation Method: Poured

Type of Backfill Material: NA (if applicable)

Installation Method: ____



Elevations (MSL)*	Depths (BGS)	(.01ft.)
535.52	-3.06	Top of Protective Casing
535.16	-2.70	Top of Riser Pipe
532.46	0.00	Ground Surface
529.46	3.00	Top of Annular Sealant
____	____	Static Water Level (After Completion)
461.31	71.15	Top of Seal
458.31	74.15	Top of Sand Pack
456.09	76.37	Top of Screen
446.41	86.05	Bottom of Screen
446.35	86.11	Bottom of Well
445.46	87.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIAL

(Choose one type of material for each area)

Protective Casing	SS304, SS316, PTFE, PVC, or Other (Other circled)
Riser Pipe Above W.T.	SS304, SS316, PTFE, PVC, or Other (PVC circled)
Riser Pipe Below W.T.	SS304, SS316, PTFE, PVC, or Other (SS304 circled)
Screen	SS304, SS316, PTFE, PVC, or Other (SS304 circled)

CASING MEASURMENTS

Diameter of Borehole (inches)	9
ID of Riser Pipe (inches)	2
Protective Casing Length (feet)	5
Riser Pipe Length (feet)	79.07
Bottom of Screen to End Cap (feet)	0.06
Screen Length (1st slot to last slot) (feet)	9.68
Total Length of Casing (feet)	88.81
Screen Slot Size **	0.010

**Hand-Slotted Well Screens are Unacceptable

Illinois Environmental Protection Agency **Well Completion Report**

Site Number: 0798085001 County: Jasper

Well #: G222

Site Name: Newton Power Station Landfill Phase II

Borehole #: B222

State Plane Coordinate: X ____ Y ____ (or) Latitude: ° ' " Longitude: ° ' "

Plant Coordinates: Northing 5322.24 Easting 3989.08

Surveyed by: Ken Miller IL Registration #: 196-001263

Drilling Contractor: Skinner Ltd. Driller: Todd Skinner

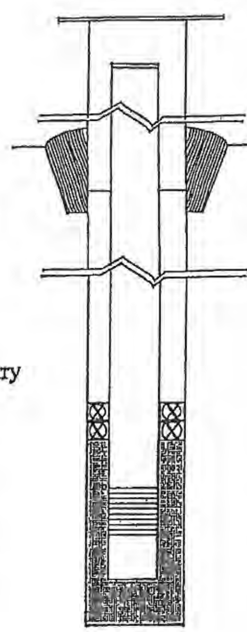
Consulting Firm: Rapps Engineering Geologist: Ken Miller

Drilling Method: HSA Drilling Fluid (Type): None

Logged By: Ken Miller Date Started: 10/24/11 Date Finished: 10/25/11

Report Form Completed By: Ken Miller Date: 11/30/11

ANNULAR SPACE DETAILS



Elevations (MSL)*	Depths (BGS)	(.01ft.)
535.16	-3.04	Top of Protective Casing
534.78	-2.66	Top of Riser Pipe
532.12	0.00	Ground Surface
529.12	3.00	Top of Annular Sealant
		Static Water Level (After Completion)
472.55	59.57	Top of Seal
469.55	62.57	Top of Sand Pack
467.55	64.57	Top of Screen
452.88	79.24	Bottom of Screen
452.81	79.31	Bottom of Well
452.12	80.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

Type of Surface Seal: Concrete

Type of Annular Sealant: Bentonite Slurry

Installation Method: Tremi

Setting Time: ____

Type of Bentonite Seal - - Granular, (Pellet), Slurry (Choose One)

Installation Method: Poured

Setting Time: ____

Type of Sand Pack: Silica Sand

Grain Size: 20/40 (Sieve Size)

Installation Method: Poured

Type of Backfill Material: NA (if applicable)

Installation Method: ____

CASING MEASURMENTS

Diameter of Borehole (inches)	9
ID of Riser Pipe (inches)	2
Protective Casing Length (feet)	5
Riser Pipe Length (feet)	67.27
Bottom of Screen to End Cap (feet)	0.07
Screen Length (1st slot to last slot) (feet)	14.63
Total Length of Casing (feet)	81.97
Screen Slot Size **	0.010

**Hand-Slotted Well Screens are Unacceptable

WELL CONSTRUCTION MATERIAL

(Choose one type of material for each area)

Protective Casing	SS304, SS316, PTFE, PVC, or (Other)
Riser Pipe Above W.T.	SS304, SS316, PTFE, (PVC), or Other
Riser Pipe Below W.T.	(SS304), SS316, PTFE, PVC, or Other
Screen	(SS304), SS316, PTFE, PVC, or Other

Illinois Environmental Protection Agency **Well Completion Report**

Site Number: 0798085001 County: Jasper

Well #: G223

Site Name: Newton Power Station Landfill Phase II

Borehole #: B223

State Plane Coordinate: X ____ Y ____ (or) Latitude: ____° ____' ____" Longitude: ____° ____' ____"

Plant Coordinates: Northing 6393.02 Easting 5763.68

Surveyed by: Ken Miller | IL Registration #: 196-001263

Drilling Contractor: Skinner Ltd. | Driller: Todd Skinner

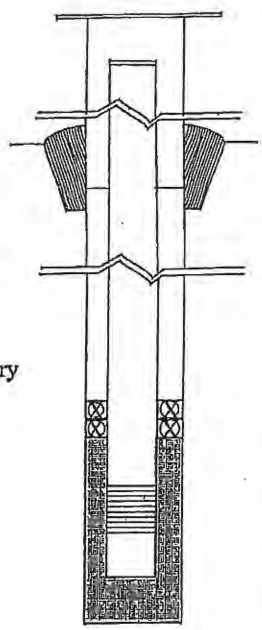
Consulting Firm: Rapps Engineering | Geologist: Ken Miller

Drilling Method: HSA | Drilling Fluid (Type): None

Logged By: Ken Miller | Date Started: 10/10/11 Date Finished: 10/11/11

Report Form Completed By: Ken Miller | Date: 11/30/11

ANNULAR SPACE DETAILS



Elevations (MSL)*	Depths (BGS)	(.01ft.)
534.54	-3.02	Top of Protective Casing
534.16	-2.64	Top of Riser Pipe
531.52	0.00	Ground Surface
528.52	3.00	Top of Annular Sealant
____	____	Static Water Level (After Completion)
457.52	74.00	Top of Seal
454.52	77.00	Top of Sand Pack
452.43	79.09	Top of Screen
442.77	88.75	Bottom of Screen
442.43	89.09	Bottom of Well
442.43	89.09	Bottom of Borehole

* Referenced to a National Geodetic Datum

Type of Surface Seal: Concrete

Type of Annular Sealant: Bentonite Slurry

Installation Method: Tremi

Setting Time: ____

Type of Bentonite Seal - - Granular, Pellet, Slurry (Choose One) [Pellet circled]

Installation Method: Poured

Setting Time: ____

Type of Sand Pack: Silica Sand

Grain Size: 20/40 (Sieve Size)

Installation Method: Poured

Type of Backfill Material: NA (if applicable)

Installation Method: ____

WELL CONSTRUCTION MATERIAL

(Choose one type of material for each area)

Protective Casing	SS304, SS316, PTFE, PVC, or Other [Other circled]
Riser Pipe Above W.T.	SS304, SS316, PTFE, PVC, or Other [PVC circled]
Riser Pipe Below W.T.	SS304, SS316, PTFE, PVC, or Other [SS304 circled]
Screen	SS304, SS316, PTFE, PVC, or Other [SS304 circled]

CASING MEASURMENTS

Diameter of Borehole (inches)	9
ID of Riser Pipe (inches)	2
Protective Casing Length (feet)	5
Riser Pipe Length (feet)	81.73
Bottom of Screen to End Cap (feet)	0.34
Screen Length (1st slot to last slot) (feet)	9.66
Total Length of Casing (feet)	91.73
Screen Slot Size **	0.010

**Hand-Slotted Well Screens are Unacceptable

Illinois Environmental Protection Agency — **Well Completion Report**

Site Number: 0798085001 County: Jasper

Well #: G224

Site Name: Newton Power Station Landfill Phase II

Borehole #: B224

State Plane Coordinate: X ____ Y ____ (or) Latitude: __° __' __" Longitude: __° __' __"

Plant Coordinates: Northing 6976.66 Easting 6067.30

Surveyed by: Ken Miller | IL Registration #: 196-001263

Drilling Contractor: Whitney & Associates | Driller: Tim Fuhl

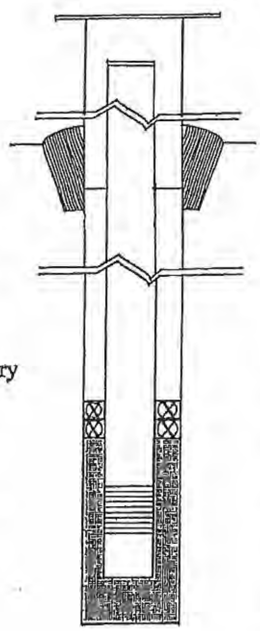
Consulting Firm: Rapps Engineering | Geologist: Ken Miller

Drilling Method: HSA | Drilling Fluid (Type): None

Logged By: Ken Miller | Date Started: 10/4/11 Date Finished: 10/5/11

Report Form Completed By: Ken Miller | Date: 11/30/11

ANNULAR SPACE DETAILS



	Elevations (MSL)*	Depths (BGS)	(.01ft.)
	535.19	-2.93	Top of Protective Casing
	534.78	-2.52	Top of Riser Pipe
Type of Surface Seal: Concrete	532.26	0.00	Ground Surface
Type of Annular Sealant: Bentonite Chips	529.26	3.00	Top of Annular Sealant
Installation Method: Poured			Static Water Level (After Completion)
Setting Time:			
Type of Bentonite Seal -- Granular, Pellet, Slurry (Choose One) [Pellet circled]	473.75	58.51	Top of Seal
Installation Method: Poured	470.75	61.51	Top of Sand Pack
Setting Time:	468.75	63.51	Top of Screen
Type of Sand Pack: Silica Sand	459.09	73.17	Bottom of Screen
Grain Size: 50 (Sieve Size)	458.75	73.51	Bottom of Well
Installation Method: Poured	458.26	74.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

Type of Backfill Material: NA (if applicable)

Installation Method:

WELL CONSTRUCTION MATERIAL

(Choose one type of material for each area)

Protective Casing	SS304, SS316, PTFE, PVC, or Other [Other circled]
Riser Pipe Above W.T.	SS304, SS316, PTFE, PVC, or Other [PVC circled]
Riser Pipe Below W.T.	SS304, SS316, PTFE, PVC, or Other [SS304 circled]
Screen	SS304, SS316, PTFE, PVC, or Other [SS304 circled]

CASING MEASURMENTS

Diameter of Borehole (inches)	9
ID of Riser Pipe (inches)	2
Protective Casing Length (feet)	5
Riser Pipe Length (feet)	66.03
Bottom of Screen to End Cap (feet)	0.34
Screen Length (1st slot to last slot) (feet)	9.66
Total Length of Casing (feet)	76.03
Screen Slot Size **	0.010

**Hand-Slotted Well Screens are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: ____ County: Jasper County Well #: G06D

Site Name: Newton Energy Center Borehole #: G06D

~~State~~ ~~Plane~~ Plant Coordinate: X 4,926.0 Y 5,328.8 (or) Latitude: 38° 55' 38.040" Longitude: -88° 17' 46.980"

Surveyed By: Michael J. Graminski IL Registration #: 035-002901

Drilling Contractor: Bulldog Drilling, Inc. Driller: J. Gates

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: Hollow Stem Auger Drilling Fluid (Type): Water

Logged By: Rhonald W. Hasenyager Date Started: 11/9/2015 Date Finished: 11/10/2015

Report Form Completed By: Suzanna L. Keim Date: 11/16/2015

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: >48 hours

Type of Bentonite Seal -- Granular **(Pellet)** Slurry (choose one)

Installation Method: Gravity

Setting Time: 45 minutes

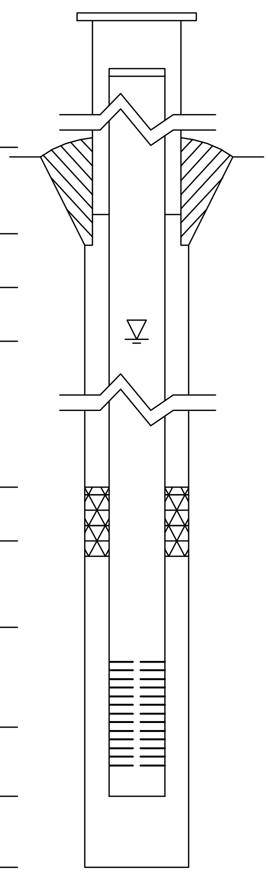
Type of Sand Pack: Quartz Sand

Grain Size: 10-20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: Quartz Sand (if applicable)

Installation Method: gravity



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
532.59	-2.90	Top of Protective Casing
532.18	-2.49	Top of Riser Pipe
529.69	0.00	Ground Surface
527.69	2.00	Top of Annular Sealant
439.57	90.12	Static Water Level (After Completion) 12/16/2016
459.39	70.30	Top of Seal
457.58	72.11	Top of Sand Pack
455.46	74.23	Top of Screen
435.80	93.89	Bottom of Screen
435.36	94.33	Bottom of Well
433.69	96.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	76.72
Bottom of Screen to End Cap	(feet)	0.44
Screen Length (1st slot to last slot)	(feet)	19.66
Total Length of Casing	(feet)	96.82
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: **(Steel)**
Riser Pipe Above W.T.	SS304	SS316	PTFE	**(PVC)**	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	**(PVC)**	OTHER:
Screen	SS304	SS316	PTFE	**(PVC)**	OTHER:

Illinois Environmental Protection Agency

Well Completion Report

Site #: ______ County: Jasper Well #: G201

Site Name: Newton Power Station Landfill Grid Coordinate: Northing 8947.43 Easting 5499.92

Drilling Contractor: Professional Service Industries, Inc. Date Drilled Start: 10/08/96

Driller: ______ Geologist: Mike Summers Date Completed: 10/10/96

Drilling Method: 4¼" I.D. HSA Drilling Fluids (type): N/A

Annular Space Details

Type of Surface Seal: Portland Cement

Type of Annular Sealant: Cement/Bentonite Grout (20:1)

Amount of cement: # of bags 12 lbs. per bag 94

Amount of bentonite: # of bags 1 lbs. per bag 50

Type of Bentonite Seal (Granular, Pellet): Pellet

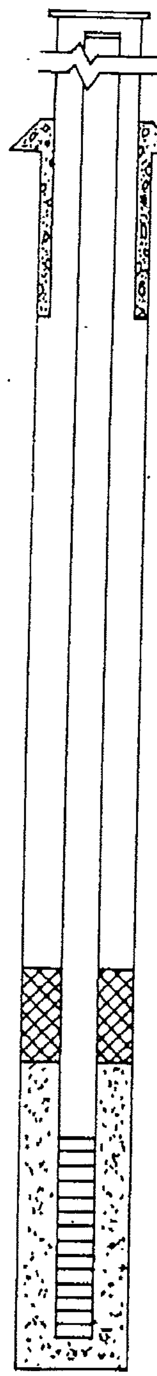
Amount of bentonite: # of Bags 3.5 lbs. per bag 50

Type of Sand Pack: Silica

Source of Sand: ______

Amount of Sand: # of bags 5 lbs. per bag 100

Elevations — .01 ft.



544	97	MSL Top of Protective Casing
		MSL Top of Riser Pipe
2	52	ft. Casing Stickup
542	45	MSL Ground Surface
		ft. Top of annular sealant
492	95	ft. Top of Seal
5	50	ft. Total Seal Interval
487	45	ft. Top of Sand
485	45	ft. Top of Screen
10	00	ft. Total Screen Interval
475	45	ft. Bottom of Screen
473	45	ft. Bottom of Borehole

Well Construction Materials

	Stainless Steel Specify Type	Teflon Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint				
Riser pipe above w.t.			Sch 40	
Riser pipe below w.t.	Type304			
Screen	Type304			
Coupling joint screen to riser				
Protective casing				Steel

Measurements

to .01 ft. (where applicable)

Riser pipe length	59.52 ft.
Protective casing length	
Screen length	10.00 ft.
Bottom of screen to end cap	
Top of screen to first joint	
Total length of casing	
Screen slot size	.010 in.
% of openings in screen	
Diameter of borehole (in)	8
ID of riser pipe (in)	2

Completed by: ______ Surveyed by: ______ Ill. registration #: ______

Illinois Environmental Protection Agency

Well Completion Report

Site #: ____ County: Jasper Well #: G202

Site Name: Newton Power Station Landfill Grid Coordinate: Northing 6649.68 Easting 6587.20

Drilling Contractor: Professional Service Industries, Inc. Date Drilled Start: 10/16/96

Driller: ____ Geologist: Mike Summers Date Completed: 10/16/96

Drilling Method: 4¼" I.D. HSA Drilling Fluids (type): N/A

Annular Space Details

Type of Surface Seal: Portland Cement

Type of Annular Sealant: Cement/Bentonite Grout (20:1)

Amount of cement: # of bags 14 lbs. per bag 94

Amount of bentonite: # of bags 1.5 lbs. per bag 50

Type of Bentonite Seal (Granular, Pellet): Pellet

Amount of bentonite: # of Bags 1 lbs. per bag 50

Type of Sand Pack: Silica

Source of Sand: ____

Amount of Sand: # of bags 12.5 lbs. per bag 100

Well Construction Materials

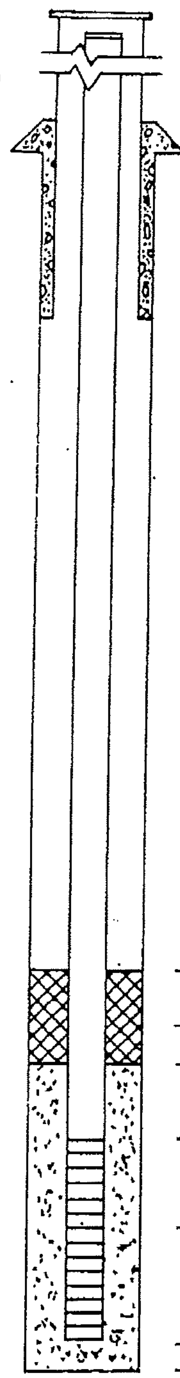
	Stainless Steel Specify Type	Teflon Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint				
Riser pipe above w.t.				
Riser pipe below w.t.				
Screen				
Coupling joint screen to riser				
Protective casing				

Measurements

to .01 ft. (where applicable)

Riser pipe length	66.78 ft.
Protective casing length	
Screen length	10.0 ft.
Bottom of screen to end cap	
Top of screen to first joint	
Total length of casing	
Screen slot size	.010 in.
% of openings in screen	
Diameter of borehole (in)	8
ID of riser pipe (in)	2

Elevations — .01 ft.



		MSL Top of Protective Casing
540	02	MSL Top of Riser Pipe
2	78	ft. Casing Stickup
537	24	MSL Ground Surface
		ft. Top of annular sealant
479	24	ft. Top of Seal
2	50	ft. Total Seal Interval
476	74	ft. Top of Sand
473	24	ft. Top of Screen
10	00	ft. Total Screen Interval
463	24	ft. Bottom of Screen
463	24	ft. Bottom of Borehole

Completed by: ____ Surveyed by: ____ Ill. registration #: ____

Illinois Environmental Protection Agency

Well Completion Report

Site #: ____ County: Jasper Well #: G203

Site Name: Newton Power Station Landfill Grid Coordinate: Northing 5821.29 Easting 6113.10

Drilling Contractor: Professional Service Industries, Inc. Date Drilled Start: 10/15/96

Driller: ____ Geologist: Mike Summers Date Completed: 10/15/96

Drilling Method: 4¼" I.D. HSA Drilling Fluids (type): N/A

Annular Space Details

Type of Surface Seal: Portland Cement

Type of Annular Sealant: Cement/Bentonite Grout (20:1)

Amount of cement: # of bags 10 lbs. per bag 94

Amount of bentonite: # of bags 1 lbs. per bag 50

Type of Bentonite Seal (Granular, Pellet): Pellet

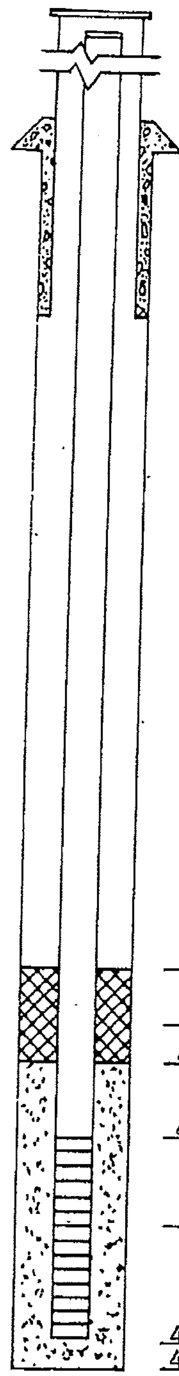
Amount of bentonite: # of Bags 8 lbs. per bag 50

Type of Sand Pack: Silica

Source of Sand: ____

Amount of Sand: # of bags 13.5 lbs. per bag 100

Elevations — .01 ft.



533	69	MSL Top of Protective Casing
		MSL Top of Riser Pipe
2	72	ft. Casing Stickup
530	97	MSL Ground Surface
		ft. Top of annular sealant
487	97	ft. Top of Seal
16	50	ft. Total Seal Interval
471	47	ft. Top of Sand
468	47	ft. Top of Screen
10	00	ft. Total Screen Interval
458	47	ft. Bottom of Screen
458	47	ft. Bottom of Borehole

Well Construction Materials

	Stainless Steel Specify Type	Teflon Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint				
Riser pipe above w.t.			Sch 40	
Riser pipe below w.t.	Type304			
Screen	Type304			
Coupling joint screen to riser				
Protective casing				Steel

Measurements

to .01 ft. (where applicable)

Riser pipe length	65.22 ft.
Protective casing length	
Screen length	10.0 ft.
Bottom of screen to end cap	
Top of screen to first joint	
Total length of casing	
Screen slot size	.010 in.
% of openings in screen	
Diameter of borehole (in)	8
ID of riser pipe (in)	2

Completed by: ____ Surveyed by: ____ Ill. registration #: ____

Illinois Environmental Protection Agency — **Well Completion Report**

Site Number: 0798085001 County: Jasper

Site Name: Newton Power Station Landfill Phase II

Well #: G208

State Plane Coordinate: X ____ Y ____ (or) Latitude: ___ ° ___ ' ___ " Longitude: ___ ° ___ ' ___ "

Borehole #: B208

Plant Coordinates: Northing 6208.18 Easting 4417.18

Surveyed by: Ken Miller

IL Registration #: 196-001263

Drilling Contractor: Skinner Ltd.

Driller: Todd Skinner

Consulting Firm: Rapps Engineering

Geologist: Ken Miller

Drilling Method: HSA

Drilling Fluid (Type): None

Logged By: Ken Miller

Date Started: 10/11/11 Date Finished: 10/13/11

Report Form Completed By: Ken Miller

Date: 11/30/11

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: Bentonite Slurry

Installation Method: Tremi

Setting Time: ____

Type of Bentonite Seal -- Granular, Pellet, Slurry (Choose One) — Pellet circled

Installation Method: Poured

Setting Time: ____

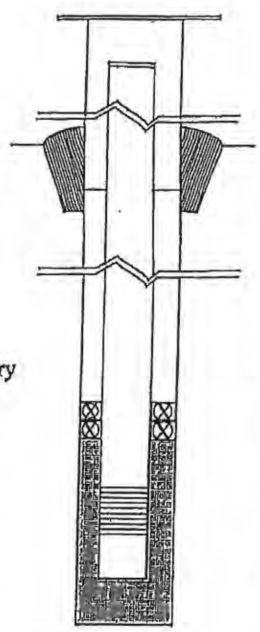
Type of Sand Pack: Silica Sand

Grain Size: 20/40 (Sieve Size)

Installation Method: Poured

Type of Backfill Material: NA (if applicable)

Installation Method: ____



Elevations (MSL)*	Depths (BGS)	(.01ft.)
535.89	-2.83	Top of Protective Casing
535.52	-2.46	Top of Riser Pipe
533.06	0.00	Ground Surface
530.06	3.00	Top of Annular Sealant
____	____	Static Water Level (After Completion)
463.13	69.93	Top of Seal
460.13	72.93	Top of Sand Pack
458.13	74.93	Top of Screen
438.35	94.71	Bottom of Screen
438.29	94.77	Bottom of Well
438.06	95.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIAL

(Choose one type of material for each area)

Protective Casing	SS304, SS316, PTFE, PVC, or Other (Other circled)
Riser Pipe Above W.T.	SS304, SS316, PTFE, PVC or Other (PVC circled)
Riser Pipe Below W.T.	SS304, SS316, PTFE, PVC, or Other (SS304 circled)
Screen	SS304, SS316, PTFE, PVC, or Other (SS304 circled)

CASING MEASURMENTS

Diameter of Borehole (inches)	9
ID of Riser Pipe (inches)	2
Protective Casing Length (feet)	5
Riser Pipe Length (feet)	77.39
Bottom of Screen to End Cap (feet)	0.06
Screen Length (1st slot to last slot) (feet)	19.78
Total Length of Casing (feet)	97.23
Screen Slot Size **	0.010

**Hand-Slotted Well Screens are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: 0798085001 County: Jasper Well #: R217D

Site Name: Newton Power Station Borehole #: R217D

~~State-~~ Plant ~~Plane~~ Coordinate: X 6,712.2 Y 7,126.9 (or) Latitude: 38° 55' 55.889" Longitude: -88° 17' 24.426"

Surveyed By: Matthew H. Schrader IL Registration #: 035-003487

Drilling Contractor: Bulldog Drilling Driller: J. Dittmaier

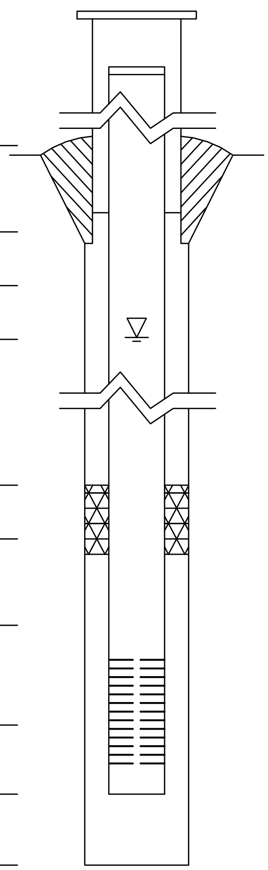
Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: Mud Rotary Drilling Fluid (Type): Bentonite mud

Logged By: Rhonald W. Hasenyager Date Started: 9/25/2017 Date Finished: 9/26/2017

Report Form Completed By: Suzanna L. Keim Date: 10/16/2017

ANNULAR SPACE DETAILS



Type of Surface Seal: Concrete

Type of Annular Sealant: high-solids bentonite

Installation Method: Tremie

Setting Time: +24 hours

Type of Bentonite Seal -- (Granular) Pellet Slurry (choose one)

Installation Method: Gravity

Setting Time: 10 minutes

Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: none (if applicable)

Installation Method:

Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
538.85	-2.94	Top of Protective Casing
538.55	-2.64	Top of Riser Pipe
535.91	0.00	Ground Surface
533.41	2.50	Top of Annular Sealant
		Static Water Level (After Completion)
479.39	56.52	Top of Seal
478.01	57.90	Top of Sand Pack
475.81	60.10	Top of Screen
470.88	65.03	Bottom of Screen
470.67	65.24	Bottom of Well
470.67	65.24	Bottom of Borehole

* Referenced to a National Geodetic Datum

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	62.64
Bottom of Screen to End Cap	(feet)	0.31
Screen Length (1st slot to last slot)	(feet)	4.93
Total Length of Casing	(feet)	67.88
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: (Steel)
Riser Pipe Above W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Screen	SS304	SS316	PTFE	(PVC)	OTHER:

Illinois Environmental Protection Agency **Well Completion Report**

Site Number: 0798085001 County: Jasper

Site Name: Newton Power Station Landfill Phase II Well #: G220

State Plane Coordinate: X ____ Y ____ (or) Latitude: ___° ___' ___" Longitude: ___° ___' ___" Borehole #: B220

Plant Coordinates: Northing 5765.30 Easting 4036.52

Surveyed by: Ken Miller IL Registration #: 196-001263

Drilling Contractor: Skinner Ltd. Driller: Todd Skinner

Consulting Firm: Rapps Engineering Geologist: Ken Miller

Drilling Method: HSA Drilling Fluid (Type): None

Logged By: Ken Miller Date Started: 10/14/11 Date Finished: 10/17/11

Report Form Completed By: Ken Miller Date: 11/30/11

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: Bentonite Slurry

Installation Method: Tremi

Setting Time: ____

Type of Bentonite Seal -- Granular, (Pellet), Slurry (Choose One)

Installation Method: Poured

Setting Time: ____

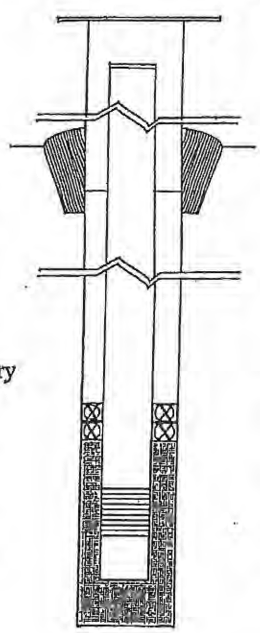
Type of Sand Pack: Quartz Sand

Grain Size: 20/40 (Sieve Size)

Installation Method: Poured

Type of Backfill Material: NA (if applicable)

Installation Method: ____



Elevations (MSL)*	Depths (BGS)	(.01ft.)
535.52	-3.06	Top of Protective Casing
535.16	-2.70	Top of Riser Pipe
532.46	0.00	Ground Surface
529.46	3.00	Top of Annular Sealant
____	____	Static Water Level (After Completion)
461.31	71.15	Top of Seal
458.31	74.15	Top of Sand Pack
456.09	76.37	Top of Screen
446.41	86.05	Bottom of Screen
446.35	86.11	Bottom of Well
445.46	87.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

CASING MEASURMENTS

Diameter of Borehole (inches)	9
ID of Riser Pipe (inches)	2
Protective Casing Length (feet)	5
Riser Pipe Length (feet)	79.07
Bottom of Screen to End Cap (feet)	0.06
Screen Length (1st slot to last slot) (feet)	9.68
Total Length of Casing (feet)	88.81
Screen Slot Size **	0.010

**Hand-Slotted Well Screens are Unacceptable

WELL CONSTRUCTION MATERIAL

(Choose one type of material for each area)

Protective Casing	SS304, SS316, PTFE, PVC, or (Other)
Riser Pipe Above W.T.	SS304, SS316, PTFE, (PVC), or Other
Riser Pipe Below W.T.	(SS304), SS316, PTFE, PVC, or Other
Screen	(SS304), SS316, PTFE, PVC, or Other

Illinois Environmental Protection Agency

Well Completion Report

Site Number: 0798085001 County: Jasper

Site Name: Newton Power Station Landfill Phase II

Well #: G222

State Plane Coordinate: X ____ Y ____ (or) Latitude: ° ' " Longitude: ° ' "

Borehole #: B222

Plant Coordinates: Northing 5322.24 Easting 3989.08

Surveyed by: Ken Miller

IL Registration #: 196-001263

Drilling Contractor: Skinner Ltd.

Driller: Todd Skinner

Consulting Firm: Rapps Engineering

Geologist: Ken Miller

Drilling Method: HSA

Drilling Fluid (Type): None

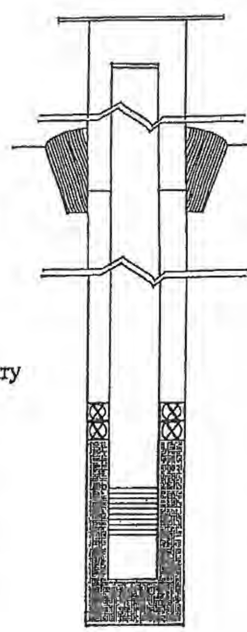
Logged By: Ken Miller

Date Started: 10/24/11 Date Finished: 10/25/11

Report Form Completed By: Ken Miller

Date: 11/30/11

ANNULAR SPACE DETAILS



Type of Surface Seal: Concrete

Type of Annular Sealant: Bentonite Slurry

Installation Method: Tremi

Setting Time: ____

Type of Bentonite Seal - - Granular, (Pellet), Slurry (Choose One)

Installation Method: Poured

Setting Time: ____

Type of Sand Pack: Silica Sand

Grain Size: 20/40 (Sieve Size)

Installation Method: Poured

Type of Backfill Material: NA (if applicable)

Installation Method: ____

Elevations (MSL)*	Depths (BGS)	(.01ft.)
535.16	-3.04	Top of Protective Casing
534.78	-2.66	Top of Riser Pipe
532.12	0.00	Ground Surface
529.12	3.00	Top of Annular Sealant
		Static Water Level (After Completion)
472.55	59.57	Top of Seal
469.55	62.57	Top of Sand Pack
467.55	64.57	Top of Screen
452.88	79.24	Bottom of Screen
452.81	79.31	Bottom of Well
452.12	80.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

CASING MEASURMENTS

Diameter of Borehole (inches)	9
ID of Riser Pipe (inches)	2
Protective Casing Length (feet)	5
Riser Pipe Length (feet)	67.27
Bottom of Screen to End Cap (feet)	0.07
Screen Length (1st slot to last slot) (feet)	14.63
Total Length of Casing (feet)	81.97
Screen Slot Size **	0.010

**Hand-Slotted Well Screens are Unacceptable

WELL CONSTRUCTION MATERIAL

(Choose one type of material for each area)

Protective Casing	SS304, SS316, PTFE, PVC, or (Other)
Riser Pipe Above W.T.	SS304, SS316, PTFE, (PVC) or Other
Riser Pipe Below W.T.	(SS304) SS316, PTFE, PVC, or Other
Screen	(SS304) SS316, PTFE, PVC, or Other

Illinois Environmental Protection Agency — **Well Completion Report**

Site Number: 0798085001 County: Jasper

Well #: G223

Site Name: Newton Power Station Landfill Phase II

State Plane Coordinate: X ____ Y ____ (or) Latitude: ___° ___' ___" Longitude: ___° ___' ___"

Borehole #: B223

Plant Coordinates: Northing 6393.02 Easting 5763.68

Surveyed by: Ken Miller IL Registration #: 196-001263

Drilling Contractor: Skinner Ltd. Driller: Todd Skinner

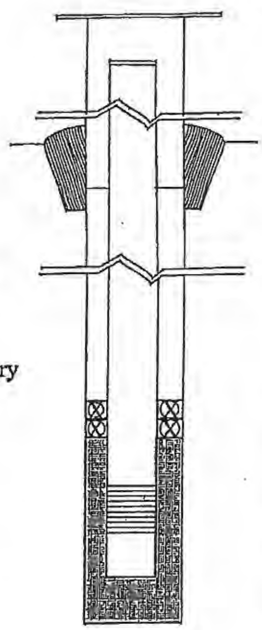
Consulting Firm: Rapps Engineering Geologist: Ken Miller

Drilling Method: HSA Drilling Fluid (Type): None

Logged By: Ken Miller Date Started: 10/10/11 Date Finished: 10/11/11

Report Form Completed By: Ken Miller Date: 11/30/11

ANNULAR SPACE DETAILS



Annular Space Details	Elevations (MSL)*	Depths (BGS)	(.01ft.)
	534.54	-3.02	Top of Protective Casing
	534.16	-2.64	Top of Riser Pipe
Type of Surface Seal: Concrete	531.52	0.00	Ground Surface
Type of Annular Sealant: Bentonite Slurry	528.52	3.00	Top of Annular Sealant
Installation Method: Tremi	____	____	Static Water Level (After Completion)
Setting Time: ____			
Type of Bentonite Seal - - Granular, Pellet (circled), Slurry (Choose One)	457.52	74.00	Top of Seal
Installation Method: Poured	454.52	77.00	Top of Sand Pack
Setting Time: ____	452.43	79.09	Top of Screen
Type of Sand Pack: Silica Sand	442.77	88.75	Bottom of Screen
Grain Size: 20/40 (Sieve Size)	442.43	89.09	Bottom of Well
Installation Method: Poured	442.43	89.09	Bottom of Borehole

* Referenced to a National Geodetic Datum

Type of Backfill Material: NA (if applicable)

Installation Method: ____

CASING MEASURMENTS

Diameter of Borehole (inches)	9
ID of Riser Pipe (inches)	2
Protective Casing Length (feet)	5
Riser Pipe Length (feet)	81.73
Bottom of Screen to End Cap (feet)	0.34
Screen Length (1[st] slot to last slot) (feet)	9.66
Total Length of Casing (feet)	91.73
Screen Slot Size **	0.010

**Hand-Slotted Well Screens are Unacceptable

WELL CONSTRUCTION MATERIAL

(Choose one type of material for each area)

Protective Casing	SS304, SS316, PTFE, PVC, or Other (circled: Other)
Riser Pipe Above W.T.	SS304, SS316, PTFE, PVC, or Other (circled: PVC)
Riser Pipe Below W.T.	SS304, SS316, PTFE, PVC, or Other (circled: SS304)
Screen	SS304, SS316, PTFE, PVC, or Other (circled: SS304)

Illinois Environmental Protection Agency — Well Completion Report

Site Number: 0798085001 County: Jasper

Well #: G224

Site Name: Newton Power Station Landfill Phase II

Borehole #: B224

State Plane Coordinate: X ____ Y ____ (or) Latitude: ___° ___' ___" Longitude: ___° ___' ___"

Plant Coordinates: Northing 6976.66 Easting 6067.30

Surveyed by: Ken Miller IL Registration #: 196-001263

Drilling Contractor: Whitney & Associates Driller: Tim Fuhl

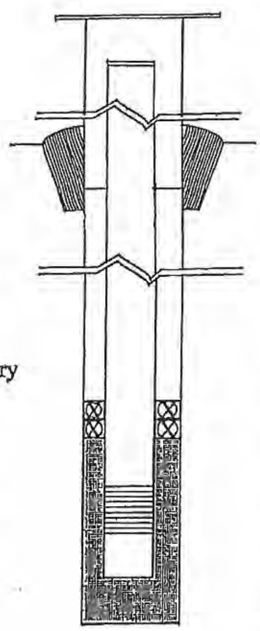
Consulting Firm: Rapps Engineering Geologist: Ken Miller

Drilling Method: HSA Drilling Fluid (Type): None

Logged By: Ken Miller Date Started: 10/4/11 Date Finished: 10/5/11

Report Form Completed By: Ken Miller Date: 11/30/11

ANNULAR SPACE DETAILS



Elevations (MSL)*	Depths (BGS)	(.01ft.)
535.19	-2.93	Top of Protective Casing
534.78	-2.52	Top of Riser Pipe
532.26	0.00	Ground Surface
529.26	3.00	Top of Annular Sealant
____	____	Static Water Level (After Completion)
473.75	58.51	Top of Seal
470.75	61.51	Top of Sand Pack
468.75	63.51	Top of Screen
459.09	73.17	Bottom of Screen
458.75	73.51	Bottom of Well
458.26	74.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

Type of Surface Seal: Concrete

Type of Annular Sealant: Bentonite Chips

Installation Method: Poured

Setting Time: ____

Type of Bentonite Seal -- Granular, **Pellet**, Slurry (Choose One)

Installation Method: Poured

Setting Time: ____

Type of Sand Pack: Silica Sand

Grain Size: 50 (Sieve Size)

Installation Method: Poured

Type of Backfill Material: NA (if applicable)

Installation Method: ____

CASING MEASURMENTS

Diameter of Borehole (inches)	9
ID of Riser Pipe (inches)	2
Protective Casing Length (feet)	5
Riser Pipe Length (feet)	66.03
Bottom of Screen to End Cap (feet)	0.34
Screen Length (1st slot to last slot) (feet)	9.66
Total Length of Casing (feet)	76.03
Screen Slot Size **	0.010

**Hand-Slotted Well Screens are Unacceptable

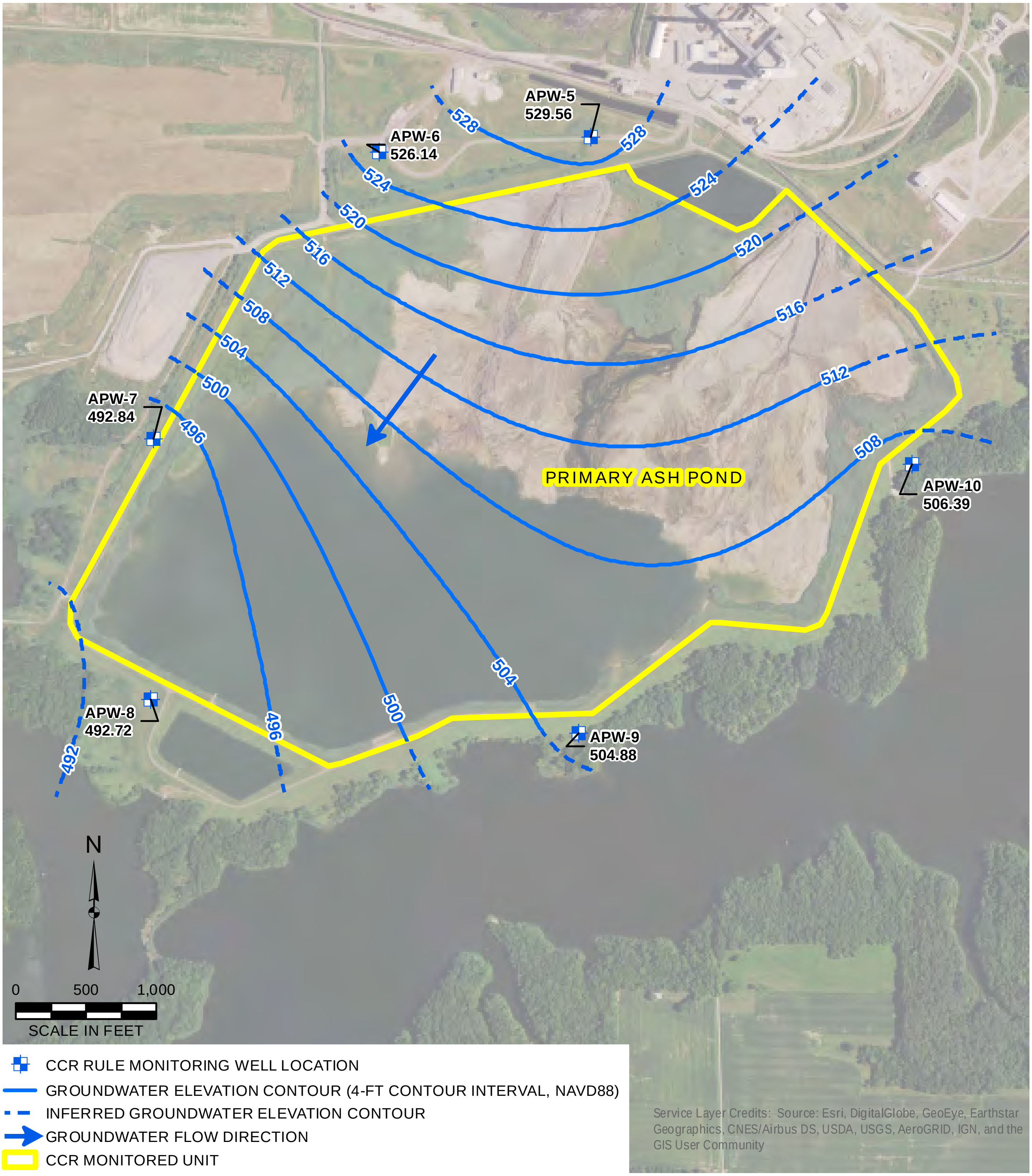
WELL CONSTRUCTION MATERIAL

(Choose one type of material for each area)

Protective Casing	SS304, SS316, PTFE, PVC, or **Other**
Riser Pipe Above W.T.	SS304, SS316, PTFE, **PVC**, or Other
Riser Pipe Below W.T.	**SS304**, SS316, PTFE, PVC, or Other
Screen	**SS304**, SS316, PTFE, PVC, or Other

Well Completion Form (revised 02/06/02)

ATTACHMENT 4 – MAPS OF THE DIRECTION OF GROUNDWATER FLOW



CCR RULE MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR (4-FT CONTOUR INTERVAL, NAVD88)

INFERRED GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW DIRECTION

CCR MONITORED UNIT

DRAWN BY/DATE:
SDS 1/23/17
REVIEWED BY/DATE:
TBN 1/25/17
APPROVED BY/DATE:
JJW 2/7/17

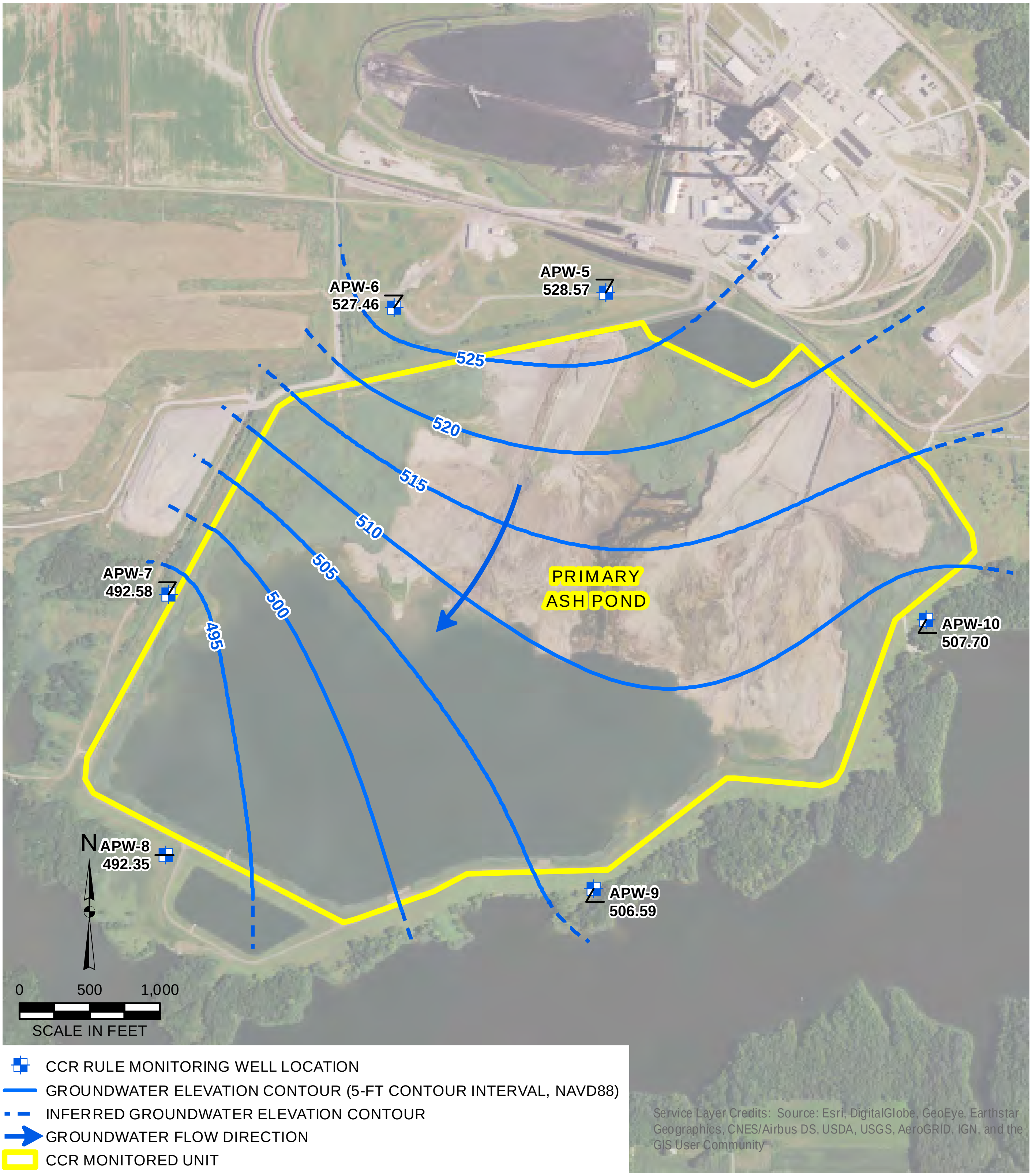
NEWTON PRIMARY ASH POND (UNIT ID: 501)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 1: DECEMBER 14, 2015

DYNEGY CCR RULE GROUNDWATER MONITORING
NEWTON POWER STATION
NEWTON, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY



NEWTON PRIMARY ASH POND (UNIT ID: 501)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 2: JANUARY 18, 2016

DYNEGY CCR RULE GROUNDWATER MONITORING
NEWTON POWER STATION
NEWTON, ILLINOIS

DRAWN BY/DATE:
SDS 1/23/17
REVIEWED BY/DATE:
TBN 1/25/17
APPROVED BY/DATE:
JJW 2/8/17

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

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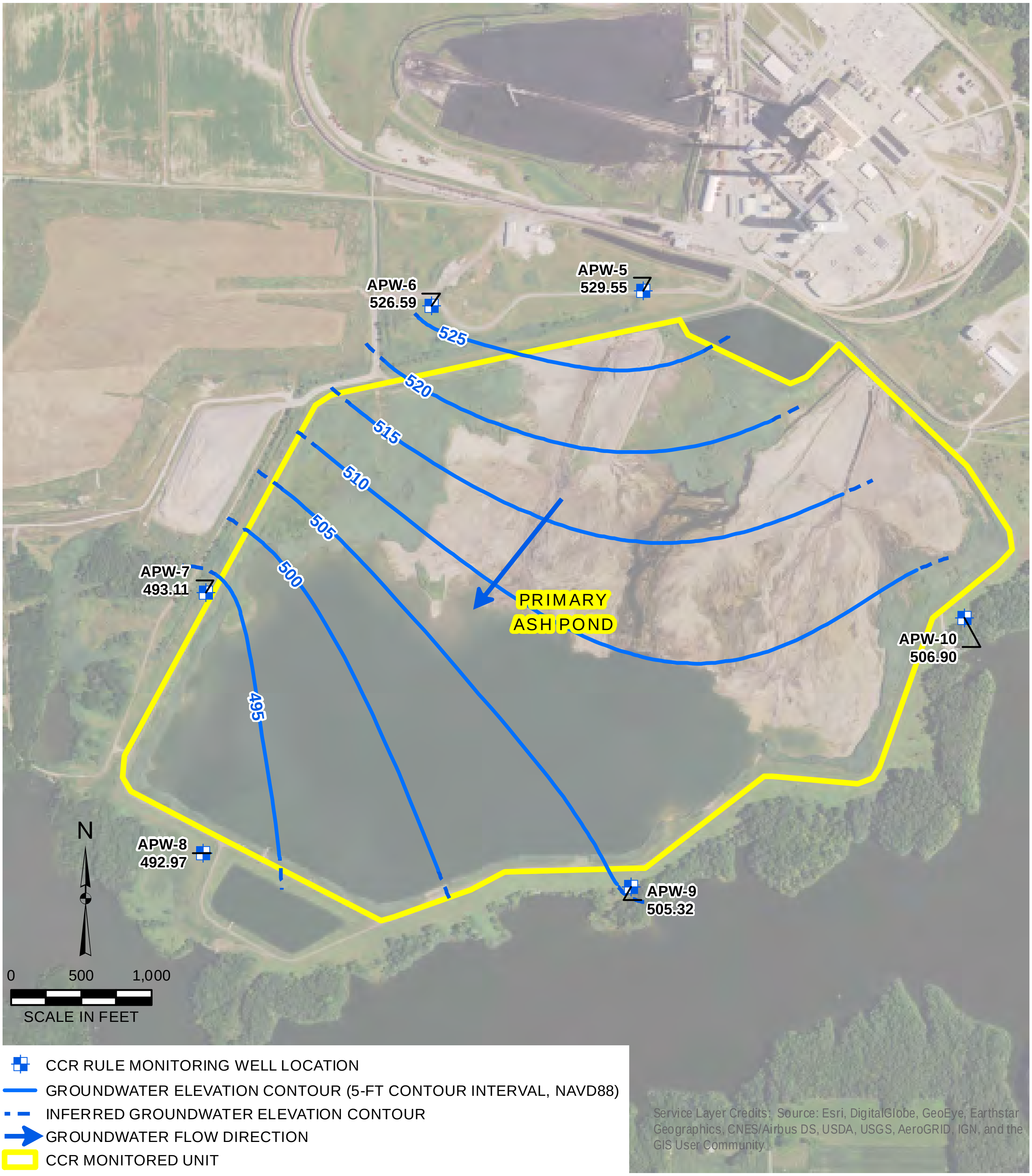


DRAWN BY/DATE:
SDS 1/23/17
REVIEWED BY/DATE:
TBN 1/25/17
APPROVED BY/DATE:
JJW 2/8/17

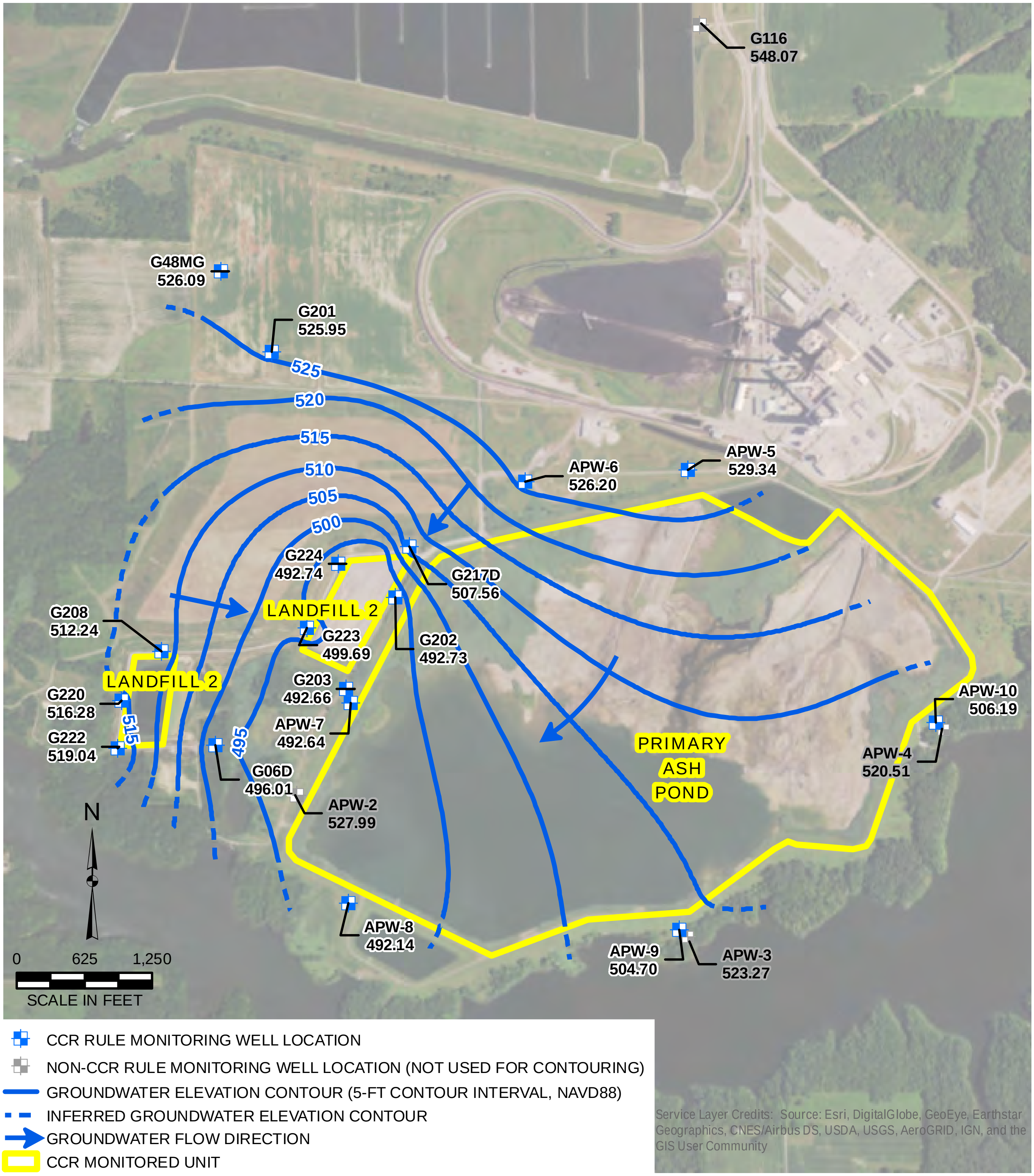
NEWTON PRIMARY ASH POND (UNIT ID: 501)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 3: APRIL 25, 2016

DYNEGY CCR RULE GROUNDWATER MONITORING
NEWTON POWER STATION
NEWTON, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY



DRAWN BY/DATE:
SDS 1/23/17
REVIEWED BY/DATE:
TBN 1/25/17
APPROVED BY/DATE:
JJW 2/8/17

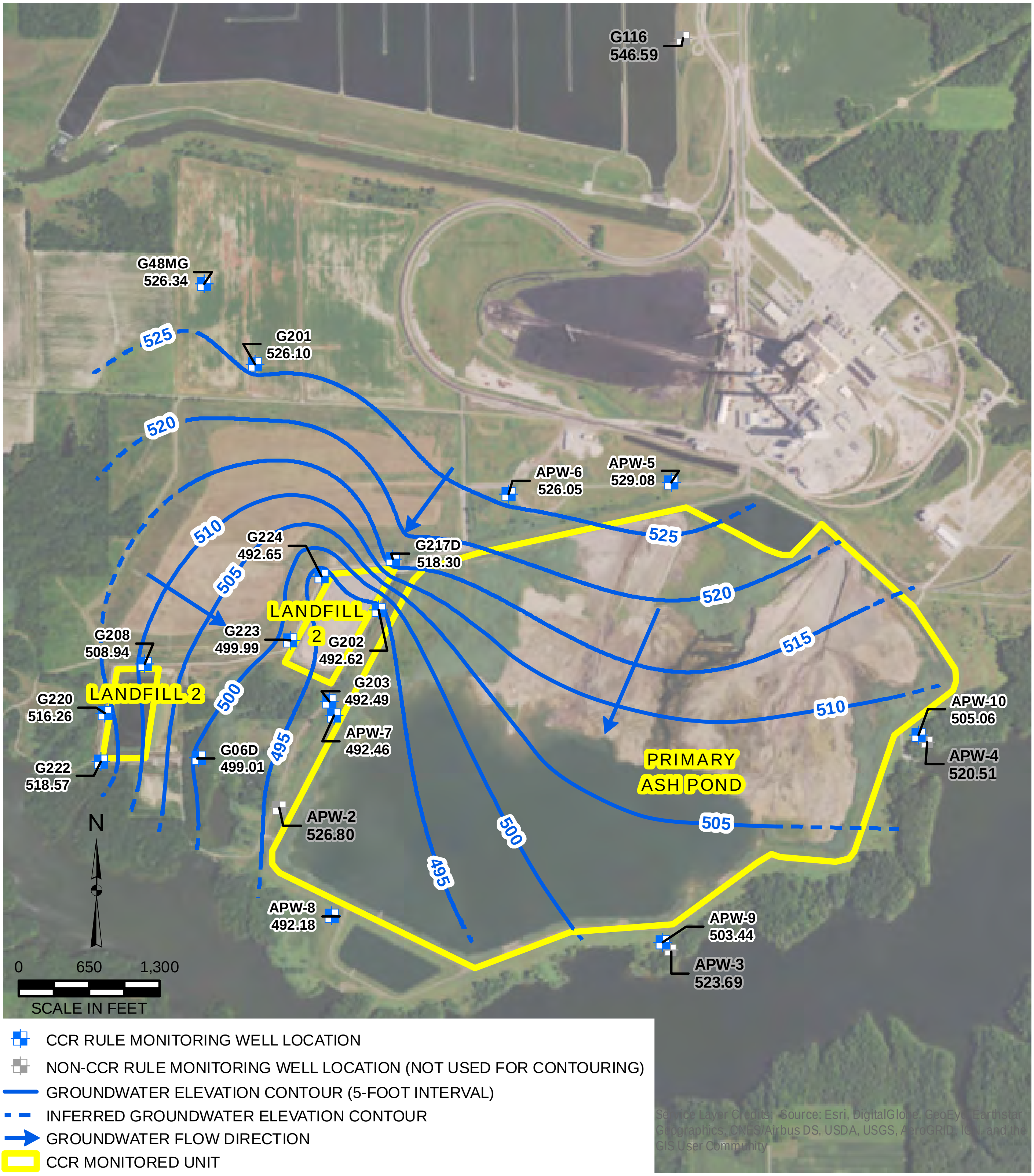
NEWTON PRIMARY ASH POND (UNIT ID: 501) AND NEWTON LANDFILL 2 (UNIT ID: 502)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 4: JULY 25, 2016

DYNEGY CCR RULE GROUNDWATER MONITORING
NEWTON POWER STATION
NEWTON, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY



DRAWN BY/DATE:
SDS 3/6/17
REVIEWED BY/DATE:
TBN 3/6/17
APPROVED BY/DATE:
JJW 8/30/17

NEWTON PRIMARY ASH POND (UNIT ID: 501) AND LANDFILL 2 (UNIT ID: 502)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 5: OCTOBER 17, 2016

DYNEGY CCR RULE GROUNDWATER MONITORING
NEWTON POWER STATION
NEWTON, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

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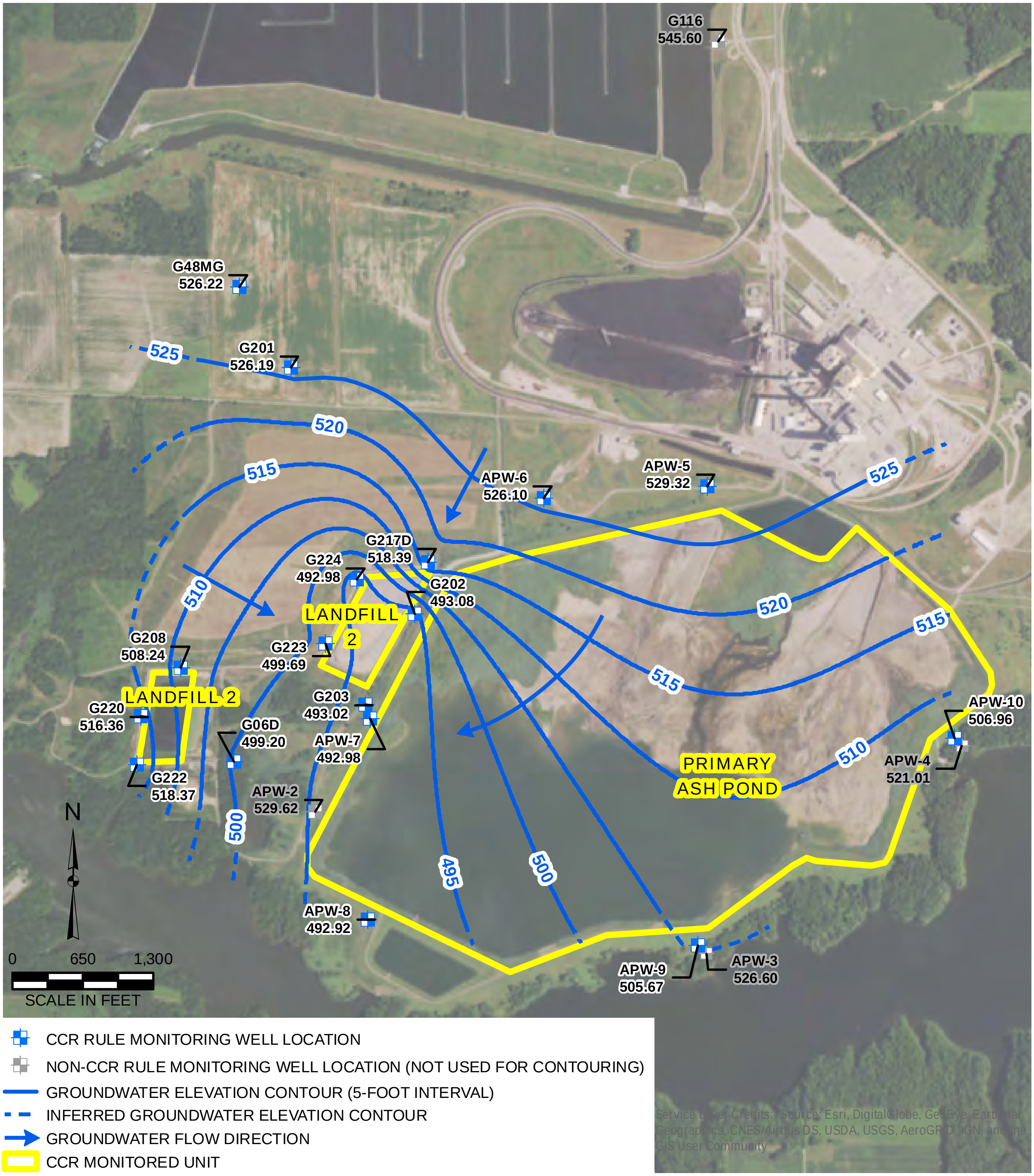

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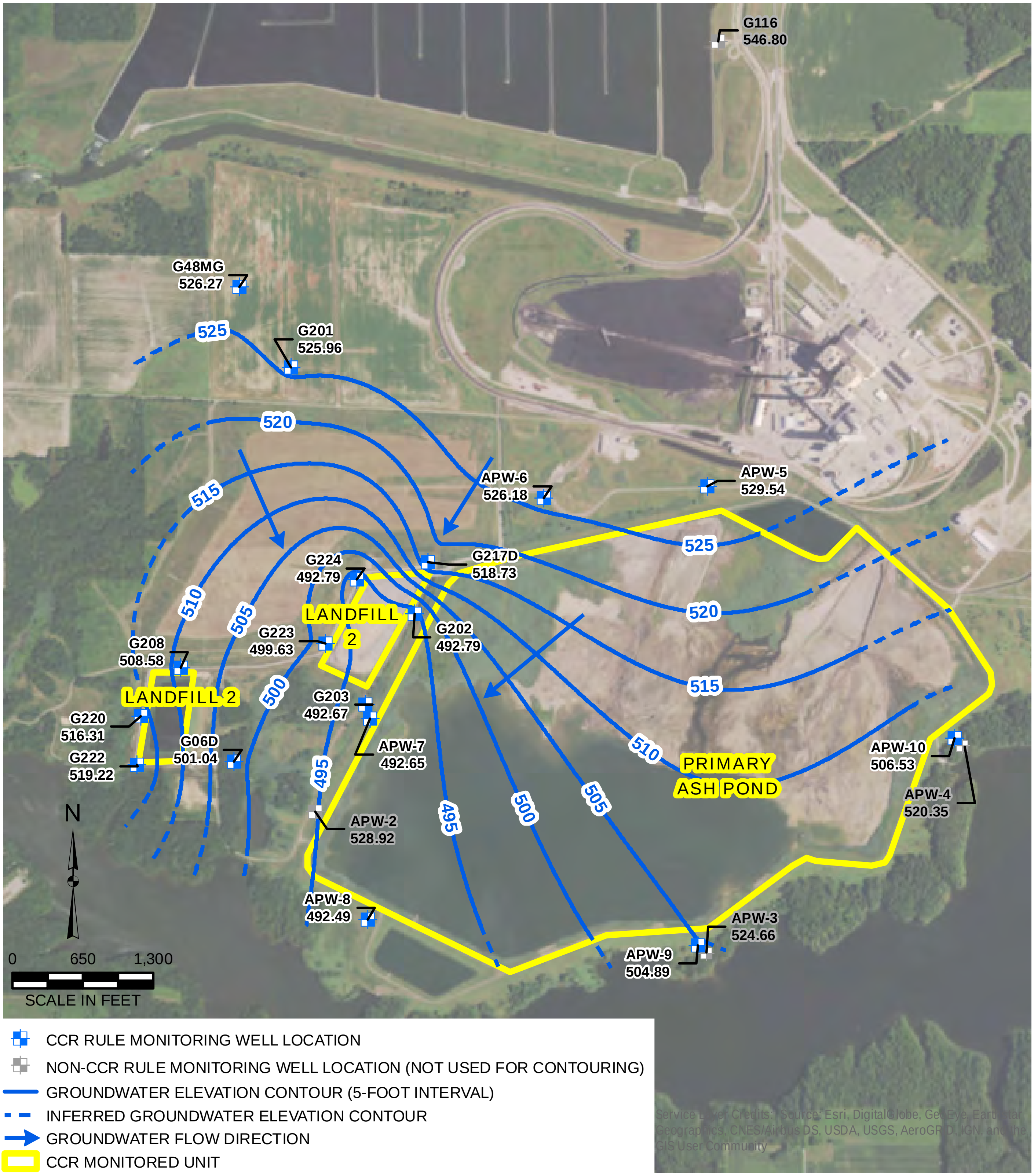
DRAWN BY/DATE:
SDS 3/6/17
REVIEWED BY/DATE:
TBN 3/6/17
APPROVED BY/DATE:
JJW 8/30/17

NEWTON PRIMARY ASH POND (UNIT ID: 501) AND LANDFILL 2 (UNIT ID: 502)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 6: JANUARY 16, 2017
DYNEGY CCR RULE GROUNDWATER MONITORING
NEWTON POWER STATION
NEWTON, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY



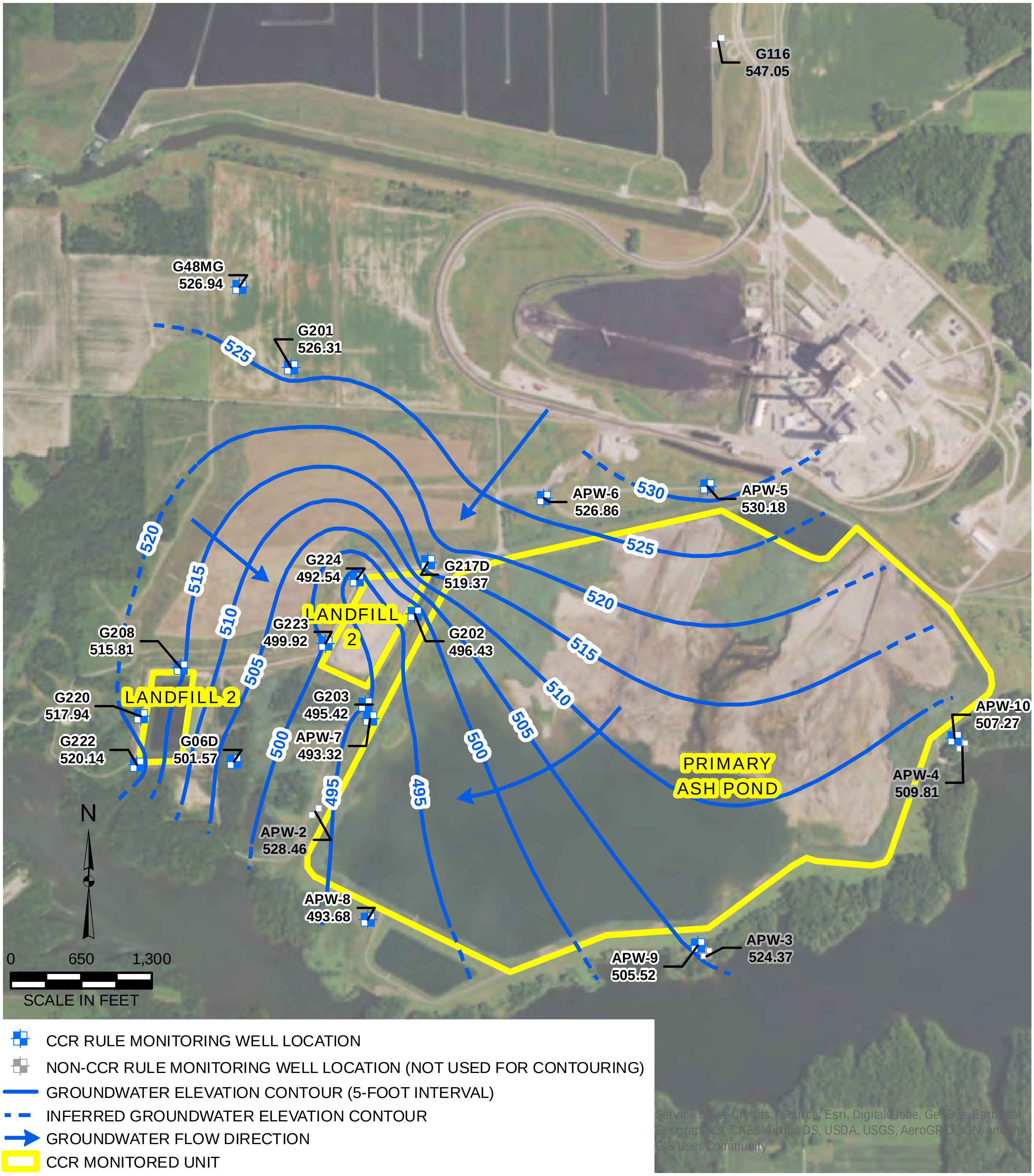
DRAWN BY/DATE:
SDS 7/10/17
REVIEWED BY/DATE:
TBN 7/10/17
APPROVED BY/DATE:
JJW 8/30/17

NEWTON PRIMARY ASH POND (UNIT ID: 501) AND LANDFILL 2 (UNIT ID: 502)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 7: APRIL 17, 2017
DYNEGY CCR RULE GROUNDWATER MONITORING
NEWTON POWER STATION
NEWTON, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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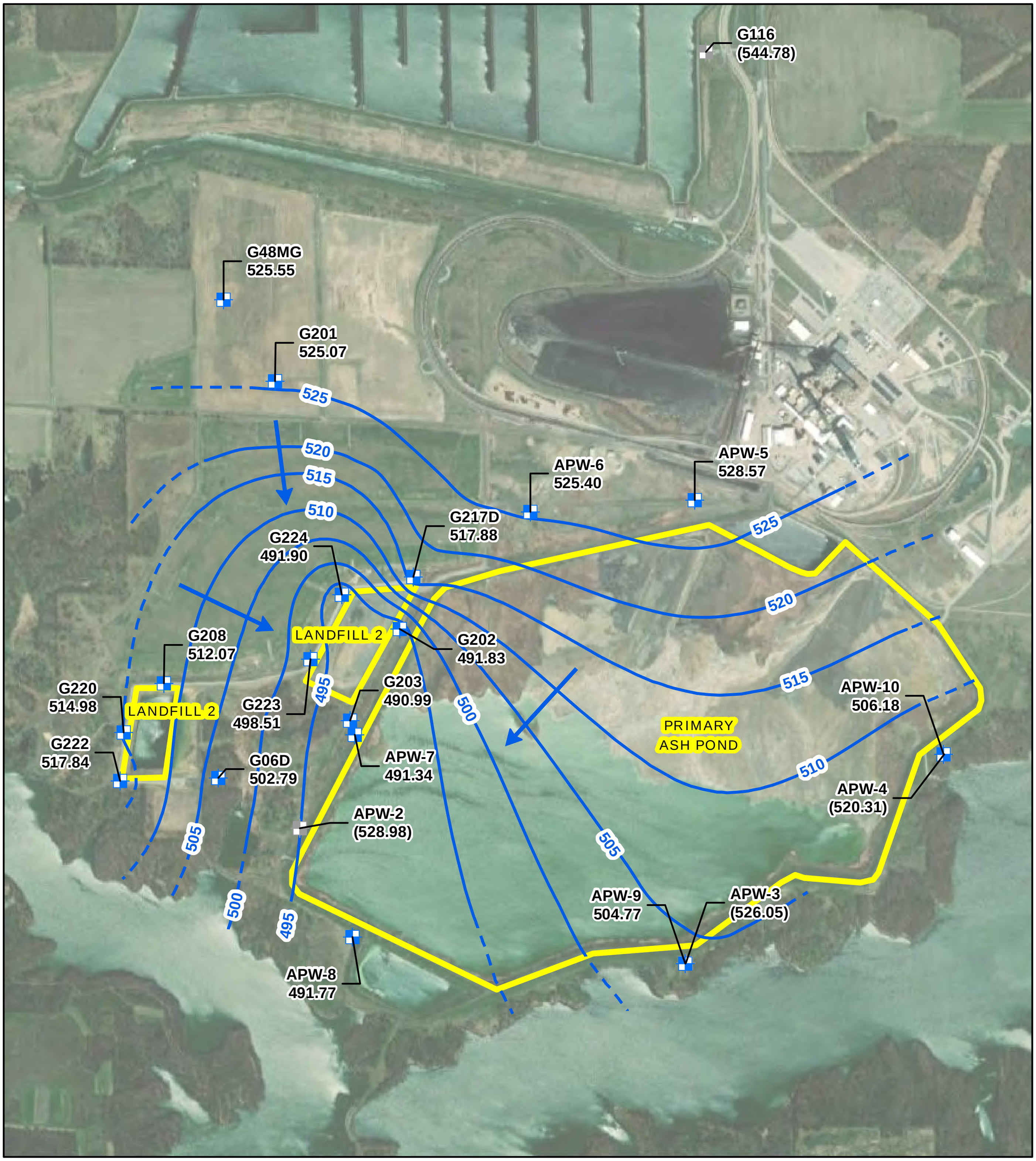
DRAWN BY/DATE: SDS 8/12/17 REVIEWED BY/DATE: TBN 8/12/17 APPROVED BY/DATE: JJW 8/30/17	**NEWTON PRIMARY ASH POND (UNIT ID: 501) AND LANDFILL 2 (UNIT ID: 502) UPPERMOST AQUIFER UNIT GROUNDWATER ELEVATION CONTOUR MAP ROUND 8: JUNE 12, 2017** DYNEGY CCR RULE GROUNDWATER MONITORING NEWTON POWER STATION NEWTON, ILLINOIS	PROJECT NO: 2285 FIGURE NO: 1 Natural Resource Technology AN OBG COMPANY



CCR RULE MONITORING WELL LOCATION

NON-CCR RULE MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR (5-FOOT CONTOUR INTERVAL, NAVD88)

INFERRED GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW DIRECTION

CCR MONITORED UNIT

NEWTON PRIMARY ASH POND (UNIT ID: 501) AND LANDFILL 2 (UNIT ID: 502) GROUNDWATER ELEVATION CONTOUR MAP NOVEMBER 14, 2017

CCR RULE GROUNDWATER MONITORING
NEWTON POWER STATION
NEWTON, ILLINOIS

0 325 650 1,300
Feet

N

O'BRIEN & GERE ENGINEERS, INC.

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CCR RULE MONITORING WELL LOCATION

NON-CCR RULE MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR (5-FOOT CONTOUR INTERVAL, NAVD88)

INFERRED GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW

CCR MONITORED UNIT

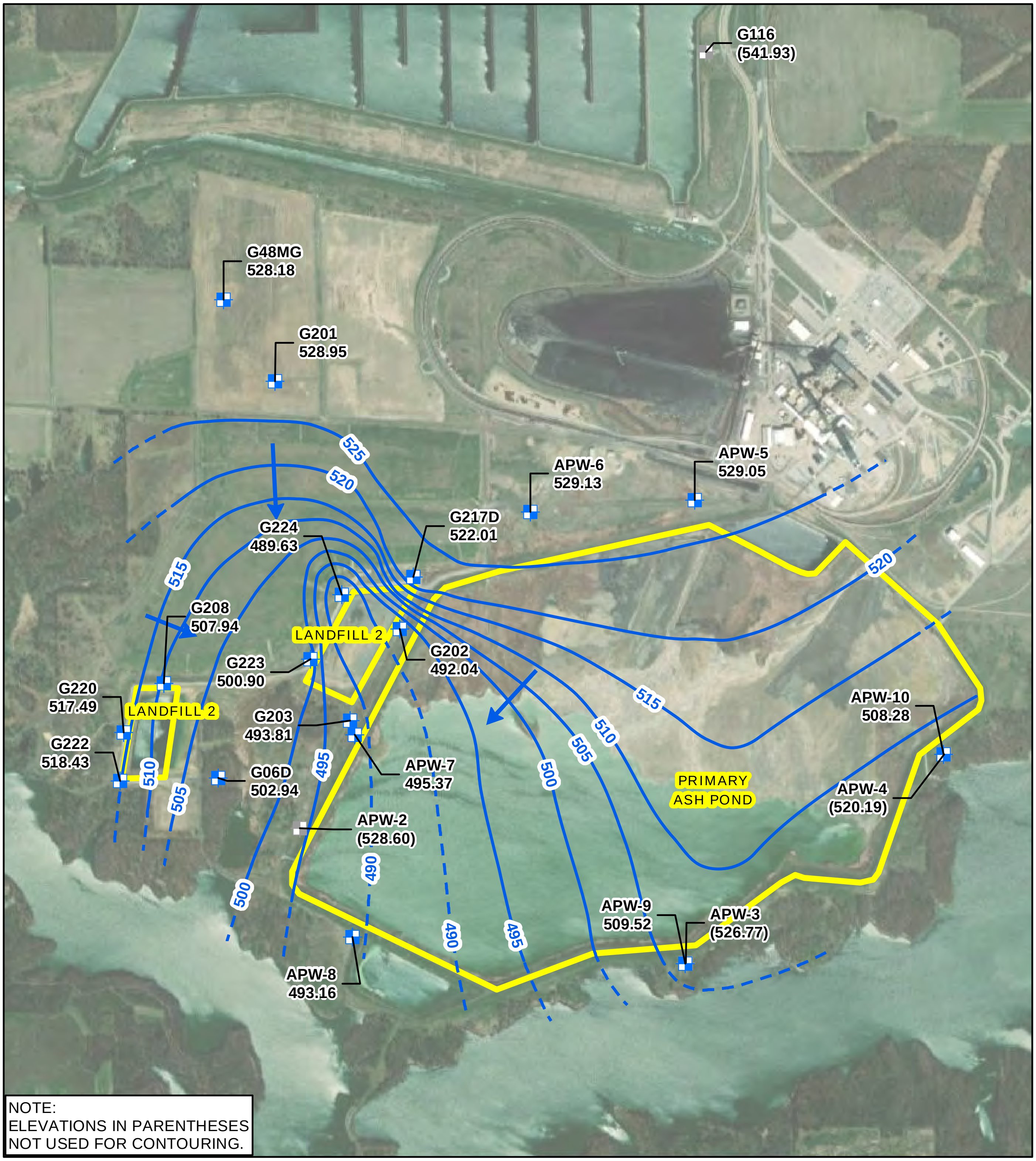
NEWTON PRIMARY ASH POND (UNIT ID: 501)
AND LANDFILL 2 (UNIT ID: 502)
GROUNDWATER ELEVATION CONTOUR MAP
MAY 17, 2018

CCR RULE GROUNDWATER MONITORING
NEWTON POWER STATION
NEWTON, ILLINOIS

0 325 650 1,300
Feet

N

O'BRIEN & GERE ENGINEERS, INC.



CCR RULE MONITORING WELL LOCATION

NON-CCR RULE MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR (5-FOOT CONTOUR INTERVAL, NAVD88)

INFERRED GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW

CCR MONITORED UNIT

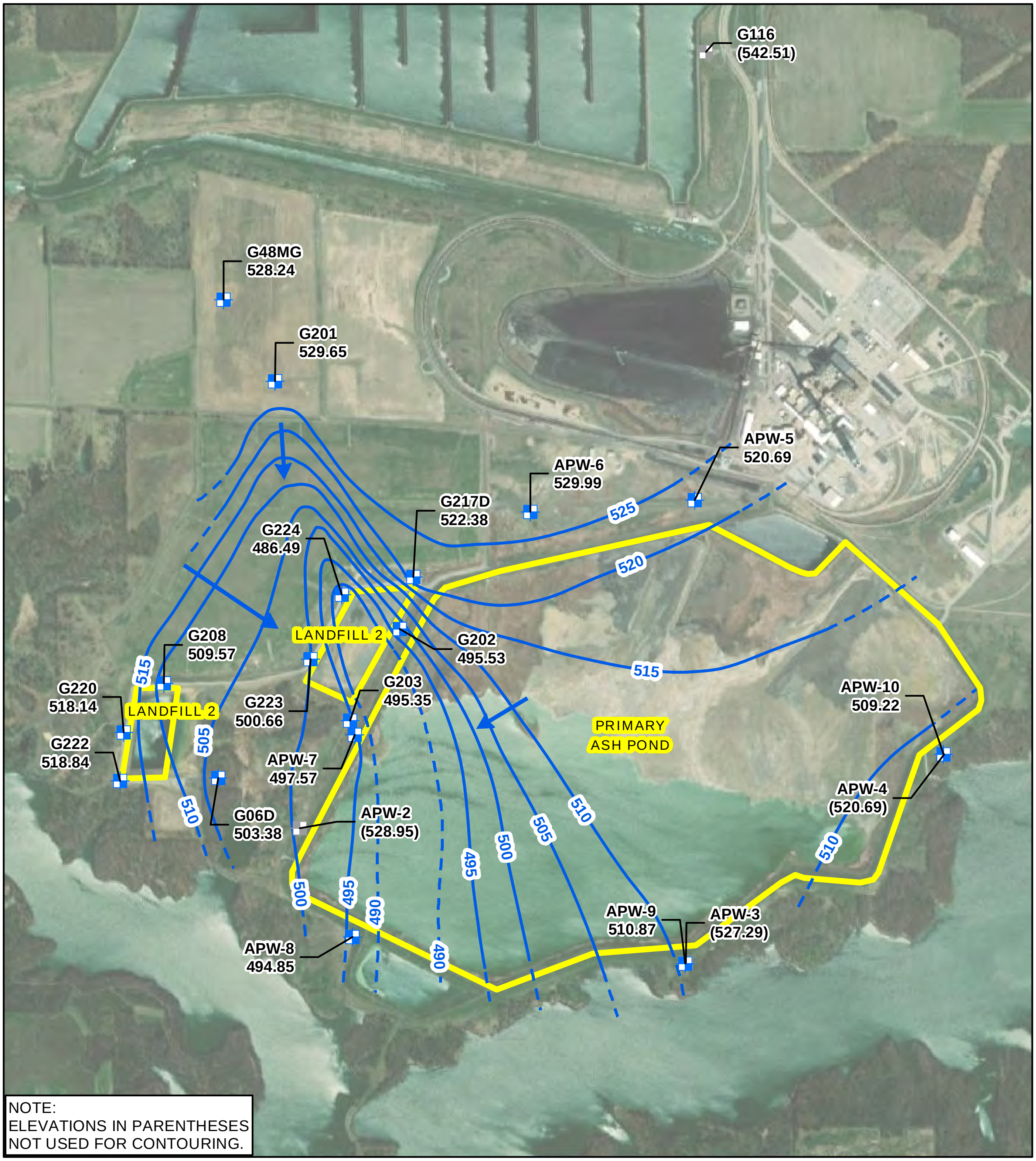
NEWTON PRIMARY ASH POND (UNIT ID: 501)
AND LANDFILL 2 (UNIT ID: 502)
GROUNDWATER ELEVATION CONTOUR MAP
AUGUST 14, 2018

CCR RULE GROUNDWATER MONITORING
NEWTON POWER STATION
NEWTON, ILLINOIS

0 325 650 1,300
Feet

N

O'BRIEN & GERE ENGINEERS, INC.



CCR RULE MONITORING WELL LOCATION

NON-CCR RULE MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR (5-FOOT CONTOUR INTERVAL, NAVD88)

INFERRED GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW DIRECTION

CCR MONITORED UNIT

NEWTON PRIMARY ASH POND (UNIT ID: 501)
AND LANDFILL 2 (UNIT ID: 502)
GROUNDWATER ELEVATION CONTOUR MAP
NOVEMBER 8, 2018

CCR RULE GROUNDWATER MONITORING
NEWTON POWER STATION
NEWTON, ILLINOIS

0 325 650 1,300
Feet

N

O'BRIEN & GERE ENGINEERS, INC.

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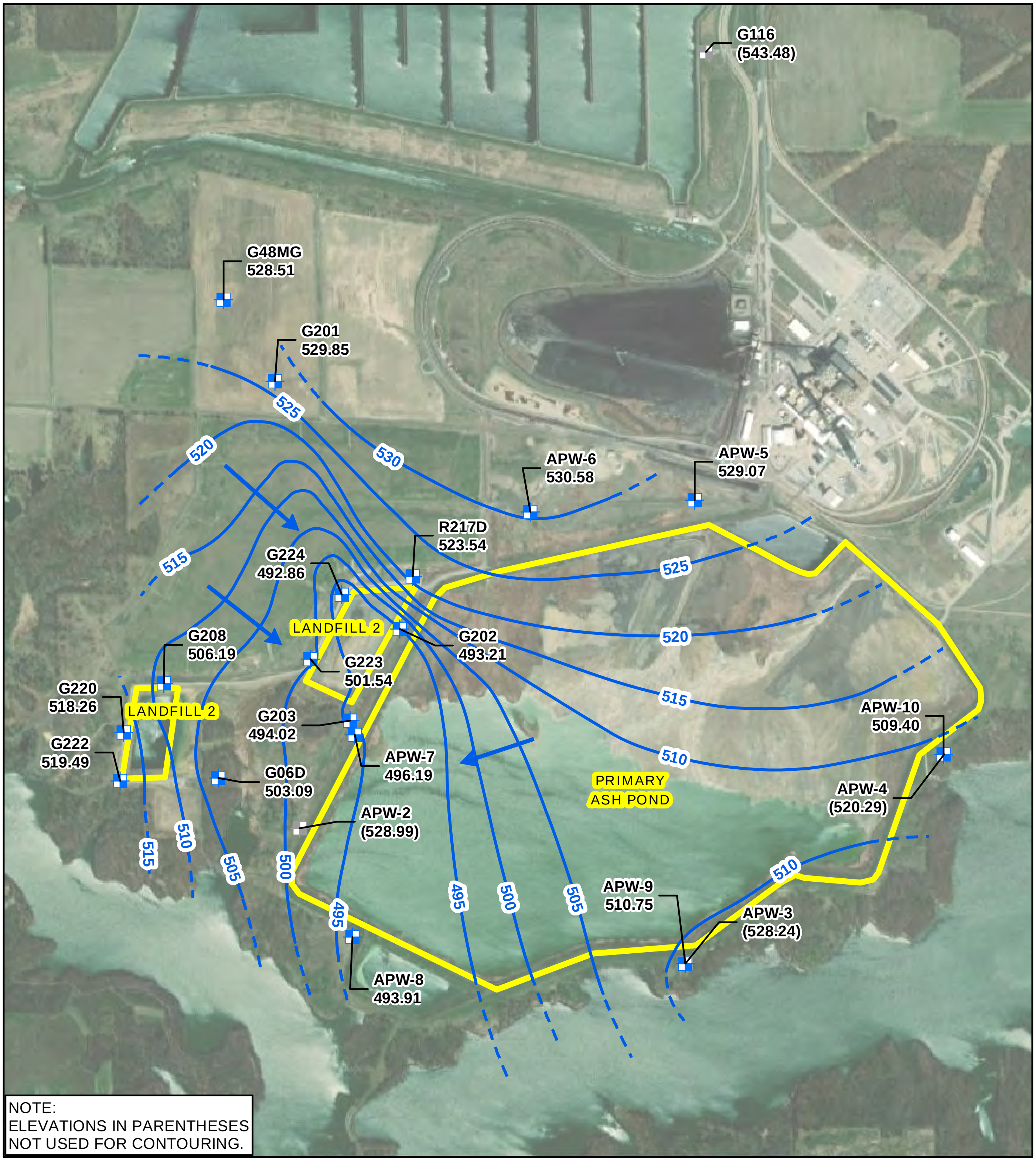

CCR RULE MONITORING WELL LOCATION

NON-CCR RULE MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR (5-FOOT CONTOUR INTERVAL, NAVD88)

INFERRED GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW DIRECTION

CCR MONITORED UNIT

NEWTON PRIMARY ASH POND (UNIT ID: 501)
AND LANDFILL 2 (UNIT ID: 502)
GROUNDWATER ELEVATION CONTOUR MAP
FEBRUARY 18, 2019

CCR RULE GROUNDWATER MONITORING
NEWTON POWER STATION
NEWTON, ILLINOIS

0 325 650 1,300
Feet

N

O'BRIEN & GERE ENGINEERS, INC.

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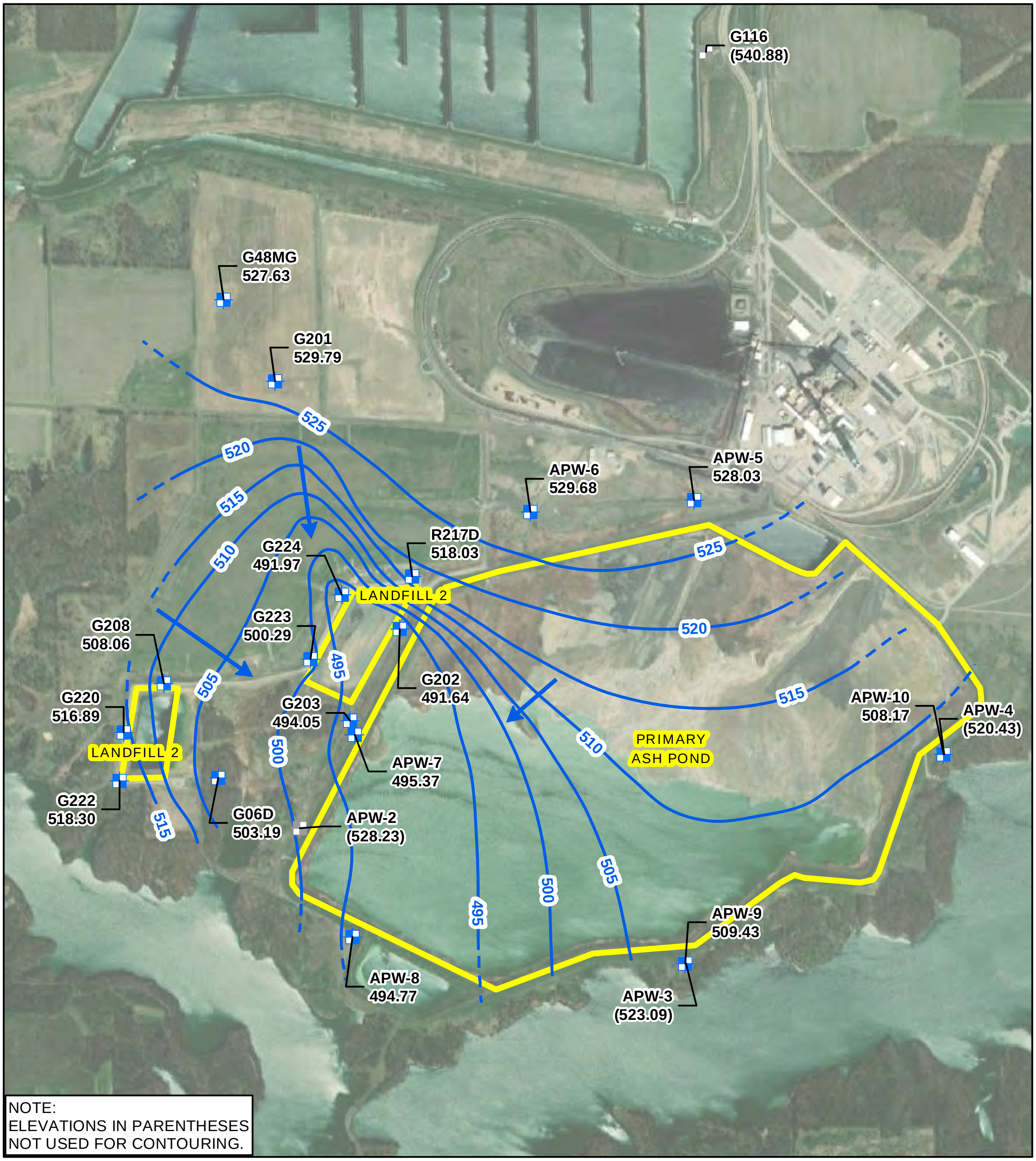


CCR RULE MONITORING WELL LOCATION

NON-CCR RULE MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR (5-FOOT CONTOUR INTERVAL, NAVD88)

INFERRED GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW DIRECTION

CCR MONITORED UNIT

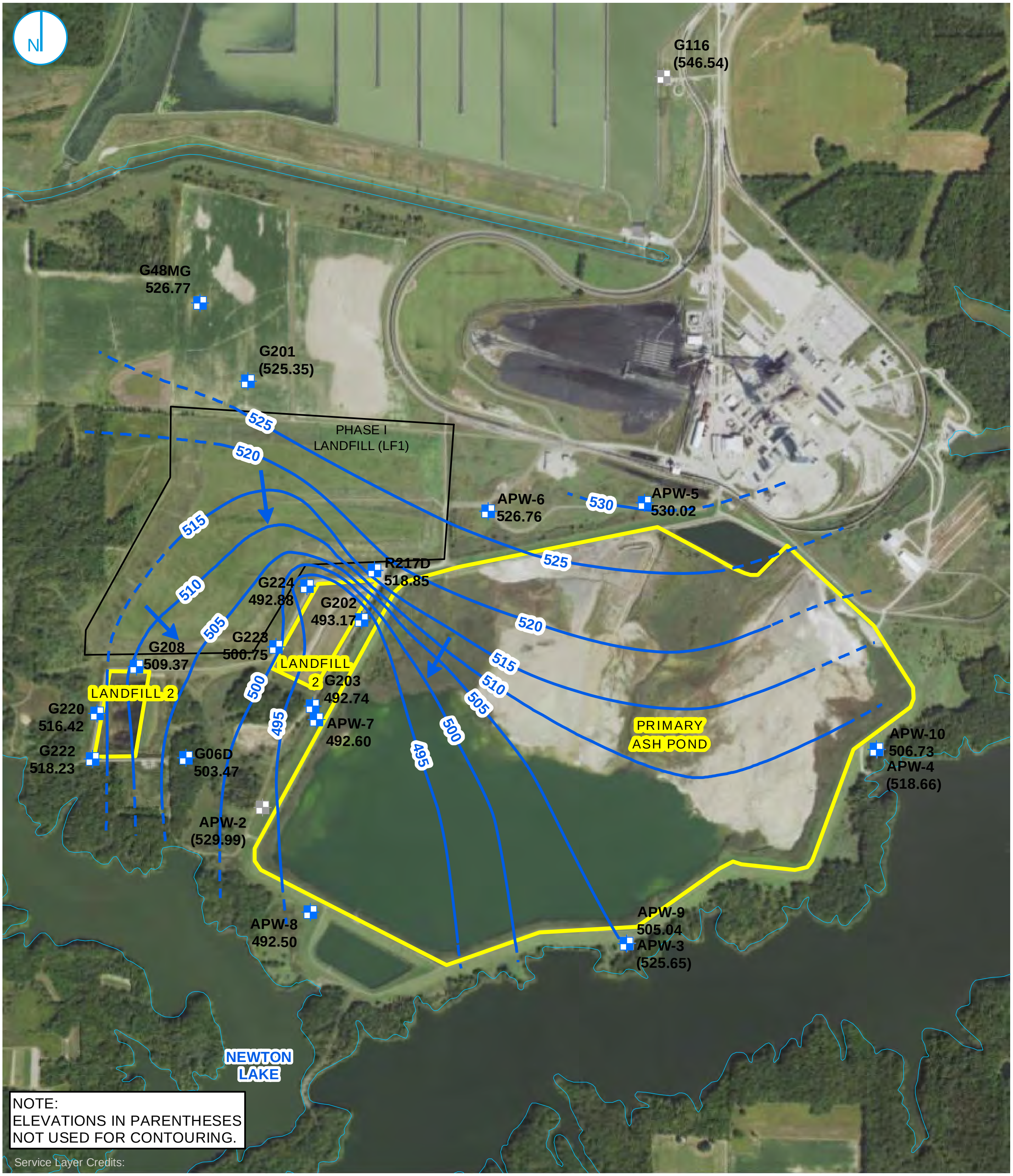
NEWTON PRIMARY ASH POND (UNIT ID: 501)
AND LANDFILL 2 (UNIT ID: 502)
GROUNDWATER ELEVATION CONTOUR MAP
AUGUST 21, 2019

CCR RULE GROUNDWATER MONITORING
NEWTON POWER STATION
NEWTON, ILLINOIS

0 325 650 1,300
Feet

N

O'BRIEN & GERE ENGINEERS, INC.



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PROJECT: 169000XXXX | DATED: 8/14/2020 | DESIGNER: STOLZSD

- CCR RULE MONITORING WELL
- NON-CCR RULE MONITORING WELL
- GROUNDWATER ELEVATION CONTOUR (5-FT CONTOUR INTERVAL, NAVD88)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- SURFACE WATER FEATURE
- CCR MONITORED UNIT
- NON-CCR UNIT

0 650 1,300 Feet

GROUNDWATER ELEVATION CONTOUR MAP FEBRUARY 3, 2020

NEWTON PRIMARY ASH POND (UNIT ID: 501) AND LANDFILL 2 (UNIT ID: 502)
NEWTON POWER STATION
NEWTON, ILLINOIS

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

ATTACHMENT 5 – TABLES SUMMARIZING CONSTITUENT CONCENTRATIONS AT EACH MONITORING WELL

Analytical Results - Appendix III
Newton Primary Ash Pond

Sample Location	Date Sampled	Boron, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Fluoride, total (mg/L)	pH (s.u.)	Sulfate, total (mg/L)	Total Dissolved Solids (mg/L)
Background Wells								
APW5	12/15/2015	0.099	51	48	0.486	7.5	15	560
APW5	1/20/2016	0.12	52	50	0.409	7.5	15	510
APW5	4/27/2016	0.10	71	58	0.494	7.7	14	520
APW5	8/1/2016	0.10	49	52	0.540	7.5	1.8	500
APW5	10/25/2016	0.12	50	50	0.660	7.6	<1	1000
APW5	1/23/2017	0.090	45	50	0.418	7.4	<1	550
APW5	4/24/2017	0.079	44	46	0.437	7.0	1.2	600
APW5	6/13/2017	0.082	48	47	0.508	7.1	<1	540
APW5	11/17/2017	0.099	51	43	0.634	6.9	<1	480
APW5	5/18/2018	0.10	48	48	0.525	7.1	2.1	480
APW5	8/17/2018	NA	54	56	NA	7.0	1.4	NA
APW5	11/9/2018	0.098	50	51	0.427	7.0	5.1	500
APW5	2/22/2019	0.11	50	48	0.374	6.9	3.5	600
APW5	8/22/2019	0.12	49	50	<0.25	7.0	2.3	530
APW5	2/4/2020	0.091	51	54	0.480	7.5	2.3	600
APW5	6/11/2020	NA	NA	NA	NA	7.4	NA	NA
APW5	7/28/2020	0.10	53	52	0.544	7.7	1.8	530
APW6	12/15/2015	0.073	53	26	0.509	7.5	9.9	480
APW6	1/20/2016	0.082	53	24	0.393	7.4	9.9	500
APW6	4/27/2016	0.16	64	29	0.564	6.5	7.4	450
APW6	8/1/2016	0.078	50	27	0.650	7.4	1.2	520
APW6	10/25/2016	0.093	50	26	0.686	7.5	<1	560
APW6	1/23/2017	0.076	46	26	0.448	6.9	<1	530
APW6	4/24/2017	0.074	43	50	0.470	7.2	<1	540
APW6	6/13/2017	0.093	51	25	0.567	7.1	2.3	460
APW6	11/17/2017	0.094	50	23	0.617	7.2	1.9	470
APW6	5/18/2018	0.087	51	25	0.564	7.3	1.7	420
APW6	8/17/2018	NA	52	25	NA	7.3	1.7	NA
APW6	11/9/2018	0.083	51	24	0.459	7.2	2.1	440
APW6	2/22/2019	0.090	45	24	0.386	7.3	1.7	480
APW6	8/23/2019	0.11	55	26	0.314	7.3	5.8	500
APW6	2/4/2020	0.080	53	27	0.483	7.5	<1	640
APW6	6/11/2020	NA	NA	NA	NA	7.4	NA	NA
APW6	7/28/2020	0.091	55	24	0.564	7.8	3.2	510
Downgradient Wells								
APW7	12/15/2015	0.073	74	69	0.467	7.4	13	520
APW7	1/21/2016	0.052	74	79	0.380	7.4	8.6	440
APW7	5/3/2016	0.071	85	72	0.545	7.5	7.5	500
APW7	8/1/2016	0.070	86	77	0.462	7.3	2.8	490
APW7	10/26/2016	0.096	76	79	0.425	7.2	<1	590
APW7	1/26/2017	0.082	87	77	0.352	7.2	<1	520
APW7	4/24/2017	0.069	87	77	0.367	7.3	<1	600
APW7	6/13/2017	0.084	93	77	0.425	7.2	<1	560
APW7	11/17/2017	0.097	72	73	0.508	7.2	3.8	530
APW7	5/18/2018	0.082	97	75	0.435	7.1	4.9	500
APW7	8/18/2018	NA	100	77	NA	7.1	3.2	NA
APW7	11/9/2018	0.080	92	71	0.343	7.0	4.5	500
APW7	2/22/2019	0.060	45	43	0.734	7.2	66	340
APW7	8/23/2019	0.075	58	46	0.632	7.1	62	350
APW7	2/5/2020	0.092	100	68	0.332	7.4	5.7	640
APW7	6/11/2020	NA	NA	68	NA	7.3	NA	NA
APW7	7/28/2020	0.086	94	77	0.412	7.3	6.7	530

Analytical Results - Appendix III
Newton Primary Ash Pond

Sample Location	Date Sampled	Boron, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Fluoride, total (mg/L)	pH (s.u.)	Sulfate, total (mg/L)	Total Dissolved Solids (mg/L)
APW8	12/15/2015	0.083	85	52	0.441	7.4	35	560
APW8	1/21/2016	0.060	85	59	0.414	7.5	34	510
APW8	5/3/2016	0.083	100	55	0.566	7.4	30	560
APW8	8/2/2016	0.076	94	56	0.504	7.2	35	520
APW8	10/26/2016	0.091	84	59	0.463	7.4	37	600
APW8	1/25/2017	0.081	100	57	0.404	7.2	36	600
APW8	4/25/2017	0.073	100	57	0.418	7.5	38	590
APW8	6/13/2017	0.092	110	57	0.449	7.3	38	600
APW8	11/17/2017	0.11	83	50	0.474	7.1	39	490
APW8	5/18/2018	0.088	92	56	0.448	7.2	37	520
APW8	8/18/2018	NA	82	57	NA	7.2	43	NA
APW8	11/9/2018	0.086	110	56	0.373	7.1	42	580
APW8	2/22/2019	0.10	80	56	0.393	7.2	46	600
APW8	8/23/2019	0.10	82	59	0.337	7.2	48	570
APW8	2/5/2020	0.10	120	55	0.331	7.4	45	700
APW8	6/11/2020	NA	NA	NA	NA	7.3	NA	NA
APW8	7/28/2020	0.087	110	62	0.441	7.3	47	620
APW9	12/15/2015	0.062	54	88	0.574	7.5	25	630
APW9	1/20/2016	0.074	57	95	0.468	7.6	27	540
APW9	5/3/2016	0.070	70	110	0.746	7.6	18	590
APW9	8/2/2016	0.073	74	130	0.532	7.2	4.2	640
APW9	10/26/2016	0.090	77	130	0.528	7.6	1.5	770
APW9	1/25/2017	0.081	79	130	0.468	7.5	<1	740
APW9	4/25/2017	0.078	67	120	0.515	7.5	1.1	840
APW9	6/13/2017	0.053	42	51	0.755	7.5	48	300
APW9	11/18/2017	0.080	68	84	0.655	7.4	4.5	720
APW9	5/18/2018	0.098	80	120	0.467	7.4	1.0	710
APW9	8/17/2018	NA	81	130	NA	7.5	2.4	NA
APW9	11/9/2018	0.055	44	44	0.730	7.4	62	300
APW9	2/22/2019	0.054	38	47	0.714	7.5	61	320
APW9	8/23/2019	0.055	41	51	0.621	7.4	51	360
APW9	2/19/2020	0.10	88	130	0.453	7.5	7.5	790
APW9	6/11/2020	NA	NA	130	NA	7.4	NA	870
APW9	7/28/2020	0.10	84	140	0.537	7.4	3.2	810
APW10	12/16/2015	0.066	120	46	0.328	7.1	430	1000
APW10	1/20/2016	0.077	120	48	<0.25	7.2	410	950
APW10	5/3/2016	0.065	140	46	0.448	7.1	410	930
APW10	8/2/2016	0.063	140	45	0.367	7.1	410	840
APW10	10/26/2016	0.069	120	48	0.371	7.1	470	960
APW10	1/25/2017	0.065	160	46	0.258	7.1	430	1000
APW10	4/25/2017	0.056	120	44	0.289	7.0	410	1000
APW10	6/13/2017	0.077	110	46	0.344	6.9	410	920
APW10	11/18/2017	0.072	120	47	0.414	6.9	390	910
APW10	5/18/2018	0.080	130	51	0.335	7.2	440	900
APW10	8/17/2018	NA	130	51	NA	6.9	420	NA
APW10	11/9/2018	0.078	140	47	0.281	7.0	410	900
APW10	2/22/2019	0.079	110	50	0.276	6.9	420	990
APW10	8/23/2019	0.096	130	50	0.359	7.0	390	1000
APW10	2/5/2020	0.094	140	44	<0.25	7.1	400	1200
APW10	6/11/2020	NA	NA	NA	NA	7.2	NA	1000
APW10	7/28/2020	0.076	140	53	0.356	7.1	410	1000

Notes:
1. Abbreviations: mg/L - milligrams per liter; NA - not analyzed; s.u. - standard units.

Analytical Results - Appendix IV
Newton Primary Ash Pond

Sample Location	Date Sampled	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Cadmium, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	Radium-226 + Radium 228, tot (pCi/L)	Selenium, total (mg/L)	Thallium, total (mg/L)
Background Wells																
APW5	12/15/2015	<0.003	0.018	0.19	<0.001	<0.001	<0.004	<0.002	0.486	0.0017	0.023	<0.0002	0.023	0.311	<0.001	<0.001
APW5	1/20/2016	<0.003	0.017	0.19	<0.001	<0.001	<0.004	<0.002	0.409	0.0016	0.017	0.00020	0.023	0.235	<0.001	<0.001
APW5	4/27/2016	<0.003	0.021	0.24	<0.001	<0.001	<0.004	<0.002	0.494	0.0012	0.020	0.002	0.032	0.281	0.001	<0.001
APW5	8/1/2016	<0.003	0.014	0.21	<0.001	<0.001	<0.004	<0.002	0.540	<0.001	0.016	<0.0002	0.027	0.616	<0.001	<0.001
APW5	10/25/2016	<0.003	0.013	0.22	<0.001	<0.001	<0.004	<0.002	0.660	<0.001	0.015	<0.0002	0.027	0.654	<0.001	<0.001
APW5	1/23/2017	<0.003	0.015	0.21	<0.001	<0.001	<0.004	<0.002	0.418	<0.001	0.013	<0.0002	0.021	0.0999	<0.001	<0.001
APW5	4/24/2017	<0.003	0.014	0.20	<0.001	<0.001	0.004	<0.002	0.437	0.0014	0.015	<0.0002	0.016	1.19	<0.001	<0.001
APW5	6/13/2017	<0.003	0.016	0.23	<0.001	<0.001	<0.004	<0.002	0.508	<0.001	0.014	<0.0002	0.018	1.32	<0.001	<0.001
APW5	11/17/2017	NA	NA	NA	NA	NA	NA	NA	0.634	NA	NA	NA	NA	NA	NA	NA
APW5	5/18/2018	NA	NA	NA	NA	NA	NA	NA	0.525	NA	NA	NA	NA	NA	NA	NA
APW5	11/9/2018	NA	NA	NA	NA	NA	NA	NA	0.427	NA	NA	NA	NA	NA	NA	NA
APW5	2/22/2019	NA	NA	NA	NA	NA	NA	NA	0.374	NA	NA	NA	NA	NA	NA	NA
APW5	8/22/2019	NA	NA	NA	NA	NA	NA	NA	<0.25	NA	NA	NA	NA	NA	NA	NA
APW5	2/4/2020	NA	NA	NA	NA	NA	NA	NA	0.480	NA	NA	NA	NA	NA	NA	NA
APW5	7/28/2020	NA	NA	NA	NA	NA	NA	NA	0.544	NA	NA	NA	NA	NA	NA	NA
APW6	12/15/2015	<0.003	0.017	0.16	<0.001	<0.001	<0.004	<0.002	0.509	<0.001	0.019	0.00023	0.012	0.591	0.006	<0.001
APW6	1/20/2016	<0.003	0.0091	0.17	<0.001	<0.001	<0.004	<0.002	0.393	<0.001	0.012	<0.0002	0.013	0.236	<0.001	<0.001
APW6	4/27/2016	<0.003	0.019	0.21	<0.001	<0.001	<0.004	<0.002	0.564	0.0012	0.019	<0.0002	0.028	0.984	<0.001	<0.001
APW6	8/1/2016	<0.003	0.0045	0.20	<0.001	<0.001	<0.004	<0.002	0.650	<0.001	0.016	<0.0002	0.0066	0.690	<0.001	<0.001
APW6	10/25/2016	<0.003	0.0041	0.22	<0.001	<0.001	<0.004	<0.002	0.686	<0.001	0.015	<0.0002	0.0087	0.329	<0.001	<0.001
APW6	1/23/2017	<0.003	0.0036	0.21	<0.001	<0.001	<0.004	<0.002	0.448	<0.001	0.014	<0.0002	0.0086	0.316	<0.001	<0.001
APW6	4/24/2017	<0.003	0.0042	0.20	<0.001	0.0012	<0.004	<0.002	0.470	0.0012	0.015	<0.0002	0.011	0.859	<0.001	0.0011
APW6	6/13/2017	<0.003	0.0057	0.22	0.0025	0.0017	<0.004	0.002	0.567	0.0025	0.014	<0.0002	0.014	0.932	0.0014	0.0025
APW6	11/17/2017	NA	NA	NA	NA	NA	NA	NA	0.617	NA	NA	NA	NA	NA	NA	NA
APW6	5/18/2018	NA	NA	NA	NA	NA	NA	NA	0.564	NA	NA	NA	NA	NA	NA	NA
APW6	11/9/2018	NA	NA	NA	NA	NA	NA	NA	0.459	NA	NA	NA	NA	NA	NA	NA
APW6	2/22/2019	NA	NA	NA	NA	NA	NA	NA	0.386	NA	NA	NA	NA	NA	NA	NA
APW6	8/23/2019	NA	NA	NA	NA	NA	NA	NA	0.314	NA	NA	NA	NA	NA	NA	NA
APW6	2/4/2020	NA	NA	NA	NA	NA	NA	NA	0.483	NA	NA	NA	NA	NA	NA	NA
APW6	7/28/2020	NA	NA	NA	NA	NA	NA	NA	0.564	NA	NA	NA	NA	NA	NA	NA
Downgradient Wells																
APW7	12/15/2015	<0.003	0.0039	0.35	<0.001	<0.001	<0.004	<0.002	0.467	<0.001	<0.01	<0.0002	0.014	1.16	<0.001	<0.001
APW7	1/21/2016	<0.003	0.0065	0.40	<0.001	<0.001	<0.004	<0.002	0.38	0.0015	<0.01	<0.0002	0.0083	1.06	<0.001	<0.001
APW7	5/3/2016	<0.003	0.0040	0.41	<0.001	<0.001	<0.004	<0.002	0.545	<0.001	<0.01	<0.0002	0.0086	1.74	<0.001	<0.001
APW7	8/1/2016	<0.003	0.0049	0.45	<0.001	<0.001	<0.004	<0.002	0.462	<0.001	<0.01	<0.0002	0.0060	1.32	<0.001	<0.001
APW7	10/26/2016	<0.003	0.0058	0.50	<0.001	<0.001	<0.004	<0.002	0.425	<0.001	<0.01	<0.0002	0.0054	2.02	<0.001	<0.001
APW7	1/26/2017	<0.003	0.0062	0.45	<0.001	<0.001	<0.004	<0.002	0.352	<0.001	<0.01	<0.0002	0.0072	1.82	<0.001	<0.001
APW7	4/24/2017	<0.003	0.0077	0.45	<0.001	<0.001	0.0049	<0.002	0.367	0.0022	<0.01	<0.0002	0.0029	1.26	<0.001	<0.001
APW7	6/13/2017	<0.003	0.0087	0.48	<0.001	<0.001	<0.004	<0.002	0.425	0.0046	<0.01	<0.0002	0.0039	1.69	<0.001	<0.001
APW7	11/17/2017	NA	NA	NA	NA	NA	NA	NA	0.508	NA	NA	NA	NA	NA	NA	NA
APW7	5/18/2018	NA	NA	NA	NA	NA	NA	NA	0.435	NA	NA	NA	NA	NA	NA	NA
APW7	11/9/2018	NA	NA	NA	NA	NA	NA	NA	0.343	NA	NA	NA	NA	NA	NA	NA
APW7	2/22/2019	NA	NA	NA	NA	NA	NA	NA	0.734	NA	NA	NA	NA	NA	NA	NA
APW7	8/23/2019	NA	NA	NA	NA	NA	NA	NA	0.632	NA	NA	NA	NA	NA	NA	NA
APW7	2/5/2020	NA	NA	NA	NA	NA	NA	NA	0.332	NA	NA	NA	NA	NA	NA	NA
APW7	7/28/2020	NA	NA	NA	NA	NA	NA	NA	0.412	NA	NA	NA	NA	NA	NA	NA
APW8	12/15/2015	<0.003	0.0083	0.24	<0.001	<0.001	<0.004	<0.002	0.441	0.0016	0.013	<0.0002	0.0075	1.95	<0.001	<0.001
APW8	12/16/2015	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
APW8	1/20/2016	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
APW8	1/21/2016	<0.003	0.016	0.30	<0.001	<0.001	0.0049	<0.002	0.414	0.0023	0.012	<0.0002	0.0055	2.27	<0.001	<0.001
APW8	4/27/2016	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Analytical Results - Appendix IV
Newton Primary Ash Pond

Sample Location	Date Sampled	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Cadmium ,total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	Radium-226 + Radium 228, tot (pCi/L)	Selenium, total (mg/L)	Thallium, total (mg/L)
APW8	5/3/2016	<0.003	0.012	0.32	<0.001	<0.001	0.0045	<0.002	0.566	0.0021	<0.01	<0.0002	0.0063	1.88	0.0016	<0.001
APW8	8/2/2016	<0.003	0.013	0.32	<0.001	<0.001	<0.004	<0.002	0.504	<0.001	<0.01	<0.0002	0.0054	0.857	<0.001	<0.001
APW8	10/26/2016	<0.003	0.013	0.35	<0.001	<0.001	<0.004	<0.002	0.463	<0.001	<0.01	<0.0002	0.0055	0.812	<0.001	<0.001
APW8	1/25/2017	<0.003	0.017	0.37	<0.001	<0.001	<0.004	<0.002	0.404	<0.001	<0.01	<0.0002	0.0057	0.499	<0.001	<0.001
APW8	4/25/2017	<0.003	0.020	0.36	<0.001	<0.001	0.016	0.0056	0.418	0.0097	0.017	<0.0002	0.0074	1.80	<0.001	<0.001
APW8	6/13/2017	<0.003	0.017	0.39	<0.001	<0.001	0.010	0.0043	0.449	0.0075	0.012	<0.0002	0.0081	2.08	<0.001	<0.001
APW8	11/17/2017	NA	NA	NA	NA	NA	NA	NA	0.474	NA	NA	NA	NA	NA	NA	NA
APW8	5/18/2018	NA	NA	NA	NA	NA	NA	NA	0.448	NA	NA	NA	NA	NA	NA	NA
APW8	11/9/2018	NA	NA	NA	NA	NA	NA	NA	0.373	NA	NA	NA	NA	NA	NA	NA
APW8	2/22/2019	NA	NA	NA	NA	NA	NA	NA	0.393	NA	NA	NA	NA	NA	NA	NA
APW8	8/23/2019	NA	NA	NA	NA	NA	NA	NA	0.337	NA	NA	NA	NA	NA	NA	NA
APW8	2/5/2020	NA	NA	NA	NA	NA	NA	NA	0.331	NA	NA	NA	NA	NA	NA	NA
APW8	7/28/2020	NA	NA	NA	NA	NA	NA	NA	0.441	NA	NA	NA	NA	NA	NA	NA
APW9	12/15/2015	<0.003	0.0070	0.24	<0.001	<0.001	<0.004	<0.002	0.574	0.0011	<0.01	<0.0002	0.021	0.612	<0.001	<0.001
APW9	1/20/2016	<0.003	0.0067	0.24	<0.001	<0.001	<0.004	<0.002	0.468	0.0044	<0.01	<0.0002	0.023	0.743	<0.001	<0.001
APW9	5/3/2016	<0.003	0.0080	0.32	<0.001	<0.001	<0.004	<0.002	0.746	0.0051	<0.01	<0.0002	0.021	1.54	<0.001	<0.001
APW9	8/2/2016	<0.003	0.014	0.41	<0.001	<0.001	<0.004	<0.002	0.532	<0.001	<0.01	<0.0002	0.011	1.137	<0.001	<0.001
APW9	10/26/2016	<0.003	0.016	0.47	<0.001	<0.001	<0.004	<0.002	0.528	<0.001	<0.01	<0.0002	0.010	1.18	<0.001	<0.001
APW9	1/25/2017	<0.003	0.018	0.44	<0.001	<0.001	<0.004	<0.002	0.468	<0.001	<0.01	<0.0002	0.0075	1.78	<0.001	<0.001
APW9	4/25/2017	<0.003	0.017	0.38	<0.001	<0.001	<0.004	<0.002	0.515	<0.001	<0.01	0.00023	0.0053	1.07	<0.001	<0.001
APW9	6/13/2017	<0.003	0.0039	0.11	<0.001	<0.001	<0.004	<0.002	0.755	<0.001	<0.01	<0.0002	0.016	0.984	<0.001	<0.001
APW9	11/18/2017	NA	NA	NA	NA	NA	NA	NA	0.655	NA	NA	NA	NA	NA	NA	NA
APW9	5/18/2018	NA	NA	NA	NA	NA	NA	NA	0.467	NA	NA	NA	NA	NA	NA	NA
APW9	11/9/2018	NA	NA	NA	NA	NA	NA	NA	0.73	NA	NA	NA	NA	NA	NA	NA
APW9	2/22/2019	NA	NA	NA	NA	NA	NA	NA	0.714	NA	NA	NA	NA	NA	NA	NA
APW9	8/23/2019	NA	NA	NA	NA	NA	NA	NA	0.621	NA	NA	NA	NA	NA	NA	NA
APW9	2/19/2020	NA	NA	NA	NA	NA	NA	NA	0.453	NA	NA	NA	NA	NA	NA	NA
APW9	7/28/2020	NA	NA	NA	NA	NA	NA	NA	0.537	NA	NA	NA	NA	NA	NA	NA
APW10	12/16/2015	<0.003	0.0034	0.038	<0.001	<0.001	<0.004	<0.002	0.328	<0.001	0.030	<0.0002	0.0094	0.755	<0.001	<0.001
APW10	1/20/2016	<0.003	0.0043	0.042	<0.001	<0.001	<0.004	<0.002	<0.25	<0.001	0.021	<0.0002	0.011	1.16	<0.001	<0.001
APW10	5/3/2016	<0.003	0.0083	0.040	<0.001	<0.001	<0.004	<0.002	0.448	<0.001	0.023	<0.0002	0.010	0.799	<0.001	<0.001
APW10	8/2/2016	<0.003	0.0092	0.037	<0.001	<0.001	<0.004	<0.002	0.367	<0.001	0.026	<0.0002	0.0091	0.600	<0.001	<0.001
APW10	10/26/2016	<0.003	0.0090	0.040	<0.001	<0.001	<0.004	<0.002	0.371	<0.001	0.027	<0.0002	0.0093	0.556	<0.001	<0.001
APW10	1/25/2017	<0.003	0.010	0.035	<0.001	<0.001	<0.004	<0.002	0.258	<0.001	0.023	<0.0002	0.0085	0.430	<0.001	<0.001
APW10	4/25/2017	<0.003	0.0084	0.031	<0.001	<0.001	<0.004	<0.002	0.289	<0.001	0.026	<0.0002	0.0071	0.604	<0.001	<0.001
APW10	6/13/2017	<0.003	0.0035	0.027	<0.001	<0.001	<0.004	<0.002	0.344	<0.001	0.026	<0.0002	0.0091	0.897	<0.001	<0.001
APW10	11/18/2017	NA	NA	NA	NA	NA	NA	NA	0.414	NA	NA	NA	NA	NA	NA	NA
APW10	5/18/2018	NA	NA	NA	NA	NA	NA	NA	0.335	NA	NA	NA	NA	NA	NA	NA
APW10	11/9/2018	NA	NA	NA	NA	NA	NA	NA	0.281	NA	NA	NA	NA	NA	NA	NA
APW10	2/22/2019	NA	NA	NA	NA	NA	NA	NA	0.276	NA	NA	NA	NA	NA	NA	NA
APW10	8/23/2019	NA	NA	NA	NA	NA	NA	NA	0.359	NA	NA	NA	NA	NA	NA	NA
APW10	2/5/2020	NA	NA	NA	NA	NA	NA	NA	<0.25	NA	NA	NA	NA	NA	NA	NA
APW10	7/28/2020	NA	NA	NA	NA	NA	NA	NA	0.356	NA	NA	NA	NA	NA	NA	NA

Notes:
1. Abbreviations: mg/L - milligrams per liter; NA - not analyzed; pCi/L - picocurie per liter;

Sample Location	Date Sampled	Boron, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Fluoride, total (mg/L)	pH (STD)	Sulfate, total (mg/L)	Total Dissolved Solids (mg/L)
Background Wells								
G48MG	12/16/2015	0.11	43	31	0.611	7.6	22	480
G48MG	1/18/2016	0.12	43	29	0.478	7.5	19	450
G48MG	4/26/2016	0.2	58	33	0.644	6.8	18	460
G48MG	7/27/2016	0.097	39	31	0.576	7.5	8.4	440
G48MG	10/18/2016	0.14	38	34	0.701	7.7	5.9	410
G48MG	1/23/2017	0.11	37	31	0.535	7.5	2	490
G48MG	4/19/2017	0.09	36	33	0.714	7	<1	820
G48MG	6/14/2017	0.12	38	30	0.503	7	1.1	460
G48MG	11/28/2017	0.11	36	31	0.682	6.9	2.5	460
G48MG	5/21/2018	0.045	63	22	0.366	7	70	450
G48MG	11/15/2018	0.053	72	13	0.334	7	54	380
G48MG	2/19/2019	0.048	71	18	0.301	7	58	580
G48MG	8/22/2019	0.14	38	26	0.657	7	110	600
G48MG	2/19/2020	0.056	70	20	0.386	7.3	46	560
G48MG	8/23/2018	NA	110	47	NA	7	190	NA
G201	12/15/2015	0.085	130	3.9	0.708	7.3	550	860
G201	1/18/2016	0.098	160	4	0.65	7.3	540	760
G201	4/26/2016	0.075	160	4.2	0.786	6.6	550	740
G201	7/27/2016	0.083	140	4	0.713	7.4	500	760
G201	10/18/2016	0.12	120	4.2	0.954	7.6	760	700
G201	1/18/2017	0.11	140	4.3	1.04	7.2	690	800
G201	4/19/2017	0.086	160	4.5	0.872	7.6	500	840
G201	6/14/2017	0.12	140	4.1	0.636	7.4	510	730
G201	11/28/2017	0.1	150	4.7	0.748	7.3	530	790
G201	5/21/2018	0.093	130	4.2	0.774	7.2	530	770
G201	11/12/2018	0.098	160	4.2	0.724	7.3	550	810
G201	2/19/2019	0.098	170	4.3	0.727	7.4	600	960
G201	8/22/2019	0.12	180	4.2	0.76	7.3	600	1000
G201	2/4/2020	0.18	130	34	1.03	7.1	500	1400
G201	8/15/2018	NA	150	3.8	NA	7.3	530	NA
Downgradient Wells								
G06D	12/16/2015	0.16	75	63	<0.25	6.7	76	750
G06D	1/19/2016	0.11	75	67	<0.25	6.8	81	690
G06D	4/27/2016	0.22	120	64	0.428	7	51	780
G06D	7/27/2016	0.16	99	58	0.463	7	33	720
G06D	10/18/2016	0.2	91	63	0.677	7	33	740
G06D	1/19/2017	0.22	95	64	0.744	7.2	28	780
G06D	4/19/2017	0.15	110	58	0.751	7.1	18	840
G06D	6/14/2017	0.17	100	59	0.642	7.2	18	760
G06D	11/15/2017	0.18	88	56	0.709	7.5	9.6	760
G06D	5/21/2018	0.17	94	57	0.696	7.4	13	780
G06D	11/12/2018	0.17	120	58	0.681	7.3	3	770
G06D	2/19/2019	0.25	120	58	0.635	7.5	5	900
G06D	8/22/2019	0.18	110	57	0.74	7.4	1.9	820
G06D	2/4/2020	0.17	110	56	0.704	7.1	1.6	900
G06D	8/16/2018	NA	110	54	NA	7.7	6.5	NA
G202	12/17/2015	0.1	110	55	0.435	7.1	120	700
G202	1/20/2016	0.055	110	57	0.401	6.8	130	640

Sample Location	Date Sampled	Boron, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Fluoride, total (mg/L)	pH (STD)	Sulfate, total (mg/L)	Total Dissolved Solids (mg/L)
G202	4/28/2016	0.083	130	61	0.486	7.4	94	640
G202	7/27/2016	0.09	110	58	0.444	7.7	82	640
G202	10/19/2016	0.12	90	70	0.552	6.9	77	560
G202	1/18/2017	0.12	100	63	0.573	7.4	150	640
G202	4/20/2017	0.078	120	62	0.55	7.3	66	680
G202	6/15/2017	0.1	120	63	0.382	7.2	53	630
G202	11/15/2017	0.1	180	55	0.618	7.2	150	720
G202	5/23/2018	0.11	150	58	0.526	7.3	160	660
G202	11/14/2018	0.1	130	56	0.421	7.2	95	590
G202	2/21/2019	0.096	130	59	0.485	7.2	190	740
G202	8/22/2019	0.12	120	61	0.51	7.2	53	680
G202	2/4/2020	0.1	94	60	0.553	7.3	94	860
G202	8/21/2018	NA	120	64	NA	7.3	73	NA
G203	12/16/2015	0.07	100	49	0.363	7.1	95	660
G203	1/20/2016	0.041	100	51	0.323	5.8	100	560
G203	4/28/2016	0.056	130	53	0.401	7.3	110	590
G203	7/27/2016	0.065	110	50	0.338	7.3	130	640
G203	10/19/2016	0.092	96	60	0.459	7.2	140	580
G203	1/19/2017	0.17	110	57	0.428	6.9	160	690
G203	4/20/2017	0.061	120	54	0.491	6.9	120	680
G203	6/15/2017	0.081	120	51	0.328	6.9	96	600
G203	11/15/2017	0.07	110	49	0.504	6.8	170	720
G203	5/23/2018	0.095	200	49	0.438	6.8	150	640
G203	11/14/2018	0.082	160	47	0.344	6.8	170	650
G203	2/21/2019	0.076	140	57	0.364	7.1	170	870
G203	8/22/2019	0.09	130	52	0.443	7	150	780
G203	2/4/2020	0.076	130	57	0.373	7.2	140	930
G203	8/21/2018	NA	140	55	NA	7	120	NA
G208	12/16/2015	0.19	110	45	0.978	7.1	220	1000
G208	1/19/2016	0.2	110	44	0.848	7.1	250	950
G208	4/28/2016	0.16	140	49	0.848	7.2	210	800
G208	7/29/2016	0.18	120	49	1.03	6.9	230	980
G208	10/25/2016	0.21	100	47	1.21	7.3	170	500
G208	1/24/2017	0.18	100	48	1.02	7.4	140	880
G208	4/20/2017	0.15	110	50	1.21	7.3	110	890
G208	6/14/2017	0.2	110	47	1.05	7.3	110	900
G208	11/17/2017	0.18	110	48	1.11	7.5	110	820
G208	5/23/2018	0.19	110	42	1.3	7.3	91	780
G208	8/20/2018	0.18	120	47	0.966	7.5	88	NA
G208	11/13/2018	0.18	120	44	1.07	7.4	45	620
G208	2/20/2019	0.17	110	53	1.04	7.5	9.5	820
G208	8/22/2019	0.21	110	45	1.07	7.5	2.7	800
G208	2/5/2020	0.19	110	54	0.707	7.1	1.6	820
G217D	12/17/2015	0.14	120	29	0.521	7.3	220	820
G217D	1/21/2016	0.1	170	30	0.469	7.4	220	820
G217D	4/29/2016	0.16	160	35	0.562	7.3	370	930
G217D	7/29/2016	0.14	150	36	0.472	7.1	450	1100
G217D	10/20/2016	0.19	140	33	0.684	7.4	470	1000
G217D	1/19/2017	0.17	170	32	0.671	7.1	520	1200

Sample Location	Date Sampled	Boron, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Fluoride, total (mg/L)	pH (STD)	Sulfate, total (mg/L)	Total Dissolved Solids (mg/L)
G217D	4/20/2017	0.13	190	29	0.679	7	360	1000
G217D	6/15/2017	0.13	150	24	0.535	6.8	240	840
G220	12/17/2015	0.44	97	35	1.13	7.2	86	750
G220	1/19/2016	0.45	93	33	1.08	7.3	90	700
G220	4/27/2016	0.31	120	37	1.33	7.3	64	720
G220	7/28/2016	0.26	98	39	1.21	7.2	46	700
G220	10/20/2016	0.4	87	40	1.48	7.3	58	680
G220	1/24/2017	0.28	99	36	1.3	7.3	38	700
G220	4/25/2017	0.24	91	36	1.35	6.9	31	780
G220	6/14/2017	0.27	100	37	1.28	6.9	29	690
G220	11/17/2017	0.26	100	37	1.37	7	24	610
G220	5/22/2018	0.49	100	31	1.46	7.1	81	770
G220	8/16/2018	0.39	120	36	1.34	7.1	64	NA
G220	11/13/2018	0.31	110	35	1.28	7	45	660
G220	2/20/2019	0.3	110	39	1.24	7.1	41	730
G220	8/21/2019	0.31	110	37	1.24	7	33	800
G220	2/4/2020	0.25	100	40	1.21	7.3	17	950
G222	12/17/2015	0.2	120	69	0.888	7.2	190	1000
G222	1/19/2016	0.22	150	67	0.827	7.5	190	980
G222	4/28/2016	0.24	120	73	0.792	7.3	190	1000
G222	7/28/2016	0.2	140	73	0.958	7.3	200	1000
G222	10/25/2016	0.23	110	70	1.13	7.4	190	880
G222	1/24/2017	0.21	130	67	1.09	7.2	180	1000
G222	4/25/2017	0.18	120	67	1.05	7	180	1100
G222	6/14/2017	0.22	120	69	1.27	7.1	56	980
G222	11/15/2017	0.21	110	67	1.09	7	200	1100
G222	5/22/2018	0.21	120	67	1.3	7.1	170	1000
G222	8/16/2018	0.22	140	70	1.08	7.1	160	NA
G222	11/12/2018	0.21	140	68	0.956	7.1	150	990
G222	2/20/2019	0.21	140	76	0.94	7	150	1000
G222	8/21/2019	0.23	140	69	0.982	7.1	130	1100
G222	2/4/2020	0.21	130	74	0.893	7.4	120	1200
G223	12/17/2015	0.2	99	91	0.691	6.7	1.3	760
G223	1/20/2016	0.15	95	93	0.723	6.5	2.4	700
G223	4/28/2016	0.22	110	88	0.799	6.8	2	720
G223	7/28/2016	0.2	110	98	0.724	6.8	1.3	720
G223	10/20/2016	0.28	85	99	0.929	6.8	2.8	710
G223	1/24/2017	0.21	94	88	0.738	6.8	2.1	760
G223	4/26/2017	0.19	83	85	0.864	6.4	<25	760
G223	6/14/2017	0.22	100	88	0.782	7.1	25	800
G223	11/29/2017	0.23	110	100	0.781	7.2	6	840
G223	5/23/2018	0.23	98	100	0.975	7.2	7.5	820
G223	8/21/2018	0.092	130	51	NA	7.2	130	NA
G223	11/13/2018	0.24	120	100	0.671	7.2	7.3	780
G223	2/21/2019	0.23	120	130	0.645	7.1	21	1000
G223	8/22/2019	0.27	140	130	0.716	7.2	55	980
G223	2/4/2020	0.23	160	150	0.603	7	210	1500
G224	12/17/2015	0.082	110	49	0.344	7.2	140	630
G224	1/21/2016	0.05	110	50	0.329	7.1	130	650

Sample Location	Date Sampled	Boron, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Fluoride, total (mg/L)	pH (STD)	Sulfate, total (mg/L)	Total Dissolved Solids (mg/L)
G224	4/28/2016	0.1	150	52	0.509	7.3	130	620
G224	7/28/2016	0.084	130	55	0.434	7.4	150	660
G224	10/20/2016	0.11	100	60	0.469	7.3	180	640
G224	1/24/2017	0.082	110	50	0.324	7.5	140	690
G224	4/20/2017	0.079	130	54	0.555	7.1	140	690
G224	6/15/2017	0.09	120	49	0.348	7.2	140	660
G224	11/15/2017	0.093	100	50	0.526	7.3	140	680
G224	5/23/2018	0.093	120	49	0.449	7.4	140	630
G224	11/15/2018	0.086	120	49	0.369	7.3	130	640
G224	2/21/2019	0.08	120	55	0.359	7.4	130	740
G224	8/22/2019	0.095	120	50	0.465	7.3	130	740
G224	2/4/2020	0.09	140	53	0.396	7.5	140	880
G224	8/21/2018	NA	130	52	NA	7.4	140	NA
R217D	11/28/2017	0.081	72	25	0.721	6.8	47	470
R217D	5/23/2018	0.057	54	28	0.694	7	66	320
R217D	11/16/2018	0.1	92	29	0.609	7	110	560
R217D	2/21/2019	0.2	550	58	0.287	6.9	2100	3200
R217D	8/21/2019	0.17	210	45	0.644	7	710	1600
R217D	2/5/2020	0.2	750	90	<0.25	6.6	2200	3900
R217D	8/22/2018	NA	120	110	NA	7	1.5	NA
L1R	2/4/2020	6.9	370	8300	0.542	11	21000	NA
L1R	2/19/2020	NA	NA	NA	NA	11	NA	49000
L301	11/19/2019	51	79	35	0.326	9.8	2600	4400
L301	2/6/2020	53	46	27	0.312	9.9	2800	4200

Notes:
1. Abbreviations: mg/L - milligrams per liter; NA - not analyzed; s.u. - standard units.

Sample Location	Date Sampled	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Cadmium, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	Radium-226 + Radium 228, total (pCi/L)	Selenium, total (mg/L)	Thallium, total (mg/L)
Background Wells																
G48MG	12/16/2015	<0.003	0.1	0.2	<0.001	<0.001	<0.004	<0.002	0.611	<0.001	0.019	<2e-04	0.039	0.411	<0.001	<0.001
G48MG	1/18/2016	<0.003	0.096	0.22	<0.001	<0.001	<0.004	<0.002	0.478	<0.001	<0.01	<2e-04	0.041	0.171	<0.001	<0.001
G48MG	4/26/2016	<0.003	0.084	0.22	<0.001	<0.001	<0.004	<0.002	0.644	<0.001	0.015	<2e-04	0.039	0.656	<0.001	<0.001
G48MG	7/27/2016	<0.003	0.059	0.2	<0.001	<0.001	<0.004	<0.002	0.576	<0.001	0.011	<2e-04	0.042	0.267	<0.001	<0.001
G48MG	10/18/2016	<0.003	0.043	0.2	<0.001	<0.001	<0.004	<0.002	0.701	<0.001	<0.01	<2e-04	0.041	1.59	<0.001	<0.001
G48MG	1/23/2017	<0.003	0.047	0.21	<0.001	<0.001	<0.004	<0.002	0.535	<0.001	<0.01	<2e-04	0.038	0.426	<0.001	<0.001
G48MG	4/19/2017	<0.003	0.048	0.21	<0.001	<0.001	<0.004	<0.002	0.714	<0.001	<0.01	<2e-04	0.04	0.319	<0.001	<0.001
G48MG	6/14/2017	<0.003	0.048	0.22	<0.001	<0.001	<0.004	<0.002	0.503	<0.001	<0.01	<2e-04	0.045	0.826	<0.001	<0.001
G48MG	11/28/2017	NA	NA	NA	NA	NA	NA	NA	0.682	NA	NA	NA	NA	NA	NA	NA
G201	12/15/2015	<0.003	0.028	0.39	<0.001	<0.001	<0.004	<0.002	0.708	0.002	<0.01	<2e-04	0.013	1.86	<0.001	<0.001
G201	1/18/2016	<0.003	0.034	0.85	<0.001	<0.001	0.016	0.0032	0.65	0.01	0.014	<2e-04	0.019	3.96	<0.001	<0.001
G201	4/26/2016	<0.003	0.033	0.36	<0.001	<0.001	<0.004	<0.002	0.786	<0.001	<0.01	<2e-04	0.013	0.354	<0.001	<0.001
G201	7/27/2016	<0.003	0.029	0.22	<0.001	<0.001	<0.004	<0.002	0.713	<0.001	<0.01	<2e-04	0.012	0.148	<0.001	<0.001
G201	10/18/2016	<0.003	0.033	0.19	<0.001	<0.001	<0.004	<0.002	0.954	<0.001	<0.01	<2e-04	0.011	0.104	<0.001	<0.001
G201	1/18/2017	<0.003	0.03	0.21	<0.001	<0.001	<0.004	<0.002	1.04	<0.001	<0.01	<2e-04	0.012	0.719	<0.001	<0.001
G201	4/19/2017	<0.003	0.032	0.24	<0.001	<0.001	<0.004	<0.002	0.872	<0.001	<0.01	<2e-04	0.012	0.434	<0.001	<0.001
G201	6/14/2017	<0.003	0.039	0.5	0.0011	<0.001	<0.004	<0.002	0.636	0.0016	<0.01	<2e-04	0.015	0.727	<0.001	0.0015
G201	11/28/2017	NA	NA	NA	NA	NA	NA	NA	0.748	NA	NA	NA	NA	NA	NA	NA
Downgradient Wells																
G06D	12/16/2015	<0.003	<0.001	0.36	<0.001	<0.001	0.0086	<0.002	<0.25	<0.001	<0.01	<2e-04	0.015	3.81	0.0011	<0.001
G06D	1/19/2016	<0.003	<0.001	0.37	<0.001	<0.001	<0.004	<0.002	<0.25	<0.001	<0.01	<2e-04	0.015	7.43	0.0011	<0.001
G06D	4/27/2016	<0.003	0.004	0.58	<0.001	<0.001	0.0052	<0.002	0.428	<0.001	<0.01	<2e-04	0.015	2.1	<0.001	<0.001
G06D	7/27/2016	<0.003	0.0062	0.63	<0.001	<0.001	0.008	<0.002	0.463	<0.001	<0.01	<2e-04	0.015	2.04	<0.001	<0.001
G06D	10/18/2016	<0.003	0.0064	0.64	<0.001	<0.001	<0.004	<0.002	0.677	<0.001	<0.01	<2e-04	0.014	2.56	<0.001	<0.001
G06D	1/19/2017	<0.003	0.0077	0.66	<0.001	<0.001	<0.004	<0.002	0.744	<0.001	<0.01	<2e-04	0.011	1.4	<0.001	<0.001
G06D	4/19/2017	<0.003	0.008	0.71	<0.001	<0.001	0.02	<0.002	0.751	<0.001	<0.01	<2e-04	0.015	2.31	<0.001	<0.001
G06D	6/14/2017	<0.003	0.012	0.73	<0.001	<0.001	0.035	<0.002	0.642	0.001	<0.01	<2e-04	0.016	2.4	<0.001	<0.001
G06D	11/15/2017	NA	NA	NA	NA	NA	NA	NA	0.709	NA	NA	NA	NA	NA	NA	NA
G202	12/17/2015	<0.003	0.0081	0.49	<0.001	<0.001	<0.004	<0.002	0.435	<0.001	<0.01	<2e-04	0.0037	0.935	<0.001	<0.001
G202	1/20/2016	<0.003	0.0089	0.5	<0.001	<0.001	<0.004	<0.002	0.401	<0.001	<0.01	<2e-04	0.0041	1.02	<0.001	<0.001
G202	4/28/2016	<0.003	0.0096	0.54	<0.001	<0.001	<0.004	<0.002	0.486	<0.001	<0.01	<2e-04	0.0036	1.72	<0.001	<0.001
G202	7/27/2016	<0.003	0.0077	0.54	<0.001	<0.001	<0.004	<0.002	0.444	<0.001	<0.01	0.00052	0.0032	1.06	<0.001	<0.001
G202	10/19/2016	<0.003	0.0066	0.54	<0.001	<0.001	<0.004	<0.002	0.552	<0.001	<0.01	<2e-04	0.0028	2.94	<0.001	<0.001
G202	1/18/2017	<0.003	0.0072	0.5	<0.001	<0.001	<0.004	<0.002	0.573	<0.001	<0.01	<2e-04	0.004	1.36	<0.001	<0.001
G202	4/20/2017	0.0036	0.0091	0.52	<0.001	<0.001	0.0047	<0.002	0.55	0.0013	<0.01	0.0012	0.0033	0.303	<0.001	<0.001
G202	6/15/2017	<0.003	0.011	0.62	<0.001	<0.001	0.0076	<0.002	0.382	0.0017	<0.01	<2e-04	0.0034	4.18	<0.001	<0.001
G202	11/15/2017	NA	NA	NA	NA	NA	NA	NA	0.618	NA	NA	NA	NA	NA	NA	NA
G203	12/16/2015	<0.003	0.014	0.38	<0.001	<0.001	<0.004	<0.002	0.363	<0.001	<0.01	<2e-04	0.0036	0.678	<0.001	<0.001
G203	1/20/2016	<0.003	0.014	0.42	<0.001	<0.001	<0.004	<0.002	0.323	0.0011	<0.01	<2e-04	0.0039	1.33	<0.001	<0.001
G203	4/28/2016	<0.003	0.016	0.44	<0.001	<0.001	<0.004	<0.002	0.401	<0.001	<0.01	<2e-04	0.0043	1.35	<0.001	<0.001
G203	7/27/2016	<0.003	0.013	0.41	<0.001	<0.001	<0.004	<0.002	0.338	<0.001	<0.01	<2e-04	0.004	1.8	<0.001	<0.001
G203	10/19/2016	<0.003	0.016	0.41	<0.001	<0.001	<0.004	<0.002	0.459	<0.001	<0.01	<2e-04	0.0039	2.3	<0.001	<0.001
G203	1/19/2017	<0.003	0.01	0.42	<0.001	<0.001	<0.004	<0.002	0.428	<0.001	<0.01	<2e-04	0.0038	0.81	<0.001	<0.001
G203	4/20/2017	<0.003	0.013	0.44	<0.001	<0.001	0.0053	<0.002	0.491	0.0016	<0.01	<2e-04	0.0043	0.395	<0.001	<0.001
G203	6/15/2017	<0.003	0.016	0.49	<0.001	<0.001	0.018	0.0029	0.328	0.0053	0.01	<2e-04	0.0059	2	<0.001	<0.001
G203	11/15/2017	NA	NA	NA	NA	NA	NA	NA	0.504	NA	NA	NA	NA	NA	NA	NA
G208	12/16/2015	<0.003	0.058	0.56	<0.001	<0.001	<0.004	<0.002	0.978	<0.001	<0.01	<2e-04	0.0021	1.4	<0.001	<0.001
G208	1/19/2016	<0.003	0.065	0.6	<0.001	<0.001	<0.004	<0.002	0.848	<0.001	<0.01	<2e-04	0.0017	3.23	<0.001	<0.001
G208	4/28/2016	<0.003	0.064	0.67	<0.001	<0.001	0.0075	<0.002	0.848	<0.001	<0.01	<2e-04	0.0022	1.14	<0.001	<0.001
G208	7/29/2016	<0.003	0.064	0.61	<0.001	<0.001	<0.004	<0.002	1.03	<0.001	<0.01	<2e-04	<0.001	2.29	<0.001	<0.001

Sample Location	Date Sampled	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Cadmium, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	Radium-226 + Radium 228, total (pCi/L)	Selenium, total (mg/L)	Thallium, total (mg/L)
G208	10/25/2016	<0.003	0.068	0.67	<0.001	<0.001	<0.004	<0.002	1.21	<0.001	<0.01	<2e-04	<0.001	1.32	<0.001	<0.001
G208	1/24/2017	<0.003	0.069	0.63	<0.001	<0.001	<0.004	<0.002	1.02	<0.001	<0.01	<2e-04	<0.001	1	<0.001	<0.001
G208	4/20/2017	<0.003	0.061	0.64	<0.001	<0.001	<0.004	<0.002	1.21	<0.001	<0.01	<2e-04	<0.001	0.999	<0.001	<0.001
G208	6/14/2017	<0.003	0.032	0.59	<0.001	<0.001	<0.004	<0.002	1.05	<0.001	<0.01	<2e-04	<0.001	2.32	<0.001	<0.001
G208	11/17/2017	NA	NA	NA	NA	NA	NA	NA	1.11	NA	NA	NA	NA	NA	NA	NA
G217D	12/17/2015	<0.003	0.048	0.35	<0.001	<0.001	0.014	0.0059	0.521	0.0094	0.025	<2e-04	0.015	1.35	<0.001	<0.001
G217D	1/21/2016	<0.003	0.073	0.6	0.0027	0.0014	0.09	0.036	0.469	0.065	0.1	0.00031	0.02	15.2	0.0032	<0.001
G217D	4/29/2016	<0.003	0.049	0.4	<0.001	<0.001	0.014	0.0046	0.562	0.0069	0.023	<2e-04	0.014	1.88	<0.001	<0.001
G217D	7/29/2016	<0.003	0.058	0.36	<0.001	<0.001	<0.004	<0.002	0.472	0.0011	0.015	<2e-04	0.013	1.45	<0.001	<0.001
G217D	10/20/2016	<0.003	0.046	0.36	<0.001	<0.001	<0.004	<0.002	0.684	<0.001	<0.01	<2e-04	0.012	1.8	<0.001	<0.001
G217D	1/19/2017	<0.003	0.054	0.36	<0.001	<0.001	0.0091	0.0048	0.671	0.0073	0.02	<2e-04	0.012	0.783	<0.001	<0.001
G217D	4/20/2017	<0.003	0.045	0.41	<0.001	<0.001	0.013	0.0052	0.679	0.0086	0.021	<2e-04	0.013	1.2	<0.001	<0.001
G217D	6/15/2017	<0.003	0.049	0.36	<0.001	<0.001	0.0073	0.0029	0.535	0.0053	0.014	<2e-04	0.011	1.93	<0.001	<0.001
G220	12/17/2015	<0.003	0.053	0.51	<0.001	<0.001	0.0061	<0.002	1.13	0.002	0.016	<2e-04	0.0073	1.62	<0.001	<0.001
G220	1/19/2016	<0.003	0.054	0.51	<0.001	<0.001	<0.004	<0.002	1.08	<0.001	<0.01	<2e-04	0.0066	3.34	<0.001	<0.001
G220	4/27/2016	<0.003	0.075	0.61	<0.001	<0.001	<0.004	<0.002	1.33	<0.001	<0.01	<2e-04	0.0067	1.08	<0.001	<0.001
G220	7/28/2016	<0.003	0.07	0.55	<0.001	<0.001	<0.004	<0.002	1.21	<0.001	<0.01	<2e-04	0.0053	2.26	<0.001	<0.001
G220	10/20/2016	<0.003	0.075	0.57	<0.001	<0.001	<0.004	<0.002	1.48	<0.001	<0.01	<2e-04	0.0053	1.46	<0.001	<0.001
G220	1/24/2017	<0.003	0.082	0.61	<0.001	<0.001	0.0075	<0.002	1.3	0.0022	<0.01	<2e-04	0.0052	1.54	<0.001	<0.001
G220	4/25/2017	<0.003	0.077	0.55	<0.001	<0.001	<0.004	<0.002	1.35	<0.001	<0.01	<2e-04	0.004	0.937	<0.001	<0.001
G220	6/14/2017	<0.003	0.06	0.56	<0.001	<0.001	<0.004	<0.002	1.28	<0.001	<0.01	<2e-04	0.0049	1.54	<0.001	<0.001
G220	11/17/2017	NA	NA	NA	NA	NA	NA	NA	1.37	NA	NA	NA	NA	NA	NA	NA
G222	12/17/2015	<0.003	0.046	0.75	<0.001	<0.001	0.004	<0.002	0.888	<0.001	<0.01	<2e-04	0.011	0.605	0.001	<0.001
G222	1/19/2016	<0.003	0.061	0.91	<0.001	<0.001	0.082	0.0076	0.827	0.0096	0.012	<2e-04	0.016	1.65	<0.001	<0.001
G222	4/28/2016	<0.003	0.047	0.78	<0.001	<0.001	0.0074	<0.002	0.792	<0.001	<0.01	<2e-04	0.01	0.788	<0.001	<0.001
G222	7/28/2016	<0.003	0.056	0.8	<0.001	<0.001	<0.004	<0.002	0.958	<0.001	<0.01	<2e-04	0.0093	0.573	<0.001	<0.001
G222	10/25/2016	<0.003	0.052	0.8	<0.001	<0.001	<0.004	<0.002	1.13	<0.001	<0.01	<2e-04	0.0074	1.55	<0.001	<0.001
G222	1/24/2017	<0.003	0.051	0.83	<0.001	<0.001	<0.004	<0.002	1.09	<0.001	<0.01	<2e-04	0.0072	0.484	<0.001	<0.001
G222	4/25/2017	<0.003	0.042	0.69	<0.001	<0.001	<0.004	<0.002	1.05	<0.001	<0.01	<2e-04	0.0057	0.819	<0.001	<0.001
G222	6/14/2017	<0.003	0.13	1.5	<0.001	<0.001	<0.004	<0.002	1.27	<0.001	<0.01	<2e-04	0.0015	2.47	<0.001	<0.001
G222	11/15/2017	NA	NA	NA	NA	NA	NA	NA	1.09	NA	NA	NA	NA	NA	NA	NA
G223	12/17/2015	<0.003	0.046	0.68	<0.001	<0.001	0.0053	<0.002	0.691	<0.001	<0.01	<2e-04	<0.001	0.69	<0.001	<0.001
G223	1/20/2016	<0.003	0.053	0.71	<0.001	<0.001	<0.004	<0.002	0.723	<0.001	<0.01	<2e-04	<0.001	1.4	<0.001	<0.001
G223	4/28/2016	<0.003	0.062	0.79	<0.001	<0.001	0.0048	<0.002	0.799	<0.001	<0.01	<2e-04	0.0011	1.47	<0.001	<0.001
G223	7/28/2016	<0.003	0.062	0.75	<0.001	<0.001	<0.004	<0.002	0.724	<0.001	<0.01	<2e-04	<0.001	1.47	<0.001	<0.001
G223	10/20/2016	<0.003	0.053	0.7	<0.001	<0.001	<0.004	<0.002	0.929	<0.001	<0.01	<2e-04	<0.001	1.77	<0.001	<0.001
G223	1/24/2017	<0.003	0.053	0.75	<0.001	<0.001	0.0041	<0.002	0.738	<0.001	<0.01	<2e-04	<0.001	0.227	<0.001	<0.001
G223	4/26/2017	<0.003	0.045	0.6	<0.001	<0.001	0.0061	<0.002	0.864	0.001	<0.01	<2e-04	0.0015	0.964	<0.001	<0.001
G223	6/14/2017	<0.003	0.0085	0.58	<0.001	<0.001	<0.004	<0.002	0.782	<0.001	<0.01	0.00049	0.0013	1.09	<0.001	<0.001
G223	11/29/2017	NA	NA	NA	NA	NA	NA	NA	0.781	NA	NA	NA	NA	NA	NA	NA

Analytical Results - Appendix IV
Newton Landfill 2

Sample Location	Date Sampled	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Cadmium, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	Radium-226 + Radium 228, total (pCi/L)	Selenium, total (mg/L)	Thallium, total (mg/L)
G224	12/17/2015	<0.003	0.0026	0.4	<0.001	<0.001	<0.004	<0.002	0.344	<0.001	<0.01	<2e-04	0.004	1.1	<0.001	<0.001
G224	1/21/2016	<0.003	0.0064	0.49	<0.001	<0.001	0.0044	<0.002	0.329	0.0038	<0.01	<2e-04	0.0053	1.69	<0.001	<0.001
G224	4/28/2016	<0.003	0.0083	0.61	<0.001	<0.001	0.016	0.0042	0.509	0.0097	0.014	<2e-04	0.0058	1.07	<0.001	<0.001
G224	7/28/2016	<0.003	0.0063	0.51	<0.001	<0.001	0.0063	0.0022	0.434	0.0051	<0.01	<2e-04	0.0044	1.19	<0.001	<0.001
G224	10/20/2016	<0.003	0.0046	0.47	<0.001	<0.001	<0.004	<0.002	0.469	<0.001	<0.01	<2e-04	0.0038	2.6	<0.001	<0.001
G224	1/24/2017	<0.003	0.0052	0.48	<0.001	<0.001	<0.004	<0.002	0.324	0.0011	<0.01	<2e-04	0.004	0.803	<0.001	<0.001
G224	4/20/2017	<0.003	0.005	0.52	<0.001	<0.001	<0.004	<0.002	0.555	0.0016	<0.01	<2e-04	0.0044	1.5	<0.001	<0.001
G224	6/15/2017	<0.003	0.0057	0.5	<0.001	<0.001	0.004	<0.002	0.348	0.0028	<0.01	<2e-04	0.0046	3.55	<0.001	<0.001
G224	11/15/2017	NA	NA	NA	NA	NA	NA	NA	0.526	NA	NA	NA	NA	NA	NA	NA
R217D	11/28/2017	NA	NA	NA	NA	NA	NA	NA	0.721	NA	NA	NA	NA	NA	NA	NA

Notes:
1. Abbreviations: mg/L - milligrams per liter; NA - not analyzed; pCi/L - picocurie per liter

40 CFR § 257.94(E)(2): Alternate Source Demonstration
Newton Landfill 2

Newton Power Station
Newton, Illinois

Illinois Power Generating Company

April 9, 2018

APRIL 9, 2018 | PROJECT #70092

40 CFR § 257.94(E)(2): Alternate Source Demonstration Newton Landfill 2

Newton Power Station
Newton, Illinois

Prepared for:
Illinois Power Generating Company

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LIST OF FIGURES

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ACRONYMS AND ABBREVIATIONS

ASD	alternate source demonstration
CCR	Coal Combustion Residuals
CFR	Code of Federal Regulation
IEPA	Illinois Environmental Protection Agency
LF1	Newton Power Station Phase I Landfill
LF2	Newton Power Station Phase II Landfill
mg/L	milligrams per liter
msl	mean sea level
NPDES	National Pollutant Discharge Elimination System
OBG	O'Brien & Gere Engineers, Inc.
PAP	Newton Power Station Primary Ash Pond
SSI	statistically significant increase

1 INTRODUCTION

1.1 OVERVIEW

This alternate source demonstration (ASD) has been prepared on behalf of Illinois Power Generating Company by O'Brien & Gere Engineers, Inc. (OBG) to provide pertinent information pursuant to 40 CFR § 257.94(e)(2) for the Newton Power Station Landfill 2 (Phase II Landfill) near Newton, Illinois.

Initial background groundwater monitoring consisting of a minimum of eight samples as required under 40 CFR § 257.94(b) was initiated in December 2015 and completed prior to October 17, 2017. The first semi-annual detection monitoring samples were collected on November 15 to 29, 2017. Evaluation of analytical data from the first detection monitoring sample for statistically significant increases (SSIs) of 40 CFR Part 257 Appendix III parameters over background concentrations was completed within 90 days of collection and analysis of the sample (January 9, 2018). That evaluation identified SSIs at downgradient monitoring wells as follows:

- Boron at wells G220, G222 and G223
- Calcium at well G202
- Chloride at wells G06D, G202, G203, G208, G220, G222, G223 and G224
- Fluoride at wells G208, G220 and G222
- Total dissolved solids at wells G222

40 CFR 257.94(e)(2) allows the owner or operator 90 days from the date of an SSI determination to complete a written demonstration that a source other than the CCR unit caused the SSI or that the SSI resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality ("alternate source demonstration"). Pursuant to 40 CFR § 257.94(e)(2), the following demonstrates that sources other than the Phase II Landfill, including anthropogenic sources and natural variation in groundwater quality, were the cause of the SSIs listed above. This alternate source demonstration (ASD) was completed within 90 days of determination of the SSIs (April 9, 2018) as required by 40 CFR § 257.94(e)(2).

1.2 SITE LOCATION AND DESCRIPTION

The Newton Power Station is located in Jasper County in the southeastern part of central Illinois, approximately 7 miles southwest of the town of Newton (Figure 1). The area is surrounded by Newton Lake. Beyond the lake is agricultural land.

1.3 DESCRIPTION OF CCR MANAGEMENT UNITS

The CCR management units at the Newton Power Station include the Phase I Landfill, Primary Ash Pond (CCR Unit ID 501), and the Phase II Landfill (CCR Unit ID 502).

1.3.1 Phase I Landfill (LF1)

The Phase I Landfill (LF1) is an unlined landfill built around 1977 and permitted to start receiving CCRs in 1979. LF1was closed in 1999 with a 40-mil thick geomembrane cap, and is consequently not subject to the USEPA CCR Rule (40 CFR Part 257).

1.3.2 Phase II Landfill (LF2)

The Phase II Landfill (LF2) includes three cells. Cells 1 and 2, encompassing approximately 46 acres, are adjacent to each other and located south and east of LF1. Cell 3 has a footprint of approximately 12 acres and is approximately 1,100 feet west of Cells 1 and 2 and south of the southwestern portion of LF1. All three cells of LF2 are constructed with composite liners with leachate collection systems that meet or exceed the landfill liner performance standards of 40 CFR § 257.70. More details on the liner construction of LF2 are provided in Section 3.1.

Cell 3 is currently inactive and has not received CCR since constructed in 2011.

1.3.3 Primary Ash Pond (PAP)

The Newton Power Station's sole CCR surface impoundment, the Primary Ash Pond (PAP), was constructed in 1977 and has a design capacity of approximately 9,715 acre-feet. The PAP has a surface area of 400 acres and a height of approximately 71 feet above grade. The PAP currently receives bottom ash, fly ash, and low-volume wastewater (LVW) from the plant's two coal-fired boilers, and is operated per NPDES Permit IL0049191, Outfall 001. The PAP was not excavated during construction except for native materials used to build the containment berms.

1.4 GEOLOGY AND HYDROGEOLOGY

The results of the site characterization activities previously performed at the Site are discussed below.

1.4.1 Geology

Quaternary deposits in the Newton area consist mainly of diamictons and outwash deposits that were deposited during Illinoian and Pre-Illinoian glaciations. The unconsolidated deposits which occur at Newton Power Station include the following units (beginning at the ground surface):

- Ash/Fill Units – CCR and fill within the various CCR Units
- Upper Confining Unit – Low permeability clays and silts, including the Peoria Silt (Loess Unit) in upland areas and the Cahokia Formation in the flood plain and channel areas to the south and east, underlain by the Sangamon Soil, and the predominantly clay diamictons of the Hagarstown (Till) Member of the Pearl Formation and the Vandalia (Till) Member of the Glasford Formation
- Uppermost Aquifer (Groundwater Monitoring Zone) – Thin to moderately thick (3 to 17 ft), moderate to high permeability sand, silty sand, and sandy silt/clay units of the Mulberry Grove Member of the Glasford Formation
- Lower Confining Unit – Thick, very low permeability silty clay diamicton of the Smithboro (Till) Member of the Glasford Formation and the silty clay diamictons of the Banner Formation

The bedrock beneath the facility consists of Pennsylvanian-age Mattoon Formation that is mostly shale near the bedrock surface, but is characterized at depth by a complex sequence of shales, thin limestones, coals, underclays, and several sandstones. The erosional surface of the Pennsylvanian-age Mattoon Formation bedrock ranges widely in depth in the vicinity of the site, but is typically encountered at 90 to 120 ft below ground surface (bgs).

1.4.2 Hydrogeology

The information used to describe the hydrogeology is based on the local geology obtained from published sources, hydrogeologic investigation data, and boring data collected during monitoring well installation. Monitoring well locations are shown in Figure 1.

1.4.2.1 Uppermost Aquifer

The uppermost aquifer is the Mulberry Grove Member, typically consisting of fine to coarse sand with varying amounts of clay, silt and fine to coarse gravel. The portion of the Mulberry Grove Member at the site that is defined as a sand layer ranges in thickness from 3 to 17 ft with an average thickness of 8 ft and, with only a few exceptions, occurs between depths of 55 to 88 ft bgs.

1.4.2.2 Lower Limit of Aquifer

The lower hydrostratigaphic units consist of the Smithboro Member and the Banner Formation, both of which are predominantly low permeability clay diamictons with varying amounts of silt, sand, and gravel. The lower unlithified confining unit is 30 to more than 50 ft thick above the underlying bedrock.

1.4.2.3 Groundwater Elevations, Flow Direction, and Velocity

Groundwater elevations across LF2 ranged from approximately 441 to 520 ft MSL (NAVD88) from 2015 to 2017. Figure 2 is the potentiometric surface from the November 2017 detection monitoring event. Overall groundwater flow beneath LF2, within the uppermost aquifer, is southward toward Newton Lake, but with a south component of flow under Areas 1 and 2, and a predominantly eastward flow under Cell 3. Horizontal hydraulic gradients are moderate at 0.016 ft/ft. Calculated groundwater flow velocity based on the January and June 2017 groundwater contour maps was 1.42 ft per day (ft/day).

2 GROUNDWATER AND LEACHATE MONITORING

The uppermost aquifer monitoring well network for Cells 1/2 and Cell 3 is shown on Figure 1 and described below.

2.1 BACKGROUND GROUNDWATER MONITORING

Monitoring wells G201 and G48MG are used to monitor background water quality for LF2. These wells are located north of LF1 and LF2.

2.2 DOWNGRADIENT GROUNDWATER MONITORING

LF2 Cells 1 and 2 are monitored using wells G202, G203, G223, G224, and R217D. LF1 borders these two cells on the north and west sides; the PAP borders them to the east. LF2 Cell 3 is located 1,500 feet to the southwest. The undeveloped area between Cells 1/2, and Cell 3, has been reserved for future landfill expansion, if needed.

LF2 Cell 3 is monitored using wells G06D, G208, G220 and G222. LF2 Cell 3 is bounded to the north by the southern end of LF1. The land bordering the cell to the east, west and south is undeveloped. The lake is 1,000 feet to the southwest. Cell 3 does not contain CCR.

2.3 LEACHATE MONITORING

Leachate generated by LF1 is monitored at location L1R and leachate from LF Cells 1 and 2 is monitored at L301; both locations are shown on Figure 1. Leachate is not generated at Cell 3 since it does not contain CCR.

3 LINES OF EVIDENCE SUPPORTING ASD

As allowed by 40 CFR § 257.94(e)(2), this ASD demonstrates that sources other than LF2 caused the SSI or that the SSI was a result of natural variation in groundwater quality. This ASD is based on the following lines of evidence (LOE) as discussed below.

3.1 LANDFILL DESIGN AND OPERATION

The LF2 includes three cells. Cells 1 and 2 are adjacent to each other and located south and east of LF1. Cells 1 and 2, encompassing approximately 46 acres, were constructed in 1997 and began receiving CCRs that same year. A portion of Cell 2 is still operational. Cell 3 was constructed in 2011 and its footprint is approximately 12 acres. It is currently inactive and has not received CCR since constructed in 2011.

The constructed landfill components for Cells 1, 2, and 3 include the following features from top to bottom:

- Soil cover for frost protection
- 10-ounce/sy geotextile for separation of the leachate management system from the frost protection soil cover
- 1-foot thick sand drainage layer for the leachate collection system
- 60-mil high-density polyethylene (HDPE) geomembrane
- Three feet of compacted, low-permeability soil with a maximum hydraulic conductivity of 1.0 x 10-7 centimeters per second (cm/sec)

All three cells of LF2 are constructed with composite liners with leachate collection systems that meet or exceed the landfill liner performance standards of 40 CFR § 257.70.

3.2 GROUNDWATER QUALITY SIGNATURE

Piper diagrams graphically represent ionic composition of aqueous solutions. A Piper diagram displays the position of water samples with respect to their major cation and anion content, providing the information needed to identify composition categories or groupings. Figure 3 is a Piper diagram that displays the ionic composition of samples from the background and downgradient monitoring wells associated with LF1, LF2, and PAP versus landfill leachate and PAP water. The groupings identified are shown in the green, brown, blue, and purple ellipses on the Piper diagram. These are discussed in more detail below.

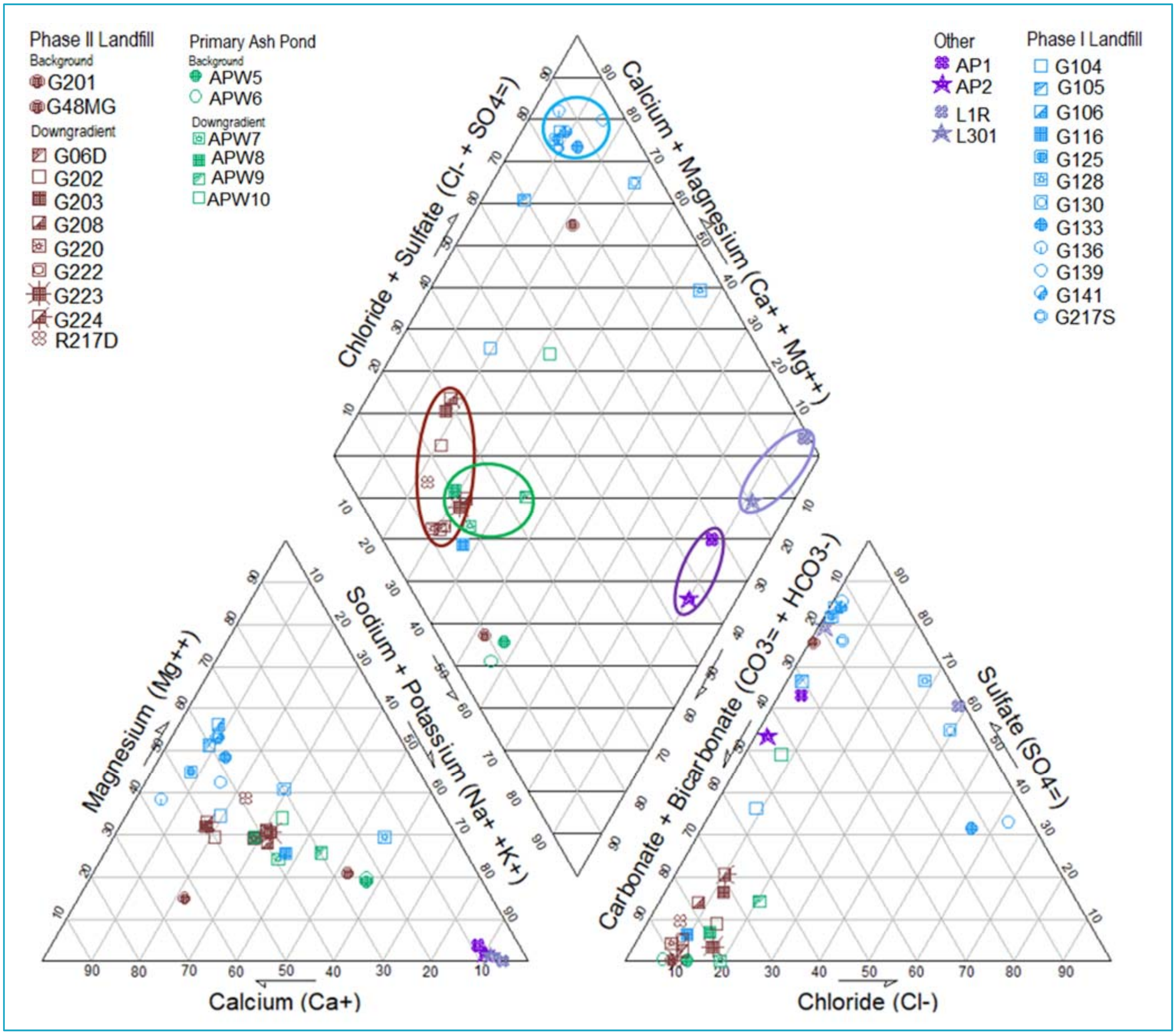


Figure 3. Piper diagram showing ionic composition of samples of background and downgradient groundwater associated with Phase I Landfill (LF1), Phase II Landfill (LF2), and Primary Ash Pond versus landfill leachate and Primary Ash Pond water

The ionic characteristics of the water samples in each grouping are provided in Table 1 below:

Grouping	Burgundy	Green	Blue	Light Purple	Purple
Locations	Phase II Landfill Wells (LF2) Groundwater	Primary Ash Pond (PAP) Groundwater	Phase I Landfill Wells (LF1) Groundwater	Landfill Leachate	Primary Ash Pond Water
Dominant Cation	No dominant cation	No dominant cation	No dominant cation	**Very High Sodium-Potassium**	**Very High Sodium-Potassium**
Dominant Anion	**Very High Carbonate-Bicarbonate**	**Very High Carbonate-Bicarbonate**	**High Sulfate**	No dominant anion	No dominant anion

Table 1. Summary of Ionic Classification

The results can be categorized into three distinct groups. The LF2 groundwater samples (burgundy grouping) and the PAP groundwater samples (green grouping) are very high carbonate-bicarbonate waters with no dominant cation. The LF1 wells (blue grouping) also have no dominant cation, but these waters are high in sulfate. The PAP waters (light purple grouping) and the landfill leachate (purple grouping) are very high sodium-potassium with no dominant anion.

The groundwater samples for both LF2 and PAP are tightly clustered on the Piper diagram. This tight grouping indicates that the groundwater is either not being influenced by other sources, or is being influenced by a consistent, steady-state source, such as LF1, that is influencing all the wells equally and simultaneously.

The presence of a potential mixing zone between LF2 groundwater, PAP groundwater, and LF1 groundwater suggests that LFI is an alternate source of the elevated major cation calcium and elevated major anions chloride and sulfate.

Figure 4 is an enlargement of the LF2 and PAP groundwater sample groupings on the Piper diagram in Figure 3. The intermingling of the results from Cells 1 and 2, and Cell 3 on the Piper diagram indicates that the ionic composition of these groundwaters are similar, despite the distance between them.

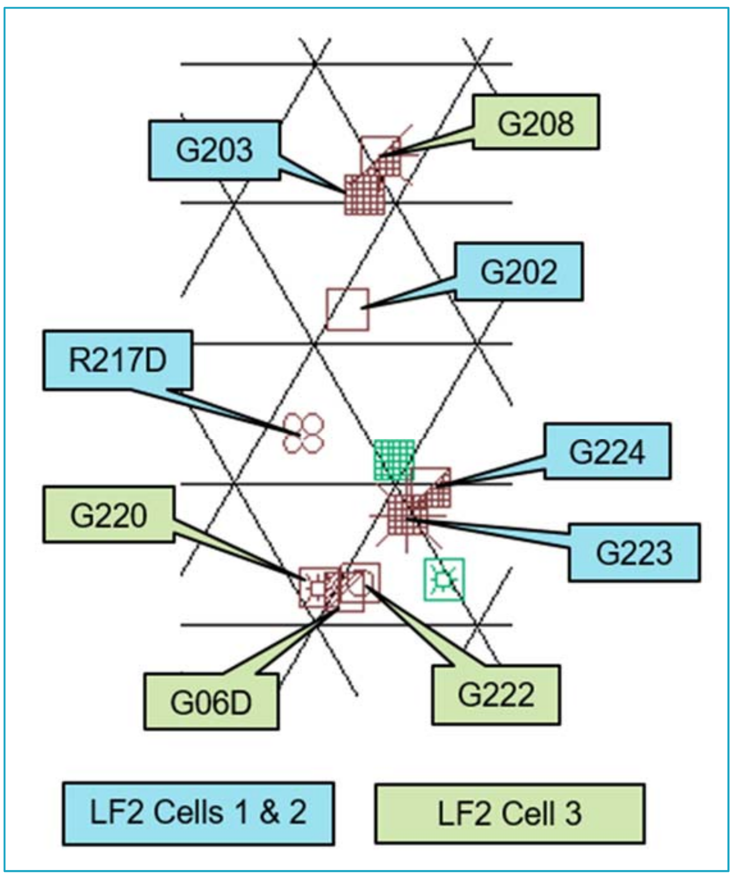


Figure 4. Enlargement of Piper Diagram

3.3 LINES OF EVIDENCE FOR SSI PARAMETERS BY WELL

3.3.1 Boron

3.3.1.1 Wells G220 and G222 (Cell 3)

Monitoring wells G220, and G222 are part of the downgradient monitoring wells for LF2 Cell 3. Cell 3 does not contain CCR; therefore, it cannot be the source of the boron in G220 or G222. The alternate source is likely a steady-state source, as inferred from the Piper diagram, such as LF1.

3.3.1.2 Well G223 (Cells 1 and 2)

It is evident from the Piper diagram (Figure 3) that groundwater samples from G223 have similar ionic composition as groundwater samples from the Cell 3 wells. Box plots of the boron concentrations observed in Cell 3 wells and G223 are shown in the figure below.

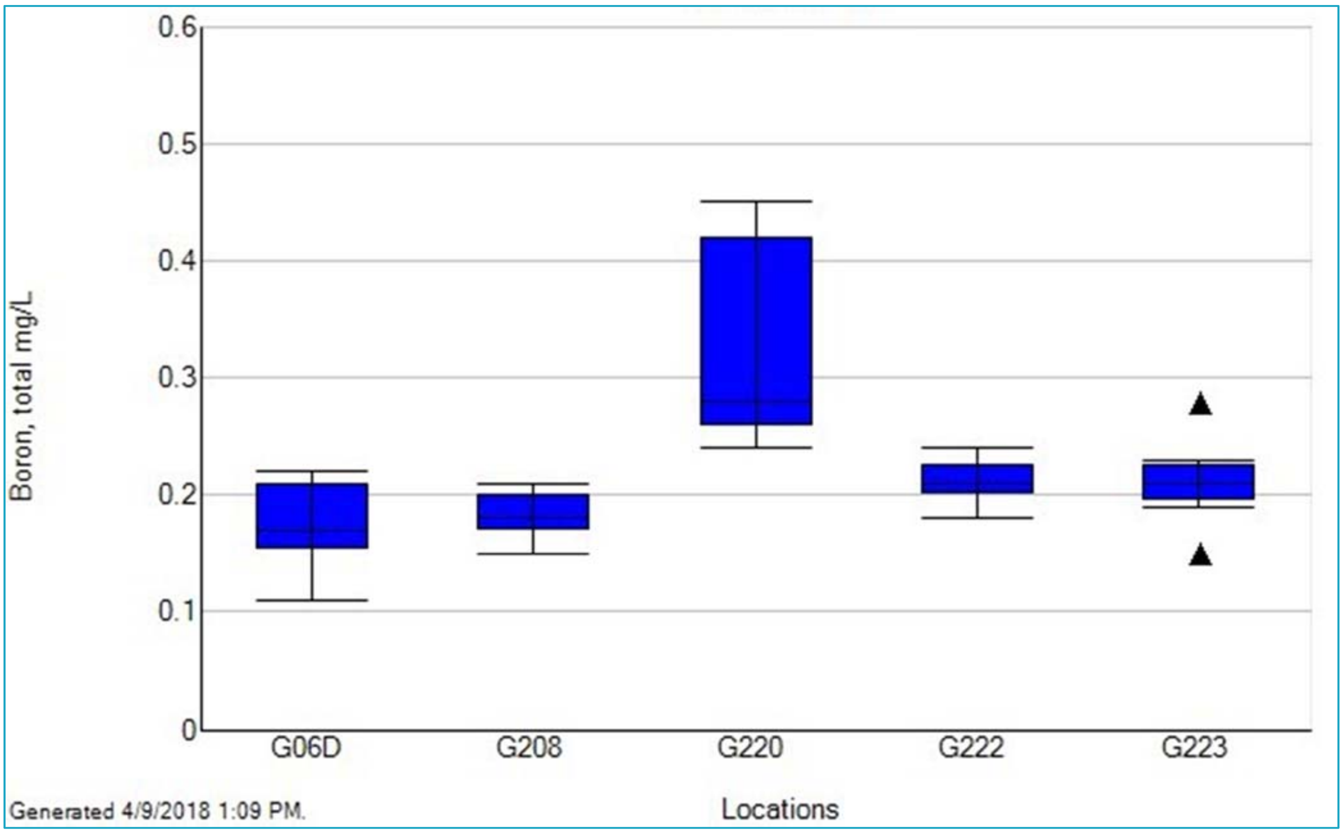


Figure 5. Box plot for boron concentrations in groundwater samples collected from Cell 3 monitoring wells and G223

Figure 5 demonstrates the following:

- Boron concentrations in groundwater samples collected from monitoring well G223 exhibit non-parametric characteristics as shown by the outliers (arrows) at 1.5 times the interquartile range (IQR).
- Boron concentrations in groundwater samples collected from the monitoring wells exhibit some level of skewness, with G06D and G220 having the most, and G223 the least.

The Kruskal-Wallis test was used to see if boron concentrations observed at G223 are part of the same statistical population as those observed at the wells near Cell 3. This is the appropriate test for comparing two or more groups that contain non-parametric data. The null hypothesis (H_0) is that the groups of data being compared have identical distributions. The hypothesis is true if chi-squared is greater than the H statistic. The test resulted in chi-squared value of 3.841 and an H statistic of 0.029, indicating that the null hypothesis is true, and the boron concentrations observed at well G223 are part of the same statistical population as those observed in the wells near Cell 3. Test results are provided in Appendix A.

Cumulative distribution curves are provided in Figure 6 below.

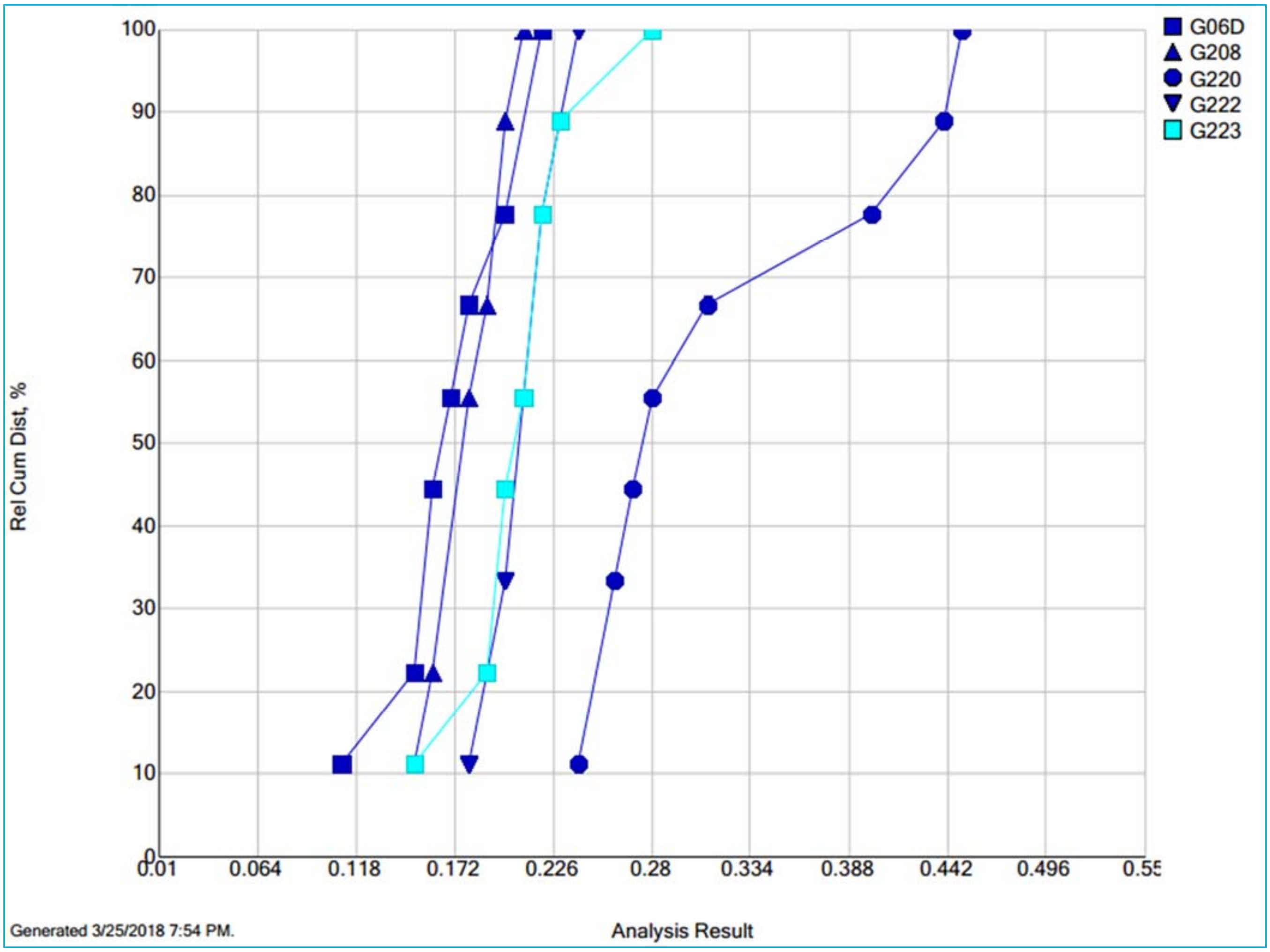


Figure 6. Boron Cumulative Distribution Curve for Cell 3 monitoring wells and G223

The near vertical lines shown in Figure 6, with the exception of G220 (Cell 3), indicate that the concentrations of boron in the wells are stable. The curve for G223 overlaps the curve for G222, further reinforcing that boron concentrations observed at G223 are part of the same statistical population as those observed in the wells near Cell 3.

Boron concentrations observed at well G223 are stable and in the same statistical population as boron concentrations observed in the wells near Cell 3; therefore, it is also likely influenced by an alternate source.

3.3.2 Calcium – G202 (Cells 1 and 2)

Calcium in groundwater at well G202, located downgradient from Cells 1 and 2, generally occurs at concentrations greater than observed in LF2 leachate at sampling location L301. Conversely, the calcium content in the LF1 leachate, as measured at sampling location L1R, is extremely elevated.

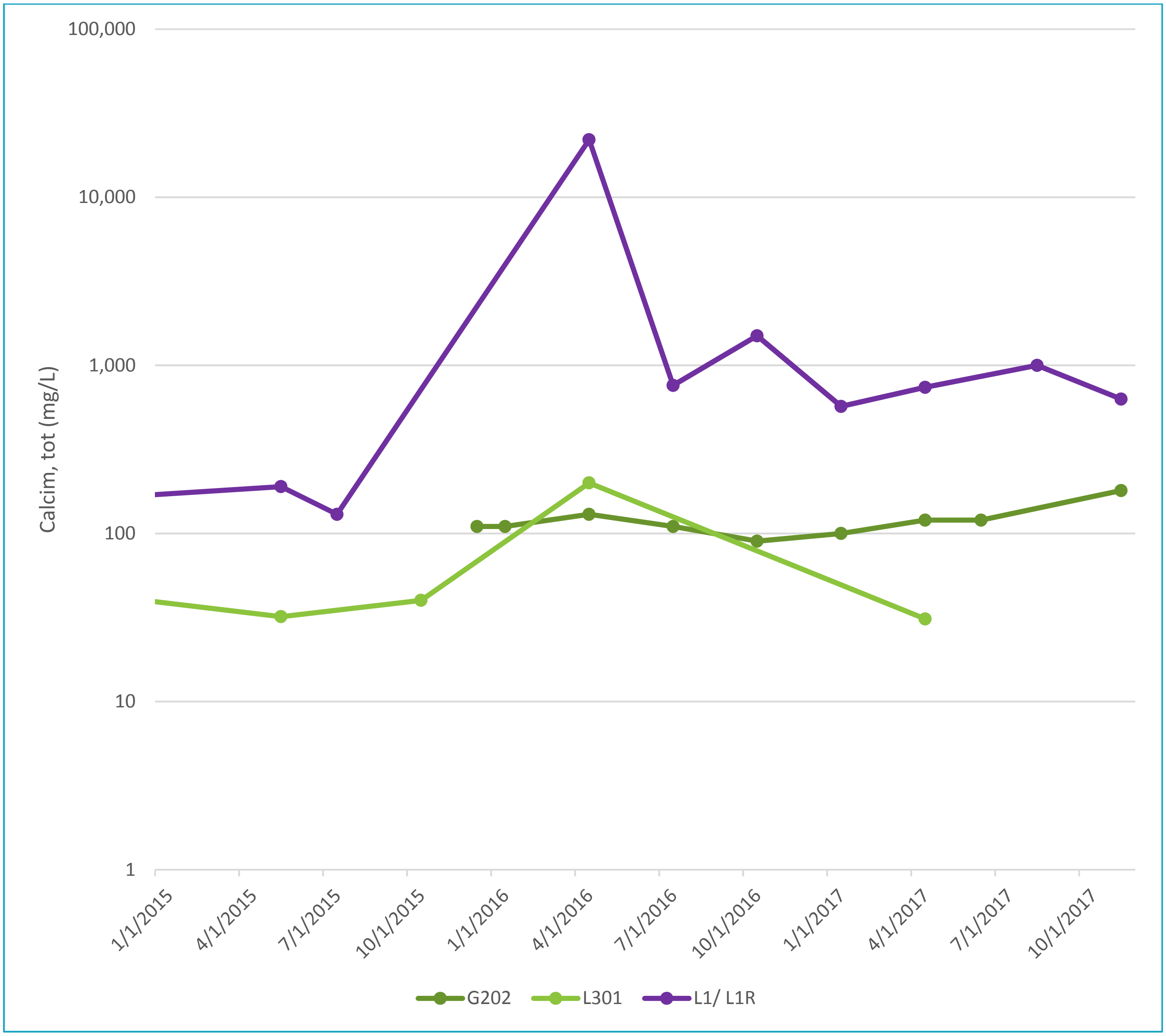


Figure 7. Calcium Time Series (logarithmic) of Leachate and G202

Figure 7 is a time series plot of calcium concentrations observed in groundwater at G202 and leachate from LF1 and LF2 from January 2015 to April 2017 and demonstrates the following:

- Calcium concentrations from LF1 leachate (sampling location L1/L1R) range from 110 to 22,000 mg/L with a median value of 180 mg/L; the 22,000 mg/L concentration appears to be an outlier
- Calcium concentrations from LF2 leachate (sampling location L301) range from 19 to 290 mg/L with a median of 52 mg/L
- Calcium concentrations in downgradient well G202 range from 90 to 180 mg/L with a median of 110 mg/L

Since median calcium concentrations measured in LF2 leachate are less than the median concentrations in well G202, LF2 cannot be the source. The source is likely LF1 since the calcium concentrations in LF1 leachate are significantly greater than in those observed in well G202. The median calcium concentration for LF1 leachate is approximately 1.5 times greater than the median calcium concentration observed in groundwater at well G202 and 3.5 times greater than the median calcium concentration in LF2 leachate.

3.3.3 Chloride

3.3.3.1 Wells G06D, G208, G220, and G222 (Cell 3)

Monitoring wells G06D, G208, G220, and G222 are part of the downgradient monitoring system for LF2 Cell 3. Cell 3 does not contain CCR; therefore, it cannot be the source of the chloride in G06D, G208, G220, and G222. The alternate source is likely a steady-state source, as inferred from the Piper diagram, such as LF1.

3.3.3.2 Wells G202, G203, and G224 (Cells 1 and 2)

It is evident from the Piper diagram that groundwater quality at G202, G203, and G224 is similar to the groundwater at Cell 3 wells. Boxplots of the Cell 3 wells and G202, G203, and G224 are shown in Figure 8.

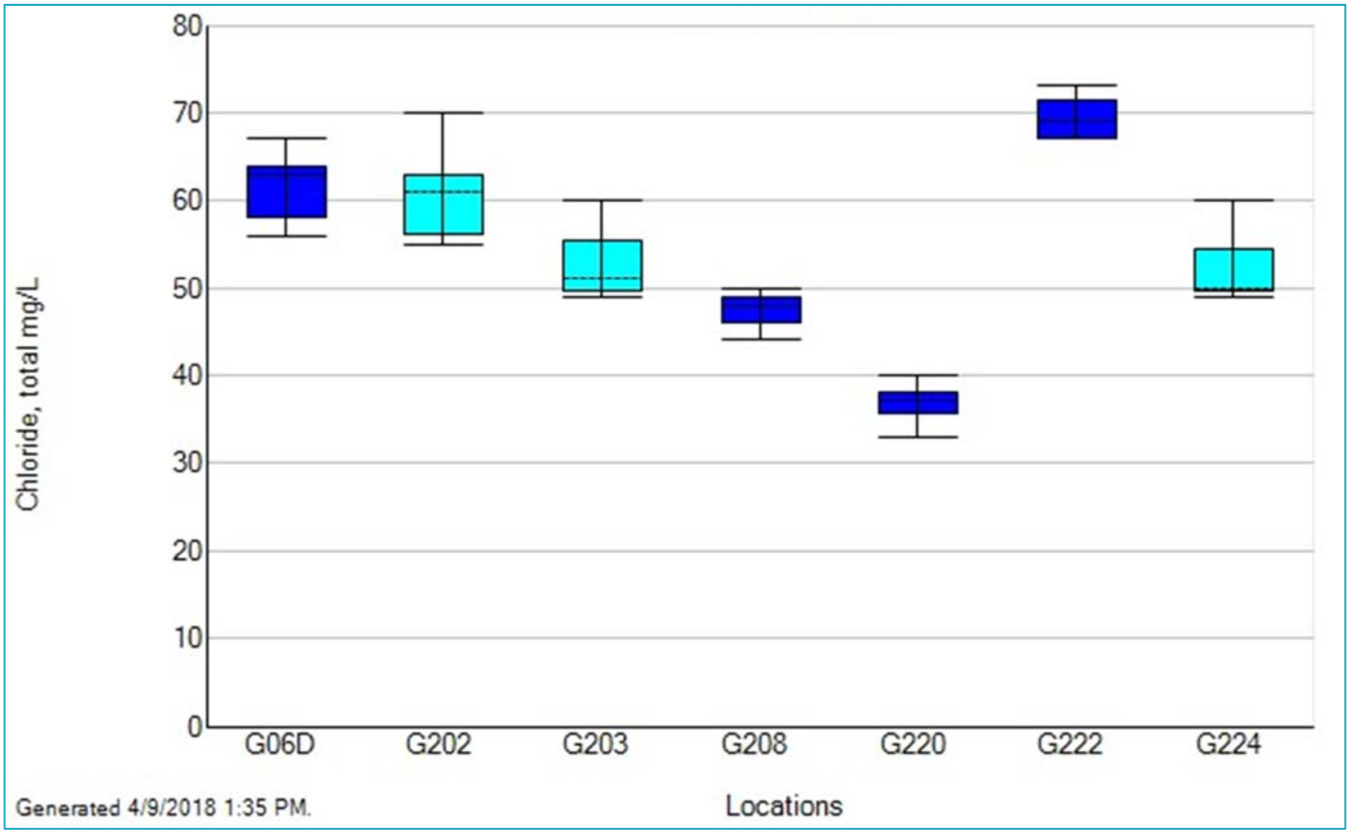


Figure 8. Chloride Boxplot for Cell 3 monitoring wells and G202, G203, and G224

The following observations can be made from Figure 8:

- The ranges of the boxes overlap, indicating that the data between the 75th and 25th quartile are similar
- The minimum and maximum chloride concentrations range from 35 to 72 mg/L
- Chloride concentrations in wells G06D, G202, G203, G208, and G224 are bounded by lower and higher concentrations at the Cell 3 downgradient wells G220 and G222

The Kruskal-Wallis test was used to see if chloride concentrations observed at wells G202, G203, and G224 are part of the same statistical population as chloride concentrations observed in groundwater downgradient from Cell 3. The test resulted in chi-squared value of 7.8 and an H statistic of 4.7, indicating that the null hypothesis is true, and the chloride concentrations observed in wells G202, G203, and G224 are part of the same statistical population as those observed near Cell 3. Test results are provided in Appendix A.

Cumulative distribution curves are presented in the figure below.

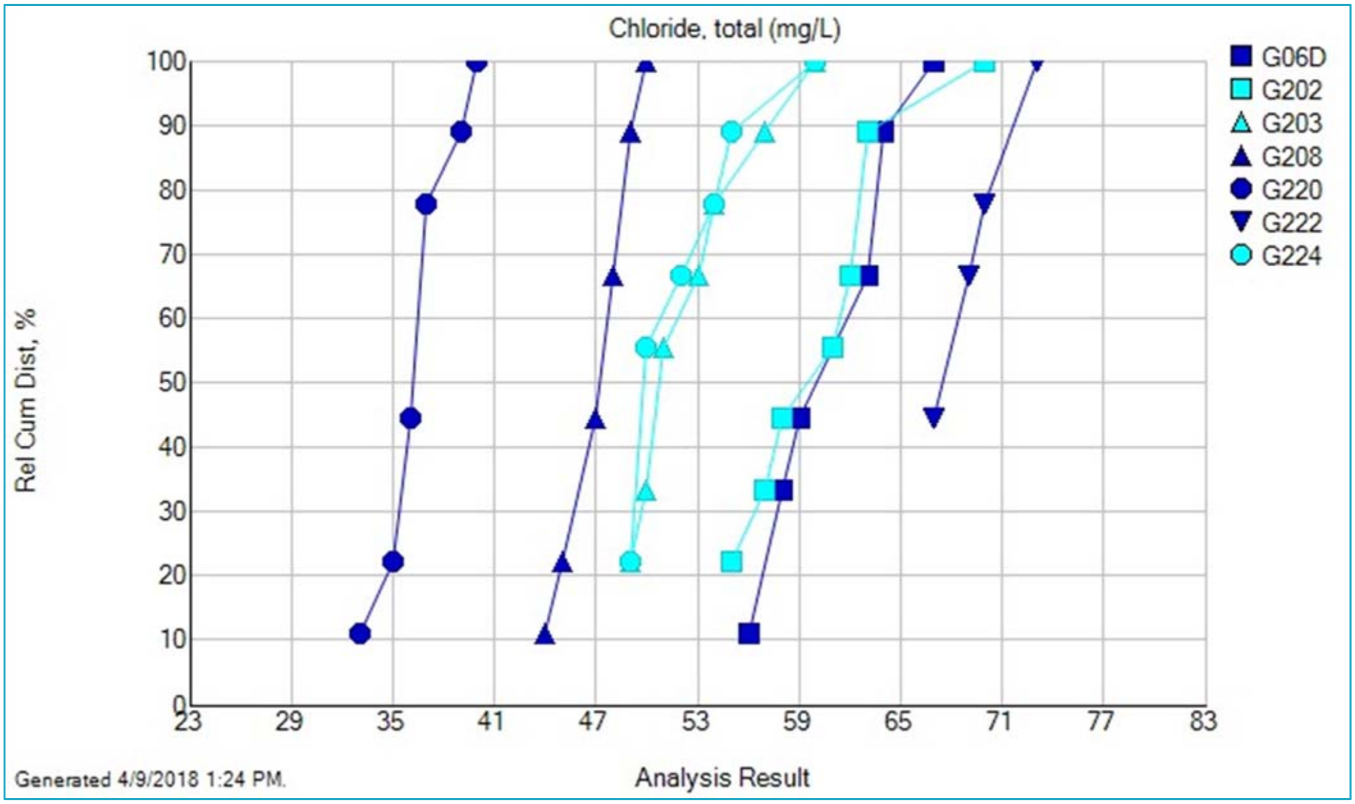


Figure 9. Chloride Cumulative Distribution Curve for Cell 3 monitoring wells and G202, G203, and G224

The near vertical lines shown in Figure 9, indicate that the concentration of chloride observed in the monitoring wells is stable. The distribution curves for concentrations observed in G202, G203, and G224 have the same shape and are parallel to those for the concentrations observed in the Cell 3 wells, further supporting that these wells are in the same statistical population.

Chloride concentrations at wells G202, G203, and G224 are stable and in the same population as Cell 3 wells; therefore, chloride in groundwater at these wells must be influenced by an alternate source.

3.3.3.3 High Concentrations in LF1 Leachate Relative to Groundwater

Additional evidence of an alternate source is the extremely high concentrations of chloride in LF1 leachate, as shown on the time series below.

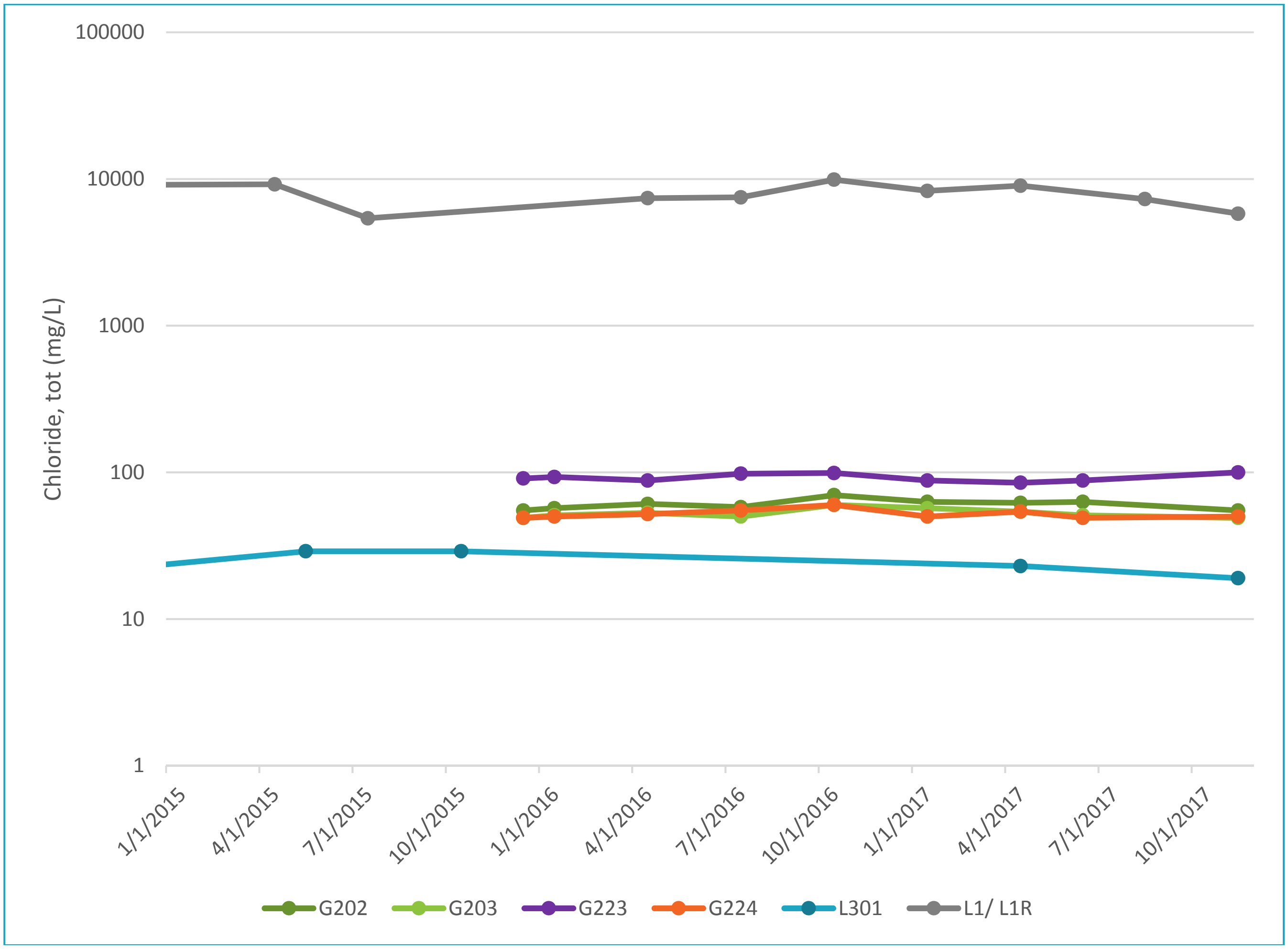


Figure 10. Chloride Time series (logarithmic) of Leachate and G202, G203, G223, and G224

The following observations can be made:

- Chloride concentrations in LF1 leachate (sampling location L1/L1R) range from 5,400 to 9,900 mg/L with a median of 7,500 mg/L
- Chloride concentrations in LF2 leachate (sampling location L301) range from 19 to 29 mg/L with a median of 26 mg/L
- Chloride concentrations in well G202 range from 55 mg/L to 70 mg/L with a median of 61 mg/L
- Chloride concentrations in well G203 range from 49 mg/L to 60 mg/L with a median of 51 mg/L
- Chloride concentrations in well G223 range from 85 mg/L to 100 mg/L with a median of 91mg/L
- Chloride concentrations in well G224 range from 49 mg/L to 60 mg/L with a median of 50 mg/L

Since the chloride concentrations in LF2 leachate are less than the concentrations in downgradient wells G202, G203, G223, and G224, LF2 cannot be the source. The alternate source is likely LF1 since the chloride concentrations in leachate are significantly greater, by two orders of magnitude, than in groundwater at wells G202, G203, G223, and G224.

3.3.4 Fluoride – G208, G220, and G222 (Cell 3)

Monitoring wells G208, G220, and G222 are part of the downgradient monitoring system for LF2 Cell 3. Cell 3 does not contain CCR; therefore, it cannot be the source of the fluoride in wells G208, G220, and G222. The alternate source is likely a steady-state source, as inferred from the Piper diagram, such as LF1.

3.3.5 Total Dissolved Solids (TDS) –G222 (Cell 3)

Monitoring well G222 is part of the downgradient monitoring system for LF2 Cell 3. Cell 3 does not contain CCR; therefore, it cannot be the source of the TDS in G222. The alternate source is likely a steady-state source, as inferred from the Piper diagram, such as LF1.

4 SUMMARY

The following bullets summarize the key information and findings:

- Overall groundwater flow within the uppermost aquifer beneath LF2 is southward toward Newton Lake, but with a predominantly eastward flow under Cell 3.
- Cell 3 does not contain CCR; therefore, it cannot be the source of any SSI.
- Groundwater quality in the uppermost aquifer beneath LF2 Cells 1/2 and Cell 3 is statistically similar (i.e. parameter concentrations are part of the same statistical population).
- Boron, calcium, and chloride concentrations in groundwater at wells with an SSI determination are stable, indicating a steady-state source, such as LF1.
- Calcium and chloride concentrations in leachate from LF1 are significantly greater than those observed in the downgradient monitoring wells with an SSI determination, and median concentrations in leachate from LF2 are less than those observed in downgradient monitoring wells with an SSI determination.

5 CONCLUSIONS AND CERTIFICATION

The lines of evidence for this ASD are summarized below.

- Boron SSIs at monitoring wells G220 and G222 are the result of an alternate source because LF2 Cell 3 does not contain CCR; therefore, it cannot be the source.
- Boron SSI at well G223 (Cells 1 and 2) is the result of an alternate source because boron concentrations in well G223 are in the same statistical population as those in the wells monitoring LF2 Cell 3; therefore, Cells 1 and 2 must also be influenced by an alternate source.
- Calcium SSI at well G202 (Cells 1 and 2) is not the result of LF2 because the calcium concentrations in LF2 leachate are lower than the concentrations in well G202. The SSI is the result of an alternate source, likely LF1, since calcium concentrations in LF1 leachate are greater than in well G202.
- Chloride SSIs at wells G06D, G208, G220, and G222 are the result of an alternate source because LF2 Cell 3 does not contain CCR; therefore, it cannot be the source.
- Chloride SSIs at wells G202, G203, G223, and G224 (Cells 1 and 2) are not the result of LF2 impacts to groundwater, as supported by the following:
  - Chloride concentration in LF2 leachate is less than the concentrations in wells G202, G203, G223, and G224. The SSI is the result of an alternate source, likely LF1, since chloride concentrations in LF1 leachate are greater than those in wells G202, G203, G223, and G224.
  - Chloride concentrations in wells G202, G203, and G224 are in the same statistical population as those in the wells monitoring LF2 Cell 3; therefore, Cells 1 and 2 must also be influenced by an alternate source.
- Fluoride SSIs at wells G208, G220, and G222 are the result of an alternate source because LF2 Cell 3 does not contain CCR; therefore, it cannot be the source.
- Total dissolved solids SSI at well G222 is the result of an alternate source because LF2 Cell 3 does not contain CCR; therefore, it cannot be the source.

Based on these lines of evidence, it has been demonstrated that the SSIs in G06D, G202, G203, G208, G220, G222, G223, and G224 are not due to the Newton Landfill 2.

This information serves as the written alternate source demonstration prepared in accordance with 40 CFR § 257.94(e)(2) that SSIs observed during the detection monitoring program were not due to the CCR unit but were from anthropogenic impacts from the closed Phase I Landfill, which is not subject to the USEPA CCR Rule. Therefore, an assessment monitoring program is not required and the Newton Phase II Landfill will remain in detection monitoring.

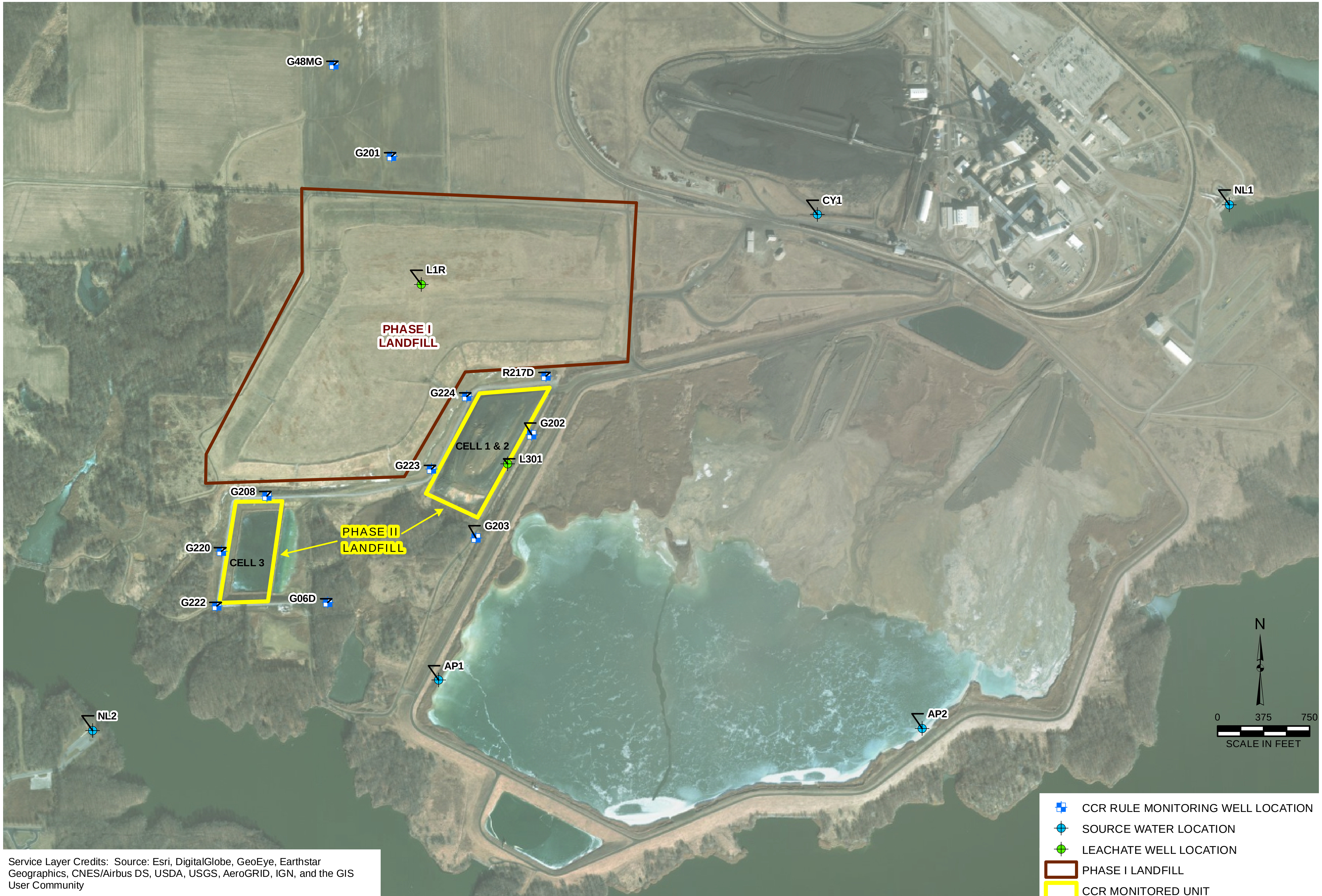
I, Eric J. Tlachac, a qualified professional engineer in good standing in the State of Illinois, certify that the information in this report is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

Eric J. Tlachac
Qualified Professional Engineer
062-063091
Illinois
O'Brien & Gere Engineers, Inc.
Date: April 9, 2018

I, Nicole M. Pagano, a professional geologist in good standing in the State of Illinois, certify that the information in this report is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

Nicole M. Pagano
Professional Geologist
196-000750
O'Brien & Gere Engineers, Inc.
Date: April 9, 2018

Figures



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

DRAWN BY/DATE:
SDS 3/28/18
REVIEWED BY/DATE:
JJW 3/28/18
APPROVED BY/DATE:
NMP 3/30/18

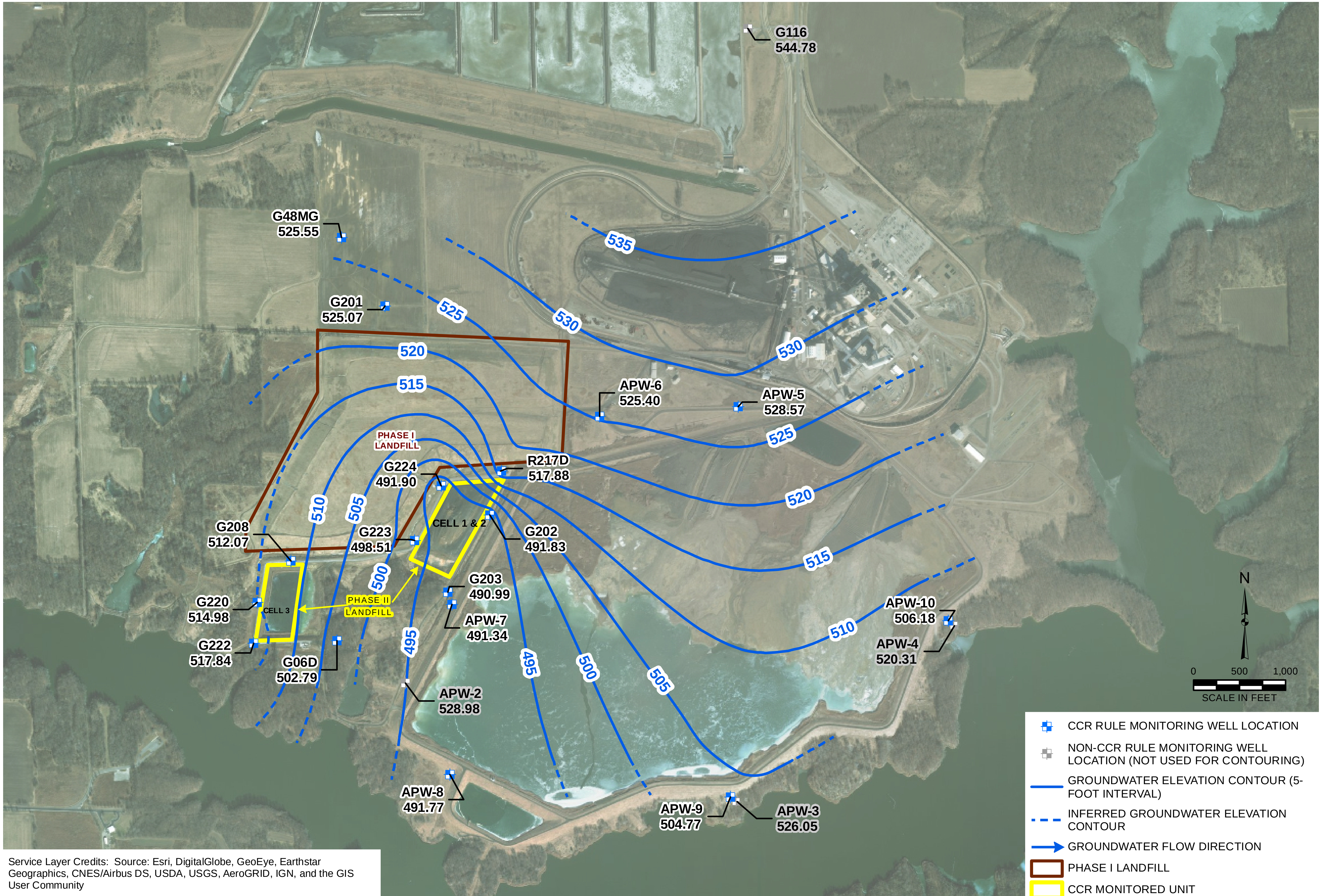
FACILITY LOCATION MAP WITH MANAGEMENT UNITS AND SAMPLE LOCATIONS - NEWTON PHASE II LANDFILL

ALTERNATE SOURCE DEMONSTRATION
NEWTON POWER STATION
NEWTON, ILLINOIS

PROJECT NO: 67719

FIGURE NO: 1

Y:\Mapping\Projects\22\2285\MXD\Alt_Source_Dem\Figure 1_Newton Landfill Phases.mxd Author: stolzsd; Date/Time: 4/6/2018, 1:40:18 PM



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Y:\Mapping\Projects\22\2285\MXD\All_Source_Dem\Figure 2_Newton Potentiometric SurfaceR9.mxd Author: stolzsd; Date/Time: 4/6/2018, 3:31:22 PM

DRAWN BY/DATE: SDS 3/28/18
REVIEWED BY/DATE: JJW 3/28/18
APPROVED BY/DATE: NMP 3/30/18

POTENTIOMETRIC SURFACE
ROUND 9: NOVEMBER 14, 2017

ALTERNATE SOURCE DEMONSTRATION
NEWTON POWER STATION
NEWTON, ILLINOIS

PROJECT NO: 67719

FIGURE NO: 2

Appendix A

Kruskal-Wallis Test Results for Boron Observed in Monitoring Well G223, and Chloride in G202, G203, G224

Newton
Kruskal-Wallis (Intergroup) Test for Group Comparison
Statistical Comparison Report

User Supplied Information

Date Range Selected:	**12/14/2015 to 11/29/2017**	**Option for LT Pts.:**	**x 0.50**
Confidence level:	**95.00%**	**Period Length, mn:**	**3**
Compliance Locations:	**G223**	**Data Averaged:**	**No**
Background Locations:	**G06D,G208,G220,G222**		

Parameter Code	Parameter Name	Units
01022	**Boron, total**	**mg/L**

Number of Groups	Total Points	Chi-Squared	H Statistic	H Statistic (Adj. for ties)	Number of Groups (tied)
2	36	3.841	0.029	0.029	11

Since H Statistic is less than Chi-Square, the means of the compliance and background groups are the same at the 5.00% significance level.
Post-hoc comparisons of compliance wells are not applicable.

Post-hoc Comparisons

Location	Type	Class Assigned	Background Rank Sum	Background Rank Average
G223	None		0.000	0.000

Critical Difference	Compliance Rank Average	Difference	Statistical Evidence of Exceedance
N/A	N/A	N/A	N/A

Newton
Kruskal-Wallis (Intergroup) Test for Group Comparison
Statistical Comparison Report

User Supplied Information

Date Range Selected:	**12/14/2015 to 11/29/2017**	**Option for LT Pts.:**	**x 0.50**
Confidence level:	**95.00%**	**Period Length, mn:**	**3**
Compliance Locations:	**G202,G203,G224**	**Data Averaged:**	**No**
Background Locations:	**G06D,G208,G220,G222**		

Parameter Code	Parameter Name	Units
00940	**Chloride, total**	**mg/L**

Number of Groups	Total Points	Chi-Squared	H Statistic	H Statistic (Adj. for ties)	Number of Groups (tied)
4	36	7.8	4.7	4.7	18

Since H Statistic is less than Chi-Square, the means of the compliance and background groups are the same at the 5.00% significance level.
Post-hoc comparisons of compliance wells are not applicable.

Post-hoc Comparisons

Location	Type	Class Assigned	Background Rank Sum	Background Rank Average
G224	None		0.0	0.0

Critical Difference	Compliance Rank Average	Difference	Statistical Evidence of Exceedance
N/A	N/A	N/A	N/A

Location	Type	Class Assigned	Background Rank Sum	Background Rank Average
G203	None		0.0	0.0

Critical Difference	Compliance Rank Average	Difference	Statistical Evidence of Exceedance
N/A	N/A	N/A	N/A

Location	Type	Class Assigned	Background Rank Sum	Background Rank Average
G202	None		0.0	0.0

Critical Difference	Compliance Rank Average	Difference	Statistical Evidence of Exceedance
N/A	N/A	N/A	N/A

OBG

Part of Ramboll

January 7, 2019

Title 40 of the Code of Federal Regulations (C.F.R.) § 257.94(e)(2) allows the owner or operator of a Coal Combustion Residuals (CCR) unit 90 days from the date of determination of Statistically Significant Increases (SSIs) over background for groundwater constituents listed in Appendix III of 40 C.F.R. Part 257 to complete a written demonstration that a source other than the CCR unit being monitored caused the SSI(s), or that the SSI(s) resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality (Alternate Source Demonstration [ASD]).

This ASD has been prepared on behalf of Illinois Power Generating Company by O'Brien & Gere Engineers, Inc., part of Ramboll (OBG) to provide pertinent information pursuant to 40 C.F.R. § 257.94(e)(2) for the Newton Landfill 2 (LF2) located near Newton, Illinois.

The second semi-annual detection monitoring samples (Detection Monitoring Round 2 [D2]) were collected on May 21-23, 2018 and analytical data were received on July 9, 2018. In accordance with 40 C.F.R. § 257.93(h)(2), statistical analysis of the data to identify SSIs of 40 C.F.R. Part 257 Appendix III parameters over background concentrations was completed by October 7, 2018, within 90 days of receipt of the analytical data. The statistical determination identified the following SSIs at downgradient monitoring wells:

- Boron at wells G208, G220, G222, and G223
- Calcium at well G203
- Chloride at wells G06D, G202, G203, G208, G222, G223, and G224
- Fluoride at wells G208, G220, and G222

In accordance with the Statistical Analysis Plan (NRT/OBG, 2017a), to confirm the SSIs, wells G06D, G202, G203, G208, G220, G222, G223, and G224 were resampled on August 15-23, 2018 and analyzed only for the SSI parameters at each well. Following evaluation of analytical data from the resample, the following SSIs were confirmed:

- Boron at wells G220 and G222
- Chloride at wells G06D, G202, G203, G208, G222, G223, and G224
- Fluoride at wells G220 and G222

Pursuant to 40 C.F.R. § 257.94(e)(2), the following demonstrates that sources other than the Newton LF2 were the cause of the SSIs listed above. This ASD was complete by January 7, 2019, within 90 days of determination of the SSIs, as required by 40 C.F.R. § 257.94(e)(2).

SITE LOCATION AND DESCRIPTION

The Newton Power Station (Site) is located in Jasper County, in the southeastern part of central Illinois, approximately 7 miles southwest of the town of Newton. The area is surrounded by Newton Lake. Beyond the lake is agricultural land.

DESCRIPTION OF PHASE II LANDFILL CCR UNIT

The Phase II Landfill (LF2) includes three lined disposal cells (Figure 1). LF2 Cells 1 and 2, encompassing approximately 12 acres, and LF2 Cell 3, encompassing approximately 7 acres.

GEOLOGY AND HYDROGEOLOGY

The site geology and hydrogeology are summarized below from the Hydrogeologic Monitoring Plan (NRT/OBG, 2017b).

GEOLOGY

Quaternary deposits in the Newton area consist mainly of diamictons and outwash deposits that were deposited during Illinoian and Pre-Illinoian glaciations. The unconsolidated deposits occurring at Newton Power Station include the following units (beginning at the ground surface):

- Ash/Fill Units – CCR and fill within the various CCR Units.
- Upper Confining Unit – Low permeability clays and silts, including the Peoria Silt (Loess Unit) in upland areas and the Cahokia Formation in the flood plain and channel areas to the south and east, underlain by the Sangamon Soil, and the predominantly clay diamictons of the Hagarstown (Till) and Vandalia (Till) Members of the Glasford Formation.
- Uppermost Aquifer (Groundwater Monitoring Zone) – Thin to moderately thick (3 to 17 ft), moderate to high permeability sand, silty sand, and sandy silt/clay units of the Mulberry Grove Member of the Glasford Formation.
- Lower Confining Unit – Thick, very low permeability silty clay diamictons of the Smithboro (Till) Member of the Glasford Formation and the silty clay diamictons of the Banner Formation.

The bedrock beneath the unconsolidated deposits consists of Pennsylvanian-age Mattoon Formation that is mostly shale near the bedrock surface, but is characterized at depth by a complex sequence of shales, thin limestones, coals, underclays, and several sandstones. The erosional surface of the Pennsylvanian-age Mattoon Formation bedrock ranges widely in depth in the vicinity of the site, but is typically encountered at 90 to 120 ft below ground surface (bgs).

HYDROGEOLOGY

The information used to describe the hydrogeology is based on the local geology obtained from published sources, hydrogeologic investigation data, and boring data collected during monitoring well installation. CCR monitoring well locations are shown in Figure 1.

The Uppermost Aquifer, the Mulberry Grove Member, typically consists of fine to coarse sand with varying amounts of clay, silt, and fine to coarse gravel. The portion of the Mulberry Grove Member at the site that is defined as a sand layer ranges in thickness from 3 to 17 ft, with an average thickness of 8 ft. With only a few exceptions, the sand layer occurs between depths of 55 to 88 ft bgs.

The lower hydrostratigaphic units, which comprise lower limit of the Uppermost Aquifer, consist of the Smithboro Member and the Banner Formation, both of which are predominantly low permeability clay diamictons with varying amounts of silt, sand, and gravel. These lower hydrostratigraphic units are 30 ft to more than 50 ft thick above the underlying bedrock.

Groundwater elevations across LF2 ranged from approximately 491 to 529 ft MSL (NAVD88) during D2 (Figure 2). The groundwater elevation contours shown on Figure 2 were measured on May 17, 2018, the first day of a combined sampling event at the Site for LF2 and the Primary Ash Pond and for multiple monitoring programs required by both federal and state regulatory agencies. Overall groundwater flow within the Uppermost Aquifer beneath the site in February 2019 was southward toward Newton Lake, but with flow converging to the south-southeast along the major axis of LF2 Cells 1 & 2, and a predominantly eastward flow under LF2 Cell 3. Based on groundwater flow directions near LF2, groundwater beneath LF2 Cells 1 and 2 does not influence groundwater beneath LF2 Cell 3.

GROUNDWATER MONITORING

The Uppermost Aquifer monitoring system for LF2 Cells 1, 2, and 3 is shown on Figure 1 and described below. The relative positions of CCR monitoring wells in relation to groundwater flow direction are shown in Figure 2.

BACKGROUND GROUNDWATER MONITORING

Monitoring wells G201 and G48MG are used to monitor background water quality for LF2 (all cells).

DOWNGRADIENT GROUNDWATER MONITORING

Downgradient groundwater quality at LF2 Cells 1 and 2 is monitored using wells G202, G203, G223, G224, and R217D (which replaced well G217D in October 2017).

Downgradient groundwater quality at LF2 Cell 3 is monitored using wells G06D, G208, G220, and G222.

ALTERNATE SOURCE DEMONSTRATION: LINES OF EVIDENCE

As allowed by 40 C.F.R. § 257.94(e)(2), this ASD demonstrates that sources other than LF2 caused the SSI(s), or that the SSI(s) was a result of natural variation in groundwater quality. This ASD is based on the following lines of evidence (LOE):

1. Landfill Design and Operation.
2. No CCR material has been placed in LF2 Cell 3.
3. The ionic composition in groundwater is different than the ionic composition of leachate.
4. The ionic composition in groundwater downgradient of LF2 Cells 1 and 2 is similar to groundwater downgradient of LF2 Cell 3 (where no CCR material has been placed).
5. Groundwater quality in monitoring wells downgradient of LF2 Cells 1 and 2 is statistically similar to groundwater quality in monitoring wells downgradient of LF2 Cell 3 (where no CCR material has been placed).
6. Groundwater flow directions indicate monitoring wells G223, G224, and R217D are not downgradient of LF2 Cells 1 and 2.

These lines of evidence are described and supported in greater detail below.

LINE OF EVIDENCE #1: LANDFILL DESIGN AND OPERATION

LF2 Cells 1 and 2 were constructed, and began receiving CCR, in 1997. A portion of LF2 Cell 2 is currently in operation. LF2 Cell 3 is currently inactive and has not received CCR since construction in 2011.

The constructed liner and leachate collection system for LF2 Cells 1, 2, and 3 include the following design components from top to bottom:

- Soil cover for frost protection;
- 10-ounce-per-square-yard (sy) geotextile separation layer between the leachate management system and the frost protection soil cover;
- 1-foot thick sand drainage layer;
- 60-mil high-density polyethylene (HDPE) geomembrane; and
- Three-foot-thick compacted, low-permeability soil having a maximum hydraulic conductivity of 1.0×10^{-7} centimeters per second (cm/sec).

These components meet or exceed the landfill liner performance standards of 40 C.F.R. § 257. The landfill design criteria were intended to provide protection to the Uppermost Aquifer. In addition, the Uppermost Confining Unit provides hydraulic separation between the CCR units at the Site and the Uppermost Aquifer (OBG, 2019). These factors support the conclusion that LF2 is not the source of CCR constituents detected in the LF2 groundwater monitoring wells.

LINE OF EVIDENCE #2: NO CCR MATERIAL HAS BEEN PLACED IN LF2 CELL 3

LF2 Cell 3 has never contained CCR; therefore, it cannot be the source of the CCR constituents boron, chloride or fluoride detected in downgradient groundwater monitoring wells. Furthermore, groundwater flow directions near LF2 (Figure 2) indicate groundwater beneath LF2 Cells 1 and 2 does not influence groundwater beneath LF2 Cell 3, so LF2 Cells 1 and 2 cannot be the source of CCR constituents detected in LF2 Cell 3 downgradient monitoring wells.

LINE OF EVIDENCE #3: THE IONIC COMPOSITION IN GROUNDWATER IS DIFFERENT THAN THE IONIC COMPOSITION OF LEACHATE

Piper diagrams graphically represent ionic composition of aqueous solutions. A Piper diagram displays the position of water samples with respect to their major cation and anion content on the two lower triangular portions of the diagram, providing the information which, when combined on the central, diamond-shaped portion of the diagram, identify composition categories or groupings (groundwater facies). Figure 3, below, is a Piper diagram that displays the ionic composition of samples from the background and downgradient monitoring wells associated with LF2 based on Quarter 3 2018 samples. Figure 3 also includes data collected from the combined LF1 and LF2 leachate tank in Quarter 2 of 2017. Major cations and anions were not analyzed in samples collected from the LF1 and LF2 leachate tank subsequent to Quarter 2 2017.

It is evident from the Piper diagram (Figure 3) that leachate is in the sodium-sulfate hydrochemical facies, and the LF2 groundwater samples (blue symbols) are in the no dominant-bicarbonate hydrochemical facies. All LF2 Cell 1, 2, and 3 groundwater samples cluster into a single distinct hydrochemical facies. Downgradient groundwater samples associated with LF2 have a different ionic composition than leachate, indicating that leachate is not the source of CCR constituents detected in the LF2 groundwater monitoring wells.

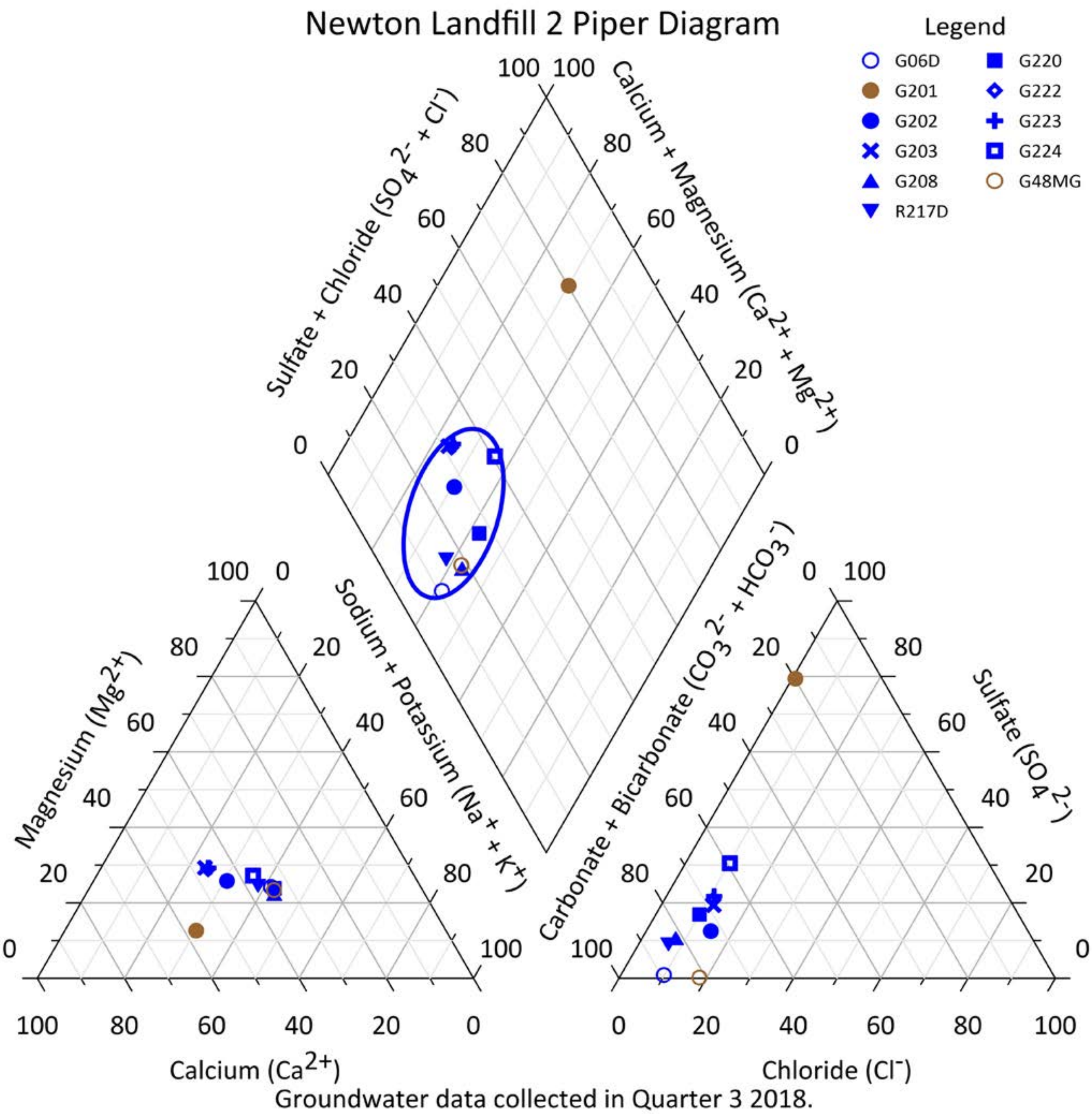


Figure 3. Piper Diagram Showing Ionic Composition of Samples of Background and Downgradient Groundwater Associated with LF2

LINE OF EVIDENCE #4: THE IONIC COMPOSITION IN GROUNDWATER DOWNGRADIENT OF LF2 CELLS 1 AND 2 IS SIMILAR TO GROUNDWATER DOWNGRADIENT OF LF2 CELL 3 (WHERE NO CCR MATERIAL HAS BEEN PLACED)

As illustrated in the Piper diagram (Figure 3), the ionic composition of all LF2 Cell 1, 2, and 3 groundwater samples are similar and cluster into a single distinct hydrochemical facies (no dominant-bicarbonate). The similarity in ionic composition of groundwater downgradient of LF2 Cell 3 and LF2 Cells 1 and 2, coupled with the fact that Cell 3 has never contained CCR, indicate that LF2 Cells 1 and 2 are not the source of CCR constituents detected in the LF2 groundwater monitoring wells.

LINE OF EVIDENCE #5: GROUNDWATER QUALITY IN MONITORING WELLS DOWNGRADIENT OF LF2 CELLS 1 AND 2 IS STATISTICALLY SIMILAR TO GROUNDWATER QUALITY IN MONITORING WELLS DOWNGRADIENT OF LF2 CELL 3 (WHERE NO CCR MATERIAL HAS BEEN PLACED)

Box plots graphically represent the first quartile (Q1), median (Q2), and third quartile (Q3) of a given dataset using lines to construct a box where the lower line, midline and upper line of the box represent the values of Q1, Q2 and Q3, respectively. The minimum and maximum values of the dataset (excluding outliers) are illustrated by whisker lines extending beyond the first and third quartiles of the box plot. Outliers are represented by single points plotted outside of the range of the whiskers. Chloride SSIs were identified at all LF2 cells (LF2 Cells 1, 2, and 3) during the D4 sampling event, whereas, other SSIs were only identified at LF2 Cell 3. Figure 4, below, display the chloride data for downgradient groundwater at LF2; triangle symbols identify outlier values that are at least 1.5 times the interquartile range (IQR) and “x” symbols identify outlier values that are at least 3 times the IQR.

Chloride

Box plots of the chloride concentrations observed in LF2 Cells 1 and 2 downgradient monitoring wells (cyan), and LF2 Cell 3 downgradient monitoring wells (blue) are shown in Figure 4 below.

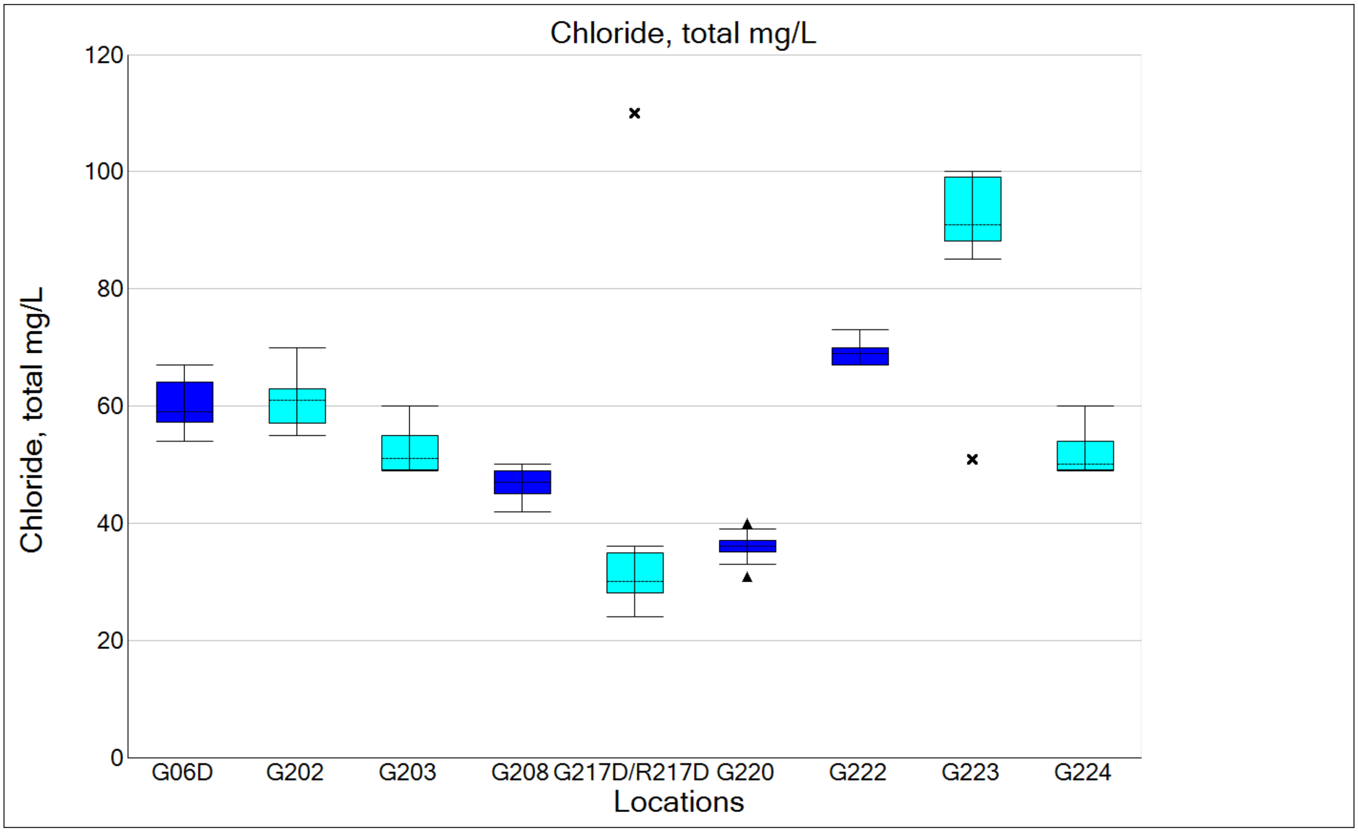


Figure 4. Chloride Box Plot for LF2 Cells 1 and 2 Downgradient Monitoring Wells (cyan) and LF2 Cell 3 Downgradient Monitoring Wells (blue)

The following observations can be made from Figure 5:

- The minimum and maximum chloride concentrations in wells downgradient of LF2 Cell 3 range from 31 to 73 mg/L.
- The minimum and maximum chloride concentrations in wells downgradient of LF2 Cells 1 and 2 range from 24 to 110 mg/L.

Chloride concentrations are within or below the range of concentrations observed at wells downgradient of LF2 Cell 3, with the exception of concentrations at monitoring well G223 and potential statistical outlier concentrations at G217D/R217D (illustrated with black symbols outside of the box plots in Figure 4).

The similarity of groundwater quality downgradient of LF2 Cell 3 and groundwater quality downgradient of LF2 Cells 1 and 2, as represented by the ranges of chloride concentrations (Figure 5), coupled with the fact that Cell 3 has never contained CCR, indicates that LF2 Cells 1 and 2 are not the source of CCR constituents detected in the LF2 groundwater monitoring wells.

LINE OF EVIDENCE #6: GROUNDWATER FLOW DIRECTIONS INDICATE MONITORING WELLS G223, G224, AND R217D ARE NOT DOWNGRADIENT OF LF2 CELLS 1 AND 2.

Downgradient groundwater at LF2 Cells 1 and 2 is monitored using wells G202, G203, G223, G224, and R217D. Groundwater flow directions indicate monitoring wells G223, G224, and R217D are not downgradient of LF2 Cells 1 and 2 as illustrated in Figure 2. LF2 Cells 1 and 2 are not the source of CCR constituents detected in the LF2 groundwater monitoring wells G223, G224, and R217D based on the position of the monitoring wells relative to groundwater flow directions.

Based on these four lines of evidence, it has been demonstrated that Newton Landfill 2 is not the source of the boron SSIs at G220 and G222; the chloride SSIs at G06D, G202, G203, G208, G222, G223, and G224; and fluoride SSIs at G220 and G222.

This information serves as the written ASD prepared in accordance with 40 C.F.R. § 257.94(e)(2) that the SSIs observed during the D2 were not due to the LF2. Therefore, an assessment monitoring program is not required, and the Newton Landfill 2 will remain in detection monitoring.

REFERENCES

Natural Resource Technology, an OBG Company (NRT/OBG), 2017a, Statistical Analysis Plan, Coffeen Power Station, Newton Power Station, Illinois Power Generating Company, October 17, 2017.

Natural Resource Technology, an OBG Company (NRT/OBG), 2017b, Hydrogeologic Monitoring Plan, Newton Primary Ash Pond – CCR Unit ID 501, Newton Landfill 2 – CCR Unit ID 502, Newton Power Station, Canton, Illinois, Illinois Power Generating Company, October 17, 2017.

OBG, 2019, 40 C.F.R. § 257.94(e)(2): Alternate Source Demonstration: Newton Primary Ash Pond, January 7, 2019.

ATTACHMENTS

Figure 1	Facility Location Map with Newton Landfill 2 (Phase II Landfill) Management Units and Sample Locations
Figure 2	Groundwater Elevation Contour Map – May 17, 2018

I, Eric J. Tlachac, a qualified professional engineer in good standing in the State of Illinois, certify that the information in this report is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

Eric J. Tlachac
Qualified Professional Engineer
062-063091
Illinois
O'Brien & Gere Engineers, Inc., part of Ramboll
Date: January 7, 2019

LICENSED PROFESSIONAL ENGINEER
ERIC J. TLACHAC
062-063091
STATE OF ILLINOIS

I, Nicole M. Pagano, a professional geologist in good standing in the State of Illinois, certify that the information in this report is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

Nicole M. Pagano
Professional Geologist
196-000750
O'Brien & Gere Engineers, Inc., part of Ramboll
Date: January 7, 2019

LICENSED PROFESSIONAL GEOLOGIST
NICOLE M. PAGANO
196-000750
ILLINOIS

Figures

DRAWN BY: MPG
REVIEWED BY: JJW
APPROVED BY: NMP

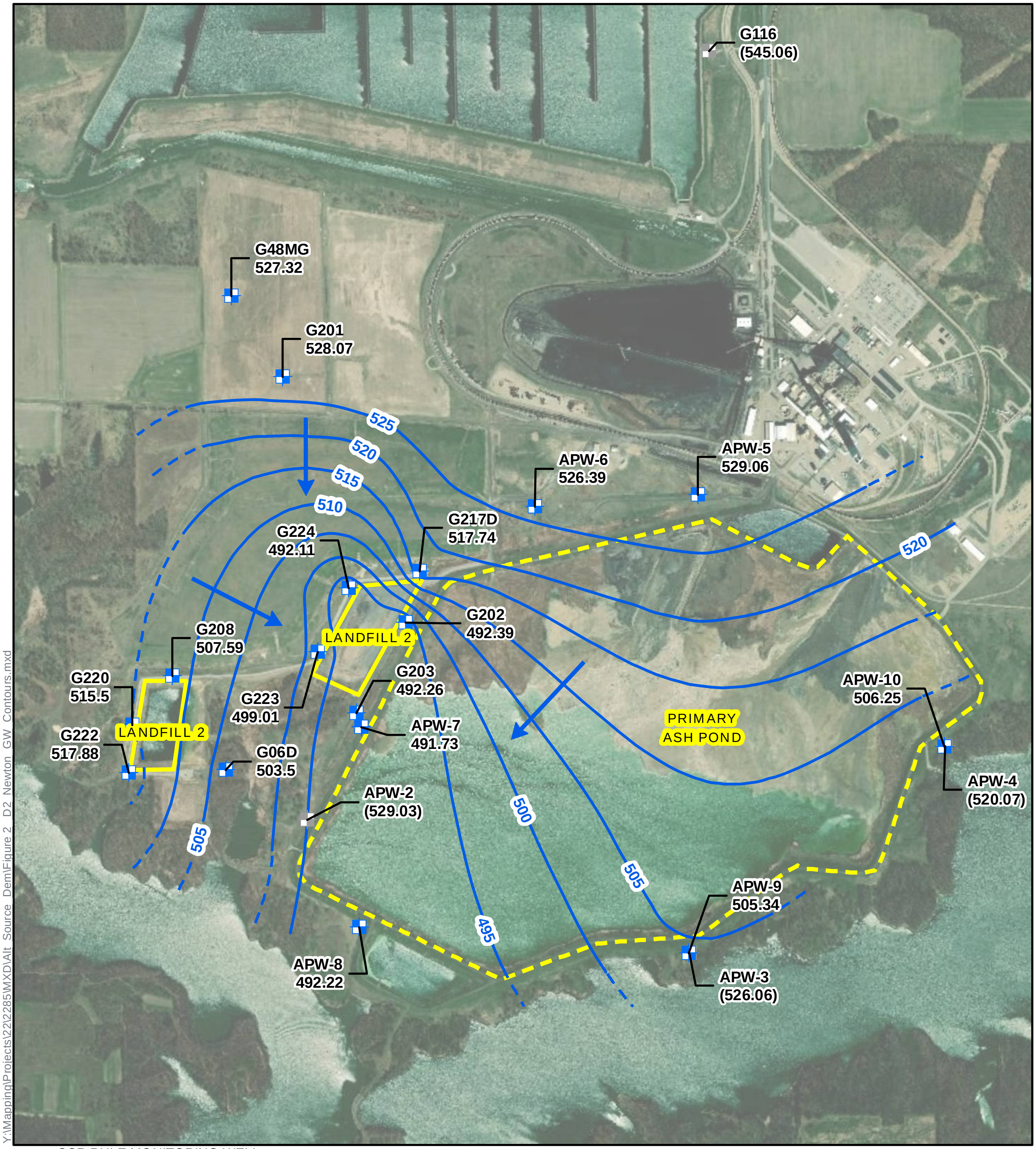
FACILITY LOCATION MAP WITH NEWTON LANDFILL 2 (PHASE II LANDFILL) MANAGEMENT UNITS AND SAMPLE LOCATIONS

ALTERNATE SOURCE DEMONSTRATION
NEWTON POWER STATION
NEWTON, ILLINOIS

PROJECT NO: 67719

FIGURE NO: 1

Y:\Mapping\Projects\22\2285\MXD\Alt_Source_Dem\Figure 1_Newton Landfill Phase2_FINAL.mxd Author: STOLZSD



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CCR RULE MONITORING WELL LOCATION

NON-CCR RULE MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR (5-FOOT INTERVAL)

INFERRED GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW DIRECTION

LANDFILL 2 CCR MONITORED UNIT

PRIMARY ASH POND CCR MONITORED UNIT

NEWTON LANDFILL 2 (UNIT ID: 502)
GROUNDWATER ELEVATION CONTOUR MAP
MAY 17, 2018

ALTERNATE SOURCE DEMONSTRATION
NEWTON POWER STATION
NEWTON, ILLINOIS

0 325 650 1,300
Feet

N

O'BRIEN & GERE ENGINEERS, INC.

July 15, 2019

Title 40 of the Code of Federal Regulations (C.F.R.) § 257.94(e)(2) allows the owner or operator of a Coal Combustion Residuals (CCR) unit 90 days from the date of determination of Statistically Significant Increases (SSIs) over background for groundwater constituents listed in Appendix III of 40 C.F.R. Part 257 to complete a written demonstration that a source other than the CCR unit being monitored caused the SSI(s), or that the SSI(s) resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality (Alternate Source Demonstration [ASD]).

This ASD has been prepared on behalf of Illinois Power Generating Company by O'Brien & Gere Engineers, Inc., part of Ramboll (OBG) to provide pertinent information pursuant to 40 C.F.R. § 257.94(e)(2) for the Newton Landfill 2 (LF2) located near Newton, Illinois.

The third semi-annual detection monitoring samples (Detection Monitoring Round 3 [D3]) were collected on November 12-16, 2018 and analytical data were received on January 16, 2019. In accordance with 40 C.F.R. § 257.93(h)(2), statistical analysis of the data to identify SSIs of 40 C.F.R. Part 257 Appendix III parameters over background concentrations was completed by April 16, 2019, within 90 days of receipt of the analytical data. The statistical analysis identified the following SSIs at downgradient monitoring wells:

- Boron at wells G220, G222, and G223
- Chloride at wells G06D, G202, G203, G208, G220, G222, G223, and G224
- Fluoride at wells G208 and G220

Because the Detection Monitoring Round 4 (D4) was completed on February 19-21, 2019, within 90 days from the D3 SSI determination, and in accordance with the Statistical Analysis Plan (NRT/OBG, 2017a), results from D4 sampling were used to verify the D3 SSIs. Following evaluation of analytical data from the D4 sampling, the following SSIs were confirmed for D3:

- Boron at wells G220, G222, and G223
- Chloride at wells G06D, G202, G203, G208, G220, G222, G223, and G224
- Fluoride at wells G208 and G220

Pursuant to 40 C.F.R. § 257.94(e)(2), the following demonstrates that sources other than the Newton LF2 were the cause of the SSIs listed above. This ASD was completed by July 15, 2019, within 90 days of determination of the SSIs, as required by 40 C.F.R. § 257.94(e)(2).

SITE LOCATION AND DESCRIPTION

The Newton Power Station (Site) is located in Jasper County, in the southeastern part of central Illinois, approximately 7 miles southwest of the town of Newton. The area is surrounded by Newton Lake. Beyond the lake is agricultural land.

DESCRIPTION OF PHASE II LANDFILL CCR UNIT

The Phase II Landfill (LF2) includes three lined disposal cells (Figure 1). LF2 Cells 1 and 2, encompassing approximately 12 acres, and LF2 Cell 3, encompassing approximately 7 acres.

GEOLOGY AND HYDROGEOLOGY

The site geology and hydrogeology are summarized below from the Hydrogeologic Monitoring Plan (NRT/OBG, 2017b).

GEOLOGY

Quaternary deposits in the Newton area consist mainly of diamictons and outwash deposits that were deposited during Illinoian and Pre-Illinoian glaciations. The unconsolidated deposits occurring at Newton Power Station include the following units (beginning at the ground surface):

- Ash/Fill Units – CCR and fill within the various CCR Units.
- Upper Confining Unit – Low permeability clays and silts, including the Peoria Silt (Loess Unit) in upland areas and the Cahokia Formation in the flood plain and channel areas to the south and east, underlain by the Sangamon Soil, and the predominantly clay diamictons of the Hagarstown (Till) and Vandalia (Till) Members of the Glasford Formation.
- Uppermost Aquifer (Groundwater Monitoring Zone) – Thin to moderately thick (3 to 17 ft), moderate to high permeability sand, silty sand, and sandy silt/clay units of the Mulberry Grove Member of the Glasford Formation.
- Lower Confining Unit – Thick, very low permeability silty clay diamictons of the Smithboro (Till) Member of the Glasford Formation and the silty clay diamictons of the Banner Formation.

The bedrock beneath the unconsolidated deposits consists of Pennsylvanian-age Mattoon Formation that is mostly shale near the bedrock surface, but is characterized at depth by a complex sequence of shales, thin limestones, coals, underclays, and several sandstones. The erosional surface of the Pennsylvanian-age Mattoon Formation bedrock ranges widely in depth in the vicinity of the site, but is typically encountered at 90 to 120 ft below ground surface (bgs).

HYDROGEOLOGY

The information used to describe the hydrogeology is based on the local geology obtained from published sources, hydrogeologic investigation data, and boring data collected during monitoring well installation. CCR monitoring well locations are shown in Figure 1.

The Uppermost Aquifer, the Mulberry Grove Member, typically consists of fine to coarse sand with varying amounts of clay, silt, and fine to coarse gravel. The portion of the Mulberry Grove Member at the site that is defined as a sand layer ranges in thickness from 3 to 17 ft, with an average thickness of 8 ft. With only a few exceptions, the sand layer occurs between depths of 55 to 88 ft bgs.

The lower hydrostratigaphic units, which comprise lower limit of the Uppermost Aquifer, consist of the Smithboro Member and the Banner Formation, both of which are predominantly low permeability clay diamictons with varying amounts of silt, sand, and gravel. These lower hydrostratigraphic units are 30 ft to more than 50 ft thick above the underlying bedrock.

Groundwater elevations across LF2 ranged from approximately 486 to 530 ft MSL (NAVD88) during D3 (Figure 2). The groundwater elevation contours shown on Figure 2 were measured on November 8, 2018, the first day of a combined sampling event at the Site for LF2 and the Primary Ash Pond and for multiple monitoring programs required by both federal and state regulatory agencies. Overall groundwater flow within the Uppermost Aquifer beneath the site in February 2019 was southward toward Newton Lake, but flow converging to the south-southeast along the major axis of LF2 Cells 1 and 2, and a predominantly eastward flow under LF2 Cell 3. Based on groundwater flow directions near LF2, groundwater beneath LF2 Cells 1 and 2 does not influence groundwater beneath LF2 Cell 3.

GROUNDWATER MONITORING

The Uppermost Aquifer monitoring system for LF2 Cells 1, 2, and 3 is shown on Figure 1 and described below. The relative positions of CCR monitoring wells in relation to groundwater flow direction are shown in Figure 2.

BACKGROUND GROUNDWATER MONITORING

Monitoring wells G201 and G48MG are used to monitor background water quality for LF2 (all cells).

DOWNGRADIENT GROUNDWATER MONITORING

Downgradient groundwater quality at LF2 Cells 1 and 2 is monitored using wells G202, G203, G223, G224, and R217D (which replaced well G217D in October 2017).

Downgradient groundwater quality at LF2 Cell 3 is monitored using wells G06D, G208, G220, and G222.

ALTERNATE SOURCE DEMONSTRATION: LINES OF EVIDENCE

As allowed by 40 C.F.R. § 257.94(e)(2), this ASD demonstrates that sources other than LF2 caused the SSI(s), or that the SSI(s) was a result of natural variation in groundwater quality. This ASD is based on the following lines of evidence (LOE):

1. Landfill Design and Operation.
2. No CCR material has been placed in LF2 Cell 3.
3. The ionic composition in groundwater is different than the ionic composition of leachate.
4. The ionic composition in groundwater downgradient of LF2 Cells 1 and 2 is similar to groundwater downgradient of LF2 Cell 3 (where no CCR material has been placed).
5. Groundwater quality in monitoring wells downgradient of LF2 Cells 1 and 2 is statistically similar to groundwater quality in monitoring wells downgradient of LF2 Cell 3 (where no CCR material has been placed).
6. Groundwater flow directions indicate monitoring wells G223, G224, and R217D are not downgradient of LF2 Cells 1 and 2.

These lines of evidence are described and supported in greater detail below.

LINE OF EVIDENCE #1: LANDFILL DESIGN AND OPERATION

LF2 Cells 1 and 2 were constructed, and began receiving CCR, in 1997. A portion of LF2 Cell 2 is currently in operation. LF2 Cell 3 is currently inactive and has not received CCR since construction in 2011.

The constructed liner and leachate collection system for LF2 Cells 1, 2, and 3 include the following design components from top to bottom:

- Soil cover for frost protection;
- 10-ounce-per-square-yard (sy) geotextile separation layer between the leachate management system and the frost protection soil cover;
- 1-foot thick sand drainage layer;
- 60-mil high-density polyethylene (HDPE) geomembrane; and
- Three-foot-thick compacted, low-permeability soil having a maximum hydraulic conductivity of 1.0×10^{-7} centimeters per second (cm/sec).

These components meet or exceed the landfill liner performance standards of 40 C.F.R. § 257. The landfill design criteria were intended to provide protection to the Uppermost Aquifer. In addition, the Uppermost Confining Unit provides hydraulic separation between the CCR units at the Site and the Uppermost Aquifer (OBG, 2019). These factors support the conclusion that LF2 is not the source of CCR constituents detected in the LF2 groundwater monitoring wells.

LINE OF EVIDENCE #2: NO CCR MATERIAL HAS BEEN PLACED IN LF2 CELL 3

LF2 Cell 3 has never contained CCR; therefore, it cannot be the source of the CCR constituents boron, chloride or fluoride detected in downgradient groundwater monitoring wells. Furthermore, groundwater flow directions near LF2 (Figure 2) indicate groundwater beneath LF2 Cells 1 and 2 does not influence groundwater beneath LF2 Cell 3, so LF2 Cells 1 and 2 cannot be the source of CCR constituents detected in LF2 Cell 3 downgradient monitoring wells.

LINE OF EVIDENCE #3: THE IONIC COMPOSITION IN GROUNDWATER IS DIFFERENT THAN THE IONIC COMPOSITION OF LEACHATE

Piper diagrams graphically represent ionic composition of aqueous solutions. A Piper diagram displays the position of water samples with respect to their major cation and anion content on the two lower triangular portions of the diagram, providing the information which, when combined on the central, diamond-shaped portion of the diagram, identify composition categories or groupings (groundwater facies). Figure 3, below, is a Piper diagram that displays the ionic composition of samples from the background and downgradient monitoring wells associated with LF2 based on Quarter 3 2018 samples. Figure 3 also includes data collected from the combined LF1 and LF2 leachate tank in Quarter 2 of 2017. Major cations and anions were not analyzed in samples collected from the LF1 and LF2 leachate tank subsequent to Quarter 2 2017.

It is evident from the Piper diagram (Figure 3) that leachate is in the sodium-sulfate hydrochemical facies, and the LF2 groundwater samples (blue symbols) are in the no dominant-bicarbonate hydrochemical facies. All LF2 Cell 1, 2, and 3 groundwater samples cluster into a single distinct hydrochemical facies. Downgradient groundwater samples associated with LF2 have a different ionic composition than leachate, indicating that leachate is not the source of CCR constituents detected in the LF2 groundwater monitoring wells.

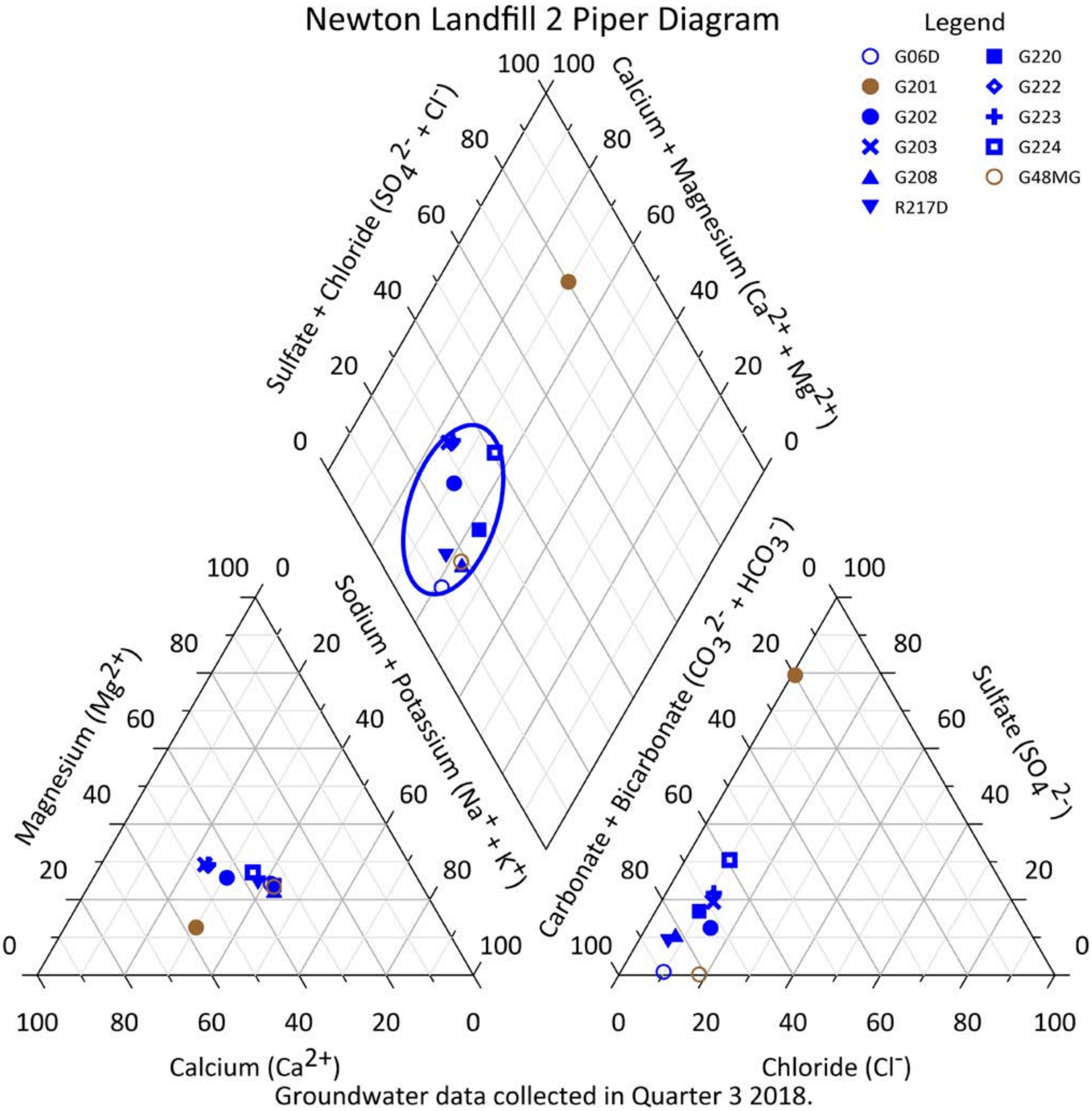


Figure 3. Piper Diagram Showing Ionic Composition of Samples of Background and Downgradient Groundwater Associated with LF2

LINE OF EVIDENCE #4: THE IONIC COMPOSITION IN GROUNDWATER DOWNGRADIENT OF LF2 CELLS 1 AND 2 IS SIMILAR TO GROUNDWATER DOWNGRADIENT OF LF2 CELL 3 (WHERE NO CCR MATERIAL HAS BEEN PLACED)

As illustrated in the Piper diagram (Figure 3), the ionic composition of all LF2 Cell 1, 2, and 3 groundwater samples are similar and cluster into a single distinct hydrochemical facies (no dominant-bicarbonate). The similarity in ionic composition of groundwater downgradient of LF2 Cell 3 and LF2 Cells 1 and 2, coupled with the fact that Cell 3 has never contained CCR, indicate that LF2 Cells 1 and 2 are not the source of CCR constituents detected in the LF2 groundwater monitoring wells.

LINE OF EVIDENCE #5: GROUNDWATER QUALITY IN MONITORING WELLS DOWNGRADIENT OF LF2 CELLS 1 AND 2 IS STATISTICALLY SIMILAR TO GROUNDWATER QUALITY IN MONITORING WELLS DOWNGRADIENT OF LF2 CELL 3 (WHERE NO CCR MATERIAL HAS BEEN PLACED)

Box plots graphically represent the first quartile (Q1), median (Q2), and third quartile (Q3) of a given dataset using lines to construct a box where the lower line, midline and upper line of the box represent the values of Q1, Q2 and Q3, respectively. The minimum and maximum values of the dataset (excluding outliers) are illustrated by whisker lines extending beyond the first and third quartiles of the box plot. Outliers are represented by single points plotted outside of the range of the whiskers. Boron and chloride SSIs were identified at all LF2 cells (LF2 Cells 1, 2, and 3) during the D4 sampling event, whereas, other SSIs were only identified at LF2 Cell 3. Figures 4 and 5, below, display the boron chloride data for downgradient groundwater at LF2; triangle symbols identify outlier values that are at least 1.5 times the interquartile range (IQR) and "x" symbols identify outlier values that are at least 3 times the IQR.

Boron

Box plots of the boron concentrations observed in LF2 Cells 1 and 2 downgradient monitoring wells (cyan), and LF2 Cell 3 downgradient monitoring wells (blue) are shown in Figure 4 below.

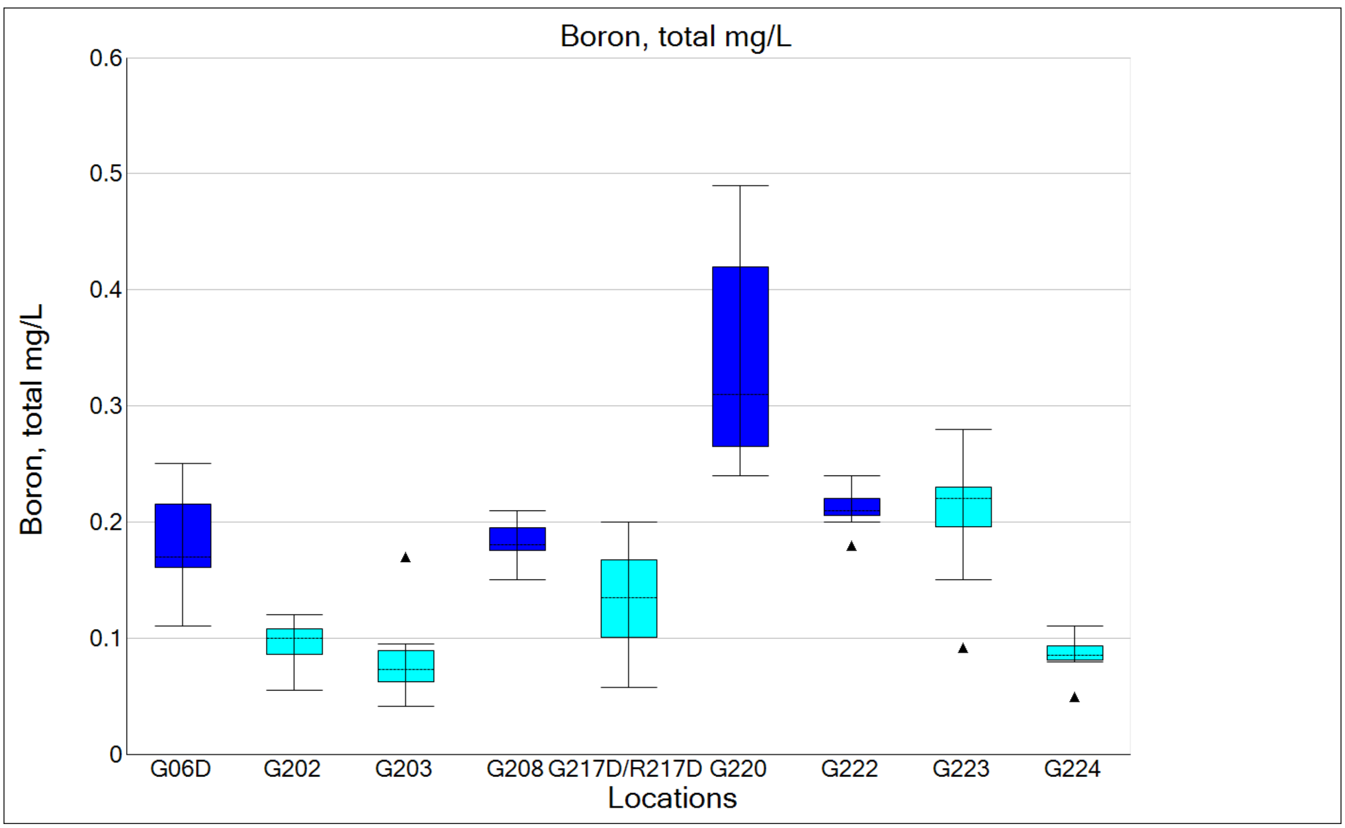


Figure 4. Boron Box Plot for LF2 Cells 1 and 2 Downgradient Monitoring Wells (cyan) and LF2 Cell 3 Downgradient Monitoring Wells (blue)

The following observations can be made from Figure 5:

- The minimum and maximum boron concentrations in wells downgradient of LF2 Cell 3 ranged from 0.11 to 0.49 mg/L.
- The minimum and maximum boron concentrations in wells downgradient of LF2 Cells 1 and 2 ranged from 0.041 to 0.28 mg/L.

Boron concentrations were within or below the range of concentrations observed at wells downgradient of LF2 Cell 3.

Chloride

Box plots of the chloride concentrations observed in LF2 Cells 1 and 2 downgradient monitoring wells (cyan), and LF2 Cell 3 downgradient monitoring wells (blue) are shown in Figure 5 below.

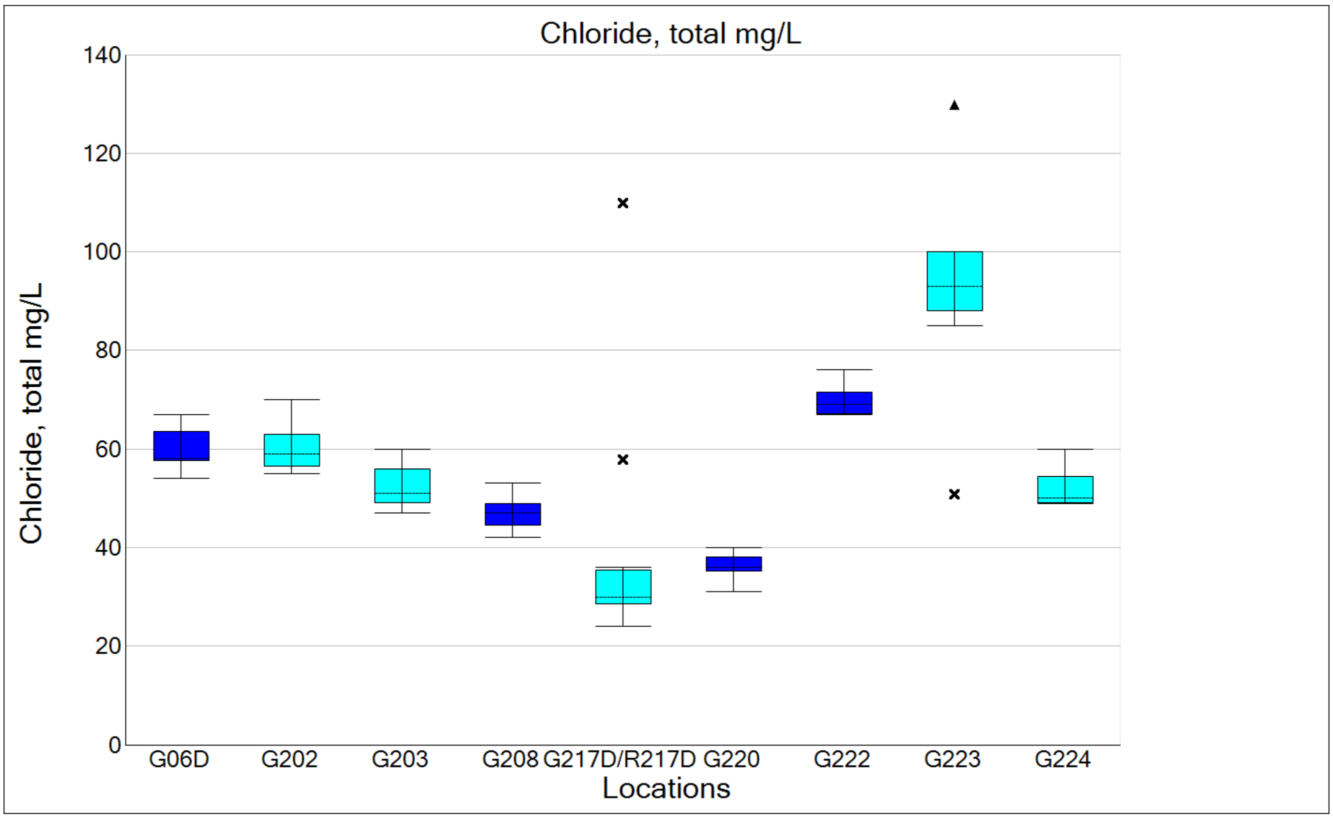


Figure 5. Chloride Box Plot for LF2 Cells 1 and 2 Downgradient Monitoring Wells (cyan) and LF2 Cell 3 Downgradient Monitoring Wells (blue)

The following observations can be made from Figure 7:

- The minimum and maximum chloride concentrations in wells downgradient of LF2 Cell 3 range from 31 to 76 mg/L.
- The minimum and maximum chloride concentrations in wells downgradient of LF2 Cells 1 and 2 range from 24 to 130 mg/L.

Chloride concentrations are within or below the range of concentrations observed at wells downgradient of LF2 Cell 3, with the exception of concentrations at monitoring well G223 and potential statistical outlier concentrations at G217D/R217D (illustrated with black symbols outside of the box plots in Figure 5).

The similarity of groundwater quality downgradient of LF2 Cell 3 and groundwater quality downgradient of LF2 Cells 1 and 2, as represented by the ranges of boron chloride concentrations (Figures 4 and 5, respectively), indicate that LF2 Cells 1 and 2 are not the source of CCR constituents detected in the LF2 groundwater monitoring wells

LINE OF EVIDENCE #6: GROUNDWATER FLOW DIRECTIONS INDICATE MONITORING WELLS G223, G224, AND R217D ARE NOT DOWNGRADIENT OF LF2 CELLS 1 AND 2.

Downgradient groundwater at LF2 Cells 1 and 2 is monitored using wells G202, G203, G223, G224, and R217D. Groundwater flow directions indicate monitoring wells G223, G224, and R217D are not downgradient of LF2 Cells 1 and 2 as illustrated in Figure 2. LF2 Cells 1 and 2 are not the source of CCR constituents detected in the LF2 groundwater monitoring wells G223, G224, and R217D based on the position of the monitoring wells relative to groundwater flow directions.

Based on these six lines of evidence, it has been demonstrated that Newton Landfill 2 is not the source of the boron SSIs at G220, G222, and G223; the chloride SSIs at G06D, G202, G203, G208, G220, G222, G223, and G224; and fluoride SSIs at G208 and G220.

This information serves as the written ASD prepared in accordance with 40 C.F.R. § 257.94(e)(2) that the SSIs observed during the D3 were not due to the LF2. Therefore, an assessment monitoring program is not required, and the Newton Landfill 2 will remain in detection monitoring.

REFERENCES

Natural Resource Technology, an OBG Company (NRT/OBG), 2017a, Statistical Analysis Plan, Coffeen Power Station, Newton Power Station, Illinois Power Generating Company, October 17, 2017.

Natural Resource Technology, an OBG Company (NRT/OBG), 2017b, Hydrogeologic Monitoring Plan, Newton Primary Ash Pond – CCR Unit ID 501, Newton Landfill 2 – CCR Unit ID 502, Newton Power Station, Canton, Illinois, Illinois Power Generating Company, October 17, 2017.

OBG, 2019, 40 C.F.R. § 257.94(e)(2): Alternate Source Demonstration: Newton Primary Ash Pond, July 15, 2019.

ATTACHMENTS

Figure 1	Facility Location Map with Newton Landfill 2 (Phase II Landfill) Management Units and Sample Locations
Figure 2	Groundwater Elevation Contour Map – November 8, 2018

I, Eric J. Tlachac, a qualified professional engineer in good standing in the State of Illinois, certify that the information in this report is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

Eric J. Tlachac
Qualified Professional Engineer
062-063091
Illinois
O'Brien and Gere Engineers, Inc., a Ramboll Company
Date: July 15, 2019

I, Nicole M. Pagano, a professional geologist in good standing in the State of Illinois, certify that the information in this report is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

Nicole M. Pagano
Professional Geologist
196-000750
O'Brien and Gere Engineers, Inc., a Ramboll Company
Date: July 15, 2019

Figures

DRAWN BY: MPG
REVIEWED BY: JJW
APPROVED BY: NMP

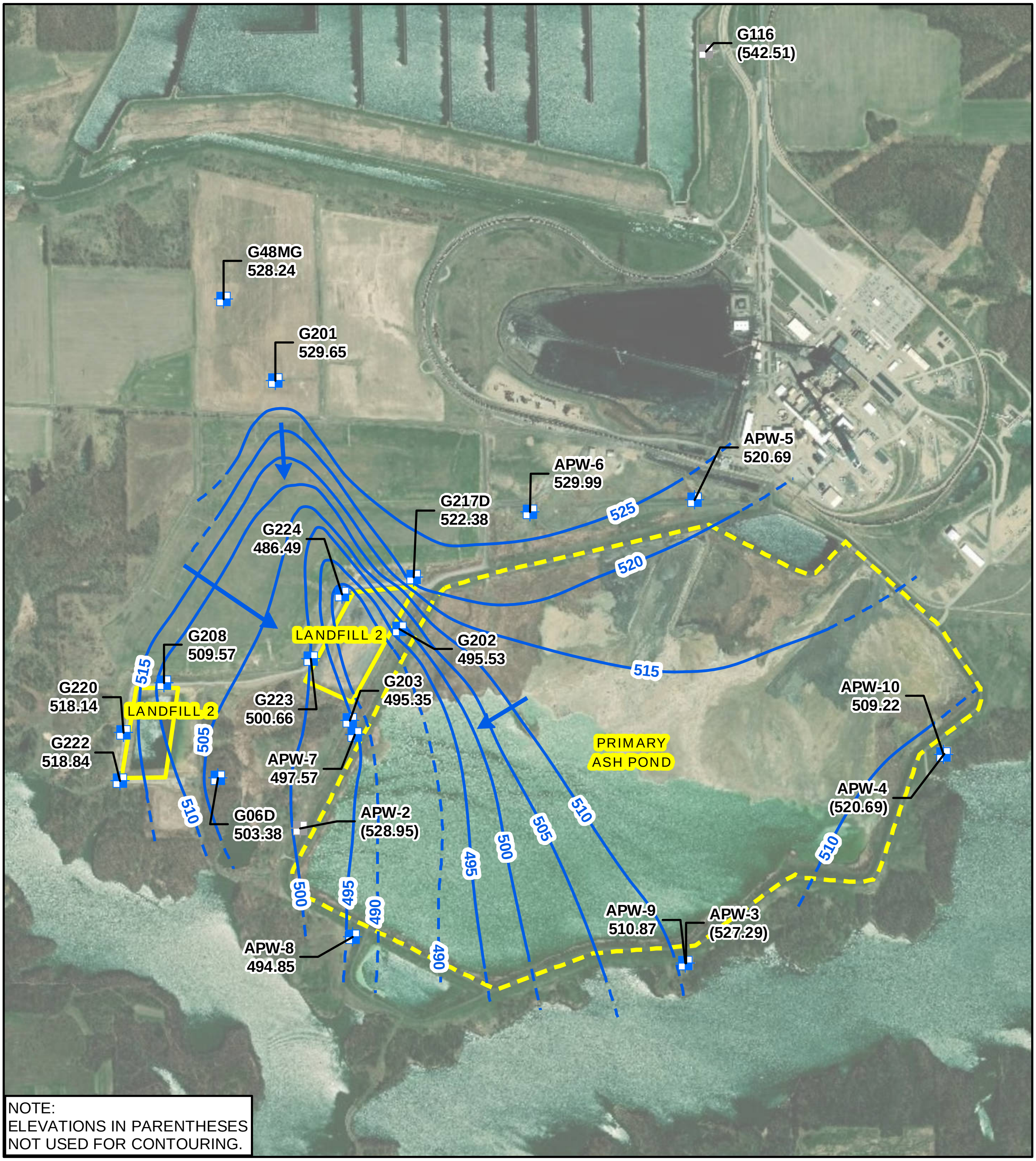
FACILITY LOCATION MAP WITH NEWTON LANDFILL 2 (PHASE II LANDFILL) MANAGEMENT UNITS AND SAMPLE LOCATIONS

ALTERNATE SOURCE DEMONSTRATION
NEWTON POWER STATION
NEWTON, ILLINOIS

PROJECT NO: 67719

FIGURE NO: 1

Y:\Mapping\Projects\22\2285\MXD\Alt_Source_Dem\Figure 1_Newton Landfill Phase2_FINAL.mxd Author: STOLZSD



CCR RULE MONITORING WELL LOCATION

NON-CCR RULE MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR (5-FOOT INTERVAL)

INFERRED GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW DIRECTION

LANDFILL 2 CCR MONITORED UNIT

PRIMARY ASH POND CCR MONITORED UNIT

NEWTON LANDFILL 2 (UNIT ID: 502)
GROUNDWATER ELEVATION CONTOUR MAP
NOVEMBER 8, 2018

ALTERNATE SOURCE DEMONSTRATION
NEWTON POWER STATION
NEWTON, ILLINOIS

0 325 650 1,300
Feet

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O'BRIEN & GERE ENGINEERS, INC.

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October 14, 2019

Title 40 of the Code of Federal Regulations (C.F.R.) § 257.94(e)(2) allows the owner or operator of a Coal Combustion Residuals (CCR) unit 90 days from the date of determination of Statistically Significant Increases (SSIs) over background for groundwater constituents listed in Appendix III of 40 C.F.R. Part 257 to complete a written demonstration that a source other than the CCR unit being monitored caused the SSI(s), or that the SSI(s) resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality (Alternate Source Demonstration [ASD]).

This ASD has been prepared on behalf of Illinois Power Generating Company by O'Brien & Gere Engineers, Inc., part of Ramboll (OBG) to provide pertinent information pursuant to 40 C.F.R. § 257.94(e)(2) for the Newton Landfill 2 (LF2) located near Newton, Illinois.

The fourth semi-annual detection monitoring samples (Detection Monitoring Round 4 [D4]) were collected on February 19-21, 2019 and analytical data were received on April 15, 2019. In accordance with 40 C.F.R. § 257.93(h)(2) and the Statistical Analysis Plan (NRT/OBG 2017a), statistical analysis of the data to identify SSIs of 40 C.F.R. Part 257 Appendix III parameters over background concentrations was completed by July 15, 2019, within 90 days of receipt of the analytical data. The statistical analysis identified the following SSIs at downgradient monitoring wells:

- Boron at wells G06D, G220, G222, G223, and R217D
- Calcium at well R217D
- Chloride at wells G06D, G202, G203, G208, G220, G222, G223, G224, and R217D
- Fluoride at wells G208 and G220
- Sulfate at well R217D
- Total Dissolved Solids (TDS) at well R217D

Pursuant to 40 C.F.R. § 257.94(e)(2), the following demonstrates that sources other than the Newton LF2 were the cause of the SSIs listed above. This ASD was completed by October 14, 2019, within 90 days of determination of the SSIs, as required by 40 C.F.R. § 257.94(e)(2).

SITE LOCATION AND DESCRIPTION

The Newton Power Station (Site) is located in Jasper County, in the southeastern part of central Illinois, approximately 7 miles southwest of the town of Newton. The area is surrounded by Newton Lake. Beyond the lake is agricultural land.

DESCRIPTION OF PHASE II LANDFILL CCR UNIT

The Phase II Landfill (LF2) includes three lined disposal cells (Figure 1). LF2 Cells 1 and 2, encompassing approximately 12 acres, and LF2 Cell 3, encompassing approximately 7 acres.

GEOLOGY AND HYDROGEOLOGY

The site geology and hydrogeology are summarized below from the Hydrogeologic Monitoring Plan (NRT/OBG, 2017b).

GEOLOGY

Quaternary deposits in the Newton area consist mainly of diamictons and outwash deposits that were deposited during Illinoian and Pre-Illinoian glaciations. The unconsolidated deposits occurring at Newton Power Station include the following units (beginning at the ground surface):

- Ash/Fill Units – CCR and fill within the various CCR Units.
- Upper Confining Unit – Low permeability clays and silts, including the Peoria Silt (Loess Unit) in upland areas and the Cahokia Formation in the flood plain and channel areas to the south and east, underlain by the Sangamon Soil, and the predominantly clay diamictons of the Hagarstown (Till) and Vandalia (Till) Members of the Glasford Formation.
- Uppermost Aquifer (Groundwater Monitoring Zone) – Thin to moderately thick (3 to 17 ft), moderate to high permeability sand, silty sand, and sandy silt/clay units of the Mulberry Grove Member of the Glasford Formation.
- Lower Confining Unit – Thick, very low permeability silty clay diamictons of the Smithboro (Till) Member of the Glasford Formation and the silty clay diamictons of the Banner Formation.

The bedrock beneath the unconsolidated deposits consists of Pennsylvanian-age Mattoon Formation that is mostly shale near the bedrock surface, but is characterized at depth by a complex sequence of shales, thin limestones, coals, underclays, and several sandstones. The erosional surface of the Pennsylvanian-age Mattoon Formation bedrock ranges widely in depth in the vicinity of the site, but is typically encountered at 90 to 120 ft below ground surface (bgs).

HYDROGEOLOGY

The information used to describe the hydrogeology is based on the local geology obtained from published sources, hydrogeologic investigation data, and boring data collected during monitoring well installation. CCR monitoring well locations are shown in Figure 1.

The Uppermost Aquifer, the Mulberry Grove Member, typically consists of fine to coarse sand with varying amounts of clay, silt, and fine to coarse gravel. The portion of the Mulberry Grove Member at the site that is defined as a sand layer ranges in thickness from 3 to 17 ft, with an average thickness of 8 ft. With only a few exceptions, the sand layer occurs between depths of 55 to 88 ft bgs.

The lower hydrostratigaphic units, which comprise lower limit of the Uppermost Aquifer, consist of the Smithboro Member and the Banner Formation, both of which are predominantly low permeability clay diamictons with varying amounts of silt, sand, and gravel. These lower hydrostratigraphic units are 30 ft to more than 50 ft thick above the underlying bedrock.

Groundwater elevations across LF2 ranged from approximately 492 to 524 ft MSL (NAVD88) during D4 (Figure 2). The groundwater elevation contours shown on Figure 2 were measured on February 18, 2019, the first day of a combined sampling event at the Site for LF2 and the Primary Ash Pond and for multiple monitoring programs required by both federal and state regulatory agencies. Overall groundwater flow beneath LF2, within the Uppermost Aquifer, is southward toward Newton Lake, but with flow converging to the south-southeast along the major axis of LF2 Cells 1 and 2, and a predominantly eastward flow near LF2 Cell 3. Based on groundwater flow directions near LF2, groundwater beneath LF2 Cells 1 and 2 does not influence groundwater beneath LF2 Cell 3.

GROUNDWATER MONITORING

The Uppermost Aquifer monitoring system for LF2 Cells 1, 2, and 3 is shown on Figure 1 and described below. The relative positions of CCR monitoring wells in relation to groundwater flow direction are shown in Figure 2.

BACKGROUND GROUNDWATER MONITORING

Monitoring wells G201 and G48MG are used to monitor background water quality for LF2 (all cells).

DOWNGRADIENT GROUNDWATER MONITORING

Downgradient groundwater quality at LF2 Cells 1 and 2 is monitored using wells G202, G203, G223, G224, and R217D (which replaced well G217D in October 2017).

Downgradient groundwater quality at LF2 Cell 3 is monitored using wells G06D, G208, G220, and G222.

ALTERNATE SOURCE DEMONSTRATION: LINES OF EVIDENCE

As allowed by 40 C.F.R. § 257.94(e)(2), this ASD demonstrates that sources other than LF2 caused the SSI(s), or that the SSI(s) was a result of natural variation in groundwater quality. This ASD is based on the following lines of evidence (LOE):

1. LF2 composite liner design.
2. No CCR material has been placed in LF2 Cell 3.
3. The ionic composition in groundwater is different than the ionic composition of leachate.
4. The ionic composition of groundwater downgradient of LF2 Cells 1 and 2 is similar to the ionic composition of groundwater downgradient of LF2 Cell 3 (where no CCR material has been placed).
5. Groundwater quality in monitoring wells downgradient of LF2 Cells 1 and 2 is statistically similar to groundwater quality in monitoring wells downgradient of LF2 Cell 3 (where no CCR material has been placed).
6. Groundwater flow directions indicate monitoring wells G223, G224, and R217D are not downgradient of LF2 Cells 1 and 2.

These lines of evidence are described and supported in greater detail below.

LINE OF EVIDENCE #1: LF2 COMPOSITE LINER DESIGN

LF2 Cells 1 and 2 were constructed, and began receiving CCR, in 1997. A portion of LF2 Cell 2 is currently in operation. LF2 Cell 3 is currently inactive and has not received CCR since construction in 2011.

The constructed liner and leachate collection system for LF2 Cells 1, 2, and 3 include the following design components from top to bottom:

- Soil cover for liner frost protection;
- 10-ounce-per-square-yard (sy) geotextile separation layer between the leachate management system and the frost protection soil cover;
- 1-foot thick sand drainage layer;
- 60 mil high-density polyethylene (HDPE) geomembrane; and
- Three-foot-thick compacted, low-permeability soil having a maximum hydraulic conductivity of 1.0×10^{-7} centimeters per second (cm/sec).

These components meet or exceed the landfill liner performance standards of 40 C.F.R. § 257. The landfill design criteria were intended to provide protection to the Uppermost Aquifer. In addition, the Uppermost Confining Unit provides hydraulic separation between the CCR units at the Site and the Uppermost Aquifer (OBG, 2019) These factors support the conclusion that LF2 is not the source of CCR constituents detected in the LF2 groundwater monitoring wells.

LINE OF EVIDENCE #2: NO CCR MATERIAL HAS BEEN PLACED IN LF2 CELL 3

LF2 Cell 3 has never contained CCR; therefore, it cannot be the source of the CCR constituents boron, calcium, chloride, fluoride, sulfate or TDS detected in downgradient groundwater monitoring wells. Furthermore, groundwater flow directions near LF2 (Figure 2) indicate groundwater beneath LF2 Cells 1 and 2 does not influence groundwater beneath LF2 Cell 3, so LF2 Cells 1 and 2 cannot be the source of CCR constituents detected in LF2 Cell 3 downgradient monitoring wells.

LINE OF EVIDENCE #3: THE IONIC COMPOSITION IN GROUNDWATER IS DIFFERENT THAN THE IONIC COMPOSITION OF LEACHATE

Piper diagrams graphically represent ionic composition of aqueous solutions. A Piper diagram displays the position of water samples with respect to their major cation and anion content on the two lower triangular portions of the diagram, providing the information which, when combined on the central, diamond-shaped portion of the diagram, identify composition categories or groupings (hydrochemical facies). Figure 3, below, is a Piper diagram that displays the ionic composition of samples collected from the background and downgradient monitoring wells associated with LF2 in Quarter 3 2018. Major cations and anions were not analyzed in samples collected from the background and downgradient wells subsequent to Quarter 3 2018. Figure 3 also displays the ionic composition of samples collected from the combined LF1 and LF2 leachate tank in Quarter 2 2017. Major cations and anions were not analyzed in samples collected from the LF1 and LF2 leachate tank subsequent to Quarter 2 2017.

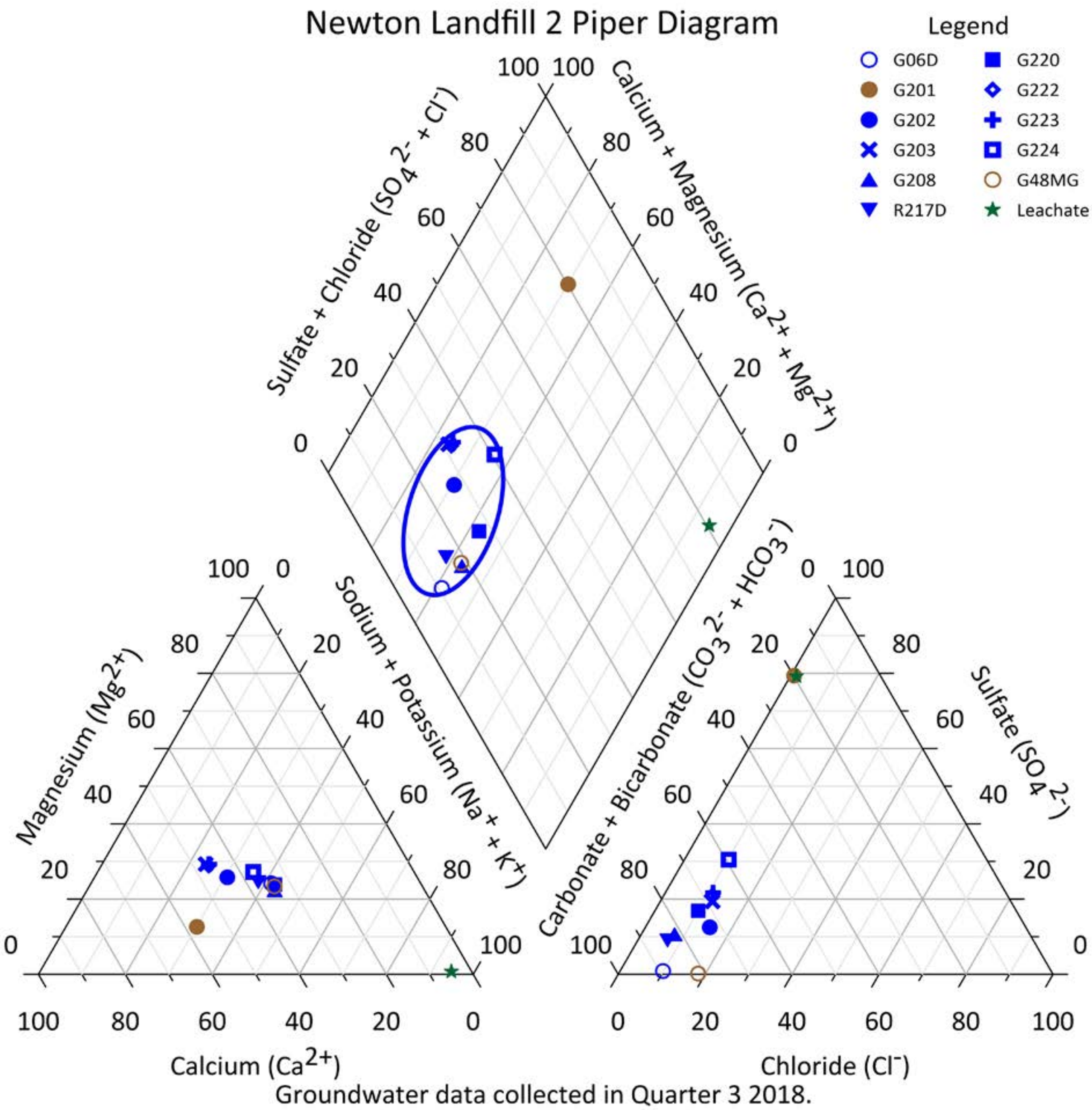


Figure 3. Piper Diagram Showing Ionic Composition of Samples of Groundwater Associated with LF2 and Leachate from Combined LF1 and LF2 Leachate Tank (note: the leachate sample was collected Quarter 2 2017).

It is evident from the Piper diagram (Figure 3) that leachate is in the sodium-sulfate hydrochemical facies, and the LF2 groundwater samples (blue symbols) are in the no dominant-bicarbonate hydrochemical facies. All LF2 Cell 1, 2, and 3 groundwater samples cluster into a single distinct hydrochemical facies. Downgradient groundwater samples associated with LF2 have a different ionic composition than leachate, indicating that leachate is not the source of CCR constituents detected in the LF2 groundwater monitoring wells.

LINE OF EVIDENCE #4: THE IONIC COMPOSITION IN GROUNDWATER DOWNGRADIENT OF LF2 CELLS 1 AND 2 IS SIMILAR TO GROUNDWATER DOWNGRADIENT OF LF2 CELL 3 (WHERE NO CCR MATERIAL HAS BEEN PLACED)

As illustrated in the Piper diagram (Figure 3), the ionic composition of all LF2 Cell 1, 2, and 3 groundwater samples are similar and cluster into a single distinct hydrochemical facies (no dominant-bicarbonate). The similarity in ionic composition of groundwater downgradient of LF2 Cell 3 and LF2 Cells 1 and 2, coupled with the fact that Cell 3 has never contained CCR, indicate that LF2 Cells 1 and 2 are not the source of CCR constituents detected in the LF2 groundwater monitoring wells.

LINE OF EVIDENCE #5: GROUNDWATER QUALITY IN MONITORING WELLS DOWNGRADIENT OF LF2 CELLS 1 AND 2 IS STATISTICALLY SIMILAR TO GROUNDWATER QUALITY IN MONITORING WELLS DOWNGRADIENT OF LF2 CELL 3 (WHERE NO CCR MATERIAL HAS BEEN PLACED)

Box plots graphically represent the first quartile (Q1), median (Q2), and third quartile (Q3) of a given dataset using lines to construct a box where the lower line, midline and upper line of the box represent the values of Q1, Q2 and Q3, respectively. The minimum and maximum values of the dataset (excluding outliers) are illustrated by whisker lines extending beyond the first and third quartiles of the box plot. Outliers are represented by single points plotted outside of the range of the whiskers. Boron and chloride SSIs were identified at all LF2 cells (LF2 Cells 1, 2, and 3) during the D4 sampling event, whereas, other SSIs were only identified at either LF2 Cells 1 and 2, or LF2 Cell 3. Figures 4 and 5, below, display the boron and chloride data for downgradient groundwater at LF2; triangle symbols identify outlier values that are at least 1.5 times the interquartile range (IQR) and "x" symbols identify outlier values that are at least 3 times the IQR.

Boron

Box plots of the boron concentrations observed in LF2 Cells 1 and 2 downgradient monitoring wells (cyan), and LF2 Cell 3 downgradient monitoring wells (blue) are shown in Figure 4 below.

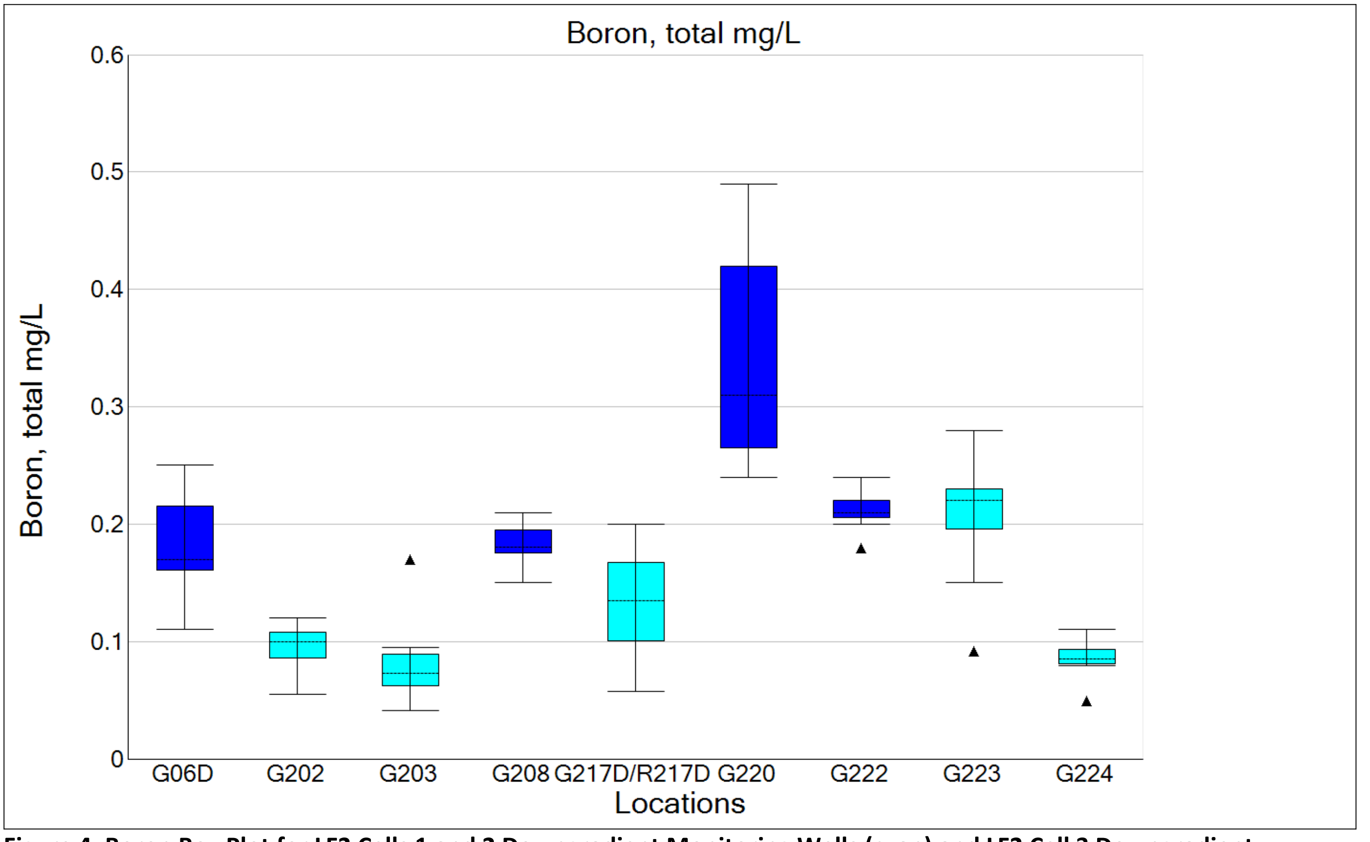


Figure 4. Boron Box Plot for LF2 Cells 1 and 2 Downgradient Monitoring Wells (cyan) and LF2 Cell 3 Downgradient Monitoring Wells (blue)

The following observations can be made from Figure 4

- The minimum and maximum boron concentrations in wells downgradient of LF2 Cell 3 ranged from 0.11 to 0.49 mg/L.
- The minimum and maximum boron concentrations in wells downgradient of LF2 Cells 1 and 2 ranged from 0.041 to 0.28 mg/L.

Boron concentrations downgradient of LF2 Cells 1 and 2 were within or below the range of concentrations observed at wells downgradient of LF2 Cell 3.

Chloride

Box plots of the chloride concentrations observed in LF2 Cells 1 and 2 downgradient monitoring wells (cyan), and LF2 Cell 3 downgradient monitoring wells (blue) are shown in Figure 5 below.

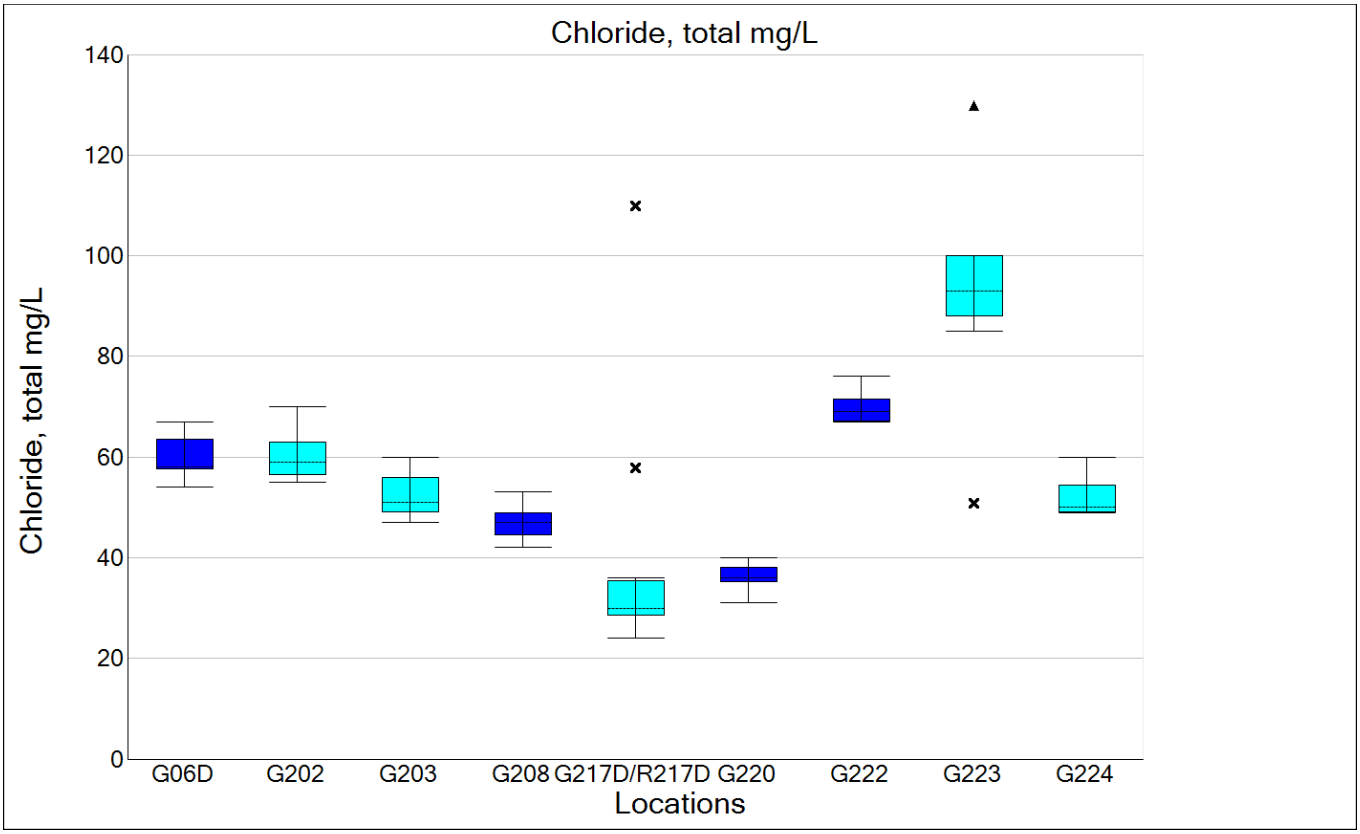


Figure 5. Chloride Box Plot for LF2 Cells 1 and 2 Downgradient Monitoring Wells (cyan) and LF2 Cell 3 Downgradient Monitoring Wells (blue)

The following observations can be made from Figure 5:

- The minimum and maximum chloride concentrations in wells downgradient of LF2 Cell 3 range from 31 to 76 mg/L.
- The minimum and maximum chloride concentrations in wells downgradient of LF2 Cells 1 and 2 range from 24 to 130 mg/L.

Chloride concentrations downgradient of LF2 Cells 1 and 2 are generally within or below the range of concentrations observed at wells downgradient of LF2 Cell 3. The exception is monitoring well G223 and potential statistical outlier concentrations at G217D/R217D (illustrated with black symbols outside of the whiskers in Figure 5).

The similarity of groundwater quality downgradient of LF2 Cell 3 and groundwater quality downgradient of LF2 Cells 1 and 2, as represented by the ranges of boron and chloride concentrations (Figures 4 and 5, respectively), coupled with the fact that Cell 3 has never contained CCR, indicates that LF2 Cells 1 and 2, are not the source of CCR constituents detected in the LF2 groundwater monitoring wells.

LINE OF EVIDENCE #6: GROUNDWATER FLOW DIRECTIONS INDICATE MONITORING WELLS G223, G224, AND R217D ARE NOT DOWNGRADIENT OF LF2 CELLS 1 AND 2.

Downgradient groundwater at LF2 Cells 1 and 2 is monitored using wells G202, G203, G223, G224, and R217D. Groundwater flow directions indicate monitoring wells G223, G224, and R217D are not downgradient of LF2 Cells 1 and 2 as illustrated in Figure 2. LF2 Cells 1 and 2 are not the source of CCR constituents detected in the LF2 groundwater monitoring wells G223, G224, and R217D based on the position of the monitoring wells relative to groundwater flow directions.

Based on these six lines of evidence, it has been demonstrated that Newton Landfill 2 is not the source of the boron SSIs at G06D, G220, G222, G223, and R217D; the calcium SSI at R217D; the chloride SSIs at G06D, G202, G203, G208, G220, G222, G223, G224, and R217D; the fluoride SSIs at G208 and G220; the sulfate SSI at R217D; and the TDS SSI at R217D.

This information serves as the written ASD prepared in accordance with 40 C.F.R. § 257.94(e)(2) that the SSIs observed during D4 were not due to the LF2. Therefore, an assessment monitoring program is not required, and the Newton Landfill 2 will remain in detection monitoring.

REFERENCES

Natural Resource Technology, an OBG Company (NRT/OBG), 2017a, Statistical Analysis Plan, Coffeen Power Station, Newton Power Station, Illinois Power Generating Company, October 17, 2017.

Natural Resource Technology, an OBG Company (NRT/OBG), 2017b, Hydrogeologic Monitoring Plan, Newton Primary Ash Pond – CCR Unit ID 501, Newton Landfill 2 – CCR Unit ID 502, Newton Power Station, Canton, Illinois, Illinois Power Generating Company, October 17, 2017.

OBG, 2019, 40 C.F.R. § 257.94(e)(2): Alternate Source Demonstration: Newton Primary Ash Pond, October 14, 2019.

ATTACHMENTS

Figure 1	Facility Location Map with Newton Landfill 2 (Phase II Landfill) Management Units and Sample Locations
Figure 2	Groundwater Elevation Contour Map – February 18, 2019

I, Eric J. Tlachac, a qualified professional engineer in good standing in the State of Illinois, certify that the information in this report is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

Eric J. Tlachac
Qualified Professional Engineer
062-063091
Illinois
O'Brien and Gere Engineers, Inc., a Ramboll Company
Date: October 14, 2019

I, Nicole M. Pagano, a professional geologist in good standing in the State of Illinois, certify that the information in this report is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

Nicole M. Pagano
Professional Geologist
196-000750
O'Brien and Gere Engineers, Inc., a Ramboll Company
Date: October 14, 2019

Figures

DRAWN BY: MPG
REVIEWED BY: JJW
APPROVED BY: NMP

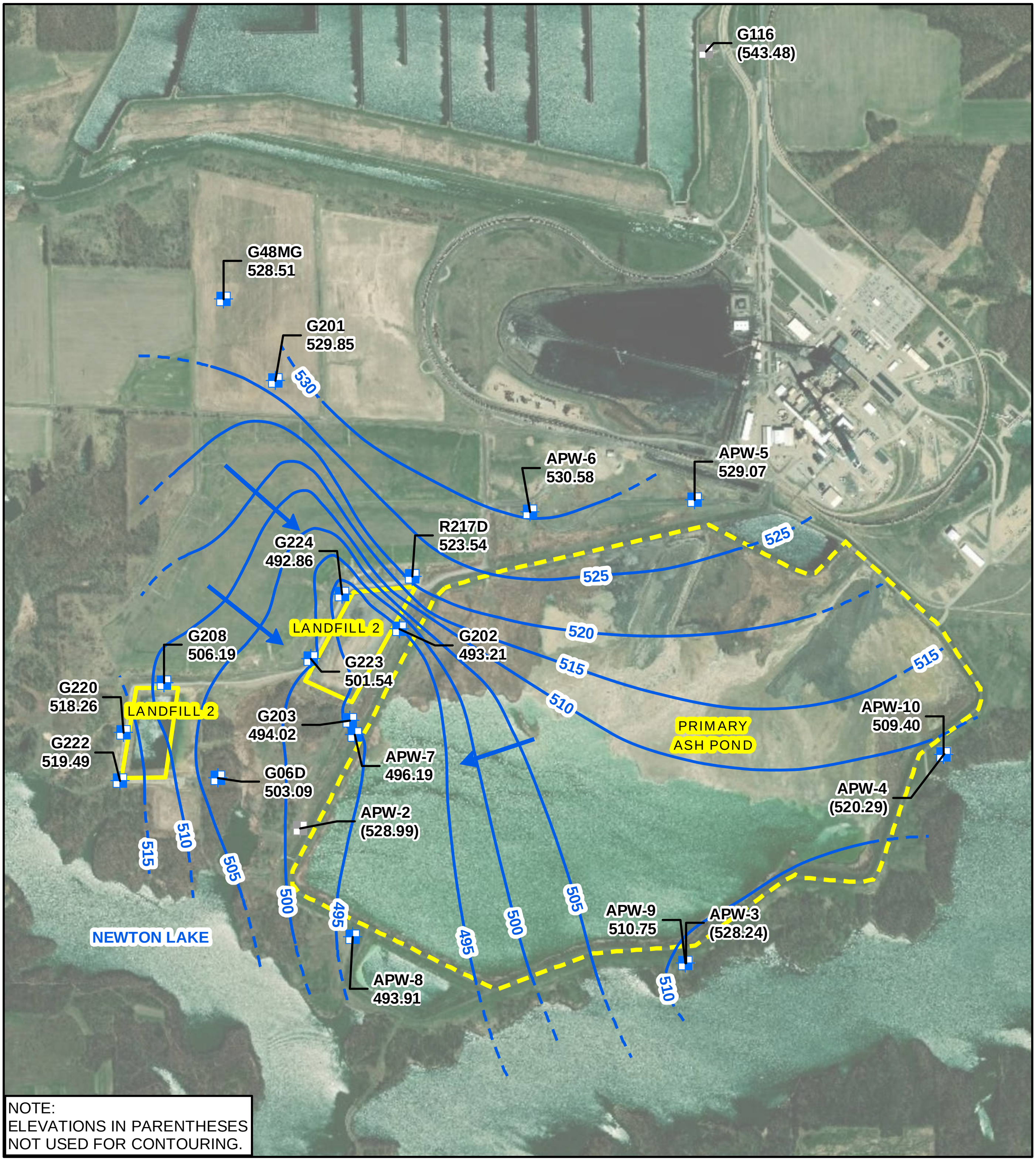
FACILITY LOCATION MAP WITH NEWTON LANDFILL 2 (PHASE II LANDFILL) MANAGEMENT UNITS AND SAMPLE LOCATIONS

ALTERNATE SOURCE DEMONSTRATION
NEWTON POWER STATION
NEWTON, ILLINOIS

PROJECT NO: 67719

FIGURE NO: 1

Y:\Mapping\Projects\22\2285\MXD\All_Source_Dem\Figure 1_Newton Landfill Phase2_FINAL.mxd Author: GALARNMC



CCR RULE MONITORING WELL LOCATION

NON-CCR RULE MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR (5-FOOT INTERVAL)

INFERRED GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW DIRECTION

LANDFILL 2 CCR MONITORED UNIT

PRIMARY ASH POND CCR MONITORED UNIT

NEWTON LANDFILL 2 (UNIT ID: 502)
GROUNDWATER ELEVATION CONTOUR MAP
FEBRUARY 18, 2019

ALTERNATE SOURCE DEMONSTRATION
NEWTON POWER STATION
NEWTON, ILLINOIS

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O'BRIEN & GERE ENGINEERS, INC.

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Intended for
Illinois Power Generating Company

Date
April 27, 2020

Project No.
74923

40 C.F.R. § 257.94(e)(2): ALTERNATE SOURCE DEMONSTRATION

NEWTON PHASE II LANDFILL (LF2)

Bright ideas. Sustainable change.

CERTIFICATIONS

I, Nicole M. Pagano, a professional geologist in good standing in the State of Illinois, certify that the information in this report is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

____

Nicole M. Pagano
Professional Geologist
196-000750
Illinois
O'Brien & Gere Engineers, Inc., a Ramboll Company
Date: April 27, 2020

I, Eric J. Tlachac, a qualified professional engineer in good standing in the State of Illinois, certify that the information in this report is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

____

Eric J. Tlachac
Qualified Professional Engineer
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Date: April 27, 2020

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CONTENTS

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ACRONYMS AND ABBREVIATIONS

40 C.F.R.	Title 40 of the Code of Federal Regulations
ASD	Alternate Source Demonstration
CCR	Coal Combustion Residuals
cm/s	centimeters per second
GMF	Gypsum Management Facility
HDPE	high-density polyethylene
IEPA	Illinois Environmental Protection Agency
LOE	Line of Evidence
mg/L	milligrams per liter
msl	mean sea level
NRT/OBG	Natural Resource Technology, an OBG Company
Site	Newton Power Station
SSI	Statistically Significant Increase
UPL	Upper Prediction Limit

1. INTRODUCTION

Title 40 of the Code of Federal Regulations (40 C.F.R.) § 257.94(e)(2) allows the owner or operator of a Coal Combustion Residuals (CCR) unit 90 days from the date of determination of a Statistically Significant Increase (SSI) over background for groundwater constituents listed in Appendix III of 40 C.F.R. Part 257 to complete a written demonstration that a source other than the CCR unit being monitored caused the SSI(s), or that the SSI(s) resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality (Alternate Source Demonstration [ASD]).

This ASD has been prepared on behalf of Illinois Power Generating Company, by O'Brien & Gere Engineers, Inc., a Ramboll Company (Ramboll), to provide pertinent information pursuant to 40 C.F.R. § 257.95(g)(3)(ii) for the Newton Phase II Landfill (LF2), located near Newton, IL.

The most recent Detection Monitoring sampling event (D5) was completed on August 21 and August 22, 2019, and analytical data were received on October 28, 2019. Analytical data from D5 were evaluated in accordance with the Statistical Analysis Plan (NRT/OBG, 2017) to determine any Statistically Significant Increases (SSIs) of Appendix III parameters over background concentrations. That evaluation identified SSIs at downgradient monitoring wells as follows:

- Boron at wells G208, G220, G222, and G223
- Calcium at well R217D
- Chloride at wells G06D, G202, G203, G208, G220, G222, G223, G224, and R217D
- Fluoride at wells G208 and G220
- Total Dissolved Solids (TDS) at wells G222 and R217D

Pursuant to 40 C.F.R. § 257.94(e)(2), the following lines of evidence demonstrate that sources other than the Newton LF2 were the cause of the boron, calcium, chloride, fluoride, and TDS SSIs listed above. This ASD was completed by April 27, 2020, within 90 days of determination of the SSIs (January 27, 2020), as required by 40 C.F.R. § 257.94(e)(2).

2. BACKGROUND

2.1 Site location and Description

The Newton Power Station (Site) is located in Jasper County in the southeastern part of central Illinois, approximately 7 miles southwest of the town of Newton. The plant is located on the north side of Newton Lake. The area is bounded by Newton Lake and agricultural land to the west, south, and east, and agricultural land to the north. Beyond the lake is additional agricultural land.

2.2 Description of Phase II Landfill CCR Unit

The Phase II Landfill (LF2) includes three lined disposal cells (Figure 1). LF2 Cells 1 and 2, encompass approximately 12 acres, are adjacent to each other and located south and east of the Phase I Landfill (LF1). LF2 Cell 3 encompasses approximately 7 acres and is located approximately 1,100 feet west of Cells 1 and 2. All three cells of LF2 are constructed with composite liners and leachate collection systems that exceed the landfill liner performance standards of 40 CFR § 257.70. Cell 3 is inactive and has not received CCR since constructed in 2011.

2.3 Geology and Hydrogeology

The information used to describe the hydrogeology is based on the local geology obtained from published sources, hydrogeologic investigation data, and boring data collected during monitoring well installation.

Quaternary deposits in the Newton area consist mainly of diamictons and outwash deposits that were deposited during Illinoian and Pre-Illinoian glaciations (Lineback, 1979; Willman et al., 1975). The unconsolidated deposits occurring at Newton Power Station include the following units beginning at the ground surface:

- Ash/Fill Units – CCR and fill within the various CCR Units.
- Upper Confining Unit – Low permeability clays and silts, including the Peoria Silt (Loess Unit) in upland areas and the Cahokia Formation in the flood plain and channel areas to the south and east, underlain by the Sangamon Soil, and the predominantly clay diamictons of the Hagarstown (Till) and Vandalia (Till) Members of the Glasford Formation .
- Uppermost Aquifer – Thin to moderately thick (3 to 17 ft), moderate to high permeability sand, silty sand, and sandy silt/clay units of the Mulberry Grove Member of the Glasford Formation.
- Lower Confining Unit – Thick, very low permeability silty clay diamictons of the Smithboro (Till) Member of the Glasford Formation and the silty clay diamictons of the Banner Formation.

The bedrock beneath the unconsolidated deposits consists of Pennsylvanian-age Mattoon Formation (Willman et al., 1967) that is mostly shale near the bedrock surface but is characterized at depth by a complex sequence of shales, thin limestones, coals, underclays, and several sandstones (Willman et al., 1975). The erosional surface of the Pennsylvanian-age Mattoon Formation bedrock ranges widely in depth in the vicinity of the Site but is typically encountered at 90 to 120 ft below ground surface (bgs).

Groundwater elevations across LF2 ranged from approximately 495 to 518 ft msl during D5 (Figure 1). The groundwater elevation contours shown on Figure 1 were measured on August 21, 2019. Overall groundwater flow beneath LF2, within the Uppermost Aquifer, is southward toward Newton Lake, but with flow converging to the south-southeast along the major axis of LF2 Cells 1 and 2, and a predominantly eastward flow near LF2 Cell 3. Based on groundwater flow directions near LF2, groundwater beneath LF2 Cells 1 and 2 does not influence groundwater beneath LF2 Cell 3.

2.4 Groundwater and Landfill Monitoring

The Uppermost Aquifer monitoring system for LF2 Cells 1, 2, and 3 is shown on Figure 1 and described below.

Monitoring wells G201 and G48MG are used to monitor background groundwater quality for LF2 (all cells). Groundwater quality at LF2 Cells 1 and 2 is monitored using wells G202, G203, G223, G224, and R217D (which replaced well G217D in October 2017). Groundwater quality at LF2 Cell 3 is monitored using wells G06D, G208, G220, and G222. Leachate from LF2 is monitored using leachate sample location L301 (Figure 1).

3. ALTERNATE SOURCE DEMONSTRATION: LINES OF EVIDENCE

As allowed by 40 C.F.R. § 257.94(e)(2), this ASD demonstrates that sources other than LF2 caused the SSI(s), or that the SSI(s) was a result of natural variation in groundwater quality. This ASD is based on the following lines of evidence (LOE):

1. LF2 composite liner design.
2. No CCR material has been placed in LF2 Cell 3.
3. The ionic composition of groundwater is different than the ionic composition of leachate.
4. The ionic composition of groundwater downgradient of LF2 Cells 1 and 2 is similar to the ionic composition of groundwater downgradient of LF2 Cell 3 (where no CCR material has been placed).
5. Groundwater quality in monitoring wells downgradient of LF2 Cells 1 and 2 is statistically similar to groundwater quality in monitoring wells downgradient of LF2 Cell 3 (where no CCR material has been placed).

These lines of evidence are described and supported in greater detail below.

3.1 LOE #1: LF2 Composite Liner Design

LF2 Cells 1 and 2 were constructed and began receiving CCR in 1997. Currently, a portion of LF2 Cell 2 is in operation. No CCR has been placed in LF2 Cell 3 .

The constructed liner and leachate collection system for LF2 Cells 1, 2, and 3 include the following design components from top to bottom:

- Soil cover for liner frost protection
- 10-ounce-per-square-yard geotextile separation layer between the leachate management system and the frost protection soil cover
- 1-foot thick sand drainage layer
- 60 mil high-density polyethylene geomembrane
- Three-foot-thick compacted, low-permeability soil having a maximum hydraulic conductivity of 1.0×10^{-7} centimeters per second (cm/sec)

These components exceed the landfill liner performance standards of 40 C.F.R. § 257. The landfill design criteria were intended to provide protection to the Uppermost Aquifer. Therefore, the presence of the composite liner suggests that LF2 is not the source of CCR constituents detected in the LF2 groundwater monitoring wells.

3.2 LOE #2: No CCR material has been placed in LF2 Cell 3

LF2 Cell 3 has never contained CCR; therefore, it cannot be the source of the CCR constituents boron, chloride, fluoride, or TDS detected in Cell 3 groundwater monitoring wells (G06D, G208, G220, and G222).

3.3 LOE #3: The ionic composition of groundwater is different than the ionic composition of leachate

Piper diagrams graphically represent ionic composition of aqueous solutions. A Piper diagram displays the position of water samples with respect to their major cation and anion content on the two lower triangular portions of the diagram, providing the information which, when combined on the central, diamond-shaped portion of the diagram, identify composition categories or groupings (hydrochemical facies). Figure A, below, is a Piper diagram that displays the ionic composition of samples collected from the background and downgradient monitoring wells associated with LF2, and leachate sampling location L301 associated with LF2, in Quarter 3 2019.

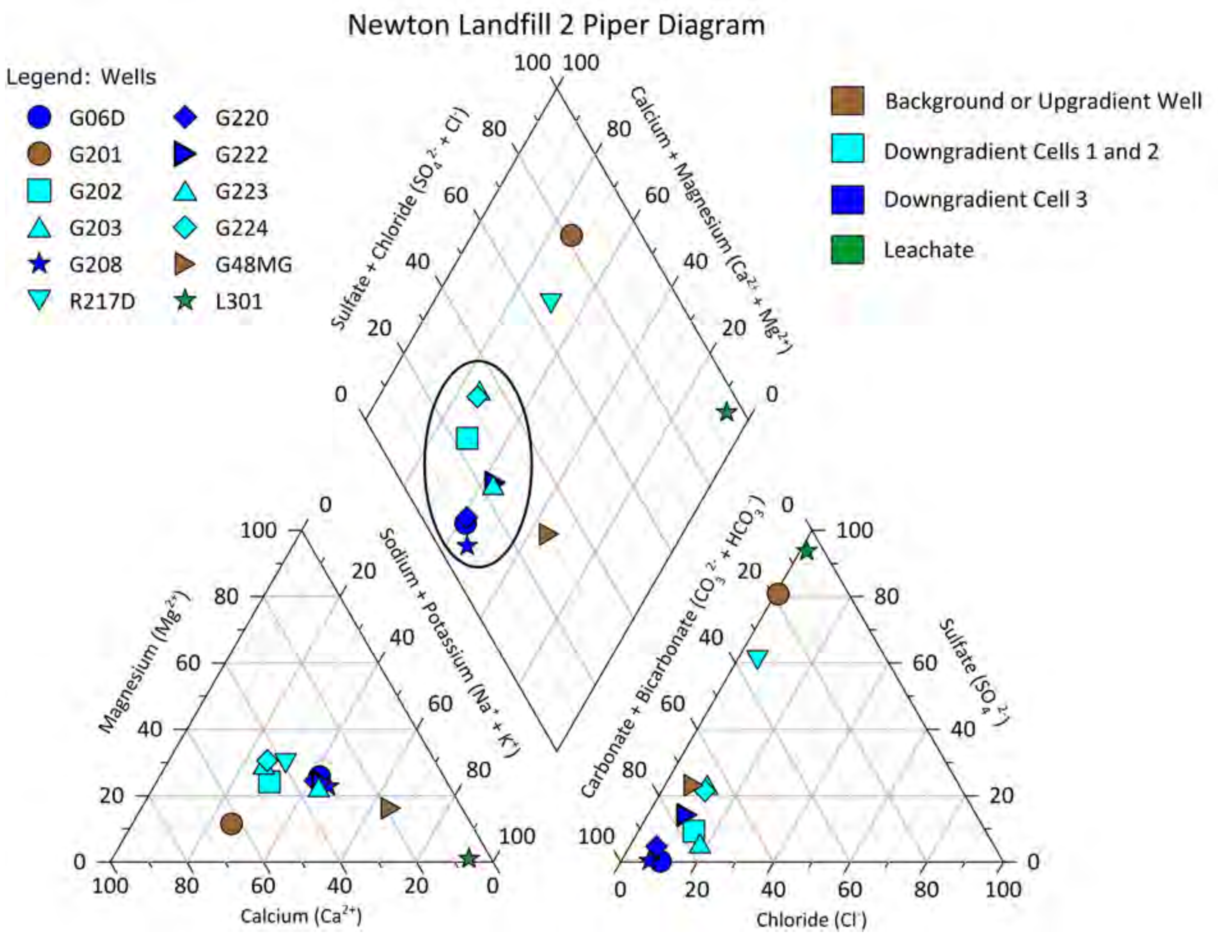


Figure A. Piper Diagram. Shows Ionic Composition of Samples of Groundwater Associated with LF2 in Q3 2019.

It is evident from the Piper diagram (Figure A) that leachate from LF2 (L301; green symbol) is in the sodium-chloride hydrochemical facies, while the LF2 groundwater samples (blue and cyan symbols) are predominantly in the calcium-bicarbonate hydrochemical facies (black grouping) with the exception of groundwater sample R217D which is in the calcium-sulfate hydrochemical facies. Therefore, downgradient groundwater samples associated with LF2 have a different ionic composition than leachate, indicating that leachate is not the source of CCR constituents detected in the LF2 groundwater monitoring wells.

3.4 LOE #4: The Ionic Composition of Groundwater Downgradient of LF2 Cells 1 and 2 Is Similar to the Ionic Composition of Groundwater Downgradient of LF2 Cell 3 (Where No CCR Material Has Been Placed)

As illustrated in the Piper diagram (Figure A), the ionic composition of all LF2 Cell 1, 2, and 3 groundwater samples (blue and cyan symbols) are similar and primarily cluster into a single distinct hydrochemical facies (calcium-bicarbonate; black grouping). The only exception is R217D, which is in the calcium-sulfate facies (along with background well G201). Furthermore, the groundwater flow direction indicates that Cell 3 wells are not influenced by Cells 1 and 2 (Figure 1). The similarity in ionic composition of groundwater downgradient of LF2 Cell 3 and LF2 Cells 1 and 2, coupled with the facts that Cell 3 has never contained CCR and groundwater beneath Cell 3 is not influenced by Cells 1 and 2, indicate that LF2 Cells 1 and 2 are not the source of CCR constituents detected in the LF2 groundwater monitoring wells.

3.5 LOE #5: Groundwater Quality in Monitoring Wells Downgradient of LF2 Cells 1 and 2 Is Statistically Similar to Groundwater Quality in Monitoring Wells Downgradient of LF2 Cell 3 (Where No CCR Material Has Been Placed)

Box plots graphically represent the first quartile, median, and third quartile of a given dataset using lines to construct a box where the lower line, midline and upper line of the box represent the values of the first quartile, median, and third quartile, respectively. The minimum and maximum values of the dataset (excluding outliers) are illustrated by whisker lines extending beyond the first and third quartiles of the box plot. Outliers are represented by single points plotted outside of the range of the whiskers. Boron, chloride, and TDS SSIs were identified at all LF2 cells (LF2 Cells 1, 2, and 3) during the D5 sampling event, whereas other SSIs were only identified at either LF2 Cells 1 and 2, or LF2 Cell 3. As noted above, groundwater flow direction indicates that Cell 3 wells are not influenced by Cells 1 and 2, and Cell 3 has never contained CCR. Figures B, C, and D display the boron, chloride and TDS data, respectively, for downgradient groundwater at LF2; triangle symbols identify outlier values that are at least 1.5 times the interquartile range (IQR) and “x” symbols identify outlier values that are at least 3 times the IQR.

3.5.1 Boron

Box plots of the boron concentrations observed in LF2 Cells 1 and 2 downgradient monitoring wells (cyan), and LF2 Cell 3 downgradient monitoring wells (blue) are shown in Figure B.

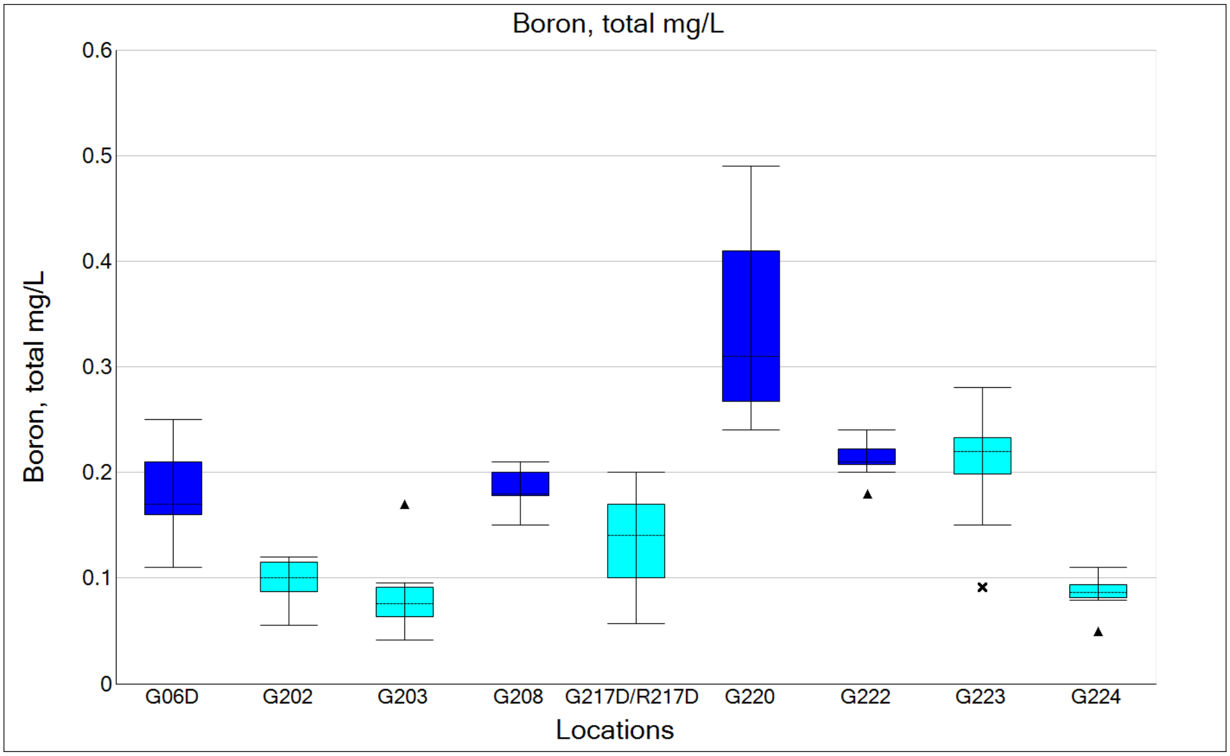


Figure B. Boron Box Plot. Includes LF2 Cells 1 and 2 Downgradient Monitoring Wells (cyan) and LF2 Cell 3 Downgradient Monitoring Wells (blue).

The minimum and maximum boron concentrations in wells downgradient of LF2 Cell 3 ranged from 0.11 to 0.49 milligrams per liter (mg/L). The minimum and maximum boron concentrations in wells downgradient of LF2 Cells 1 and 2 ranged from 0.041 to 0.28 mg/L. Boron concentrations downgradient of LF2 Cells 1 and 2 were within or below the range of concentrations observed at wells downgradient of LF2 Cell 3.

3.5.2 Chloride

Box plots of the chloride concentrations observed in LF2 Cells 1 and 2 downgradient monitoring wells (cyan), and LF2 Cell 3 downgradient monitoring wells (blue) are shown in Figure C below.

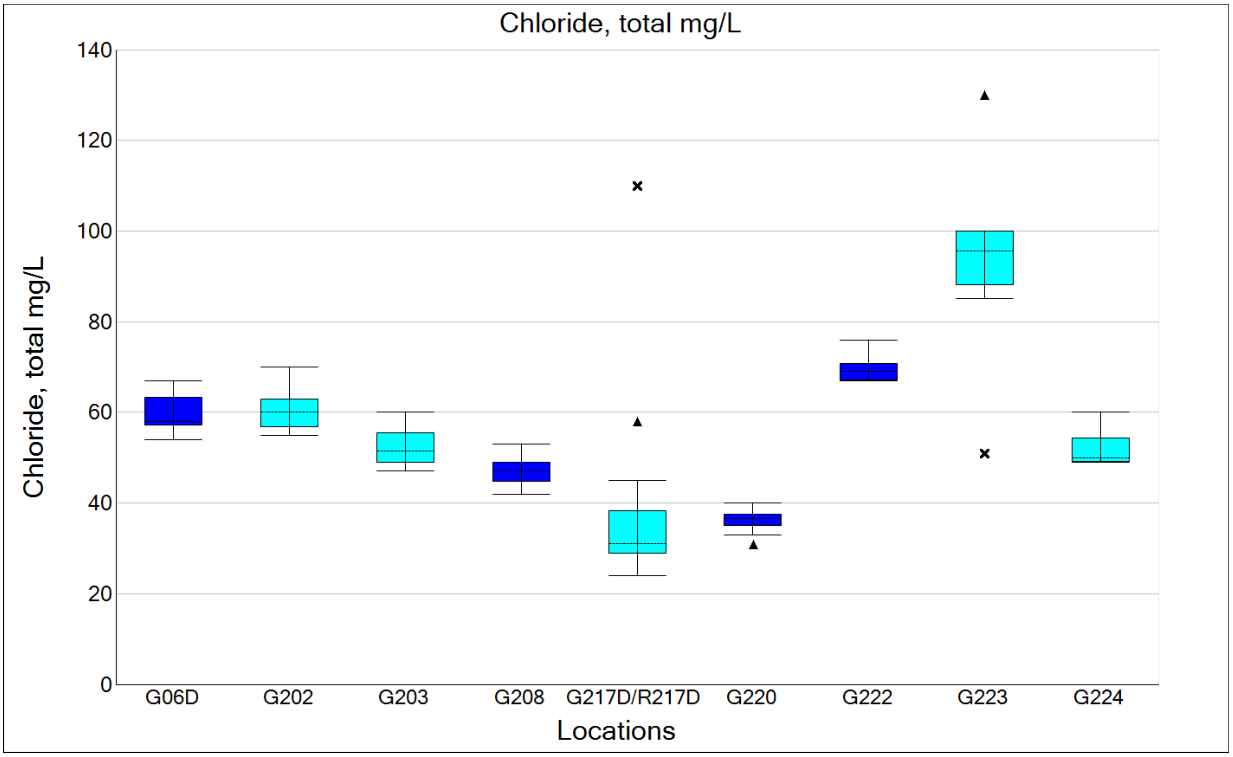


Figure C. Chloride Box Plot. Includes LF2 Cells 1 and 2 Downgradient Monitoring Wells (cyan) and LF2 Cell 3 Downgradient Monitoring Wells (blue).

The minimum and maximum chloride concentrations in wells downgradient of LF2 Cell 3 range from 31 to 76 mg/L. The minimum and maximum chloride concentrations in wells downgradient of LF2 Cells 1 and 2 range from 24 to 130 mg/L.

Chloride concentrations downgradient of LF2 Cells 1 and 2 are generally within or below the range of concentrations observed at wells downgradient of LF2 Cell 3. The exception is monitoring well G223 and potential statistical outlier concentrations at G217D/R217D (illustrated with black symbols outside of the whiskers in Figure C).

3.5.3 Total Dissolved Solids

Box plots of the TDS concentrations observed in LF2 Cells 1 and 2 downgradient monitoring wells (cyan), and LF2 Cell 3 downgradient monitoring wells (blue) are shown in Figure D below.

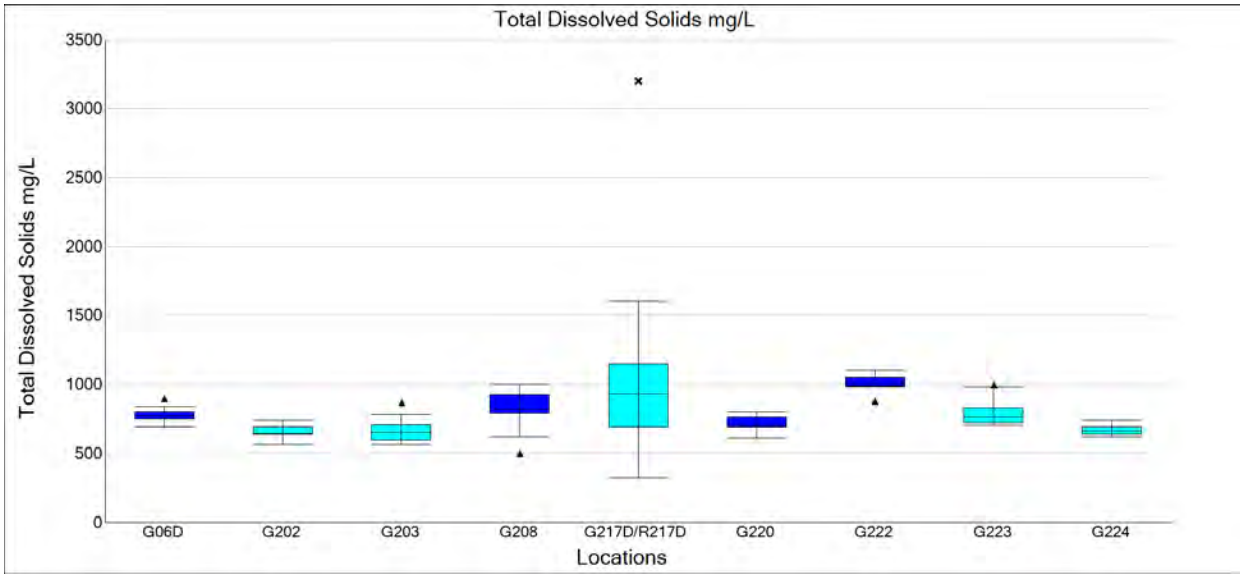


Figure D. Total Dissolved Solids Box Plot. Includes LF2 Cells 1 and 2 Downgradient Monitoring Wells (cyan) and LF2 Cell 3 Downgradient Monitoring Wells (blue).

The minimum and maximum TDS concentrations in wells downgradient of LF2 Cell 3 range from 500 to 1100 mg/L. The minimum and maximum TDS concentrations in wells downgradient of LF2 Cells 1 and 2 range from 320 to 3200 mg/L.

The minimum and maximum TDS concentrations in wells downgradient of LF2 Cells 1 and 2 range from 320 to 3200 mg/L.

TDS concentrations downgradient of LF2 Cells 1 and 2 are generally within or below the range of concentrations observed at wells downgradient of LF2 Cell 3. The exception is monitoring well G217D/R217D which had two TDS concentrations greater than 1100 mg/L, one of which is a potential statistical outlier (illustrated with black symbols outside of the whiskers in Figure D).

The similarity of groundwater quality downgradient of LF2 Cell 3 and groundwater quality downgradient of LF2 Cells 1 and 2, as represented by the ranges of boron, chloride, and TDS concentrations (Figures B, C, and D respectively), coupled with the fact that no CCR material has been placed in LF2 Cell 3, suggests that LF2 Cells 1 and 2 are not the source of CCR constituents detected in the LF2 groundwater monitoring wells.

4. CONCLUSIONS

Based on the six lines of evidence below, it has been demonstrated that the boron SSIs at G208, G220, G222, and G223; the calcium SSI at R217D; the chloride SSIs at G06D, G202, G203, G208, G220, G222, G223, G224, and R217D; the fluoride SSIs at G208 and G220; and the TDS SSIs at G222 and R217D are not due to Newton LF2 but are from a source other than the CCR unit being monitored:

1. LF2 composite liner design.
2. No CCR material has been placed in LF2 Cell 3.
3. The ionic composition of groundwater is different than the ionic composition of leachate.
4. The ionic composition of groundwater downgradient of LF2 Cells 1 and 2 is similar to the ionic composition of groundwater downgradient of LF2 Cell 3 (where no CCR material has been placed).
5. Groundwater quality in monitoring wells downgradient of LF2 Cells 1 and 2 is statistically similar to groundwater quality in monitoring wells downgradient of LF2 Cell 3 (where no CCR material has been placed).
6. This information serves as the written ASD prepared in accordance with 40 C.F.R. § 257.94(e)(2) that the SSIs observed during D5 were not due to the LF2. Therefore, an assessment monitoring program is not required, and the Newton Landfill 2 will remain in detection monitoring.

This information serves as the written ASD prepared in accordance with 40 C.F.R. § 257.94(e)(2) that the SSIs observed during D5 were not due to the LF2. Therefore, an assessment monitoring program is not required, and the Newton Landfill 2 will remain in detection monitoring.

5. REFERENCES

Lineback, J., 1979, Quaternary Deposits of Illinois: Illinois State Geological Survey map, scale 1:500,000.

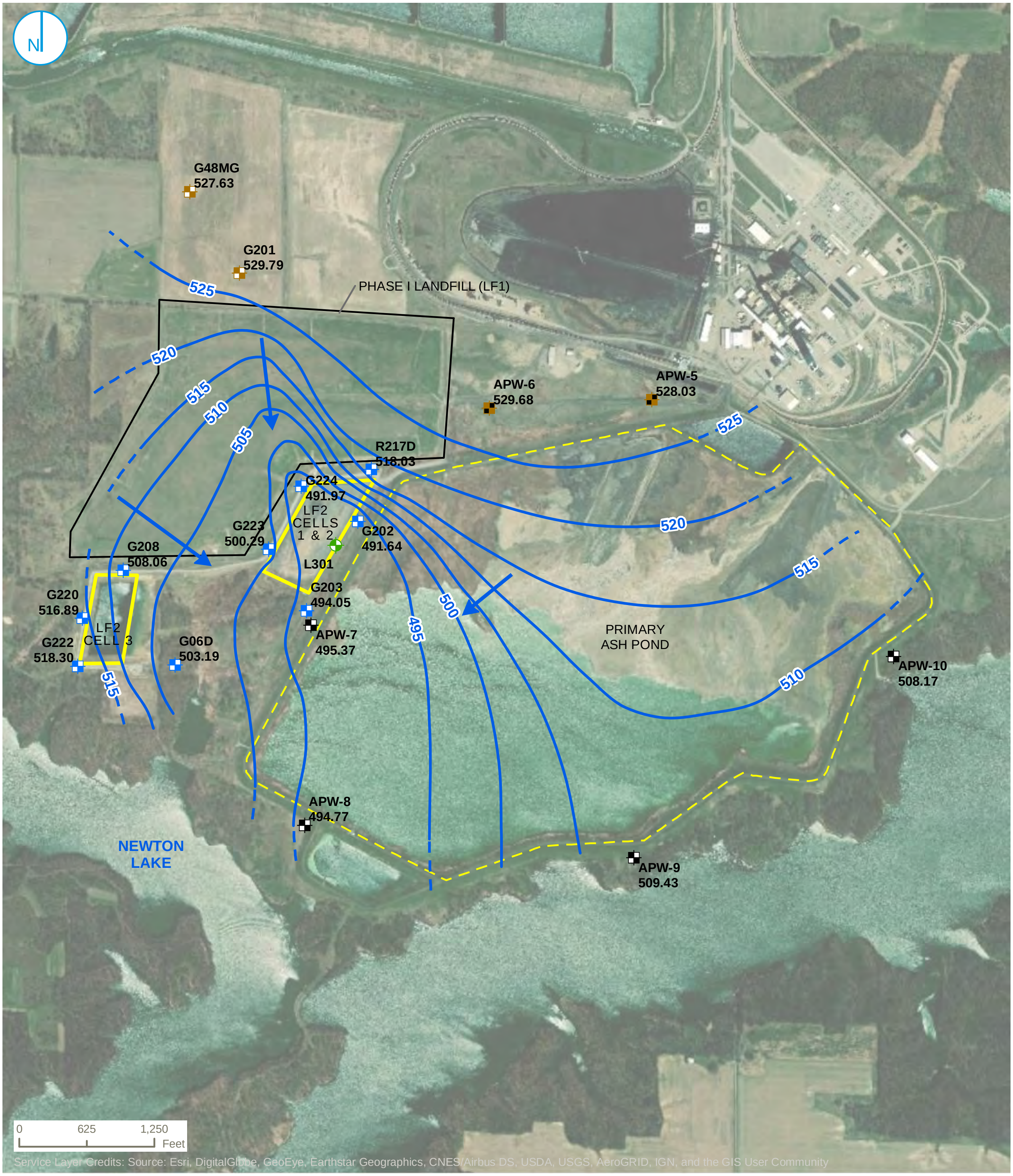
Natural Resource Technology, an OBG Company (NRT/OBG), 2017a, Statistical Analysis Plan, Coffeen Power Station, Newton Power Station, Illinois Power Generating Company, October 17, 2017.

Natural Resource Technology, an OBG Company (NRT/OBG), 2017b, Hydrogeologic Monitoring Plan, Newton Primary Ash Pond – CCR Unit ID 501, Newton Landfill 2 – CCR Unit ID 502, Newton Power Station, Canton, Illinois, Illinois Power Generating Company, October 17, 2017.

Willman, H.B., J.C. Frye, J.A. Simon, K.E. Clegg, D.H. Swann, E. Atherton, C. Collinson, J.A. Lineback, T.C. Buschbach, and H.B. Willman, 1967, Geologic Map of Illinois: Illinois State Geological Survey map, scale 1:500,000.

Willman, H.B., E. Atherton, T.C. Buschbach, C. Collinson, J.C. Frye, M.E. Hopkins, J.A. Lineback, and J.A. Simon, 1975, Handbook of Illinois Stratigraphy: Illinois State Geological Survey, Bulletin 95, 261 p.

FIGURES



Y:\Mapping\Projects\22\2285\MXD\Alt_Source_Dem\Newton\Figure 1_SampLoc and GWC Map LF2_D5.mxd

PROJECT: 169000XXXX | DATED: 4/3/2020 | DESIGNER: STOLZSD

- LF2 CCR MONITORING WELL
- LF2 BACKGROUND CCR MONITORING WELL
- PRIMARY ASH POND CCR MONITORING WELL
- PRIMARY ASH POND BACKGROUND CCR MONITORING WELL
- LF2 LEACHATE SAMPLE LOCATION
- GROUNDWATER ELEVATION CONTOUR (5-FOOT INTERVAL)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- LF2 CCR UNIT BOUNDARY
- PRIMARY ASH POND CCR UNIT BOUNDARY
- LF1 UNIT BOUNDARY

SAMPLING LOCATION AND GROUNDWATER ELEVATION CONTOUR MAP AUGUST 21, 2019

NEWTON PHASE II LANDFILL (LF2) (UNIT ID: 502)
ALTERNATE SOURCE DEMONSTRATION
VISTRA ENERGY
NEWTON POWER STATION
NEWTON, ILLINOIS

FIGURE 1

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

Intended for
Illinois Power Generating Company

Date
October 12, 2020

Project No.
1940074923

40 C.F.R. § 257.94(e)(2): ALTERNATE SOURCE DEMONSTRATION

NEWTON PHASE II LANDFILL (LF2)

Bright ideas. Sustainable change.

CERTIFICATIONS

I, Nicole M. Pagano, a professional geologist in good standing in the State of Illinois, certify that the information in this report is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

____

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Date: October 12, 2020

I, Anne Frances Ackerman, a qualified professional engineer in good standing in the State of Illinois, certify that the information in this report is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

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ACRONYMS AND ABBREVIATIONS

40 C.F.R.	Title 40 of the Code of Federal Regulations
ASD	Alternate Source Demonstration
CCR	Coal Combustion Residuals
cm/s	centimeters per second
f/k/a	formerly known as
IEPA	Illinois Environmental Protection Agency
IQR	interquartile range
LF2	Newton Phase II Landfill
LOE	line of evidence
mg/L	milligrams per liter
msl	mean sea level
NRT/OBG	Natural Resource Technology, an OBG Company
Site	Newton Power Station
SSI	Statistically Significant Increase
TDS	total dissolved solids
UPL	Upper Prediction Limit

1. INTRODUCTION

Title 40 of the Code of Federal Regulations (40 C.F.R.) § 257.94(e)(2) allows the owner or operator of a Coal Combustion Residuals (CCR) unit 90 days from the date of determination of a Statistically Significant Increase (SSI) over background for groundwater constituents listed in Appendix III of 40 C.F.R. Part 257 to complete a written demonstration that a source other than the CCR unit being monitored caused the SSI(s), or that the SSI(s) resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality (Alternate Source Demonstration [ASD]).

This ASD has been prepared on behalf of Illinois Power Generating Company, by Ramboll Americas Engineering Solutions, Inc., formerly known as (f/k/a) O'Brien & Gere Engineers, Inc., to provide pertinent information pursuant to 40 C.F.R. § 257.95(g)(3)(ii) for the Newton Phase II Landfill (LF2), located near Newton, IL.

A background total dissolved solids (TDS) concentration for one of the eight baseline sampling events from 2015-2017 was revised by the lab shortly after the initial report was released, but inadvertently omitted from the database until realized during a database QC in 2020. Including this data point caused a change in the distribution of the background TDS data from normal to non-normal, prompting a change in the way that the background Upper Prediction Limit (UPL) is calculated and resulting in a reduction of the UPL from 1,005 milligrams per liter (mg/L) to 860 mg/L.

Because the corrected TDS UPL is lower than the one used to determine SSIs through the D5 sampling event, there were unreported TDS SSIs during these events as follows:

- Well G222 during the D2 sampling event (Q2 2018)
- Well G222 during the D3 sampling event (Q4 2018)
- Wells G06D, G203, G222, and G223 during the D4 sampling event (Q1 2019)
- Well G223 during the D5 sampling event (Q3 2019)

These wells all had one or more SSIs for other parameters during these sampling events, and ASDs for those SSIs were completed [self-implementing program]. The lines of evidence (LOE) presented in these ASDs address the unreported TDS SSIs as well as the reported SSIs for other parameters. Therefore, the previous ASDs support the conclusion that the unreported TDS SSIs are not caused by LF2.

The most recent Detection Monitoring sampling event (Detection Monitoring Round 6 [D6]) was completed on February 4, 5, 6 and 19, 2020, and analytical data were received on April 15, 2020. Analytical data from D6 were evaluated in accordance with the Statistical Analysis Plan (Natural Resource Technology, an OBG Company [NRT/OBG], 2017) to determine any SSIs of Appendix III parameters over background concentrations. That evaluation identified SSIs at downgradient monitoring wells as follows:

- Boron at wells G208, G220, G222, G223, and R217D
- Calcium at well R217D
- Chloride at wells G06D, G202, G203, G208, G220, G222, G223, G224, and R217D
- Fluoride at well G220
- Sulfate at R217D

- TDS at wells G06D, G203, G220, G222, G223, G224, and R217D

In accordance with the Statistical Analysis Plan, wells G202, G203, G208, G220, G222, G223, G224, and R217D were resampled on May 20-21 (as part of the Illinois Environmental Protection Agency [IEPA] quarterly sampling event) and well G06D was resampled on June 11, 2020 and analyzed only for TDS (all wells), calcium (R217D), and sulfate (R217D) to confirm the SSIs. Following evaluation of analytical data from the resample event, the following SSIs remained:

- Boron at wells G208, G220, G222, G223, and R217D
- Calcium at well R217D
- Chloride at wells G06D, G202, G203, G208, G220, G222, G223, G224, and R217D
- Fluoride at well G220
- TDS at wells G06D, G222, G223, and R217D

Pursuant to 40 C.F.R. § 257.94(e)(2), the following LOEs demonstrate that sources other than LF2 were the cause of the boron, calcium, chloride, fluoride, and TDS SSIs listed above. This ASD was completed by October 12, 2020, within 90 days of determination of the SSIs (July 14, 2020), as required by 40 C.F.R. § 257.94(e)(2).

2. BACKGROUND

2.1 Site location and Description

The Newton Power Station (Site) is located in Jasper County in the southeastern part of central Illinois, approximately 7 miles southwest of the town of Newton. The plant is located on the north side of Newton Lake. The area is bounded by Newton Lake and agricultural land to the west, south, and east, and agricultural land to the north. Beyond the lake is additional agricultural land.

2.2 Description of Phase II Landfill CCR Unit

LF2 includes three lined disposal cells (Figure 1). LF2 Cells 1 and 2, encompassing approximately 12 acres, are adjacent to each other and located south and east of the Phase I Landfill (LF1). LF2 Cell 3 encompasses approximately 7 acres and is located approximately 1,100 feet west of Cells 1 and 2. All three cells of LF2 are constructed with composite liners and leachate collection systems that exceed the landfill liner performance standards of 40 CFR § 257.70. Cell 3 is inactive and has not received CCR since it was constructed in 2011.

2.3 Geology and Hydrogeology

The information used to describe the hydrogeology is based on the local geology obtained from published sources, hydrogeologic investigation data, and boring data collected during monitoring well installation.

Quaternary deposits in the Newton area consist mainly of diamictons and outwash deposits that were deposited during Illinoian and Pre-Illinoian glaciations (Lineback, 1979; Willman et al., 1975). The unconsolidated deposits occurring at Newton Power Station include the following units beginning at the ground surface:

- Upper Confining Unit – Low permeability clays and silts, including the Peoria Silt (Loess Unit) in upland areas and the Cahokia Formation in the flood plain and channel areas to the south and east, underlain by the Sangamon Soil, and the predominantly clay diamictons of the Hagarstown (Till) and Vandalia (Till) Members of the Glasford Formation.
- Uppermost Aquifer – Thin to moderately thick (3 to 17 feet), moderate to high permeability sand, silty sand, and sandy silt/clay units of the Mulberry Grove Member of the Glasford Formation.
- Lower Confining Unit – Thick, very low permeability silty clay diamictons of the Smithboro (Till) Member of the Glasford Formation and the silty clay diamictons of the Banner Formation.

The bedrock beneath the unconsolidated deposits consists of Pennsylvanian-age Mattoon Formation (Willman et al., 1967) that is mostly shale near the bedrock surface but is characterized at depth by a complex sequence of shales, thin limestones, coals, underclays, and several sandstones (Willman et al., 1975). The erosional surface of the Pennsylvanian-age Mattoon Formation bedrock ranges widely in depth in the vicinity of the Site but is typically encountered at 90 to 120 feet below ground surface (bgs).

Groundwater elevations across LF2 ranged from approximately 493 to 519 feet mean sea level (msl) during D6 (Figure 1). The groundwater elevation contours shown on Figure 1 were measured on February 3, 2020. Overall groundwater flow beneath LF2, within the Uppermost Aquifer, is southward toward Newton Lake, but with flow converging to the south-southeast along the major axis of LF2 Cells 1 and 2, and a predominantly eastward flow near LF2 Cell 3. Based on groundwater flow directions near LF2, groundwater beneath LF2 Cells 1 and 2 does not influence groundwater beneath LF2 Cell 3.

2.4 Groundwater and Landfill Monitoring

The Uppermost Aquifer monitoring system for LF2 Cells 1, 2, and 3 is shown on Figure 1.

Monitoring wells G201 and G48MG are used to monitor background groundwater quality for LF2 (all cells). Groundwater quality at LF2 Cells 1 and 2 is monitored using wells G202, G203, G223, G224, and R217D (which replaced well G217D in October 2017). Groundwater quality at LF2 Cell 3 is monitored using wells G06D, G208, G220, and G222. Leachate from LF2 is monitored using leachate sample location L301 (Figure 1).

3. ALTERNATE SOURCE DEMONSTRATION: LINES OF EVIDENCE

As allowed by 40 C.F.R. § 257.94(e)(2), this ASD demonstrates that sources other than LF2 caused the SSI(s), or that the SSI(s) was a result of natural variation in groundwater quality. This ASD is based on the following LOE:

1. LF2 composite liner design.
2. No CCR material has been placed in LF2 Cell 3.
3. The ionic composition of groundwater is different than the ionic composition of leachate.
4. The ionic composition of groundwater downgradient of LF2 Cells 1 and 2 is similar to the ionic composition of groundwater downgradient of LF2 Cell 3 (where no CCR material has been placed).
5. Groundwater quality in monitoring wells downgradient of LF2 Cells 1 and 2 is statistically similar to groundwater quality in monitoring wells downgradient of LF2 Cell 3 (where no CCR material has been placed).

These LOEs are described and supported in greater detail below.

3.1 LOE #1: LF2 Composite Liner Design

LF2 Cells 1 and 2 were constructed and began receiving CCR in 1997. Currently, a portion of LF2 Cell 2 is in operation. No CCR has been placed in LF2 Cell 3.

The constructed liner and leachate collection system for LF2 Cells 1, 2, and 3 include the following design components from top to bottom:

- Soil cover for liner frost protection
- 10-ounce-per-square-yard geotextile separation layer between the leachate management system and the frost protection soil cover
- 1-foot thick sand drainage layer
- 60-millimeter high-density polyethylene geomembrane
- Three-foot-thick compacted, low-permeability soil having a maximum hydraulic conductivity of 1.0×10^{-7} centimeters per second (cm/s)

These components exceed the landfill liner design criteria of 40 C.F.R. § 257. The landfill design criteria were intended to provide protection to the Uppermost Aquifer. Therefore, the presence of the composite liner suggests that LF2 is not contributing CCR constituents to the groundwater in the vicinity of LF2.

3.2 LOE #2: No CCR material has been placed in LF2 Cell 3

LF2 Cell 3 has never contained CCR; therefore, it cannot be the source of the CCR constituents boron, chloride, fluoride, or TDS detected in Cell 3 groundwater monitoring wells (G06D, G208, G220, and G222).

3.3 LOE #3: The ionic composition of groundwater is different than the ionic composition of leachate

Piper diagrams graphically represent ionic composition of aqueous solutions. A Piper diagram displays the position of water samples with respect to their major cation and anion content on the two lower triangular portions of the diagram, providing the information which, when combined on the central, diamond-shaped portion of the diagram, identify composition categories or groupings (hydrochemical facies). Figure A, below, is a Piper diagram that displays the ionic composition of samples collected from the background and downgradient monitoring wells associated with LF2, and leachate sampling location L301 associated with LF2, in the D6 sampling event.

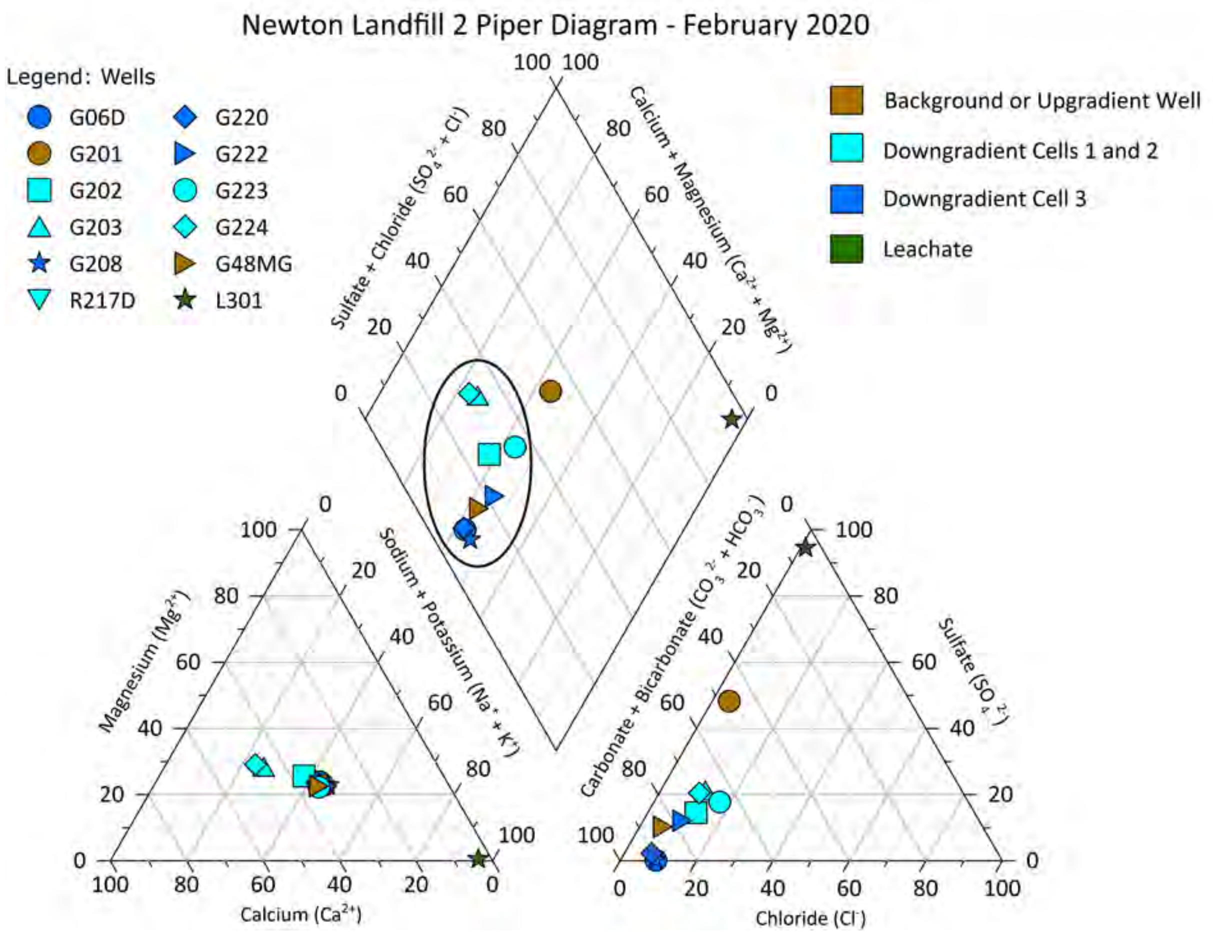

Figure A. Piper Diagram. Shows Ionic Composition of Samples of Groundwater and Leachate Associated with LF2 During D6 Sampling Event.

It is evident from the Piper diagram (Figure A) that leachate from LF2 (L301; green symbol) is in the sodium-chloride hydrochemical facies, while the LF2 groundwater samples (blue and cyan symbols) are predominantly in the calcium-bicarbonate hydrochemical facies (black grouping). Therefore, downgradient groundwater samples associated with LF2 have a different ionic composition than leachate, indicating that leachate is not the source of CCR constituents detected in the LF2 groundwater monitoring wells.

3.4 LOE #4: The Ionic Composition of Groundwater Downgradient of LF2 Cells 1 and 2 Is Similar to the Ionic Composition of Groundwater Downgradient of LF2 Cell 3 (Where No CCR Material Has Been Placed)

As illustrated in the Piper diagram (Figure A), the ionic composition of all LF2 Cell 1, 2, and 3 groundwater samples (blue and cyan symbols) are similar and primarily cluster into a single distinct hydrochemical facies (calcium-bicarbonate; black grouping). Furthermore, the groundwater flow direction indicates that Cell 3 wells are not influenced by Cells 1 and 2 (Figure 1). The similarity in ionic composition of groundwater downgradient of LF2 Cell 3 and LF2 Cells 1 and 2, coupled with the facts that Cell 3 has never contained CCR and groundwater beneath Cell 3 is not influenced by Cells 1 and 2, indicate that LF2 Cells 1 and 2 are not the source of CCR constituents detected in the LF2 groundwater monitoring wells.

3.5 LOE #5: Groundwater Quality in Monitoring Wells Downgradient of LF2 Cells 1 and 2 Is Statistically Similar to Groundwater Quality in Monitoring Wells Downgradient of LF2 Cell 3 (Where No CCR Material Has Been Placed)

Box plots graphically represent the range of values of a given dataset using lines to construct a box where the lower line, midline and upper line of the box represent the values of the first quartile, median, and third quartile values, respectively. The minimum and maximum values of the dataset (excluding outliers) are illustrated by whisker lines extending beyond the first and third quartiles of (*i.e.*, below and above) the box. The interquartile range (IQR) is the distance between the first and third quartiles. Outliers (values that are at least 1.5 times the IQR away from the edges of the box) are represented by single points plotted outside of the range of the whiskers. Boron, chloride, and TDS SSIs were identified at all LF2 cells (LF2 Cells 1, 2, and 3) during the D6 sampling event, whereas other SSIs were only identified at either LF2 Cells 1 and 2, or LF2 Cell 3. As noted above, groundwater flow direction indicates that Cell 3 wells are not influenced by Cells 1 and 2, and Cell 3 has never contained CCR.

3.5.1 Boron

Box plots of the boron concentrations observed in LF2 Cells 1 and 2 downgradient monitoring wells (cyan), and LF2 Cell 3 downgradient monitoring wells (blue) are shown in Figure B.

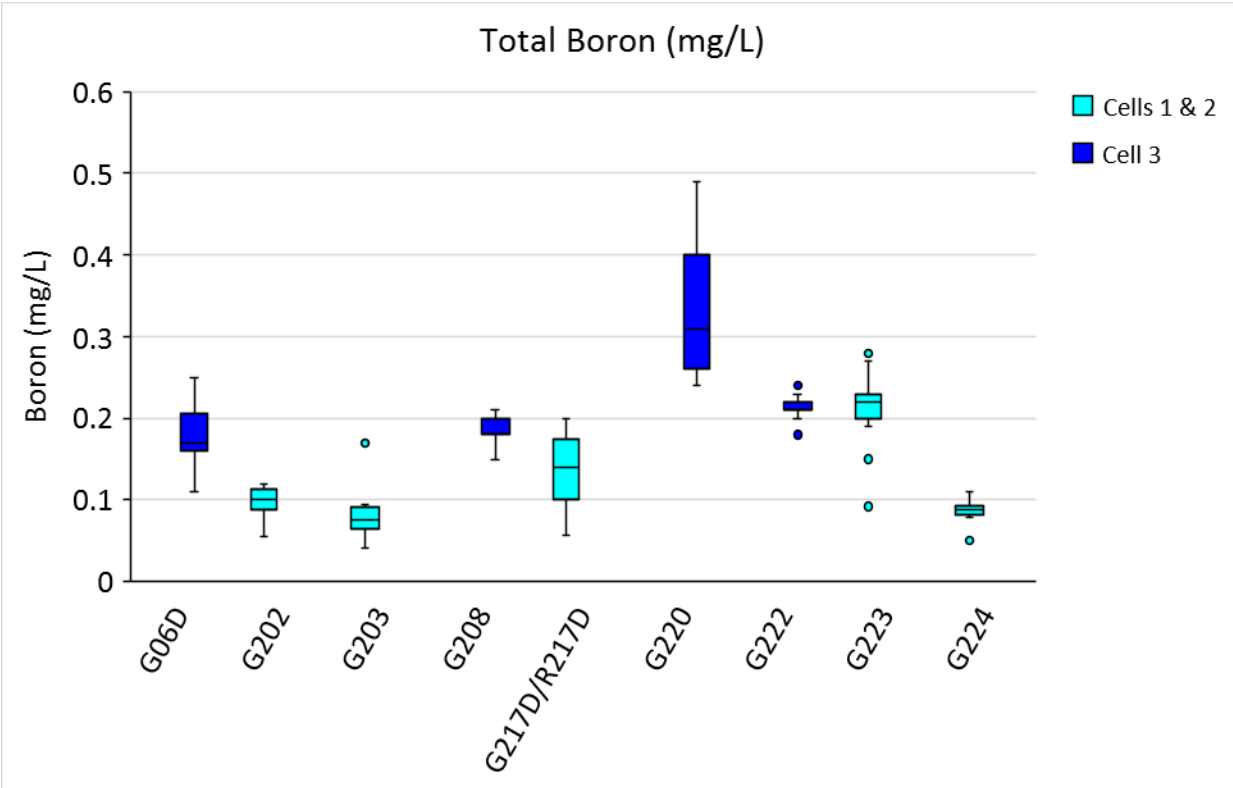

Figure B. Boron Box Plot. Includes LF2 Cells 1 and 2 Downgradient Monitoring Wells (cyan) and LF2 Cell 3 Downgradient Monitoring Wells (blue).

The minimum and maximum boron concentrations in wells downgradient of LF2 Cell 3 ranged from 0.11 to 0.49 mg/L. The minimum and maximum boron concentrations in wells downgradient of LF2 Cells 1 and 2 ranged from 0.041 to 0.28 mg/L. Boron concentrations downgradient of LF2 Cells 1 and 2 were within or below the range of concentrations observed at wells downgradient of LF2 Cell 3.

3.5.2 Chloride

Box plots of the chloride concentrations observed in LF2 Cells 1 and 2 downgradient monitoring wells (cyan), and LF2 Cell 3 downgradient monitoring wells (blue) are shown in Figure C below.

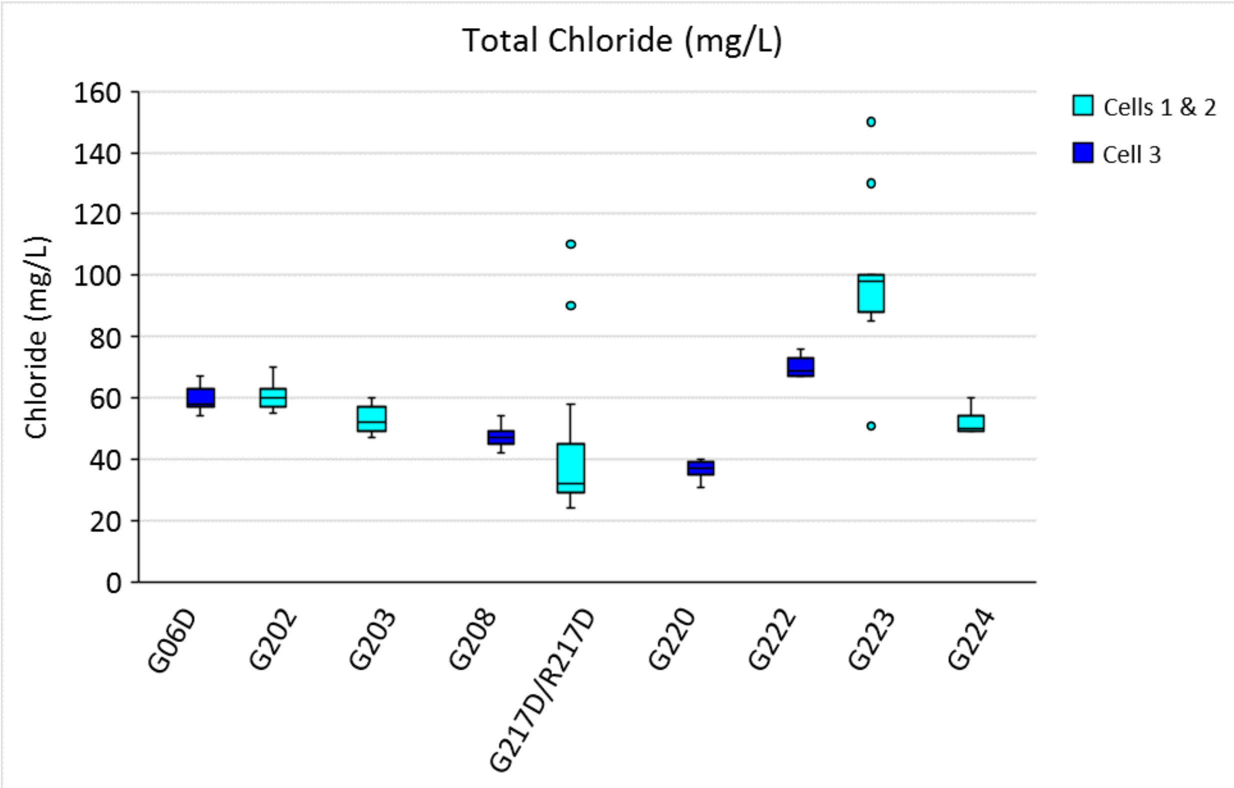

Figure C. Chloride Box Plot. Includes LF2 Cells 1 and 2 Downgradient Monitoring Wells (cyan) and LF2 Cell 3 Downgradient Monitoring Wells (blue).

The minimum and maximum chloride concentrations in wells downgradient of LF2 Cell 3 range from 31 mg/L to 76 mg/L. The minimum and maximum chloride concentrations in wells downgradient of LF2 Cells 1 and 2 range from 24 mg/L to 150 mg/L.

Chloride concentrations downgradient of LF2 Cells 1 and 2 are generally within or below the range of concentrations observed at wells downgradient of LF2 Cell 3. The exceptions are monitoring well G223 and potential statistical outlier concentrations only at G217D/R217D (illustrated with filled symbols outside of the whiskers in Figure C).

3.5.3 Total Dissolved Solids

Box plots of the TDS concentrations observed in LF2 Cells 1 and 2 downgradient monitoring wells (cyan), and LF2 Cell 3 downgradient monitoring wells (blue) are shown in Figure D below.

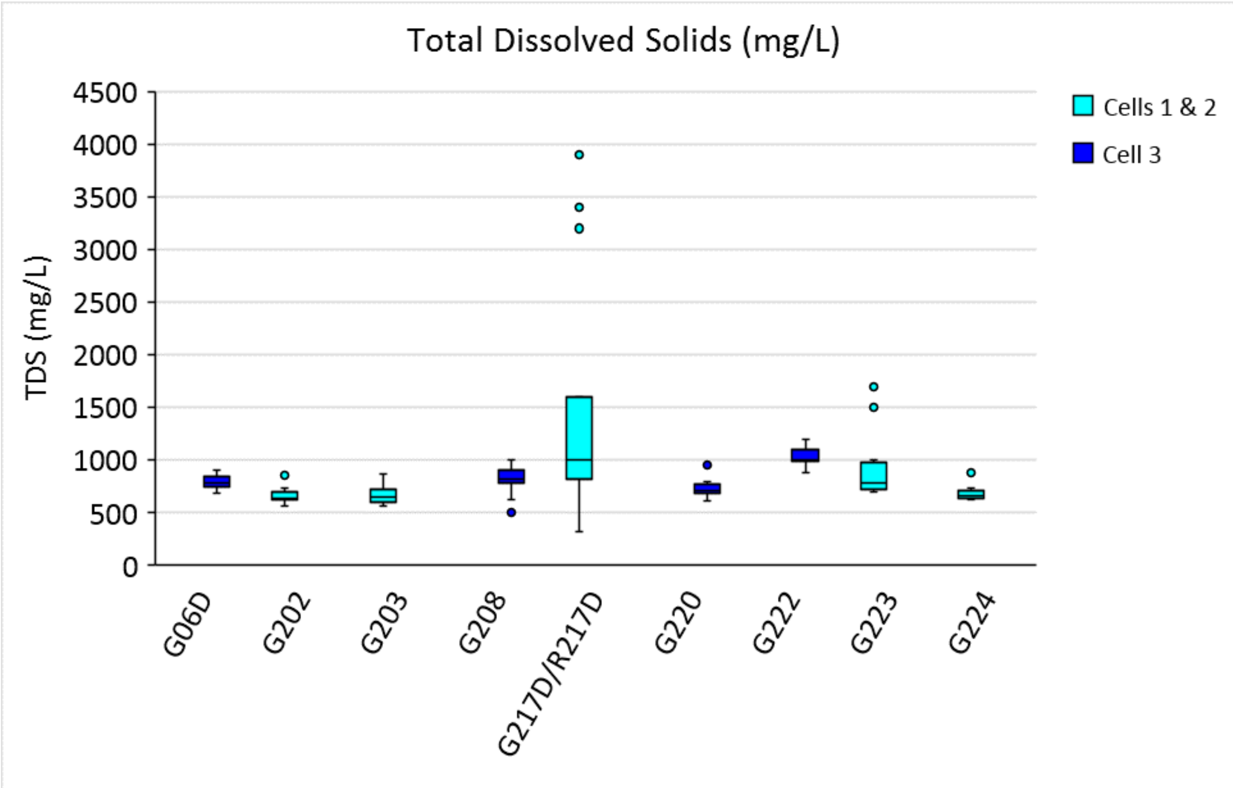

Figure D. Total Dissolved Solids Box Plot. Includes LF2 Cells 1 and 2 Downgradient Monitoring Wells (cyan) and LF2 Cell 3 Downgradient Monitoring Wells (blue).

The minimum and maximum TDS concentrations in wells downgradient of LF2 Cell 3 range from 500 to 1200 mg/L. The minimum and maximum TDS concentrations in wells downgradient of LF2 Cells 1 and 2 range from 320 mg/L to 3900 mg/L.

TDS concentrations downgradient of LF2 Cells 1 and 2 are generally within or below the range of concentrations observed at wells downgradient of LF2 Cell 3. The exceptions (*i.e.*, have concentrations greater than 1200 mg/L) are three data points at monitoring well G217D/R217D (two of which are potential statistical outliers, illustrated with filled symbols outside of the whiskers in Figure D) and one at monitoring well G223 (which is also a potential statistical outlier).

The similarity of groundwater quality downgradient of LF2 Cell 3 and groundwater quality downgradient of LF2 Cells 1 and 2, as represented by the ranges of boron, chloride, and TDS concentrations (Figures B, C, and D respectively), coupled with the fact that no CCR material has been placed in LF2 Cell 3, suggests that LF2 Cells 1 and 2 are not the source of CCR constituents detected in the LF2 groundwater monitoring wells.

4. CONCLUSIONS

Based on the five LOE below, it has been demonstrated that the boron SSIs at G208, G220, G222, G223, and R217D; the calcium SSI at R217D; the chloride SSIs at G06D, G202, G203, G208, G220, G222, G223, G224, and R217D; the fluoride SSI at G220; and the TDS SSIs at G06D, G222, G223 and R217D are not due to LF2 but are from a source other than the CCR unit being monitored:

1. LF2 composite liner design.
2. No CCR material has been placed in LF2 Cell 3.
3. The ionic composition of groundwater is different than the ionic composition of leachate.
4. The ionic composition of groundwater downgradient of LF2 Cells 1 and 2 is similar to the ionic composition of groundwater downgradient of LF2 Cell 3 (where no CCR material has been placed).
5. Groundwater quality in monitoring wells downgradient of LF2 Cells 1 and 2 is statistically similar to groundwater quality in monitoring wells downgradient of LF2 Cell 3 (where no CCR material has been placed).

This information serves as the written ASD prepared in accordance with 40 C.F.R. § 257.94(e)(2) that the SSIs observed during D6 were not due to the LF2. Therefore, an assessment monitoring program is not required, and the Newton Landfill 2 will remain in detection monitoring.

5. REFERENCES

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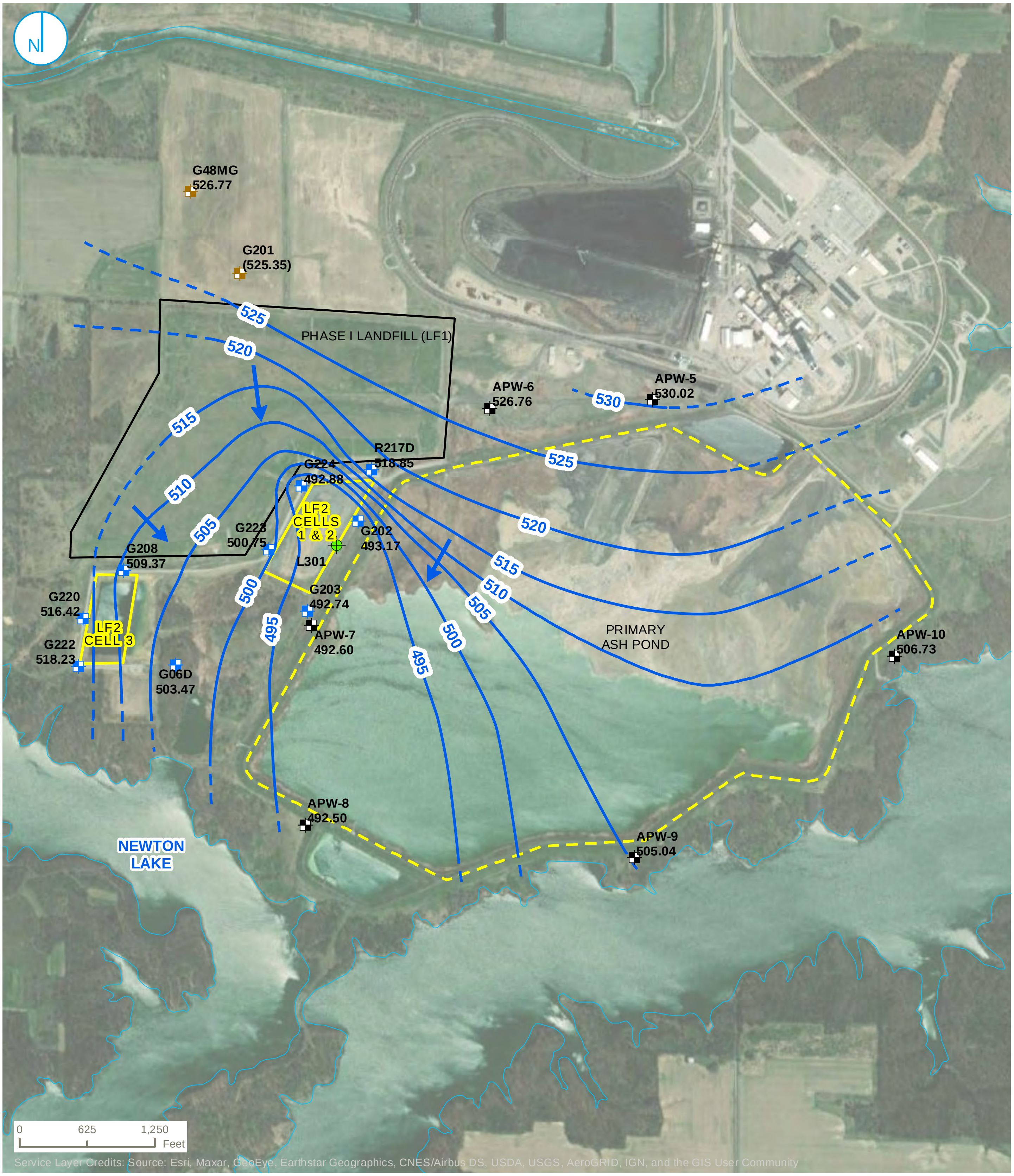
FIGURES



Y:\Mapping\Projects\22\2285\MXD\Alt_Source_Dem\Newton\Figure 1_SampLoc and GWC Map LF2_D6.mxd

PROJECT: 169000XXXX | DATED: 7/6/2020 | DESIGNER: galarnmc

LF2 DOWNGRADIENT MONITORING WELL
LF2 UPGRADIENT MONITORING WELL
PRIMARY ASH POND CCR RULE MONITORING
LF2 LEACHATE SAMPLE LOCATION
GROUNDWATER ELEVATION CONTOUR (5-FT CONTOUR INTERVAL, NAVD 88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
SURFACE WATER FEATURE
LF2 CCR UNIT BOUNDARY
PRIMARY ASH POND CCR UNIT BOUNDARY
LF1 UNIT BOUNDARY

SAMPLING LOCATION AND GROUNDWATER ELEVATION CONTOUR MAP
FEBRUARY 3, 2020

NEWTON PHASE II LANDFILL (LF2) (UNIT ID: 502)
ALTERNATE SOURCE DEMONSTRATION
VISTRA ENERGY
NEWTON POWER STATION
NEWTON, ILLINOIS

FIGURE 1

RAMBOLL US CORPORATION
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ATTACHMENT 6 – SITE HYDROGEOLOGY AND STRATIGRAPHIC CROSS-SECTIONS OF THE SITE

CONCEPTUAL SITE MODEL AND DESCRIPTION OF SITE HYDROGEOLOGY (PRIMARY ASH POND)

The Newton Power Station (Power Station) conceptual site model (CSM) and Description of Site Hydrogeology for the Primary Ash Pond (PAP) located near Newton, Illinois is described in the following sections.

REGIONAL SETTING

The PAP is located in Jasper County in the southeastern part of central Illinois, approximately 7 miles southwest of the town of Newton. The PAP lies at the southeastern portion of the Springfield Plain of the Till Plains section, the largest physiographic division in Illinois, covering approximately four-fifths of the state. It is characterized by its flatness and shallowly entrenched drainage. The unlithified geologic deposits in the region range from 100 to 120 feet (ft) thick and are derived from recent river deposition (alluvium), glacial outwash, and glacial till deposits. The unlithified deposits directly overly Pennsylvanian Mattoon Formation bedrock.

The Mattoon Formation is the youngest formation in the Pennsylvanian System in Illinois. It is underlain by the Bond Formation, while the top is mostly an erosional surface overlain by Pleistocene glacial deposits. The Mattoon Formation has a maximum thickness of more than 600 feet in the central part of the Illinois Basin in Jasper County. It is characterized by a complex sequence of thin limestones, coals, black fissile shales, underclays, thick gray shales, and several well-developed sandstones. Quaternary deposits in the Newton area consist mainly of diamictons and outwash deposits that were deposited during Illinoian and Pre-Illinoian glaciations (Lineback, 1979; Willman et al., 1975). Borings advanced at the Power Station indicate that the elevation of the top of the bedrock surface at the PAP is approximately 400 to 450 ft above mean sea level (msl). The depth to bedrock varies widely in the area owing to the undulatory nature of the eroded upper bedrock surface and ranges from approximately 90 to 120 ft. Logs indicate that the lithology of the uppermost bedrock is mostly shale.

SITE GEOLOGY

The unconsolidated deposits occurring at the PAP include the following units (beginning at the ground surface):

- Upper Confining Unit – Low permeability clays and silts, including the Peoria Silt (Loess Unit) in upland areas and the Cahokia Formation in the flood plain and channel areas to the south and east, underlain by the Sangamon Soil, and the predominantly clay diamictons of the Hagarstown (Till) and Vandalia (Till) Members of the Glasford Formation.
- Uppermost Aquifer – Thin to moderately thick (3 to 17 ft), moderate to high permeability sand, silty sand, and sandy silt/clay units of the Mulberry Grove Member of the Glasford Formation.
- Lower Confining Unit – Thick, very low permeability silty clay diamictons of the Smithboro (Till) Member of the Glasford Formation and the silty clay diamictons of the Banner Formation.
- Bedrock – Pennsylvanian-age Mattoon Formation that is mostly shale near the bedrock surface, but is characterized at depth by a complex sequence of shales, thin limestones, coals, underclays, and several sandstones. The erosional surface of the Pennsylvanian-age Mattoon Formation bedrock ranges widely in depth in the vicinity of the PAP, but is typically encountered at 90 to 120 ft below ground surface (bgs).

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Two cross-sections showing the subsurface materials encountered at the PAP is included as an attachment to this demonstration.

SITE HYDROGEOLOGY

The CCR groundwater monitoring system consists of six monitoring wells installed in the uppermost aquifer and adjacent to the PAP (APW5, APW6, APW7, APW8, APW9 and APW10) (see Monitoring Well Location Map, and Well Construction Diagrams and Drilling Logs attached to this demonstration). The unit utilizes two background monitoring wells (APW5 and APW6) as part of the CCR groundwater monitoring system.

Hydraulic Conductivity

Hydraulic conductivity/slug tests were completed in wells screened in the unlithified material during prior site investigations and by NRT in April 2017. The hydraulic conductivity values determined from 15 individual monitoring wells within the uppermost aquifer ranged from 3.9×10^{-8} to 3.6×10^{-2} centimeters per second (cm/s). The geometric mean of the hydraulic conductivity for NRT tested monitoring wells in the Uppermost Aquifer, excluding one outlier, is 2.5×10^{-4} cm/s.

The uppermost unit intercepted in the area of the PAP is the silty to sandy clay of the “Upper Drift”, or aquitard, as identified in the Rapps’ 1997 landfill investigation and consists of Peoria Silt, Sangamon Soil, and/or Hagarstown Member. The hydraulic conductivity of this unit, as tested at monitoring wells near the landfill with screen depths between 8 and 36 ft bgs (Rapps, 1997), ranged from 2.4×10^{-6} to 6.1×10^{-5} cm/s with a geometric mean of 1.7×10^{-5} cm/s. Three in-situ tests conducted by NRT of the uppermost materials near the Primary Ash Pond, on wells screened between 7 and 20 ft bgs, had a geometric mean hydraulic conductivity of 1.3×10^{-5} cm/s.

Groundwater Elevations, Flow Direction and Velocity

Groundwater elevations across the PAP ranged from 491 to 530 ft msl from December 2015 to June 2020. Groundwater flow in the Uppermost Aquifer beneath the eastern portion of PAP is generally to the south toward Newton Lake. The flow direction diverges to the southwest beneath the western portion of the PAP, consistent with groundwater flow in the area converging between the PAP and the Phase 2 Landfill to the west (see Groundwater Contour Maps attached to this demonstration). Calculated groundwater flow velocity based on the January and June 2017 groundwater contours was 0.12 ft/day.

REFERENCES

Lineback, J., 1979, Quaternary Deposits of Illinois: Illinois State Geological Survey map, scale 1:500,000.

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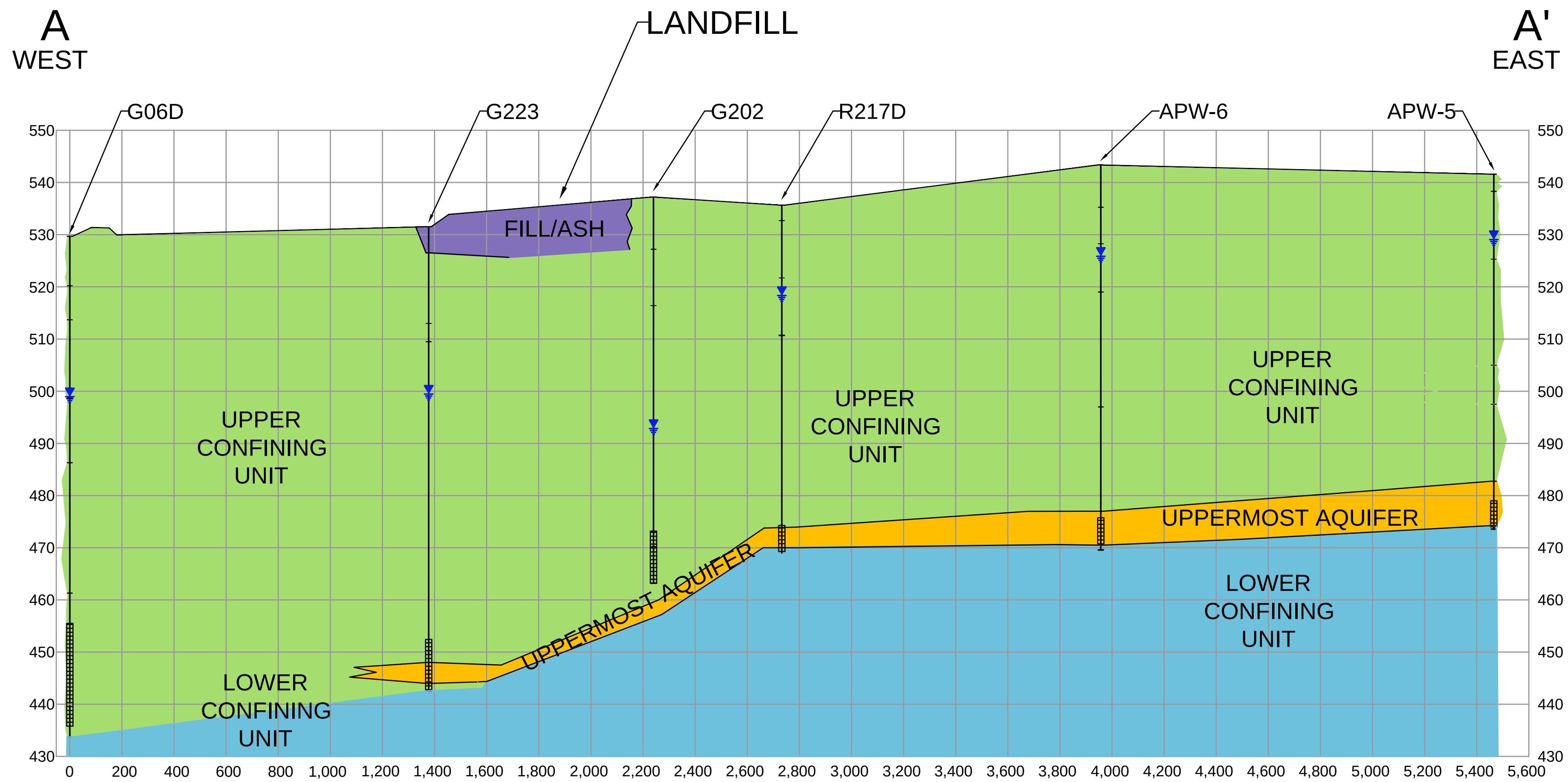
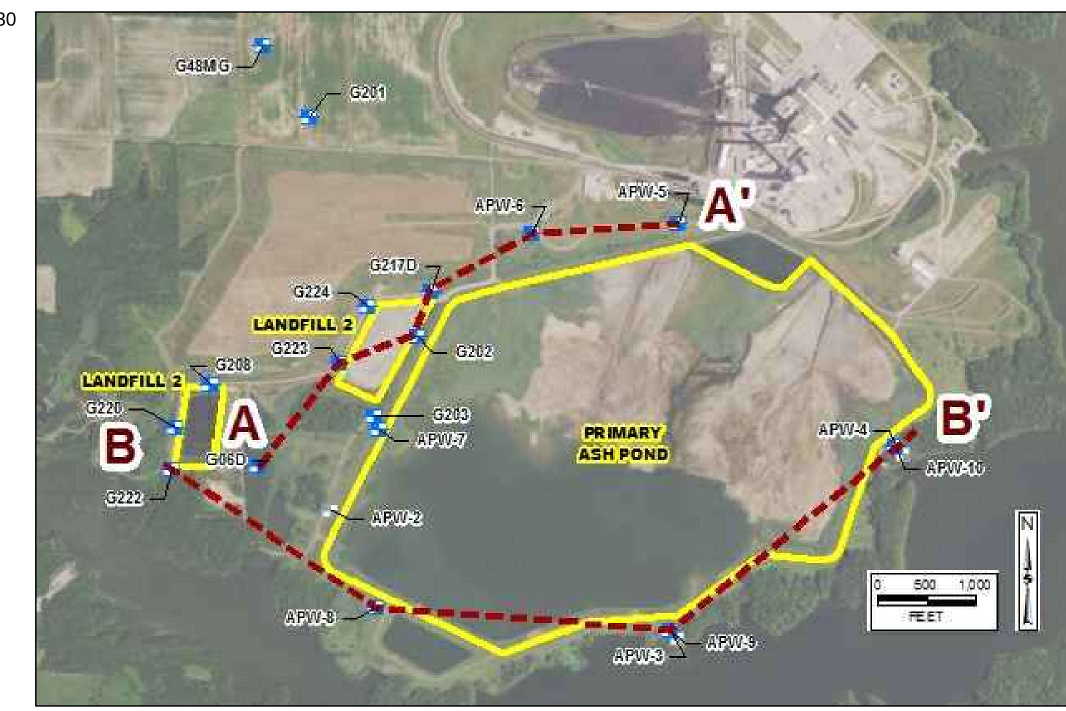




LEGEND

- FILL / ASH
- UPPER CONFINING UNIT
- UPPERMOST AQUIFER
- LOWER CONFINING UNIT
- WELL SCREEN
- GROUNDWATER ELEVATION

VERTICAL SCALE IN FEET 30

HORIZONTAL SCALE IN FEET 600

VERTICAL EXAGGERATION =20

GEOLOGIC CROSS SECTION A-A'

NEWTON PRIMARY ASH POND (UNIT ID: 501)

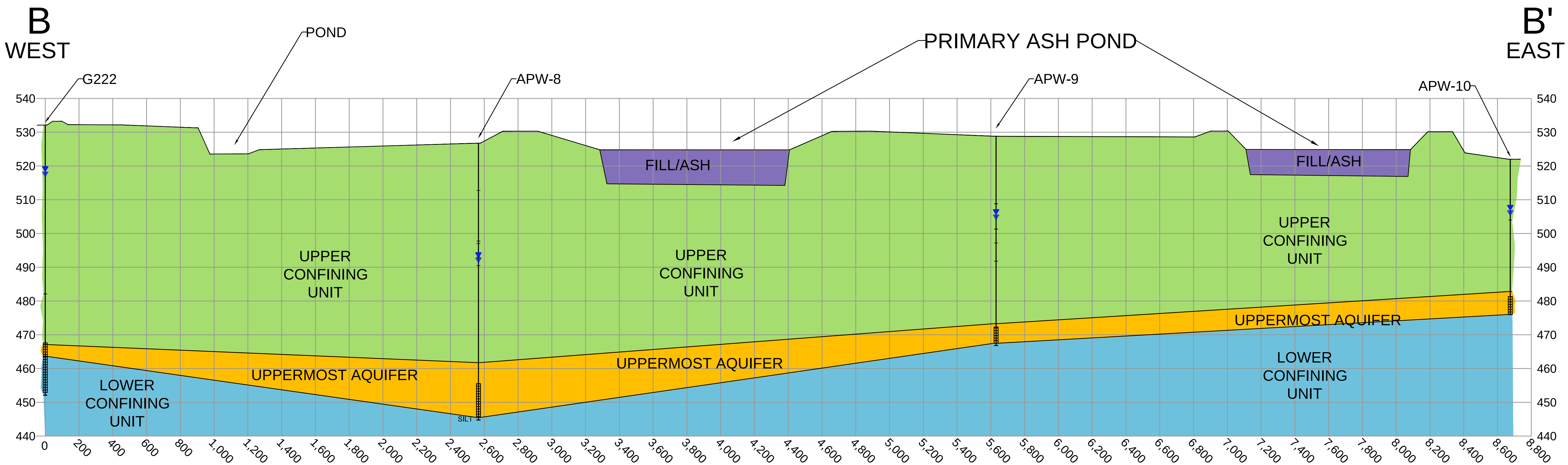
40 C.F.R § 257.94(e)(2): ALTERNATE SOURCE DEMONSTRATION

NEWTON POWER STATION

NEWTON, ILLINOIS

FIGURE X

RAMBOLL US CORPORATION
A RAMBOLL COMPANY



LEGEND

- FILL / ASH
- UPPER CONFINING UNIT
- UPPERMOST AQUIFER
- LOWER CONFINING UNIT
- WELL SCREEN
- GROUNDWATER ELEVATION

VERTICAL SCALE IN FEET: 30

HORIZONTAL SCALE IN FEET: 600

VERTICAL EXAGGERATION =20

GEOLOGIC CROSS SECTION B-B'

NEWTON PRIMARY ASH POND (UNIT ID: 501)
40 C.F.R § 257.94(e)(2): ALTERNATE SOURCE DEMONSTRATION
NEWTON POWER STATION
NEWTON, ILLINOIS

FIGURE X

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

RAMBOLL

OBG

Hydrogeologic Monitoring Plan

Newton Primary Ash Pond – CCR Unit ID 501
Newton Landfill 2 – CCR Unit ID 502

Newton Power Station
Canton, Illinois

Illinois Power Generating Company

October 17, 2017

Natural Resource Technology
AN OBG COMPANY

OCTOBER 17, 2017 | PROJECT #2285

Hydrogeologic Monitoring Plan

Newton Primary Ash Pond – CCR Unit ID 501
Newton Landfill 2 – CCR Unit ID 502

Newton Power Station
Canton, Illinois

Prepared for:
Illinois Power Generating Company

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ACRONYMS AND ABBREVIATIONS

bgs	below ground surface
CCR	coal combustion residual
CFR	Code of Federal Regulations
cm/s	centimeters per second
CPT	Cone Penetrometer Test
ft	feet
ft/ft	feet per feet
ft MSL	feet above Mean Sea Level
HMP	Hydrogeologic Monitoring Plan
ID	Identification number
IEPA	Illinois Environmental Protection Agency
IPGC	Illinois Power Generating Company
ISGS	Illinois State Geological Survey
NPS	Newton Power Station
NRT	Natural Resource Technology, an OBG Company
PWS	Public Water Supply
RCRA	Resource Conservation and Recovery Act
SAP	Sampling and Analysis Plan
USEPA	United States Environmental Protection Agency

1 INTRODUCTION

1.1 OVERVIEW

This Hydrogeologic Monitoring Plan (HMP) has been prepared by Natural Resource Technology, an OBG Company (NRT) to provide background information necessary to support the monitoring well network established for development of the Sampling and Analysis Plan (SAP) requirements of the United States Environmental Protection Agency (USEPA) Final Rule to regulate the disposal of Coal Combustion Residual (CCR) as solid waste under Subtitle D of the Resource Conservation and Recovery Act (RCRA) [40 CFR 257 Subpart D; published in 80 FR 21302-21501, April 17, 2015] for the Newton Power Station, Jasper County, Illinois. The Newton Power Station is owned by Illinois Power Generating Company (IPGC). This HMP will apply specifically to the following CCR Units: Newton Primary Ash Pond (CCR Unit ID 501) and Newton Landfill 2 (CCR Unit ID 502), as defined further below.

1.2 PREVIOUS INVESTIGATIONS AND REPORTS

Numerous hydrogeologic investigations have been performed concerning the CCR Units located at the Newton Power Station. The information presented in this HMP includes data collected in support of the monitoring well network established for development of the Sampling and Analysis Plan (SAP) and supplements comprehensive data collection and evaluations from prior hydrogeologic investigation reports (most recent to oldest), including, but not limited to, the following:

- ***Rapps Engineering and Applied Science, April 10 2013, Phase I Hydrogeological Assessment Report, Coal Combustion Product Impoundment, Ameren Energy Generating Company, Newton Energy Center, Jasper County, Illinois.*** A hydrogeologic study to assess the potential for constituent migration from this impoundment. Report includes: water well survey, development of a groundwater monitoring plan, and an initial groundwater quality assessment. This report summarizes hydrogeologic information pertinent to the site, evaluates groundwater quality data to determine if operation of the impoundment has adversely affected groundwater, and makes recommendations for future actions related to groundwater quality management.
- ***Geotechnology, Inc., February 8, 2011, Initiation of Monitoring Report, Ameren, Newton Power Station, Newton, Illinois.*** This report documents the results of the monitoring well installation and groundwater monitoring activities performed at the site. Three wells were installed, developed and sampled.
- ***Rapps Engineering and Applied Science, November 2009, Site Characterization and Groundwater Monitoring Plan for CCP Impoundment, Ameren Energy Generating Company, Newton Power Station, Jasper County, Illinois.*** Hydrogeologic study and groundwater monitoring plan to assess the potential for constituent migration from this impoundment. Includes an assessment of subsurface hydrogeologic conditions at the site, identification of private, potable water wells and oil and gas wells within 2,500 feet of the facility, public water supply (PWS) wells within 10 miles of the facility, and plans for a groundwater monitoring well network designed to characterize and monitor groundwater quality.
- ***Rapps Engineering and Applied Science, 1997, Hydrogeologic Investigation and Groundwater Monitoring Program, Newton Power Station, Jasper County, Illinois.*** Investigation presents site-specific data obtained through the completion of approximately 40 borings, 20 monitoring wells, and review of regional information and an evaluation of subsurface data from nearby residential wells. Part of Application for Landfill Permit – Rapps 1997.

The HMP supports the monitoring well network established for development of the SAP and provides the following background information:

- Site Geology and Hydrogeology
- Aquifer Properties
- Monitoring Network Placement and Rationale

1.3 SITE LOCATION AND DESCRIPTION

The Newton Power Station (NPS) is located in Jasper County in the southeastern part of central Illinois, approximately 7 miles southwest of the town of Newton (Figure 1). The plant is located on the north side of Newton Lake and has one active CCR impoundment (Newton Primary Ash Pond) located in Section 26 and the western half of Section 25, Township 6 North, Range 8 East. The site also contains the Newton Landfill 2, located in the western half of Section 26 and eastern half of Section 27, Township 6 North, Range 8 East. The area is also bounded by agricultural land and Newton Lake to the west, south, and east. Beyond the lake is additional agricultural land.

1.4 DESCRIPTION OF CCR MANAGEMENT UNITS

The CCR Units at the Newton Power Station, including the Newton Primary Ash Pond (CCR Unit ID 501) and the Newton Landfill 2 (CCR Unit ID 502), will hereafter be referred to as the 'Site'.

1.4.1 Newton Primary Ash Pond (CCR Unit ID 501)

The NPS's sole CCR impoundment, consisting of a Primary Ash Pond, was constructed in 1977 and has a design capacity of approximately 9,715 acre-feet for the primary pond. There is also a non-CCR 83.6 acre-feet Secondary Pond. The Primary Ash Pond has a surface area of 400 acres and a height of approximately 71 feet above grade. The Secondary Pond has an area of 9.3 acres and a height of approximately 29 feet above grade. The Primary Ash Pond currently receives bottom ash, fly ash, and low-volume wastewater (LVW) from the plant's two coal-fired boilers. The CCR impoundment is operated per NPDES Permit IL0049191, Outfall 001. The impoundment was not excavated during construction except for native materials used to build the containment berms.

1.4.2 Newton Landfill 2 (CCR Unit ID 502)

Newton Landfill 2 includes two cells, Phase I (west) cell and Phase II (east) cell. The Phase I cell, built around 1977, was unlined, and accepted sodium-based flue gas desulfurization (FGD) wastes. Phase I was closed in 1999 with a 40-millimeter thick geomembrane cap and currently has a Groundwater Management Zone (GMZ) established. Following a switch by the NPS to western coal in 1997, the Phase II cell began receiving coal ash that same year; a portion of the Phase II cell is still operational. The Phase II cell has a geomembrane liner with a leachate collection system.

2 GEOLOGY AND HYDROGEOLOGY

The results of the site characterization activities performed at the Site are discussed below.

2.1 GEOLOGY

Geologic units present at the Site include fill, ash generated at the site, unlithified alluvial sediments, unlithified glacial deposits, and Pennsylvanian-age bedrock.

2.1.1 Regional Setting

Illinois is situated in the south-central part of the great Central Lowland Province near the confluence of two major lines of drainage, the Mississippi and Ohio Rivers (Leighton et al., 1948). The NPS lies at the southeastern portion of the Springfield Plain of the Till Plains section, the largest physiographic division in Illinois, covering approximately four-fifths of the state. It is characterized by its flatness and shallowly entrenched drainage. Drainage systems are well developed, and the district is in a late youthful stage of dissection.

The unlithified geologic deposits in the region range from 100 to 120 feet (ft) thick and are derived from recent river deposition (alluvium), glacial outwash, and glacial till deposits. The unlithified deposits directly overly Pennsylvanian Mattoon Formation bedrock. The Mattoon Formation is the youngest formation in the Pennsylvanian System in Illinois. It is underlain by the Bond Formation, while the top is mostly an erosional surface overlain by Pleistocene glacial deposits. The Mattoon Formation has a maximum thickness of more than 600 feet in the central part of the Illinois Basin in Jasper County. It is characterized by a complex sequence of thin limestones, coals, black fissile shales, underclays, thick gray shales, and several well developed sandstones. The lateral extent of many of the named units has not been determined due to widely scattered outcrops and scarce subsurface data. However, coals and limestone units are considered to be as persistent as those in the underlying Bond Formation.

Borings advanced at the NPS as part of a hydrogeologic site investigation for a CCP landfill indicate that the elevation of the top of the bedrock surface at the site is approximately 400 to 450 ft MSL. The depth to bedrock varies widely in the area owing to the undulatory nature of the eroded upper bedrock surface and ranges from approximately 90 to 120 ft. Logs indicate that the lithology of the uppermost bedrock is mostly shale.

2.1.2 Site Geology

The geology has been evaluated during previous hydrogeologic investigations and groundwater quality assessments since the first borings and monitoring wells were installed. Quaternary deposits in the Newton area consist mainly of diamictons and outwash deposits that were deposited during Illinoian and Pre-Illinoian glaciations. The unconsolidated deposits which occur at Newton Power Station include the following units (beginning at the ground surface):

- Ash/Fill Units – CCR and fill within the various CCR Units
- Upper Confining Unit – Low permeability clays and silts, including the Peoria Silt (Loess Unit) in upland areas and the Cahokia Formation in the flood plain and channel areas to the south and east, underlain by the Sangamon Soil, and the predominantly clay diamictons of the Hagarstown (Till) Member of the Pearl Formation and the Vandalia (Till) Member of the Glasford Formation
- Uppermost Aquifer (Groundwater Monitoring Zone) – Thin to moderately thick (3 to 17 ft), moderate to high permeability sand, silty sand, and sandy silt/clay units of the Mulberry Grove Member of the Glasford Formation
- Lower Confining Unit – Thick, very low permeability silty clay diamicton of the Smithboro (Till) Member of the Glasford Formation and the silty clay diamictons of the Banner Formation
- Bedrock – Pennsylvanian-age Mattoon Formation that is mostly shale near the bedrock surface, but is characterized at depth by a complex sequence of shales, thin limestones, coals, underclays, and several

sandstones. The erosional surface of the Pennsylvanian-age Mattoon Formation bedrock ranges widely in depth in the vicinity of the site, but is typically encountered at 90 to 120 ft below ground surface (bgs).

The major unconsolidated materials present at the site are discussed in greater detail below:

2.1.2.1 Ash/Fill Units

Ash is present within the Newton Primary Ash Pond as well as the Newton Landfill 2. The majority of ash fill at the Newton Primary Ash Pond lies on top of the loess and clay.

2.1.2.2 Cahokia Formation

The Cahokia Formation of the Holocene Stage consists of deposits in floodplains and channels of modern rivers and streams and consists of mostly poorly sorted sand, silt, and clay with wood and shell fragments and local deposits of sandy gravel. The Cahokia is likely present in the Big Muddy Creek valley west of the site and along the bottom of Newton Lake to the east, which used to be the bottomland for Law Creek (Lineback, 1979; Berg and Kempton, 1987).

2.1.2.3 Peoria Silt (Loess Unit)

The Peoria Silt is a Loess Unit which extends from beneath the topsoil, derived from the loess, to the top of the Hagarstown Member. The loess, ranging in thickness from 3 to 9 ft where present, has been described as silt, clayey silt, and silty clay. The Loess Unit is generally considered unsaturated.

2.1.2.4 Sangamon Soil

The Sangamon Soil formed between the interglacial period between the Illinoian and Wisconsinan stages of glaciation as a result of weathering of the upper portion of the Illinoian drift. This layer occurs throughout the site and consists of approximately 2 to 6 ft of light brown to light gray silty clay

2.1.2.5 Hagarstown (Till) Member

The Hagarstown Member (also referred to as Hagarstown Beds) of the Pearl Formation, consists of clay till with varying amounts of sand and gravel. Where present at the site, the clay till ranges in thickness from 3 to over 24 ft. Where present, the sandy portion of the Hagarstown is generally less than 5 ft thick. The composition of the sandy portion of the Hagarstown unit varies across the site and was classified as gravelly till, poorly sorted gravel, well sorted gravel, sand and silty sand.

2.1.2.6 Vandalia (Till) Member

The Vandalia Member is a sandy/silty till with thin, discontinuous lenses of silt, sand, and gravel. The Vandalia Till was encountered in all borings advanced at the site. The Vandalia Till typically ranges in thickness from 20 to 60 ft. Results from laboratory tests completed for vertical hydraulic conductivity indicate the Vandalia unit has a very low vertical hydraulic conductivity.

2.1.2.7 Mulberry Grove Member

As described by Willman et al. (1975), the Mulberry Grove Member of the Glasford Formation typically consists of a thin, lenticular unit of gray sandy silt (Willman et al., 1975). It represents the interval between the retreat of the glacier that deposited the Smithboro Member and the advance of the glacier that deposited the Vandalia Member. At the site, the Mulberry Grove Member consists of fine to coarse sand with varying amounts of silt and small to large gravel. The portion of the Mulberry Grove Member at the site that is defined as a sand layer ranges in thickness from 3 to 17 ft with an average thickness of 8 ft. This unit generally occurs across the site at depths between 55 and 88 ft bgs.

2.1.2.8 Smithboro (Till) Member

The Smithboro Member is described as a gray, compact, silty-clay diamicton. The Smithboro Member typically ranges in thickness from 10 to 20 ft.

2.1.2.9 Banner Formation

The Banner Formation consists of pre-Illinoian undifferentiated diamictons and intercalated sand and gravel outwash that generally rest directly on bedrock. The Banner Formation is approximately 20 to 30 ft thick at the site and consist of greenish-gray silty clay with traces of sand.

Name	Age	Description
Cahokia	Holocene	poorly sorted sand, silt, and clay (alluvial)
Peoria Silt	Wisconsinan	sandy silt along bluffs to clayey silt away from bluffs; local lenses of fine to med grained sand; 3-9 ft thick
Sangamon Soil	Sangamonian	light brown to light gray silty clay; weathered upper portion of Illinoisan drift; 2.5-5.5 ft thick
Hagarstown Member	Illinoisan	gravel, sand, and gravelly diamicton; 3-24' thick where present; reddish-brown silty clay with some sand and gravel; surface at 510 to 532 ft; can also be gravelly till with poorly sorted gravel, well sorted gravel, and sand
Vandalia Member	Illinoisan	gray silty to sandy clay diamicton with traces sand and gravel; thin lenses of silt, sand, and gravel; 20-60 ft thick
Mulberry Grove	Illinoisan	fine to coarse sand with varying amounts of silt and fine to coarse gravel; 3 - 17 ft thick; may contain lenses of silt, sand and gravel
Smithboro Member	Illinoisan	gray, silty clay diamicton w/ traces sand and gravel; 10-20 ft thick
Banner Formation	pre-Illinoisan	undifferentiated diamictons; greenish-gray moist silty clay with traces of sand; 20-30 ft thick

2.2 HYDROGEOLOGY

The information used to describe the hydrogeology is based on the local geology obtained from published sources, hydrogeologic investigation data, and boring data collected during monitoring well installation.

2.2.1 Uppermost Aquifer

The uppermost aquifer is the Mulberry Grove Member, typically consisting of fine to coarse sand with varying amounts of clay, silt and fine to coarse gravel. The portion of the Mulberry Grove Member at the site that is defined as a sand layer ranges in thickness from 3 to 17 ft. with an average thickness of 8 ft and with only a few exceptions occurs between depths of 55 to 88 ft bgs.

2.2.2 Lower Limit of Aquifer

The lower hydrostratigaphic units consist of the Smithboro Member and the Banner Formation, both of which are predominantly low permeability clay diamictons with varying amounts of silt, sand and gravel. The lower unlithified confining unit is 30 to more than 50 ft thick above the underlying bedrock.

2.2.3 Hydraulic Conductivity

Hydraulic conductivity/slug tests were completed in wells screened in the unlithified material during prior site investigations and by NRT in April 2017. The hydraulic conductivity values determined from 15 individual monitoring wells (Appendix C) within the uppermost aquifer (Mulberry Grove Member) ranged from 3.9×10^{-8} to 3.6×10^{-2} centimeters per second (cm/s). The geometric mean of the hydraulic conductivity for NRT tested monitoring wells in the Uppermost Aquifer, excluding one outlier, is 2.5×10^{-4} cm/s. Monitoring wells around the Primary Ash Pond had a geometric mean hydraulic conductivity of 1.2×10^{-3} cm/s and those around Landfill 2, excluding one outlier, had a geometric mean hydraulic conductivity of 7.4×10^{-5} cm/s. Field hydraulic conductivity test results reported by Rapps (1997) for six locations near Landfill 1 ranged from 2.5×10^{-6} to 6.0×10^{-3} cm/s with a geometric mean of 9.8×10^{-4} cm/s.

The uppermost unit intercepted in the area of the Primary Ash Pond and Landfill 2 is the silty to sandy clay of the "Upper Drift", or aquitard, as identified in the Rapp's 1997 landfill investigation and consists of Peoria Silt, Sangamon Soil, and/or Hagarstown Member. The hydraulic conductivity of this unit, as tested at monitoring wells near the landfill with screen depths between 8 and 36 ft bgs (Rapps, 1997), ranged from 2.4×10^{-6} to 6.1×10^{-5} cm/s with a geometric mean of 1.7×10^{-5} cm/s. Three in-situ tests conducted by NRT of the uppermost materials near the Primary Ash Pond, on wells screened between 7 and 20 ft bgs, had a geometric mean hydraulic conductivity of 1.3×10^{-5} cm/s. Laboratory testing results for five soil samples collected from depths of 20 to 32 ft bgs in the underlying Vandalia Member (Rapps, 1997) ranged from 6.3×10^{-9} to 2.1×10^{-8} cm/s with a geometric mean hydraulic conductivity of 1.1×10^{-8} cm/s.

The hydraulic conductivity value determined from one field (i.e. in-situ) test of the upper part of the Lower Confining Unit by Rapps (1997), at a depth of 79 to 87 ft bgs, was 1.4×10^{-7} cm/s.

2.2.4 Groundwater Elevations, Flow Direction and Velocity

Seasonal variation of groundwater levels and flow direction at the Landfill is indicated in the series of 2015-2017 groundwater elevation contour maps (Appendix D). Groundwater elevations across Landfill 2 ranged from approximately 441 to 520 ft MSL (NAVD88) from 2015 to 2017. Overall groundwater flow beneath the two phases of Landfill 2 within the uppermost aquifer is southward toward Newton Lake, but with predominantly eastward flow under Phase I (west phase of Landfill 2) and an east and south component of flow under Phase II (east phase of Landfill 2). Horizontal hydraulic gradients (Table 1) were moderate at 0.016 ft/ft. Calculated groundwater flow velocity based on the January and June 2017 groundwater contour maps was 1.42 ft per day (ft/day).

Seasonal variation of groundwater levels and flow direction at the Primary Ash Pond is indicated in the series of 2015-2017 groundwater elevation contour maps (Appendix D). Groundwater elevations across the GMF Pond ranged from approximately 492 to 508 ft MSL. Groundwater flow across Primary Ash Pond within the uppermost aquifer is consistently in a south to southwest direction toward Newton Lake. Horizontal hydraulic gradients (Table 1) were low at 0.007 ft/ft. Calculated groundwater flow velocity based on the January and June 2017 groundwater contour maps was 0.12 ft/day.

Vertical hydraulic gradients as measured between shallow water table wells and uppermost aquifer monitoring wells was consistently downward at both the Landfill 2 and the Primary Ash Pond (Table 1).

3 GROUNDWATER MONITORING

In August 2015, NRT began an assessment of the existing monitoring well network(s) at the Newton Power Station with respect to the existing CCR units. Included in the assessment was a review of the current placement and number of monitoring wells with respect to individual and contiguous CCR units as well as potential locations for new monitoring wells, as appropriate. The discussion below summarizes the results of this assessment and the supplemental well installations.

3.1 CCR Monitoring Well Network

The 40 CFR Part 257 well network consists of seventeen monitoring wells installed in the uppermost aquifer and adjacent to the Newton Landfill 2 (G06D, G48MG, G201, G202, G203, G208, G217D, G220, G222, G223, G224) and the Newton Primary Ash Pond (APW5, APW6, APW7, APW8, APW9, APW10). The Site utilizes four upgradient (or background) monitoring wells (APW5, APW6, G201, and G48MG) as part of their CCR monitoring well network. The boring logs, well construction forms and other related monitoring well forms are available in the Operating Records as required by Title 40 CFR Part 257 Section 257.91 for each monitored CCR Unit. Sampling of these wells commenced December 2015. The 40 CFR Part 257 groundwater monitoring network well locations are shown on Figure 1. Details on the procedures and techniques used to fulfill the groundwater sampling and analysis program requirements are found in the SAPs for Newton Power Station. The well depths, well screen intervals, depth to groundwater and monitored units at the 40 CFR Part 257 monitoring well network locations are summarized below:

Table 3: CCR Groundwater Monitoring Well Information

Primary Ash Pond Monitoring Well Information (Unit ID: 501)					
Well Number	Well Depth (ft bgs)	Well Screen Interval (ft bgs)	Depth to Water (ft bgs)	Unit Monitored	Screened Interval Lithology
APW5	68	63-68	13.89	Upgradient Shallow Unlithified	Sand
APW6	74	68-73	19.21	Upgradient Shallow Unlithified	Sand
APW7	83	78-83	45.05	Downgradient Shallow Unlithified	Sand
APW8	82	71-81	35.29	Downgradient Shallow Unlithified	Sand
APW9	62	56-61	26.00	Downgradient Shallow Unlithified	Sand
APW10	46	41-46	16.98	Downgradient Shallow Unlithified	Sand

Landfill 2 Monitoring Well Information (Unit ID: 502)					
Well Number	Well Depth (ft bgs)	Well Screen Interval (ft bgs)	Depth to Water (ft bgs)	Unit Monitored	Screened Interval Lithology
G06D	96	74-94	30.12	Downgradient Shallow Unlithified	Clay
G48MG	77	71.5-76.5	18.59	Upgradient Shallow Unlithified	Sand
G201	69	59-69	18.54	Upgradient Shallow Unlithified	Sand
G202	74	64-74	43.21	Downgradient Shallow Unlithified	Clay/Gravel
G203	73	63-73	37.60	Downgradient Shallow Unlithified	Sand/Silt
G208	95	74-94	19.13	Downgradient Shallow Unlithified	Silty Clay
G217D	69.3	* - 69.3	16.14	Downgradient Shallow Unlithified	N/A*
G220	87	76-86	16.59	Downgradient Shallow Unlithified	Silt/Sand
G222	80	64-79	14.09	Downgradient Shallow Unlithified	Silty Clay/Sand
G223	89	79-89	33.64	Downgradient Shallow Unlithified	Silty/ Clay/Silty Sand
G224	74	63-73	41.73	Downgradient Shallow Unlithified	Silty Sand/Sand

Notes:
Groundwater depth measurements were collected June 12, 2017.
NM indicates groundwater depth was not measured.
*boring log not available for review

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Tables

Table 1. Vertical Gradients
Newton Power Station
January 2017 and June 2017
Hydrogeologic Monitoring Plan

Date	06/12/2017					
	Groundwater Elevation	Reference Elevation	**Head Change (dH)**	**Dist. Change (dL)**	**Vertical Hydraulic Gradient (dH/dL)***	
APW-7	493.32	455.92	2.10	7.55	0.278	down
G203	495.42	463.47				
APW-9	505.52	469.76	18.85	44.04	0.428	down
APW-3	524.37	513.80				
APW-10	507.27	478.84	2.54	30.06	0.084	down
APW-4	509.81	508.90				
Date	01/16/2017					
	Groundwater Elevation	Reference Elevation	**Head Change (dH)**	**Dist. Change (dL)**	**Vertical Hydraulic Gradient (dH/dL)***	
APW-7	492.98	455.92	0.04	7.55	0.005	down
G203	493.02	463.47				
APW-9	505.67	469.76	20.93	44.04	0.475	down
APW-3	526.60	513.80				
APW-10	506.96	478.84	14.05	30.06	0.467	down
APW-4	521.01	508.90				

Notes:

1. The reference point is equal to the water elevation when the water table intersects the screen, or the screen midpoint if the screen is submerged.

*: Vertical gradients less than ±0.0015 are considered flat, and they typically have less than 0.02 foot difference between wells

Table 2. Groundwater Flow Velocities
Newton Power Station
January 2017 and June 2017
Hydrogeologic Monitoring Plan

6/12/2017 (Round 8)				
	Average Hydraulic Conductivity (cm/s)	**Horizontal Hydraulic Gradient***	**Effective Porosity**	**Velocity (ft/day)**
Newton Primary Ash Pond	1.2E-03	0.007	0.2	0.12
Newton Landfill 2	7.4E-05	0.016	0.2	1.42
1/16/2017 (Round 6)				
	Average Hydraulic Conductivity (cm/s)	**Horizontal Hydraulic Gradient***	**Effective Porosity**	**Velocity (ft/day)**
Newton Primary Ash Pond	1.2E-03	0.007	0.2	0.12
Newton Landfill 2	7.4E-05	0.016	0.2	1.42

Note:

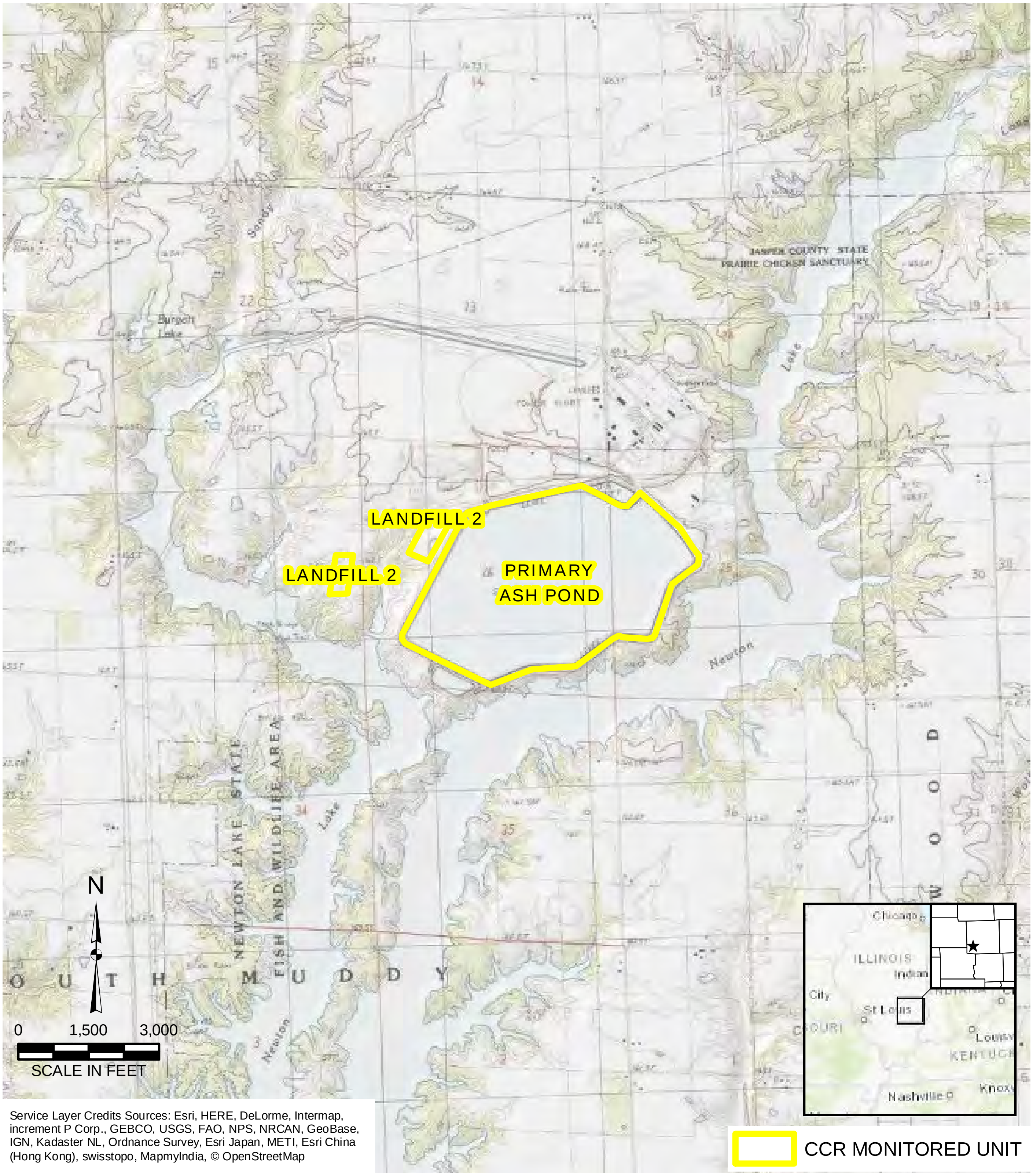
1) cm/sec x 2,835 = feet/day

2) Source of hydraulic conductivity values is the geometric mean value for the aquifer unit.

3) The effective porosity of the clayey sand/silty sand aquifer (20%) was estimated from literature values (Sanders, 1998)

* Horizontal hydraulic gradient calculated from water levels in CCR wells near the primary ash pond and landfill 2

Figures



DRAWN BY/DATE: SDS 7/27/17 REVIEWED BY/DATE: TBN 10/2/17 APPROVED BY/DATE: SJC 10/3/17	SITE LOCATION MAP HYDROGEOLOGIC MONITORING PLAN NEWTON POWER PLANT NEWTON, ILLINOIS	PROJECT NO: 2285 FIGURE NO: 1 Natural Resource Technology AN OBG COMPANY

GROUNDWATER SAMPLING WELL LOCATION MAP

HYDROGEOLOGIC MONITORING PLAN
NEWTON POWER PLANT
NEWTON, ILLINOIS

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

CCR RULE MONITORING WELL LOCATION
CCR MONITORED UNIT

DRAWN BY/DATE: SDS 7/27/17
REVIEWED BY/DATE: TBN 10/2/17
APPROVED BY/DATE: SJC 10/3/17

PROJECT NO: 2285

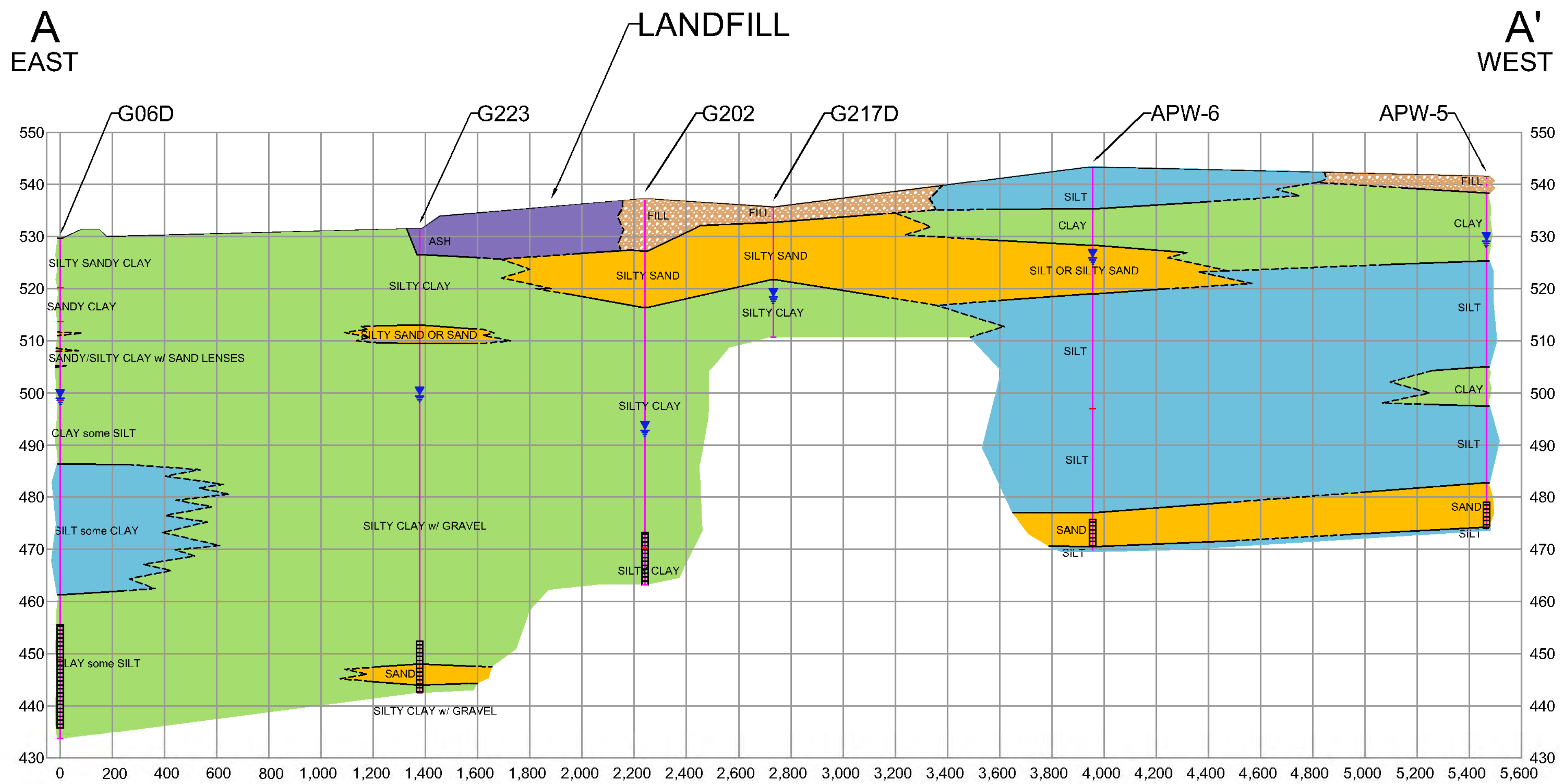
FIGURE NO: 2

Natural Resource Technology
AN OBG COMPANY

Y:\Mapping\Projects\22\2285\MXD\Newton_HGMP\Figure 2_Well Location Map - Newton.mxd Author: stolzsd; Date/Time: 10/4/2017, 5:03:47 PM

Appendix A

Geologic Cross Sections

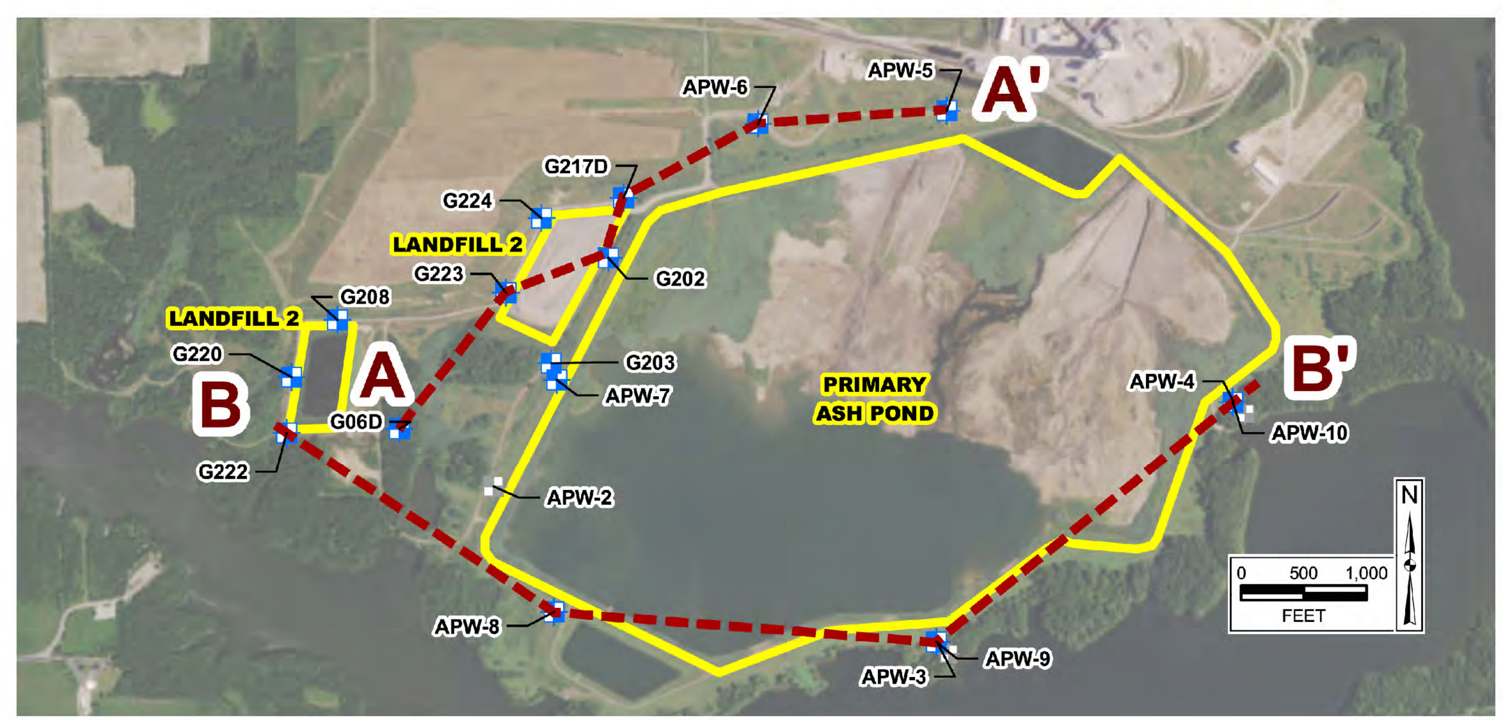


FILL	WELL SCREEN
ASH	GROUNDWATER ELEVATION
CLAY	
SILT	
SAND	

VERTICAL SCALE IN FEET 30

HORIZONTAL SCALE IN FEET 600

VERTICAL EXAGGERATION =20



GEOLOGIC CROSS-SECTION A-A'

HYDROGEOLOGIC MONITORING PLAN

NEWTON POWER STATION
NEWTON, ILLINOIS

DRAWN BY:	JMO	DATE:	08/29/2017
CHECKED BY:	TBN	DATE:	10/2/2017
APPROVED BY:	SJC	DATE:	10/2/2017
DRAWING NO:	Fig A - Geologic Cross-Section A-A'		
REFERENCE: .			

Natural Resource Technology
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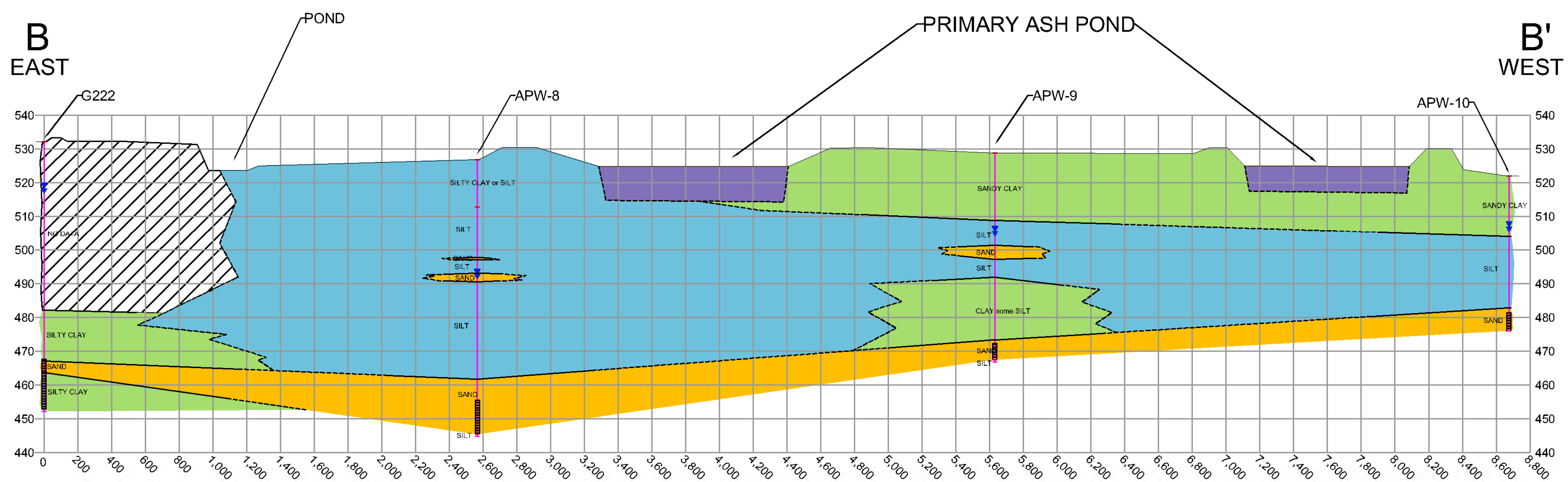
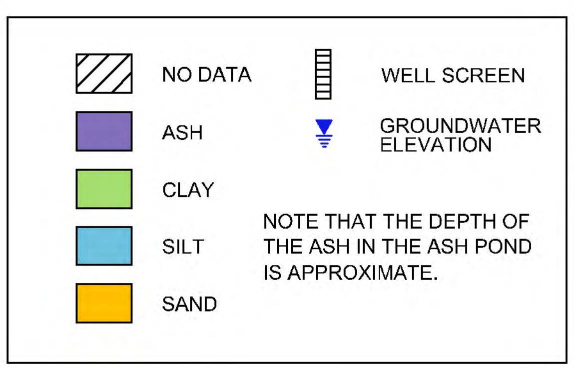
PROJECT NO.
2285

FIGURE NO.
APPENDIX A-1

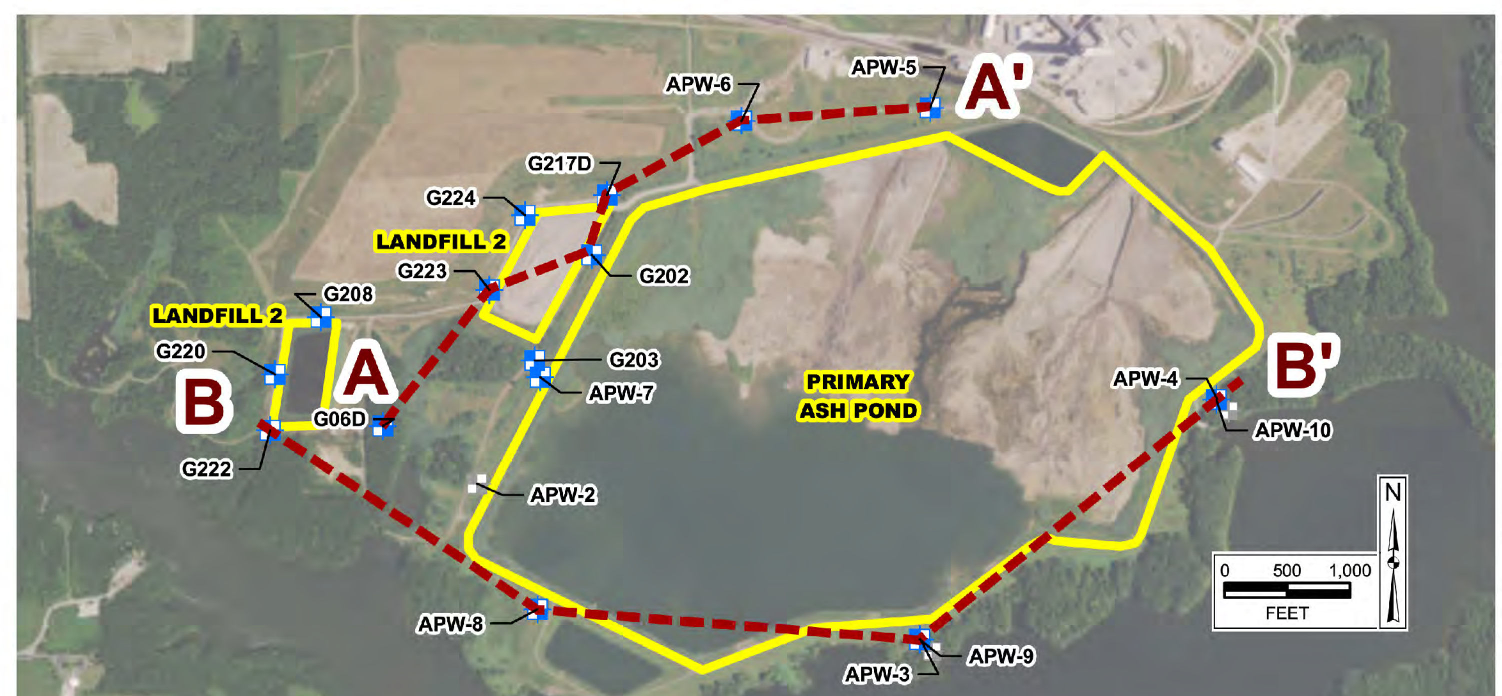




VERTICAL SCALE IN FEET 40

HORIZONTAL SCALE IN FEET 800

VERTICAL EXAGGERATION =20



DRAWN BY:	JMO	DATE:	08/29/2017
CHECKED BY:	TBN	DATE:	10/2/2017
APPROVED BY:	SJC	DATE:	10/2/2017
DRAWING NO:	Fig X_Geologic Cross-Section A-A'		
REFERENCE: .			

GEOLOGIC CROSS-SECTION B-B'

HYDROGEOLOGIC MONITORING PLAN

NEWTON POWER STATION
NEWTON, ILLINOIS

Natural Resource Technology
AN OBG COMPANY

PROJECT NO.
2285

FIGURE NO.
APPENDIX A-2

Appendix B

Geotechnical Exploration Locations and Laboratory Test Results

Appendix B From:
AECOM, 2015, Dynegy CCR-Newton Investigation

Q:\Projects\DOE\0 Projects\Dynegy\Newton\09_Data\GIS\Maps\Newton_Exporation_Locations.mxd

Legend

- AECOM Boring Location
- AECOM CPT Location

N W E S

0.1 0 0.1 0.2 Miles

DYNEGY

Figure D-01
Exploration Locations
Newton Power Station
Jasper County, Illinois

AECOM

AECOM #60428794-108
Dynegy CCR - Newton
LABORATORY TESTING DATA SUMMARY

BORING NO.	SAMPLE NO.	DEPTH (ft)	IDENTIFICATION TESTS									PERMEABILITY	STRENGTH			CONSOLIDATION INITIAL CONDITIONS		REMARKS
			WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO. % MINUS 2 μm (%)	TOTAL UNIT WEIGHT (pcf)	DRY UNIT WEIGHT (pcf)	(cm/sec)	TEST TYPE @STRESS (ksf)	PEAK SHEAR STRESS (ksf)	STRAIN @ PEAK STRESS (%)	VOID RATIO (-)	SATUR-ATION (%)	
NEW-B001	ST-5	10-12								125.4								
NEW-B001	ST-5	10.55	19.3															
NEW-B001	ST-5B	10.75	18.1	50	14	36	CH	79.1		132.6	112.3		CIU@1.5	2.3	21.3			T3937
NEW-B001	ST-7	20-22								130.1								
NEW-B001	ST-7	20.3	22.8															
NEW-B001	ST-7	20.85	18.4															
NEW-B001	ST-7B	21.1	16.2	49	13	36	CL	59.9		134.5	115.7		CIU@3.0	2.6	20.6			T3939
NEW-B001	S-8	25-27	17.1				CL	65.3										
NEW-B001	S-10	35-37	15.8	25	14	11	CL	55.6	17									
NEW-B001	S-11	40-41	14.6	22	13	9	CL	57.0	11									
NEW-B001	S-13	45-47	11.8															
NEW-B001	S-15	50-52	12.3	27	18	9	CL											
NEW-B001	S-16	55-57	11.5	30	13	17	CL	63.3	16									
NEW-B001	S-18	65-67	12.8	33	14	19	CL	64.6	18									
NEW-B001	S-19	70-70.92	12.4	24	15	9	CL											
NEW-B001	S-20	75-77	13.0															
NEW-B001	S-23	90-92	12.8	28	14	14	CL											
NEW-B001	S-24	95-97	11.0				SM	13.4	2									
NEW-B003	S-3	9-11	16.1															
NEW-B003	ST-1	14-15.9								129.5								
NEW-B003	ST-1	14.55	16.3															
NEW-B003	ST-1	15.1	23.7															
NEW-B003	ST-1C	15.35	20.9	59	15	44	CH	77.3		129.5	107.1		CIU@2.5	1.7	15.7			T3940
NEW-B003	S-4	20-22	17.7															
NEW-B003	ST-2	23-24.6								130.6								
NEW-B003	ST-2	23.35	16.6															
NEW-B003	ST-2	23.9	19.5															
NEW-B003	ST-2B	24.15	19.4	43	17	26	CL	82.7		130.9	109.7		UU@4	2.5	15.0			UU296a
NEW-B003	S-5	25-27	19.2															
NEW-B003	ST-3	27.5-29.5								128.1								
NEW-B003	ST-3	28.05	19.7															
NEW-B003	ST-3B	28.3	21.2				CH			126.4	104.3	9.6E-8						P10611
NEW-B003	ST-3	28.6	22.8															
NEW-B003	ST-3C	28.8	21.1	55	16	39	CH			129.2	106.7		UU@3	3.0	15.0			UU296b

Prepared by: YC
Reviewed by: GET
Date: 11/17/2015

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Project No.: T60428794
File: Indx1.xls

AECOM #60428794-108
Dynegy CCR - Newton
LABORATORY TESTING DATA SUMMARY

BORING	SAMPLE	DEPTH	IDENTIFICATION TESTS									PERMEABILITY	STRENGTH			CONSOLIDATION		REMARKS
			WATER	LIQUID	PLASTIC	PLAS.	USCS	SIEVE	HYDRO.	TOTAL	DRY		TEST	PEAK	STRAIN	INITIAL CONDITIONS		
NO.	NO.		CONTENT	LIMIT	LIMIT	INDEX	SYMB.	MINUS	% MINUS	UNIT	UNIT		TYPE	SHEAR	@ PEAK	VOID	SATUR-	
							(1)	NO. 200	2 μm	WEIGHT	WEIGHT		@STRESS	STRESS	STRESS	RATIO	ATION	
		(ft)	(%)	(-)	(-)	(-)		(%)	(%)	(pcf)	(pcf)	(cm/sec)	(ksf)	(ksf)	(%)	(-)	(%)	
NEW-B003	S-6	30-32	19.6	42	14	28	CL	69.8	23									
NEW-B003	S-7	35-37	17.0	41	15	26	CL											
NEW-B003	S-8	40-42	22.9	50	18	32	CH	88.2	25									
NEW-B003	S-9B	46-47	11.7															
NEW-B003	S-12	60-62	13.3	32	35	17	CL											
NEW-B003	S-13	65-67	12.7				CL	67.6	19									
NEW-B004	S-3	5-7	13.9				CL	64.2										
NEW-B004	ST-4	8-10								132.3								
NEW-B004	ST-4	8.15	16.1															
NEW-B004	ST-4	8.7	18.5															
NEW-B004	ST-4	9.25	17.9															
NEW-B004	ST-4C	9.5	18.5	50	13	37	CH	83.9	28	131.3	110.9		CIU@0.5	1.4	17.9			T3936
NEW-B004	S-5	10-12	20.0															
NEW-B004	S-6	15-17	20.3				CL	79.3										
NEW-B004	ST-7	18-20								126.9								
NEW-B004	ST-7	18.55	18.1															
NEW-B004	ST-7	19.1	16.7															
NEW-B004	ST-7C	19.35	18.3	52	15	37	CH			128.5	108.7		CIU@3.0	2.4	20.5			T3941
NEW-B004	S-8	20-22	20.3															
NEW-B004	S-9	25-27	20.7															
NEW-B004	S-10	27.5-29.5	17.7	37	14	23	CL	61.7	25									
NEW-B004	ST-12	33-33.5								106.5								
NEW-B004	ST-12A	33.2	9.7	24	13	11	CL			136.2	124.2	6.4E-6						P10610
NEW-B004	ST-12	33.5	10.2															
NEW-B004	S-13	33.5-35.5	9.0				CL	52.8	16									
NEW-B004	S-14	36-37.92	8.9	26	13	13	CL											
NEW-B004A	S-1	45-46	10.4				CL	63.2	13									
NEW-B004A	S-2	50-52	11.3	29	15	14	CL											
NEW-B004A	S-3	55-57	10.0															
NEW-B004A	S-4	60-62	11.4				CL	68.1										
NEW-B004A	S-6	70-72	16.8	32	14	18	CL											
NEW-B004A	S-8	80-82	12.5	31	14	17	CL											
NEW-B004A	S-10	90-92	10.9															
NEW-B004A	S-11	95-97	11.1				SW-SM	11.2	3									

Prepared by: YC
Reviewed by: GET
Date: 11/17/2015

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Dynegy CCR - Newton
LABORATORY TESTING DATA SUMMARY

BORING NO.	SAMPLE NO.	DEPTH (ft)	IDENTIFICATION TESTS: WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO. % MINUS 2 μm (%)	TOTAL UNIT WEIGHT (pcf)	DRY UNIT WEIGHT (pcf)	PERMEABILITY (cm/sec)	STRENGTH: TEST TYPE @STRESS (ksf)	PEAK SHEAR STRESS (ksf)	STRAIN @ PEAK STRESS (%)	CONSOLIDATION INITIAL CONDITIONS: VOID RATIO (-)	SATUR-ATION (%)	REMARKS
NEW-B005	S-3	5-7	17.9	47	15	32	CL											
NEW-B005	S-5	10-12	9.8	24	13	11	CL											
NEW-B005	S-6	15-16.5	9.4	27	12	15	CL	54.6	16									
NEW-B005	S-7	20-20.92	10.8	26	13	13	CL											
NEW-B005	S-8	25-26	11.6				CL	54.6	18									
NEW-B005	S-10	35-37	11.3				ML	66.4										
NEW-B005	S-11	40-42	14.0															
NEW-B005	S-12	45-47	13.1	33	15	18	CL	70.2	19									
NEW-B006	S-3	10-12	21.2	66	14	52	CH	88.2	36									
NEW-B006	ST-1	20-22								128.0								
NEW-B006	ST-1	20.4	21.6															
NEW-B006	ST-1	20.95	16.4															
NEW-B006	ST-1B	21.2	18.2	40	17	23	CL	78.4	22	130.8	110.6		UU@3.5	2.3	8.7			UU301f
NEW-B006	ST-2	25-27								140.1								
NEW-B006	ST-2	25.4	17.9															
NEW-B006	ST-2	25.95	18.2															
NEW-B006	ST-2	26.5	18.6															
NEW-B006	ST-2C	26.75	19.7	44	12	32	CL	65.6	28	128.8	107.6		CIU@7.5	3.0	12.8			T3945
NEW-B006	S-6	27-29	19.4	54	13	41	CH											
NEW-B006	ST-3	30-32								133.0								
NEW-B006	ST-3	30.45	29.1															
NEW-B006	ST-3	31.0	20.4															
NEW-B006	ST-3B	31.25	20.7				CL			130.6	108.1	1.6E-7						P10597
NEW-B006	ST-3	31.55	18.5															
NEW-B006	ST-3C	31.8	18.3	37	15	22	CL	52.1	21	133.3	112.8		CIU@7.2	4.0	14.8			T3915
NEW-B006	S-7	32-34	17.5															
NEW-B006	ST-4	35-35.8		30	13	17	CL	58.3	20	148.8								
NEW-B006	ST-4	35.4	11.1				CL			140.2	126.2		DS@9	6.6				DS1619
NEW-B006	ST-4	35.6	15.8				CL			147.4	127.2		DS@18	11.5				DS1617
NEW-B006	ST-4	35.7	11.2															
NEW-B006	S-9	40-42	13.0															
NEW-C006	ST-1	10-12								115.2								
NEW-C006	ST-1	10.5	26.7															
NEW-C006	ST-1	11.05	27.1															

AECOM #60428794-108
Dynegy CCR - Newton
LABORATORY TESTING DATA SUMMARY

BORING	SAMPLE	DEPTH	IDENTIFICATION TESTS									PERMEABILITY	STRENGTH			CONSOLIDATION		REMARKS
			WATER CONTENT	LIQUID LIMIT	PLASTIC LIMIT	PLAS. INDEX	USCS SYMB. (1)	SIEVE MINUS NO. 200	HYDRO. % MINUS 2 µm	TOTAL UNIT WEIGHT	DRY UNIT WEIGHT		TEST TYPE @STRESS	PEAK SHEAR STRESS	STRAIN @ PEAK STRESS	INITIAL CONDITIONS VOID RATIO	SATUR-ATION	
NO.	NO.	(ft)	(%)	(-)	(-)	(-)		(%)	(%)	(pcf)	(pcf)	(cm/sec)	(ksf)	(ksf)	(%)	(-)	(%)	
NEW-C006	ST-1B	11.3	25.2	54	16	38	CH			124.1	99.2		CIU@1.5	1.2	13.7			T3916
NEW-C006	ST-2	12-14								121.4								
NEW-C006	ST-2	12.75	19.3															
NEW-C006	ST-2B	13.0	18.9	53	14	39	CH			131.5	110.6		CIU@2.0	2.4	16.7			T3917
NEW-B007	S-4	7.5-9.5	13.2															
NEW-B007	ST-1	10-12								131.6								
NEW-B007	ST-1	10.75	16.5															
NEW-B007	ST-1	11.3	17.3															
NEW-B007	ST-1C	11.55	15.4	38	14	24	CL			135.1	117.1		CIU@1.0	2.3	21.5			T3933
NEW-B007	ST-2	20-22								143.6								
NEW-B007	ST-2	20.25	10.1															
NEW-B007	ST-2	20.8	12.7															
NEW-B007	ST-2B	21.0	12.1	30	13	17	CL	52.3		140.5	125.4		CIU@2.5	3.7	21.1			T3934
NEW-B007	S-6	25-27	16.3															
NEW-B007	ST-3	30-32								131.1								
NEW-B007	ST-3	30.35	17.8															
NEW-B007	ST-3	30.9	20.1															
NEW-B007	ST-3	31.45	19.2															
NEW-B007	ST-3C	31.7	21.5	52	12	40	CH	71.5	29	132.0	108.6		UU@6.0	2.6	11.7			UU288d
NEW-B007	S-7	35-37	14.8															
NEW-B007	ST-4	40-42																
NEW-B007	ST-4	40.85	25.1															
NEW-B007	ST-4B	41.0	17.5	57	13	44	CH			129.9	110.5		DS@5	2.7				DS1620
NEW-B007	ST-4C	41.3	14.7				CH			128.7	112.2		DS@10	5.4				DS1621
NEW-B007	ST-4B	41.5	16.1				CH			132.6	114.2		DS@15	7.6				DS1622
NEW-B007	ST-5	50-51.5								131.5								
NEW-B007	ST-5A	50.3	16.3				CH			137.1	117.9	5.1E-9						P10598
NEW-B007	ST-5	50.8	14.0															
NEW-B007	ST-5B	51.05	13.9	32	16	16	CL			136.1	119.5		DSS@7.6	3.5	5.6			DSS855
NEW-B008	ST-1	15-17								132.9								
NEW-B008	ST-1	15.85	11.1															
NEW-B008	ST-1	16.4	16.9															
NEW-B008	ST-1C	16.65	16.7	50	13	37	CH	74.4		136.3	116.8		UU@2.5	3.1	15.0			UU288e
NEW-B008	S-4	20-22	20.1															

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AECOM #60428794-108
Dynegy CCR - Newton
LABORATORY TESTING DATA SUMMARY

BORING	SAMPLE	DEPTH	IDENTIFICATION TESTS									PERMEABILITY	STRENGTH			CONSOLIDATION		REMARKS
			WATER	LIQUID	PLASTIC	PLAS.	USCS	SIEVE	HYDRO.	TOTAL	DRY		TEST	PEAK	STRAIN	INITIAL CONDITIONS		
NO.	NO.		CONTENT	LIMIT	LIMIT	INDEX	SYMB.	MINUS	% MINUS	UNIT	UNIT		TYPE	SHEAR	@ PEAK	VOID	SATUR-	
							(1)	NO. 200	2 μm	WEIGHT	WEIGHT		@STRESS	STRESS	STRESS	RATIO	ATION	
		(ft)	(%)	(-)	(-)	(-)		(%)	(%)	(pcf)	(pcf)	(cm/sec)	(ksf)	(ksf)	(%)	(-)	(%)	
NEW-B008	S-5	22.5-24.5	22.6															
NEW-B008	S-6	25-27	23.2															
NEW-B008	ST-2	27.5-28.75								130.3								
NEW-B008	ST-2A	27.7	20.3				CL			122.5	101.8		DS@2	1.2				DS1624
NEW-B008	ST-2B	28	14.4	49	14	35	CL			133.8	117.0		DS@4	2.9				DS1626
NEW-B008	ST-2C	28.4	16.4				CL			133.2	114.5		DS@8	4.4				DS1628
NEW-B008	S-7	35-37	13.8															
NEW-B008	S-8	40-42	14.6				SC	46.9	9									
NEW-B008	S-10	50-51.5	15.4	32	16	16	CL	65.4	20									
NEW-B009	ST-1	9-11								131.1								
NEW-B009	ST-1	9.5	20.0															
NEW-B009	ST-1B	9.75	19.0	47	15	32	CL			132.3	111.2		UU@2.0	2.5	15.0			UU288f
NEW-B009	S-3	14-16	15.3															
NEW-B009	S-4	19-21	18.3															
NEW-B009	ST-2	29-31.3								128.8								
NEW-B009	ST-2B	30.0	16.7	31	14	17	CL			132.6	113.6		CIU@4.0	2.9	10.5			T3942
NEW-B009	ST-2	30.35	19.5															
NEW-B009	S-6	34-35.5	8.6	24	12	12	CL	51.6										
NEW-B009	S-7	37.5-38	16.9		19	NP	ML											
NEW-B009	S-9	42.5-44.5	15.0															
NEW-B009	S-10	50-52	13.7				CL	74.0	21									
NEW-B009	S-11	55-57	14.6															
NEW-B009	S-12	60-62	13.5	24	16	8	CL	66.4	18									
NEW-B009	S-14	70-71.42	12.2				CL	51.5	12									
NEW-B010	ST-1	5-7								137.3								
NEW-B010	ST-1	5.55	10.9															
NEW-B010	ST-1	6.1	15.8															
NEW-B010	ST-1C	6.3	10.2	24	13	11	CL			140.5	127.5		CIU@1.0	4.4	21.3			T3943
NEW-B010	S-4	10-12	13.7															
NEW-B010	ST-2	15-17								137.9								
NEW-B010	ST-2	15.7	13.9															
NEW-B010	ST-2	16.25	12.7															
NEW-B010	ST-2C	16.5	13.8	33	13	20	CL			137.3	120.6		CIU@2	3.5	20.9			T3944
NEW-B010	S-5	20-22	16.1															

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Dynegy CCR - Newton
LABORATORY TESTING DATA SUMMARY

BORING NO.	SAMPLE NO.	DEPTH (ft)	IDENTIFICATION TESTS: WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO. % MINUS 2 μm (%)	TOTAL UNIT WEIGHT (pcf)	DRY UNIT WEIGHT (pcf)	PERMEABILITY (cm/sec)	STRENGTH: TEST TYPE @STRESS (ksf)	PEAK SHEAR STRESS (ksf)	STRAIN @ PEAK STRESS (%)	CONSOLIDATION INITIAL CONDITIONS: VOID RATIO (-)	SATUR-ATION (%)	REMARKS
NEW-B010	S-6	25-27	19.1															
NEW-B010	S-7	30-32	21.0	49	16	33	CL	62.3	24									
NEW-B010	S-8	35-37	8.5	23	12	11	CL											
NEW-B010	S-12	47.5-48.2	13.5															
NEW-B010	S-13	50-50.8	10.1				SC	22.3	6									
NEW-B010	S-16	65-67	15.0				CL	70.6										
NEW-B010	S-18	75-77	14.5	28	15	13	CL											
NEW-B010	S-19	80-82	14.7	25	15	10	CL											
NEW-B012	ST-4	8-10								134.0								
NEW-B012	ST-4	8.65	15.5															
NEW-B012	ST-4	9.2	14.9															
NEW-B012	ST-4C	9.45	12.6	34	13	21	CL			139.6	123.9		UU@1.5	4.1	15.0			UU296d
NEW-B012	ST-7	20-21.7								135.0								
NEW-B012	ST-7	20.35	14.8															
NEW-B012	ST-7A	20.6	13.3				CL			137.1	121.0	7.8E-9						P10609
NEW-B012	ST-7	20.9	16.7															
NEW-B012	ST-7B	21.15	13.3	35	13	22	CL	52.1		138.4	122.1		CIU@2.5	3.2	21.8			T3938
NEW-B012	S-8	25-27	15.2	36	13	23	CL											
NEW-B012	S-9	30-32	12.9															
NEW-B012	S-10	35-37	16.8	40	15	25	CL											
NEW-B012	S-11	40-42	9.9				CL	55.9	17									
NEW-B012	ST-12	45-47								131.7								
NEW-B012	ST-12	45.55	19.8															
NEW-B012	ST-12	46.15	14.3															
NEW-B012	ST-12C	46.4	17.5	43	14	29	CL	62.1	30	133.6	113.8		CIU@6	3.4	23.3			T3883
NEW-B012	S-13	50-52	20.0															
NEW-B012	S-14	55-57	15.8	41	13	28	CL											
NEW-B012	ST-15	60-62								136.2								
NEW-B012	ST-15	60.65	18.7															
NEW-B012	ST-15	61.2	14.1															
NEW-B012	ST-15C	61.45	12.8	42	14	28	CL			132.5	117.6		DSS@7.2	2.8	7.1			DSS849
NEW-B012	S-17	70-72	10.9															
NEW-B012	S-18	75-77	11.8	29	13	16	CL	53.3	17									
NEW-B012	ST-19	80-82								139.7								

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Dynegy CCR - Newton
LABORATORY TESTING DATA SUMMARY

BORING	SAMPLE	DEPTH	IDENTIFICATION TESTS									PERMEABILITY	STRENGTH			CONSOLIDATION		REMARKS
																INITIAL CONDITIONS		
NO.	NO.	(ft)	WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO. % MINUS 2 μm (%)	TOTAL UNIT WEIGHT (pcf)	DRY UNIT WEIGHT (pcf)	(cm/sec)	TEST TYPE @STRESS (ksf)	PEAK SHEAR STRESS (ksf)	STRAIN @ PEAK STRESS (%)	VOID RATIO (-)	SATUR-ATION (%)	
NEW-B012	ST-19	80.85	12.2															
NEW-B012	ST-19	80.95	11.7															
NEW-B012	ST-19	81.1	11.2	25	14	11	SC			136.8	122.9		DS@6	4.2				DS1611
NEW-B012	ST-19	81.5	10.5				SC			139.2	126.0		DS@24	15.1				DS1612
NEW-B012	ST-19	81.8	16.9				SC			130.5	111.7		DS@12	7.2				DS1613
NEW-B012	S-20	85-87	16.2	34	14	20	CL											
NEW-B012	S-22	95-97	15.7															
NEW-B014	ST-1	2.5-4.1								140.5								
NEW-B014	ST-1A	2.95																
NEW-B014	ST-1	3.25	13.5															
NEW-B014	ST-1B	3.5	9.5	28	13	15	SC	46.2	16	142.7	130.3		UU@0.5	5.8	8.4			UU260f
NEW-B014	S-3	7.5-9.5	13.7	41	14	27	CL											
NEW-B014	S-4	10-12	18.7	42	15	27	CL											
NEW-B014	ST-2	15-16.9								133.8								
NEW-B014	ST-2	15.6	11.6															
NEW-B014	ST-2B	15.85	12.2	31	14	17	CL			139.2	124.1		EXT CIU	-1.6	-8.4			TE15001
NEW-B014	ST-2	16.15	10.2															
NEW-B014	S-5	20-22	9.6				SC	49.8										
NEW-B014	S-6	25-27	16.1	40	15	25	CL	59.0										
NEW-B014	S-7	30-31.33	16.7															
NEW-B014	S-7A	31.33-32	17.5				CL	60.4										
NEW-B014	ST-3	35-37								135.0								
NEW-B014	ST-3	35.3	19.7															
NEW-B014	ST-3	35.85	15.9															
NEW-B014	ST-3	36.4	12.6															
NEW-B014	ST-3C	36.65	16.3	38	13	25	SC	13.5	4	132.6	114.0		CIU@3	4.2	12.9			T3884
NEW-B014	S-8	40-42	16.2	39	14	25	CL											
NEW-B014	S-10	48-50	17.5															
NEW-B015	ST-1	10-12								130.3								
NEW-B015	ST-1A	10.4																
NEW-B015	ST-1	10.7	20.7															
NEW-B015	ST-1B	10.95	23.0	59	15	44	CH			126.0	102.5		CIU@1.5	1.3	18.0			T3885
NEW-B015	S-5	15-17	18.4															
NEW-B015	S-6	20-22	18.2															

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LABORATORY TESTING DATA SUMMARY

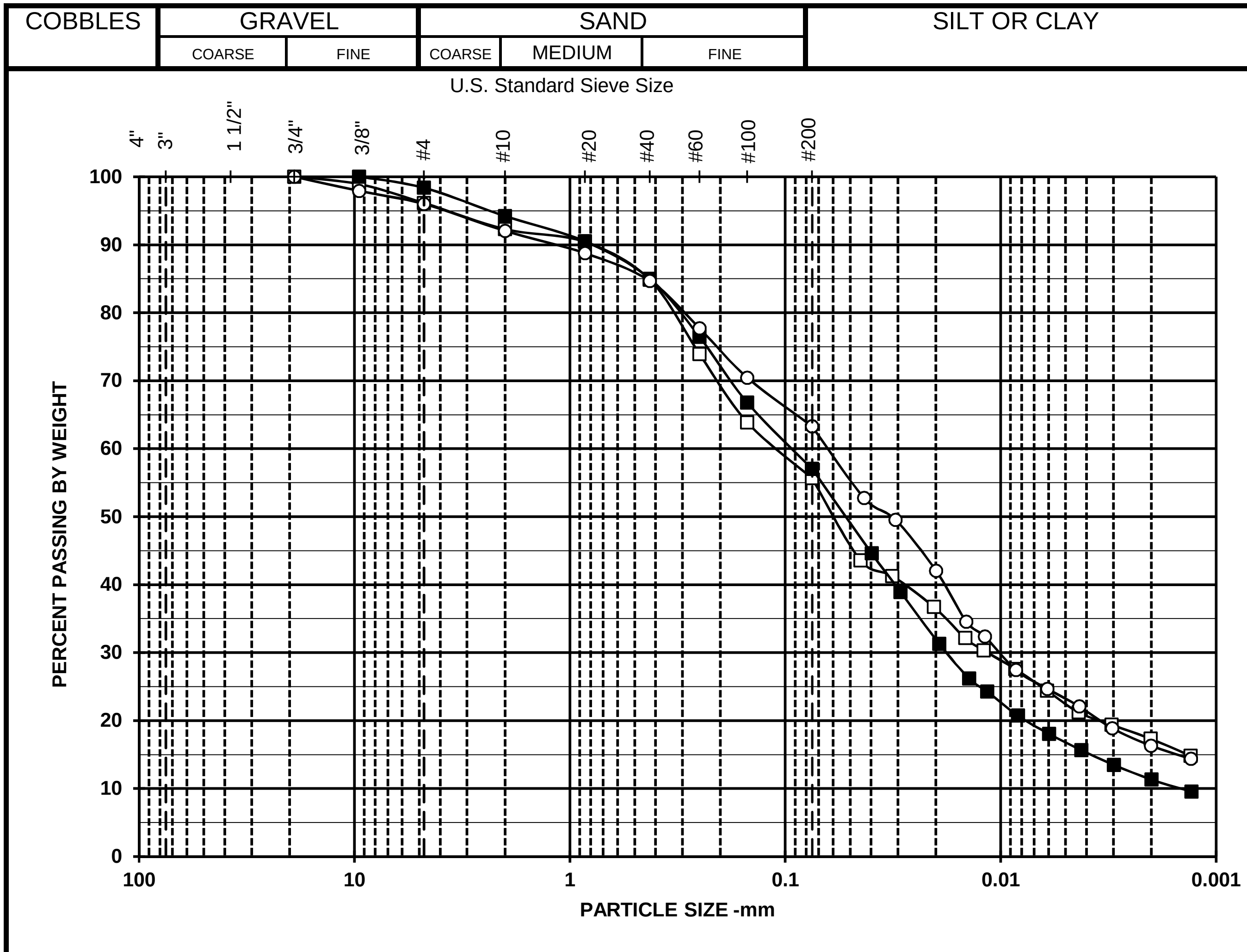
BORING NO.	SAMPLE NO.	DEPTH (ft)	IDENTIFICATION TESTS: WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO. % MINUS 2 µm (%)	TOTAL UNIT WEIGHT (pcf)	DRY UNIT WEIGHT (pcf)	PERMEABILITY (cm/sec)	STRENGTH: TEST TYPE @STRESS (ksf)	PEAK SHEAR STRESS (ksf)	STRAIN @ PEAK STRESS (%)	CONSOLIDATION INITIAL CONDITIONS: VOID RATIO (-)	SATUR-ATION (%)	REMARKS
NEW-B015	ST-2	25-27								130.2								
NEW-B015	ST-2	25.2	15.6															
NEW-B015	ST-2A	25.45	24.0				CH			126.1	101.7	1.8E-9						P10608
NEW-B015	ST-2	25.75	24.7															
NEW-B015	ST-2B	26.0	19.5	52	15	37	CH			131.4	110.0		CIU@5	3.1	13.2			T3935
NEW-B015	S-7	30-32	16.3	37	13	24	CL											
NEW-B015	S-8	35-37	21.5	46	14	32	CL	84.5	36									
NEW-B015	S-9	40-42	8.1															
NEW-B015	S-11	50-52	14.1															
NEW-B015	ST-3	60-61.3								137.7								
NEW-B015	ST-3	60.15	11.7															
NEW-B015	ST-3	60.35	11.2				CL			139.6	125.5		DS@3.75	3.2				DS1623
NEW-B015	ST-3	60.75	11.9	30	15	15	CL			140.2	125.3		DS@7.5	5.4				DS1625
NEW-B015	ST-3	61.05	12.7				CL			139.8	124.1		DS@15	9.1				DS1627
NEW-B015	ST-4	70-70.3																no tests
NEW-B016	S-3A	5-6	16.4	35	13	22	CL											
NEW-B016	S-3B	6.5-7					SM	13.2	7									
NEW-B016	S-4B	8-9	11.3															
NEW-B016	S-5	10-12	12.1				ML	62.6										
NEW-B016	S-6	15-17	11.1	52	14	38	CH	73.0	20									
NEW-B016	S-7	20-22	14.5															
NEW-B016	S-9	30-32	11.6	29	15	14	CL											
NEW-B016	S-10	35-37	13.2															

Note: (1) USCS symbol based on visual observation and Sieve and Atterberg limits reported.

Prepared by: YC
Reviewed by: GET
Date: 11/17/2015

TerraSense, LLC
45H Commerce Way
Totowa, NJ 07512

Project No.: T60428794
File: Indx1.xls



Symbol	□	■	○
Boring	NEW-B001	NEW-B001	NEW-B001
Sample	S-10	S-11	S-16
Depth	35-37	40-41	55-57
% +3"	0.0	0.0	0.0
% Gravel	3.9	1.6	4.0
% SAND	40.5	41.4	32.7
%C SAND	3.9	4.2	4.0
%M SAND	7.5	9.2	7.4
%F SAND	29.2	28.0	21.4
% FINES	55.6	57.0	63.3
% -2µ	17	11	16
D_{100} (mm)	19.00	9.50	19.00
D_{60} (mm)	0.11	0.10	0.07
D_{30} (mm)	0.01	0.02	0.01
D_{10} (mm)			
Cc			
Cu			

Particle Size (Sieve #)	PERCENT FINER □	■	○
4"			
3"			
1 1/2"			
3/4"	100.0		100.0
3/8"	98.9	100.0	97.9
4	96.1	98.4	96.0
10	92.3	94.2	92.0
20	90.4	90.5	88.8
40	84.8	85.0	84.7
60	73.9	76.4	77.7
100	63.9	66.8	70.4
200	55.6	57.0	63.3

SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□	15.8	25	14	11	CL	Brown, Sandy lean clay	9/2/2015
■	14.6	22	13	9	CL	Brown, Sandy lean clay	9/2/2015
○	11.5	30	13	17	CL	Dark brown, Sandy lean clay	9/2/2015

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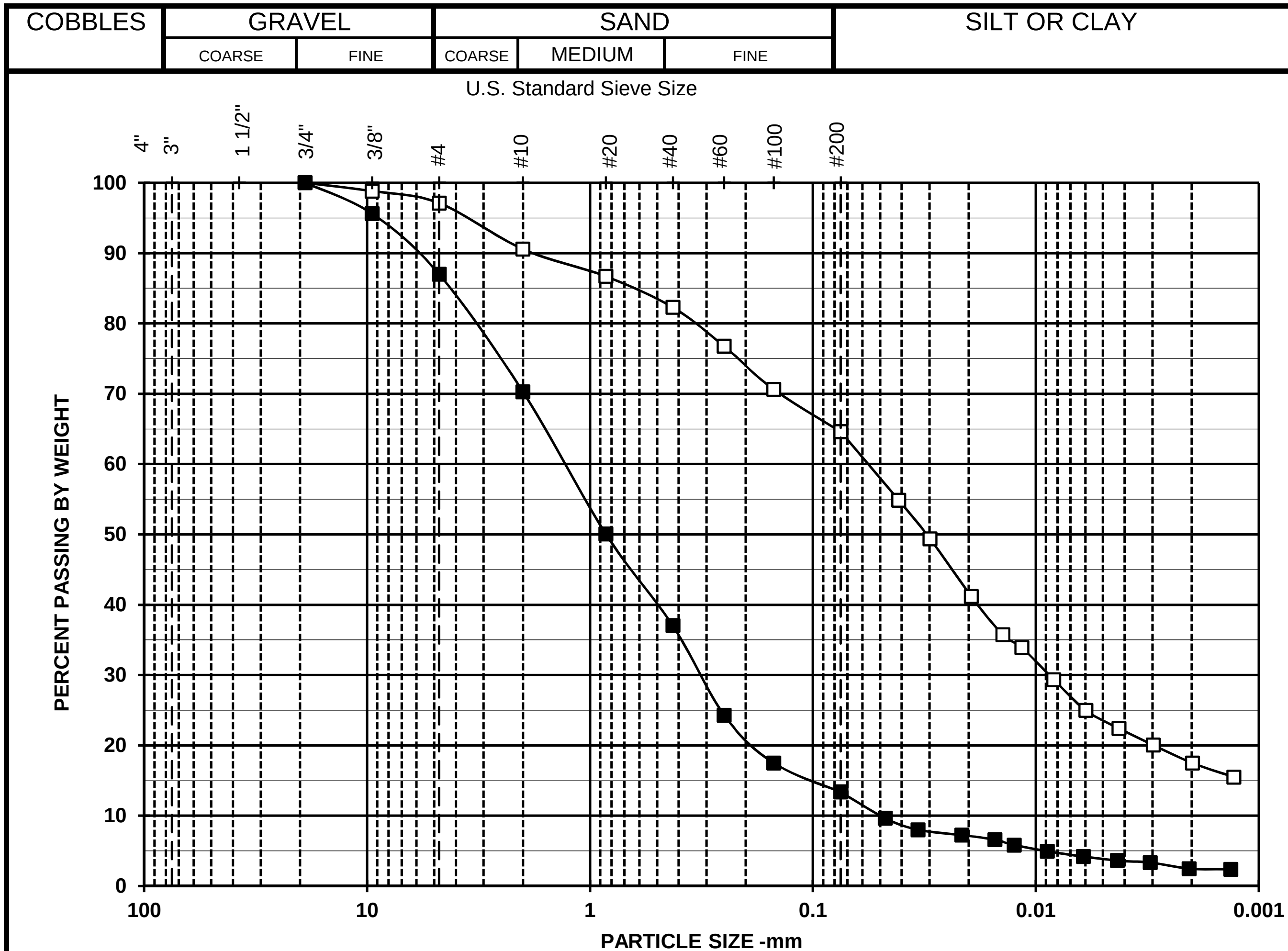
Dynegy CCR - Newton



Symbol	□	■	○
Boring	NEW-B001	NEW-B001	
Sample	S-18	S-24	
Depth	65-67	95-97	
% +3"	0.0	0.0	
% Gravel	2.9	13.0	
% SAND	32.5	73.6	
%C SAND	6.6	16.7	
%M SAND	8.3	33.3	
%F SAND	17.7	23.6	
% FINES	64.6	13.4	
% -2μ	18	2	
D_{100} (mm)	19.00	19.00	
D_{60} (mm)	0.06	1.41	
D_{30} (mm)	0.01	0.33	
D_{10} (mm)			
Cc			
Cu			

Particle Size (Sieve #)	PERCENT FINER □	■	○
4"			
3"			
1 1/2"			
3/4"	100.0	100.0	
3/8"	98.8	95.6	
4	97.1	87.0	
10	90.6	70.3	
20	86.7	50.1	
40	82.3	37.0	
60	76.7	24.3	
100	70.6	17.5	
200	64.6	13.4	

SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□	12.8	33	14	19	CL	Dark brown, Sandy lean clay	9/2/2015
■	11.0				SM	Brown, Silty sand	9/2/2015
○							

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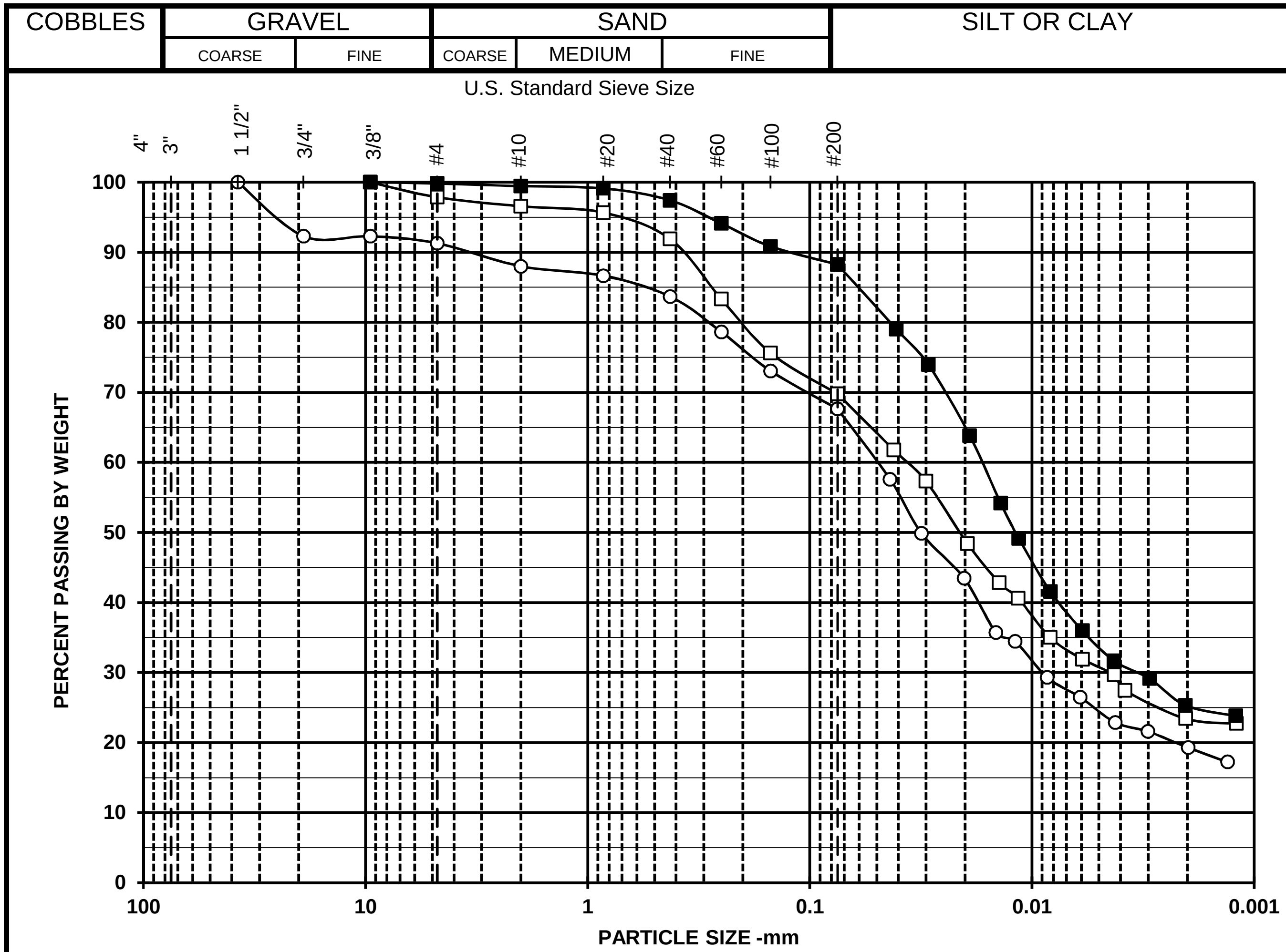

Symbol	□	■	○
Boring	NEW-B003	NEW-B003	NEW-B003
Sample	S-6	S-8	S-13
Depth	30-32	40-42	65-67
% +3"	0.0	0.0	0.0
% Gravel	2.1	0.2	8.7
% SAND	28.1	11.6	23.7
%C SAND	1.3	0.4	3.3
%M SAND	4.7	2.0	4.3
%F SAND	22.1	9.2	16.0
% FINES	69.8	88.2	67.6
% -2µ	23	25	19
D_{100} (mm)	9.50	9.50	37.50
D_{60} (mm)	0.04	0.02	0.05
D_{30} (mm)	0.00	0.00	0.01
D_{10} (mm)			
Cc			
Cu			

Particle Size (Sieve #)	PERCENT FINER □	■	○
4"			
3"			
1 1/2"			100.0
3/4"			92.3
3/8"	100.0	100.0	92.3
4	97.9	99.8	91.3
10	96.6	99.4	88.0
20	95.7	99.1	86.6
40	91.9	97.4	83.7
60	83.3	94.1	78.6
100	75.6	90.8	73.0
200	69.8	88.2	67.6

SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□	19.6	42	14	28	CL	Brown , Sandy lean clay	9/3/2015
■	22.9	50	18	32	CH	Brown, Fat clay	9/3/2015
○	12.7				CL	Brown, Sandy lean clay	8/31/2015

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PARTICLE SIZE DISTRIBUTION

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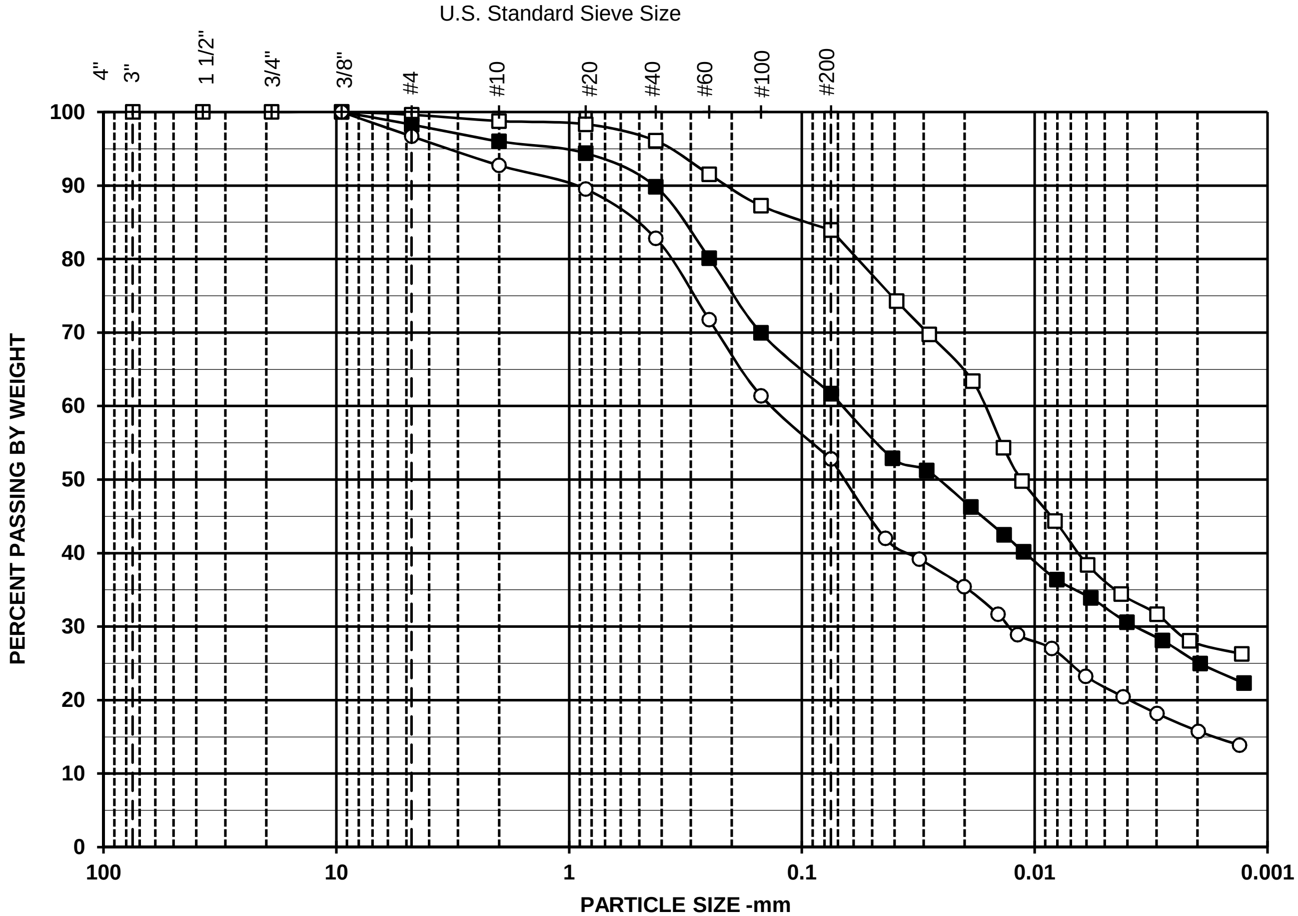
COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



Symbol	□	■	○
Boring	NEW-B004	NEW-B004	NEW-B004
Sample	ST-4C	S-10	S-13
Depth	9.5	27.5-29.5	33.5-35.5
% +3"	0.0	0.0	0.0
% Gravel	0.4	1.7	3.3
% SAND	15.7	36.6	43.9
%C SAND	0.9	2.3	4.0
%M SAND	2.7	6.2	9.9
%F SAND	12.1	28.1	30.0
% FINES	83.9	61.7	52.8
% -2μ	28	25	16
D_{100} (mm)	9.50	9.50	9.50
D_{60} (mm)	0.02	0.07	0.14
D_{30} (mm)	0.00	0.00	0.01
D_{10} (mm)			
Cc			
Cu			

Particle Size (Sieve #)	PERCENT FINER □	■	○
4"	100.0		
3"	100.0		
1 1/2"	100.0		
3/4"	100.0		
3/8"	100.0	100.0	100.0
4	99.6	98.3	96.7
10	98.8	96.0	92.7
20	98.3	94.4	89.5
40	96.1	89.8	82.8
60	91.5	80.1	71.7
100	87.2	70.0	61.4
200	83.9	61.7	52.8

SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□		50	13	37	CH	Gray brown , Fat clay with sand	10/27/2015
■	17.7	37	14	23	CL	Brown, Sandy lean clay	9/2/2015
○	9.0				CL	Light brown, Sandy lean clay	8/31/2015

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PARTICLE SIZE DISTRIBUTION

Dynegy CCR - Newton

Analysis File: 3SV-MasterRev4b

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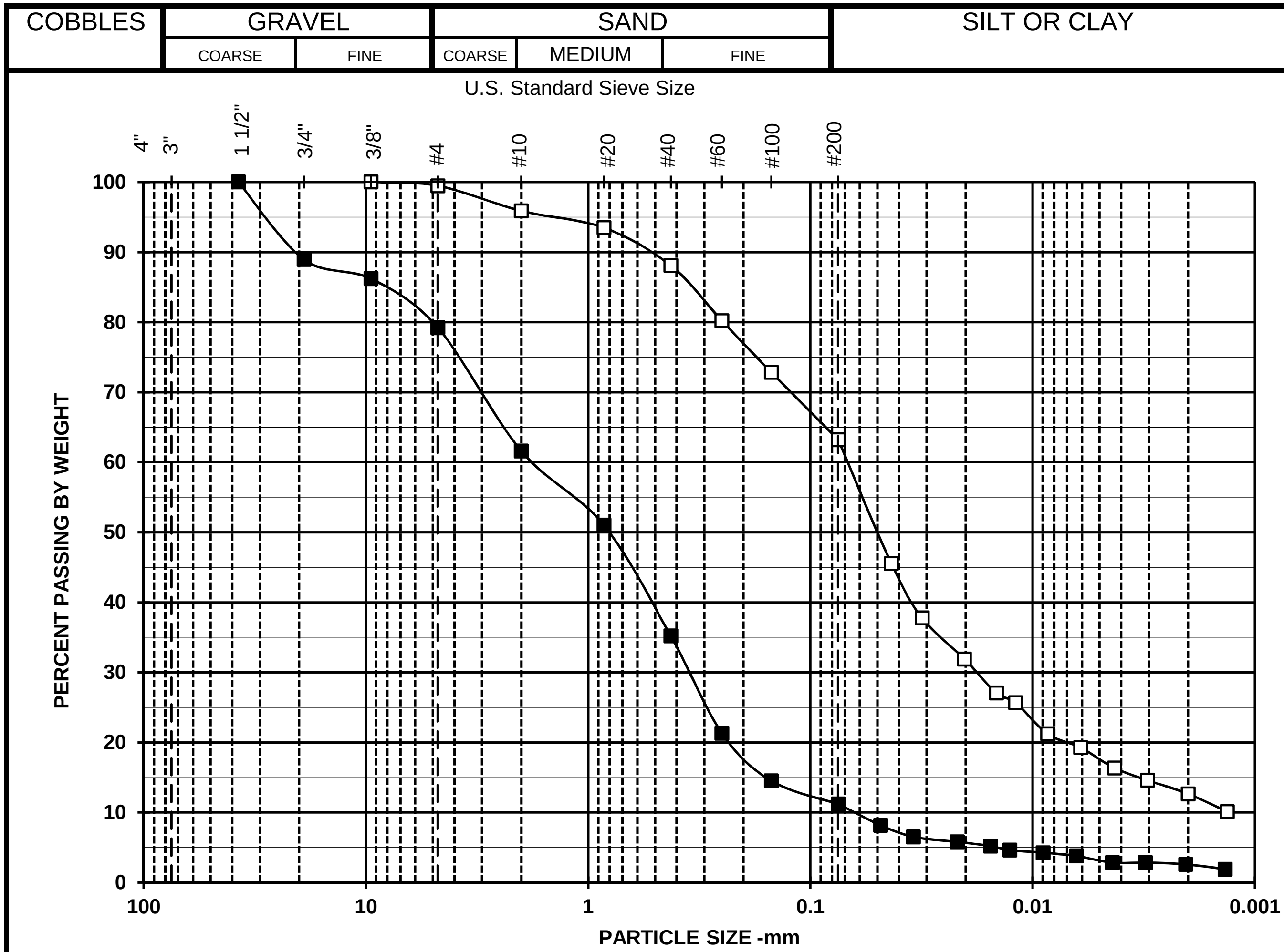

Symbol	□	■	○
Boring	NEW-B004A	NEW-B004A	
Sample	S-1	S-11	
Depth	45-46	95-96.5	
% +3"	0.0	0.0	
% Gravel	0.5	20.8	
% SAND	36.3	68.0	
%C SAND	3.6	17.6	
%M SAND	7.8	26.4	
%F SAND	24.9	24.0	
% FINES	63.2	11.2	
% -2μ	13	3	
D_{100} (mm)	9.50	37.50	
D_{60} (mm)	0.07	1.82	
D_{30} (mm)	0.02	0.36	
D_{10} (mm)		0.06	
Cc		1.1	
Cu		28.4	

Particle Size (Sieve #)	PERCENT FINER □	■	○
4"			
3"			
1 1/2"		100.0	
3/4"		88.9	
3/8"	100.0	86.2	
4	99.5	79.2	
10	95.9	61.6	
20	93.5	51.0	
40	88.1	35.2	
60	80.2	21.3	
100	72.8	14.5	
200	63.2	11.2	

SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□	10.4				CL	Brown, Sandy lean clay	8/31/2015
■	11.1				SW-SM	Brown, Well-graded sand with silt and gravel	8/31/2015
○							

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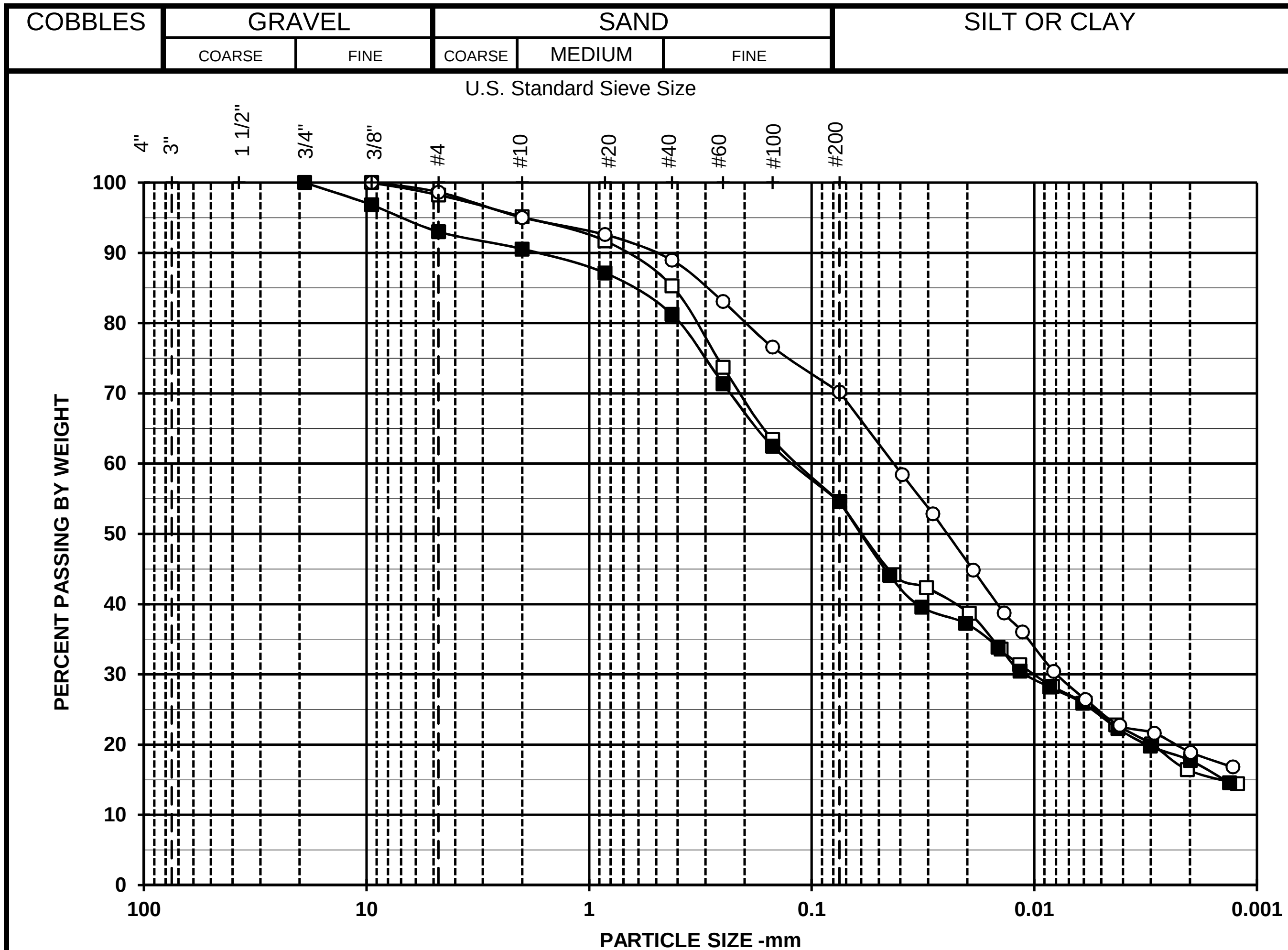
PARTICLE SIZE DISTRIBUTION

Dynegy CCR - Newton



Symbol	□	■	○
Boring	NEW-B005	NEW-B005	NEW-B005
Sample	S-6	S-8	S-12
Depth	15-16.5	25-26	45-47
% +3"	0.0	0.0	0.0
% Gravel	1.8	7.0	1.4
% SAND	43.6	38.4	28.4
%C SAND	3.1	2.5	3.6
%M SAND	9.8	9.3	6.1
%F SAND	30.7	26.7	18.8
% FINES	54.6	54.6	70.2
% -2μ	16	18	19
D_{100} (mm)	9.50	19.00	9.50
D_{60} (mm)	0.12	0.13	0.04
D_{30} (mm)	0.01	0.01	0.01
D_{10} (mm)			
Cc			
Cu			

Particle Size (Sieve #)	PERCENT FINER □	■	○
4"			
3"			
1 1/2"			
3/4"		100.0	
3/8"	100.0	96.8	100.0
4	98.2	93.0	98.6
10	95.1	90.5	95.0
20	91.7	87.1	92.6
40	85.3	81.2	89.0
60	73.7	71.4	83.1
100	63.4	62.5	76.6
200	54.6	54.6	70.2

SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□	9.4	27	12	15	CL	Brown, Sandy lean clay	9/3/2015
■	11.6				CL	Brown, Sandy lean clay	8/31/2015
○	13.1	33	15	18	CL	Dark brown, Lean clay with sand	9/2/2015

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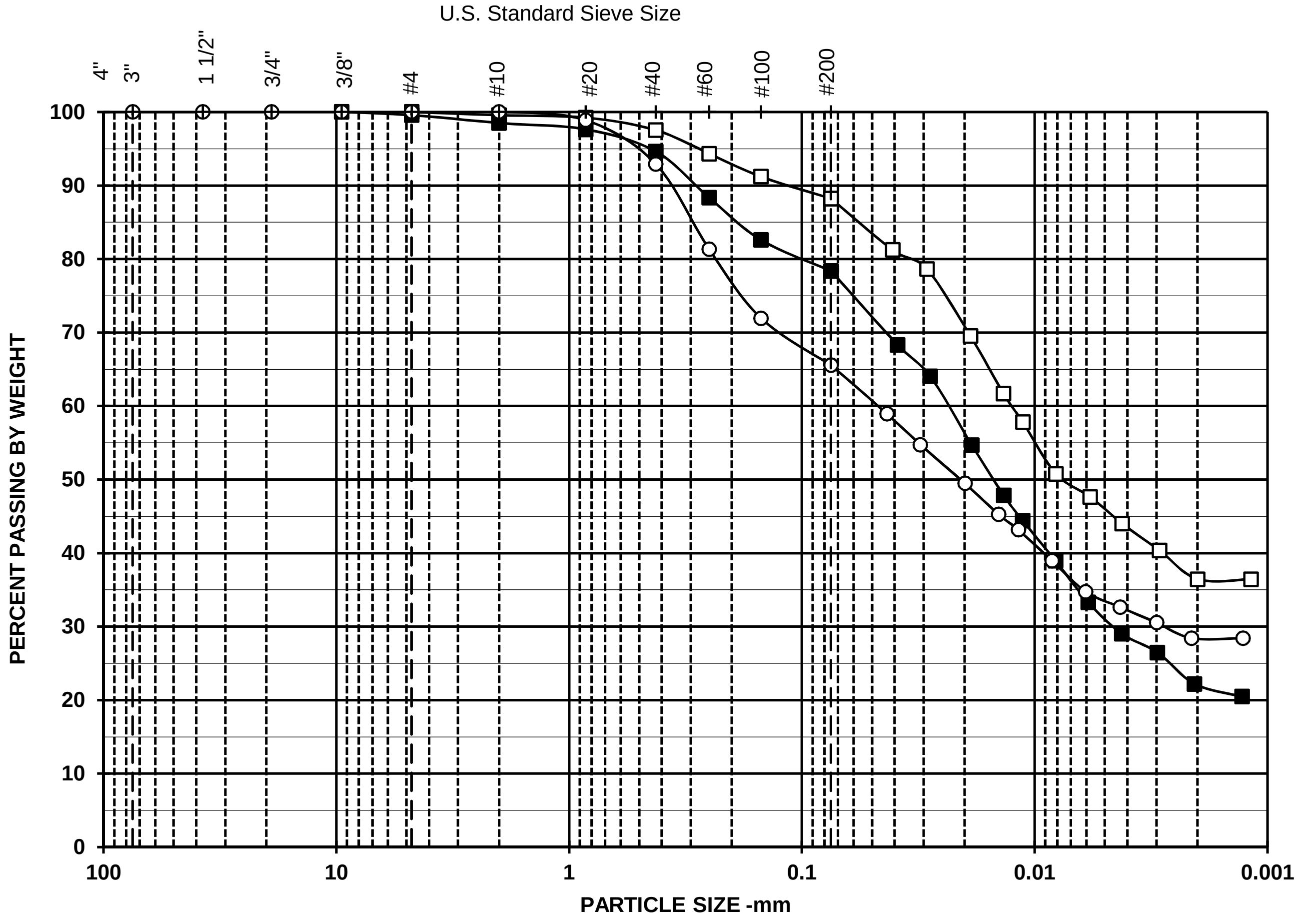
PARTICLE SIZE DISTRIBUTION

Dynegy CCR - Newton

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



Symbol	□	■	○
Boring	NEW-B006	NEW-B006	NEW-B006
Sample	S-3	ST-1B	ST-2
Depth	10-12	21.20	26.75
% +3"	0.0	0.0	0.0
% Gravel	0.0	0.4	0.0
% SAND	11.8	21.2	34.4
%C SAND	0.4	1.1	0.0
%M SAND	2.0	3.9	7.1
%F SAND	9.3	16.3	27.4
% FINES	88.2	78.4	65.6
% -2µ	36	22	28
D_{100} (mm)	4.75	9.50	2.00
D_{60} (mm)	0.01	0.02	0.05
D_{30} (mm)	0.00	0.00	0.00
D_{10} (mm)			
Cc			
Cu			

Particle Size (Sieve #)	PERCENT FINER □	PERCENT FINER ■	PERCENT FINER ○
4"			100.0
3"			100.0
1 1/2"			100.0
3/4"			100.0
3/8"		100.0	100.0
4	100.0	99.6	100.0
10	99.6	98.5	100.0
20	99.2	97.6	98.9
40	97.5	94.6	92.9
60	94.3	88.3	81.3
100	91.2	82.6	71.9
200	88.2	78.4	65.6

SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□	21.2	66	14	52	CH	Brown, Fat clay	9/3/2015
■	18.2	40	17	23	CL	Brown, Lean clay with sand	10/29/2015
○		44	12	32	CL	Brown, Sandy lean clay	11/5/2015

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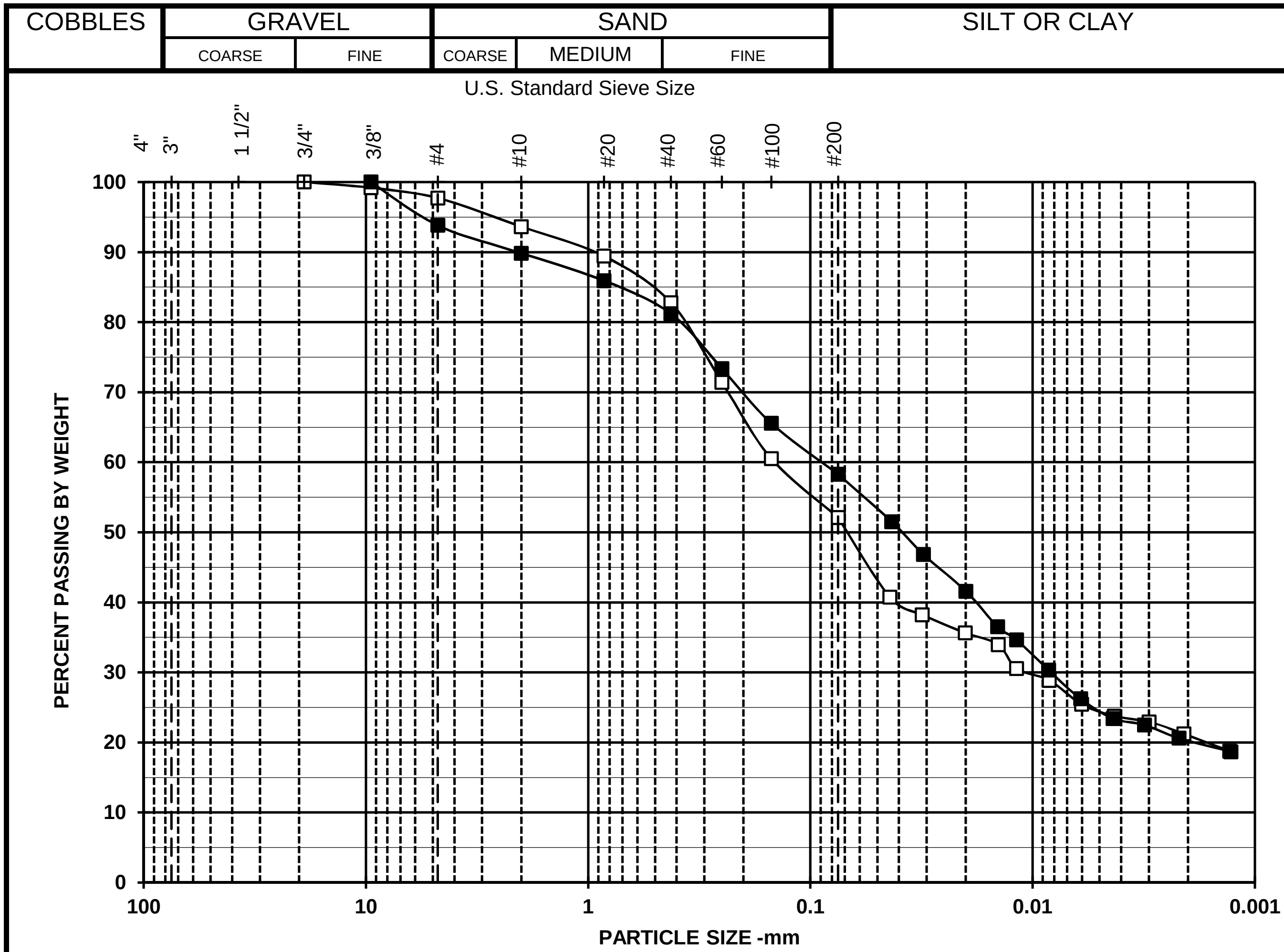
PARTICLE SIZE DISTRIBUTION

Dynegy CCR - Newton



Symbol	□	■	○
Boring	NEW-B006	NEW-B006	
Sample	ST-3C	ST-4	
Depth	31.8	35-35.8	
% +3"	0.0	0.0	
% Gravel	2.3	6.2	
% SAND	45.6	35.5	
%C SAND	4.1	4.0	
%M SAND	10.8	8.6	
%F SAND	30.7	22.9	
% FINES	52.1	58.3	
% -2μ	21	20	
D_{100} (mm)	19.00	9.50	
D_{60} (mm)	0.15	0.09	
D_{30} (mm)	0.01	0.01	
D_{10} (mm)			
Cc			
Cu			

Particle Size (Sieve #)	PERCENT FINER □	■	○
4"			
3"			
1 1/2"			
3/4"	100.0		
3/8"	99.2	100.0	
4	97.7	93.8	
10	93.6	89.8	
20	89.4	85.9	
40	82.8	81.2	
60	71.4	73.4	
100	60.5	65.6	
200	52.1	58.3	

SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□		37	15	22	CL	Dark brown, Sandy lean clay	10/13/2015
■		30	13	17	CL	Light brown, Sandy lean clay	9/28/2015
○							

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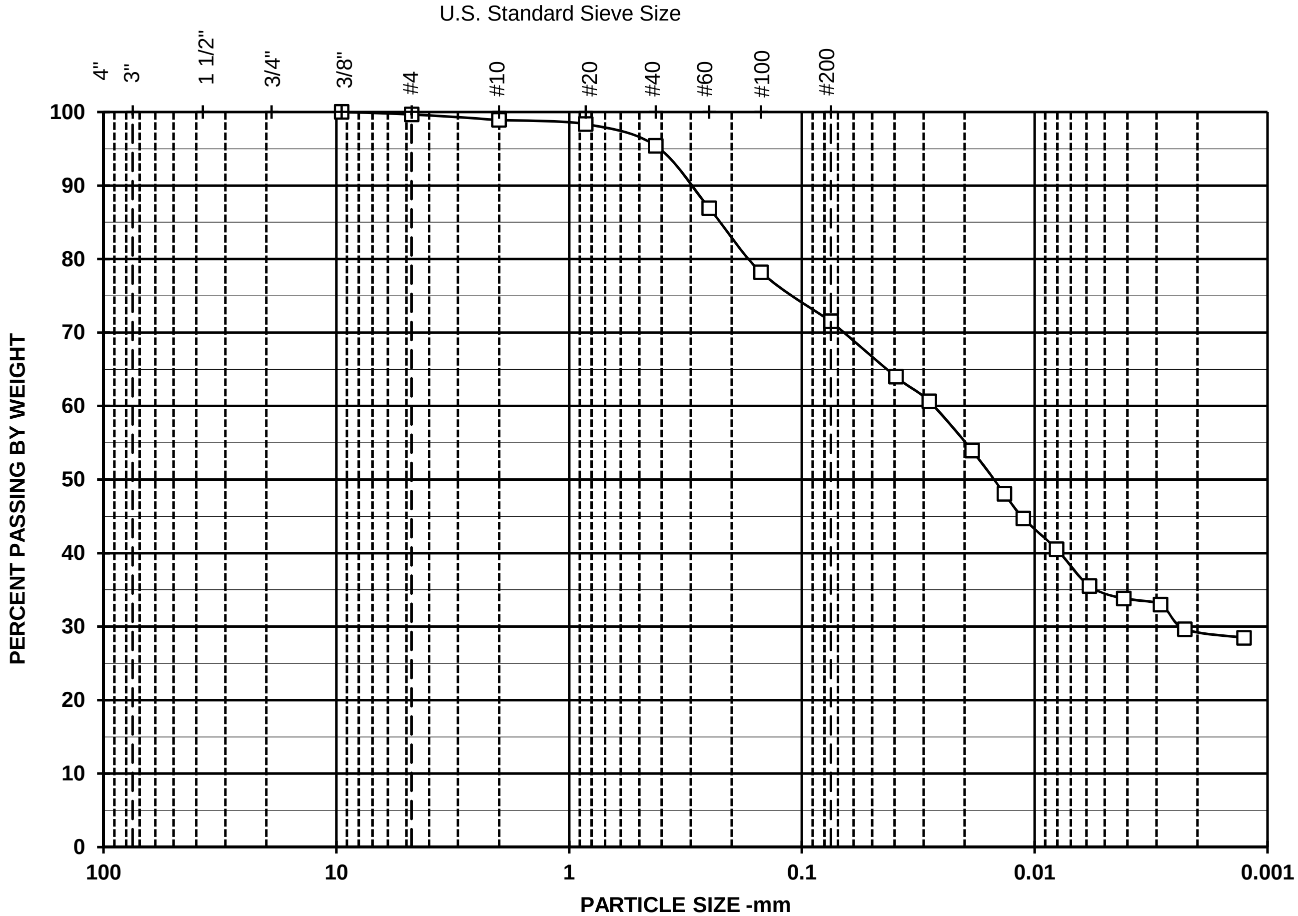
COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□	21.5	52	12	40	CH	Brown , Fat clay with sand	10/19/2015
■							
○							

Symbol	□	■	○
Boring	NEW-B007		
Sample	ST-3C		
Depth	31.7		
% +3"	0.0		
% Gravel	0.3		
% SAND	28.2		
%C SAND	0.7		
%M SAND	3.5		
%F SAND	23.9		
% FINES	71.5		
% -2µ	29		
D_{100} (mm)	9.50		
D_{60} (mm)	0.03		
D_{30} (mm)	0.00		
D_{10} (mm)			
Cc			
Cu			

Particle Size (Sieve #)	PERCENT FINER □	■	○
4"			
3"			
1 1/2"			
3/4"			
3/8"	100.0		
4	99.7		
10	98.9		
20	98.4		
40	95.4		
60	86.9		
100	78.2		
200	71.5		

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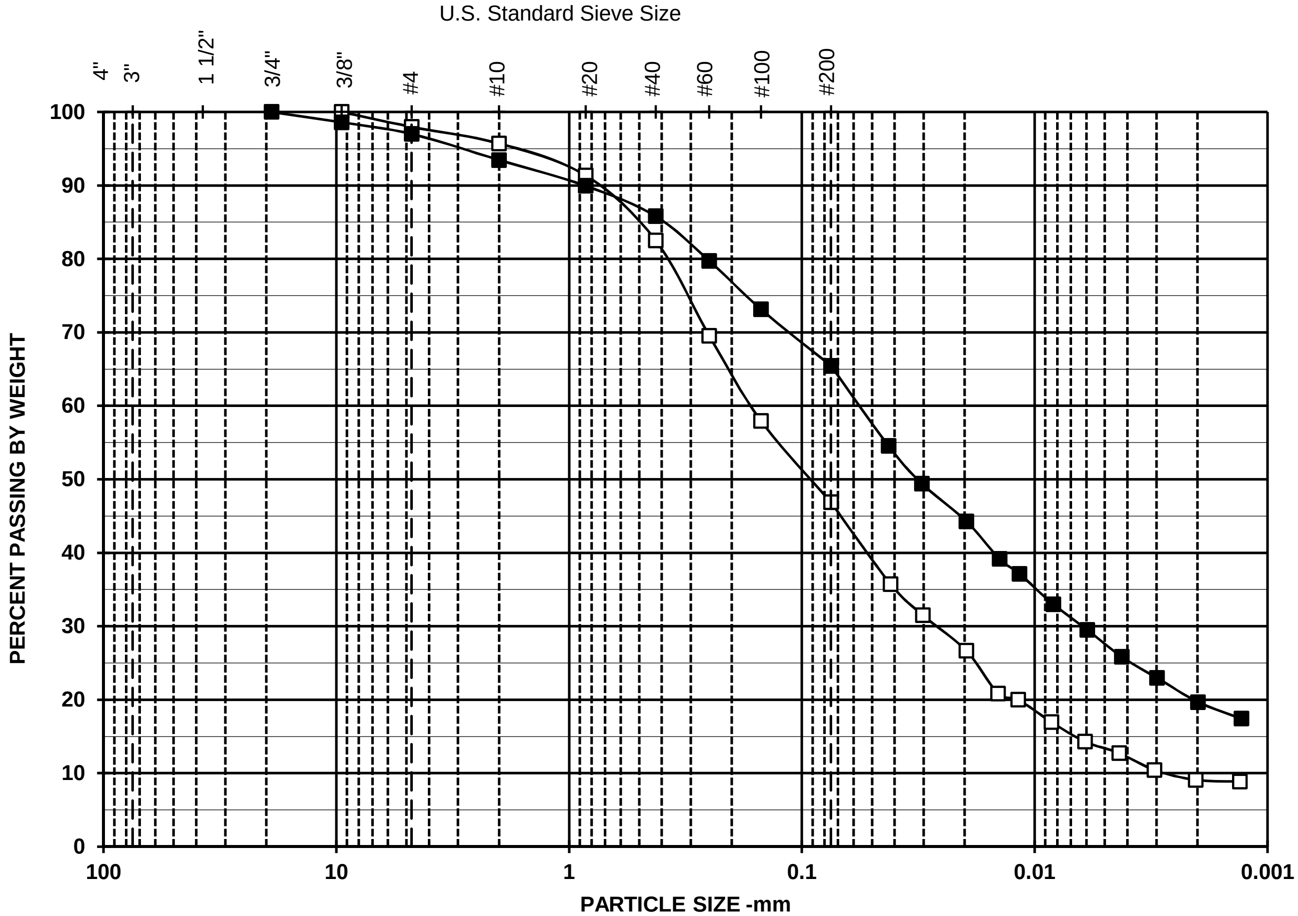
COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



Symbol	□	■	○
Boring	NEW-B008	NEW-B008	
Sample	S-8	S-10	
Depth	40-42	50-51.5	
% +3"	0.0	0.0	
% Gravel	2.0	3.0	
% SAND	51.1	31.6	
%C SAND	2.3	3.5	
%M SAND	13.2	7.7	
%F SAND	35.7	20.4	
% FINES	46.9	65.4	
% -2µ	9	20	
D_{100} (mm)	9.50	19.00	
D_{60} (mm)	0.17	0.06	
D_{30} (mm)	0.03	0.01	
D_{10} (mm)			
Cc			
Cu			

Particle Size (Sieve #)	PERCENT FINER □	■	○
4"			
3"			
1 1/2"			
3/4"		100.0	
3/8"	100.0	98.6	
4	98.0	97.0	
10	95.7	93.5	
20	91.4	89.9	
40	82.5	85.8	
60	69.5	79.7	
100	58.0	73.1	
200	46.9	65.4	

SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□	14.6				SC	Brown , Clayey sand	9/2/2015
■	15.4	32	16	16	CL	Brown, Sandy lean clay	9/2/2015
○							

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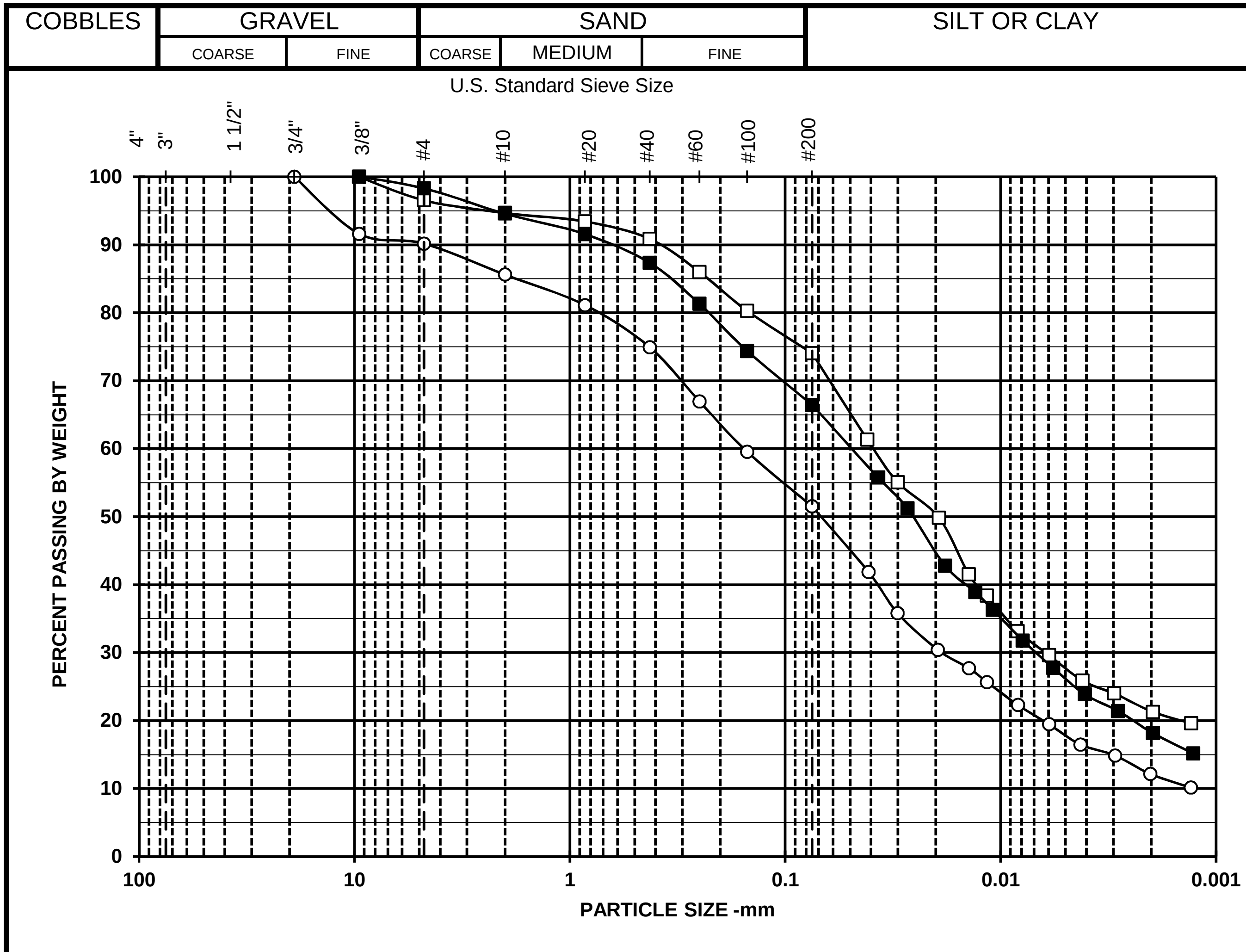

Symbol	□	■	○
Boring	NEW-B009	NEW-B009	NEW-B009
Sample	S-10	S-12	S-14
Depth	50-52	60-62	70-71.4
% +3"	0.0	0.0	0.0
% Gravel	3.5	1.7	9.8
% SAND	22.5	31.9	38.7
%C SAND	1.9	3.7	4.6
%M SAND	3.8	7.3	10.7
%F SAND	16.8	20.9	23.4
% FINES	74.0	66.4	51.5
% -2μ	21	18	12
D_{100} (mm)	9.50	9.50	19.00
D_{60} (mm)	0.04	0.05	0.16
D_{30} (mm)	0.01	0.01	0.02
D_{10} (mm)			
Cc			
Cu			

Particle Size (Sieve #)	PERCENT FINER □	■	○
4"			
3"			
1 1/2"			
3/4"			100.0
3/8"	100.0	100.0	91.6
4	96.5	98.3	90.2
10	94.7	94.6	85.6
20	93.4	91.6	81.1
40	90.9	87.3	74.9
60	86.0	81.3	67.0
100	80.3	74.4	59.5
200	74.0	66.4	51.5

SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□	13.7				CL	Brown, Lean clay with sand	8/31/2015
■	13.5	24	16	8	CL	Brown, Sandy lean clay	9/2/2015
○	12.2				CL	Brown, Sandy lean clay	9/2/2015

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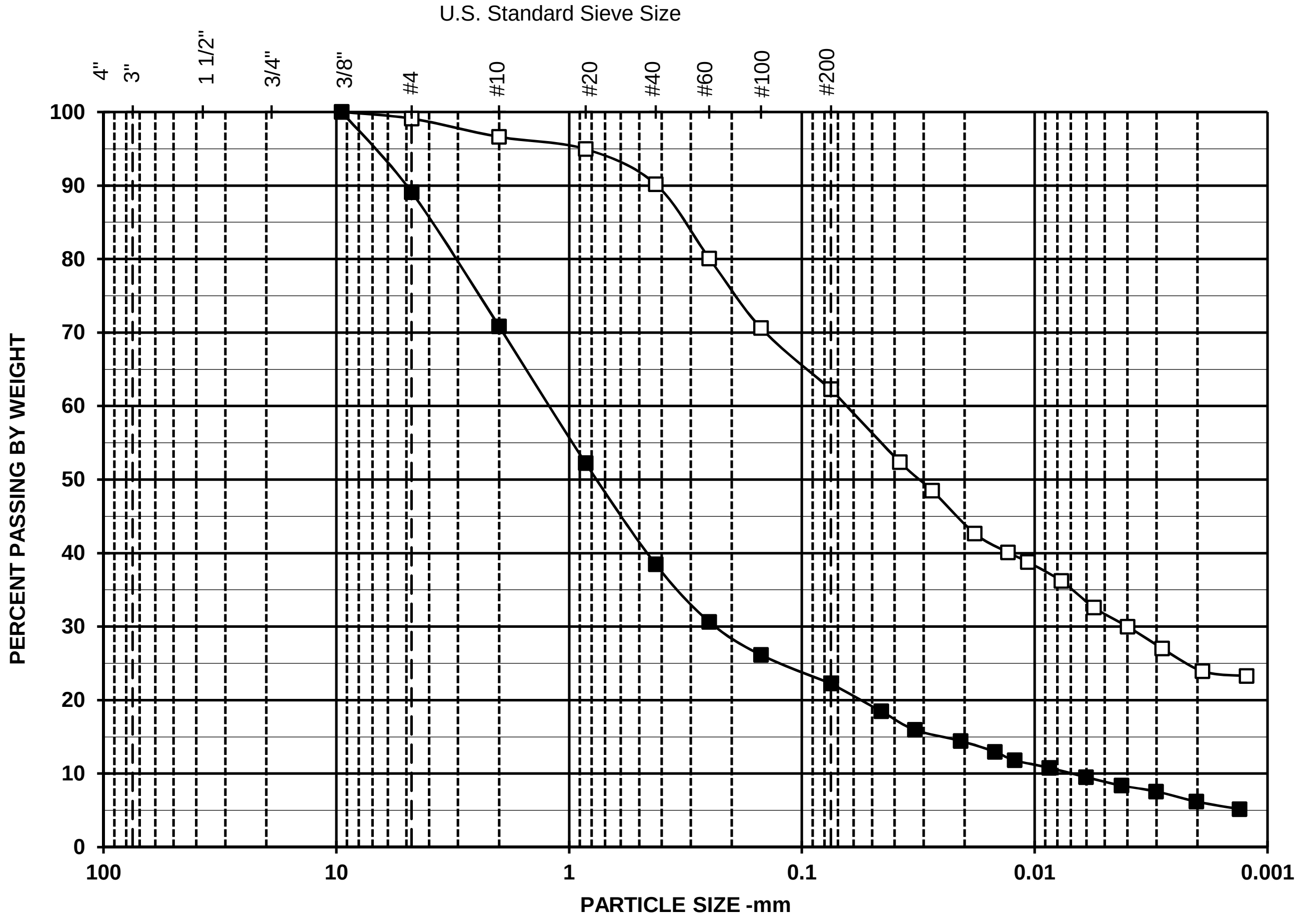
COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



Symbol	□	■	○
Boring	NEW-B010	NEW-B010	
Sample	S-7	S-13	
Depth	30-32	50-50.8	
% +3"	0.0	0.0	
% Gravel	0.9	10.9	
% SAND	36.8	66.8	
%C SAND	2.5	18.3	
%M SAND	6.5	32.3	
%F SAND	27.9	16.2	
% FINES	62.3	22.3	
% -2μ	24	6	
D_{100} (mm)	9.50	9.50	
D_{60} (mm)	0.07	1.33	
D_{30} (mm)	0.00	0.24	
D_{10} (mm)			
Cc			
Cu			

Particle Size (Sieve #)	PERCENT FINER □	■	○
4"			
3"			
1 1/2"			
3/4"			
3/8"	100.0	100.0	
4	99.1	89.1	
10	96.6	70.8	
20	95.0	52.2	
40	90.2	38.5	
60	80.1	30.6	
100	70.6	26.1	
200	62.3	22.3	

SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□	21.0	49	16	33	CL	Brown , Sandy lean clay	9/2/2015
■	10.1				SC	Brown, Clayey sand	9/2/2015
○							

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PARTICLE SIZE DISTRIBUTION

Dynegy CCR - Newton

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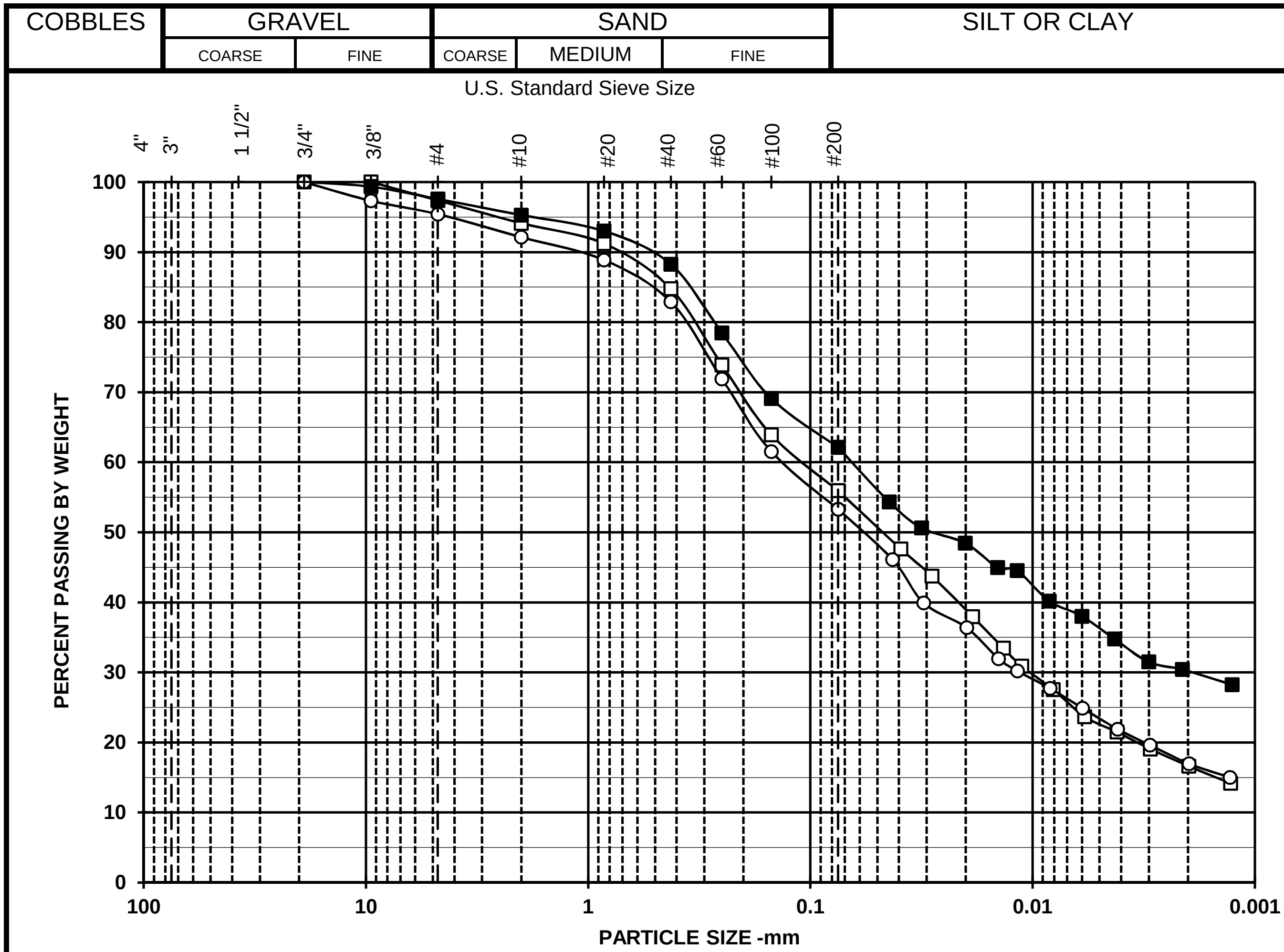

Symbol	□	■	○
Boring	NEW-B012	NEW-B012	NEW-B012
Sample	S-11	ST-12C	S-18
Depth	40-42	46.4	75-77
% +3"	0.0	0.0	0.0
% Gravel	2.6	2.4	4.6
% SAND	41.5	35.5	42.1
%C SAND	3.3	2.3	3.3
%M SAND	9.3	7.0	9.2
%F SAND	28.8	26.1	29.6
% FINES	55.9	62.1	53.3
% -2μ	17	30	17
D_{100} (mm)	9.50	19.00	19.00
D_{60} (mm)	0.11	0.07	0.14
D_{30} (mm)	0.01	0.00	0.01
D_{10} (mm)			
Cc			
Cu			

Particle Size (Sieve #)	PERCENT FINER □	■	○
4"			
3"			
1 1/2"			
3/4"		100.0	100.0
3/8"	100.0	99.4	97.3
4	97.4	97.6	95.4
10	94.1	95.3	92.1
20	91.2	93.0	88.9
40	84.8	88.3	82.9
60	73.9	78.5	71.9
100	63.9	69.1	61.5
200	55.9	62.1	53.3

SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□	9.9				CL	Brown , Sandy lean clay	9/2/2015
■		43	14	29	CL	Brown, Sandy lean clay	9/23/2015
○	11.8	29	13	16	CL	Brown, Sandy lean clay	9/2/2015

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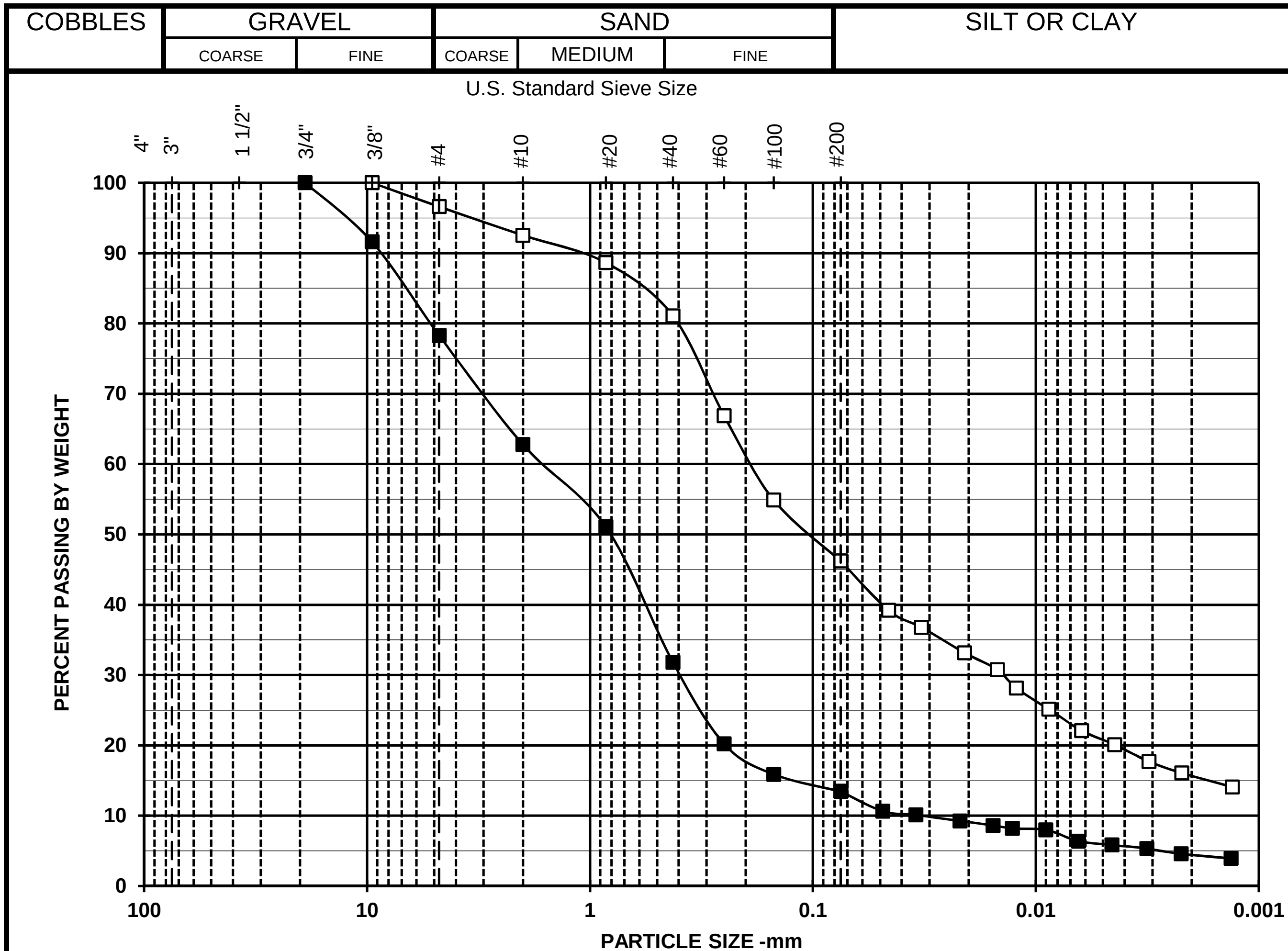

Symbol	□	■	○
Boring	NEW-B014	NEW-B014	
Sample	ST-1B	ST-3C	
Depth	3.5	36.65	
% +3"	0.0	0.0	
% Gravel	3.4	21.7	
% SAND	50.4	64.8	
%C SAND	4.1	15.5	
%M SAND	11.5	31.0	
%F SAND	34.9	18.3	
% FINES	46.2	13.5	
% -2μ	16	4	
D_{100} (mm)	9.50	19.00	
D_{60} (mm)	0.19	1.73	
D_{30} (mm)	0.01	0.40	
D_{10} (mm)			
Cc			
Cu			

Particle Size (Sieve #)	PERCENT FINER □	PERCENT FINER ■	PERCENT FINER ○
4"			
3"			
1 1/2"			
3/4"		100.0	
3/8"	100.0	91.6	
4	96.6	78.3	
10	92.5	62.8	
20	88.7	51.1	
40	81.1	31.8	
60	66.9	20.2	
100	54.9	15.9	
200	46.2	13.5	

SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□	9.5	28	13	15	SC	Orange brown, Clayey sand	9/18/2015
■		38	13	25	SC	Brown, Clayey sand with gravel	9/23/2015
○							

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Dynegy CCR - Newton

Analysis File: 3SV-MasterRev4b

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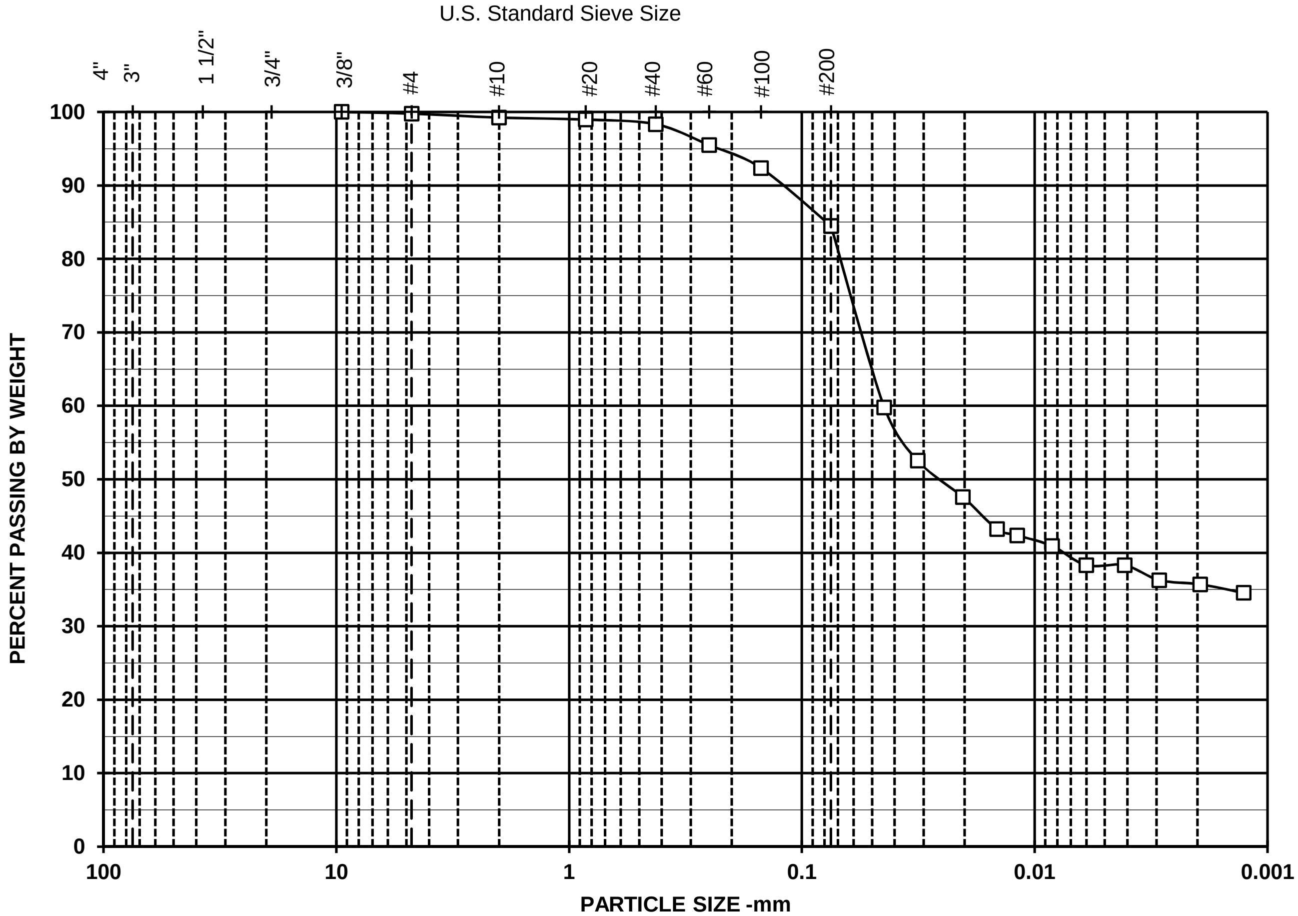
COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



Symbol	□	■	○
Boring	NEW-B015		
Sample	S-8		
Depth	35-37		
% +3"	0.0		
% Gravel	0.2		
% SAND	15.3		
%C SAND	0.5		
%M SAND	0.9		
%F SAND	13.8		
% FINES	84.5		
% -2µ	36		
D_{100} (mm)	9.50		
D_{60} (mm)	0.04		
D_{30} (mm)	0.00		
D_{10} (mm)			
Cc			
Cu			

Particle Size (Sieve #)	PERCENT FINER □	■	○
4"			
3"			
1 1/2"			
3/4"			
3/8"	100.0		
4	99.8		
10	99.2		
20	99.0		
40	98.3		
60	95.5		
100	92.4		
200	84.5		

SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□	21.5	46	14	32	CL	Brown , Lean clay with sand	9/2/2015
■							
○							

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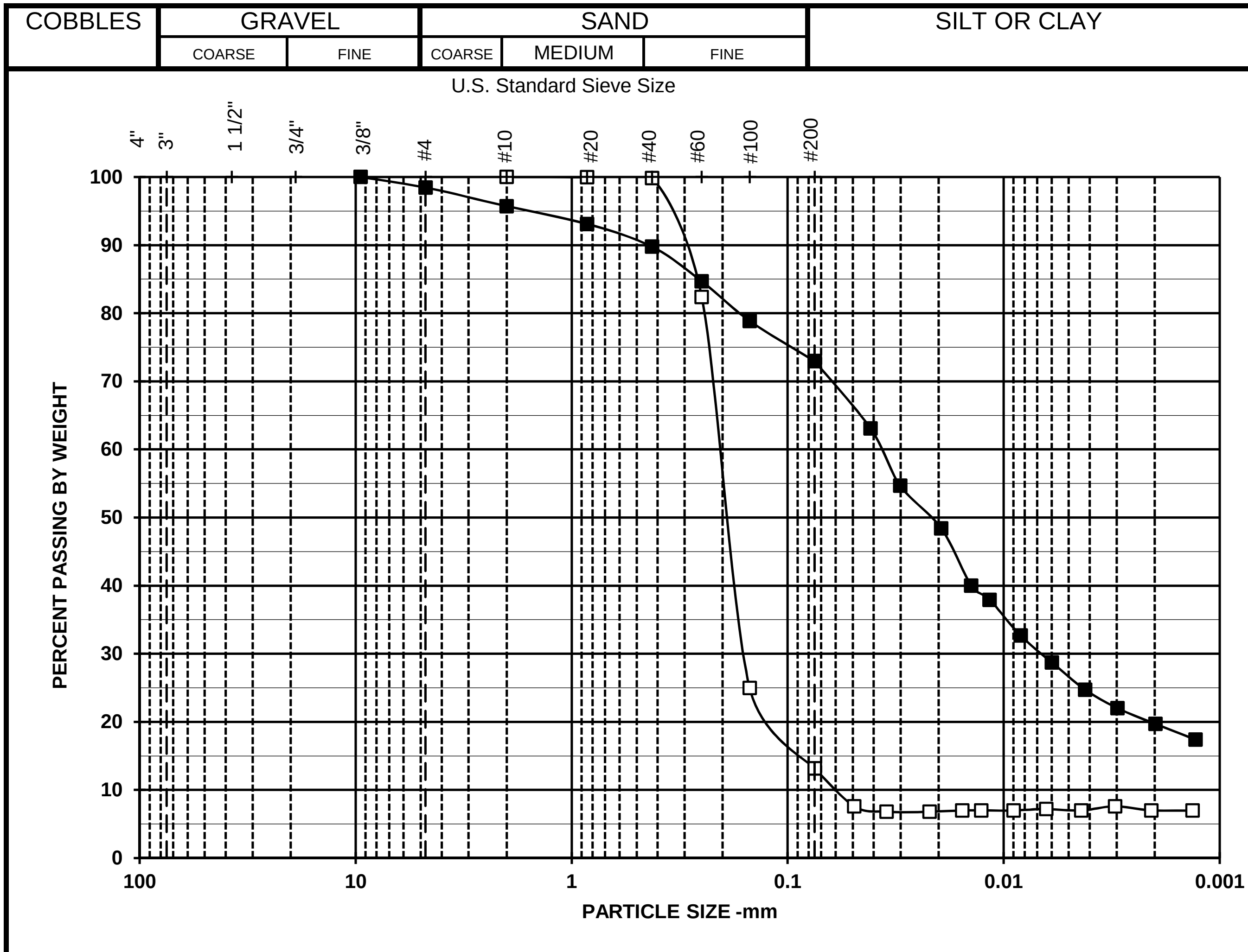

Symbol	□	■	○
Boring	NEW-B016	NEW-B016	
Sample	S-3B	S-6	
Depth	6.5-7	15-17	
% +3"	0.0	0.0	
% Gravel	0.0	1.6	
% SAND	86.8	25.4	
%C SAND	0.0	2.7	
%M SAND	0.2	5.9	
%F SAND	86.7	16.8	
% FINES	13.2	73.0	
% -2μ	7	20	
D_{100} (mm)	2.00	9.50	
D_{60} (mm)	0.21	0.04	
D_{30} (mm)	0.16	0.01	
D_{10} (mm)			
Cc			
Cu			

Particle Size (Sieve #)	PERCENT FINER □	■	○
4"			
3"			
1 1/2"			
3/4"			
3/8"		100.0	
4		98.4	
10	100.0	95.7	
20	100.0	93.1	
40	99.8	89.8	
60	82.4	84.7	
100	25.0	78.9	
200	13.2	73.0	

SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□					SM	Brown, Silty sand	9/1/2015
■	11.1	52	14	38	CH	Dark brown, Fat clay with sand	9/2/2015
○							

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PARTICLE SIZE DISTRIBUTION

Dynegy CCR - Newton

PERMEABILITY TEST: FALLING HEAD - CONSTANT VOLUME U-TUBE
ASTM D 5084 - Method F

Project No.: T60428794 | BORING: NEW-B003 | Test No.: P10611
Project Name: Dynegy CCR - Newton | SAMPLE: ST-3 | DEPTH (ft): 28.3

Specimen - Apparatus set-up - Test Information | Cell No. D | Apparatus No. 2 | Stage No.: 4

Preliminary Length/Area Calculations

Lo =	4.021	in	Lo=	10.212	cm
dLc=	0.057	in	Ao =	42.07	cm^2
Lc=	3.964	in	Vo =	429.65	cm^3
			Lc=	10.068	cm
dVc = 3 Vo * (dLc/Lo)			dVc=	18.27	cm^3
			Vc =	411.38	cm^3
Sc =	0.246	cm^{-1}	Ac=	40.862	cm^2

1) Specimen Tested in : [x] Triaxial Cell or [ ] Compaction Mold or
[x] with stones or [ ] Stones with filter paper or top + bottom
2) Specimen orientation for: [x] Vertical or [ ] Horizontal permeability determination
3) During saturation: Water flushed up sides of specimen to remove air [x] No [ ] Yes
4) During consolidation: [x] Top and bottom drainage or [ ] Top [ ] Bottom only
5) Direction of permeant : [x] Up during or [ ] Down during permeation
6) Permeant: water used [x] Tap [ ] Distilled
or [ ] Demineralized [ ] 0.005 N calcium sulfate (CaSO4)

Equations Used
Kt = - 0.0000746 * Sc/dT(min) * ln (ho/hf)
RT = (-0.02452*(ave. temp in C) + 1.495)
K @ 20 ºC = RT * Kt TubeC= 1.3214

Consol Stage-Trial No.	Temp. º C	Date	Time hr	min	sec	Initial σ_c psi	Ub psi	U-tube Reading Head (cm) (cc)	Tail (cm) (cc)	Flow in/out gradient	Permeability Preliminary Final at 20ºC cm/sec Dev. from Ave.
initial	21.0	10/27/15	09	13	00	120.8	100.0	60.70	42.60	1.01	9.84E-08
final	21.2	10/27/15	09	51	00			58.18	43.40		9.51E-08
1	RT = 0.978	dT =	38.00 min			σ'c =	3.0 ksf	0.187	0.185	io= 22.6	-1%
initial	21.2	10/27/15	09	52	00	120.8	100.0	59.07	43.10	1.05	1.01E-07
final	21.5	10/27/15	10	30	00			56.79	43.80		9.72E-08
2	RT = 0.971	dT =	38.00 min			σ'c =	3.0 ksf	0.170	0.162	io= 19.9	1%
initial	21.5	10/27/15	10	31	00	120.8	100.0	58.80	43.20	1.00	1.03E-07
final	21.8	10/27/15	11	15	00			56.22	44.03		9.82E-08
3	RT = 0.964	dT =	44.00 min			σ'c =	3.0 ksf	0.192	0.192	io= 19.5	2%
initial	21.8	10/27/15	11	16	00	120.8	100.0	58.70	43.23	1.00	1.01E-07
final	22.3	10/27/15	12	07	00			55.84	44.15		9.53E-08
4	RT = 0.954	dT =	51.00 min			σ'c =	3.0 ksf	0.213	0.213	io= 19.3	-1%
initial											
final											
5											
initial											
final											
6											

TEST SUMMARY

Final Specimen and Test Conditions

Lc = 10.068 cm ε_{axial} = 1.4%
Ac = 41.331 cm^2
Vc= 416.10 cm^3 ε_{vol} = 3.2%
Sc = 0.244 cm^{-1} Sc = Lc / Ac , final

	w (%)	γ_t (pcf)	γ_d (pcf)	S (%)
Initial	21.21	126.4	104.3	91.3
PreTest	21.34	130.7	107.7	100.0

HYDRAULIC CONDUCTIVITY SUMMARY

Averages for trials: 1-4
ave K @ 20 ºC: **9.64E-08** cm/sec
(i_o)ave = 20.3

Tested By: BB Reviewed By: G. Thomas

PERMEABILITY TEST: FALLING HEAD - CONSTANT VOLUME U-TUBE
ASTM D 5084 - Method F

Project No.: T60428794 | BORING: NEW-B004 | Test No.: P10610

Project Name: Dynegy CCR - Newton | SAMPLE: ST-12 | DEPTH (ft): 33.2

Specimen - Apparatus set-up - Test Information | Cell No. 6 | Apparatus No. 3 | Stage No.: 5

Preliminary Length/Area Calculations

Lo =	3.994	in	Lo=	10.145	cm
dLc=	0.058	in	Ao =	42.13	cm^2
Lc=	3.936	in	Vo =	427.40	cm^3
			Lc=	9.997	cm
dVc = 3 Vo * (dLc/Lo)			dVc=	18.62	cm^3
			Vc =	408.78	cm^3
Sc =	0.245	cm^{-1}	Ac=	40.889	cm^2

1) Specimen Tested in : [x] Triaxial Cell or [ ] Compaction Mold or
[x] with stones or [ ] Stones with filter paper or ____ top + bottom

2) Specimen orientation for: [x] Vertical or [ ] Horizontal permeability determination

3) During saturation: Water flushed up sides of specimen to remove air [x] No [ ] Yes

4) During consolidation: [x] Top and bottom drainage or [ ] Top [ ] Bottom only

5) Direction of permeant : [x] Up during or [ ] Down during permeation

6) Permeant: water used [x] Tap [ ] Distilled

or [ ] Demineralized [ ] 0.005 N calcium sulfate (CaSO4)

Equations Used

Kt = - 0.0000755 * Sc/dT(min) * ln (ho/hf)

RT = (-0.02452*(ave. temp in C) + 1.495)

K @ 20 ºC = RT * Kt TubeC= 1.3132

Consol Stage-Trial No.	Temp. º C	Date	Time hr	min	sec	Initial σ_c psi	Ub psi	U-tube Reading Head (cm) (cc)	Tail (cm) (cc)	Flow in/out gradient	Permeability Preliminary Final at 20ºC cm/sec Dev. from Ave.
initial	21.0	10/27/15	09	06	00	131.3	100.0	58.00	49.20	1.02	6.64E-06
final	21.0	10/27/15	09	08	00			54.56	50.26		6.41E-06
1	RT = 0.980	dT =	2.00 min			σ'_c =	4.5 ksf	0.257	0.253	io= 11.1	0%
initial	21.0	10/27/15	09	09	00	131.3	100.0	58.00	49.20	0.99	6.63E-06
final	21.0	10/27/15	09	12	00			53.58	50.60		6.40E-06
2	RT = 0.980	dT =	3.00 min			σ'_c =	4.5 ksf	0.330	0.334	io= 11.1	-1%
initial	21.0	10/27/15	09	13	00	131.3	100.0	58.00	49.20	1.00	6.65E-06
final	21.0	10/27/15	09	14	30			55.20	50.08		6.42E-06
3	RT = 0.980	dT =	1.50 min			σ'_c =	4.5 ksf	0.209	0.210	io= 11.1	0%
initial	21.0	10/27/15	09	16	00	131.3	100.0	58.00	49.20	0.97	6.76E-06
final	21.0	10/27/15	09	18	30			53.98	50.50		6.52E-06
4	RT = 0.980	dT =	2.50 min			σ'_c =	4.5 ksf	0.300	0.310	io= 11.1	1%
initial											
final											
5											
initial											
final											
6											

TEST SUMMARY

Final Specimen and Test Conditions

Lc = 9.997 cm ε_{axial} = 1.5%

Ac = 41.520 cm^2

Vc= 415.09 cm^3 ε_{vol} = 2.9%

Sc = 0.241 cm^{-1} Sc = Lc / Ac , final

	w (%)	γ_t (pcf)	γ_d (pcf)	S (%)
Initial	9.67	136.2	124.2	70.9
PreTest	12.18	143.5	127.9	100.0

HYDRAULIC CONDUCTIVITY SUMMARY

Averages for trials: 1-4

ave K @ 20 ºC: **6.44E-06** cm/sec

(i_o)ave = 11.1

Tested By: BB Reviewed By: G. Thomas

PERMEABILITY TEST: FALLING HEAD - CONSTANT VOLUME U-TUBE
ASTM D 5084 - Method F

Project No.: T60428794 | BORING: NEW-B006 | Test No.: P10597
Project Name: Dynegy CCR - Newton | SAMPLE: ST-3 | DEPTH (ft): 31.25

Specimen - Apparatus set-up - Test Information | Cell No. D | Apparatus No. 1 | Stage No.: 5

Preliminary Length/Area Calculations

Lo =	3.986	in	Lo=	10.124	cm
dLc=	0.132	in	Ao =	41.97	cm^2
Lc=	3.854	in	Vo =	424.87	cm^3
			Lc=	9.789	cm
dVc = 3 Vo * (dLc/Lo)			dVc=	42.21	cm^3
			Vc =	382.66	cm^3
Sc =	0.250	cm^{-1}	Ac=	39.091	cm^2

1) Specimen Tested in : [x] Triaxial Cell or [ ] Compaction Mold or ______
[x] with stones or [ ] Stones with filter paper or ______ top + bottom
2) Specimen orientation for: [x] Vertical or [ ] Horizontal permeability determination
3) During saturation: Water flushed up sides of specimen to remove air [x] No [ ] Yes
4) During consolidation: [x] Top and bottom drainage or [ ] Top [ ] Bottom only
5) Direction of permeant : [x] Up during or [ ] Down during permeation
6) Permeant: water used [x] Tap [ ] Distilled
or [ ] [ ] Demineralized [ ] 0.005 N calcium sulfate (CaSO4)

Equations Used

Kt = - 0.0000757 * Sc/dT(min) * ln (ho/hf)
RT = (-0.02452*(ave. temp in C) + 1.495)
K @ 20 ºC = RT * Kt TubeC= 1.3127

Consol Stage-Trial No.	Temp. º C	Date	Time hr	min	sec	Initial σ_c psi	Ub psi	U-tube Reading Head (cm) (cc)	Tail (cm) (cc)	Flow in/out gradient	Permeability Preliminary Final at 20ºC cm/sec Dev. from Ave.
initial	22.7	10/7/15	09	32	00	130.0	80.0	55.90	38.12	0.98	1.95E-07
final	22.5	10/7/15	10	57	00			48.00	40.65		1.70E-07
1	RT = 0.941	dT =	85.00 min			σ'_c =	7.2 ksf	0.592	0.606	io= 22.8	5%
initial	22.6	10/7/15	11	52	00	130.0	80.0	55.90	38.10	0.99	1.86E-07
final	22.5	10/7/15	13	37	00			47.18	40.85		1.62E-07
2	RT = 0.942	dT =	105.00 min			σ'_c =	7.2 ksf	0.653	0.659	io= 22.9	0%
initial	22.5	10/7/15	13	39	00	130.0	80.0	56.20	38.00	1.01	1.82E-07
final	22.7	10/7/15	14	44	00			49.75	40.00		1.59E-07
3	RT = 0.941	dT =	65.00 min			σ'_c =	7.2 ksf	0.483	0.479	io= 23.4	-2%
initial	22.7	10/7/15	14	48	00	130.0	80.0	55.80	38.12	0.99	1.78E-07
final	22.8	10/7/15	17	24	00			45.44	41.40		1.55E-07
4	RT = 0.937	dT =	156.00 min			σ'_c =	7.2 ksf	0.776	0.786	io= 22.7	-4%
initial											
final											
5		dT =				σ'_c =					
initial											
final											
6		dT =				σ'_c =					

TEST SUMMARY

Final Specimen and Test Conditions

Lc = 9.789 cm ε_{axial} = 3.3%
Ac = 42.154 cm^2
Vc= 412.65 cm^3 ε_{vol} = 2.9%
Sc = 0.232 cm^{-1} Sc = Lc / Ac , final

	w (%)	γ_τ (pcf)	γ_d (pcf)	S (%)
Initial	20.74	130.6	108.1	98.3
PreTest	19.44	133.0	111.3	100.0

HYDRAULIC CONDUCTIVITY SUMMARY

Averages for trials: 1-4
ave K @ 20 ºC: **1.62E-07** cm/sec
(i_o)ave = 22.9

Tested By: BB Reviewed By: G. Thomas

PERMEABILITY TEST: FALLING HEAD - CONSTANT VOLUME U-TUBE
ASTM D 5084 - Method F

Project No.: T60428794 | BORING: NEW-B007 | Test No.: P10598
Project Name: Dynegy CCR - Newton | SAMPLE: ST-5A | DEPTH (ft): 50.3

Specimen - Apparatus set-up - Test Information | Cell No. 6 | Apparatus No. 2 | Stage No.: 5

Preliminary Length/Area Calculations

Lo =	3.981	in	Lo=	10.112	cm
dLc=	0.088	in	Ao =	42.06	cm^2
Lc=	3.893	in	Vo =	425.32	cm^3
			Lc=	9.888	cm
dVc = 3 Vo * (dLc/Lo)			dVc=	28.21	cm^3
			Vc =	397.12	cm^3
Sc =	0.246	cm^{-1}	Ac=	40.161	cm^2

1) Specimen Tested in :	x	Triaxial Cell or		Compaction Mold or
	x	with stones or		Stones with filter paper or top + bottom
2) Specimen orientation for:	x	Vertical or		Horizontal permeability determination
3) During saturation: Water flushed up sides of specimen to remove air	x	No		Yes
4) During consolidation:	x	Top and bottom drainage or		Top / Bottom only
5) Direction of permeant :	x	Up during or		Down during permeation
6) Permeant: water used	x	Tap		Distilled
or		Demineralized		0.005 N calcium sulfate (CaSO4)

Equations Used

Kt = - 0.0000746 * Sc/dT(min) * ln (ho/hf)

RT = (-0.02452*(ave. temp in C) + 1.495)

K @ 20 ºC = RT * Kt   TubeC= 1.3214

Consol Stage-Trial No.	Temp. º C	Date	Time hr	min	sec	Initial σ_c psi	Ub psi	U-tube Reading Head (cm) (cc)	Tail (cm) (cc)	Flow in/out gradient	Permeability Preliminary Final at 20ºC cm/sec Dev. from Ave.
initial	22.8	10/8/15	09	06	00	132.0	80.0	60.40	42.75	1.02	4.30E-09
final	22.3	10/9/15	08	55	00			56.60	43.95		3.90E-09
1	RT = 0.942	dT =	1429.00 min			σ'_c =	7.5 ksf	0.283	0.278	io= 22.4	-24%
initial	22.3	10/9/15	08	59	00	132.0	80.0	60.75	42.65	0.99	5.83E-09
final	22.7	10/9/15	19	26	00			58.28	43.45		5.28E-09
2	RT = 0.943	dT =	627.00 min			σ'_c =	7.5 ksf	0.184	0.185	io= 23.0	3%
initial	22.7	10/9/15	19	31	00	132.0	80.0	60.30	42.80	1.02	5.81E-09
final	23.0	10/10/15	11	41	00			56.80	43.90		5.22E-09
3	RT = 0.935	dT =	970.00 min			σ'_c =	7.5 ksf	0.260	0.255	io= 22.2	2%
initial	23.1	10/10/15	12	10	00	132.0	80.0	60.35	42.70	0.98	5.99E-09
final	22.0	10/11/15	11	33	00			55.45	44.30		5.42E-09
4	RT = 0.942	dT =	1403.00 min			σ'_c =	7.5 ksf	0.365	0.370	io= 22.4	6%
initial	23.2	10/11/15	19	17	00	132.0	80.0	60.13	42.50	0.86	4.99E-09
final	22.9	10/13/15	16	42	00			53.15	45.10		4.46E-09
5	RT = 0.930	dT =	2725.00 min			σ'_c =	7.5 ksf	0.519	0.602	io= 22.4	-13%
initial	22.9	10/13/15	16	53	00	132.0	80.0	60.05	42.87	1.00	5.93E-09
final	22.4	10/14/15	08	45	00			56.61	43.98		5.36E-09
6	RT = 0.940	dT =	952.00 min			σ'_c =	7.5 ksf	0.256	0.257	io= 21.8	5%

TEST SUMMARY

Final Specimen and Test Conditions

Lc = 9.888 cm ε_{axial} = 2.2%

Ac = 41.793 cm^2

Vc= 413.25 cm^3 ε_{vol} = 2.8%

Sc = 0.237 cm^{-1} Sc = Lc / Ac , final

	w (%)	γ_t (pcf)	γ_d (pcf)	S (%)
Initial	16.26	137.1	117.9	99.6
PreTest	14.82	139.3	121.3	100.0

HYDRAULIC CONDUCTIVITY SUMMARY

Averages for trials: 2-6

ave K @ 20 ºC: **5.11E-09** cm/sec

(i_o)ave = 22.2

Tested By: BB   Reviewed By: G. Thomas

PERMEABILITY TEST: FALLING HEAD - CONSTANT VOLUME U-TUBE
ASTM D 5084 - Method F

Project No.: T60428794	BORING: NEW-B012	Test No.: P10609
Project Name: Dynegy CCR - Newton	SAMPLE: ST-7	DEPTH (ft): 20.6

Specimen - Apparatus set-up - Test Information Cell No. C Apparatus No. 1 Stage No.: 5

Preliminary Length/Area Calculations

Lo =	4.004	in	Lo=	10.171	cm
dLc=	0.045	in	Ao =	41.88	cm^2
Lc=	3.959	in	Vo =	425.95	cm^3
			Lc=	10.057	cm
dVc = 3 Vo * (dLc/Lo)			dVc=	14.36	cm^3
			Vc =	411.59	cm^3
Sc =	0.246	cm^{-1}	Ac=	40.926	cm^2

1) Specimen Tested in :	x	Triaxial Cell or		Compaction Mold or	
	x	with stones or		Stones with filter paper or	top + bottom
2) Specimen orientation for:	x	Vertical or		Horizontal permeability determination	
3) During saturation: Water flushed up sides of specimen to remove ai	x	No		Yes	
4) During consolidation:	x	Top and bottom drainage or		Top	Bottom only
5) Direction of permeant :	x	Up during or		Down during permeation	
6) Permeant: water used	x	Tap		Distilled	
or		Demineralized		0.005 N calcium sulfate (CaSO4)	

Equations Used

Kt = - 0.0000757 * Sc/dT(min) * ln (ho/hf)

RT = (-0.02452*(ave. temp in C) + 1.495)

K @ 20 ºC = RT * Kt TubeC= 1.3127

Consol Stage-Trial No.	Temp. º C	Date	Time hr	min	sec	Initial σ_c psi	Ub psi	U-tube Reading Head (cm) (cc)	Tail (cm) (cc)	Flow in/out gradient	Permeability Preliminary Final at 20ºC cm/sec Dev. from Ave.
initial	21.6	10/26/15	09	43	00	117.4	100.0	58.25	37.33	0.97	8.93E-09
final	22.5	10/26/15	12	19	00			57.10	37.70		8.38E-09
1	RT = 0.954	dT =	156.00 min			σ'_c =	2.5 ksf	0.086	0.089	io= 26.2	8%
initial	22.5	10/26/15	12	20	00	117.4	100.0	58.63	37.24	1.04	8.86E-09
final	23.6	10/26/15	14	37	00			57.60	37.55		8.11E-09
2	RT = 0.930	dT =	137.00 min			σ'_c =	2.5 ksf	0.077	0.074	io= 26.7	4%
initial	23.6	10/26/15	14	38	00	117.4	100.0	58.85	37.16	0.99	8.15E-09
final	23.5	10/26/15	18	00	00			57.45	37.60		7.36E-09
3	RT = 0.918	dT =	202.00 min			σ'_c =	2.5 ksf	0.105	0.105	io= 27.1	-5%
initial	23.5	10/26/15	18	03	00	117.4	100.0	59.00	37.19	1.02	7.74E-09
final	21.0	10/27/15	08	44	00			53.90	38.75		7.23E-09
4	RT = 0.949	dT =	881.00 min			σ'_c =	2.5 ksf	0.382	0.374	io= 27.3	-7%
initial											
final											
5											
initial											
final											
6											

TEST SUMMARY

Final Specimen and Test Conditions

Lc =	10.057	cm	ε_{axial} =	1.1%	
Ac =	41.598	cm^2			
Vc=	418.35	cm^3	ε_{vol} =	1.8%	
Sc =	0.242	cm^{-1}	Sc = Lc / Ac , final		

	w (%)	γ_τ (pcf)	γ_d (pcf)	S (%)
Initial	13.28	137.1	121.0	88.9
PreTest	14.02	140.5	123.2	100.0

HYDRAULIC CONDUCTIVITY SUMMARY

Averages for trials: 1-4

ave K @ 20 ºC: **7.77E-09** cm/sec

(i_o)ave = 26.8

Tested By: BB Reviewed By: G. Thomas

PERMEABILITY TEST: FALLING HEAD - CONSTANT VOLUME U-TUBE
ASTM D 5084 - Method F

Project No.: T60428794 BORING: NEW-B015 Test No.: P10608

Project Name: Dynegy CCR - Newton SAMPLE: ST-2A DEPTH (ft): 25.45

Specimen - Apparatus set-up - Test Information Cell No. C Apparatus No. 3 Stage No.: 2

Preliminary Length/Area Calculations

Lo =	4.012	in	Lo=	10.191	cm
dLc=	0.025	in	Ao =	42.03	cm^2
Lc=	3.987	in	Vo =	428.31	cm^3
			Lc=	10.127	cm
dVc = 3 Vo * (dLc/Lo)			dVc=	8.01	cm^3
			Vc =	420.30	cm^3
Sc =	0.244	cm^{-1}	Ac=	41.501	cm^2

1) Specimen Tested in :	x	Triaxial Cell or		Compaction Mold or
	x	with stones or		Stones with filter paper or top + bottom
2) Specimen orientation for:	x	Vertical or		Horizontal permeability determination
3) During saturation: Water flushed up sides of specimen to remove air	x	No		Yes
4) During consolidation:	x	Top and bottom drainage or	Top	Bottom only
5) Direction of permeant :	x	Up during or		Down during permeation
6) Permeant: water used	x	Tap		Distilled
or		Demineralized		0.005 N calcium sulfate (CaSO4)

Equations Used

Kt = - 0.0000755 * Sc/dT(min) * ln (ho/hf)

RT = (-0.02452*(ave. temp in C) + 1.495)

K @ 20 ºC = RT * Kt TubeC= 1.3132

Consol Stage-Trial No.	Temp. º C	Date	Time hr	min	sec	Initial σ_c psi	Ub psi	U-tube Reading Head (cm) (cc)	Tail (cm) (cc)	Flow in/out gradient	Permeability Preliminary Final at 20ºC cm/sec Dev. from Ave.
initial	22.5	10/16/15	09	48	00	106.9	100.0	63.45	47.50	0.86	3.95E-09
final	24.0	10/16/15	16	24	00			62.46	47.86		3.57E-09
1	RT = 0.925	dT =	396.00 min			σ'_c =	1.0 ksf	0.074	0.086	io= 19.8	95%
initial	21.0	10/19/15	09	42	00	106.9	100.0	64.94	47.00	0.80	2.38E-09
final	22.5	10/19/15	17	53	00			64.10	47.33		2.24E-09
2	RT = 0.962	dT =	491.00 min			σ'_c =	1.0 ksf	0.063	0.079	io= 22.3	22%
initial	22.5	10/19/15	17	54	00	106.9	100.0	66.26	46.67	0.87	2.07E-09
final	22.0	10/20/15	08	42	00			64.84	47.18		1.92E-09
3	RT = 0.949	dT =	888.00 min			σ'_c =	1.0 ksf	0.106	0.122	io= 24.3	5%
initial	22.0	10/20/15	08	45	00	106.9	100.0	66.70	46.50	0.89	1.67E-09
final	23.1	10/20/15	17	04	00			66.02	46.74		1.54E-09
4	RT = 0.942	dT =	499.00 min			σ'_c =	1.0 ksf	0.051	0.057	io= 25.1	-16%
initial	23.1	10/20/15	17	07	00	106.9	100.0	66.82	46.46	1.02	1.76E-09
final	21.5	10/21/15	08	45	00			65.49	46.87		1.63E-09
5	RT = 0.948	dT =	938.00 min			σ'_c =	1.0 ksf	0.099	0.098	io= 25.3	-11%
initial											
final											
6		dT =				σ'_c =					

TEST SUMMARY

Final Specimen and Test Conditions

Lc =	10.127	cm	ε_{axial} =	0.6%
Ac =	42.456	cm^2		
Vc=	429.98	cm^3	ε_{vol} =	-0.4%
Sc =	0.239	cm^{-1}	Sc = Lc / Ac , final	

	w (%)	γ_τ (pcf)	γ_d (pcf)	S (%)
Initial	23.96	126.1	101.7	96.8
PreTest	24.99	126.6	101.3	100.0

HYDRAULIC CONDUCTIVITY SUMMARY

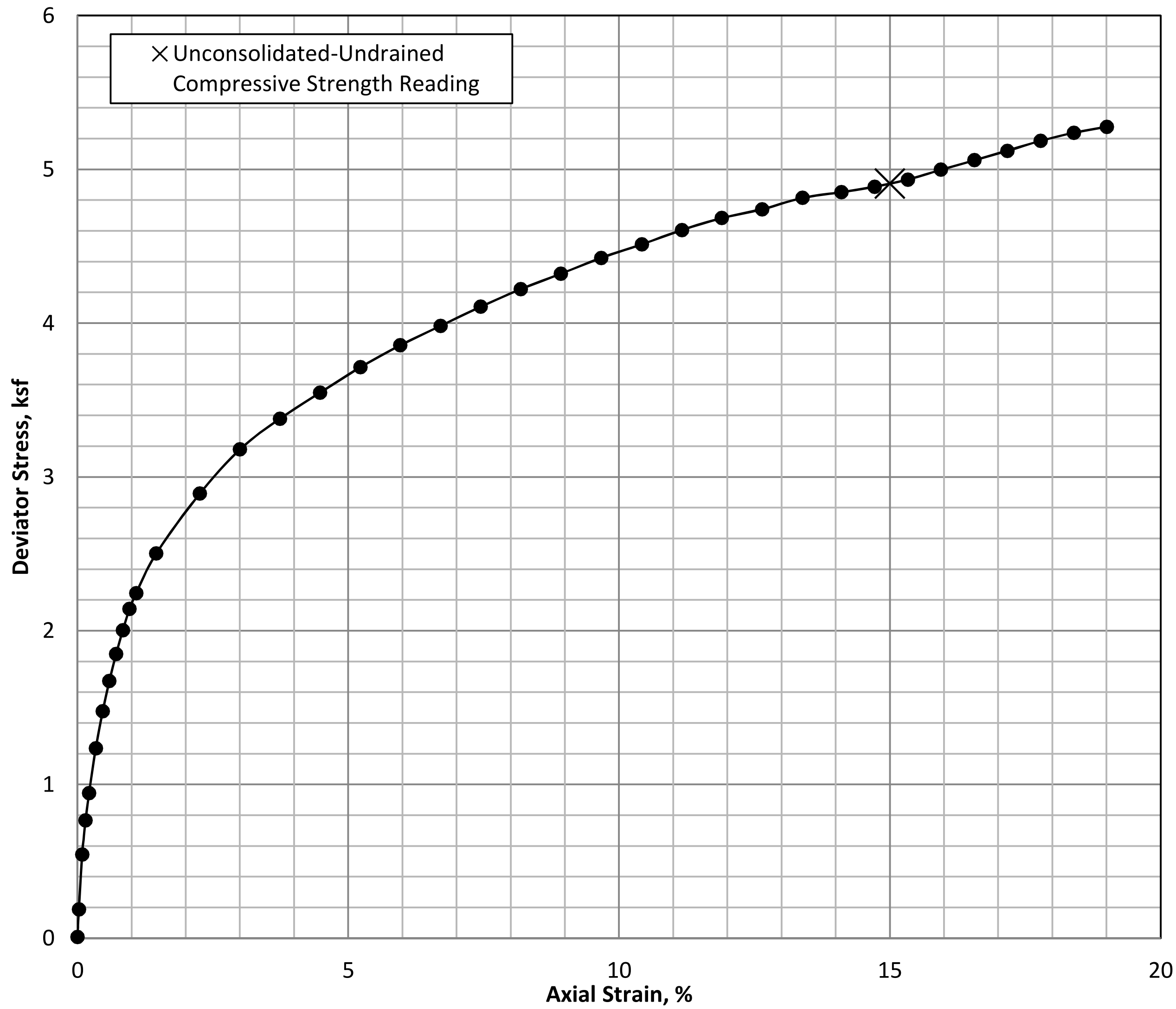
Averages for trials: 2-5

ave K @ 20 ºC: **1.83E-09** cm/sec

(i_o)ave = 24.2

Tested By: BB Reviewed By: G. Thomas

UNCONSOLIDATED-UNDRAINED COMPRESSIVE STRENGTH TEST, ASTM METHOD D2850



Specimen and Material Property Information

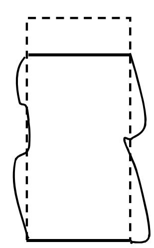
Sample Type: Intact tube sample

Description and/or Classification: CL, brown lean clay

Cell Pressure (ksf)	Water Content (%) (1)	Wet Unit Weight (pcf)	Dry Unit Weight (pcf) (1)	Void Ratio (-)	Saturation (%) (2)	Length (inch)	Diameter (inch)	L/D (-)	LL/PL (-)	PI (-)	Specific Gravity (-) (2)
0 (Initial)	19.4	130.9	109.7	0.56	94.8	5.999	2.880	2.1	43	26	2.74
4.0	19.4	132.2	110.8	0.54	97.5	5.979	2.870	2.1	17		

Failure Summary

U-U Compressive Strength (ksf)	U-U Shear Strength, s_u (ksf)	Strain to to Peak (%)	Strain Rate (%/min)
4.91	2.455	15.0	0.74



FAILURE SKETCH

Remarks and Notes:

(1) Water Content determined after shear from partial specimen.

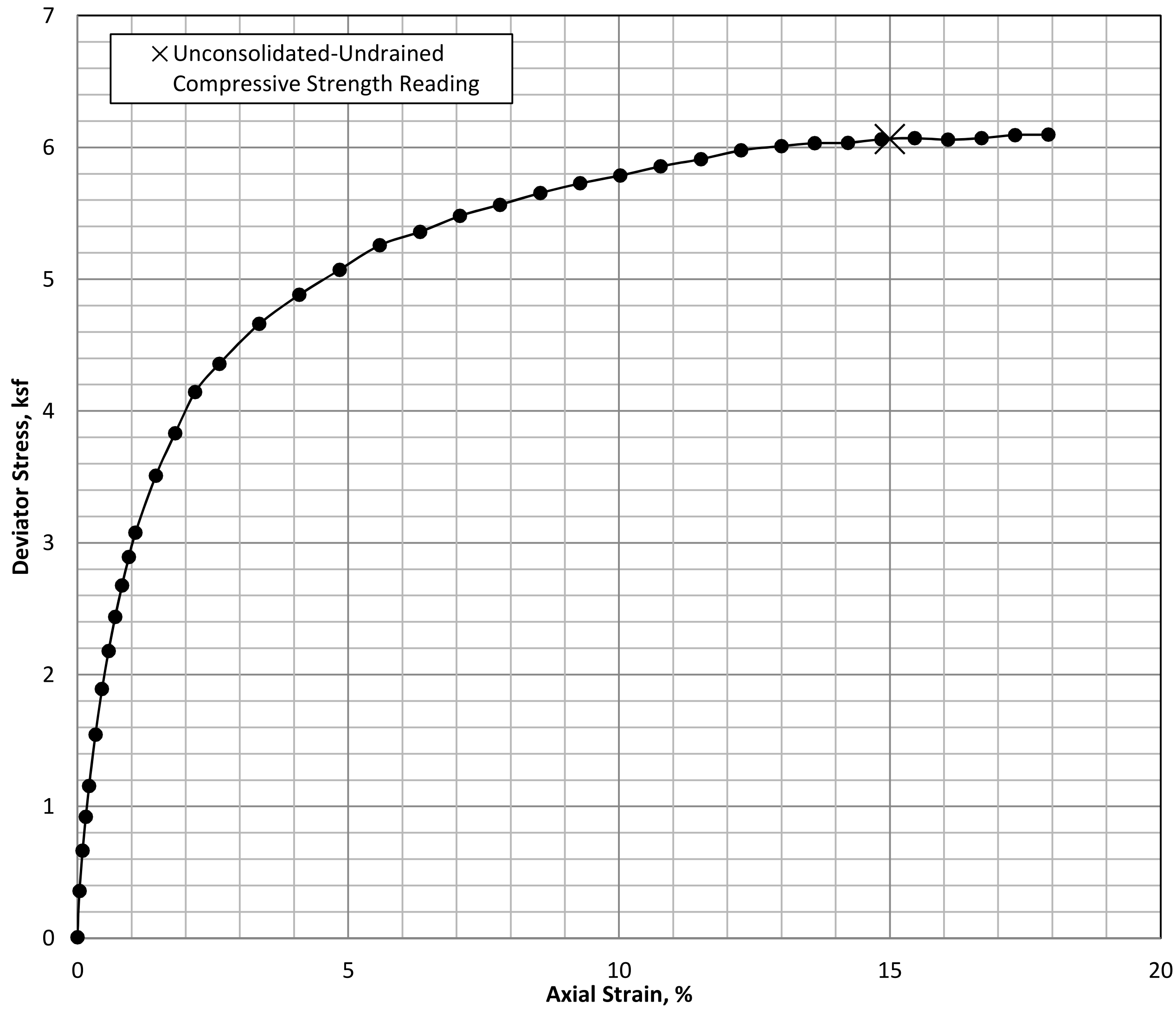
(2) Assumed specific gravity

Tested by: BB
Test Date: 10/23/2015

Reviewed by: GET
Review Date: 10/27/2015

AECOM **Project # 60428794-108** **TerraSense, LLC** **Project # T60428794**	**Dynegy CCR - Newton**	**UNCONSOLIDATED-UNDRAINED COMPRESSION TEST** **Boring: NEW-B003 Sample: ST-2** **Section: B Depth: 24.15 ft.**

UNCONSOLIDATED-UNDRAINED COMPRESSIVE STRENGTH TEST, ASTM METHOD D2850



Specimen and Material Property Information

Sample Type: Intact tube sample

Description and/or Classification: CH, brown fat clay

Cell Pressure (ksf)	Water Content [1] (%)	Wet Unit Weight (pcf)	Dry Unit Weight [1] (pcf)	Void Ratio (-)	Saturation [2] (%)	Length (inch)	Diameter (inch)	L/D (-)	LL/PL (-)	PI (-)	Specific Gravity [2] (-)
0 (Initial)	21.1	129.2	106.7	0.60	96.0	6.014	2.881	2.1	55	39	2.74
3.0	21.1	130.0	107.3	0.59	97.5	6.002	2.875	2.1	16		

Failure Summary

U-U Compressive Strength (ksf)	U-U Shear Strength, s_u (ksf)	Strain to to Peak (%)	Strain Rate (%/min)
6.06	3.03	15.0	0.74

FAILURE SKETCH

Remarks and Notes:

(1) Water Content determined after shear from partial specimen.

(2) Assumed specific gravity

Tested by: BB

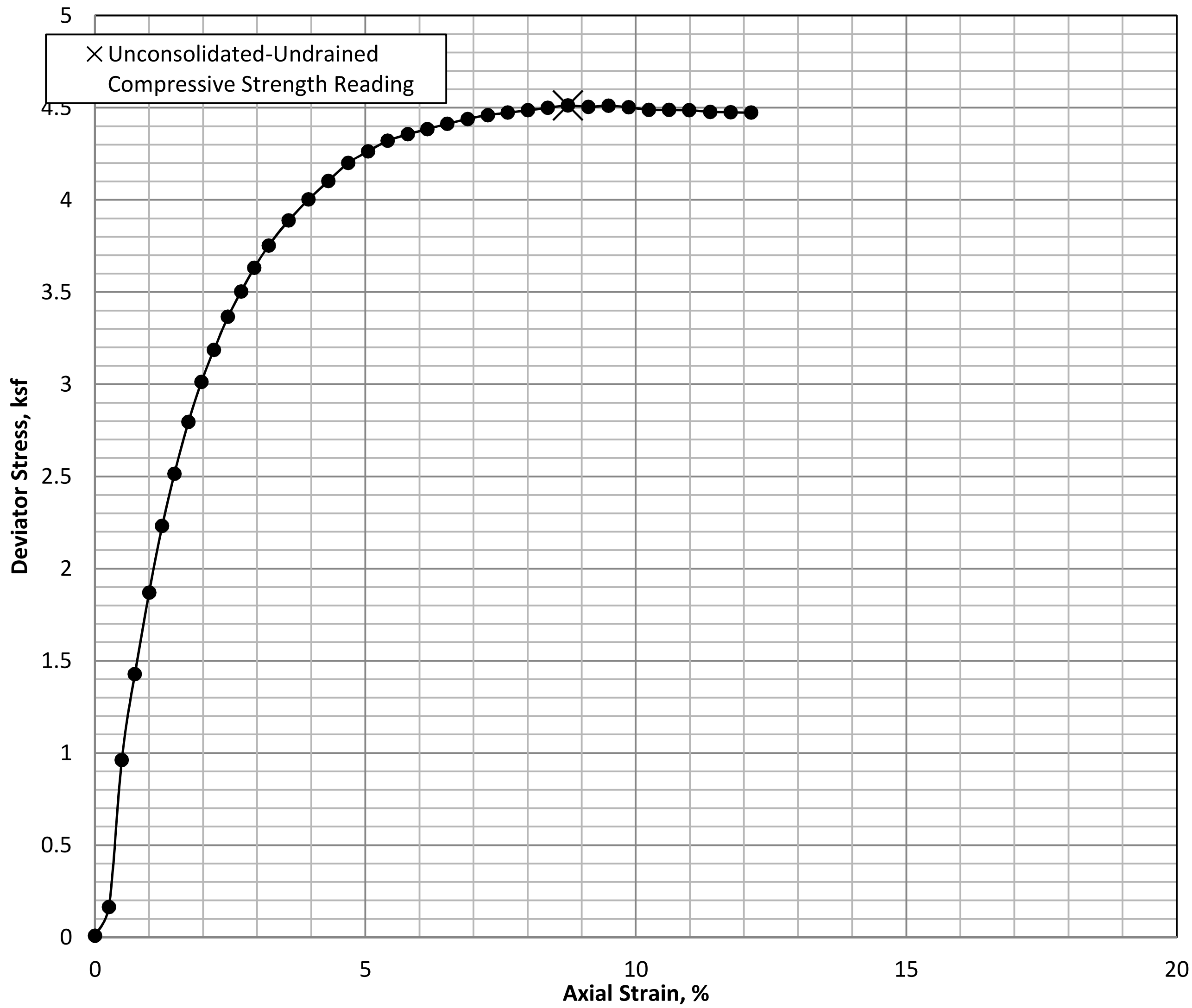
Test Date: 10/23/2015

Reviewed by: GET

Review Date: 10/27/2015

AECOM Project # 60428794-108	**Dynegy CCR - Newton**	**UNCONSOLIDATED-UNDRAINED COMPRESSION TEST**
TerraSense, LLC Project # T60428794		**Boring: NEW-B003 Sample: ST-3 Section: C Depth: 28.8 ft.**

UNCONSOLIDATED-UNDRAINED COMPRESSIVE STRENGTH TEST, ASTM METHOD D2850



Specimen and Material Property Information

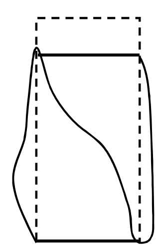
Sample Type: Intact tube sample

Description and/or Classification: CL, orange-brown clay

Cell Pressure (ksf)	Water Content [1] (%)	Wet Unit Weight (pcf)	Dry Unit Weight [1] (pcf)	Void Ratio (-)	Saturation [2] (%)	Length (inch)	Diameter (inch)	L/D (-)	LL/PL (-)	PI (-)	Specific Gravity [2] (-)
0 (Initial)	18.2	130.8	110.6	0.54	92.0	5.996	2.879	2.1	40	23	2.73
3.5	18.2	131.8	111.5	0.53	94.2	5.980	2.871	2.1	17		

Failure Summary

U-U Compressive Strength (ksf)	U-U Shear Strength, s_u (ksf)	Strain to to Peak (%)	Strain Rate (%/min)
4.51	2.255	8.7	0.74



FAILURE SKETCH

Remarks and Notes:

(1) Water Content determined after shear from partial specimen.

(2) Assumed specific gravity

Tested by: BB

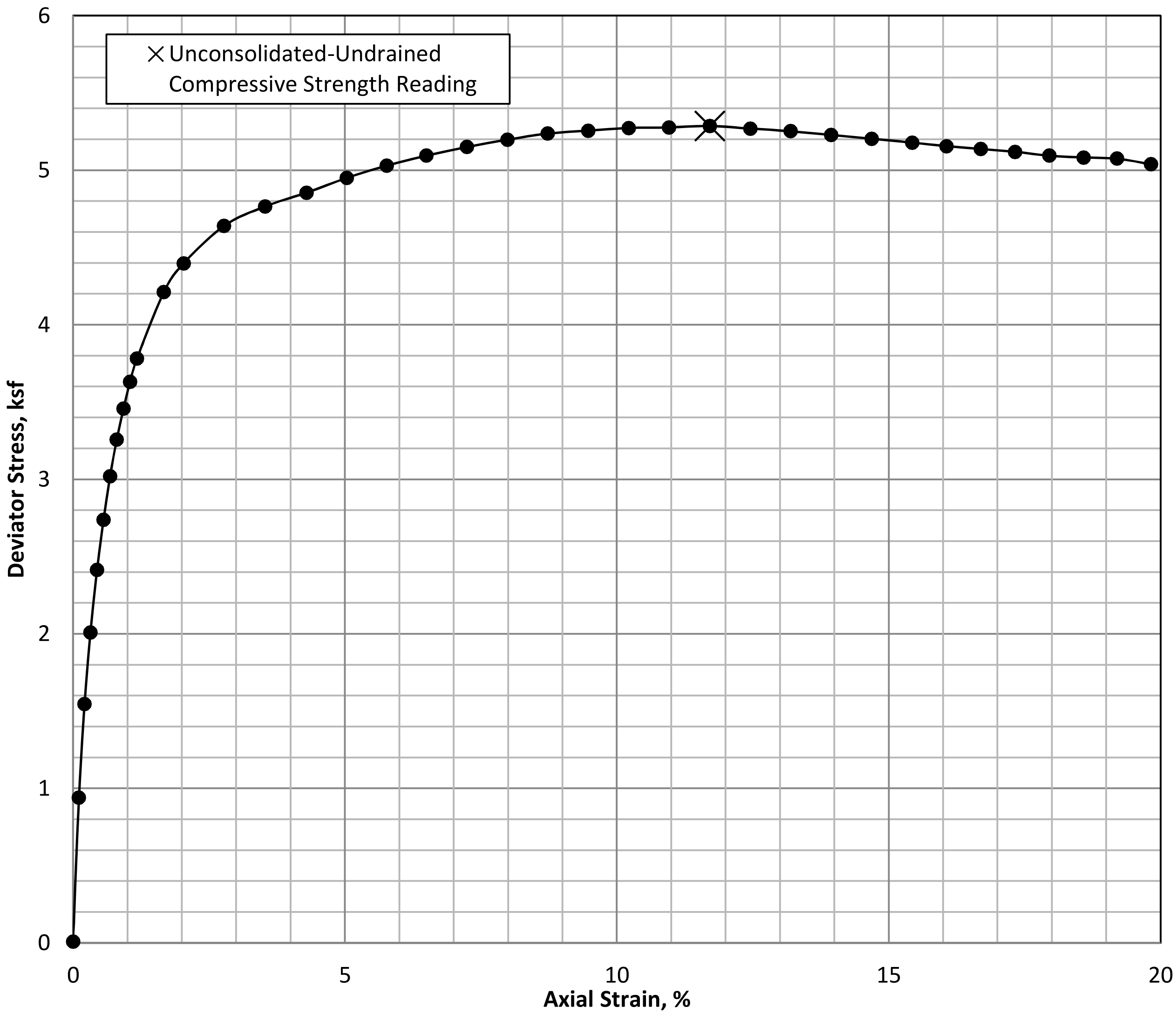
Test Date: 10/28/2015

Reviewed by: GET

Review Date: 11/2/2015

AECOM Project # 60428794-108	Dynegy CCR - Newton	UNCONSOLIDATED-UNDRAINED COMPRESSION TEST
TerraSense, LLC Project # T60428794		Boring: NEW-B006 Sample: ST-1 Section: B Depth: 21.20 ft.

UNCONSOLIDATED-UNDRAINED COMPRESSIVE STRENGTH TEST, ASTM METHOD D2850



Specimen and Material Property Information

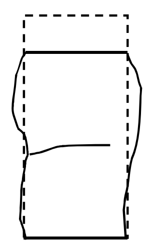
Sample Type: Intact tube sample

Description and/or Classification: CH, brown fat clay

Cell Pressure (ksf)	Water [(1)] Content (%)	Wet Unit Weight (pcf)	Dry Unit [(1)] Weight (pcf)	Void Ratio (-)	Saturation[(2)] (%)	Length (inch)	Diameter (inch)	L/D (-)	LL/PL (-)	PI (-)	Specific [(2)] Gravity (-)
0 (Initial)	21.5	132.0	108.6	0.61	98.9	5.987	2.877	2.1	52	40	2.80
6.0	21.5	133.0	109.4	0.60	100.9	5.972	2.870	2.1	12		

Failure Summary

U-U Compressive Strength (ksf)	U-U Shear Strength, s_u (ksf)	Strain to to Peak (%)	Strain Rate (%/min)
5.29	2.645	11.7	0.74



FAILURE SKETCH

Remarks and Notes:

(1) Water Content determined after shear from partial specimen.

(2) Assumed specific gravity

Tested by: BB

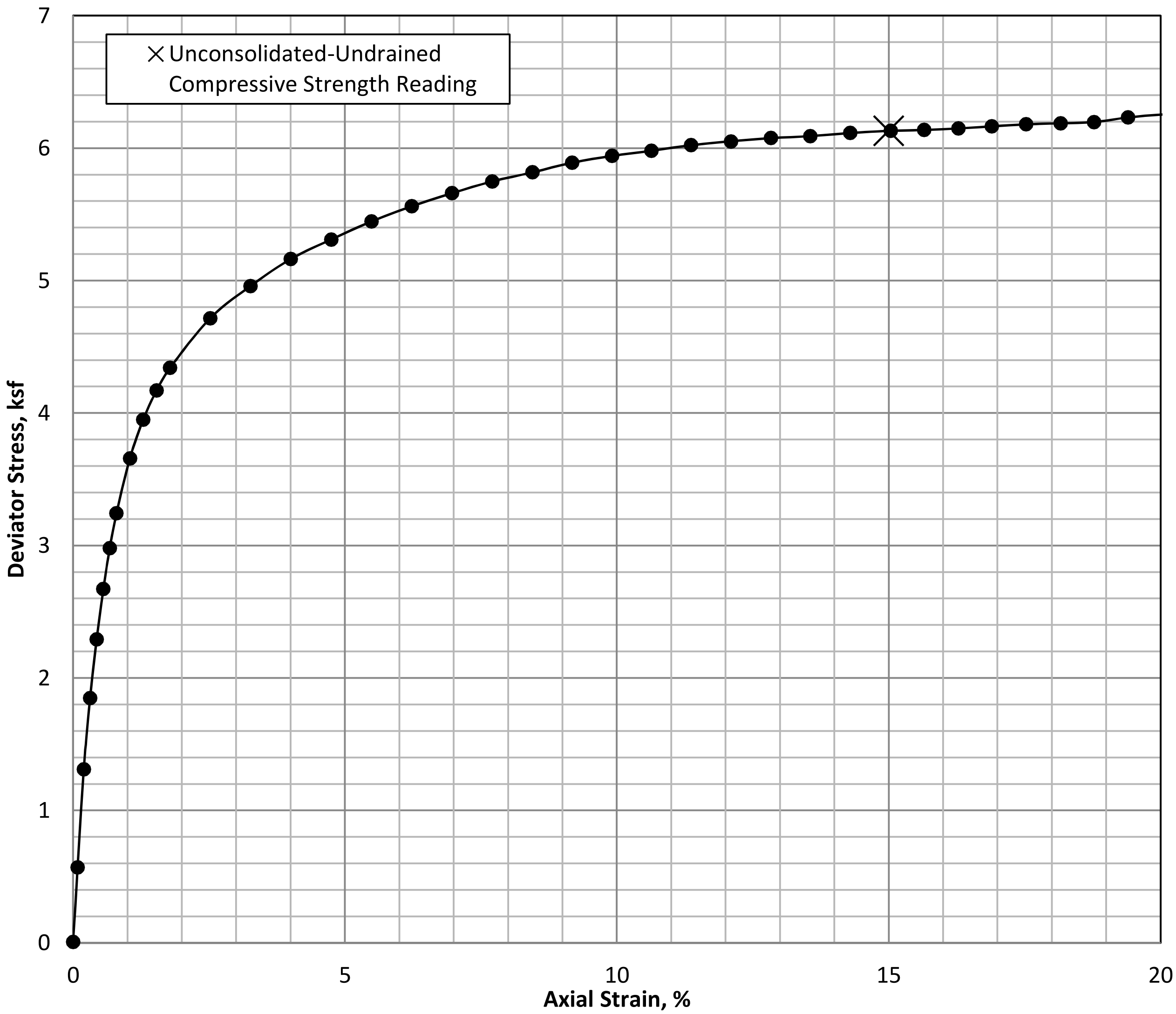
Test Date: 10/15/2015

Reviewed by: CMJ

Review Date: 10/26/2015

AECOM **Project # 60428794-108**	**Dynegy CCR - Newton**	**UNCONSOLIDATED-UNDRAINED COMPRESSION TEST**
TerraSense, LLC **Project # T60428794**		**Boring: NEW-B007 Sample: ST-3C Section: Depth: 31.70 ft.**

UNCONSOLIDATED-UNDRAINED COMPRESSIVE STRENGTH TEST, ASTM METHOD D2850



Specimen and Material Property Information

Sample Type: Intact tube sample

Description and/or Classification: CH, brown fat clay

Cell Pressure (ksf)	Water [1] Content (%)	Wet Unit Weight (pcf)	Dry Unit [1] Weight (pcf)	Void Ratio (-)	Saturation [2] (%)	Length (inch)	Diameter (inch)	L/D (-)	LL/PL (-)	PI (-)	Specific [2] Gravity (-)
0 (Initial)	16.7	136.3	116.8	0.46	98.2	5.986	2.882	2.1	50	37	2.74
2.5	16.7	136.7	117.2	0.46	99.3	5.979	2.878	2.1	13		

Failure Summary

U-U Compressive Strength (ksf)	U-U Shear Strength, s_u (ksf)	Strain to to Peak (%)	Strain Rate (%/min)
6.13	3.065	15.0	0.74

FAILURE SKETCH

Remarks and Notes:

(1) Water Content determined after shear from partial specimen.

(2) Assumed specific gravity

Tested by: BB
Test Date: 10/15/2015

Reviewed by: CMJ
Review Date: 10/26/2015

AECOM
Project # 60428794-108

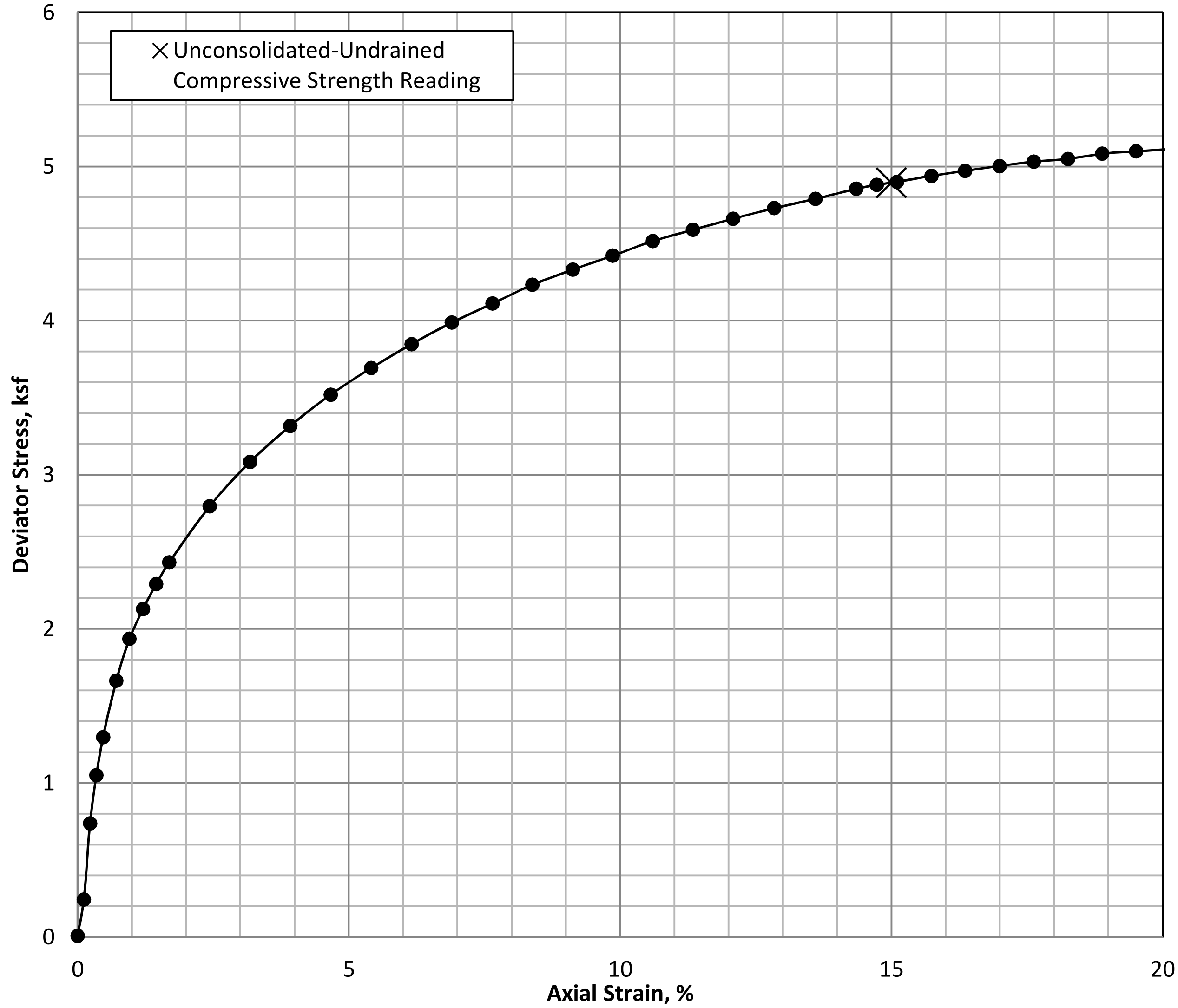
TerraSense, LLC
Project # T60428794

Dynegy CCR - Newton

UNCONSOLIDATED-UNDRAINED COMPRESSION TEST

Boring: NEW-B008 Sample: ST-1C
Section: Depth: 16.65 ft.

UNCONSOLIDATED-UNDRAINED COMPRESSIVE STRENGTH TEST, ASTM METHOD D2850



Specimen and Material Property Information

Sample Type: Intact tube sample

Description and/or Classification: CL, brown lean clay

Cell Pressure (ksf)	Water Content (%) [1]	Wet Unit Weight (pcf)	Dry Unit Weight (pcf) [1]	Void Ratio (-)	Saturation (%) [2]	Length (inch)	Diameter (inch)	L/D (-)	LL/PL (-)	PI (-)	Specific Gravity (-) [2]
0 (Initial)	19.0	132.3	111.2	0.52	98.6	5.982	2.874	2.1	47	32	2.71
2.0	19.0	132.7	111.6	0.52	99.6	5.975	2.870	2.1	15		

Failure Summary

U-U Compressive Strength (ksf)	U-U Shear Strength, s_u (ksf)	Strain to to Peak (%)	Strain Rate (%/min)
4.9	2.45	15.0	0.75

FAILURE SKETCH

Remarks and Notes:

(1) Water Content determined after shear from partial specimen.

(2) Assumed specific gravity

Tested by: BB
Test Date: 10/15/2015

Reviewed by: CMJ
Review Date: 10/26/2015

AECOM
Project # 60428794-108

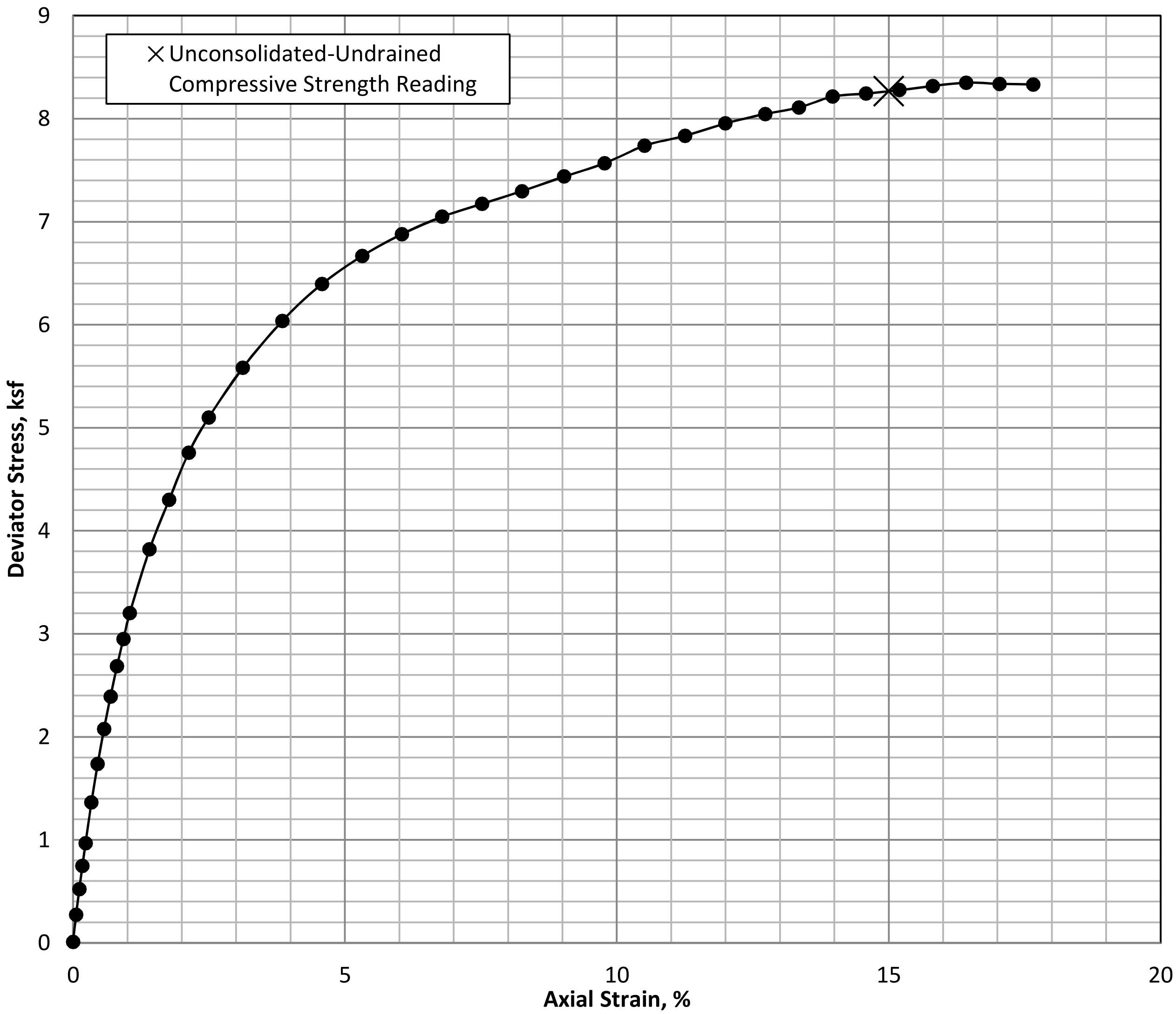
TerraSense, LLC
Project # T60428794

Dynegy CCR - Newton

UNCONSOLIDATED-UNDRAINED COMPRESSION TEST

Boring: NEW-B009 Sample: ST-1B
Section: Depth: 9.75 ft.

UNCONSOLIDATED-UNDRAINED COMPRESSIVE STRENGTH TEST, ASTM METHOD D2850



Specimen and Material Property Information

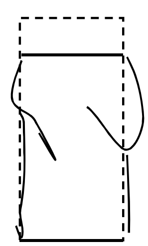
Sample Type: Intact tube sample

Description and/or Classification: CL, brown sandy clay, trace gravel

Cell Pressure (ksf)	Water [(1)] Content (%)	Wet Unit Weight (pcf)	Dry Unit [(1)] Weight (pcf)	Void Ratio (-)	Saturation[(2)] (%)	Length (inch)	Diameter (inch)	L/D (-)	LL/PL (-)	PI (-)	Specific [(2)] Gravity (-)
0 (Initial)	12.6	139.6	123.9	0.38	91.1	6.033	2.883	2.1	34	21	2.74
1.5	12.6	140.3	124.5	0.37	92.7	6.023	2.878	2.1	13		

Failure Summary

U-U Compressive Strength (ksf)	U-U Shear Strength, s_u (ksf)	Strain to to Peak (%)	Strain Rate (%/min)
8.27	4.135	15.0	0.74



FAILURE SKETCH

Remarks and Notes:

(1) Water Content determined after shear from partial specimen.

(2) Assumed specific gravity

Tested by: BB
Test Date: 10/23/2015

Reviewed by: GET
Review Date: 10/29/2015

AECOM
Project # 60428794-108

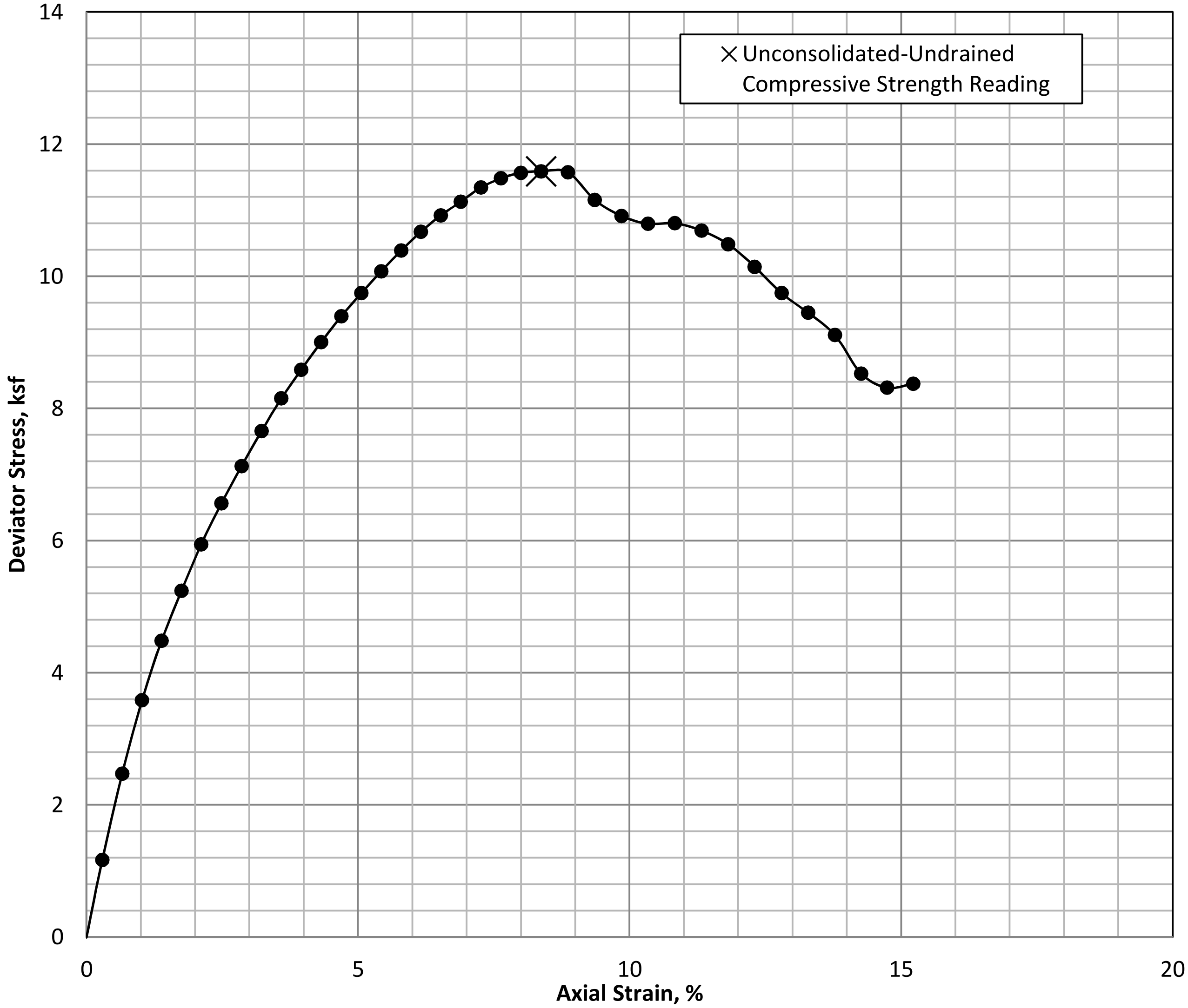
TerraSense, LLC
Project # T60428794

Dynegy CCR - Newton

UNCONSOLIDATED-UNDRAINED COMPRESSION TEST

Boring: NEW-B012 Sample: ST-4
Section: C Depth: 9.45 ft.

UNCONSOLIDATED-UNDRAINED COMPRESSIVE STRENGTH TEST, ASTM METHOD D2850



Specimen and Material Property Information

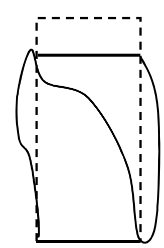
Sample Type: Intact tube sample

Description and/or Classification: SC, orange brown clayey sand

Cell Pressure (ksf)	Water [(1)] Content (%)	Wet Unit Weight (pcf)	Dry Unit [(1)] Weight (pcf)	Void Ratio (-)	Saturation[(2)] (%)	Length (inch)	Diameter (inch)	L/D (-)	LL/ PL (-)	PI (-)	Specific [(2)] Gravity (-)
0 (Initial)	9.5	142.7	130.3	0.31	84.3	6.025	2.886	2.1	28	15	2.73
0.5	9.5	142.9	130.4	0.31	84.7	6.023	2.885	2.1	13		

Failure Summary

U-U Compressive Strength (ksf)	U-U Shear Strength, s_u (ksf)	Strain to to Peak (%)	Strain Rate (%/min)
11.6	5.8	8.4	0.73



FAILURE SKETCH

Remarks and Notes:

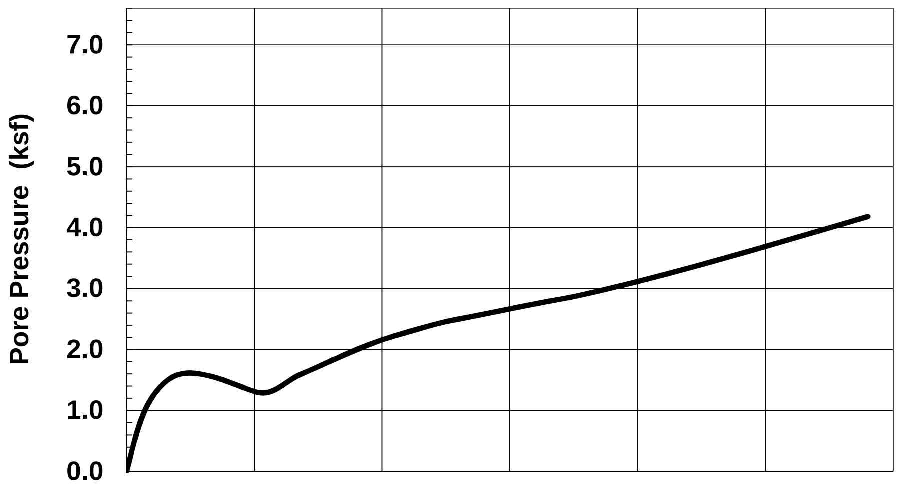
(1) Water Content determined after shear from partial specimen.

(2) Assumed specific gravity

Tested by: BB
Test Date: 9/17/2015

Reviewed by: GET
Review Date: 10/27/2015

AECOM **Project # 60428794-108**	**Dynegy CCR - Newton**	**UNCONSOLIDATED-UNDRAINED COMPRESSION TEST**
TerraSense, LLC **Project # T60428794**		**Boring: NEW-B014 Sample: ST-1** **Section: B Depth: 3.50 ft.**

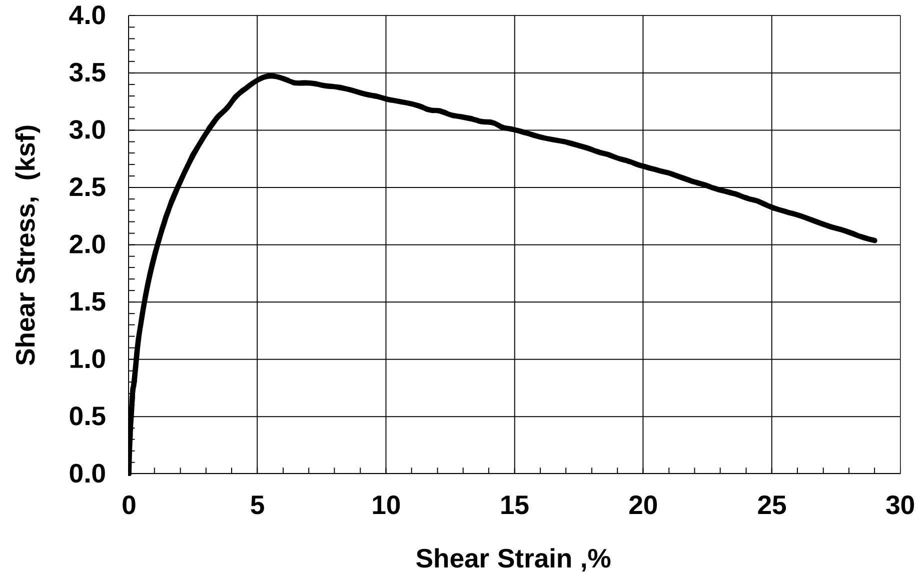


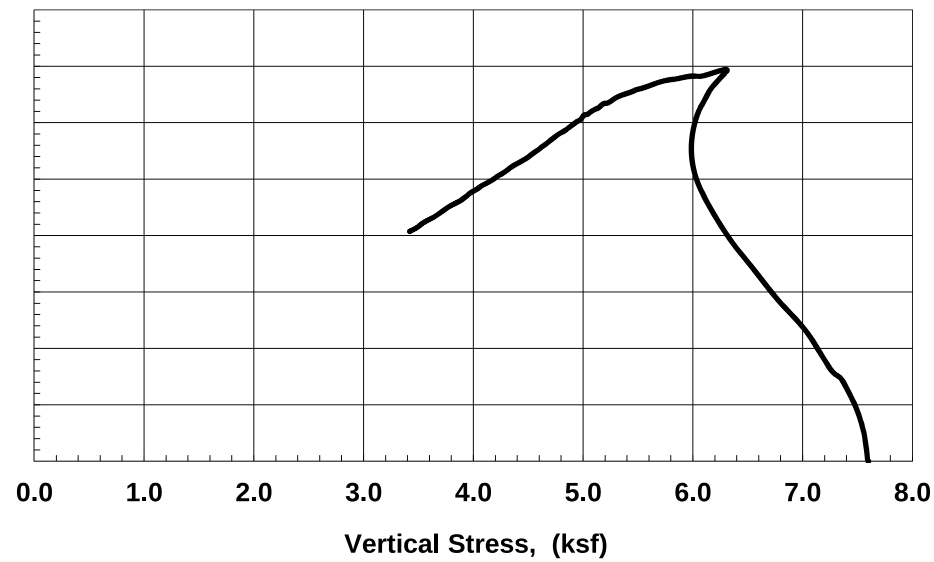
SAMPLE INFORMATION
Boring: NEW-B007 Sample: ST-5 Depth: 51.05 feet
Type: Intact tube sample
Description: CL, stiff brown clay, trace c-f sand, fine gravel
LL = 32 PL = 16 PI = 16

SPECIMEN INFORMATION (Initial)
Height: 0.72 Diameter: 2.63 inch Area: 5.42 in²
Water Content: 13.9 % Total Unit Weight: 136.1 pcf

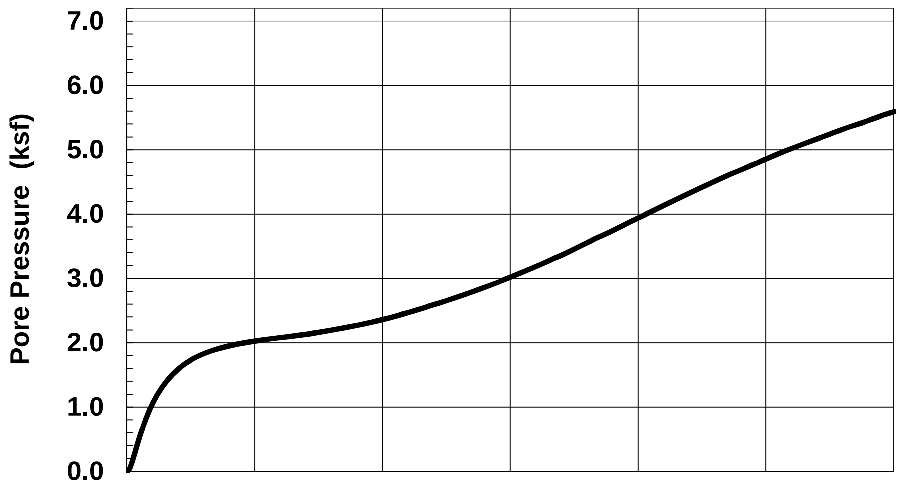
TEST SUMMARY
Vertical Consolidation Stress: 7.60 ksf OCR = 1.0
Water Content: 14.8 % Total Unit Weight: 139.9 pcf
Peak Shear Strength: 3.47 ksf @ 5.6 % Strain
Strain Rate: 0.064 %/min

REMARKS:





Test by: D Tso	Project No. T60428794	AECOM #60428794 Dynegy CCR - Newton	CONSTANT VOLUME	
Checked by: GET	**TerraSense, LLC**		DIRECT SIMPLE SHEAR Boring NEW-B007 Sample ST-5	October-15



SAMPLE INFORMATION

Boring: NEW-B012 Sample: ST-15 Depth: 61.45 feet
Type: Intact tube sample
Description: CL, brown clay
LL = 42 PL = 14 PI = 28

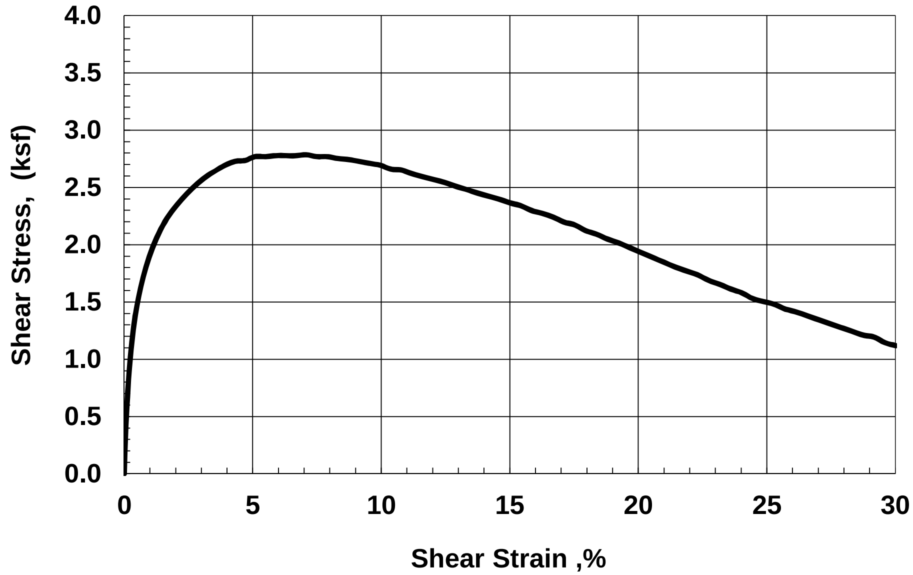
SPECIMEN INFORMATION (Initial)

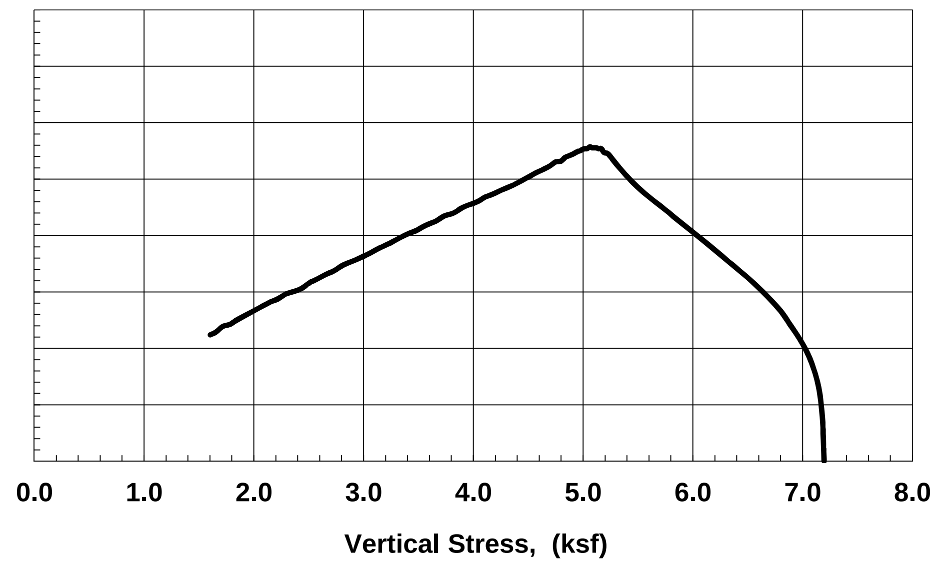
Height: 0.72 Diameter: 2.63 inch Area: 5.45 in²
Water Content: 12.8 % Total Unit Weight: 132.5 pcf

TEST SUMMARY

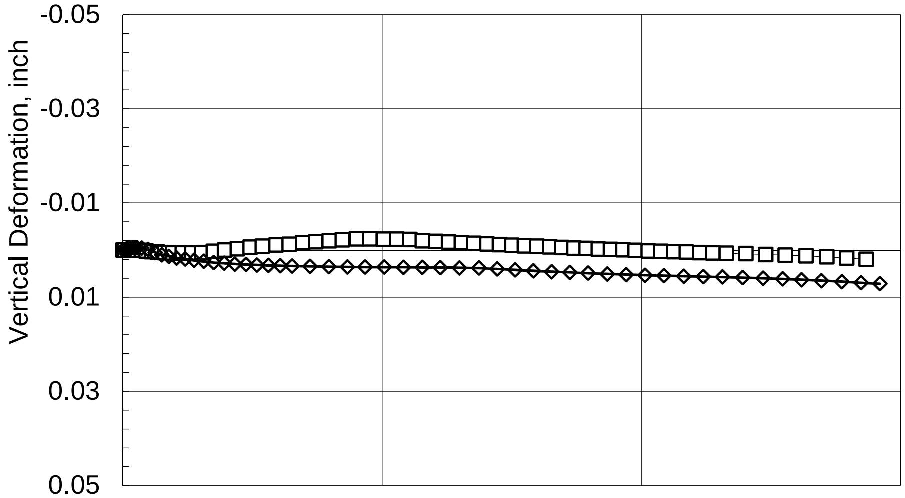
Vertical Consolidation Stress: 7.20 ksf OCR = 1.0
Water Content: 13.6 % Total Unit Weight: 138.6 pcf
Peak Shear Strength: 2.79 ksf @ 7.1 % Strain
Strain Rate: 0.067 %/min

REMARKS:





Test by:	G. Thomas	Project No. T60428794	AECOM #60428794 Dynegy CCR - Newton	CONSTANT VOLUME DIRECT SIMPLE SHEAR Boring NEW-B012 Sample ST-15	
Checked by:	GET	**TerraSense, LLC**			October-15



SAMPLE INFORMATION

Boring: NEW-B006 Sample: ST- 4 Depth: 35-35.8 feet
Type: Intact tube sample
Description: CL, brown sandy clay

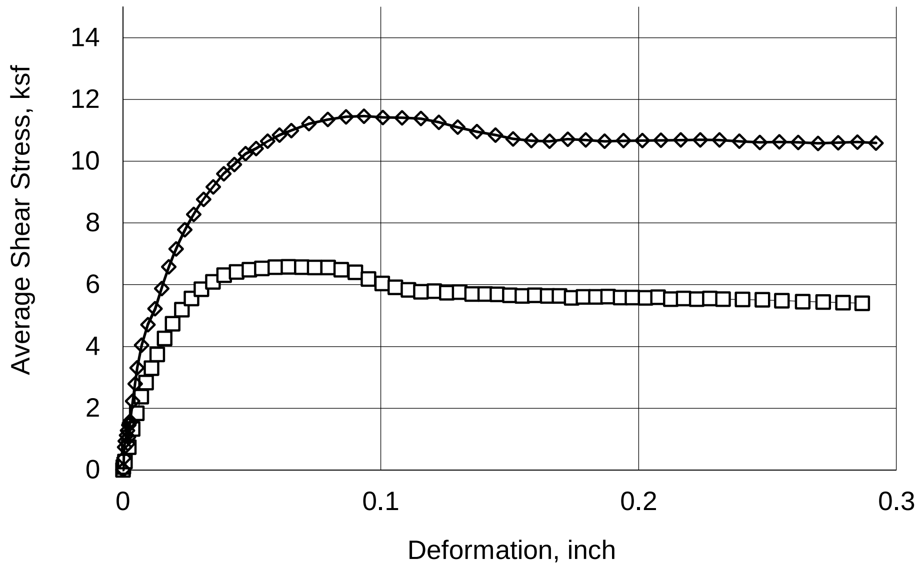
TEST INFORMATION

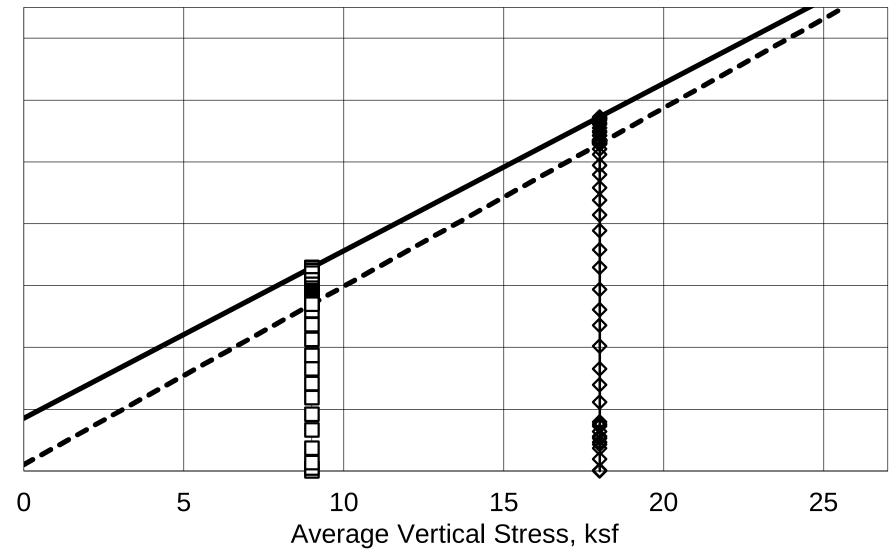
Test	Symbol	Vertical Stress (ksf)	Deformation Rate (inch/min.)
DS1619	□	9.0	0.0022
DS1617	◊	18.0	0.0020

TEST SUMMARY

Peak Effective Friction Angle: 28.4°, cohesion = 1.7ksf (solid line)
Final Effective Friction Angle: 30.0°, cohesion = 0.2ksf (dashed line)

REMARKS:





AECOM #60428794	Dynegy CCR - Newton	**DRAINED DIRECT SHEAR** **SERIES SUMMARY**	
TerraSense, LLC	T60428794	Boring: NEW-B006 Sample: ST- 4 Depth: 35-35.8	November 2015

Prepared by: MHC
Checked by: GET

STAGED DRAINED DIRECT SHEAR TEST SERIES

Boring No / Sample/ Specimen	Depth (ft) / Test ID	w_o / w_c (estimated) (%)	γ_{to} / γ_{tc} (estimated) (pcf)	γ_{do} / γ_{dc} (estimated) (pcf)	$\sigma'_{v,c}$ (ksf) / $\varepsilon_{v,c}$ (%)	Deformation rate (inch/min) / t_c (days)	at Peak Shear Stress / at High Deformation: ΔL (inch)	τ_h (ksf)	ε_v (%)	Φ' for c'=0	Remarks
NEW-B006	35.4	11.1	140.2	126.2	9.00	2.2E-3	0.06	6.58	-0.12	36.2	
ST- 4	DS1619	12.7	142.9	126.9	2.4	0.05	0.29	5.39	0.19	30.9	
NEW-B006	35.6	15.8	147.4	127.2	18.00	2.0E-3	0.09	11.46	0.36	32.5	
ST- 4	DS1617	12.4	148.1	131.7	27.0	0.16	0.29	10.59	0.71	30.5	

Description of Material Tested and Remarks	
DS1619	CL, brown sandy clay
DS1617	CL, brown sandy clay

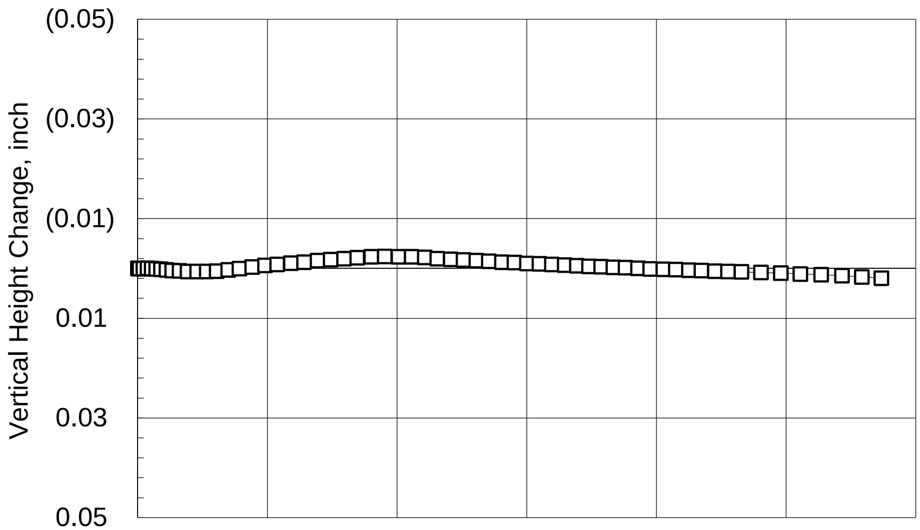
Strength Envelope Summary

Test Series	Failure Criterion	Φ' (degree)	c' (ksf)
1	1	28.4	1.7
	2	30.0	0.2

Failure Criterion: 1. Peak shear stress; 2. High deformation

Prepared by: MHC
Checked by: GET

AECOM #60428794	Dynegy CCR - Newton	**DRAINED DIRECT SHEAR SERIES SUMMARY**
TerraSense, LLC	T60428794	Boring: NEW-B006 Sample: ST- 4 Depth: 35-35.8 ft

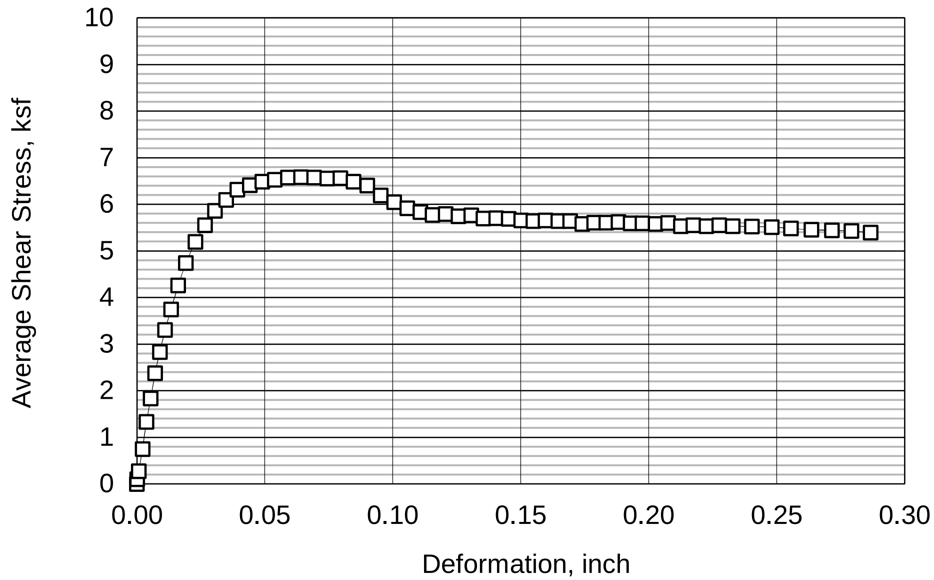


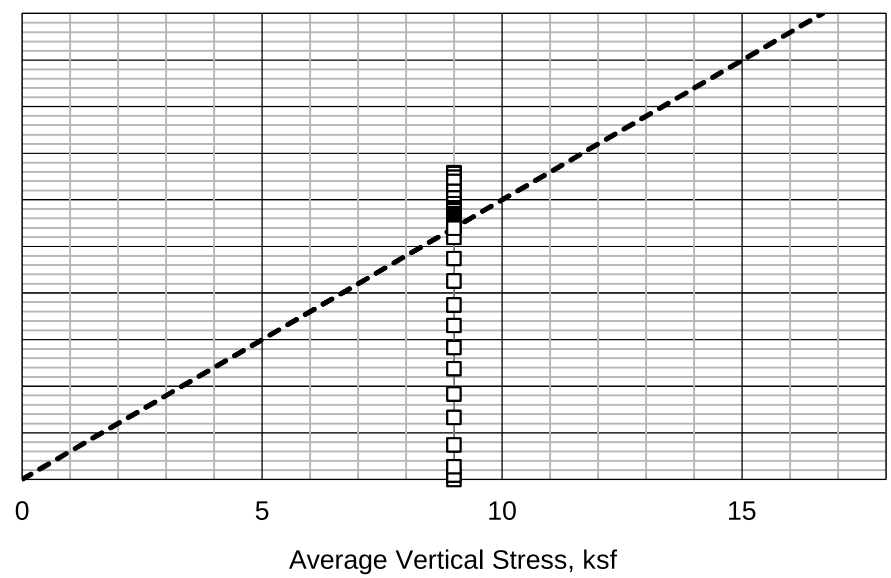
SAMPLE INFORMATION
Boring: NEW-B006 Sample: ST- 4 Specimen: B Depth: 35.4 ft
Type: Intact tube sample

SPECIMEN INFORMATION (Initial)
Description: CL, brown sandy clay
Height: 1.01 inch Diameter: 2.50 inch Area: 4.91 in²
Water Content: 11.1 % Dry Unit Weight: 126.2 pcf

TEST SUMMARY
Vertical Consolidation Stress: 9.00 ksf
Water Content: 12.7 % Dry Unit Weight: 126.9 pcf
Deformation Rate: 0.00224 inch/min.
Peak Shear Strength: 6.58 ksf @ 0.06 inch deformation
Peak Effective Friction Angle: 36.2°, cohesion = 0.0ksf
Final Shear Strength: 5.39 ksf @ 0.29 inch deformation
Final Effective Friction Angle: 30.9° (Shown)

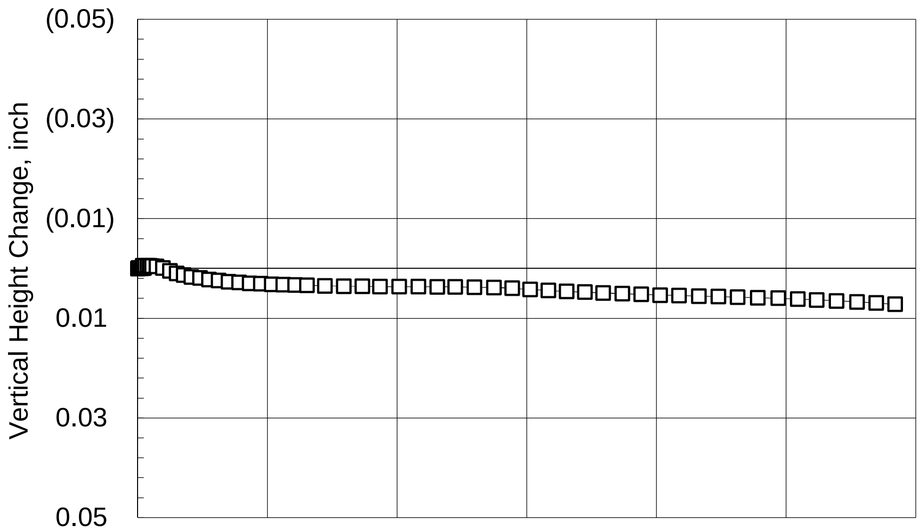
REMARKS:





	AECOM 60428794	Dynegy CCR - Newton	**DRAINED DIRECT SHEAR** **TEST SUMMARY**	
Prepared by: MHC Checked by: GET	**TerraSense, LLC**	T60428794	Boring: NEW-B006 Sample: ST- 4 Specimen: B Depth: 35.4 ft	November 15

Analysis File: DsV8.xlsx DS1619.xlsx 11/17/2015



SAMPLE INFORMATION

Boring: NEW-B006 Sample: ST- 4 Specimen: A Depth: 35.55 ft

Type: Intact tube sample

SPECIMEN INFORMATION (Initial)

Description: CL, brown sandy clay

Height: 1.01 inch Diameter: 2.50 inch Area: 4.91 in²

Water Content: 15.8 % Dry Unit Weight: 127.2 pcf

TEST SUMMARY

Vertical Consolidation Stress: 18.00 ksf

Water Content: 12.4 % Dry Unit Weight: 131.7 pcf

Deformation Rate: 0.00200 inch/min.

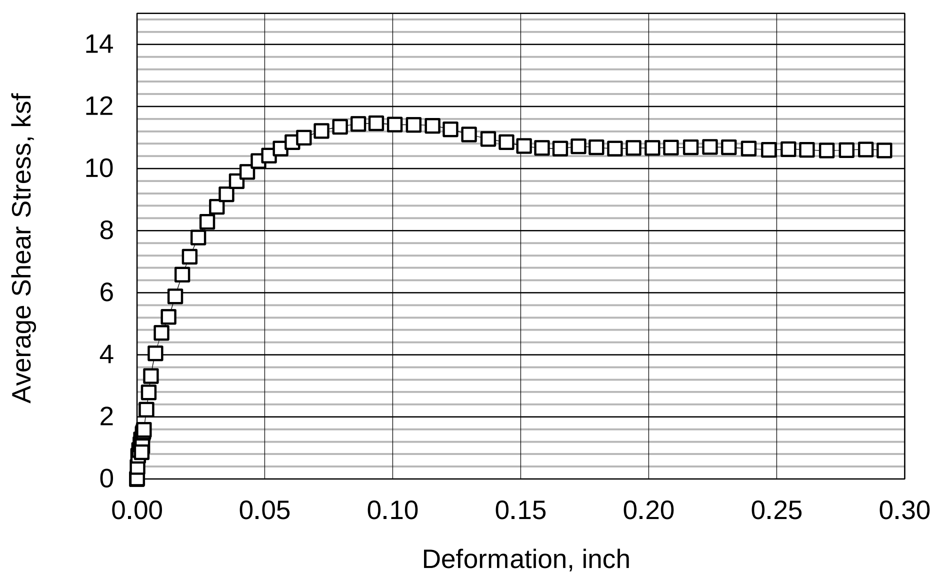
Peak Shear Strength: 11.46 ksf @ 0.09 inch deformation

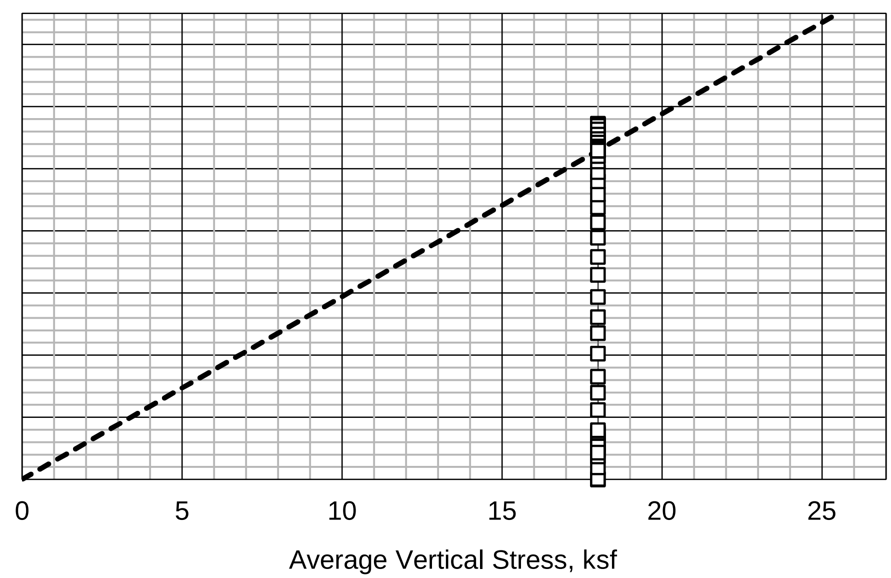
Peak Effective Friction Angle: 32.5°, cohesion = 0.0ksf

Final Shear Strength: 10.59 ksf @ 0.29 inch deformation

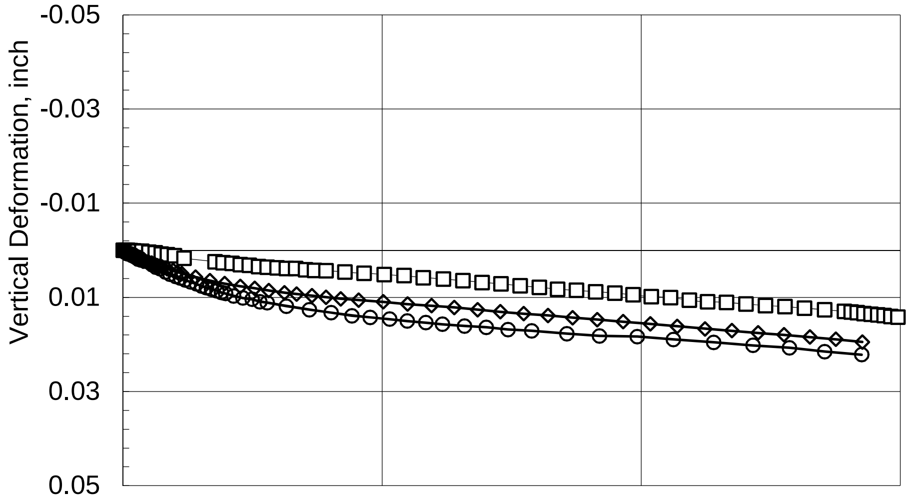
Final Effective Friction Angle: 30.5° (Shown)

REMARKS:





	AECOM 60428794	Dynegy CCR - Newton	**DRAINED DIRECT SHEAR** **TEST SUMMARY** Boring: NEW-B006 Sample: ST- 4 Specimen: A Depth: 35.55 ft	
Prepared by: MHC Checked by: GET	**TerraSense, LLC**	T60428794		November 15



SAMPLE INFORMATION

Boring: NEW-B007 Sample: ST-4 Depth: 40-42 feet

Type: Intact tube sample

Description: CH, brown clay with sand

TEST INFORMATION

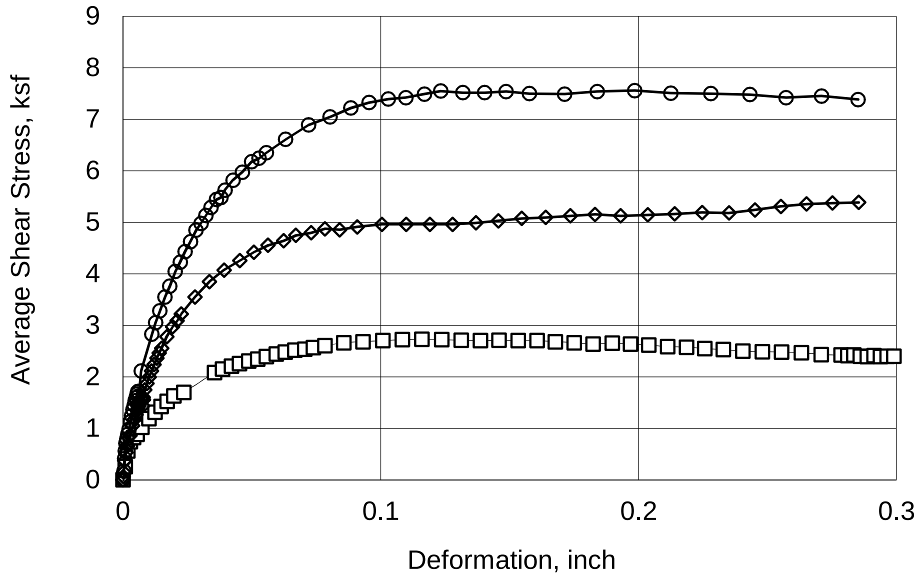
Test	Symbol	Vertical Stress (ksf)	Deformation Rate (inch/min.)
DS1620	□	5.0	0.0022
DS1621	◊	10.0	0.0002
DS1622	○	15.0	0.0001

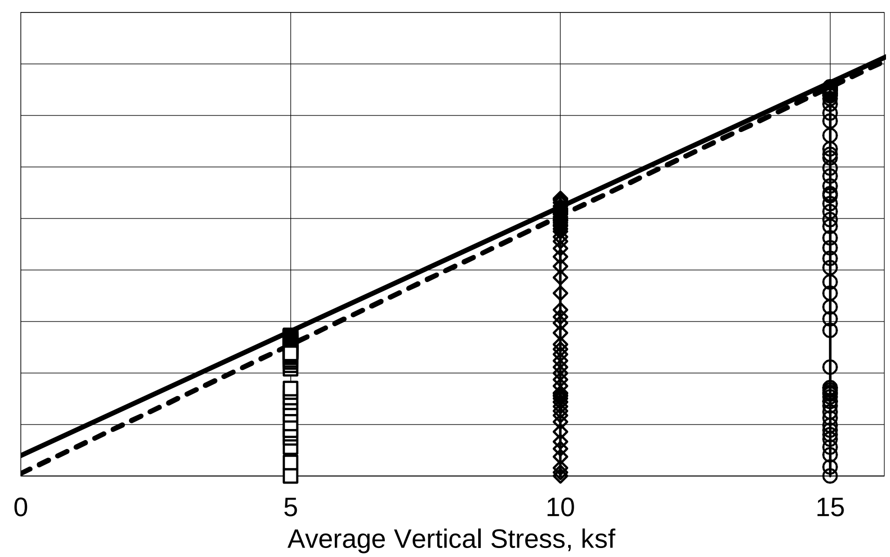
TEST SUMMARY

Peak Effective Friction Angle: 25.8°, cohesion = 0.4ksf (solid line)

Final Effective Friction Angle: 26.6°, cohesion = 0.1ksf (dashed line)

REMARKS:





AECOM #60428794	Dynegy CCR - Newton	**DRAINED DIRECT SHEAR** **SERIES SUMMARY** Boring: NEW-B007 Sample: ST-4 Depth: 40-42	
TerraSense, LLC	T60428794		November 2015

Prepared by: MHC

Checked by: GET

STAGED DRAINED DIRECT SHEAR TEST SERIES

Boring No / Sample/ Specimen	Depth (ft) / Test ID	w_o / w_c (estimated) (%)	γ_{to} / γ_{tc} (estimated) (pcf)	γ_{do} / γ_{dc} (estimated) (pcf)	$\sigma'_{v,c}$ (ksf) / $\varepsilon_{v,c}$ (%)	Deformation rate (inch/min) / t_c (days)	at Peak Shear Stress / at High Deformation: ΔL (inch)	τ_h (ksf)	ε_v (%)	Φ' for c'=0	Remarks
NEW-B007	41.0	17.5	129.9	110.5	5.00	2.2E-3	0.12	2.73	0.58	28.6	
ST-4	DS1620	18.6	131.8	111.1	2.9	1.69	0.30	2.38	1.45	25.5	
NEW-B007	41.3	14.7	128.7	112.2	10.00	1.8E-4	0.29	5.39	1.91	28.3	
ST- 4	DS1621	16.3	132.9	114.2	4.7	0.71	0.29	5.39	1.91	28.3	
NEW-B007	41.5	16.1	132.6	114.2	15.00	1.3E-4	0.20	7.56	1.83	26.7	
ST- 4	DS1622	14.8	138.9	121.0	8.5	0.78	0.29	7.38	2.21	26.2	

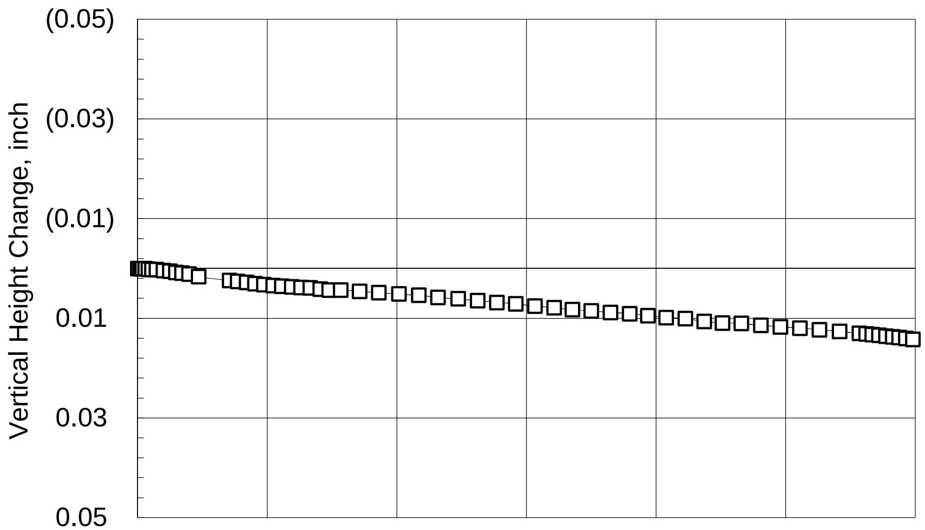
Description of Material Tested and Remarks	
DS1620	CH, brown clay with sand
DS1621	CH, brown clay with sand
DS1622	CH, brown clay with sand

Strength Envelope Summary

Test Series	Failure Criterion	Φ' (degree)	c' (ksf)
1	1	25.8	0.4
	2	26.6	0.1

Failure Criterion: 1. Peak shear stress; 2. High deformation

Prepared by: MHC Checked by: GET	AECOM #60428794 **TerraSense, LLC**	Dynegy CCR - Newton T60428794	**DRAINED DIRECT SHEAR SERIES SUMMARY** Boring: NEW-B007 Sample: ST-4 Depth: 40-42 ft



SAMPLE INFORMATION

Boring: NEW-B007 Sample: ST-4 Specimen: B Depth: 41 ft

Type: Intact tube sample

SPECIMEN INFORMATION (Initial)

Description: CH, brown clay with sand

Height: 1.00 inch Diameter: 2.50 inch Area: 4.91 in²

Water Content: 17.5 % Dry Unit Weight: 110.5 pcf

TEST SUMMARY

Vertical Consolidation Stress: 5.00 ksf

Water Content: 18.6 % Dry Unit Weight: 111.1 pcf

Deformation Rate: 0.00222 inch/min.

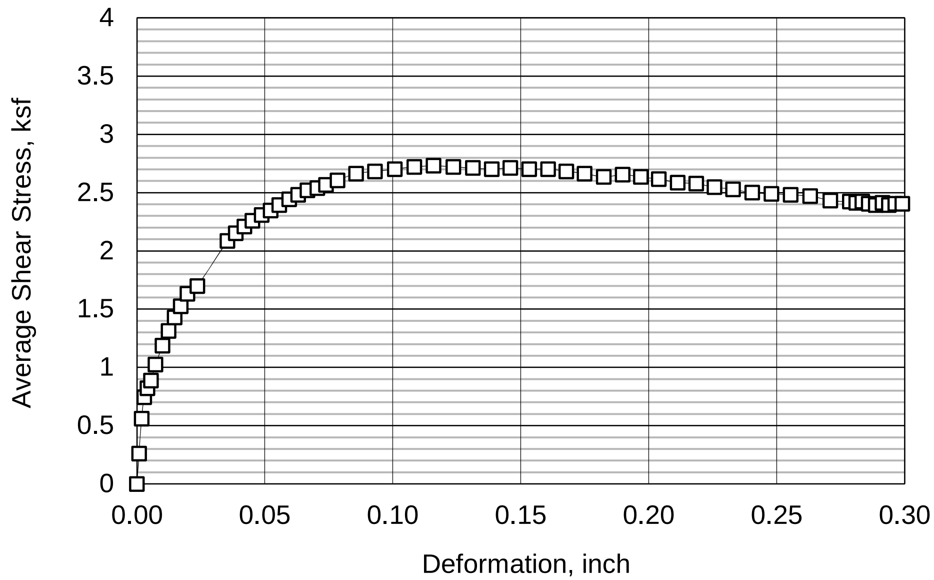
Peak Shear Strength: 2.73 ksf @ 0.12 inch deformation

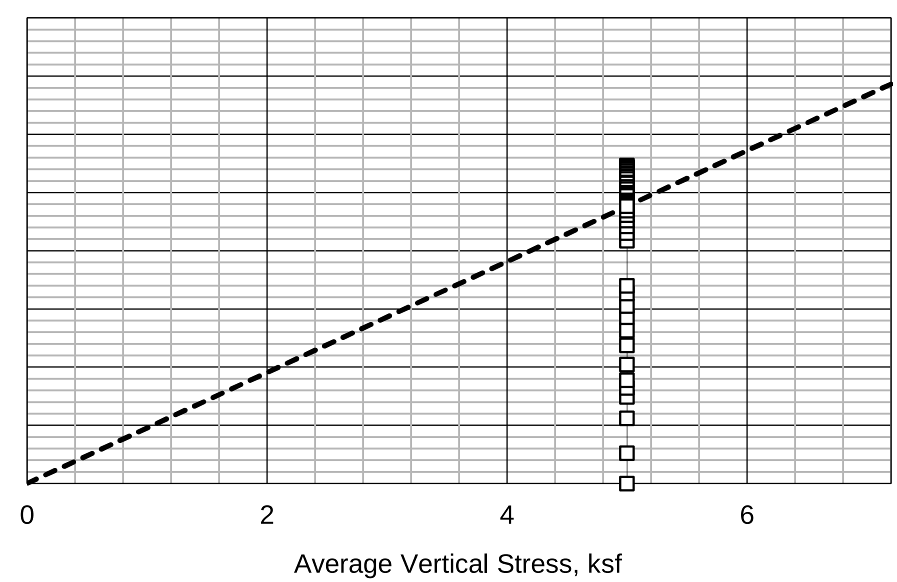
Peak Effective Friction Angle: 28.6°, cohesion = 0.0ksf

Final Shear Strength: 2.38 ksf @ 0.30 inch deformation

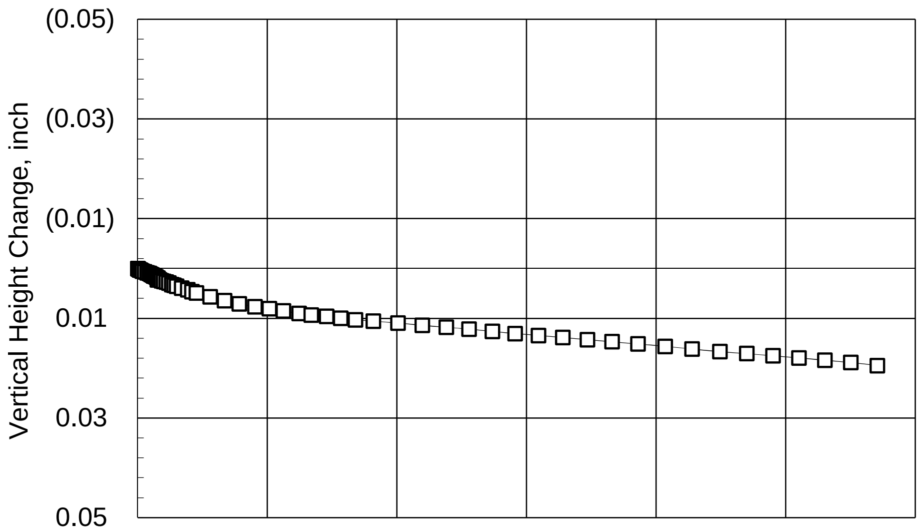
Final Effective Friction Angle: 25.5° (Shown)

REMARKS:





Prepared by: MHC Checked by: GET	AECOM 60428794 **TerraSense, LLC**	Dynegy CCR - Newton T60428794	**DRAINED DIRECT SHEAR** **TEST SUMMARY** Boring: NEW-B007 Sample: ST-4 Specimen: B Depth: 41 ft	November 15



SAMPLE INFORMATION

Boring: NEW-B007 Sample: ST- 4 Specimen: C Depth: 41.25 ft

Type: Intact tube sample

SPECIMEN INFORMATION (Initial)

Description: CH, brown clay with sand

Height: 1.02 inch Diameter: 2.50 inch Area: 4.91 in²

Water Content: 14.7 % Dry Unit Weight: 112.2 pcf

TEST SUMMARY

Vertical Consolidation Stress: 10.00 ksf

Water Content: 16.3 % Dry Unit Weight: 114.2 pcf

Deformation Rate: 0.00018 inch/min.

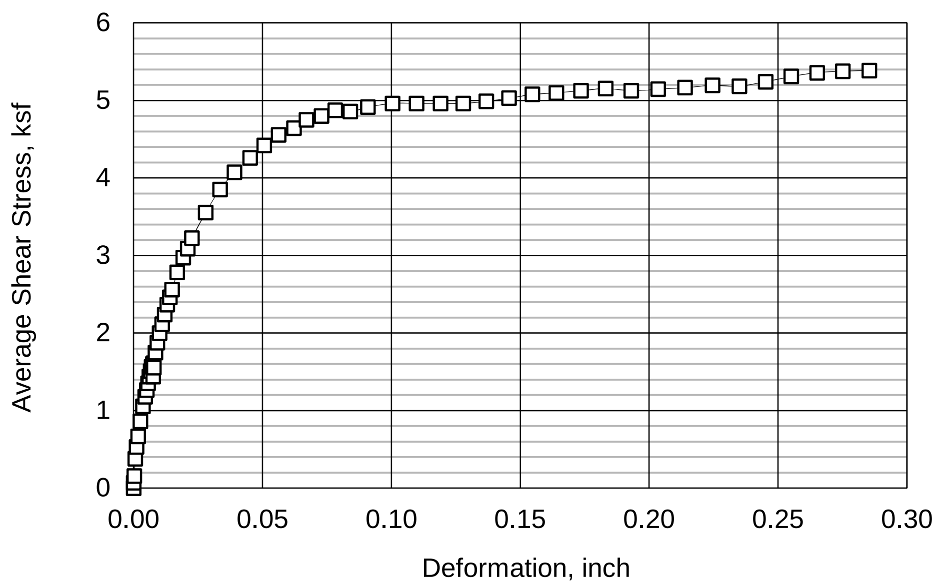
Peak Shear Strength: 5.39 ksf @ 0.29 inch deformation

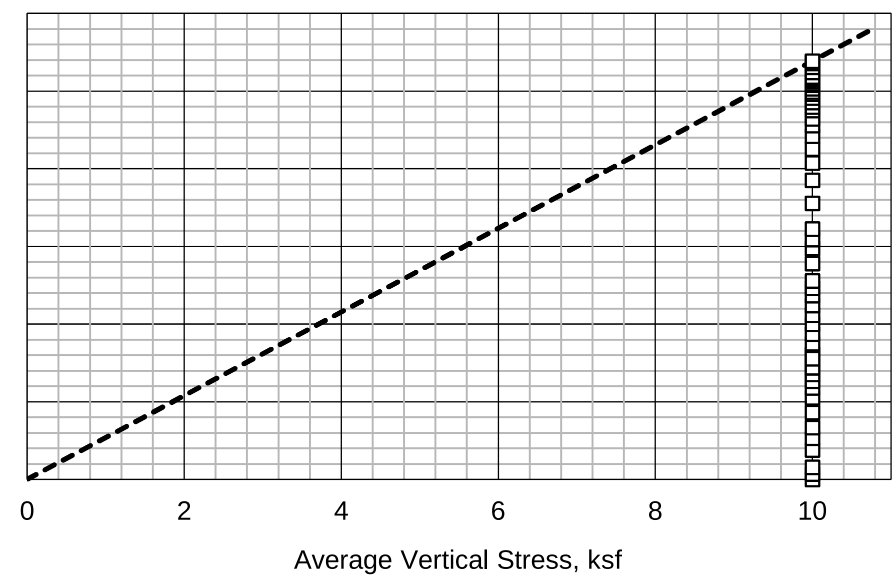
Peak Effective Friction Angle: 28.3°, cohesion = 0.0ksf

Final Shear Strength: 5.39 ksf @ 0.29 inch deformation

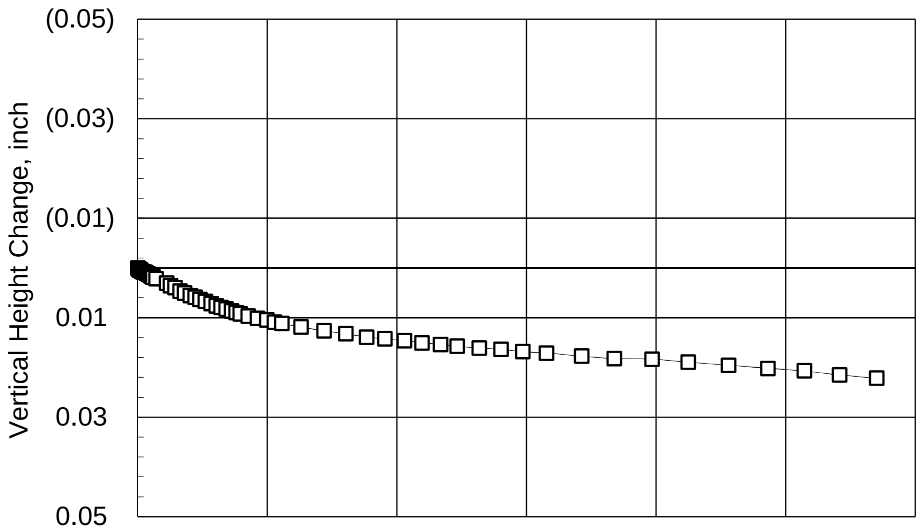
Final Effective Friction Angle: 28.3° (Shown)

REMARKS:





Prepared by: MHC Checked by: GET	AECOM 60428794	Dynegy CCR - Newton	**DRAINED DIRECT SHEAR** **TEST SUMMARY** Boring: NEW-B007 Sample: ST- 4 Specimen: C Depth: 41.25 ft	
	TerraSense, LLC	T60428794		November 15



SAMPLE INFORMATION

Boring: NEW-B007 Sample: ST- 4 Specimen: D Depth: 41.45 ft

Type: Intact tube sample

SPECIMEN INFORMATION (Initial)

Description: CH, brown clay with sand

Height: 1.00 inch Diameter: 2.50 inch Area: 4.91 in²

Water Content: 16.1 % Dry Unit Weight: 114.2 pcf

TEST SUMMARY

Vertical Consolidation Stress: 15.00 ksf

Water Content: 14.8 % Dry Unit Weight: 121.0 pcf

Deformation Rate: 0.00013 inch/min.

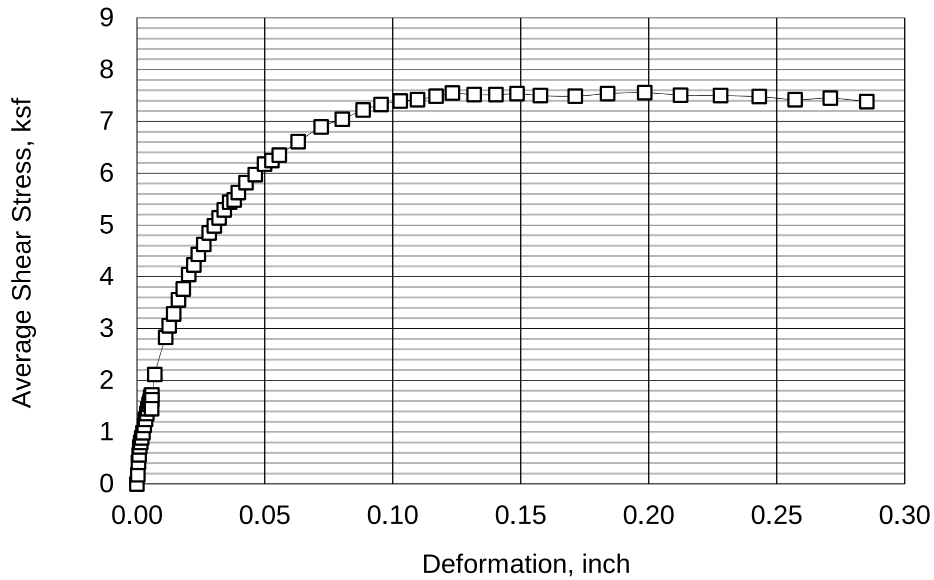
Peak Shear Strength: 7.56 ksf @ 0.20 inch deformation

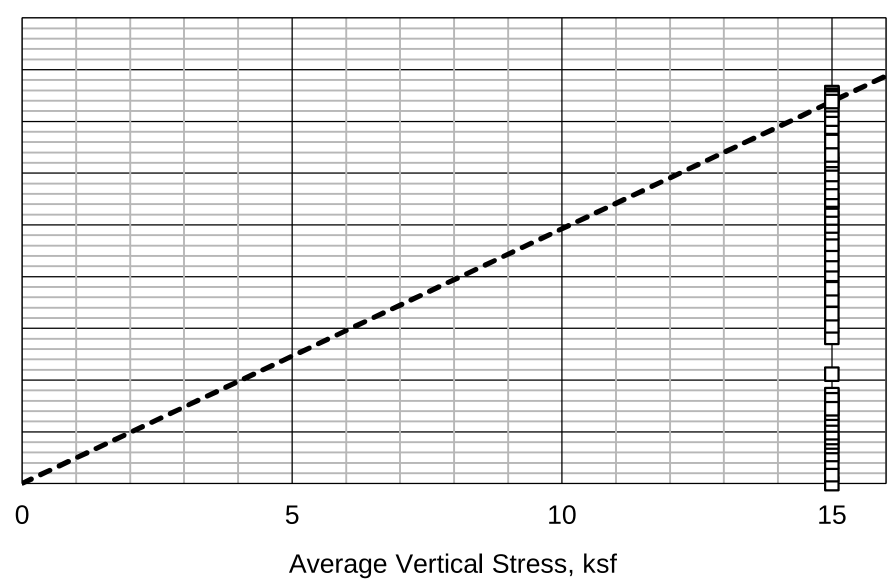
Peak Effective Friction Angle: 26.7°, cohesion = 0.0ksf

Final Shear Strength: 7.38 ksf @ 0.29 inch deformation

Final Effective Friction Angle: 26.2° (Shown)

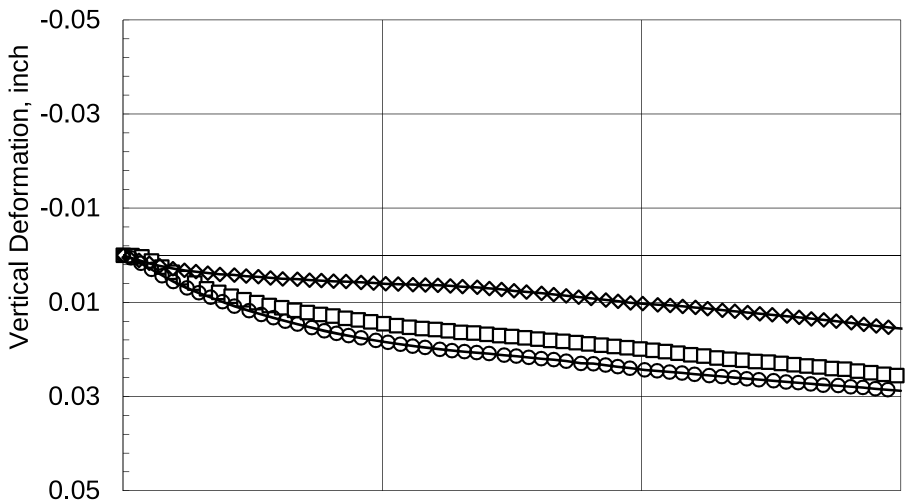
REMARKS:





Prepared by: MHC
Checked by: GET

AECOM 60428794	Dynegy CCR - Newton	**DRAINED DIRECT SHEAR** **TEST SUMMARY**	
TerraSense, LLC	T60428794	Boring: NEW-B007 Sample: ST- 4 Specimen: D Depth: 41.45 ft	November 15



SAMPLE INFORMATION

Boring: NEW-B008 Sample: ST-2 Depth: 27.5-28.75 feet
Type: Intact tube sample
Description: CL, dark brown sandy clay with gravel

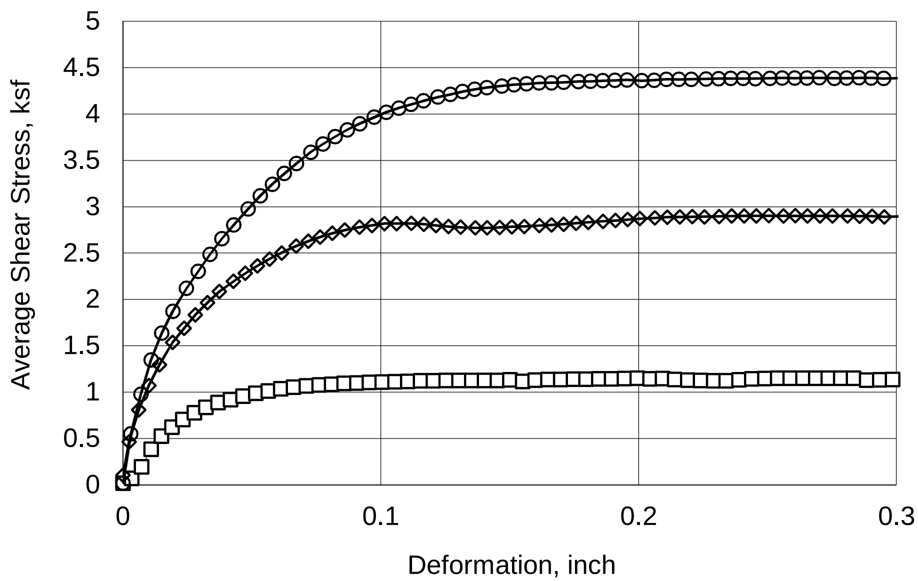
TEST INFORMATION

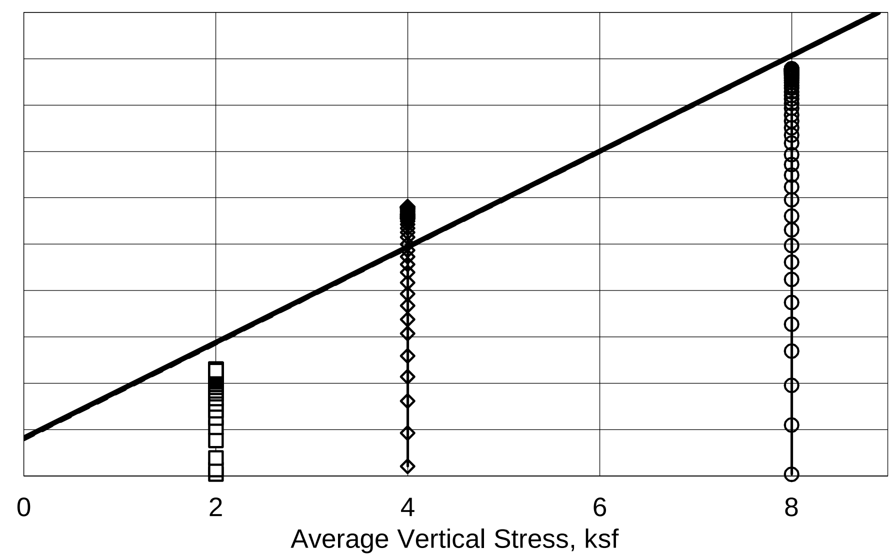
Test	Symbol	Vertical Stress (ksf)	Deformation Rate (inch/min.)
DS1624	□	2.0	0.0002
DS1626	◊	4.0	0.0002
DS1628	○	8.0	0.0002

TEST SUMMARY

Peak Effective Friction Angle: 27.3°, cohesion = 0.4ksf (solid line)
Final Effective Friction Angle: 27.3°, cohesion = 0.4ksf (dashed line)

REMARKS:





Prepared by: MHC Checked by: GET	AECOM #60428794	Dynegy CCR - Newton	**DRAINED DIRECT SHEAR** **SERIES SUMMARY** Boring: NEW-B008 Sample: ST-2 Depth: 27.5-28.75	
	TerraSense, LLC	T60428794		November 2015

STAGED DRAINED DIRECT SHEAR TEST SERIES

Boring No / Sample/ Specimen	Depth (ft) / Test ID	w_o / w_c (estimated) (%)	γ_{to} / γ_{tc} (estimated) (pcf)	γ_{do} / γ_{dc} (estimated) (pcf)	$\sigma'_{v,c}$ (ksf) / $\varepsilon_{v,c}$ (%)	Deformation rate (inch/min) / t_c (days)	at Peak Shear Stress / at High Deformation: ΔL (inch)	τ_h (ksf)	ε_v (%)	Φ' for c'=0	Remarks
NEW-B008	27.7	20.3	122.5	101.8	2.00	1.9E-4	0.27	1.15	2.29	29.9	
ST-2	DS1624	20.9	126.7	104.8	4.0	0.33	0.28	1.15	2.34	29.9	
NEW-B008	28.0	14.4	133.8	117.0	4.00	1.9E-4	0.25	2.90	1.26	36.0	
ST-2	DS1626	19.3	143.5	120.3	4.4	0.67	0.29	2.90	1.46	35.9	
NEW-B008	28.4	16.4	133.2	114.5	8.00	1.9E-4	0.29	4.39	2.79	28.8	
ST-2	DS1628	18.2	141.6	119.9	7.2	0.67	0.29	4.39	2.79	28.8	

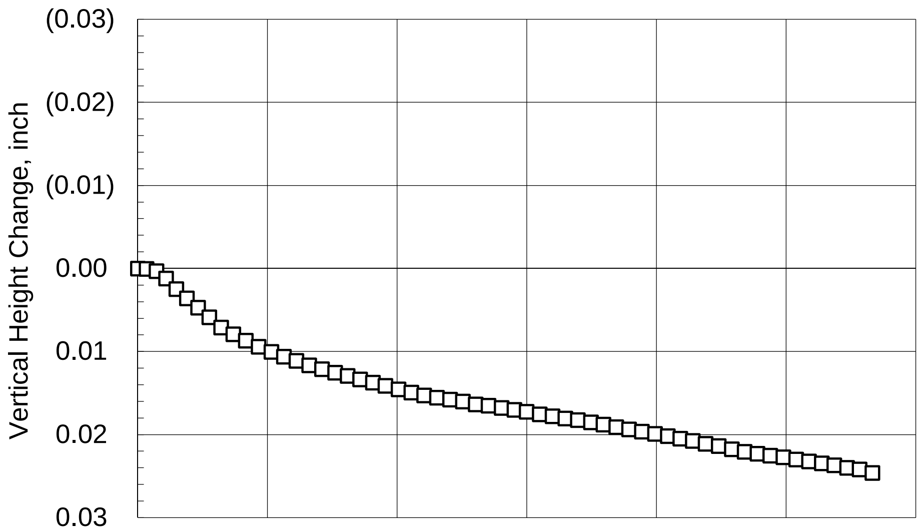
Description of Material Tested and Remarks	
DS1624	CL, dark brown sandy clay with gravel
DS1626	CL, dark brown sandy clay with gravel
DS1628	CL, dark brown clay with sand and gravel

Strength Envelope Summary

Test Series	Failure Criterion	Φ' (degree)	c' (ksf)
1	1	27.3	0.4
	2	27.3	0.4

Failure Criterion: 1. Peak shear stress; 2. High deformation

Prepared by: MCH Checked by: GET	AECOM #60428794	Dynegy CCR - Newton	**DRAINED DIRECT SHEAR SERIES SUMMARY**
	TerraSense, LLC	T60428794	Boring: NEW-B008 Sample: ST-2 Depth: 27.5-28.75 ft



SAMPLE INFORMATION

Boring: NEW-B008 Sample: ST-2 Specimen: A Depth: 27.7 ft

Type: Intact tube sample

SPECIMEN INFORMATION (Initial)

Description: CL, dark brown clay with sand and gravel

Height: 1.05 inch Diameter: 2.50 inch Area: 4.91 in²

Water Content: 20.3 % Dry Unit Weight: 101.8 pcf

TEST SUMMARY

Vertical Consolidation Stress: 2.00 ksf

Water Content: 20.9 % Dry Unit Weight: 104.8 pcf

Deformation Rate: 0.00019 inch/min.

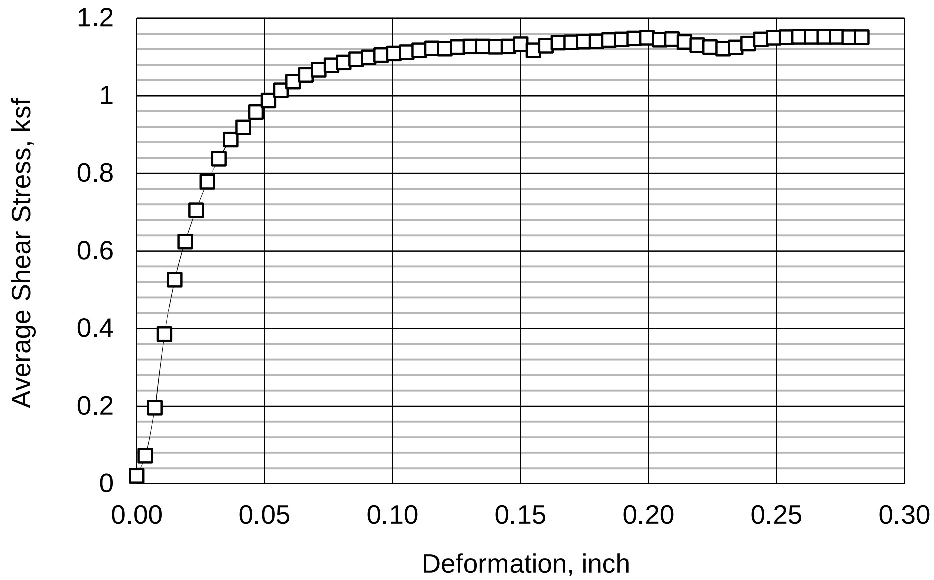
Peak Shear Strength: 1.15 ksf @ 0.27 inch deformation

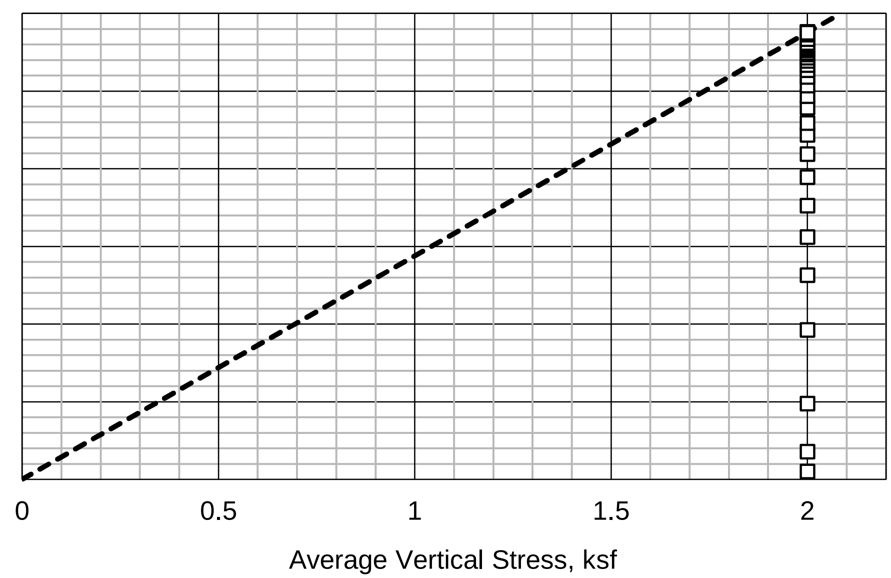
Peak Effective Friction Angle: 29.9°, cohesion = 0.0 ksf

Final Shear Strength: 1.15 ksf @ 0.28 inch deformation

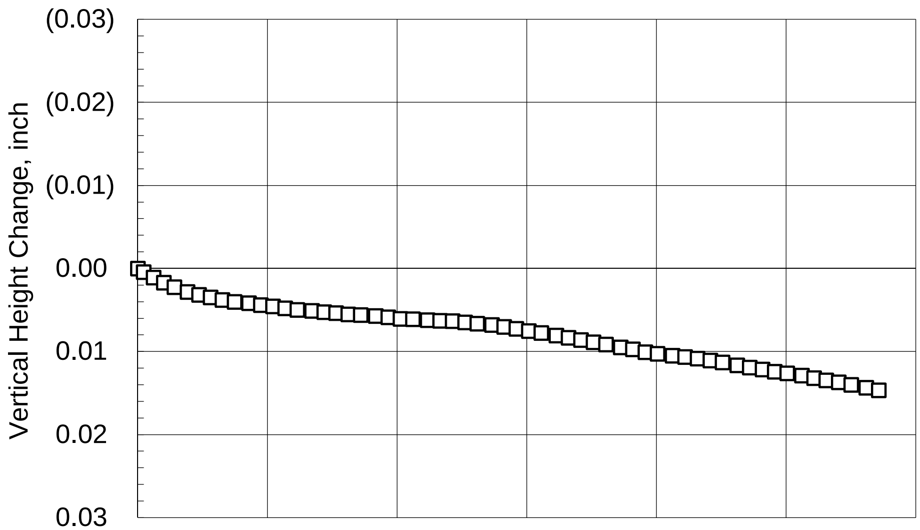
Final Effective Friction Angle: 29.9° (Shown)

REMARKS:





Prepared by: MCH Checked by: GET	AECOM 60428794	Dynegy CCR - Newton	**DRAINED DIRECT SHEAR** **TEST SUMMARY** Boring: NEW-B008 Sample: ST-2 Specimen: A Depth: 27.7 ft	
	TerraSense, LLC	T60428794		November 15



SAMPLE INFORMATION

Boring: NEW-B008 Sample: ST-2 Specimen: B Depth: 28 ft

Type: Intact tube sample

SPECIMEN INFORMATION (Initial)

Description: CL, dark brown sandy clay with gravel

Height: 1.00 inch Diameter: 2.50 inch Area: 4.91 in²

Water Content: 14.4 % Dry Unit Weight: 117.0 pcf

TEST SUMMARY

Vertical Consolidation Stress: 4.00 ksf

Water Content: 19.3 % Dry Unit Weight: 120.3 pcf

Deformation Rate: 0.00019 inch/min.

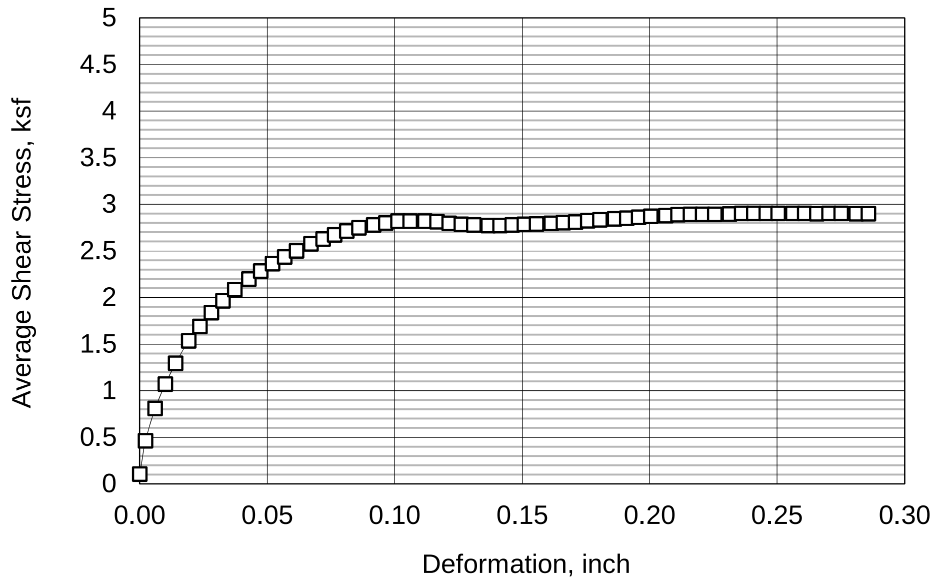
Peak Shear Strength: 2.90 ksf @ 0.25 inch deformation

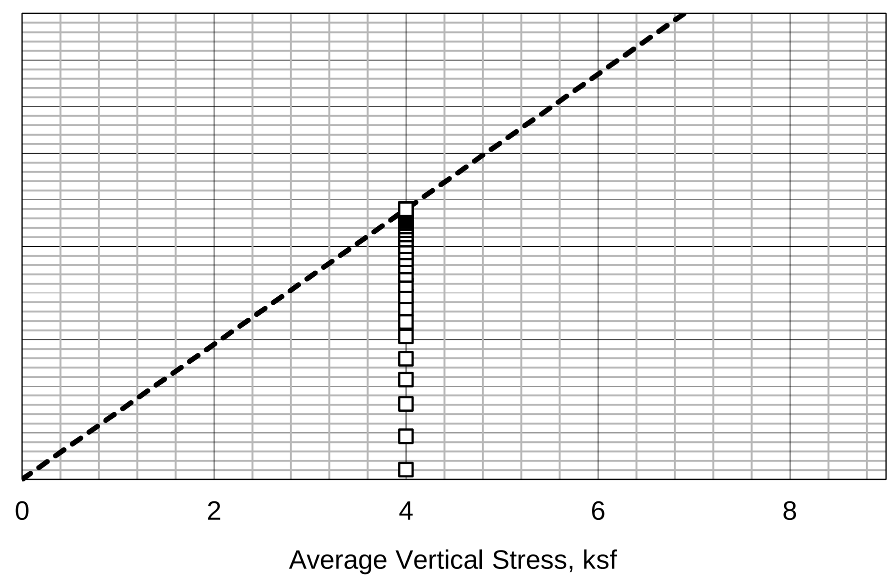
Peak Effective Friction Angle: 36.0°, cohesion = 0.0 ksf

Final Shear Strength: 2.90 ksf @ 0.29 inch deformation

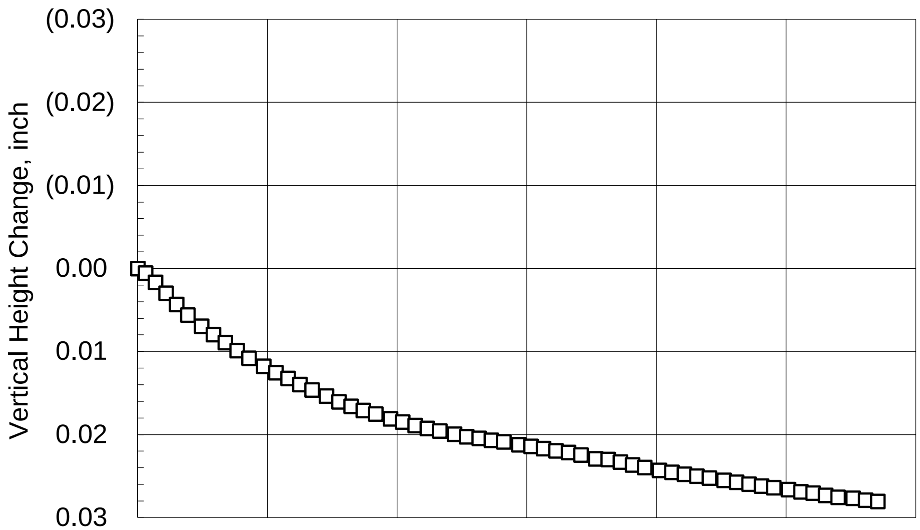
Final Effective Friction Angle: 35.9° (Shown)

REMARKS:





Prepared by: MCH Checked by: GET	AECOM 60428794	Dynegy CCR - Newton	**DRAINED DIRECT SHEAR** **TEST SUMMARY** Boring: NEW-B008 Sample: ST-2 Specimen: B Depth: 28 ft	
	TerraSense, LLC	T60428794		November 15



SAMPLE INFORMATION

Boring: NEW-B008 Sample: ST-2 Specimen: C Depth: 28.4 ft

Type: Intact tube sample

SPECIMEN INFORMATION (Initial)

Description: CL, dark brown sandy clay with gravel

Height: 1.01 inch Diameter: 2.50 inch Area: 4.91 in²

Water Content: 16.4 % Dry Unit Weight: 114.5 pcf

TEST SUMMARY

Vertical Consolidation Stress: 8.00 ksf

Water Content: 18.2 % Dry Unit Weight: 119.9 pcf

Deformation Rate: 0.00019 inch/min.

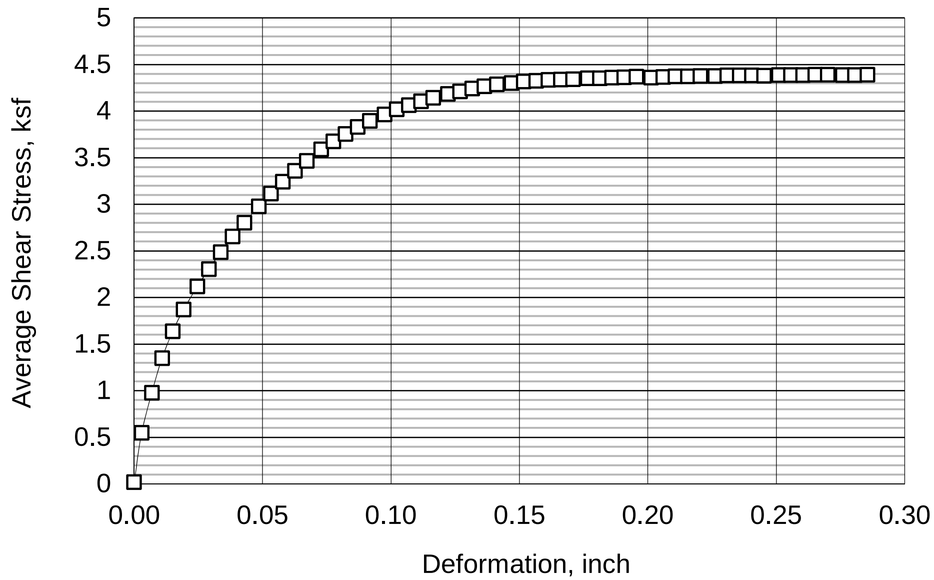
Peak Shear Strength: 4.39 ksf @ 0.29 inch deformation

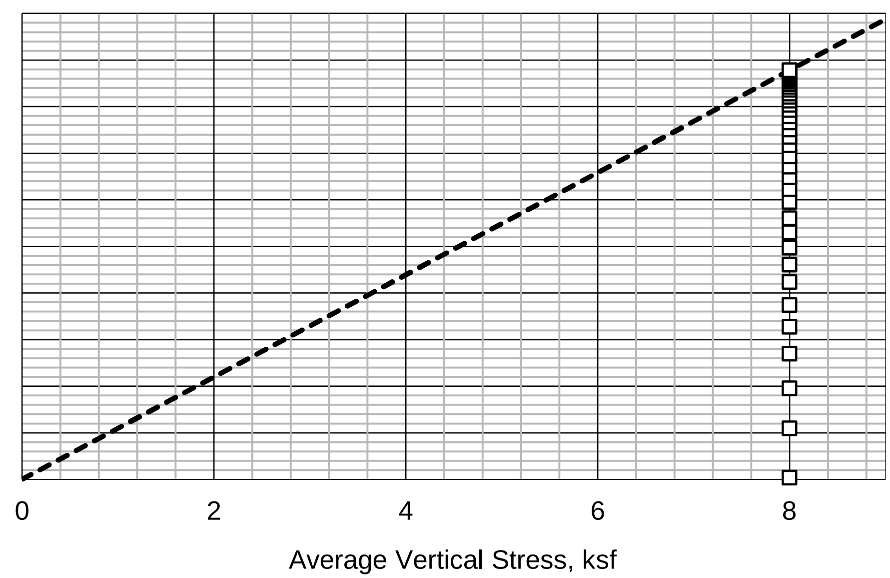
Peak Effective Friction Angle: 28.8°, cohesion = 0.0 ksf

Final Shear Strength: 4.39 ksf @ 0.29 inch deformation

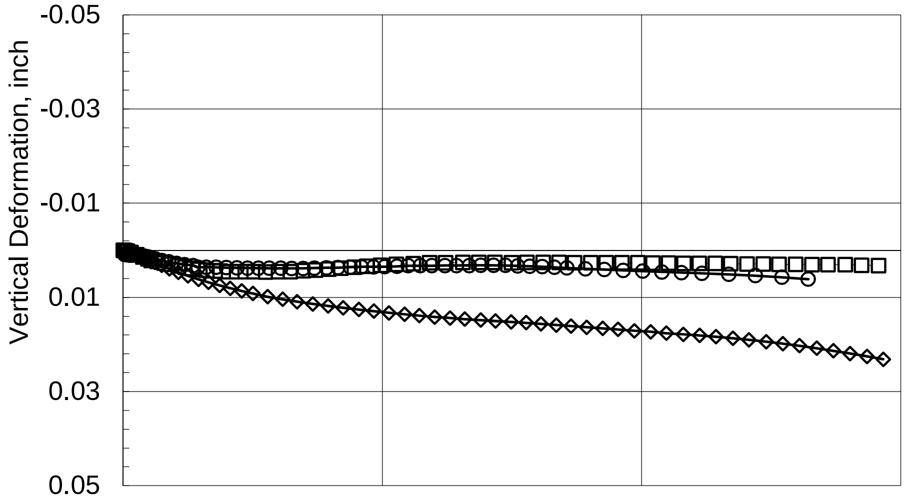
Final Effective Friction Angle: 28.8° (Shown)

REMARKS:





Prepared by: MCH Checked by: GET	AECOM 60428794	Dynegy CCR - Newton	**DRAINED DIRECT SHEAR** **TEST SUMMARY** Boring: NEW-B008 Sample: ST-2 Specimen: C Depth: 28.4 ft	
	TerraSense, LLC	T60428794		November 15



SAMPLE INFORMATION

Boring: NEW-B012 Sample: ST-19 A Depth: 80-82 feet
Type: Intact tube sample
Description: SC, brown clayey sand

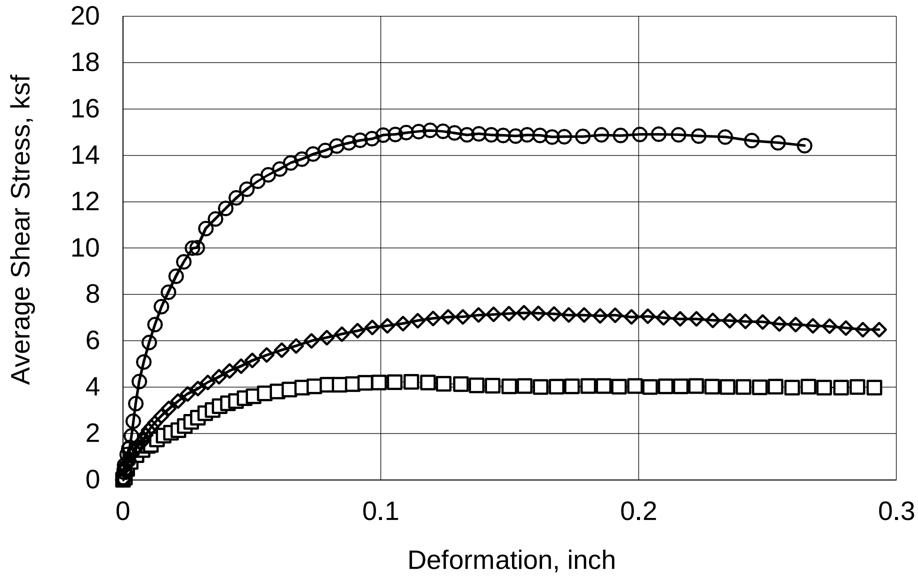
TEST INFORMATION

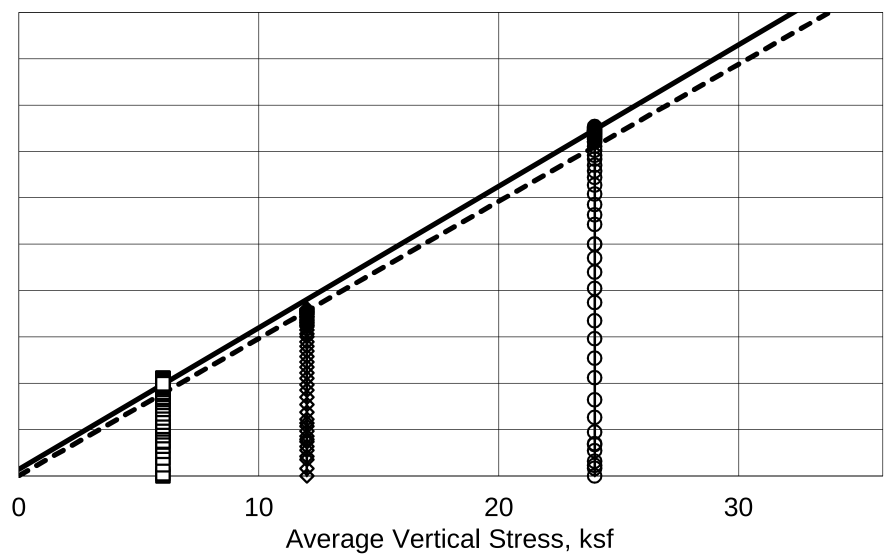
Test	Symbol	Vertical Stress (ksf)	Deformation Rate (inch/min.)
DS1611	□	6.0	0.0022
DS1613	◊	12.0	0.0021
DS1612	○	24.0	0.0017

TEST SUMMARY

Peak Effective Friction Angle: 31.4°, cohesion = 0.3ksf ———
Final Effective Friction Angle: 30.6°, cohesion = 0.0ksf - - - -

REMARKS:





AECOM #60428794	Dynegy CCR - Newton	**DRAINED DIRECT SHEAR** **SERIES SUMMARY**	
TerraSense, LLC	T60428794	Boring: NEW-B012 Sample: ST-19 A Depth: 80-82	November 2015

Prepared by: MHC
Checked by: GET

STAGED DRAINED DIRECT SHEAR TEST SERIES

Boring No / Sample/ Specimen	Depth (ft) / Test ID	w_o / w_c (estimated) (%)	γ_{to} / γ_{tc} (estimated) (pcf)	γ_{do} / γ_{dc} (estimated) (pcf)	$\sigma'_{v,c}$ (ksf) / $\varepsilon_{v,c}$ (%)	Deformation rate (inch/min) / t_c (days)	at Peak Shear Stress / at High Deformation ΔL (inch)	τ_h (ksf)	ε_v (%)	Φ' for c'=0	Remarks
NEW-B012	81.1	11.2	136.8	122.9	6.00	2.2E-3	0.11	4.23	0.28	35.2	
ST-19 A	DS1611	12.1	140.7	125.5	4.4	0.06	0.29	3.98	0.32	33.5	
NEW-B012	81.8	16.9	130.5	111.7	12.00	2.1E-3	0.16	7.21	1.54	31.0	
ST-19	DS1613	16.7	136.2	116.7	8.6	1.81	0.29	6.49	2.32	28.4	
NEW-B012	81.5	10.5	139.2	126.0	24.00	1.7E-3	0.12	15.08	0.33	32.1	
ST-19	DS1612	10.9	145.6	131.3	14.6	0.13	0.26	14.42	0.61	31.0	

Description of Material Tested and Remarks

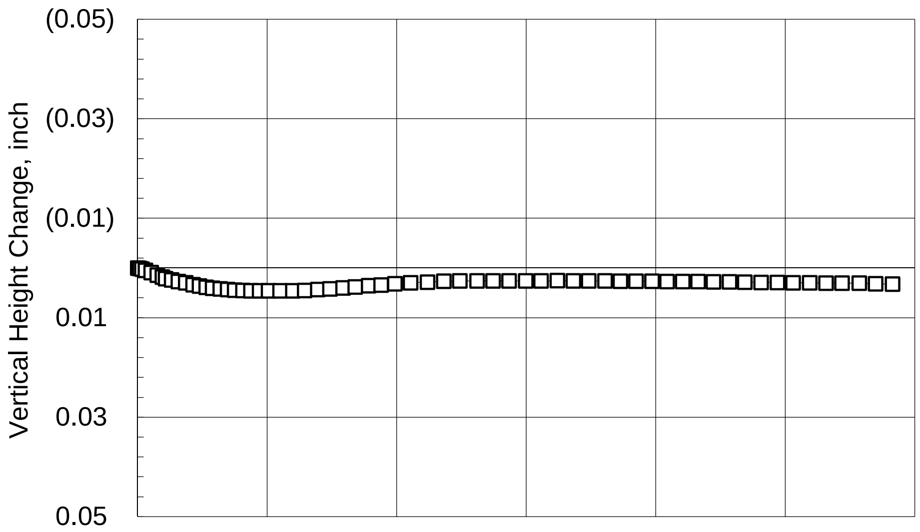
DS1611	SC, brown clayey sand
DS1613	SC, brown clayey sand
DS1612	SC, brown clayey sand

Strength Envelope Summary

Test Series	Failure Criterion	Φ' (degree)	c' (ksf)
1	1	31.4	0.3
	2	30.6	0.0

Failure Criterion: 1. Peak shear stress; 2. High deformation

Prepared by: MHC Checked by: GET	AECOM #60428794 **TerraSense, LLC**	Dynegy CCR - Newton T60428794	**DRAINED DIRECT SHEAR SERIES SUMMARY** Boring: NEW-B012 Sample: ST-19 A Depth: 80-82 ft



SAMPLE INFORMATION

Boring: NEW-B012 Sample: ST-19 A Specimen: 1 Depth: 81.1 ft

Type: Intact tube sample

SPECIMEN INFORMATION (Initial)

Description: SC, brown clayey sand

Height: 1.00 inch Diameter: 2.50 inch Area: 4.91 in²

Water Content: 11.2 % Dry Unit Weight: 122.9 pcf

TEST SUMMARY

Vertical Consolidation Stress: 6.00 ksf

Water Content: 12.1 % Dry Unit Weight: 125.5 pcf

Deformation Rate: 0.00222 inch/min.

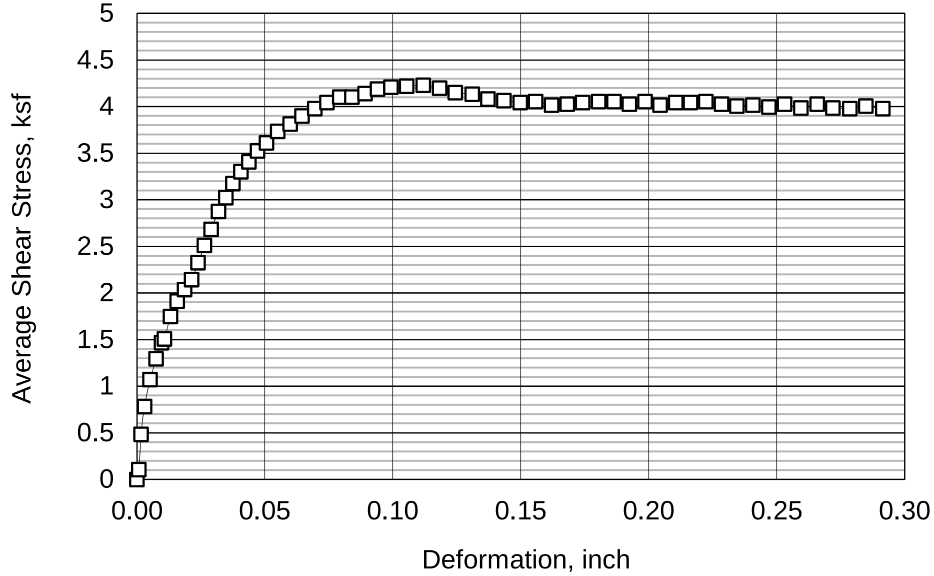
Peak Shear Strength: 4.23 ksf @ 0.11 inch deformation

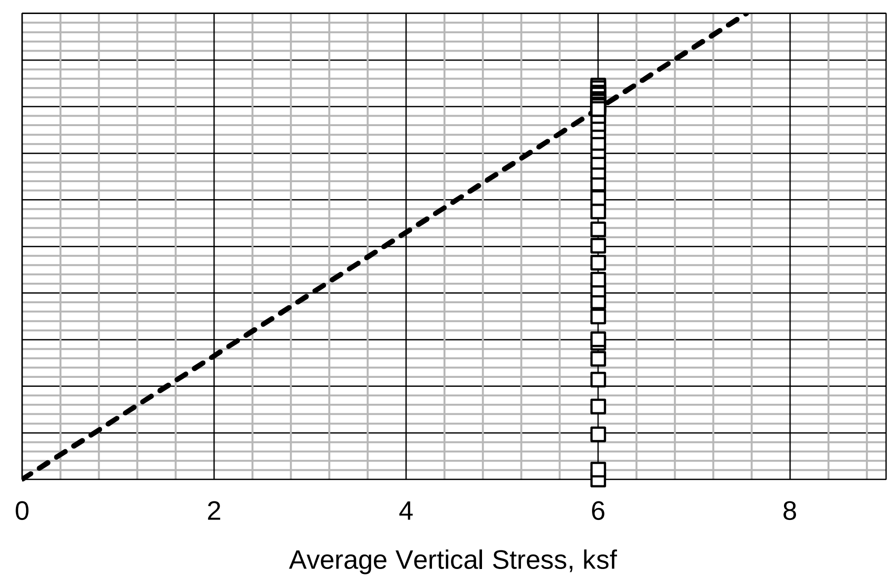
Peak Effective Friction Angle: 35.2°, cohesion = 0.0ksf

Final Shear Strength: 3.98 ksf @ 0.29 inch deformation

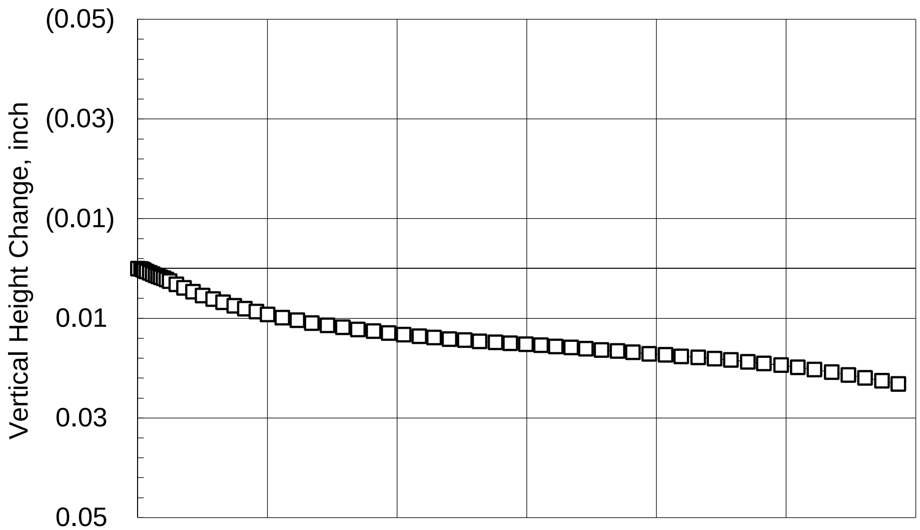
Final Effective Friction Angle: 33.5° (Shown)

REMARKS:





Prepared by: MHC Checked by: GET	AECOM 60428794 **TerraSense, LLC**	Dynegy CCR - Newton T60428794	**DRAINED DIRECT SHEAR** **TEST SUMMARY** Boring: NEW-B012 Sample: ST-19 A Specimen: 1 Depth: 81.1 ft	November 15

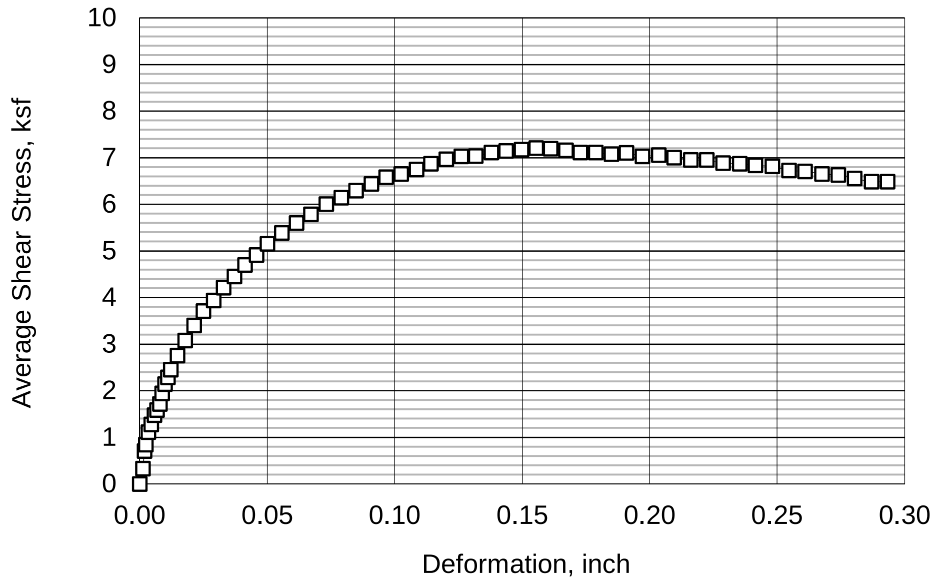


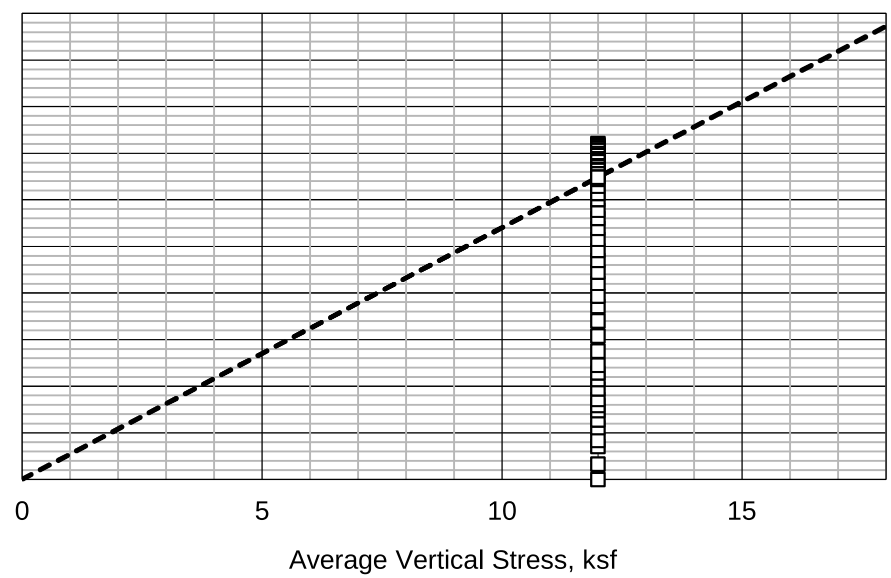
SAMPLE INFORMATION
Boring: NEW-B012 Sample: ST-19 Specimen: C Depth: 81.8 ft
Type: Intact tube sample

SPECIMEN INFORMATION (Initial)
Description: SC, brown clayey sand
Height: 1.00 inch Diameter: 2.50 inch Area: 4.91 in²
Water Content: 16.9 % Dry Unit Weight: 111.7 pcf

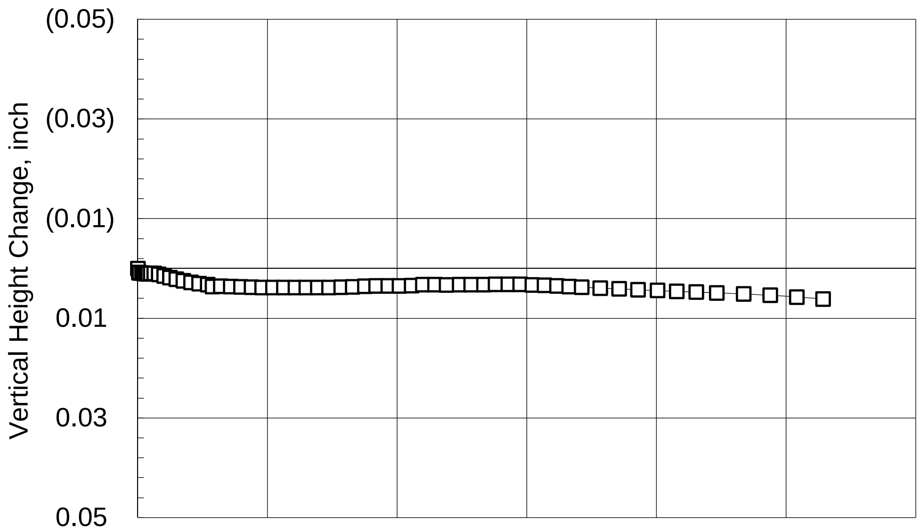
TEST SUMMARY
Vertical Consolidation Stress: 12.00 ksf
Water Content: 16.7 % Dry Unit Weight: 116.7 pcf
Deformation Rate: 0.00211 inch/min.
Peak Shear Strength: 7.21 ksf @ 0.16 inch deformation
Peak Effective Friction Angle: 31.0°, cohesion = 0.0ksf
Final Shear Strength: 6.49 ksf @ 0.29 inch deformation
Final Effective Friction Angle: 28.4° (Shown)

REMARKS:





Prepared by: MHC Checked by: GET	AECOM 60428794	Dynegy CCR - Newton	**DRAINED DIRECT SHEAR** **TEST SUMMARY**	
	TerraSense, LLC	T60428794	Boring: NEW-B012 Sample: ST-19 Specimen: C Depth: 81.8 ft	November 15



SAMPLE INFORMATION

Boring: NEW-B012 Sample: ST-19 Specimen: B Depth: 81.5 ft

Type: Intact tube sample

SPECIMEN INFORMATION (Initial)

Description: SC, brown clayey sand

Height: 1.00 inch Diameter: 2.50 inch Area: 4.91 in²

Water Content: 10.5 % Dry Unit Weight: 126.0 pcf

TEST SUMMARY

Vertical Consolidation Stress: 24.00 ksf

Water Content: 10.9 % Dry Unit Weight: 131.3 pcf

Deformation Rate: 0.00171 inch/min.

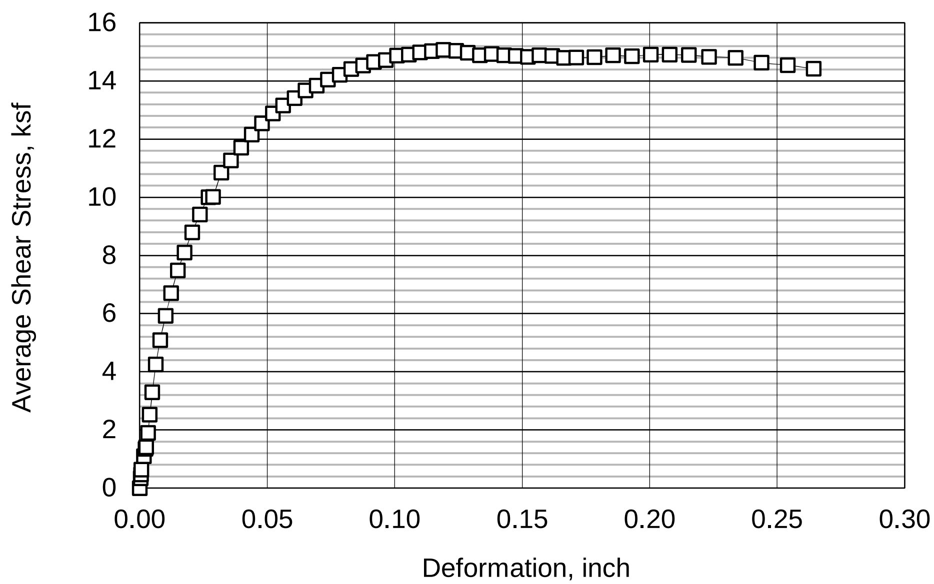
Peak Shear Strength: 15.08 ksf @ 0.12 inch deformation

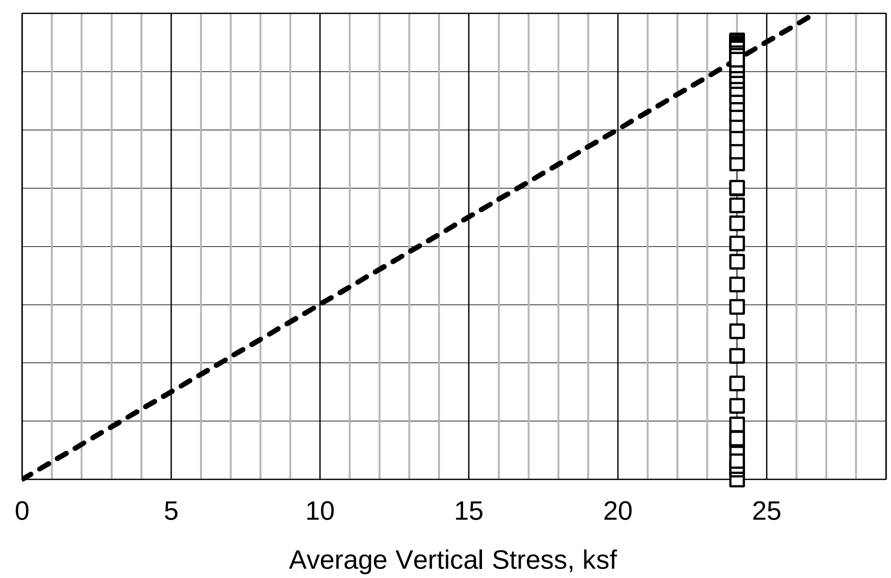
Peak Effective Friction Angle: 32.1°, cohesion = 0.0ksf

Final Shear Strength: 14.42 ksf @ 0.26 inch deformation

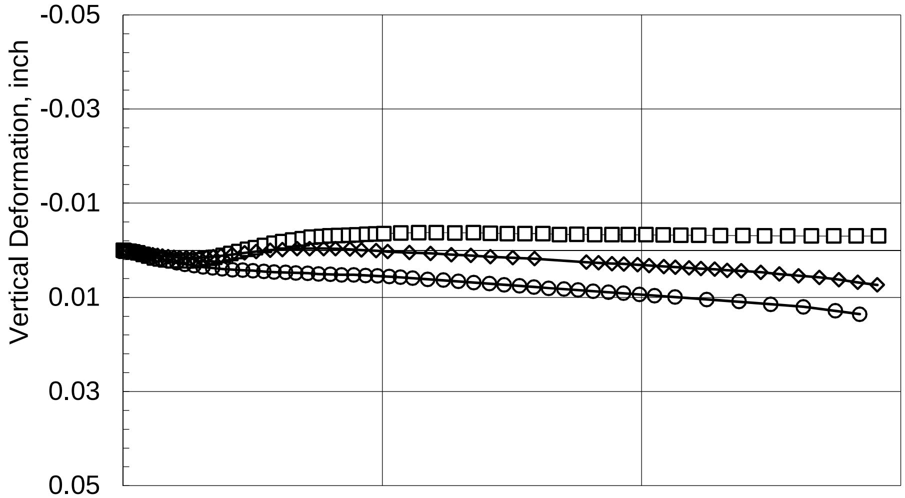
Final Effective Friction Angle: 31.0° (Shown)

REMARKS:





Prepared by: MHC Checked by: GET	AECOM 60428794	Dynegy CCR - Newton	**DRAINED DIRECT SHEAR** **TEST SUMMARY** Boring: NEW-B012 Sample: ST-19 Specimen: B Depth: 81.5 ft	November 15
	TerraSense, LLC	T60428794		



SAMPLE INFORMATION

Boring: NEW-B015 Sample: ST-3 Depth: 60-61.3 feet
Type: Intact tube sample
Description: CL, brown clay with sand and gravel

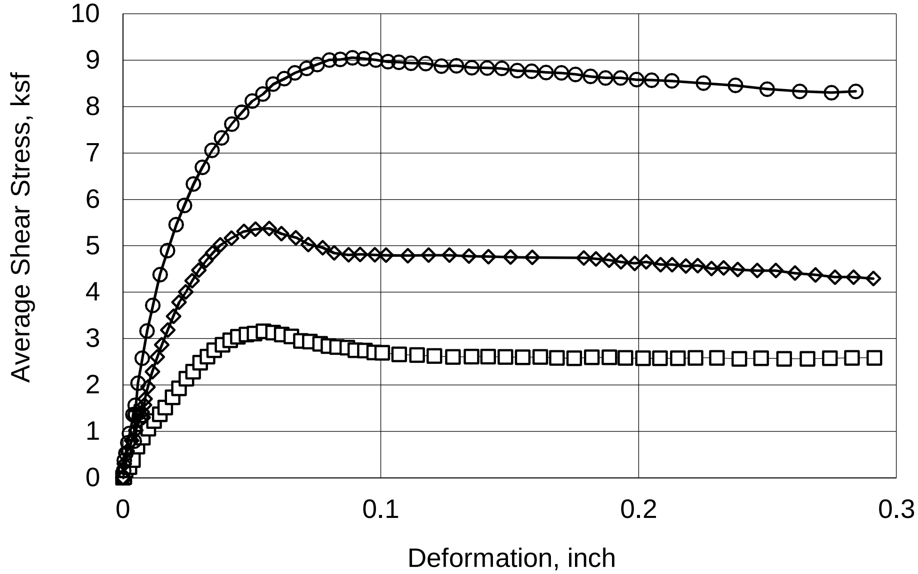
TEST INFORMATION

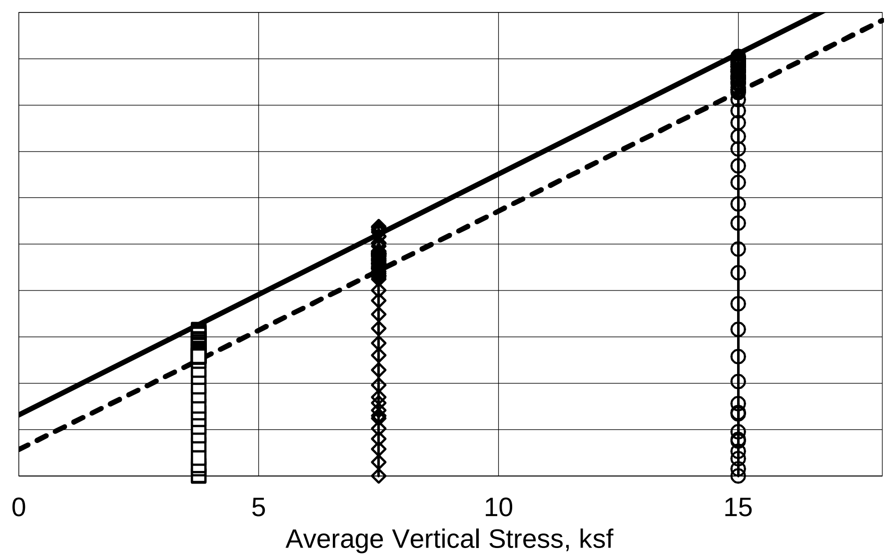
Test	Symbol	Vertical Stress (ksf)	Deformation Rate (inch/min.)
DS1623	□	3.8	0.0008
DS1625	◊	7.5	0.0008
DS1627	○	15.0	0.0007

TEST SUMMARY

Peak Effective Friction Angle: 27.4°, cohesion = 1.3ksf (solid line)
Final Effective Friction Angle: 27.2°, cohesion = 0.6ksf (dashed line)

REMARKS:





Prepared by: MHC Checked by: GET	AECOM #60428794	Dynegy CCR - Newton	**DRAINED DIRECT SHEAR** **SERIES SUMMARY** Boring: NEW-B015 Sample: ST-3 Depth: 60-61.3	
	TerraSense, LLC	T60428794		November 2015

STAGED DRAINED DIRECT SHEAR TEST SERIES

Boring No / Sample/ Specimen	Depth (ft) / Test ID	w_o / w_c (estimated) (%)	γ_{to} / γ_{tc} (estimated) (pcf)	γ_{do} / γ_{dc} (estimated) (pcf)	$\sigma'_{v,c}$ (ksf) / $\varepsilon_{v,c}$ (%)	Deformation rate (inch/min) / t_c (days)	at Peak Shear Stress / at High Deformation: ΔL (inch)	τ_h (ksf)	ε_v (%)	Φ' for c'=0	Remarks
NEW-B015	60.4	11.2	139.6	125.5	3.75	8.2E-4	0.05	3.16	-0.10	40.1	
ST-3	DS1623	12.0	141.2	126.1	2.8	0.63	0.29	2.59	-0.30	34.6	
NEW-B015	60.8	11.9	140.2	125.3	7.50	7.8E-4	0.06	5.38	0.00	35.6	
ST-3	DS1625	13.3	142.1	125.5	2.7	0.24	0.29	4.29	0.73	29.8	
NEW-B015	61.1	12.7	139.8	124.1	15.00	6.6E-4	0.09	9.05	0.51	31.1	
ST-3	DS1627	12.0	141.4	126.2	4.9	1.08	0.28	8.33	1.33	29.0	

Description of Material Tested and Remarks	
DS1623	CL, brown clay with sand and gravel
DS1625	CL, brown clay with sand
DS1627	CL, brown clay with sand

Strength Envelope Summary

Test Series	Failure Criterion	Φ' (degree)	c' (ksf)
1	1	27.4	1.3
	2	27.2	0.6

Failure Criterion: 1. Peak shear stress; 2. High deformation

Prepared by: MHC
Checked by: GET

AECOM #60428794

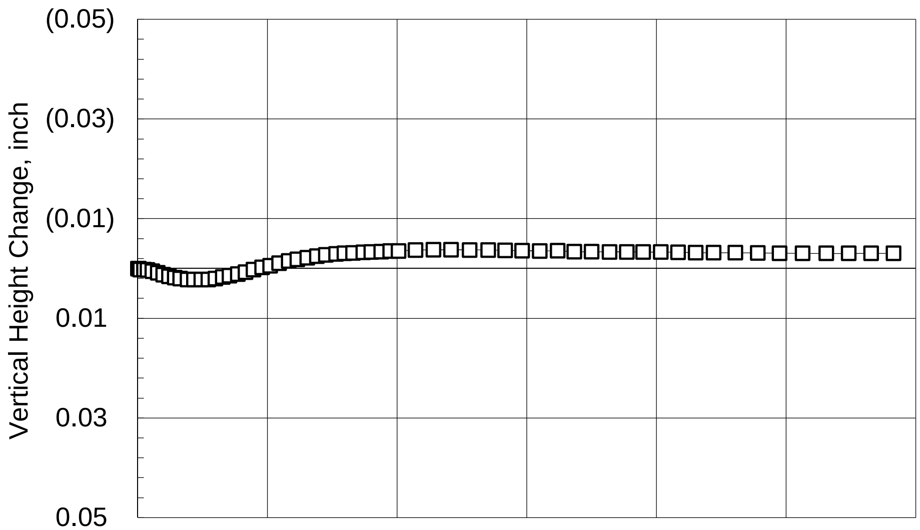
TerraSense, LLC

Dynegy CCR - Newton

T60428794

DRAINED DIRECT SHEAR SERIES SUMMARY

Boring: NEW-B015 Sample: ST-3
Depth: 60-61.3 ft

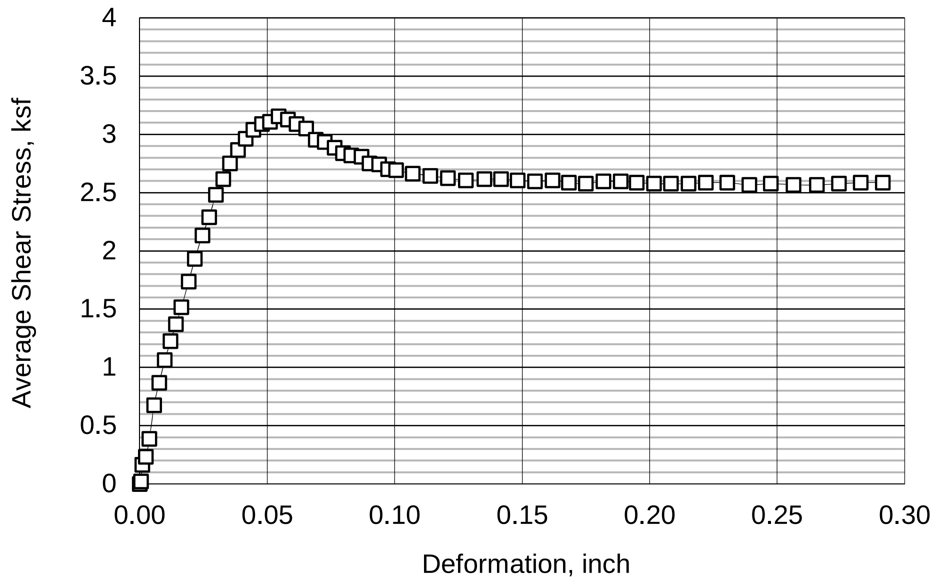


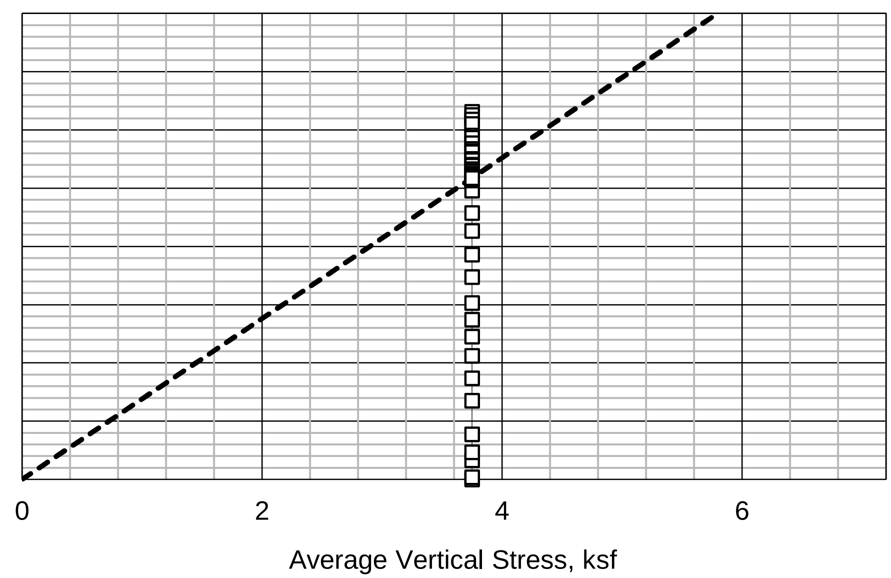
SAMPLE INFORMATION
Boring: NEW-B015 Sample: ST-3 Specimen: B Depth: 60.35 ft
Type: Intact tube sample

SPECIMEN INFORMATION (Initial)
Description: CL, brown clay with sand and gravel
Height: 1.01 inch Diameter: 2.50 inch Area: 4.91 in²
Water Content: 11.2 % Dry Unit Weight: 125.5 pcf

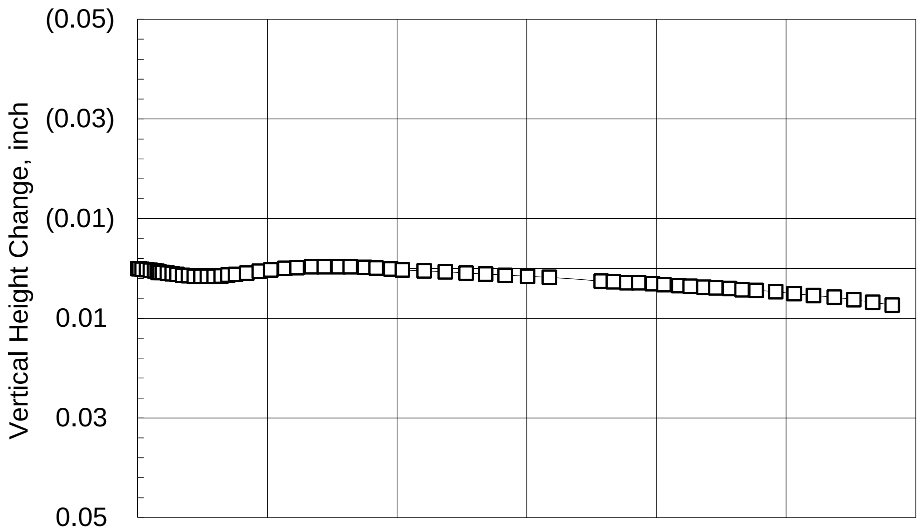
TEST SUMMARY
Vertical Consolidation Stress: 3.75 ksf
Water Content: 12.0 % Dry Unit Weight: 126.1 pcf
Deformation Rate: 0.00082 inch/min.
Peak Shear Strength: 3.16 ksf @ 0.05 inch deformation
Peak Effective Friction Angle: 40.1°, cohesion = 0.0ksf
Final Shear Strength: 2.59 ksf @ 0.29 inch deformation
Final Effective Friction Angle: 34.6° (Shown)

REMARKS:





Prepared by: MHC Checked by: GET	AECOM 60428794	Dynegy CCR - Newton	**DRAINED DIRECT SHEAR** **TEST SUMMARY**	
	TerraSense, LLC	T60428794	Boring: NEW-B015 Sample: ST-3 Specimen: B Depth: 60.35 ft	November 15



SAMPLE INFORMATION

Boring: NEW-B015 Sample: ST-3 Specimen: C Depth: 60.75 ft

Type: Intact tube sample

SPECIMEN INFORMATION (Initial)

Description: CL, brown clay with sand

Height: 1.00 inch Diameter: 2.50 inch Area: 4.91 in²

Water Content: 11.9 % Dry Unit Weight: 125.3 pcf

TEST SUMMARY

Vertical Consolidation Stress: 7.50 ksf

Water Content: 13.3 % Dry Unit Weight: 125.5 pcf

Deformation Rate: 0.00078 inch/min.

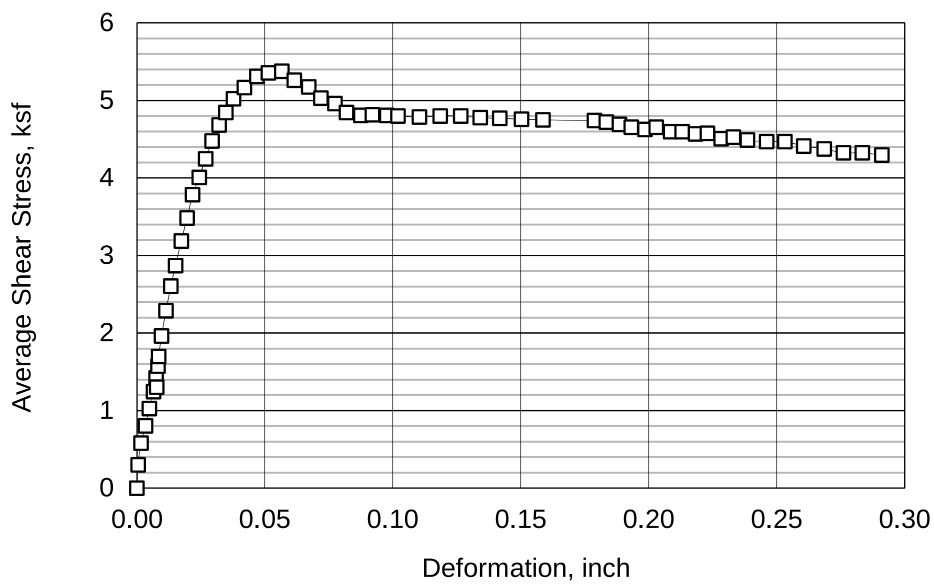
Peak Shear Strength: 5.38 ksf @ 0.06 inch deformation

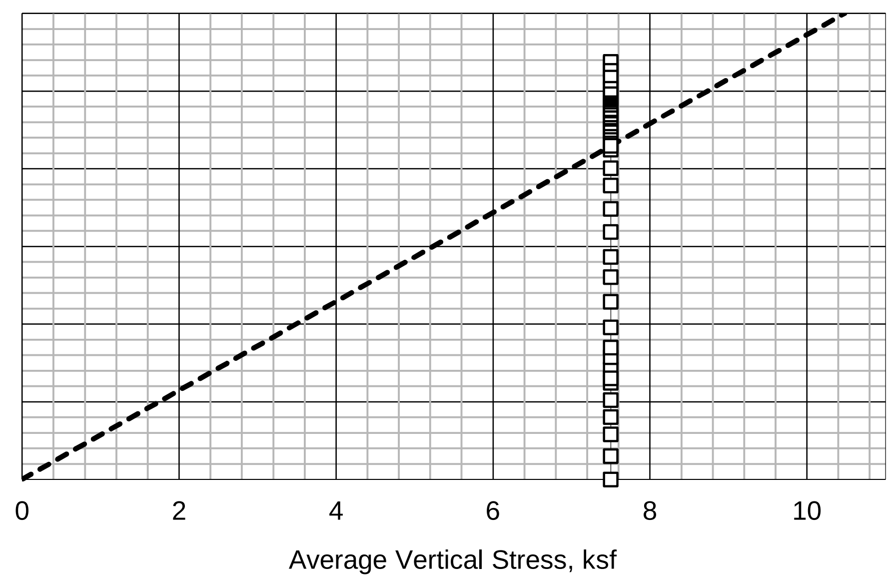
Peak Effective Friction Angle: 35.6°, cohesion = 0.0ksf

Final Shear Strength: 4.29 ksf @ 0.29 inch deformation

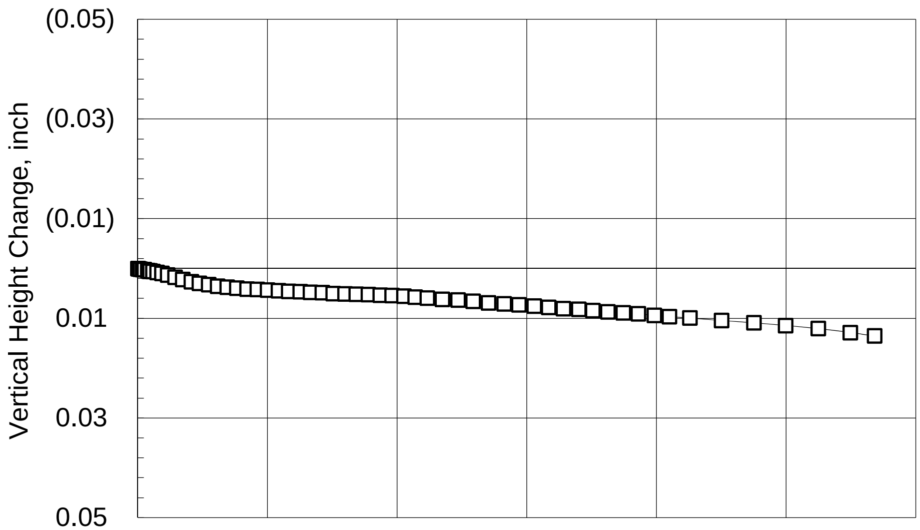
Final Effective Friction Angle: 29.8° (Shown)

REMARKS:





	AECOM 60428794	Dynegy CCR - Newton	**DRAINED DIRECT SHEAR** **TEST SUMMARY** Boring: NEW-B015 Sample: ST-3 Specimen: C Depth: 60.75 ft	
Prepared by: MHC Checked by: GET	**TerraSense, LLC**	T60428794		November 15



SAMPLE INFORMATION

Boring: NEW-B015 Sample: ST-3 Specimen: D Depth: 61.05 ft

Type: Intact tube sample

SPECIMEN INFORMATION (Initial)

Description: CL, brown clay with sand

Height: 1.02 inch Diameter: 2.50 inch Area: 4.91 in²

Water Content: 12.7 % Dry Unit Weight: 124.1 pcf

TEST SUMMARY

Vertical Consolidation Stress: 15.00 ksf

Water Content: 12.0 % Dry Unit Weight: 126.2 pcf

Deformation Rate: 0.00066 inch/min.

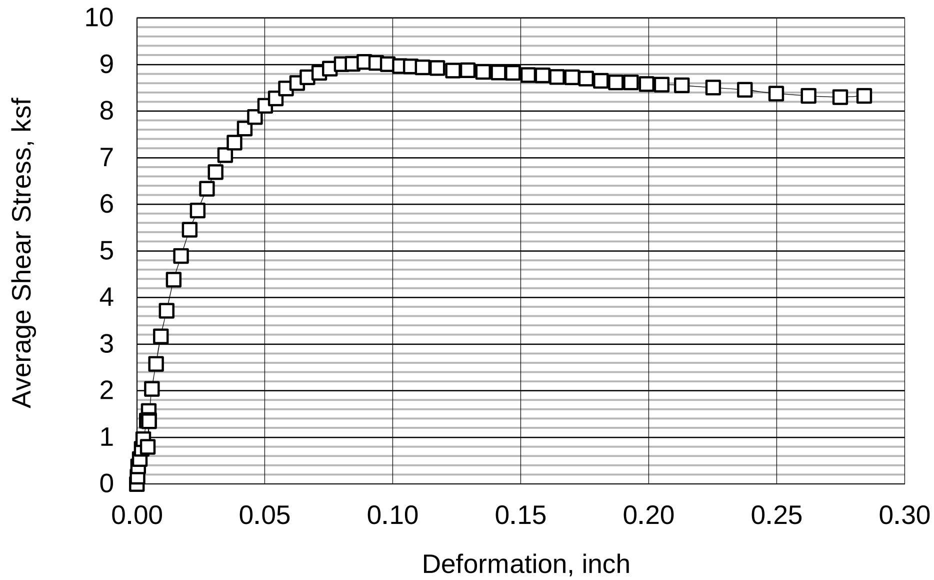
Peak Shear Strength: 9.05 ksf @ 0.09 inch deformation

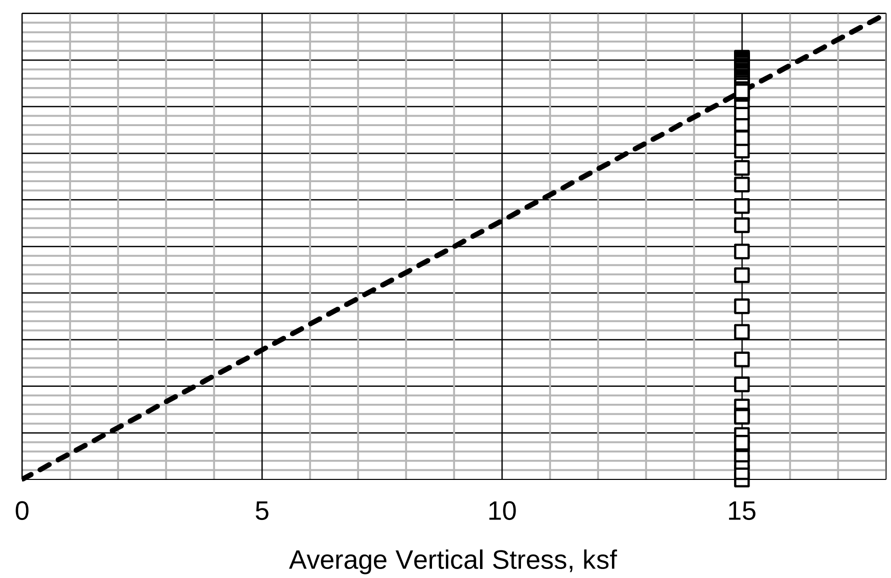
Peak Effective Friction Angle: 31.1°, cohesion = 0.0ksf

Final Shear Strength: 8.33 ksf @ 0.28 inch deformation

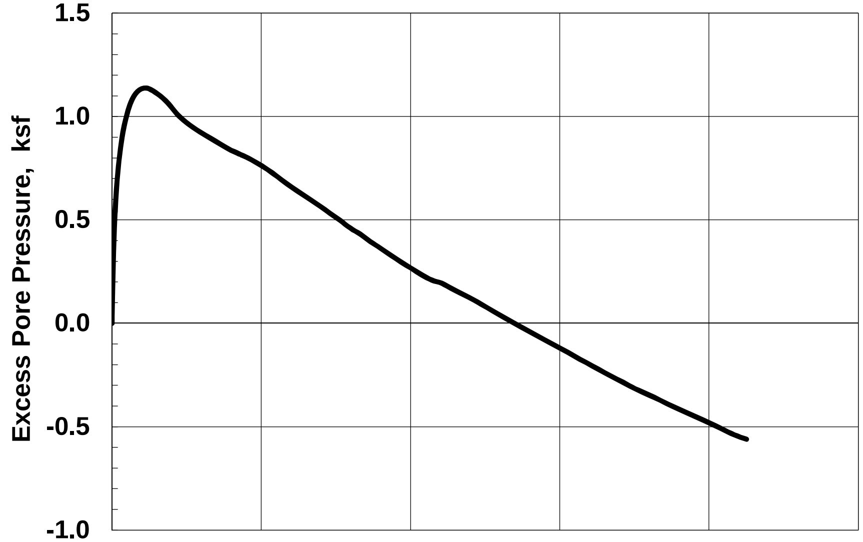
Final Effective Friction Angle: 29.0° (Shown)

REMARKS:





Prepared by: MHC Checked by: GET	AECOM 60428794	Dynegy CCR - Newton	**DRAINED DIRECT SHEAR** **TEST SUMMARY** Boring: NEW-B015 Sample: ST-3 Specimen: D Depth: 61.05 ft	November 15
	TerraSense, LLC	T60428794		



SAMPLE INFORMATION

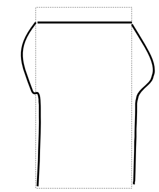
Boring: NEW-B001 Sample: ST-5 Depth: 10.75 ft
Type: Intact tube sample
Description: CH, gray fat clay
LL = 50 PL = 14 PI = 36

SPECIMEN INFORMATION (Initial)

Height: 6.00 inch Diameter: 2.88 inch Area: 6.51 in²
Water Content: 18.1 % Total Unit Weight: 132.6 pcf

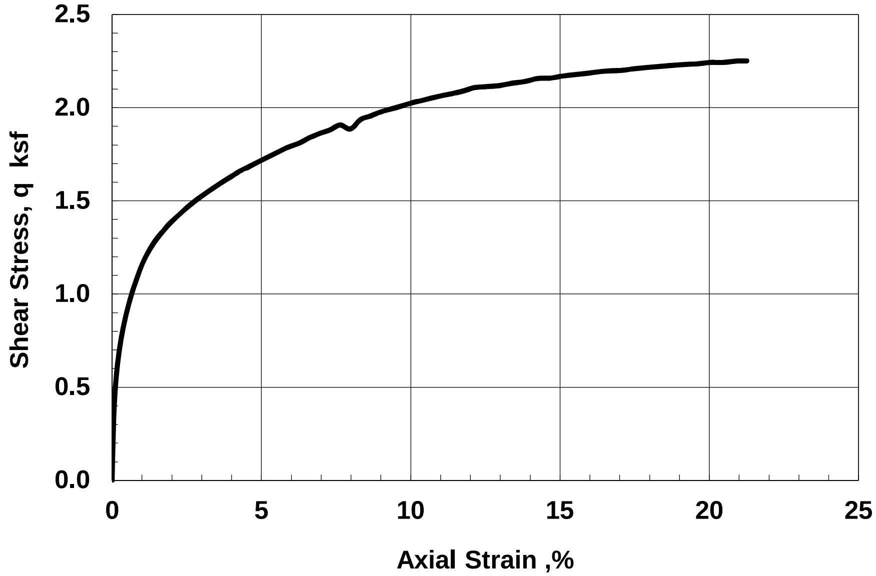
TEST SUMMARY

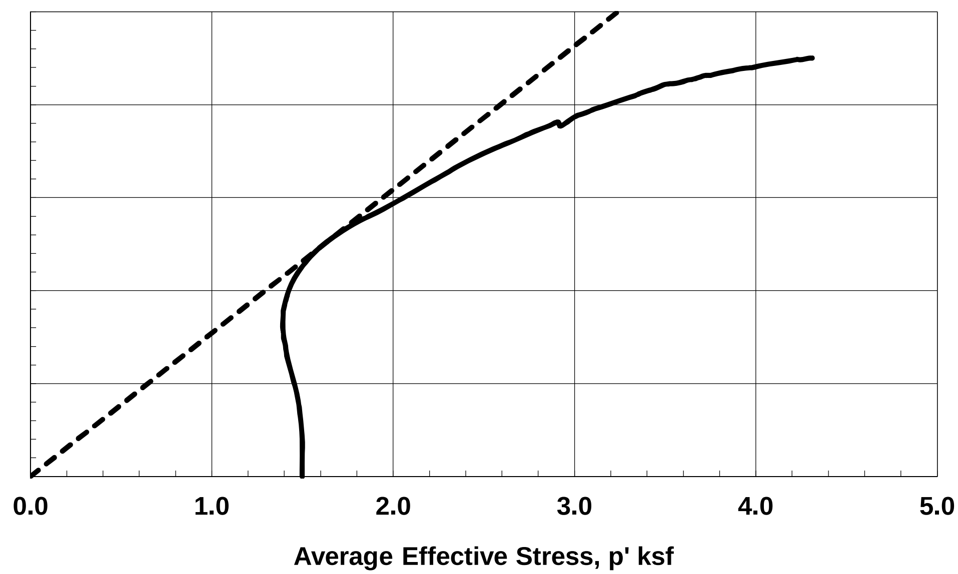
Consolidation Stresses: 1.50 ksf vertical, 1.50 ksf lateral
Water Content: 19.1 % Total Unit Weight: 133.4 pcf
B Coefficient: 99.6 Strain Rate: 0.021 %/min
Peak Shear Strength: 2.25 ksf @ 21.3 % Strain
Peak Effective Friction Angle: 50.5°



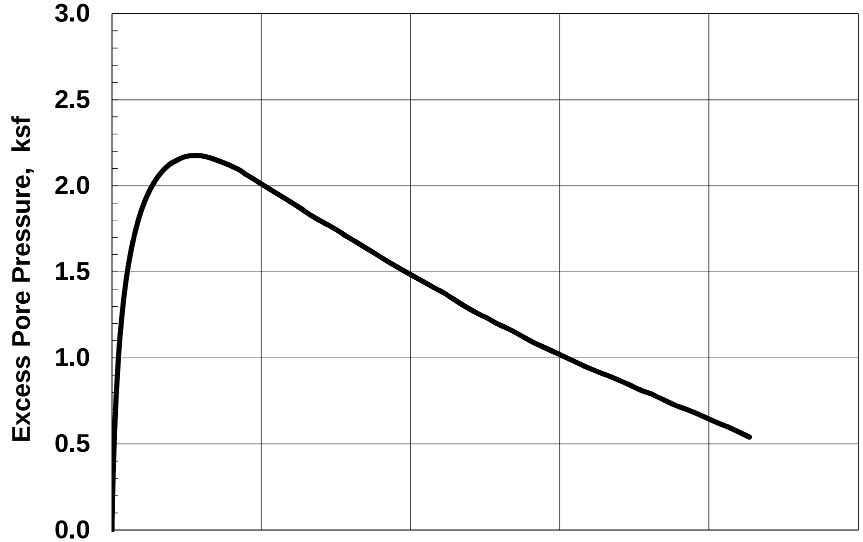
Failure Sketch

REMARKS:





Test by: BB	Project No. T60428794	AECOM Dynegy CCR - Newton	CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements	
Checked by: GET		**TerraSense, LLC**	Boring: NEW-B001 Sample: ST-5	November-15



SAMPLE INFORMATION

Boring: NEW-B001 Sample: ST-7B Depth: 21.1 ft
Type: Intact tube sample
Description: CL, gray brown sandy lean clay
LL = 49 PL = 13 PI = 36

SPECIMEN INFORMATION (Initial)

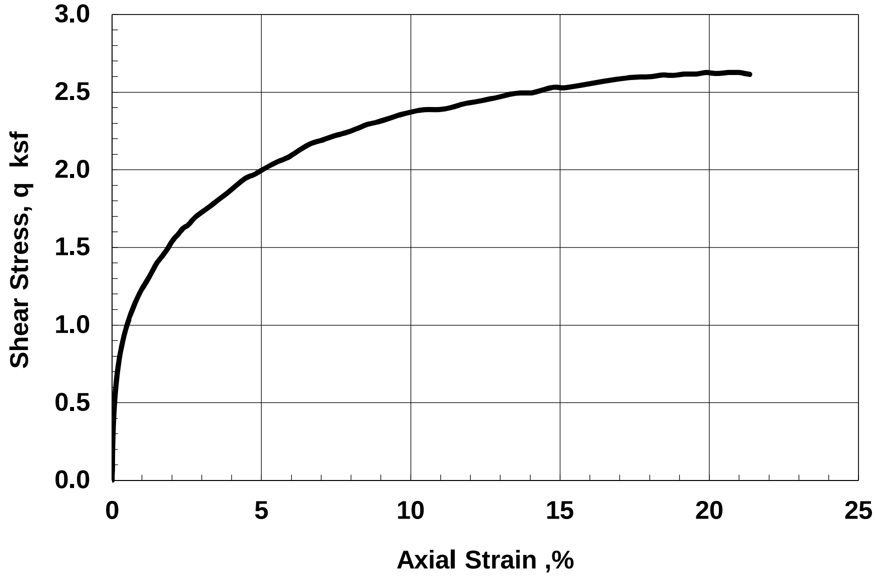
Height: 6.00 inch Diameter: 2.88 inch Area: 6.51 in²
Water Content: 16.2 % Total Unit Weight: 134.5 pcf

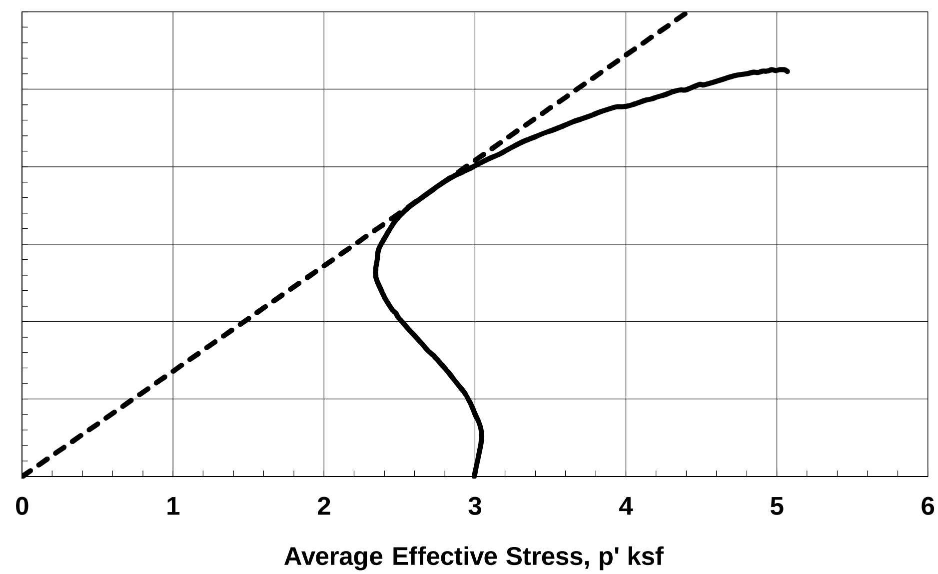
TEST SUMMARY

Consolidation Stresses: 3.00 ksf vertical, 3.00 ksf lateral
Water Content: 17.0 % Total Unit Weight: 136.5 pcf
B Coefficient: 99.14 Strain Rate: 0.023 %/min
Peak Shear Strength: 2.63 ksf @ 20.6 % Strain
Peak Effective Friction Angle: 42.9°

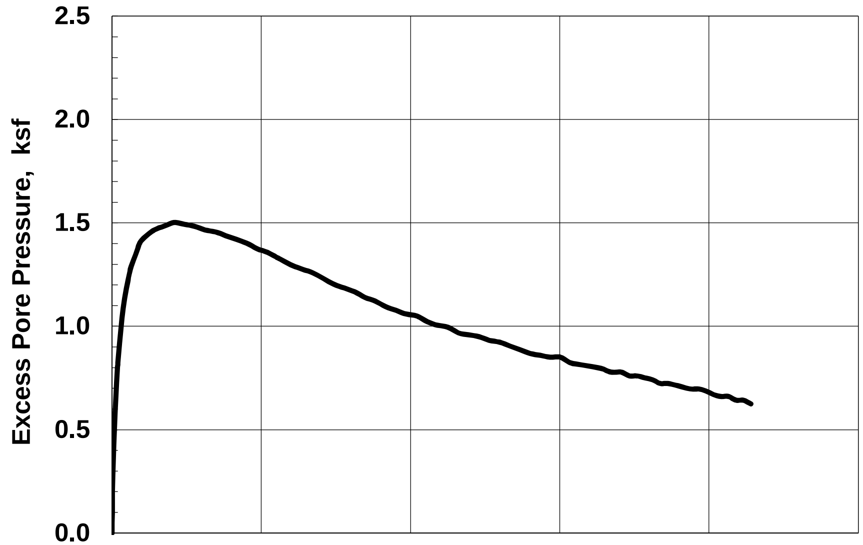
Failure Sketch

REMARKS:





Test by: BB	Project No. T60428794	AECOM Dynegy CCR - Newton	CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements	
Checked by: GET	TerraSense, LLC		Boring: NEW-B001 Sample: ST-7B	November-15

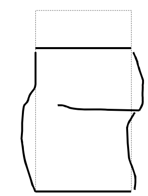


SAMPLE INFORMATION

Boring: NEW-B003 Sample: ST-1C Depth: 15.35 ft
Type: Intact tube sample
Description: CH, gray brown fat clay with sand
LL = 59 PL = 15 PI = 44

SPECIMEN INFORMATION (Initial)

Height: 6.00 inch Diameter: 2.87 inch Area: 6.49 in²
Water Content: 20.9 % Total Unit Weight: 129.5 pcf

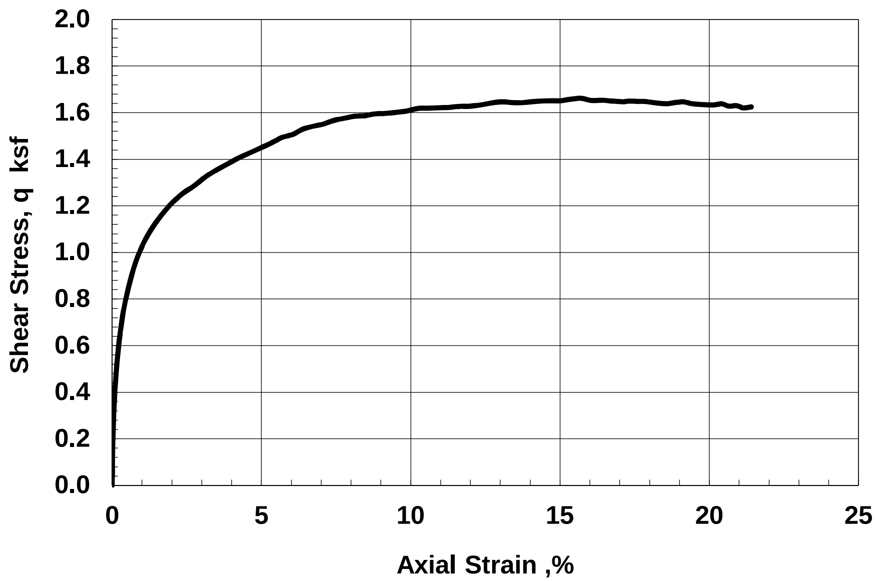


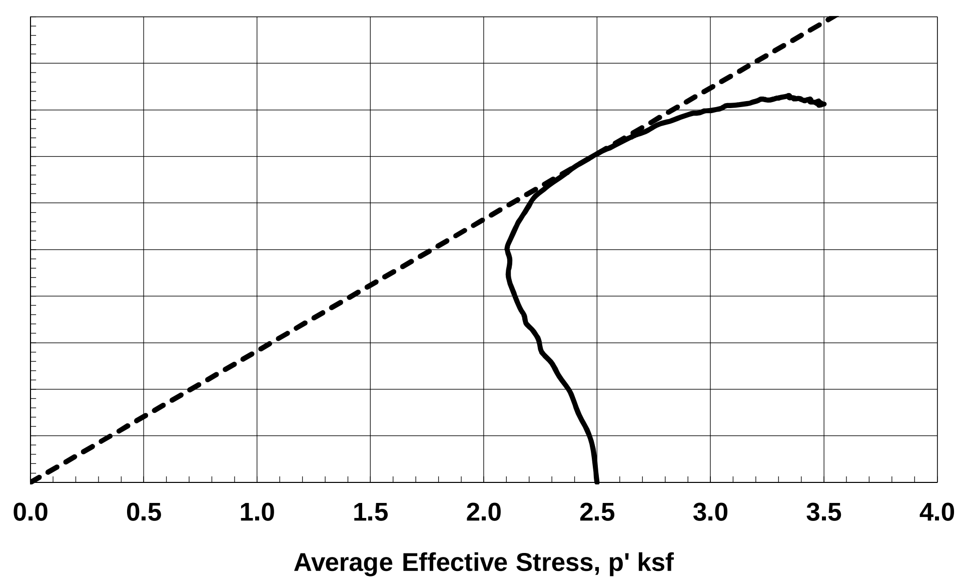
Failure Sketch

TEST SUMMARY

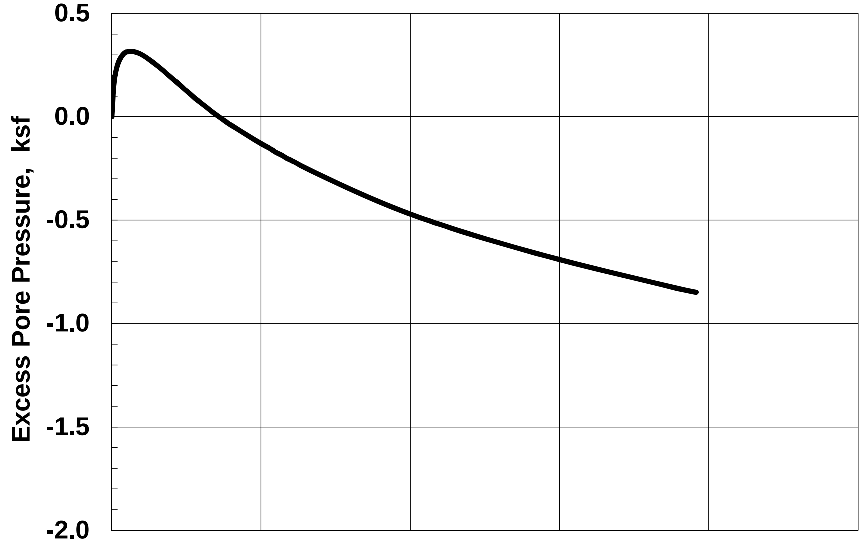
Consolidation Stresses: 2.50 ksf vertical, 2.50 ksf lateral
Water Content: 21.1 % Total Unit Weight: 131.8 pcf
B Coefficient: 99.52 Strain Rate: 0.021 %/min
Peak Shear Strength: 1.66 ksf @ 15.7 % Strain
Peak Effective Friction Angle: 34.4°

REMARKS:





Test by: BB	Project No. T60428794	AECOM Dynegy CCR - Newton	CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements	
Checked by: GET	TerraSense, LLC		Boring: NEW-B003 Sample: ST-1C	November-15

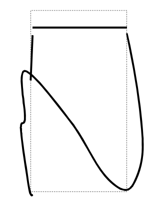


SAMPLE INFORMATION

Boring: NEW-B004 Sample: ST-4 Depth: 9.5 ft
Type: Intact tube sample
Description: CH, gray fat clay with sand
LL = 50 PL = 13 PI = 37

SPECIMEN INFORMATION (Initial)

Height: 6.00 inch Diameter: 2.88 inch Area: 6.52 in²
Water Content: 18.5 % Total Unit Weight: 131.3 pcf

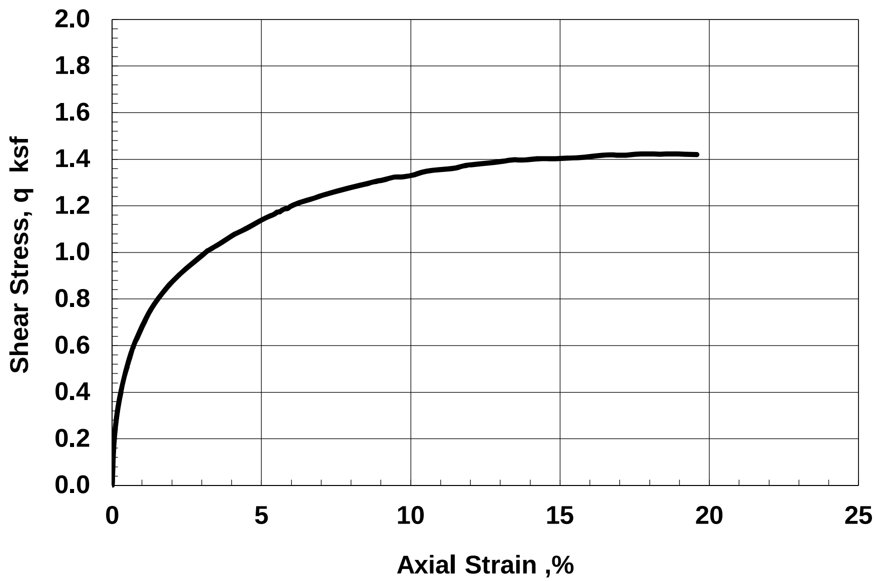


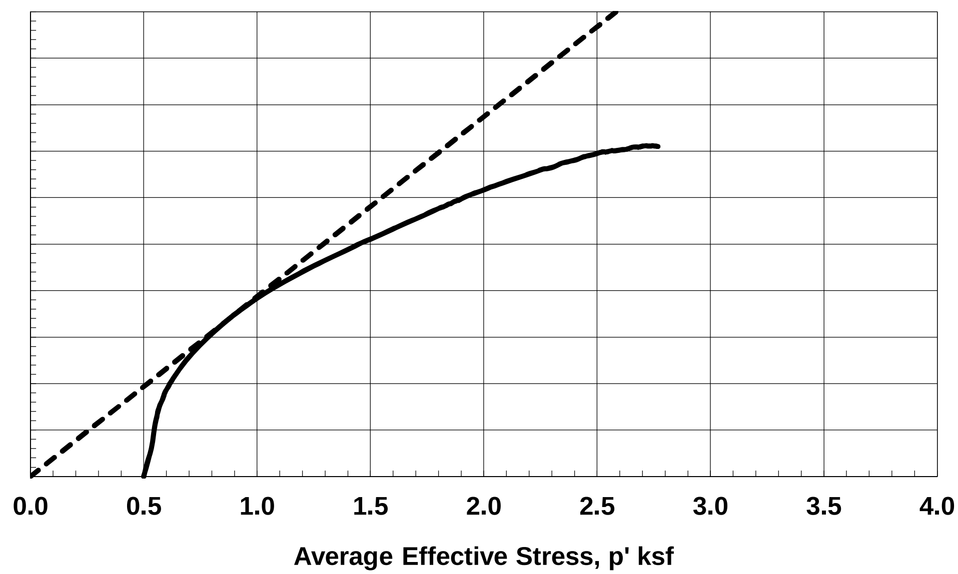
Failure Sketch

TEST SUMMARY

Consolidation Stresses: 0.50 ksf vertical, 0.50 ksf lateral
Water Content: 19.7 % Total Unit Weight: 132.6 pcf
B Coefficient: 99 Strain Rate: 0.022 %/min
Peak Shear Strength: 1.42 ksf @ 17.9 % Strain
Peak Effective Friction Angle: 50.7°

REMARKS:





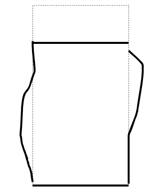
Test by: BB	Project No. T60428794	AECOM Dynegy CCR - Newton	CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements	
Checked by: GET	TerraSense, LLC		Boring: NEW-B004 Sample: ST-4	November-15

SAMPLE INFORMATION

Boring: NEW-B004 Sample: ST-7C Depth: 19.35 ft
Type: Intact tube sample
Description: CH, gray brown fat clay with sand
LL = 52 PL = 15 PI = 37

SPECIMEN INFORMATION (Initial)

Height: 6.01 inch Diameter: 2.88 inch Area: 6.50 in²
Water Content: 18.3 % Total Unit Weight: 128.5 pcf

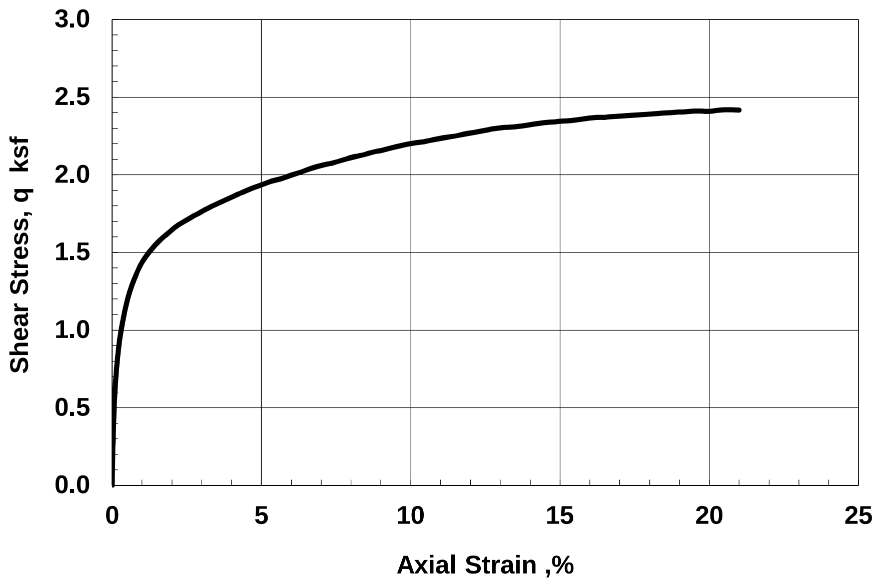


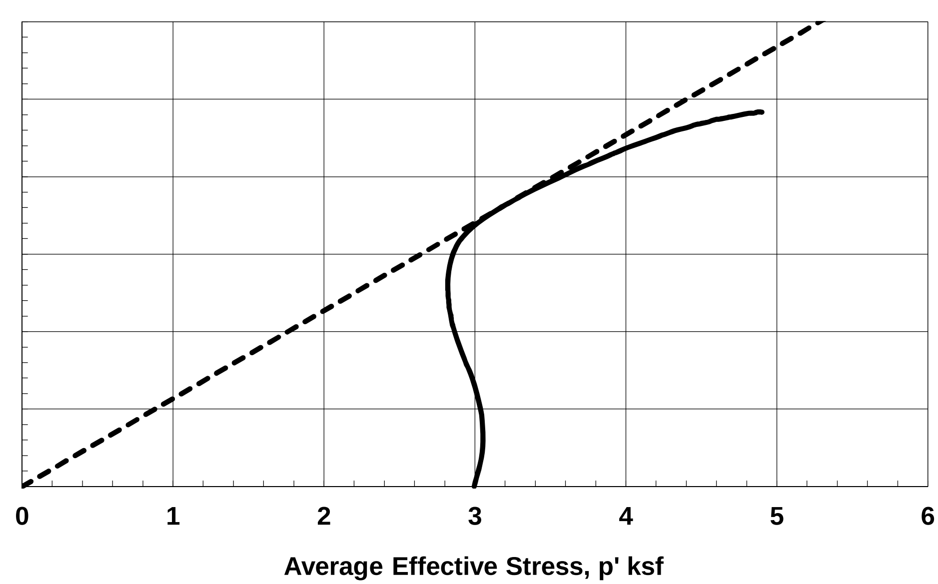
Failure Sketch

TEST SUMMARY

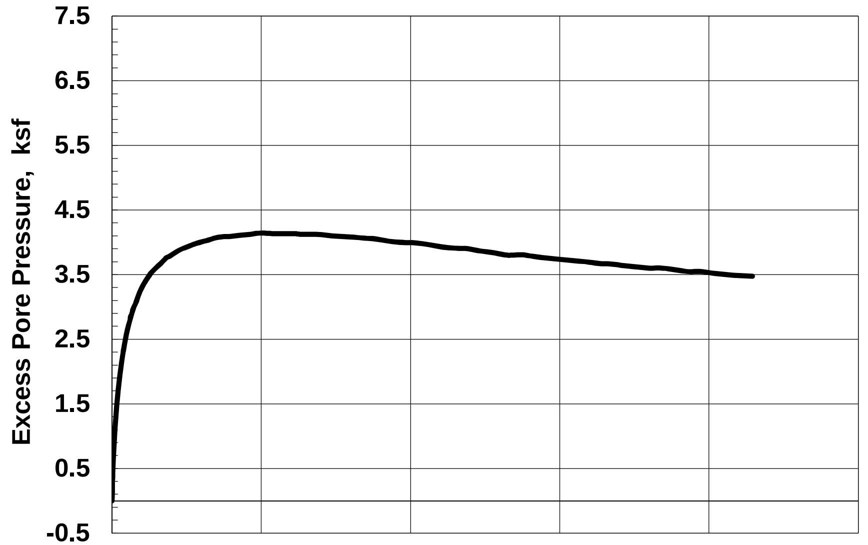
Consolidation Stresses: 3.00 ksf vertical, 3.00 ksf lateral
Water Content: 19.6 % Total Unit Weight: 133.7 pcf
B Coefficient: 99.56 Strain Rate: 0.021 %/min
Peak Shear Strength: 2.42 ksf @ 20.5 % Strain
Peak Effective Friction Angle: 34.6°

REMARKS:





Test by: BB	Project No. T60428794	AECOM Dynegy CCR - Newton	CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements	
Checked by: GET	TerraSense, LLC		Boring: NEW-B004 Sample: ST-7C	November-15

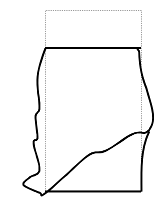


SAMPLE INFORMATION

Boring: NEW-B006 Sample: ST-2 Depth: 26.75 ft
Type: Intact tube sample
Description: CL, gray sandy clay
LL = 44 PL = 12 PI = 32

SPECIMEN INFORMATION (Initial)

Height: 6.01 inch Diameter: 2.88 inch Area: 6.52 in²
Water Content: 19.7 % Total Unit Weight: 128.8 pcf

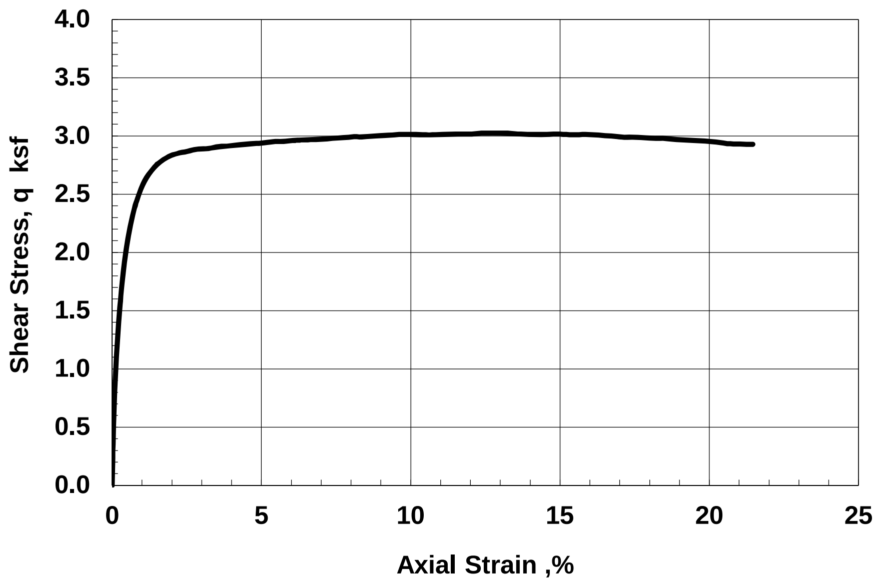


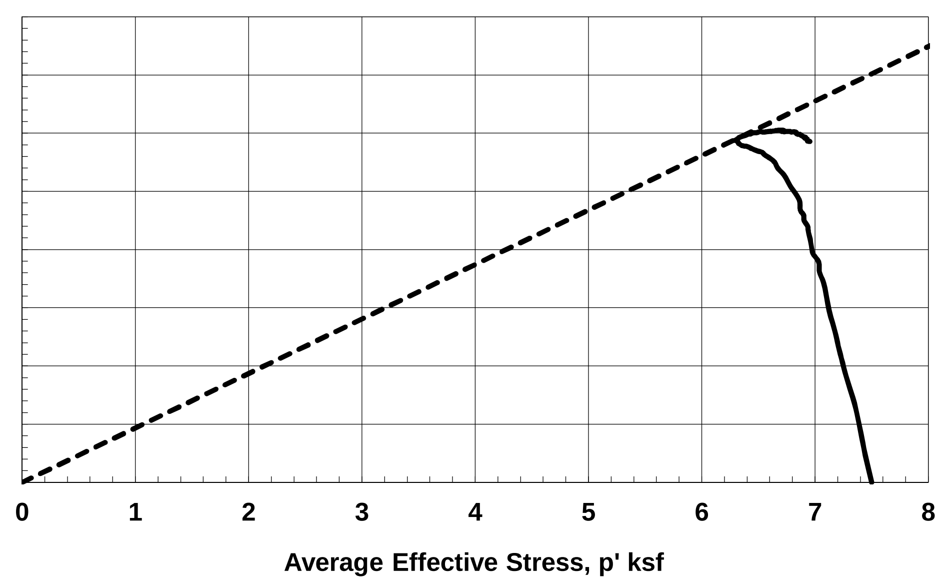
Failure
Sketch

TEST SUMMARY

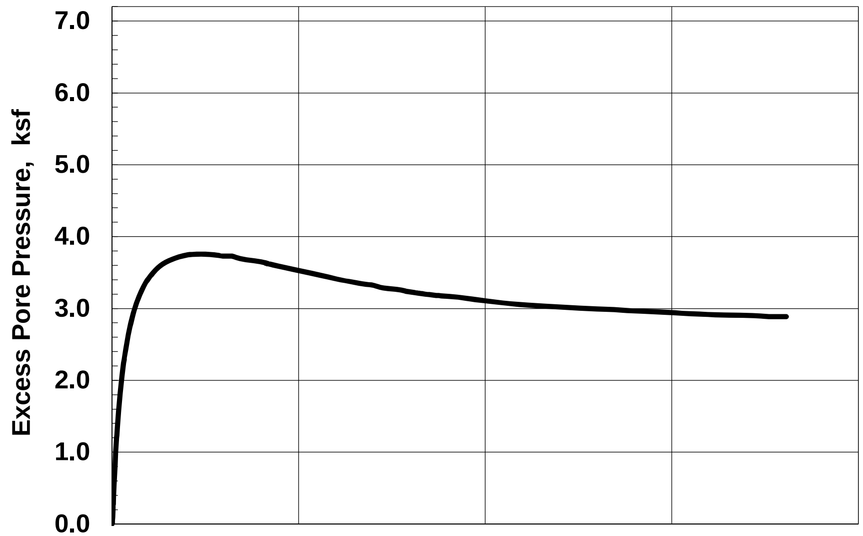
Consolidation Stresses: 7.50 ksf vertical, 7.50 ksf lateral
Water Content: 18.2 % Total Unit Weight: 134.6 pcf
B Coefficient: 97.7 Strain Rate: 0.022 %/min
Peak Shear Strength: 3.03 ksf @ 12.8 % Strain
Peak Effective Friction Angle: 27.9°

REMARKS:





Test by: BB	Project No. T60428794	AECOM Dynegy CCR - Newton	CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements Boring: NEW-B006 Sample: ST-2	
Checked by: GET	TerraSense, LLC			November-15

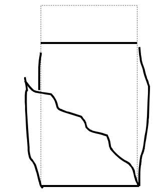


SAMPLE INFORMATION

Boring: NEW-B006 Sample: ST-3C Depth: 31.8 ft
Type: Intact tube sample
Description: CL, dark brown sandy lean clay
LL = 37 PL = 15 PI = 22

SPECIMEN INFORMATION (Initial)

Height: 6.00 inch Diameter: 2.88 inch Area: 6.52 in²
Water Content: 18.3 % Total Unit Weight: 133.3 pcf

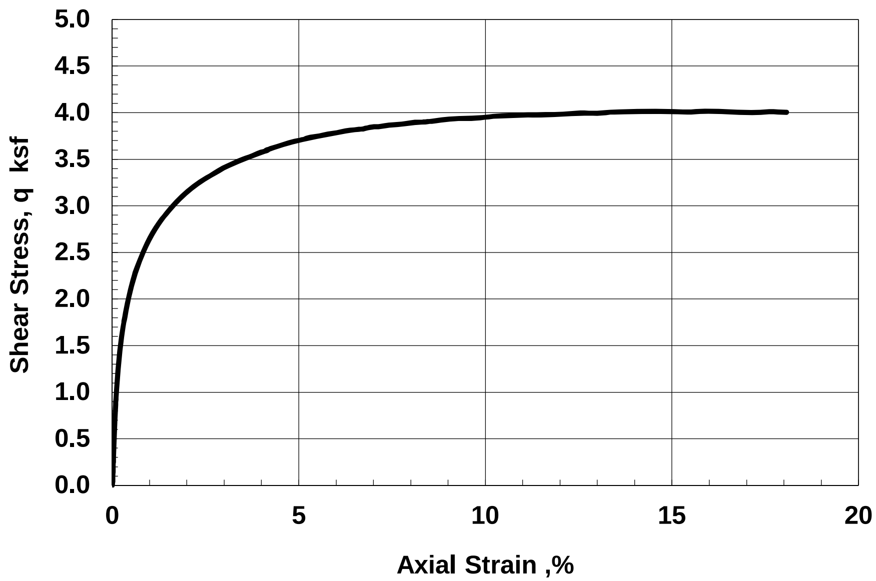


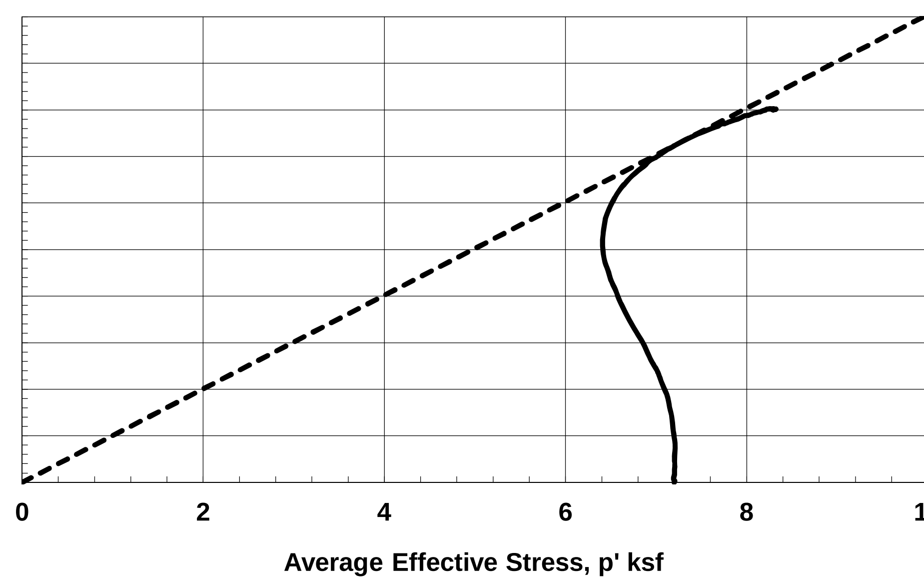
Failure Sketch

TEST SUMMARY

Consolidation Stresses: 7.20 ksf vertical, 7.20 ksf lateral
Water Content: 17.0 % Total Unit Weight: 138.2 pcf
B Coefficient: Strain Rate: 0.019 %/min
Peak Shear Strength: 4.01 ksf @ 14.8 % Strain
Peak Effective Friction Angle: 30.2°

REMARKS:

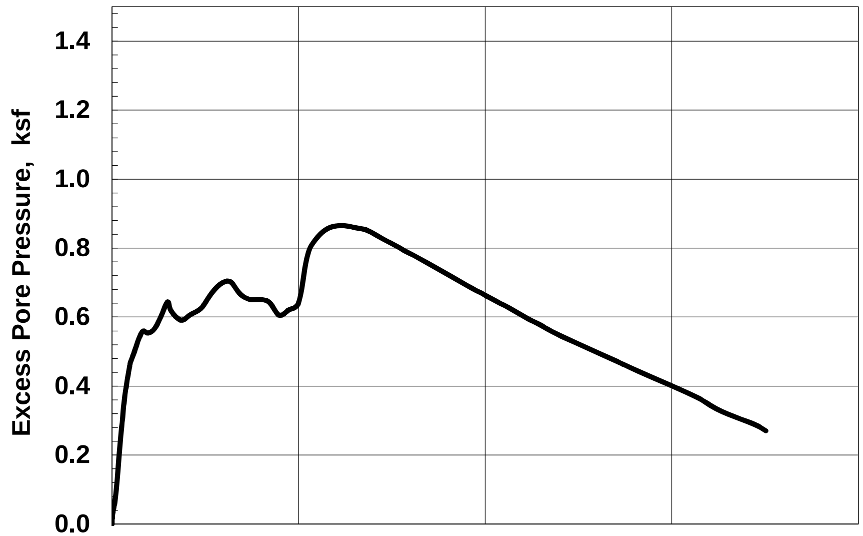




Test by: BB

Checked by: GET

Project No. T60428794	AECOM Dynegy CCR - Newton	CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements Boring: NEW-B006 Sample: ST-3C	
TerraSense, LLC			November-15

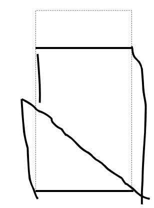


SAMPLE INFORMATION

Boring: NEW-C006 Sample: ST-1B Depth: 11.3 ft
Type: Intact tube sample
Description: CH, brown fat clay with sand
LL = 54 PL = 16 PI = 38

SPECIMEN INFORMATION (Initial)

Height: 6.03 inch Diameter: 2.87 inch Area: 6.48 in²
Water Content: 25.2 % Total Unit Weight: 124.1 pcf

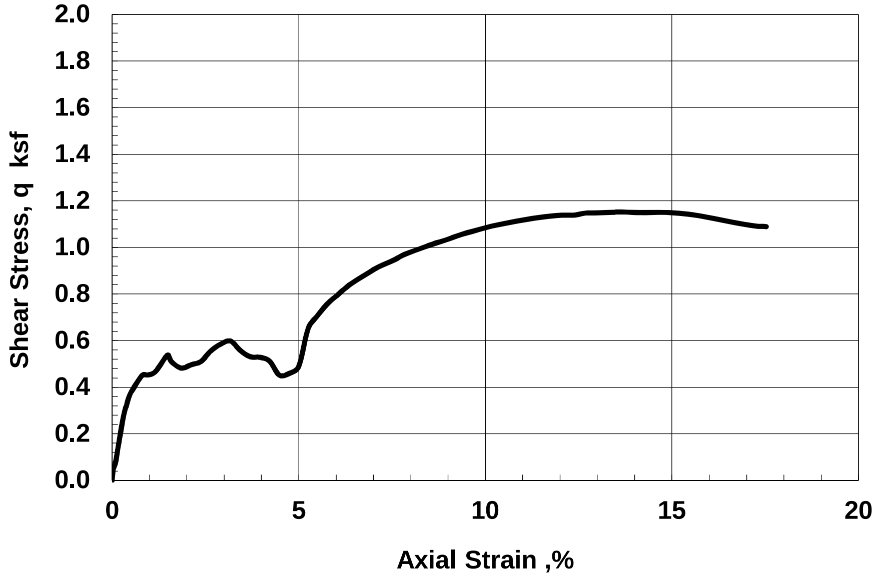


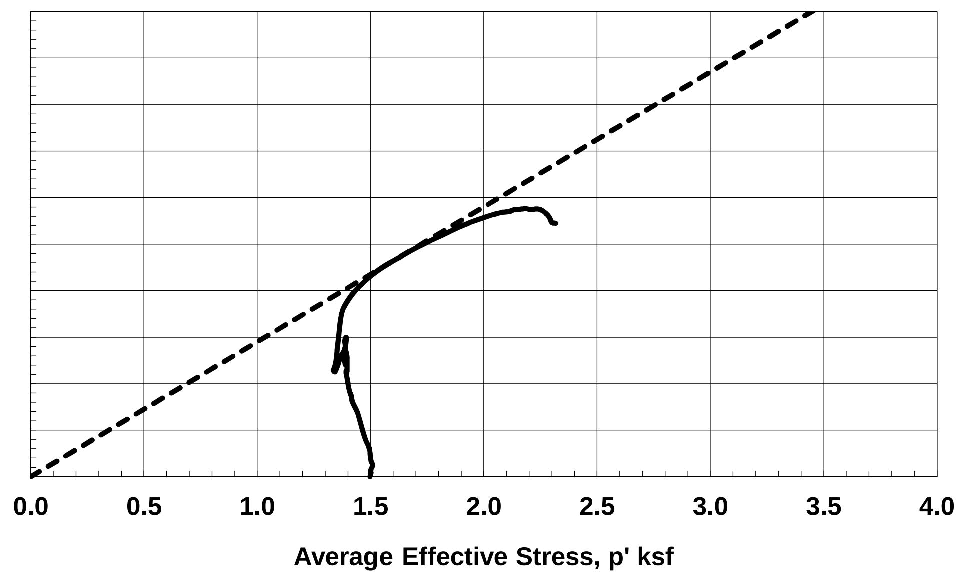
Failure
Sketch

TEST SUMMARY

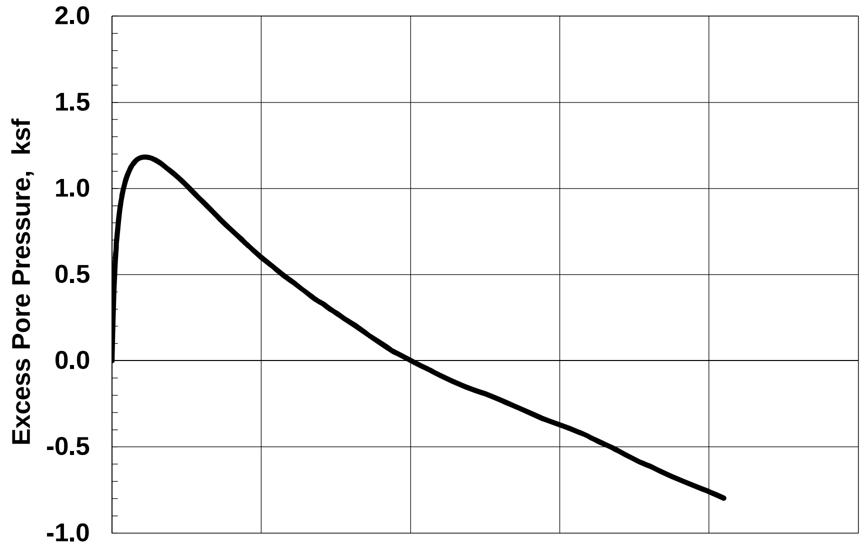
Consolidation Stresses: 1.50 ksf vertical, 1.50 ksf lateral
Water Content: 25.0 % Total Unit Weight: 127.5 pcf
B Coefficient: Strain Rate: 0.021 %/min
Peak Shear Strength: 1.15 ksf @ 13.7 % Strain
Peak Effective Friction Angle: 35.5°

REMARKS:



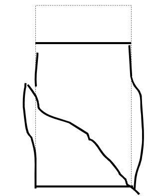


Test by: BB	Project No. T60428794	AECOM Dynegy CCR - Newton	CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements	
Checked by: GET	TerraSense, LLC		Boring: NEW-C006 Sample: ST-1B	November-15



SAMPLE INFORMATION
Boring: NEW-C006 Sample: ST-2B Depth: 13 ft
Type: Intact tube sample
Description: CH, brown fat clay
LL = 53 PL = 14 PI = 39

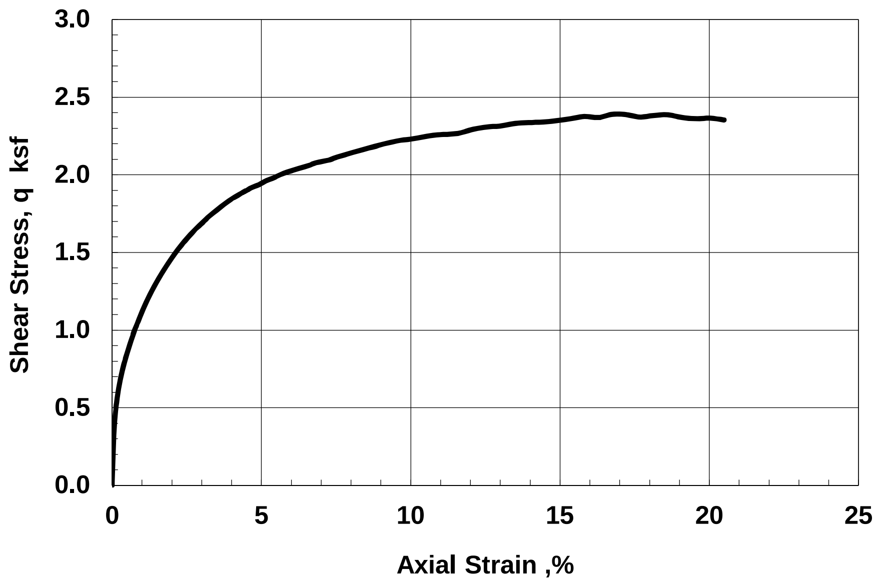
SPECIMEN INFORMATION (Initial)
Height: 6.02 inch Diameter: 2.88 inch Area: 6.49 in²
Water Content: 18.9 % Total Unit Weight: 131.5 pcf

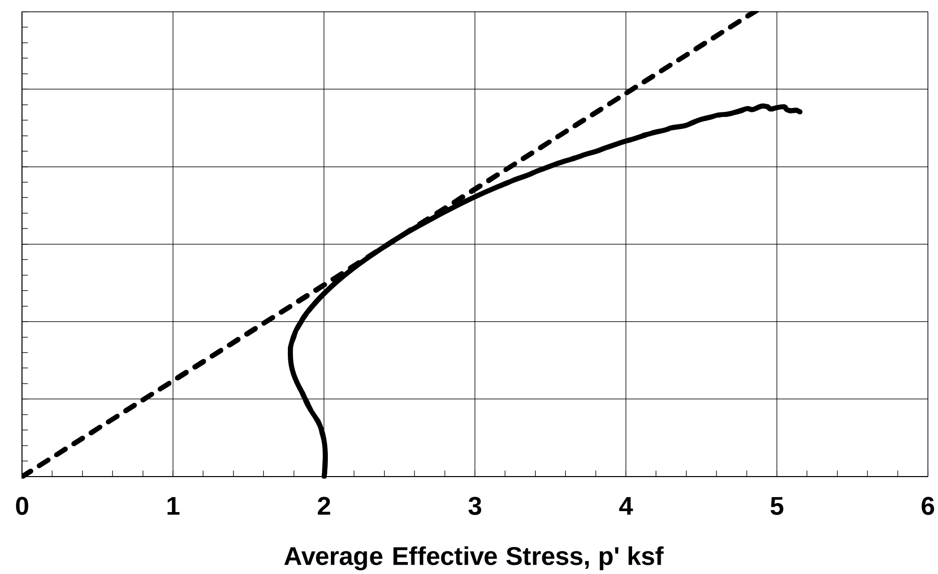


Failure Sketch

TEST SUMMARY
Consolidation Stresses: 2.00 ksf vertical, 2.00 ksf lateral
Water Content: 19.4 % Total Unit Weight: 134.0 pcf
B Coefficient: Strain Rate: 0.020 %/min
Peak Shear Strength: 2.39 ksf @ 16.7 % Strain
Peak Effective Friction Angle: 38.2°

REMARKS:





Test by: BB	Project No. T60428794	AECOM Dynegy CCR - Newton	CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements	
Checked by: GET	TerraSense, LLC		Boring: NEW-C006 Sample: ST-2B	November-15

SAMPLE INFORMATION

Boring: NEW-B007 Sample: ST-1C Depth: 11.55 ft

Type: Intact tube sample

Description: CL, brown lean clay with sand

LL = 38 PL = 14 PI = 24

SPECIMEN INFORMATION (Initial)

Height: 6.01 inch Diameter: 2.88 inch Area: 6.51 in²

Water Content: 15.4 % Total Unit Weight: 135.1 pcf

TEST SUMMARY

Consolidation Stresses: 1.00 ksf vertical, 1.00 ksf lateral

Water Content: 15.9 % Total Unit Weight: 137.7 pcf

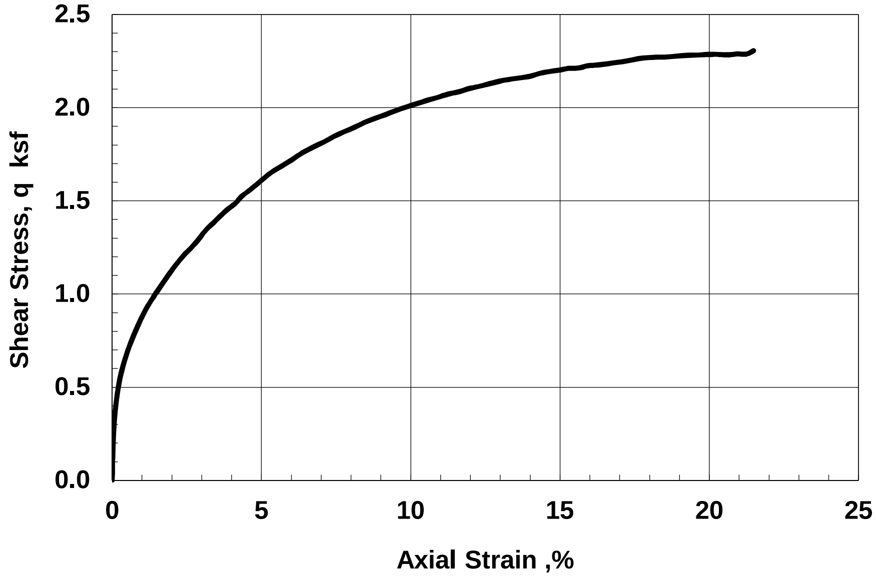
B Coefficient: 99.2 Strain Rate: 0.021 %/min

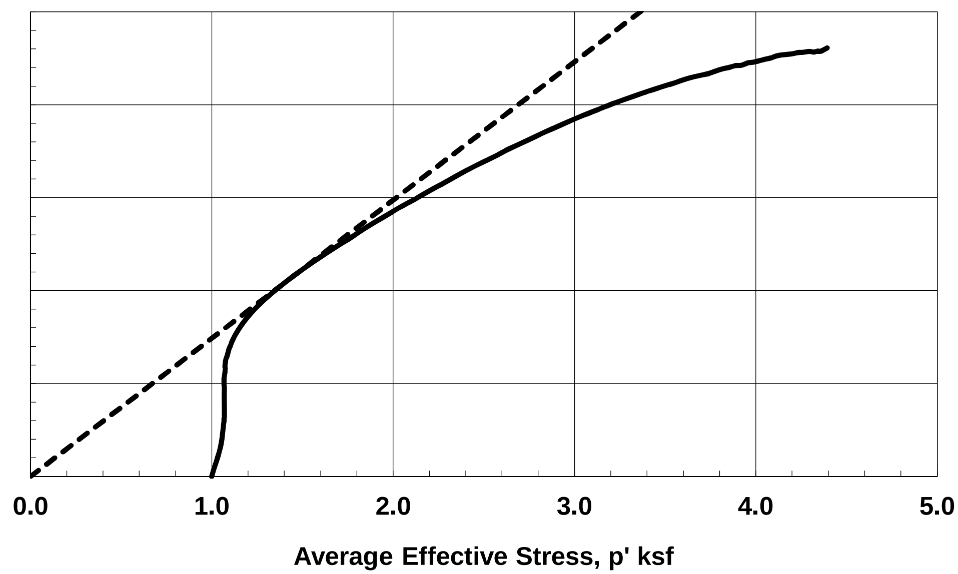
Peak Shear Strength: 2.31 ksf @ 21.5 % Strain

Peak Effective Friction Angle: 48.0°

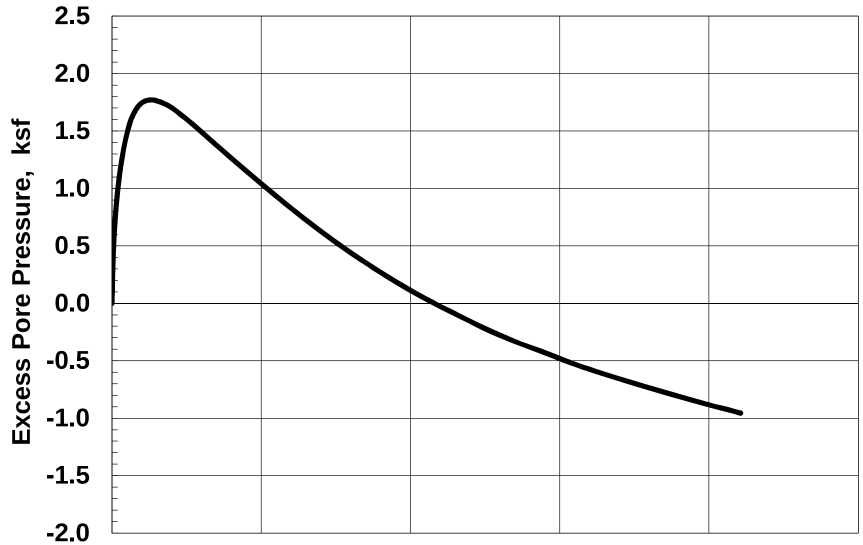
Failure Sketch

REMARKS:





Test by: BB	Project No. T60428794	AECOM Dynegy CCR - Newton	CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements
Checked by: GET		**TerraSense, LLC**	Boring: NEW-B007 Sample: ST-1C — November-15

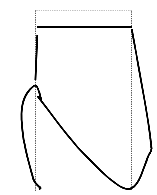


SAMPLE INFORMATION

Boring: NEW-B007 Sample: ST-2 Depth: 21 ft
Type: Intact tube sample
Description: CL, brown sandy lean clay
LL = 30 PL = 13 PI = 17

SPECIMEN INFORMATION (Initial)

Height: 5.99 inch Diameter: 2.88 inch Area: 6.50 in²
Water Content: 12.1 % Total Unit Weight: 140.5 pcf

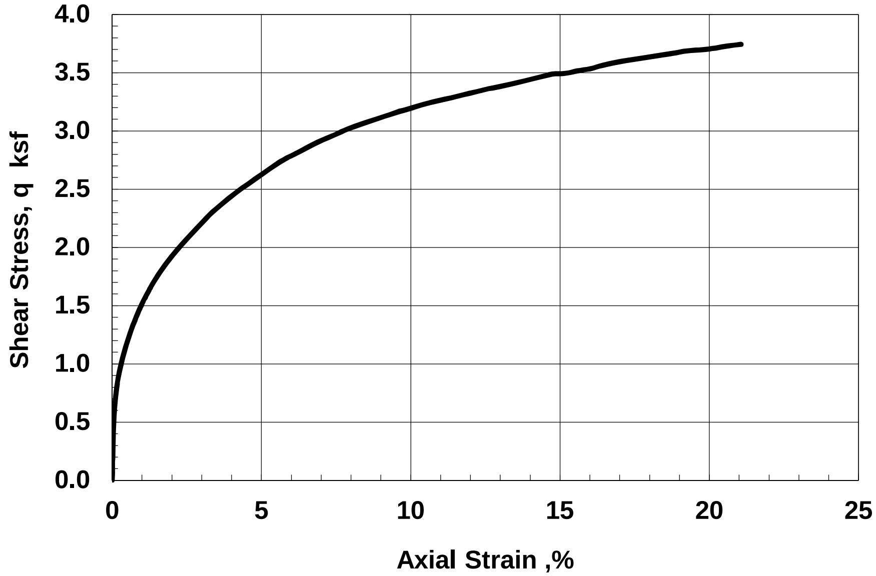


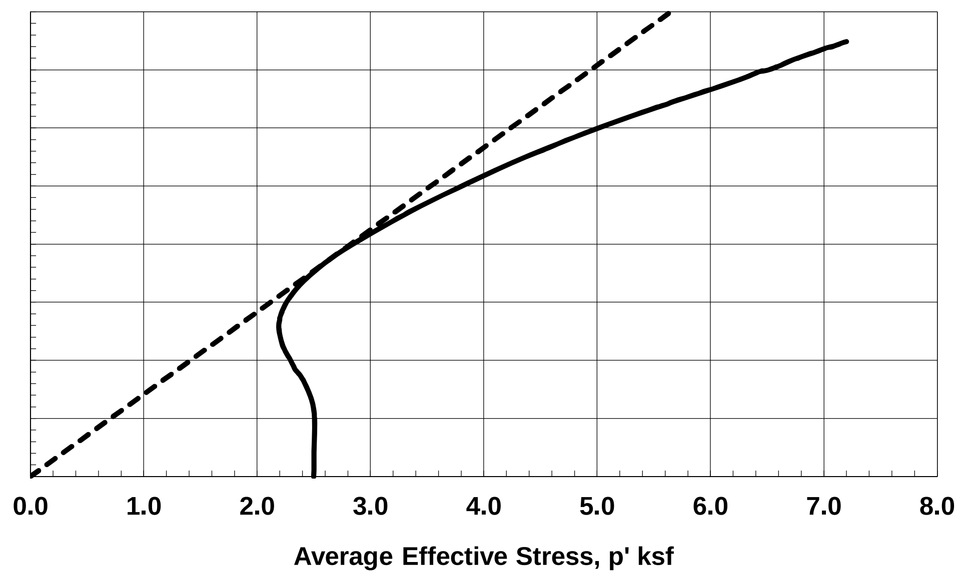
Failure Sketch

TEST SUMMARY

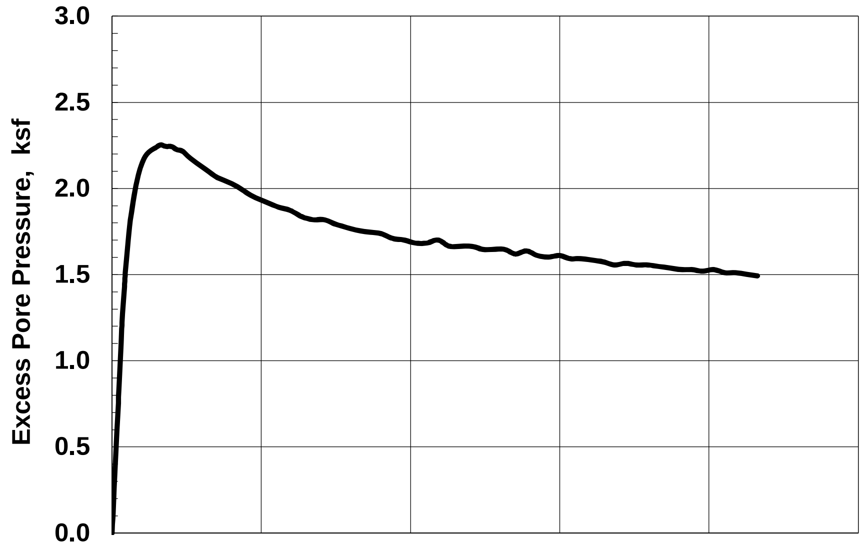
Consolidation Stresses: 2.50 ksf vertical, 2.50 ksf lateral
Water Content: 12.5 % Total Unit Weight: 142.9 pcf
B Coefficient: 99.62 Strain Rate: 0.021 %/min
Peak Shear Strength: 3.74 ksf @ 21.1 % Strain
Peak Effective Friction Angle: 45.1°

REMARKS:





Test by: BB	Project No. T60428794	AECOM Dynegy CCR - Newton	CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements	
Checked by: GET	TerraSense, LLC		Boring: NEW-B007 Sample: ST-2	November-15

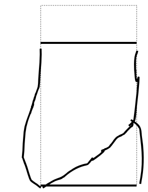


SAMPLE INFORMATION

Boring: NEW-B009 Sample: ST-2B Depth: 30 ft
Type: Intact tube sample
Description: CL, yellowish brown lean clay with sand
LL = 31 PL = 14 PI = 17

SPECIMEN INFORMATION (Initial)

Height: 5.96 inch Diameter: 2.89 inch Area: 6.55 in²
Water Content: 16.7 % Total Unit Weight: 132.6 pcf

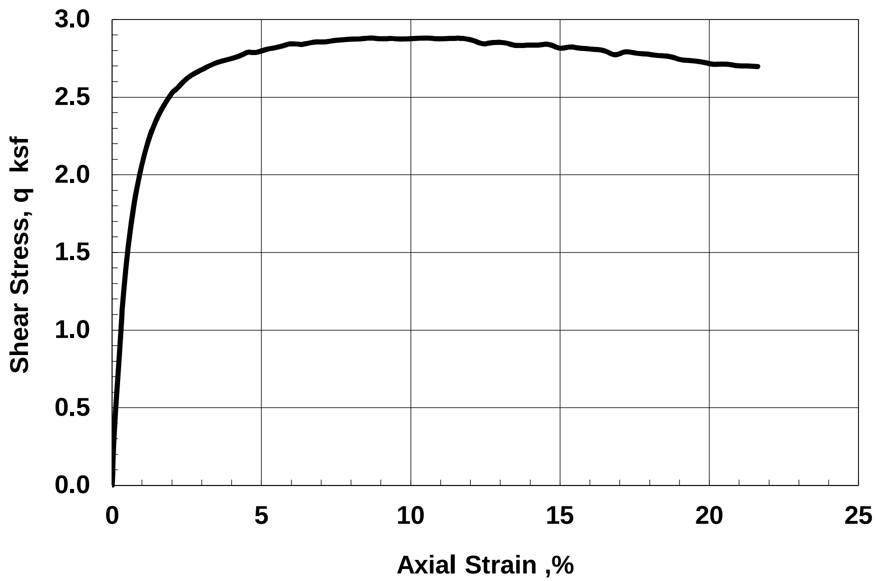


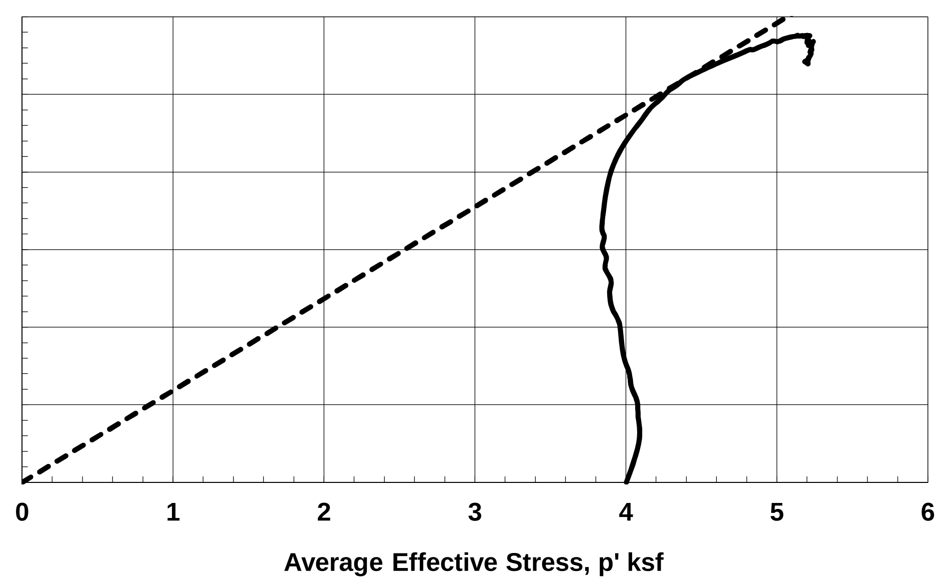
Failure
Sketch

TEST SUMMARY

Consolidation Stresses: 4.00 ksf vertical, 4.00 ksf lateral
Water Content: 17.1 % Total Unit Weight: 136.8 pcf
B Coefficient: 98.02 Strain Rate: 0.023 %/min
Peak Shear Strength: 2.88 ksf @ 10.5 % Strain
Peak Effective Friction Angle: 36.3°

REMARKS:





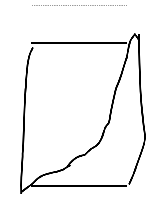
Test by: BB	Project No. T60428794	AECOM Dynegy CCR - Newton	CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements	
Checked by: GET	TerraSense, LLC		Boring: NEW-B009 Sample: ST-2B	November-15

SAMPLE INFORMATION

Boring: NEW-B010 Sample: ST-1C Depth: 6.3 ft
Type: Intact tube sample
Description: CL, brown lean clay with sand
LL = 24 PL = 13 PI = 11

SPECIMEN INFORMATION (Initial)

Height: 6.05 inch Diameter: 2.88 inch Area: 6.51 in²
Water Content: 10.2 % Total Unit Weight: 140.5 pcf

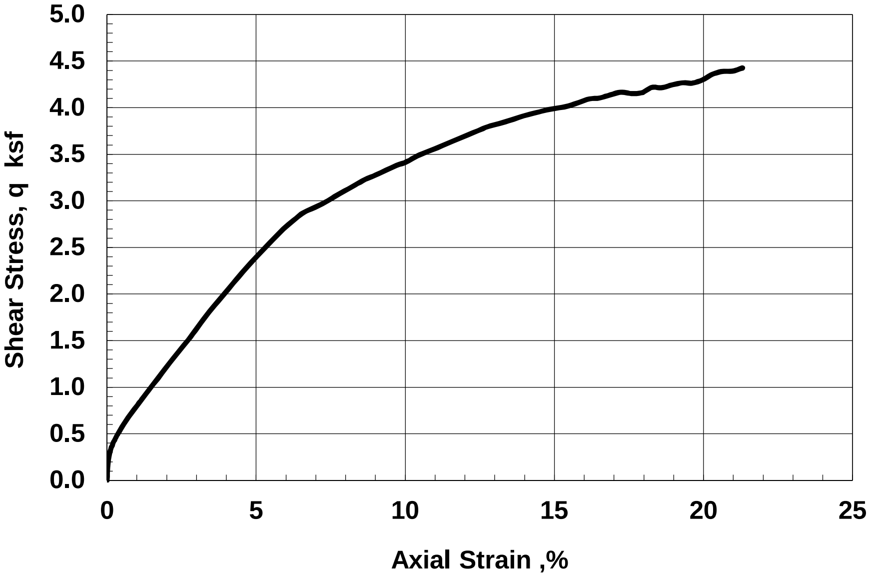


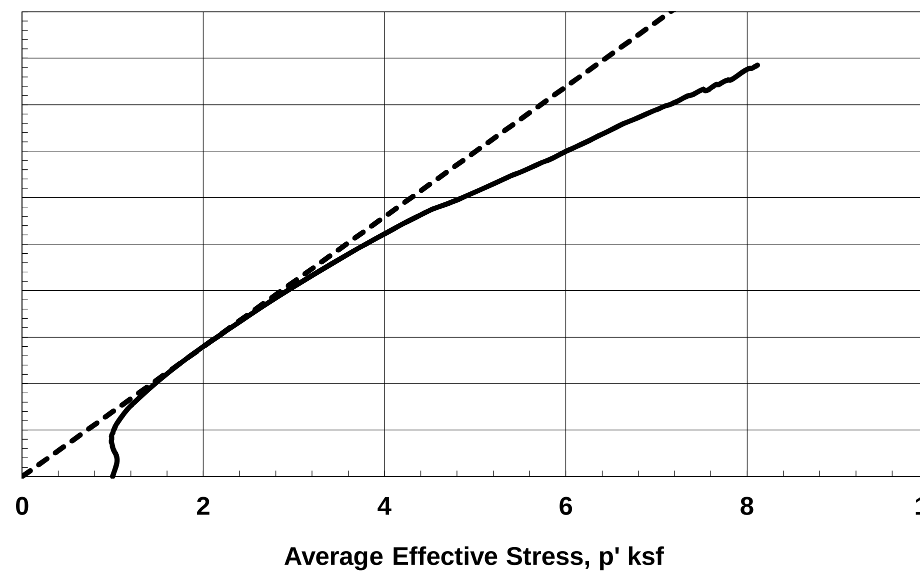
Failure Sketch

TEST SUMMARY

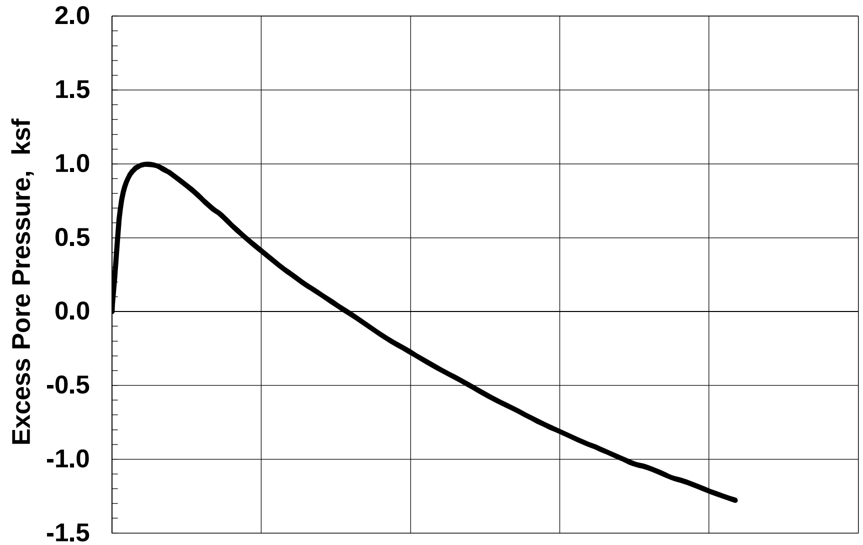
Consolidation Stresses: 1.00 ksf vertical, 1.00 ksf lateral
Water Content: 11.6 % Total Unit Weight: 145.2 pcf
B Coefficient: 98.32 Strain Rate: 0.021 %/min
Peak Shear Strength: 4.43 ksf @ 21.3 % Strain
Peak Effective Friction Angle: 44.4°

REMARKS:





Test by: BB	Project No. T60428794	AECOM Dynegy CCR - Newton	CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements	
Checked by: GET	TerraSense, LLC		Boring: NEW-B010 Sample: ST-1C	November-15

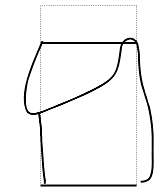


SAMPLE INFORMATION

Boring: NEW-B010 Sample: ST-2 Depth: 16.5 ft
Type: Intact tube sample
Description: CL, yellowish brown lean clay with sand, some m-f gravel
LL = 33 PL = 13 PI = 20

SPECIMEN INFORMATION (Initial)

Height: 6.02 inch Diameter: 2.88 inch Area: 6.53 in²
Water Content: 13.8 % Total Unit Weight: 137.3 pcf

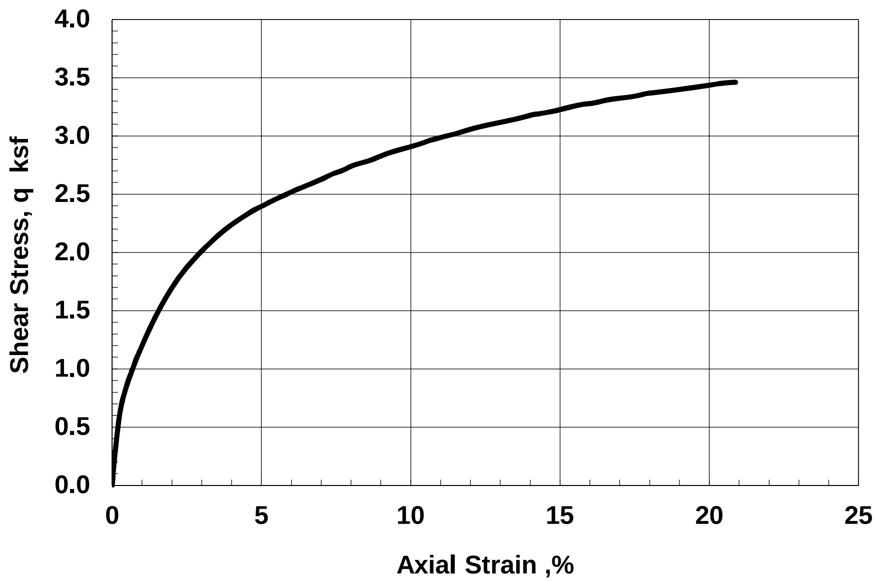


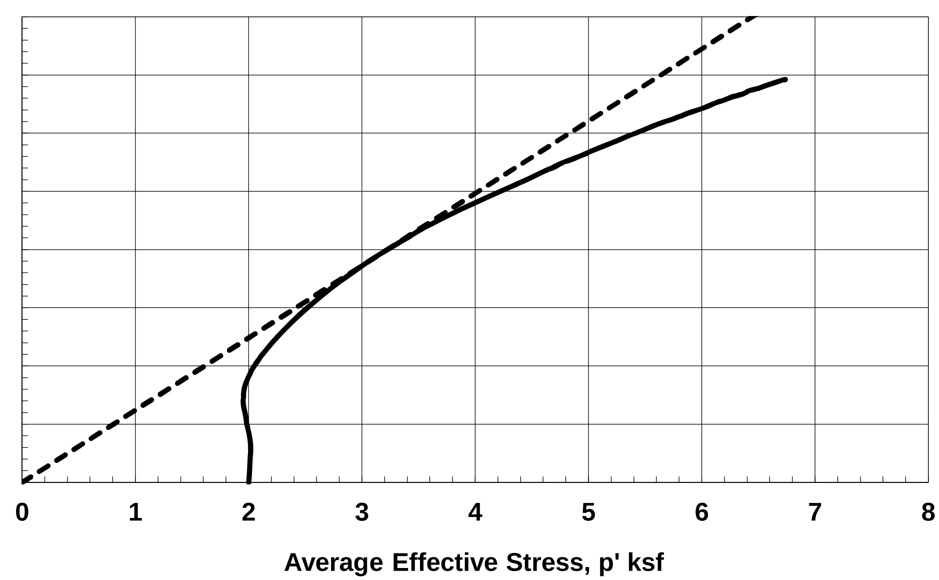
Failure Sketch

TEST SUMMARY

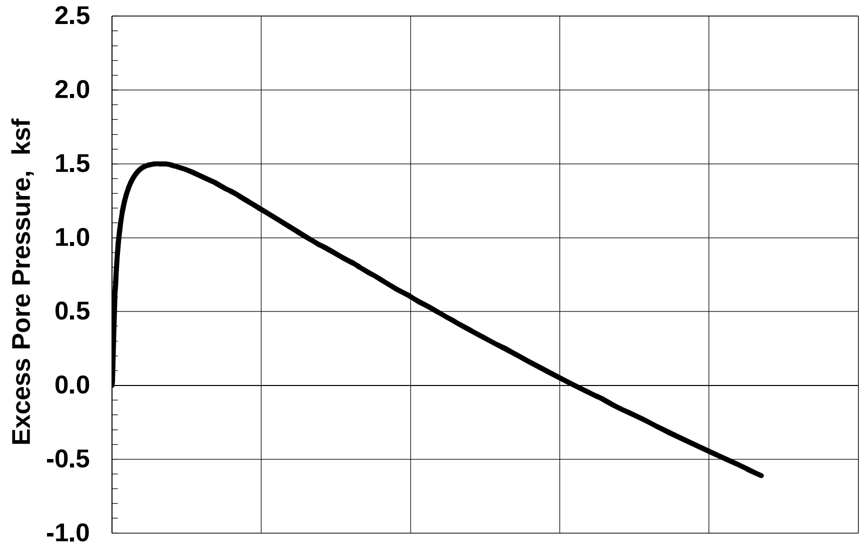
Consolidation Stresses: 2.00 ksf vertical, 2.00 ksf lateral
Water Content: 14.7 % Total Unit Weight: 139.5 pcf
B Coefficient: 99.6 Strain Rate: 0.022 %/min
Peak Shear Strength: 3.46 ksf @ 20.9 % Strain
Peak Effective Friction Angle: 38.4°

REMARKS:





Test by: BB	Project No. T60428794	AECOM Dynegy CCR - Newton	CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements	
Checked by: GET	TerraSense, LLC		Boring: NEW-B010 Sample: ST-2	November-15

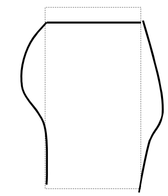


SAMPLE INFORMATION

Boring: NEW-B012 Sample: ST-7 Depth: 21.15 ft
Type: Intact tube sample
Description: CL, brown sandy clay
LL = 35 PL = 13 PI = 22

SPECIMEN INFORMATION (Initial)

Height: 6.00 inch Diameter: 2.88 inch Area: 6.52 in²
Water Content: 13.3 % Total Unit Weight: 138.4 pcf

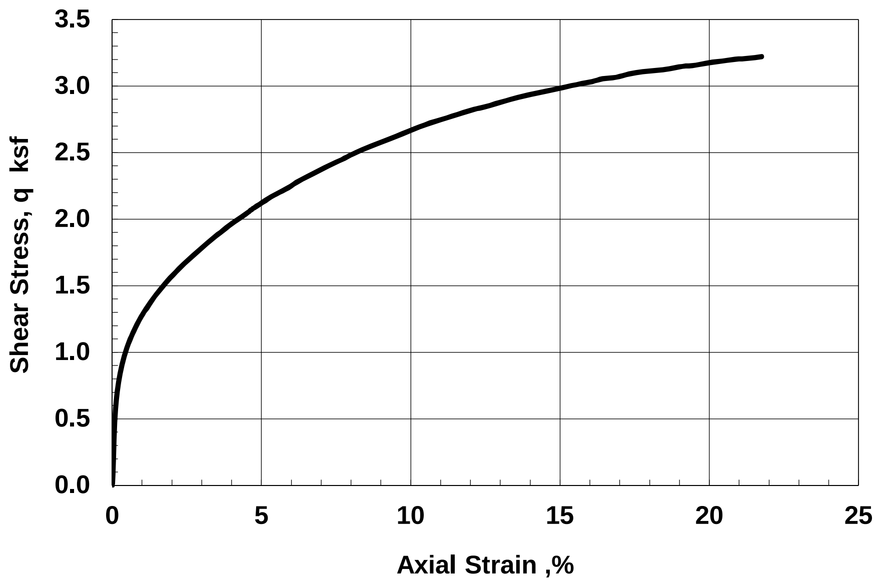


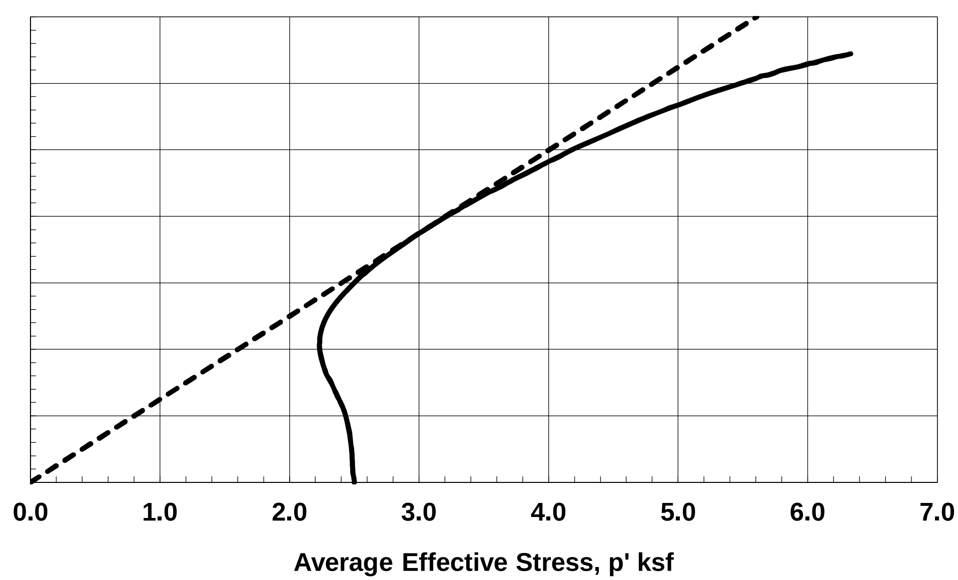
Failure Sketch

TEST SUMMARY

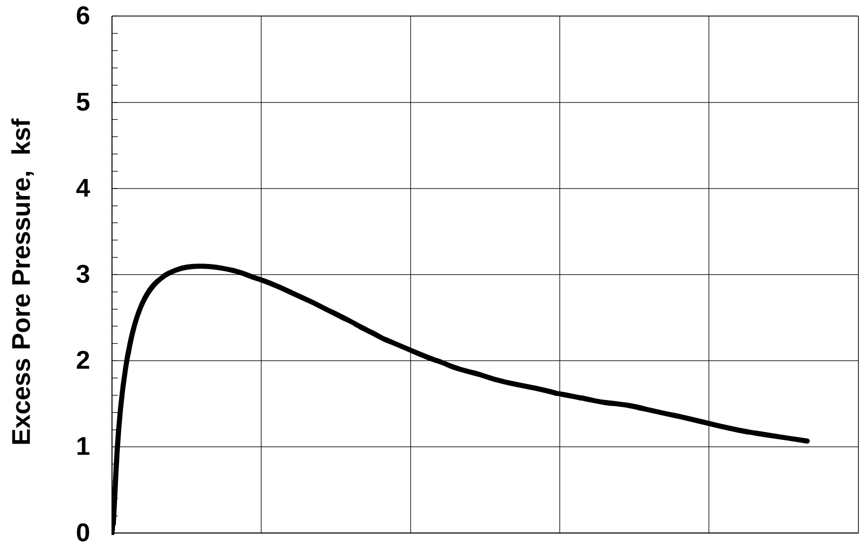
Consolidation Stresses: 2.50 ksf vertical, 2.50 ksf lateral
Water Content: 14.0 % Total Unit Weight: 140.6 pcf
B Coefficient: 97.9 Strain Rate: 0.023 %/min
Peak Shear Strength: 3.22 ksf @ 21.8 % Strain
Peak Effective Friction Angle: 38.6°

REMARKS:





Test by: BB	Project No. T60428794	AECOM Dynegy CCR - Newton	CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements
Checked by: GET	TerraSense, LLC		Boring: NEW-B012 Sample: ST-7 November-15

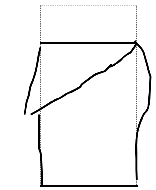


SAMPLE INFORMATION

Boring: NEW-B012 Sample: ST-12C Depth: 46.4 ft
Type: Intact tube sample
Description: CL, brown sandy lean clay
LL = 43 PL = 14 PI = 29

SPECIMEN INFORMATION (Initial)

Height: 6.04 inch Diameter: 2.88 inch Area: 6.52 in²
Water Content: 17.5 % Total Unit Weight: 133.6 pcf

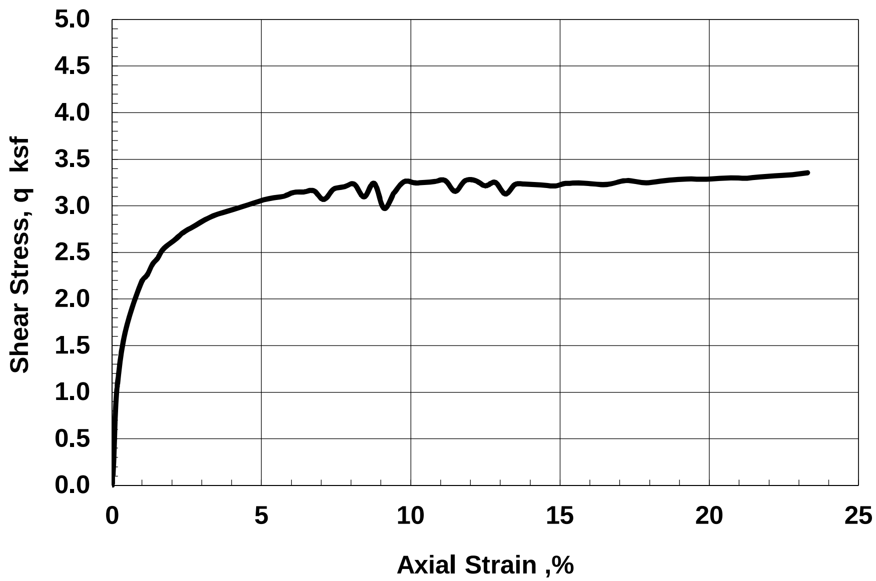


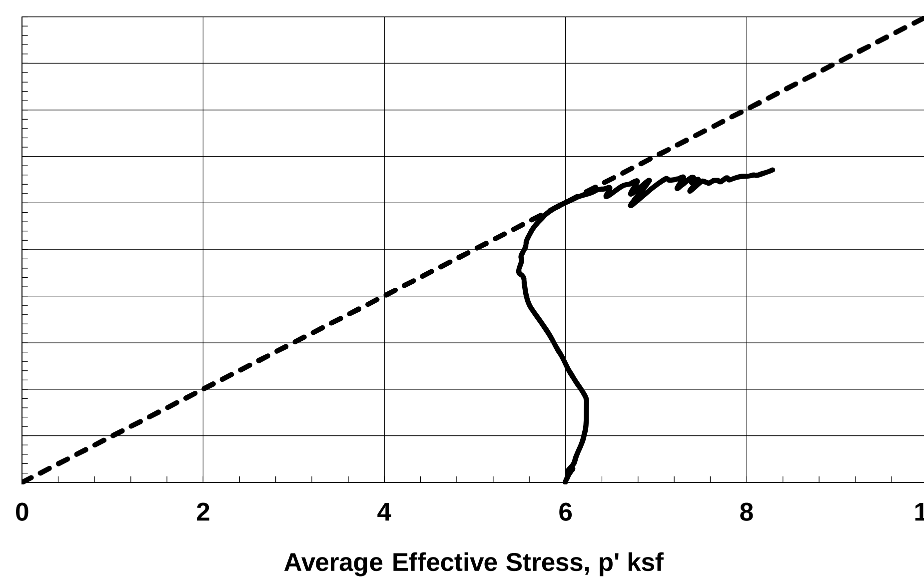
Failure Sketch

TEST SUMMARY

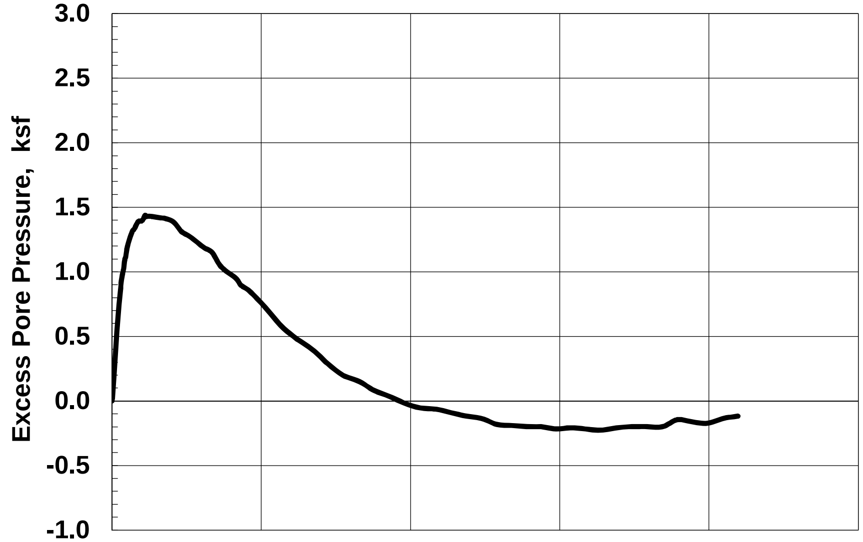
Consolidation Stresses: 6.00 ksf vertical, 6.00 ksf lateral
Water Content: 17.2 % Total Unit Weight: 137.3 pcf
B Coefficient: 96.31 Strain Rate: 0.021 %/min
Peak Shear Strength: 3.36 ksf @ 23.3 % Strain
Peak Effective Friction Angle: 30.1°

REMARKS:





Test by: BB	Project No. T60428794	AECOM Dynegy CCR - Newton	CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements	
Checked by: GET	TerraSense, LLC		Boring: NEW-B012 Sample: ST-12C	November-15



SAMPLE INFORMATION

Boring: NEW-B014 Sample: ST-3C Depth: 36.65 ft

Type: Intact tube sample

Description: SC, brown clayey sand with gravel

LL = 38 PL = 13 PI = 25

SPECIMEN INFORMATION (Initial)

Height: 6.06 inch Diameter: 2.90 inch Area: 6.62 in²

Water Content: 16.3 % Total Unit Weight: 132.6 pcf

TEST SUMMARY

Consolidation Stresses: 3.00 ksf vertical, 3.00 ksf lateral

Water Content: 15.1 % Total Unit Weight: 134.8 pcf

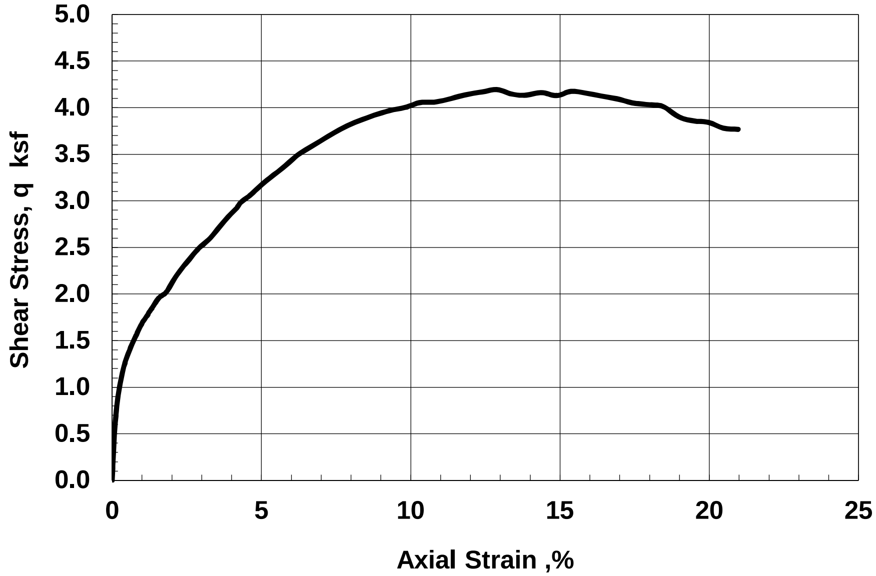
B Coefficient: Strain Rate: 0.021 %/min

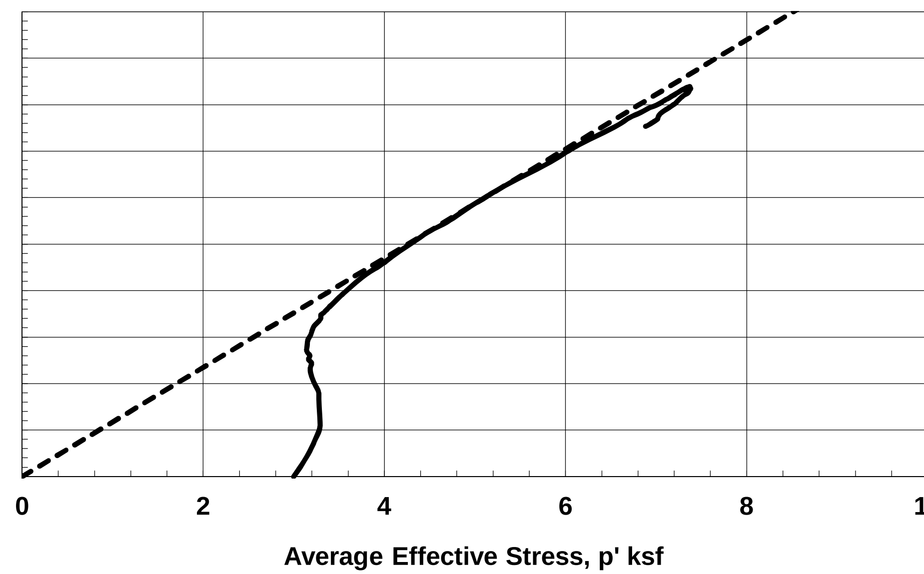
Peak Shear Strength: 4.19 ksf @ 12.9 % Strain

Peak Effective Friction Angle: 36.0°

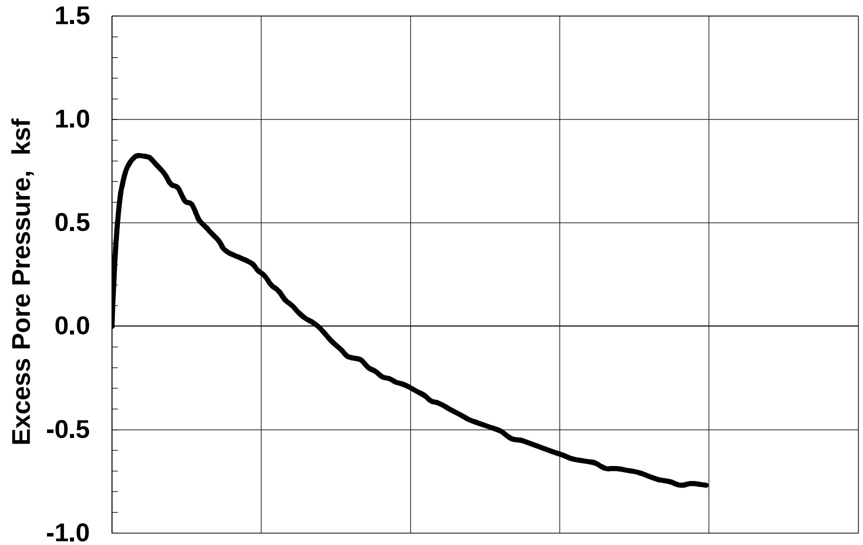
Failure Sketch

REMARKS:





Test by: BB	Project No. T60428794	AECOM Dynegy CCR - Newton	CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements	
Checked by: GET	TerraSense, LLC		Boring: NEW-B014 Sample: ST-3C	November-15



SAMPLE INFORMATION

Boring: NEW-B015 Sample: ST-1B Depth: 10.95 ft

Type: Intact tube sample

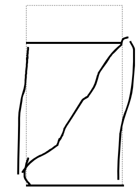
Description: CH, gray brown fat clay

LL = 59 PL = 15 PI = 44

SPECIMEN INFORMATION (Initial)

Height: 6.02 inch Diameter: 2.89 inch Area: 6.56 in²

Water Content: 23.0 % Total Unit Weight: 126.0 pcf



Failure Sketch

TEST SUMMARY

Consolidation Stresses: 1.50 ksf vertical, 1.50 ksf lateral

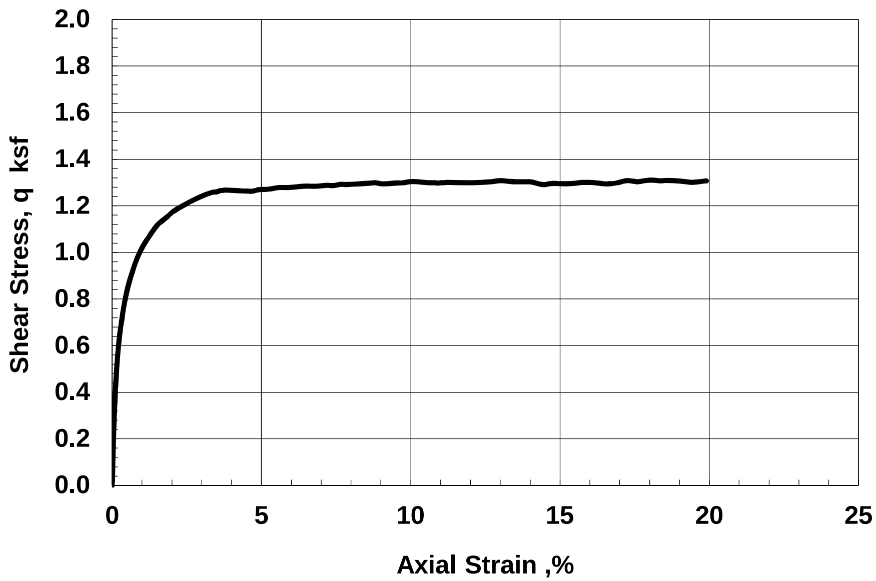
Water Content: 23.6 % Total Unit Weight: 128.1 pcf

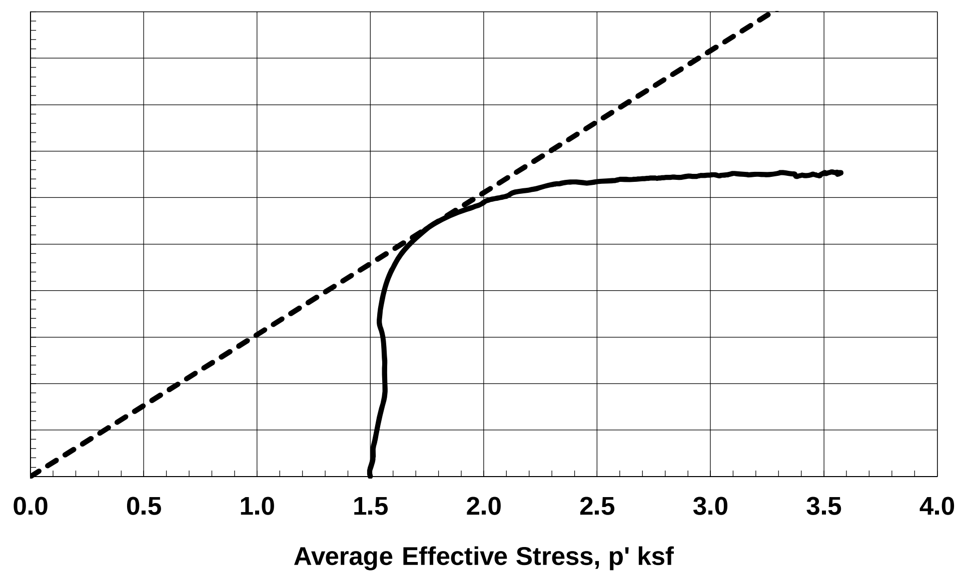
B Coefficient: Strain Rate: 0.020 %/min

Peak Shear Strength: 1.31 ksf @ 18.0 % Strain

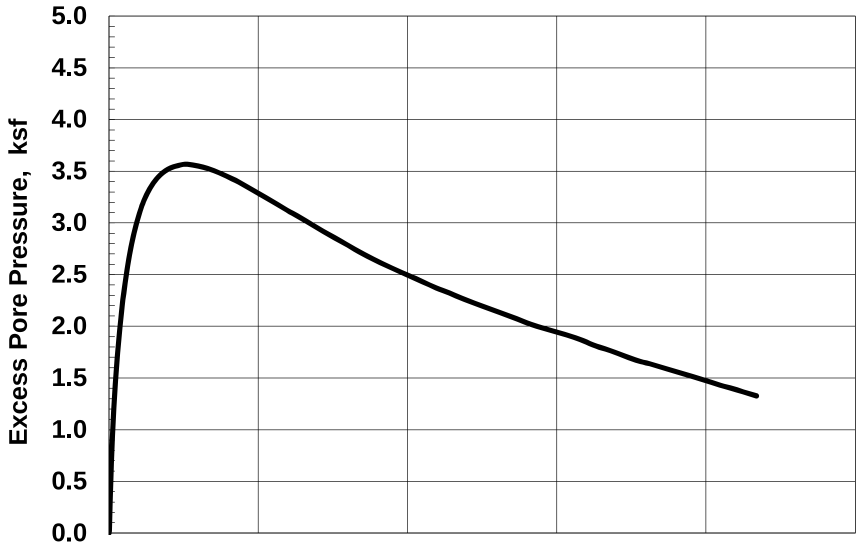
Peak Effective Friction Angle: 37.7°

REMARKS:





Test by: BB	Project No. T60428794	AECOM Dynegy CCR - Newton	CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements	
Checked by: GET	TerraSense, LLC		Boring: NEW-B015 Sample: ST-1B	November-15



SAMPLE INFORMATION

Boring: NEW-B015 Sample: ST-2 Depth: 26 ft

Type: Intact tube sample

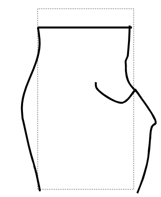
Description: CH, gray fat clay

LL = 52 PL = 15 PI = 37

SPECIMEN INFORMATION (Initial)

Height: 6.00 inch Diameter: 2.88 inch Area: 6.50 in²

Water Content: 19.5 % Total Unit Weight: 131.4 pcf



Failure Sketch

TEST SUMMARY

Consolidation Stresses: 5.00 ksf vertical, 5.00 ksf lateral

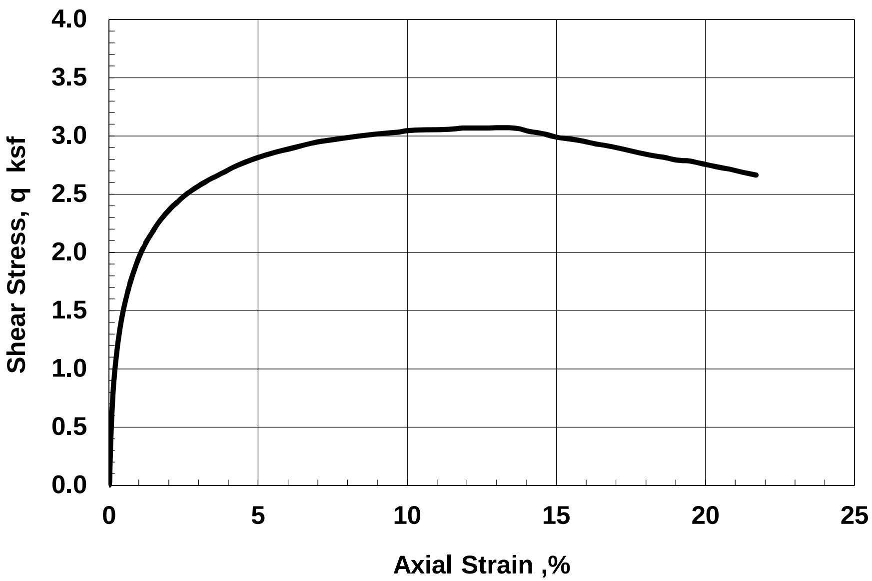
Water Content: 19.6 % Total Unit Weight: 132.8 pcf

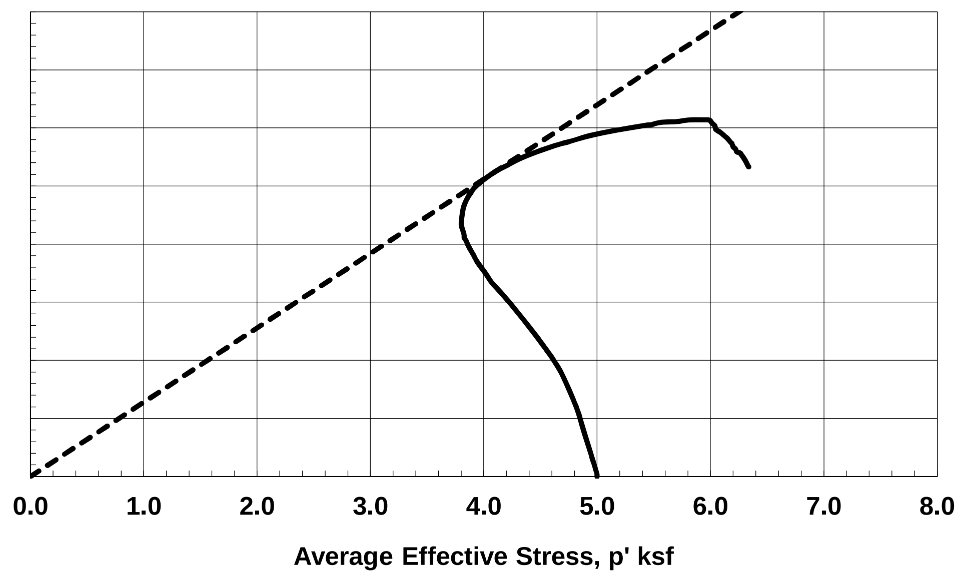
B Coefficient: 99.27 Strain Rate: 0.023 %/min

Peak Shear Strength: 3.07 ksf @ 13.2 % Strain

Peak Effective Friction Angle: 39.8°

REMARKS:





Test by: BB	Project No. T60428794	AECOM Dynegy CCR - Newton	CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements	
Checked by: GET	TerraSense, LLC		Boring: NEW-B015 Sample: ST-2	November-15

SAMPLE INFORMATION

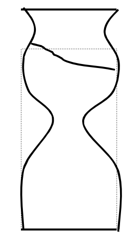
Boring: NEW-B014 Sample: ST-2 Depth: 15.85 ft
Type: Intact tube sample
Description: CL, gray clay, some f-c sand, trace gravel
LL = 31 PL = 14 PI = 17

SPECIMEN INFORMATION (Initial)

Height: 6.03 inch Diameter: 2.88 inch Area: 6.50 in²
Water Content: 12.2 % Total Unit Weight: 139.2 pcf

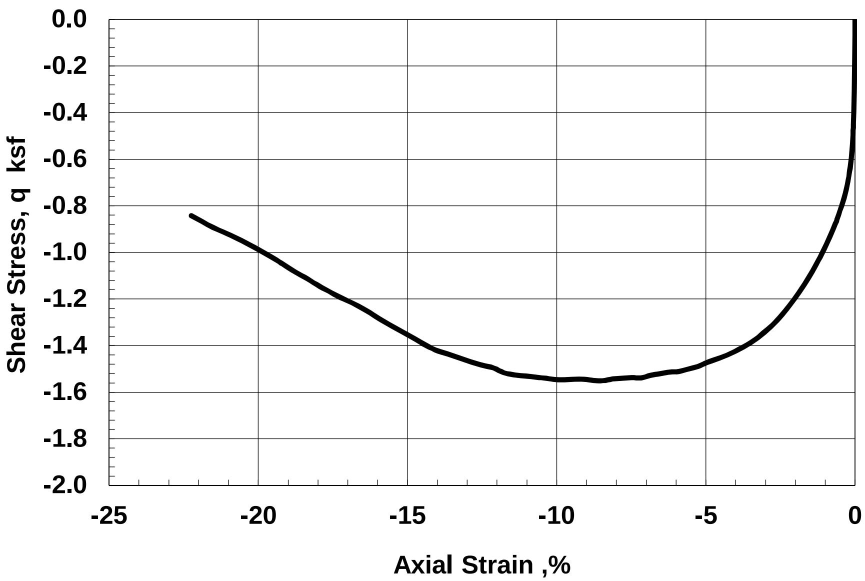
TEST SUMMARY

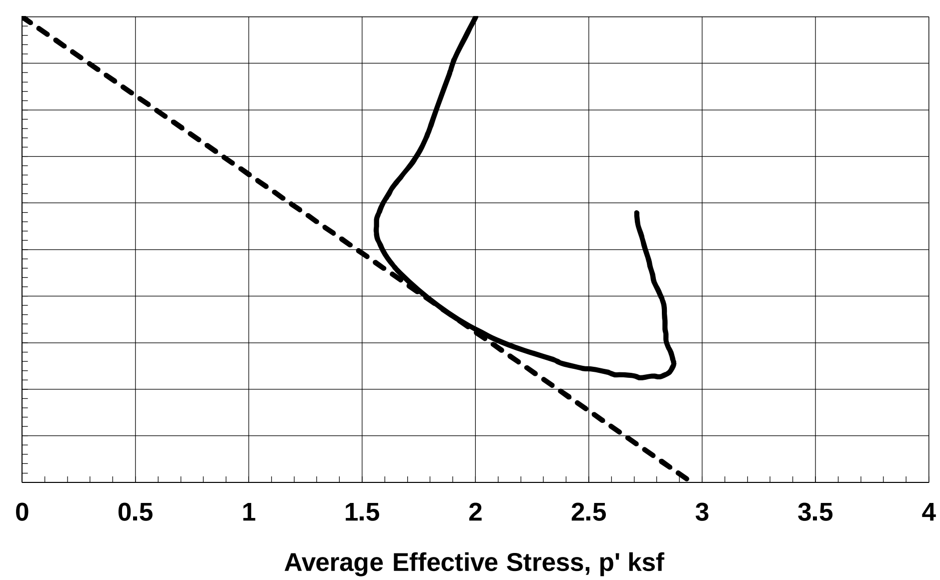
Consolidation Stresses: 2.00 ksf vertical, 2.00 ksf lateral
Water Content: 12.8 % Total Unit Weight: 142.5 pcf
B Coefficient: 98 Strain Rate: -0.020 %/min
Peak Shear Strength: -1.55 ksf @ -8.4 % Strain
Peak Effective Friction Angle: 42.6°



Failure Sketch

REMARKS:





Test by: GT	Project No. T60428794	AECOM Dynegy CCR - Newton	CONSOLIDATED UNDRAINED TRIAXIAL EXTENSION with Pore Pressure Measurements Boring: NEW-B014 Sample: ST-2	
Checked by: GET	TerraSense, LLC			November-15

Appendix C

Hydraulic Conductivity/Slug Test Results

Appendix C - Table 1
Newton Power Station
Slug Test Results - Primary Ash Pond Wells (ID 501)
Hydrogeologic Monitoring Plan

Well ID	Slug In 1	Slug In 2	Slug In 3	Slug Out 1	Slug Out 2	Slug Out 3	Slug Out 4	MIN	MAX	GEOMEAN	Solution
APW2		4.41E-05		4.52E-05		3.45E-05		3.45E-05	4.52E-05	4.1E-05	Bouwer-Rice
APW3	8.44E-06			8.61E-06				8.44E-06	8.61E-06	8.5E-06	Bouwer-Rice
APW4	6.66E-06			5.14E-06				5.14E-06	6.66E-06	5.8E-06	Bouwer-Rice
APW5	5.66E-04	1.42E-03		1.54E-04	2.74E-04	2.56E-04		1.54E-04	1.42E-03	3.9E-04	Bouwer-Rice
APW6	1.64E-03	2.18E-03			2.09E-03	1.98E-03		1.64E-03	2.18E-03	2.0E-03	Bouwer-Rice
APW7	2.25E-03				3.24E-03	2.99E-03	2.75E-03	2.25E-03	3.24E-03	2.8E-03	Bouwer-Rice
APW8	6.60E-04	1.31E-03			1.06E-03	7.89E-04		6.60E-04	1.31E-03	9.2E-04	Bouwer-Rice
APW9	3.21E-03	3.28E-03		3.40E-03	3.00E-03			3.00E-03	3.40E-03	3.2E-03	Bouwer-Rice
APW10	5.27E-04	5.49E-04			5.73E-04	5.60E-04		5.27E-04	5.73E-04	5.5E-04	Bouwer-Rice

All slug test (i.e. hydraulic conductivity) results are in centimeters per second

Not Applicable

Natural Resource Technology
AN OBG COMPANY

Appendix C - Table 2
Newton Power Station
Slug Test Results - Landfill 2 CCR Wells (ID 502)
Hydrogeologic Monitoring Plan

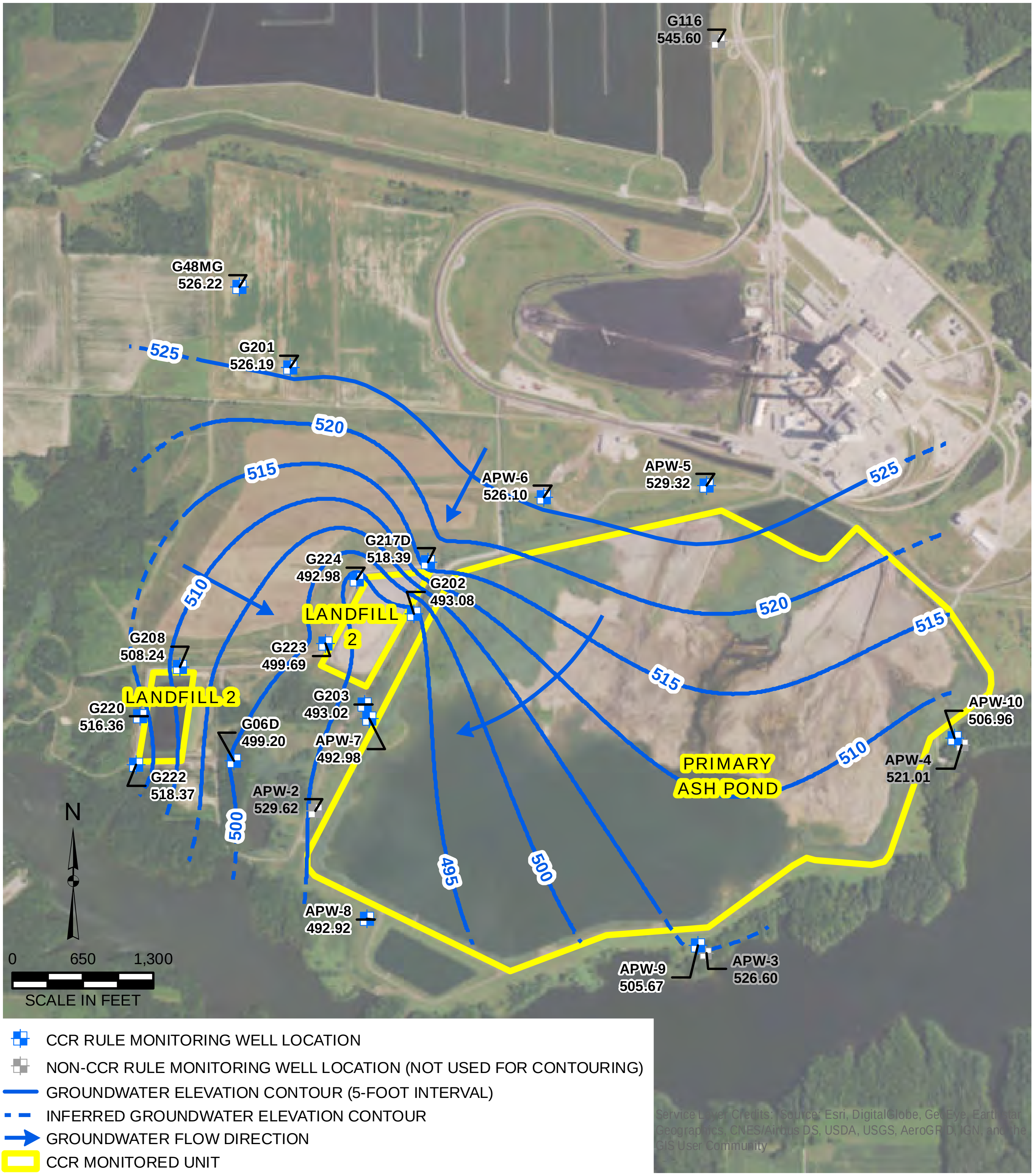
Well ID	Slug In 1	Slug In 2	Slug In 3	Slug Out 1	Slug Out 2	Slug Out 3	MIN	MAX	GEOMEAN	Solution
G06D				3.92E-08			3.92E-08	3.92E-08	3.9E-08	Bouwer-Rice
G202	1.70E-02	1.43E-02			2.87E-02	2.33E-02	1.43E-02	2.87E-02	2.0E-02	Bouwer-Rice
G203	2.53E-02			2.42E-02	3.47E-02		2.42E-02	3.47E-02	2.8E-02	Bouwer-Rice
G208				1.32E-08			1.32E-08	1.32E-08	1.3E-08	Bouwer-Rice
G217D	2.27E-04	2.92E-04				3.03E-04	2.27E-04	3.03E-04	2.7E-04	Bouwer-Rice
G220				3.51E-07			3.51E-07	3.51E-07	3.5E-07	Bouwer-Rice
G222				1.54E-06			1.54E-06	1.54E-06	1.5E-06	Bouwer-Rice
G223	5.19E-05	2.50E-05		1.37E-05	1.79E-05		1.37E-05	5.19E-05	2.4E-05	Bouwer-Rice
G224	5.15E-02	1.90E-02	4.64E-02	4.31E-02		2.97E-02	1.90E-02	5.15E-02	3.6E-02	Bouwer-Rice

All slug test (i.e. hydraulic conductivity) results are in centimeters per second

(grey shading) Not Applicable

Appendix D

Groundwater Elevation Contour Maps



DRAWN BY/DATE:
SDS 10/3/17
REVIEWED BY/DATE:
TBN 10/3/17
APPROVED BY/DATE:
SJC 10/3/17

GROUNDWATER ELEVATION CONTOUR MAP
ROUND 6: JANUARY 16, 2017

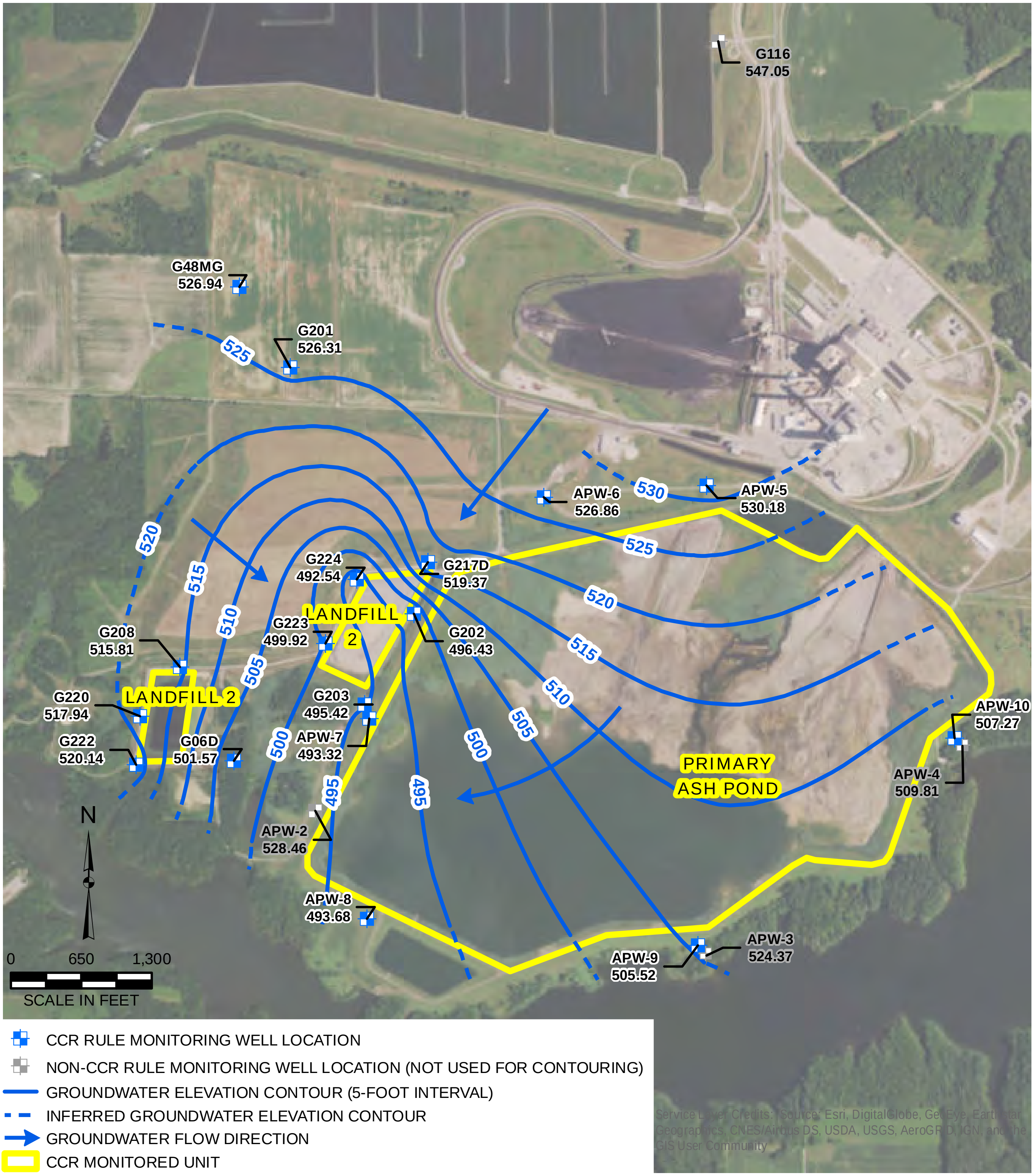
HYDROGEOLOGIC MONITORING PLAN
NEWTON POWER STATION
NEWTON, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

Y:\Mapping\Projects\22\2285\MXD\Newton_HGMP\R6_Newton_GW_Contours.mxd Author: stolzsd; Date/Time: 10/3/2017, 2:20:45 PM



DRAWN BY/DATE:
SDS 8/12/17
REVIEWED BY/DATE:
TBN 8/12/17
APPROVED BY/DATE:
JJW 8/30/17

GROUNDWATER ELEVATION CONTOUR MAP
ROUND 8: JUNE 12, 2017

HYDROGEOLOGIC MONITORING PLAN
NEWTON POWER STATION
NEWTON, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
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OBG

THERE'S A WAY

Natural Resource Technology
AN OBG COMPANY

ATTACHMENT 7 – STRUCTURAL STABILITY ASSESSMENT

AECOM

Submitted to
Illinois Power Generating Company
6725 North 500th Street
Newton, IL 62448

Submitted by
AECOM
1001 Highlands Plaza Drive West
Suite 300
St. Louis, MO 63110

October 2016

CCR Rule Report: Initial Structural Stability Assessment

For

Primary Ash Pond

At Newton Power Station

1 Introduction

This Coal Combustion Residual (CCR) Rule Report documents that the Primary Ash Pond at the Illinois Power Generating Company Newton Power Station meets the structural stability assessment requirements specified in 40 Code of Federal Regulations (CFR) §257.73(d). The Primary Ash Pond is located near Newton, Illinois in Jasper County, approximately 0.2 miles southwest of the Newton Power Station. The Primary Ash Pond serves as the wet impoundment basin for CCR produced by the Newton Power Station.

The Primary Ash Pond is an existing CCR surface impoundment as defined by 40 CFR §257.53. The CCR Rule requires that an initial structural stability assessment for an existing CCR surface impoundment be completed by October 17, 2016. In general, the initial structural stability assessment must document that the design, construction, operation, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering practices.

The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the initial structural stability assessment was conducted in accordance with the requirements of 40 CFR § 257.73(d). The owner or operator must prepare a periodic structural stability assessment every five years.

2 Initial Structural Stability Assessment

40 CFR §257.73(d)(1)
The owner or operator of the CCR unit must conduct initial and periodic structural stability assessments and document whether the design, construction, operation, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering practices for the maximum volume of CCR and CCR wastewater which can be impounded therein. The assessment must, at a minimum, document whether the CCR unit has been designed, constructed, operated, and maintained with [the standards in (d)(1)(i)-(vii)].

An initial structural stability assessment has been performed to document that the design, construction, operation and maintenance of the Primary Ash Pond is consistent with recognized and generally accepted good engineering practices and meets the standards in 257.73(d)(1)(i)-(vii). The results of the structural stability assessment are discussed in the following sections. Based on the assessment and its results, the design, construction, operation, and maintenance of the Primary Ash Pond were found to be consistent with recognized and generally accepted good engineering practices.

2.1 Foundations and Abutments (§257.73(d)(1)(i))

CCR unit designed, constructed, operated, and maintained with stable foundations and abutments.

The stability of the foundations was evaluated using soil data from field investigations and reviewing design drawings, operational and maintenance procedures, and conditions observed in the field by AECOM. Additionally, slope stability analyses were performed to evaluate slip surfaces passing through the foundations. The Primary Ash Pond is a ring dike structure and does not have abutments.

The foundation consists of stiff to hard soil, which indicates stable foundations. Slope stability analyses exceed the criteria listed in §257.73(e)(1) for slip surfaces passing through the foundation. The slope stability analyses are discussed in the *CCR Rule Report: Initial Safety Factor Assessment for Primary Ash Pond at Newton Power Station* (October 2016). A review of operational and maintenance procedures as well as current and past performance of the dikes has determined appropriate processes are in place for continued operational performance.

Based on the conditions observed by AECOM, the Primary Ash Pond was designed and constructed with stable foundations. Operational and maintenance procedures are in place to address any issues related to the stability of foundations; therefore, the Primary Ash Pond meets the requirements in §257.73(d)(1)(i).

2.2 Slope Protection (§257.73(d)(1)(ii))

CCR unit designed, constructed, operated, and maintained with adequate slope protection to protect against surface erosion, wave action and adverse effects of sudden drawdown.

The adequacy of slope protection was evaluated by reviewing design drawings, operational and maintenance procedures, and conditions observed in the field by AECOM.

Based on this evaluation, adequate slope protection was designed and constructed at the Primary Ash Pond. No evidence of significant areas of erosion or wave action were observed. The interior and exterior slopes are protected with vegetation. Where the exterior slopes are adjacent to Newton Lake, they are protected with crushed stone erosion protection. Crushed stone erosion protection is also located on the interior slopes in limited areas. Operational and maintenance procedures are in place to repair the vegetation as needed to protect against surface erosion or wave action. Sudden drawdown of the pool in the Primary Ash Pond is not expected to occur due to operational controls associated with lowering the pool level. Therefore, slope protection to protect against the adverse effects of sudden drawdown is not required as sudden drawdown conditions are not expected to occur. Therefore, the Primary Ash Pond meets the requirements in §257.73(d)(1)(ii).

2.3 Dike Compaction (§257.73(d)(1)(iii))

CCR unit designed, constructed, operated, and maintained with dikes mechanically compacted to a density sufficient to withstand the range of loading conditions in the CCR unit.

The density of the dike materials was evaluated using soil data from field investigations and reviewing design drawings, operational and maintenance procedures, and conditions observed in the field by AECOM. Additionally, slope stability analyses were performed to evaluate slip surfaces passing through the dike over the range of expected loading conditions as defined within §257.73(e)(1).

Based on this evaluation, the dike consists of stiff material, with isolated zones of soft, medium stiff, and very stiff material, which is indicative of mechanically compacted dikes. Slope stability analyses exceed the criteria listed in §257.73(e)(1) for slip surfaces passing through the dike; therefore, the original design and construction of the Primary Ash Pond included sufficient dike compaction. The slope stability analyses are discussed in the *CCR Rule Report: Initial Safety Factor Assessment for Primary Ash Pond at Newton Power Station* (October 2016); Operational and maintenance procedures are in place to identify and mitigate deficiencies in order to maintain sufficient density and compaction of the dikes to withstand the range of loading conditions. Therefore, the Primary Ash Pond meets the requirements in §257.73(d)(1)(iii).

2.4 Vegetated Slopes (§257.73(d)(1)(iv))[1]

CCR unit designed, constructed, operated, and maintained with vegetated slopes of dikes and surrounding areas, except for slopes which have an alternate form or forms of slope protection.

The adequacy of slope vegetation was evaluated by reviewing design drawings, operational and maintenance procedures, and conditions observed in the field by AECOM.

Based on this evaluation, the vegetation on the interior and exterior slopes is adequate as no substantial bare or overgrown areas were observed. Crushed stone erosion protection is present on portions of the exterior slopes adjacent to Newton Lake and is used as an alternative form of slope protection, which is adequate as significant areas of erosion were not observed. Therefore, the original design and construction of the Primary Ash Pond included adequate vegetation of the dikes and surrounding areas. Adequate operational and maintenance procedures are in place to regularly manage vegetation growth, including mowing and seeding any bare areas, as evidenced by the conditions observed by AECOM. Therefore, the Primary Ash Pond meets the requirements in §257.73(d)(1)(iv).

[1] As modified by court order issued June 14, 2016, Utility Solid Waste Activities Group v. EPA, D.C. Cir. No. 15-1219 (order granting remand and vacatur of specific regulatory provisions).

2.5 Spillways (§257.73(d)(1)(v))

CCR unit designed, constructed, operated, and maintained with a single spillway or a combination of spillways configured as specified in [paragraph (A) and (B)]:

(A) All spillways must be either:

(1) of non-erodible construction and designed to carry sustained flows; or

(2) earth- or grass-lined and designed to carry short-term, infrequent flows at non-erosive velocities where sustained flows are not expected.

(B) The combined capacity of all spillways must adequately manage flow during and following the peak discharge from a:

(1) Probable maximum flood (PMF) for a high hazard potential CCR surface impoundment; or

(2) 1000-year flood for a significant hazard potential CCR surface impoundment; or

(3) 100-year flood for a low hazard potential CCR surface impoundment.

The spillways were evaluated using design drawings, operational and maintenance procedures, and conditions observed in the field by AECOM. Additionally, hydrologic and hydraulic analyses were completed to evaluate the capacity of the spillway relative to inflow estimated for the 1,000-year flood event for the significant hazard potential Primary Ash Pond. The hazard potential classification assessment was performed by Stantec in 2016 in accordance with §257.73(a)(2).

The spillways are comprised of concrete and sliplined corrugated metal pipes, which are non-erodible materials designed to carry sustained flows. The capacity of the spillway was evaluated using hydrologic and hydraulic analysis performed per §257.82(a). The analysis found that the spillways can adequately manage flow during peak discharge resulting from the 1,000-year storm event without overtopping of the embankments. The hydrologic and hydraulic analyses are discussed in the *CCR Rule Report: Initial Inflow Design Flood Control System Plan for Primary Ash Pond at Newton Power Station* (October 2016). Operational and maintenance procedures are in place to repair any issues with the spillways and remove debris or other obstructions from the spillways, as evidenced by the conditions observed by AECOM. As a result, these procedures are appropriate for maintaining the spillways. Therefore, the Primary Ash Pond meets the requirements in §257.73(d)(1)(v).

2.6 Stability and Structural Integrity of Hydraulic Structures (§257.73(d)(1)(vi))

CCR unit designed, constructed, operated, and maintained with hydraulic structures underlying the base of the CCR unit or passing through the dike of the CCR unit that maintain structural integrity and are free of significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, and debris which may negatively affect the operation of the hydraulic structure.

The stability and structural integrity of the slip-lined corrugated metal pipe (CMP) outflow pipes passing through the dike of the Primary Ash Pond were evaluated using design drawings, operational and maintenance procedures, closed-circuit television (CCTV) pipe inspection, and conditions observed in the field by AECOM. No other hydraulic structures are known to pass through the dike of or underlie the base of the Primary Ash Pond.

The CCTV pipe inspection of the slip-lined CMP outflow pipes covered the complete length of both pipes and found the pipes to be free of significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, and debris that may negatively affect the operation of the hydraulic structure. Operational and maintenance procedures are in place to repair any issues with the spillway and remove debris or other obstructions from the spillways, as evidenced by the conditions observed by AECOM. As a result, these procedures are appropriate for maintaining the spillway. Therefore, the Primary Ash Pond meets the requirements in §257.73(d)(1)(vi).

2.7 Downstream Slope Inundation/Stability (§257.73(d)(1)(vii))

CCR unit designed, constructed, operated, and maintained with, for CCR units with downstream slopes which can be inundated by the pool of an adjacent water body, such as a river, stream or lake, downstream slopes that maintain structural stability during low pool of the adjacent water body or sudden drawdown of the adjacent water body.

The structural stability of the downstream slopes of the Primary Ash Pond was evaluated by comparing the location of the Primary Ash Pond relative to adjacent water bodies using published Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM), aerial imagery, conditions observed in the field by AECOM, and sudden drawdown slope stability analyses.

Based on this evaluation, Newton Lake is adjacent to the southern downstream slopes of the Primary Ash Pond. No other rivers, streams, or lakes are adjacent to the downstream slopes of the Primary Ash Pond. Sudden drawdown slope stability analyses were performed at 4 cross sections adjacent to Newton Lake, and considered a drawdown from a normal pool to empty pool condition, thereby evaluating both sudden drawdown and empty and low pool conditions. The resulting factors of safety were found to satisfy the criteria listed in United States Army Corps of Engineers Engineer Manual 1110-2-1902 for drawdown from normal to low pool, as factor of safety criteria for sudden drawdown slope stability is not expressly stated as a requirement of §257.73(d)(1)(vii). Therefore, the Primary Ash Pond meets the requirements listed in §257.73(d)(1)(vii).

3 Certification Statement

CCR Unit: Illinois Power Generating Company; Newton Power Station; Primary Ash Pond

I, Victor A. Modeer, being a Registered Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief that the information contained in this CCR Rule Report, and the underlying data in the operating record, has been prepared in accordance with the accepted practice of engineering. I certify, for the above-referenced CCR Unit, that the initial structural stability assessment dated October 13, 2016 was conducted in accordance with the requirements of 40 CFR § 257.73(d).

VICTOR A MODEER JR.
Printed Name

10/13/16
Date

VICTOR ALBERT MODEER JR.
062-043112
REGISTERED
PROFESSIONAL
ENGINEER
OF
ILLINOIS
11/30/17

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ATTACHMENT 8 – SAFETY FACTOR ASSESSMENT

AECOM

Submitted to
Illinois Power Generating Company
6725 North 500th Street
Newton, IL 62448

Submitted by
AECOM
1001 Highlands Plaza Drive West
Suite 300
St. Louis, MO 63110

October 2016

CCR Rule Report: Initial Safety Factor Assessment

For

Primary Ash Pond

At Newton Power Station

1 Introduction

This Coal Combustion Residual (CCR) Rule Report documents that the Primary Ash Pond at the Illinois Power Generating Company Newton Power Station meets the safety factor assessment requirements specified in 40 Code of Federal Regulations (CFR) §257.73(e). The Primary Ash Pond is located near Newton, Illinois in Jasper County, approximately 0.2 miles southwest of the Newton Power Station. The Primary Ash Pond serves as the wet impoundment basin for CCR produced by the Newton Power Station.

The Primary Ash Pond is an existing CCR surface impoundment as defined by 40 CFR §257.53. The CCR Rule requires that the initial safety factor assessment for an existing CCR surface impoundment be completed by October 17, 2016.

The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the initial safety factor assessment meets the requirements of 40 CFR § 257.73(e). The owner or operator must prepare a safety factor assessment every five years.

2 Initial Safety Factor Assessment

40 CFR §257.73(e)(1)
The owner or operator must conduct initial and periodic safety factor assessments for each CCR unit and document whether the calculated factors of safety for each CCR unit achieve the minimum safety factors specified in (e)(1)(i) through (iv) of this section for the critical cross section of the embankment. The critical cross section is the cross section anticipated to be the most susceptible of all cross sections to structural failure based on appropriate engineering considerations, including loading conditions. The safety factor assessments must be supported by appropriate engineering calculations.

(i) The calculated static factor of safety under the long-term, maximum storage pool loading condition must equal or exceed 1.50.
(ii) The calculated static factor of safety under the maximum surcharge pool loading condition must equal or exceed 1.40.
(iii) The calculated seismic factor of safety must equal or exceed 1.00.
(iv) For dikes constructed of soils that have susceptibility to liquefaction, the calculated liquefaction factor of safety must equal or exceed 1.20.

A geotechnical investigation program and stability analyses were performed to evaluate the design, performance, and condition of the earthen dikes of the Primary Ash Pond. The exploration consisted of hollow-stem auger borings, cone penetration testing, piezometer installation and laboratory program including strength, hydraulic conductivity, consolidation, and index testing. Data collected from the geotechnical investigation, available design drawings, construction records, inspection reports, previous engineering investigations, and other pertinent historic documents were utilized to perform the safety factor assessment and geotechnical analyses.

In general, the subsurface conditions at the Primary Ash Pond consist of medium stiff to stiff embankment fill (clay) overlying stiff to hard clay, which in turn overlies very stiff to very hard glacial till. Phreatic water is above the embankment/foundation of the Primary Ash Pond.

Ten (10) representative cross sections were analyzed using limit equilibrium slope stability analysis software to evaluate stability of the perimeter dike system and foundations. The cross sections were located to represent critical surface geometry, subsurface stratigraphy, and phreatic conditions across the site. Each cross section was evaluated for each of the loading conditions stipulated in §257.73(e)(1).

The Soils Susceptible to Liquefaction loading condition, §257.73(e)(1)(iv), was not evaluated because a liquefaction susceptibly evaluation did not find soils susceptible to liquefaction within the Primary Ash Pond dikes. As a result, this loading condition is not applicable to the Primary Ash Pond at the Newton Power Station.

Results of the Initial Safety Factor Assessments for the critical cross-section for each loading condition (i.e., the lowest calculated factor of safety out of the 10 cross sections analyzed for each loading condition) are listed in Table 1.

Table 1 – Summary of Initial Safety Factor Assessments

Loading Conditions	§257.73(e)(1) Subsection	Minimum Factor of Safety	Calculated Factor of Safety
Maximum Storage Pool Loading	(i)	1.50	1.66
Maximum Surcharge Pool Loading	(ii)	1.40	1.66
Seismic	(iii)	1.00	1.07
Soils Susceptible to Liquefaction	(iv)	1.20	Not Applicable

Based on this evaluation, the Primary Ash Pond meets the requirements in §257.73(e)(1).

3 Certification Statement

CCR Unit: Illinois Power Generating Company; Newton Power Station; Primary Ash Pond

I, Victor A. Modeer, being a Registered Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief that the information contained in this CCR Rule Report, and the underlying data in the operating record, has been prepared in accordance with the accepted practice of engineering. I certify, for the above-referenced CCR Unit, that the initial safety factor assessment dated October 13, 2016 meets the requirements of 40 CFR §257.73(e).

VICTOR A MODEER JR.

Printed Name

10/13/16

Date

VICTOR ALBERT MODEER JR.
062-043112
REGISTERED PROFESSIONAL ENGINEER OF ILLINOIS
11/30/17

About AECOM

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More information on AECOM and its services can be found at www.aecom.com.

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ATTACHMENT 9 – CLOSURE PLAN

CLOSURE PLAN FOR EXISTING CCR SURFACE IMPOUNDMENT
40 CFR 257.102(b)
REV 0 – 10/17/2016

SITE INFORMATION

Site Name / Address	Newton Power Station / 6725 North 500th Street, Newton, IL 62448		
Owner Name / Address	Illinois Power Generating Company / 1500 Eastport Plaza Drive, Collinsville, IL 62234		
CCR Unit	Primary Ash Pond	Closure Method and Final Cover Type	Close In-Place Clayey Soil Cover with Vegetation

CLOSURE PLAN DESCRIPTION

(b)(1)(i) – Narrative description of how the CCR unit will be closed in accordance with this section.	The Primary Ash Pond will be dewatered, as necessary, to facilitate closure by leaving CCR in place. The CCR in the Primary Ash Pond will be shaped and graded. The final cover will be sloped to promote drainage and stormwater runoff will be conveyed through a series of drainage channels on the cover system to a perimeter stormwater collection channel. From the perimeter channel, stormwater will flow to the Secondary Settling Pond to the north and the Secondary Pond to the south. From the Secondary Pond a spillway will lead to Newton Lake. In accordance with 257.102(b)(3), this initial written closure plan will be amended to provide additional details after the final engineering design for the grading and cover system is completed, if the final design would substantially affect this written closure plan. This initial closure plan reflects the information available to date.
(b)(1)(iii) – If closure of the CCR unit will be accomplished by leaving CCR in place, a description of the final cover system and methods and procedures used to install the final cover.	The soils for the final cover system will be placed directly on top of the graded CCR material to achieve final grades and will include (from bottom up): 1) 18" of compacted earthen material with a permeability of less than or equal to the permeability of the natural subsoils present at the site or no greater than $1x10^{-5}$ cm/sec, whichever is less; 2) 6" of soil capable of sustaining native plant growth; and 3) planted native grasses. Emplaced CCR material will be regraded as fill and supplemented with borrow soils as necessary to achieve design grades. Earthen material will be placed, graded, and compacted to meet the thickness and permeability as discussed above for the cover system. Organic earthen material will be placed on top of the 18" of compacted soils to create a 6" soil layer capable of sustaining native plant growth. The final cover surface will be seeded and vegetated. The final cover slope will have a minimum slope of 2% and will be graded to convey stormwater runoff to the perimeter drainage channel, which leads to the Secondary Pond at the north and the Secondary Settling Pond at the south and Newton Lake.

(b)(1)(iii) – How the final cover system will achieve the performance standards in 257.102(d).	
(d)(1)(i) Control, minimize or eliminate, to the maximum extent feasible, post-closure infiltration of liquids into the waste and releases of CCR, leachate, or contaminated run-off to the ground or surface waters or to the atmosphere.	The permeability of the final cover will be equal to or less than the permeability of the natural subsoils present below the CCR material or permeability no greater than $1x10^{-5}$ cm/sec, whichever is less. Therefore, the permeability of the final cover system will not be greater than $1x10^{-5}$ cm/sec. The final cover system will be graded with a minimum 2% slope.
(d)(1)(ii) – Preclude the probability of future impoundment of water, sediment, or slurry.	The final cover will be installed with a minimum 2% slope. Drainage channels will be installed with a minimum 0.5% slope.
(d)(1)(iii) – Include measures that provide for major slope stability to prevent the sloughing or movement of the final cover system during the closure and post-closure care period.	The final cover will have a minimum 2% slope and drainage channels will have minimum 0.5% slope. Drainage channels will be lined with turf reinforced mats where required to reduce the potential for erosion. The final slope of the berms and cover will meet the stability requirements to prevent sloughing or movement of the final cover system.
(d)(1)(iv) – Minimize the need for further maintenance of the CCR unit.	The final cover will be vegetated to minimize erosion and maintenance.

CLOSURE PLAN DESCRIPTION	
(d)(1)(v) – Be completed in the shortest amount of time consistent with recognized and generally accepted good engineering practices.	Closure is estimated to be completed no later than five years upon commencement of activities.
(d)(2)(i) – Free liquids must be eliminated by removing liquid wastes or solidifying the remaining wastes and waste residue.	The unit will be dewatered sufficiently, as necessary, to remove the free liquids to provide a stable base for the construction of the final cover system.
(d)(2)(ii) – Remaining wastes must be stabilized sufficiently to support the final cover system.	Dewatering as necessary and regrading of existing in-place CCR will sufficiently stabilize the waste such that the final cover will be supported.
(d)(3) – A final cover system must be installed to minimize infiltration and erosion, and at minimum, meets the requirements of (d)(3)(i).	The final cover will consist of a minimum 18" earthen material layer with permeability equal to or less than the permeability of the natural subsoils or no greater than $1x10^{-5}$ cm/sec, whichever is less. Therefore, the permeability of the final cover system will be not greater than $1x10^{-5}$ cm/sec. Erosion will be minimized with a soil layer of no less than 6" of earthen material capable of sustaining native plant growth. The final cover surface will be seeded and vegetated.
(d)(3)(i) – The design of the final cover system must be included in the written closure plan.	When the design of the final cover system is completed, the written closure plan will be amended if the final design would substantially change this written closure plan. The design of the final cover system will meet the requirements of §(d)(3)(i)(A)–(D) as described below.
(d)(3)(i)(A) – The permeability of the final cover system must be less than or equal to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than $1x10^{-5}$cm/sec, whichever is less.	The permeability of the final cover will be equal to or less than the permeability of the natural subsoils or no greater than $1x10^{-5}$ cm/sec, whichever is less. Therefore, the permeability of the final cover system will be not greater than $1x10^{-5}$ cm/sec.
(d)(3)(i)(B) – The infiltration of liquids through the closed CCR unit must be minimized by the use of an infiltration layer than contains a minimum of 18 inches of earthen material.	The final cover will include a minimum 18" of compacted earthen material with a permeability equal to or less than the permeability of the natural subsoils or no greater than $1x10^{-5}$ cm/sec, whichever is less. Therefore, the permeability of the final cover system will be not greater than $1x10^{-5}$ cm/sec.
(d)(3)(i)(C) – The erosion of the final cover system must be minimized by the use of an erosion layer that contains a minimum of six inches of earthen material that is capable of sustaining native plant growth.	The final cover will include a minimum 6" of an earthen erosion layer that is capable of sustaining native plant growth. The final cover will be seeded and vegetated.
(d)(3)(i)(D) – The disruption of the integrity of the final cover system must be minimized through a design that accommodates settling and subsidence.	The final cover will be installed with a minimum 2% slope and will incorporate calculated settlement as well as differential settling and subsidence.

INVENTORY AND AREA ESTIMATES	
(b)(1)(iv) – Estimate of the maximum inventory of CCR ever on-site over the active life of the CCR unit	39,790,000 cubic yards
(b)(1)(v) – Estimate of the largest area of the CCR unit ever requiring a final cover	404 acres

CLOSURE SCHEDULE	
(b)(1)(vi) – Schedule for completing all activities necessary to satisfy the closure criteria in this section, including an estimate of the year in which all closure activities for the CCR unit will be completed. The schedule should provide sufficient information to describe the sequential steps that will be taken to close the CCR unit, including major milestones and the estimated timeframes to complete each step or phase of CCR unit closure.	
The milestone and the associated timeframes are initial estimates. Some of the activities associated with the milestones will overlap. Amendments to the milestones and timeframes will be made as more information becomes available.	
Written Closure Plan	October 17, 2016
Notification of Intent to Close Placed in Operating Record	No later than the date closure of the CCR unit is initiated. Closure to commence in accordance with the applicable timeframes in 40 CFR 257.102(e).
Agency coordination and permit acquisition • Coordinating with state agencies for compliance • Acquiring state permits	 Year 1 – 5 (estimated) Year 1 (estimated)
Mobilization	Year 1 (estimated)
Dewater and stabilize CCR • Complete dewatering, as necessary • Complete stabilization of CCR	 Year 2 (estimated) Year 2 (estimated)
Grading • Grading of CCR material in pond to facilitate surface water drainage	Year 2 - 5 (estimated)
Installation of final cover	Year 2 - 5 (estimated)
Estimate of Year in which all closure activities will be completed	Year 5

AMENDMENT AND CERTIFICATION	
(b)(3)(i) – The owner or operator may amend the initial or any subsequent written closure plan developed pursuant to 257.102(b)(1) at any time. (b)(3)(ii) – The owner or operator must amend the written closure plan whenever: (A) There is a change in the operation of the CCR unit that would substantially affect the written closure plan in effect; or (B) Before or after closure activities have commenced, unanticipated events necessitate a revision of the written closure plan. (b)(3)(iii) – The owner or operator must amend the closure plan at least 60 days prior to a planned change in the operation of the facility or CCR unit, or no later than 60 days after an unanticipated event requires the need to revise an existing written closure plan. If a written closure plan is revised after closure activities have commenced for a CCR unit, the owner or operator must amend the current closure plan no later than 30 days following the triggering event.	This initial closure plan will be amended as required by 257.102(b)(3) and, as allowed by 257.102(b)(3), may be amended at any time, including as more information becomes available.
(b)(4) – The owner or operator of the CCR unit must obtain a written certification from a qualified professional engineer that the initial and any amendment of the written closure plan meets the requirements of this 40 CFR 257.102.	Certification by a qualified professional engineer will be appended to this plan.

Certification Statement 40 CFR § 257.102 (d)(3)(iii) – Design of the Final Cover System for a CCR Surface Impoundment

CCR Unit: Illinois Power Generating Company; Newton Power Station; Primary Ash Pond

I, Victor Modeer, being a Registered Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief, that the information contained in this certification has been prepared in accordance with the accepted practice of engineering. I certify, for the above referenced CCR Unit, that the design of the final cover system as included in the initial written closure plan, dated October 17, 2016 meets the requirements of 40 CFR § 257.102.

Victor Modeer, PE, D.GE

Printed Name

10/11/16

Date

VICTOR ALBERT MODEER JR.
062-043112
REGISTERED PROFESSIONAL ENGINEER OF ILLINOIS

11/30/17

Certification Statement 40 CFR § 257.102 (b)(4) – Initial Written Closure Plan for a CCR Surface Impoundment

CCR Unit: Illinois Power Generating Company; Newton Power Station; Primary Ash Pond

I, Victor Modeer, being a Registered Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief, that the information contained in this certification has been prepared in accordance with the accepted practice of engineering. I certify, for the above referenced CCR Unit, that the information contained in the initial written closure plan, dated October 17, 2016, meets the requirements of 40 CFR § 257.102.

Victor Modeer, PE, D.GE

Printed Name

10/11/16

Date

VICTOR ALBERT MODEER JR.
062-048112
REGISTERED PROFESSIONAL ENGINEER OF ILLINOIS

11/30/17

ENVIRONMENT
& HEALTH

ADDENDUM NO. 1
NEWTON PRIMARY ASH POND CLOSURE PLAN

This Addendum No. 1 to the Closure Plan for Existing Coal Combustion Residuals (CCR) Impoundment for the Newton Primary Ash Pond at the Newton Power Station, Revision 0 - October 17, 2016 has been prepared to meet the requirements of Title 40 of the Code of Federal Regulations (40 C.F.R.) Section 257.103(f)(2)(v)(D) as a component of the demonstration that the Newton Primary Ash Pond qualifies for a site-specific alternative deadline to initiate closure due to permanent cessation of a coal-fired boiler by a certain date.

The Newton Primary Ash Pond will begin construction of closure by July 17, 2024 and cease receipt and placement of CCR and non-CCR wastestreams no later than July 17, 2027 as indicated in the Newton Power Station Alternative Closure Demonstration dated September 29, 2020. Closure will be completed by October 17, 2028 within the 5-year timeframe included in the Closure Schedule identified in the Newton Primary Ash Pond Closure Plan in accordance with 40 C.F.R. § 257.102(f)(ii).

All other aspects of the Closure Plan remain unchanged.

CERTIFICATION

I, Eric J. Tlachac, a Qualified Professional Engineer in good standing in the State of Illinois, certify that the information in this addendum is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

LICENSED PROFESSIONAL ENGINEER
ERIC J. TLACHAC
062-063091
STATE OF ILLINOIS

Eric J. Tlachac
Qualified Professional Engineer
062-063091
Illinois
Ramboll Americas Engineering Solutions, Inc., f/k/a O'Brien & Gere Engineers, Inc.
Date: September 29, 2020

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